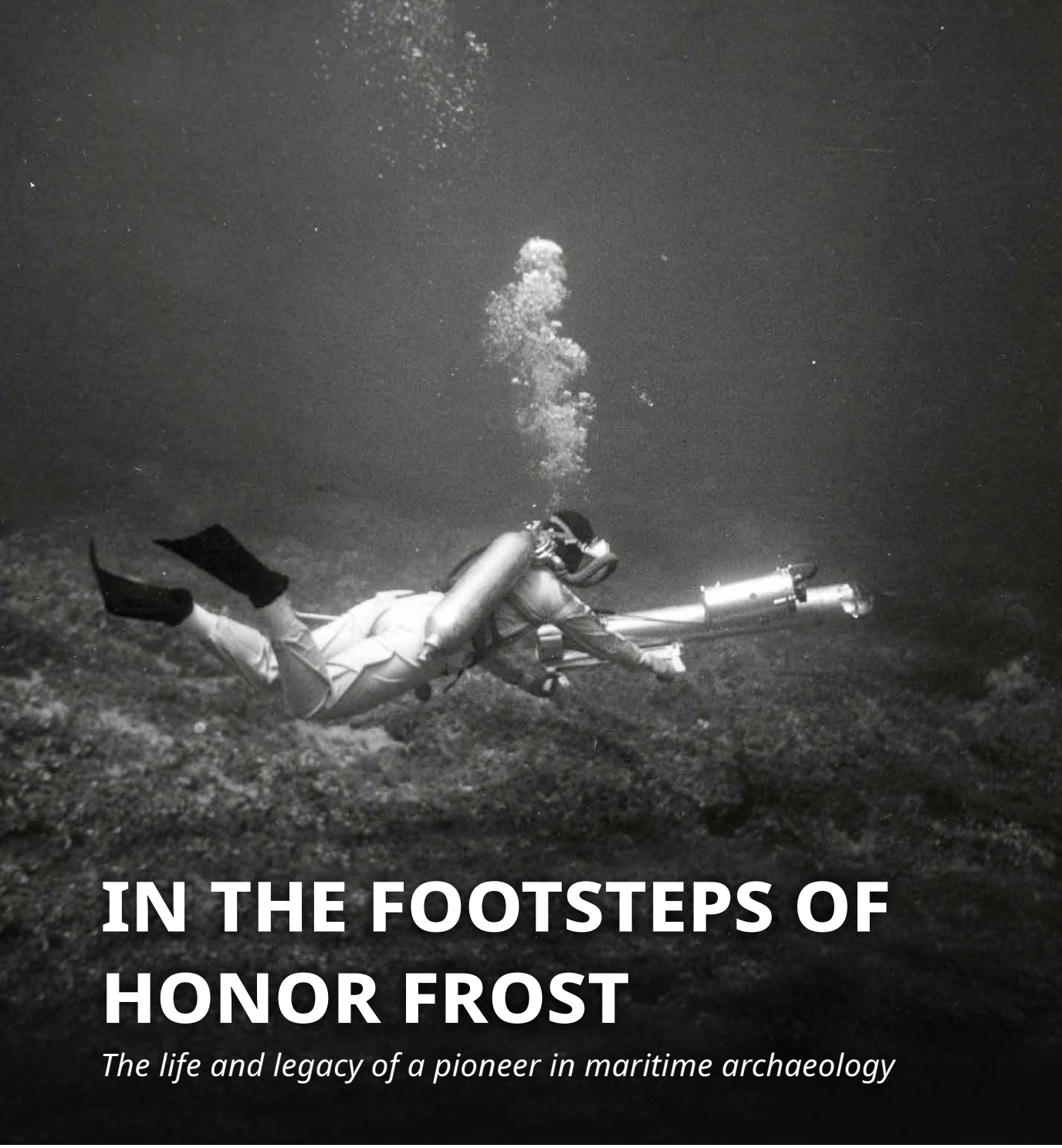

IN THE FOOTSTEPS OF HONOR FROST

The life and legacy of a pioneer in maritime archaeology

edited by
LUCY BLUE

HONOR FROST FOUNDATION

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Sidestone Press

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Published by Sidestone Press, Leiden
www.sidestone.com

Lay-out & cover design: Sidestone Press
Photograph cover: Honor Frost Archive, Hartley Library
Southampton University

ISBN 978-90-8890-830-9 (softcover)
ISBN 978-90-8890-831-6 (hardcover)
ISBN 978-90-8890-832-3 (PDF e-book)

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Foreword

*Lucy Blue**

* *Maritime Archaeological Director, Honor Frost Foundation*

The world of maritime archaeology has undoubtedly changed significantly since Honor Frost (1917-2010) published her seminal volume *Under the Mediterranean* in 1963. Frost's maritime archaeological career began in the 1950s. She came to the field with skills acquired from her former life as an artist, designer, and illustrator but, having learned to dive in France, she soon began to explore the underwater world of archaeology in the Mediterranean. Her remarkable journey led her to investigate ancient shipwrecks and research former sea-levels and harbours. Her approach was truly interdisciplinary and often groundbreaking and was driven by a unique passion and determination that saw her still conducting research up until her death in 2010 at the age of 93.

This volume is representative of a session of papers presented at an international conference of maritime archaeology in the Mediterranean that was held in Nicosia, Cyprus in October 2017 to mark the anniversary of the centenary of Frost's birth on the island. The conference was entitled 'Under the Mediterranean: 100 years on…', which reflected the title of her formative volume as well as the contribution that she made to the development of maritime archaeology in the region. The 2017 'Under the Mediterranean' conference was the first in a series that will be held every few years in the Mediterranean to promote research in maritime archaeology. The creation of this new conference series by Dr Stella Demesticha of the University of Cyprus and the editor of this volume was very much inspired and encouraged by the 'TROPIS International Symposium on Ship Construction in Antiquity' series of ten conferences coordinated by Harry Tzalas that were held, principally in Greece, between 1985 and 2008.

Frost is sadly no longer with us, but her legacy lives on not only in terms of the significant research contributions she made to the field but also in her creation of another milestone in the history of maritime archaeology, the Honor Frost Foundation (HFF). Since 2011, the Foundation has already made a dramatic difference to the growth of maritime archaeology, particularly in the eastern Mediterranean region (http://honorfrostfoundation.org/about-hff/). The Foundation also encourages research and

dialogue between scholars of maritime archaeology in the region through its support of the 'Under the Mediterranean' conference series.

The opening session of the first 'Under the Mediterranean' conference was dedicated to Frost, her life and her legacy. The session was entitled 'In the Footsteps of Honor Frost' and hence that is the title of this publication. The volume includes 12 papers that were presented in the session, as well as the two keynote addresses at the conference. One keynote paper is by Patrice Pomey, who provides an overview of Frost's achievements as a maritime archaeologist, and the other is by Sophie Basch, who outlines her career as an artist. Thus, these two contributions represent the diversity of Frost's life and show how skills honed in her first career contributed to her second as an archaeologist.

The themes of the papers published in this volume were selected by the editor to reflect the extraordinary life of this pioneering maritime archaeologist. The authors of each paper were approached based on their expertise in their particular fields of research, and they include former colleagues and friends of Frost as well as some of those she mentored at earlier stages in their maritime archaeological careers.

The volume presents a retrospective view of Frost's work and the specific research that she explored, developed, and in many cases pioneered through the course of her career as a maritime archaeologist. As the title suggests, it aims to investigate the development of the discipline through the lens of specific aspects of her research such as harbours, anchors, shipwrecks, and coastal change, to see how she inspired subsequent research and researchers. The papers reveal the varying regional contexts in which Frost worked, exploring specific projects and angles of inquiry that she initiated, and reflect on how maritime archaeology has subsequently advanced since those early pioneering days.

The volume begins with the context of Frost's life, with an overview of her artistic and her maritime archaeological careers. These two papers provide a window into her world(s), independently so successful and yet so separate. They also set the scene for the volume. The third paper provides the context of previous forums for dialogue and debate with respect to maritime archaeological research in the Mediterranean. It presents a summary of the 'TROPIS International Symposium on Ship Construction in Antiquity' symposia, meetings to which Frost herself regularly contributed. Subsequent papers focus on her research on harbours, anchors, and shipwrecks, much of it in the Levant, in particular in Lebanon and Syria, concerning changing maritime landscapes; in Greece; in Egypt with her work at the famous lighthouse of Alexandria; and finally, in Sicily where she discovered, excavated and eventually raised the wreck of the Marsala Punic Ship, now on display in the Baglio Anselmi, Lilibeo Museum in Marsala, Sicily. The last subject concludes with a paper that reveals a remarkable discovery, a volume that Frost wrote but never published, entitled *The Second Life of a Phoenix: Portrait of a Punic Ship Resurrected in a Sicilian Town.* An afterword provides a short overview of the Honor Frost Foundation, the living legacy of the lady herself.

The volume is thus dedicated to Honor Frost and the legacy of her work and the Foundation that takes her name. It is a celebration of the life of a remarkable person and the contribution she made to scholarship in the development of maritime archaeology in the eastern Mediterranean and beyond.

Honor Frost Under the Mediterranean

From maritime to nautical archaeology

*Patrice Pomey**

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In 1954, following a dive on an ancient wreck, Honor Frost began her long career as an underwater archaeologist devoted to Mediterranean maritime archaeology. Among her many activities, she was particularly interested in stone anchors of the Bronze Age, Phoenician harbours of the Near East, and ancient wrecks. Her excavation of the Punic wreck of Marsala was her major work. By linking anchors, ports, and ships in the same perspectives, she helped to define maritime archaeology as a true scientific discipline, in which the study of ships and naval archaeology occupy a privileged position. By adding methods based on precise mapping to the theoretical perspective, Frost was one of the founders of maritime archaeology, and her significant scientific work is of international renown.

Keywords: Underwater archaeology, maritime archaeology, ancient Mediterranean, anchors, harbours, wrecks.

Honor Frost was one of those exceptional characters whose strong personality and multiplicity of talents could fill several lifetimes. And if I evoke her role in the birth and development of Mediterranean maritime archaeology here, it should also be recalled that her work was not limited to this aspect, even if it occupied most of her life.

It is commonly known that Frost was born in Cyprus on 28 October, 1917. Her childhood is less familiar: it was spent between Cyprus, London, and her schooling in Lausanne in Switzerland, and was followed by studies at the Central School of Art in London and the Ruskin School of Art in Oxford.

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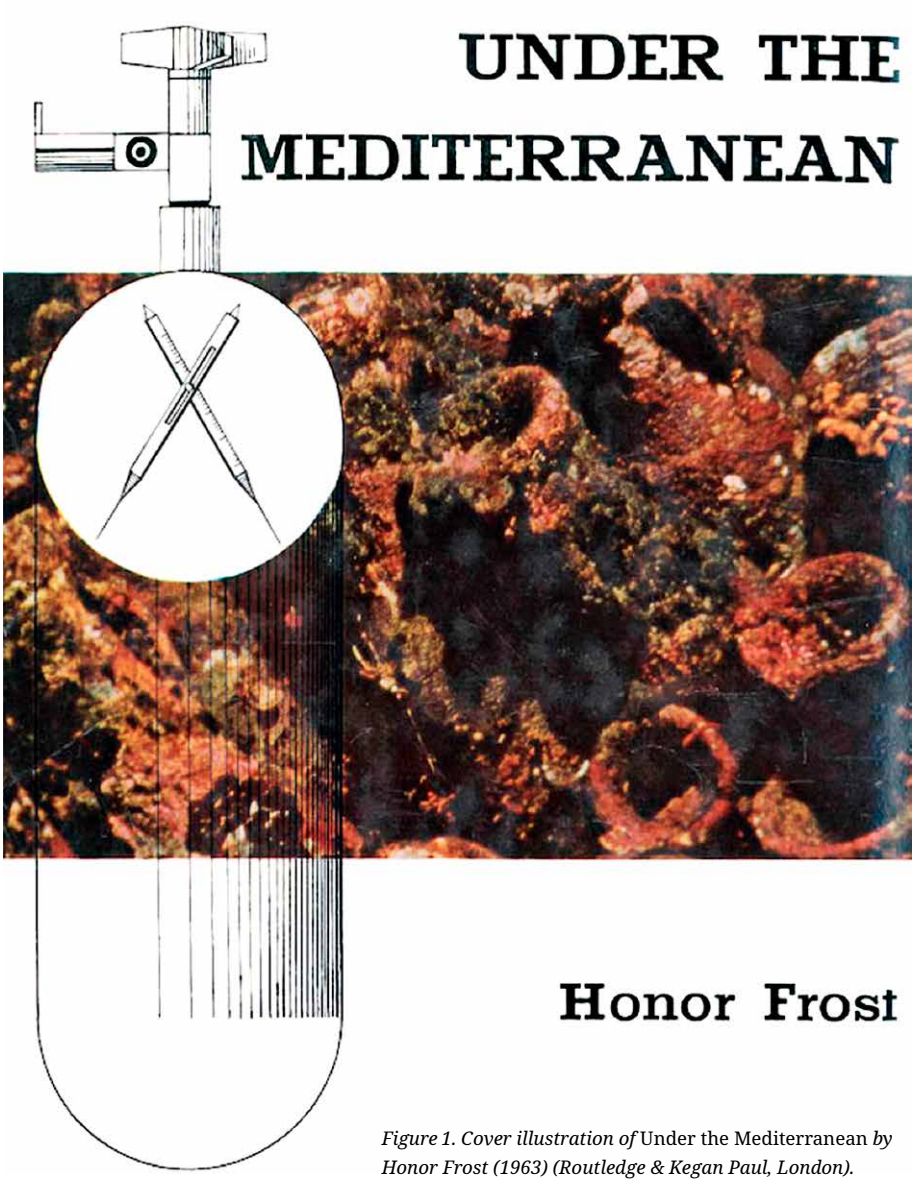


Figure 1. Cover illustration of Under the Mediterranean *by Honor Frost (1963) (Routledge & Kegan Paul, London).*

Sophie Basch (see Basch, this volume) has lifted a large part of the veil on Frost's early career – her first life – engaged in London's artistic circles of the immediate post-war period, in which she was able to express her talents for drawing, painting, and decorative arts. More particularly she worked as set and costume designer for the Sadler's Wells Theatre Ballet in collaboration with her friend, the choreographer Celia Franca.

In this chapter, I outline her second career – her second life – in underwater archaeology and the birth of maritime and nautical archaeology. The first pages of *Under the Mediterranean*, the book containing her founding thoughts (1963 a), open on the narrative of her initiation dive, when she discovered her fascination for being

Figure 2. Chrétienne A. View of the shipwreck. (Photo F. Dumas).

under water and the lure of a forbidden world (Fig. 1). This strange event occurred in a well at a friend's house in Wimbledon. It took place after a final rehearsal at the Mercury Theatre, as described by Frost in an interview with the BBC (Basch, this volume). The conjunction of these two events – her final rehearsal and her discovery of diving – has a strong symbolic value that emphasizes the upheaval that subsequently occurred in Frost's life. It was winter 1953 and she had just given up her brilliant artistic career as a ballet set-designer; an activity that revealed Frost's great sensibility, her vast culture, and the breadth of her talents. These are qualities and experiences that would preside over her future life as a diving archaeologist and explain her success in her future occupation.

But in 1953 it was not yet a question of archaeology, only of the discovery of a new, fascinating world. Shortly after that first dive, while recovering from illness on the French Riviera, she met Georges Barnier, a dive instructor at the Club Alpin Sous-Marin of Cannes. It was Barnier who taught her scuba diving with breathing equipment that Commander Jacques-Yves Cousteau and the engineer Emile Gagnan had developed a decade earlier. Barnier introduced her to the main underwater sites of the coast and, in 1954, Frost dived for the first time on an ancient wreck: the so-called Chrétienne A shipwreck, discovered in 1948 (Fig. 2). The shipwreck lies 20 m deep, at the foot of a beacon marking a reef located east of the Cap Dramont, off Anthéor in the region of Saint-Raphaël. It included a cargo of wine amphorae from Campania in southern Italy, closed by pozzolana stoppers and marked in Oscan writing with the name *Lassii*, which dated the wreck to *c.*75 BC. This shipwreck was investigated by Frédéric Dumas in a study that long served as the model and reference for future nautical archaeologists. The Chrétienne A is counted among the first ancient wrecks to be discovered by divers and

became one of the most famous sites on the French coast. The site, with a sandy valley in the middle of a field of Posidonia grass and delimited by reefs, has an undeniable charm – as I can personally attest, having dived there with Dumas 15 years later.

Obviously, the site made a marked impression on Frost. During this dive Barnier identified, uncovered, and retrieved a lead stock belonging to one of the ship's anchors. Thus, during a single dive, Frost encountered an ancient shipwreck and an ancient anchor for the first time: she found herself confronted with the two subjects of study that would occupy most of the rest of her life. Writing in *Under the Mediterranean* she later stated: 'After Anthéor, some form of diving became a necessary part of my life' (Frost, 1963 a: 29). It was also on this dive that Frost met Dumas for the first time: he was one of the most famous divers of the time and a close colleague of Commander Cousteau, and was subsequently to play an important role in her reflections on underwater archaeology and the excavation of wrecks.

After the discovery of the underwater world and of ancient wrecks, there remains one final founding element that would define the direction of her new life. It came three years later in 1957, when she participated in the last campaign of the famous excavations of Jericho, in Palestine, led by Kathleen Kenyon on behalf of the British School of Archaeology in Jerusalem. Her artistic talents enabled her to be taken on as a draughtsman and she was responsible for mapping and recording the rock tombs of the necropolis dating to the end of the Early Bronze Age. As a student of Mortimer Wheeler, Kenyon practised an archaeology of great methodological rigour, from which Frost reaped maximum benefit. The rock tombs reminded her of wrecks: she was struck by the analogy between tombs and wrecks as closed and homogeneous contexts in which the contents and the container are synchronous. She wrote: 'Both are instances of closed groups, or objects which were sealed off at a given date and preserved by chance for posterity' (Frost, 1963 a: 32). As a result of meticulously recording the tombs, the task of which she was in charge, she would then apply the same rigour to subsequently recording ancient wrecks. It became her creed. Pushing the comparison even further, she considered the essential contribution of tomb studies and wondered what else it might contribute to the study of wrecks. The answer came gradually: Economic History first; the study of wrecks and of their distribution would by necessity be extended to take account of the ports and the mooring sites where anchors were lost. But, she noted, there are also anchors on land as objects of worship, and therefore their context should also be considered.

Thus, all the elements of the puzzle were gathered to form the basis of Frost's future scientific approach and to definitively orientate her research. The object would be the maritime world. Its study would be based on wrecks, harbours, moorings, and anchors; and all would be subjected to the most accurate mapping and recording.

So, to the revelations of Anthéor and the Chrétienne A wreck must be added the lessons of Jericho, what Frost called her 'road to Damascus' (Frost, 1963 a: 29) or 'her conversion' (Frost, 1963 a: 34). By bringing these dual experiences together in the same methodological approach she articulated an initial attempt at including the various aspects of underwater archaeological research in the same disciplinary field; a field that would come to be known as 'maritime archaeology', in line with the concepts that would eventually be set out by Keith Muckelroy in his 1978 publication of that title. In 1963, a few years after the excavations of Jericho but 15 years before Muckelroy's book appeared, Frost published a

Figure 3. Honor Frost with a stone anchor. (© Honor Frost Archives).

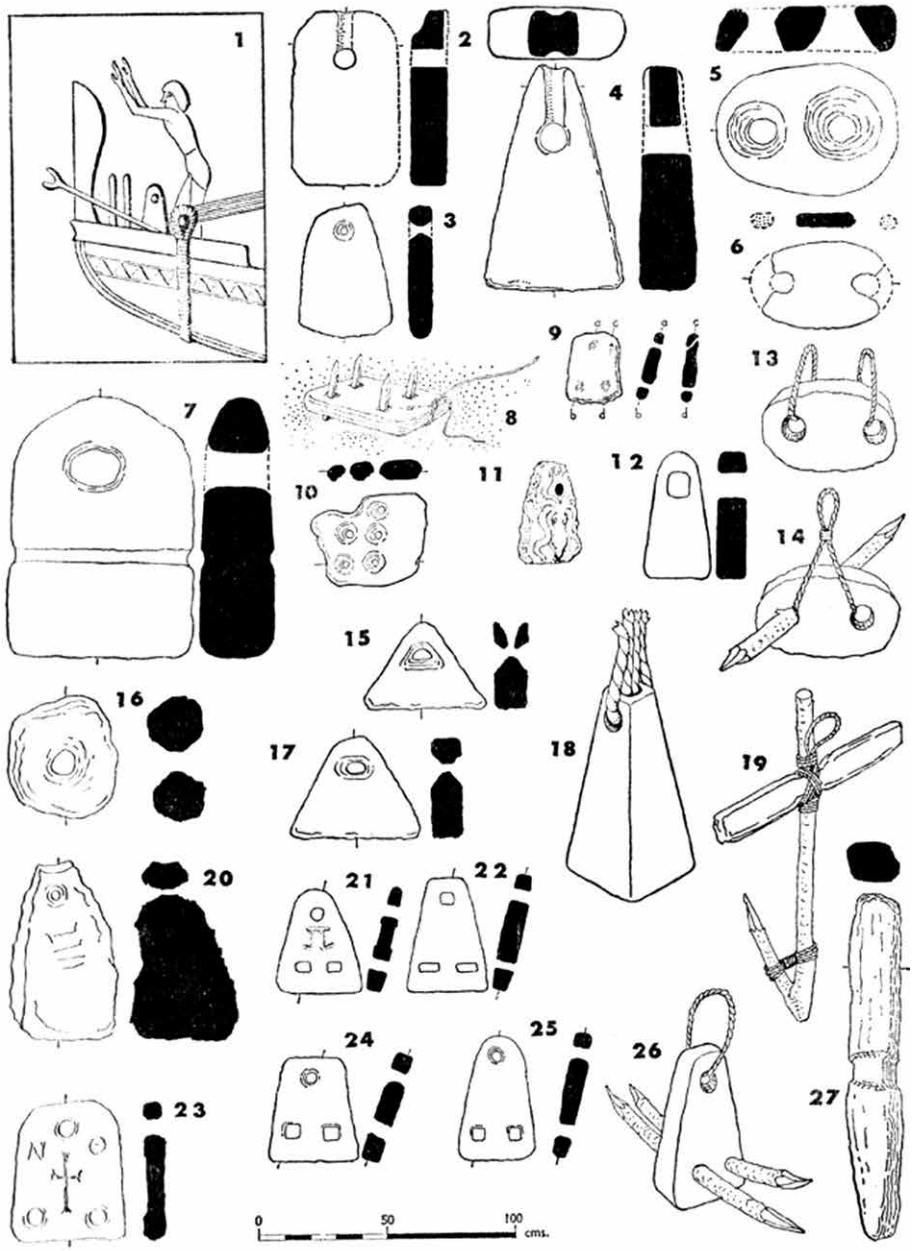
Figure 4. Byblos, Temple of the Obelisks. Votive stone anchors. (Photo H. Frost).

memoir recounting a decade of diving, titled *Under the Mediterranean* (Frost, 1963 a). The book was one of the first works on underwater archaeology. She shared her experiences and formalized her thinking in one of the first methodological and theoretical approaches to the new discipline of maritime archaeology.

Frost's experiences in Jericho were also a return to the Middle East and, as such, a true return to her roots. After the excavation, she travelled to Lebanon and visited the ancient port of Tyre, where she was struck by the quantity of stone anchors that dotted the site. She also realized that it is easier to study anchors and ports than wrecks, which require more considerable means and specialized knowledge. She therefore embarked on the two themes of study that would occupy a privileged place in her research until the last days of her life.

Her activity on the coasts of Lebanon and Syria was unflagging. During her dives in Tyre and Tabarja, she noticed that the many stone anchors that littered the seafloor belonged to different types. She then became aware that the anchors constituted a relevant marker for the existence of a port or anchorage, and that their typological diversity was related to the vessel itself, its nature, and tonnage (Fig. 3). By questioning, while waiting to dive, the sponge fishermen with whom she shared life aboard their boats – which at the time was quite unusual for a woman, especially in the Middle East – she began to appreciate how the anchors functioned: the round anchors with a single drilled hole were used for rocky bottoms whereas the triangular anchors, smaller and flat, and pierced by several holes, were used on sandy bottoms.

The study of stone anchors, in particular those dated to the Bronze Age, a period for which she became an undisputed specialist, then became the guiding thread that drew her for the rest of her life to the maritime activity of the Phoenician coast. Her profound knowledge of these objects led her to identify for the first time the votive anchors at the Temple of the Obelisks at Byblos and to be interested as much in the anchors found at sea as in the votive anchors deposited ashore (Fig. 4). As a result, she began to compile a typology of these objects, which were more and more frequently found in the Mediterranean and in many sanctuaries, in particular in Ugarit in Syria



Figs. 1–27. (For legends, see p. 6.)

Figure 5. Different sorts of stone anchors. (Drawing H. Frost, 1963 b: 4, figs 1-27).

and in Kition in Cyprus. Subsequently, she became interested in all ancient anchors whatever their type, whether with stone stocks or lead stocks, made of wood or iron. In 1963 she published in the *Mariner's Mirror* 'From Rope to Chain. On the development

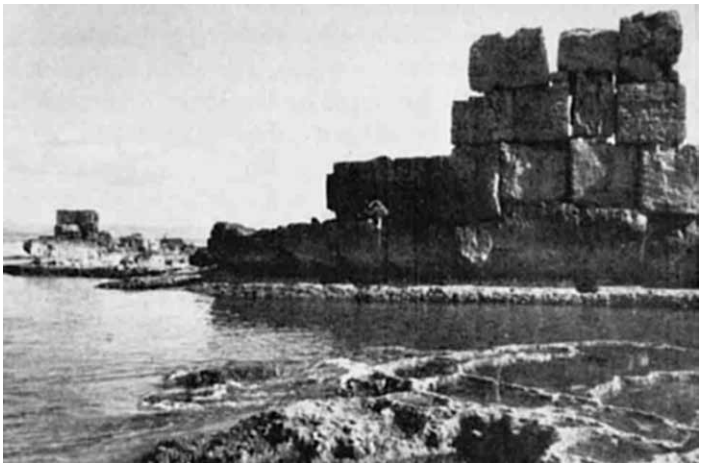


Figure 6. Honor Frost in Arwad, Syria (c.1970). (© Honor Frost Archives).

Figure 7. Arwad. View of the ancient harbour. (Photo H. Frost).

Figure 8. Malia, Crete. Honor Frost in the ancient Minoan harbour (1960). (Photo F. Dumas).

of anchors in the Mediterranean' (Frost, 1963 b), which can be considered her seminal article on the subject (Fig. 5).

Due to this interest, between 1980 and 1990 she contributed, with the assistance of nautical historian Lucien Basch (1985), to the debate surrounding the nature of Egyptian stone anchors. According to Egyptologist Alessandra Nibbi, these anchors, including those discovered in maritime contexts in Alexandria and in Mersa Gawasis, were only used on the Nile (Nibbi, 1984; 1992). In contrast, Frost considered that they were also associated with maritime navigation and published her findings in a series of articles in the *Mariner's Mirror* (Frost, 1964; 1979; 1985). The recent discoveries of ship remains at Ayn Soukhna (Pomey, 2012) and Wadi Gawasis associated with such anchors (Zazzaro & Abd el-Maguid, 2012), along with the hundreds of stone anchors found today in the port of Khufu at Wadi el-Jarf (Tallet, 2015), put a final end to the controversy by giving credibility – once again – to Frost and her reasoned argument.

In her mind, the study of anchors was directly linked to that of harbours and moorings. In liaison with the French Institute of Archaeology of Beirut, led by Henri Seyrig, and the Archaeological Museum, led by the Emir Chehab, and with the Department of Antiquities of Syria, Frost went on to lead, in the footsteps of Père Antoine Poidebard, from 1957, then regularly from 1963 to 1968, the exploration and underwater study of the Phoenician harbours of Tyre and Sidon in Lebanon, and Tabbat al-Hamman and Arwad (Ruad) in Syria (Figs 6-7). Subsequently, the same interest brought her to the Minoan ports of Mochlos and Malia in Crete (Fig. 8), and of the Mycenaean port of Asine.

The results obtained had a great impact on harbour archaeology research. First methodologically, by showing that a multi-disciplinary technical approach, as recommended by Poidebard (1939), combining surface observations, aerial photographs, and underwater surveys, to which Frost added the use of marine geology, made it possible to achieve significant results (see Carayon, this volume). Next, on the historical level, she demonstrated the importance of Bronze Age harbours and highlighted their formation from pre-existing islets, according to a theory that has since been unanimously adopted. Finally, on the maritime level, she linked these harbours with the development of maritime trade by questioning their relationship with ships; their tonnage, routes, and anchorages. The methodological aspect of this work was published in 1969 in *Surveying in Archaeology Underwater* (Frost, 1969 b). The results of her experiences were the subject of a chapter entirely dedicated to 'Ancient harbours and anchorages in the eastern Mediterranean' written by Frost and published in *Underwater Archaeology: A Nascent Discipline* published by UNESCO in Paris in 1973 (Frost, 1973). Frost's name will always be remembered for these early works, which revealed to the scientific world the importance of her research on the ports and harbours of the Bronze Age of the Levantine coast. In 1998, on the occasion of the re-opening of the National Museum of Beirut and the classification of Byblos as a world heritage site by UNESCO, she wrote for the commemorative book an article that summarized her work and also opened new perspectives of research (Frost, 2004) (see Francis-Allouche & Grimal, this volume). During the last TROPIS meeting, held at Hydra in 2008, but as yet unpublished, she gave her last presentation on anchors, again highlighting their relationship with the tonnage of ships (see Tzalas, this volume). In 2011 she was considering returning to the shores of Lebanon to continue her studies, and was planning to participate at the international

Figure 9. Honor Frost in Alexandria watching the salvage of elements from the Pharos (1995). (Photo A. Pelle, © CEAlex/CNRS).

conference, 'Gujarat and the Sea', in India, to present another paper on the anchors and harbours of the Mediterranean Bronze Age. Only fate prevented her.

Her scientific reputation was widely established in 1968, when UNESCO, at the request of the Egyptian government, entrusted to Frost a mission to explore and study the port of Alexandria. Frost, having been very attached to the city of Alexandria since her early childhood, accepted the mission with enthusiasm and left forthwith for Egypt. She led her project with the help of an Egyptian diver, Kamel Abul-Saadat, who had drawn the authorities' attention to the presence of important remains at the entrance to the port of Alexandria, of which a colossal statue of Isis was subsequently retrieved. In 1995, Jean-Yves Empereur, in turn alerted by new threats to the site, began, with the Centre d'Études Alexandrines (CEAlex), a systematic study of the site and recognized the remains of the lighthouse. Naturally, he invited Frost to return to the site to enjoy the experience (Fig. 9). He noted with admiration the extraordinary accuracy of the mapping carried out 17 years earlier by Frost, despite the rudimentary means that she had at the time to undertake this survey (see Empereur and Hairy, this volume). The following year, diving in my turn on the remains of the lighthouse in Frost's company, I was struck by the ease with which, despite the poor visibility, she guided me in the maze of accumulated blocks as if she had never left the site.

While the study of anchors and ports largely occupied her intellect during the early years of her maritime archaeological career, Frost was yet to develop a third field of activity: the study of shipwrecks. These last, since diving at Anthéor on the

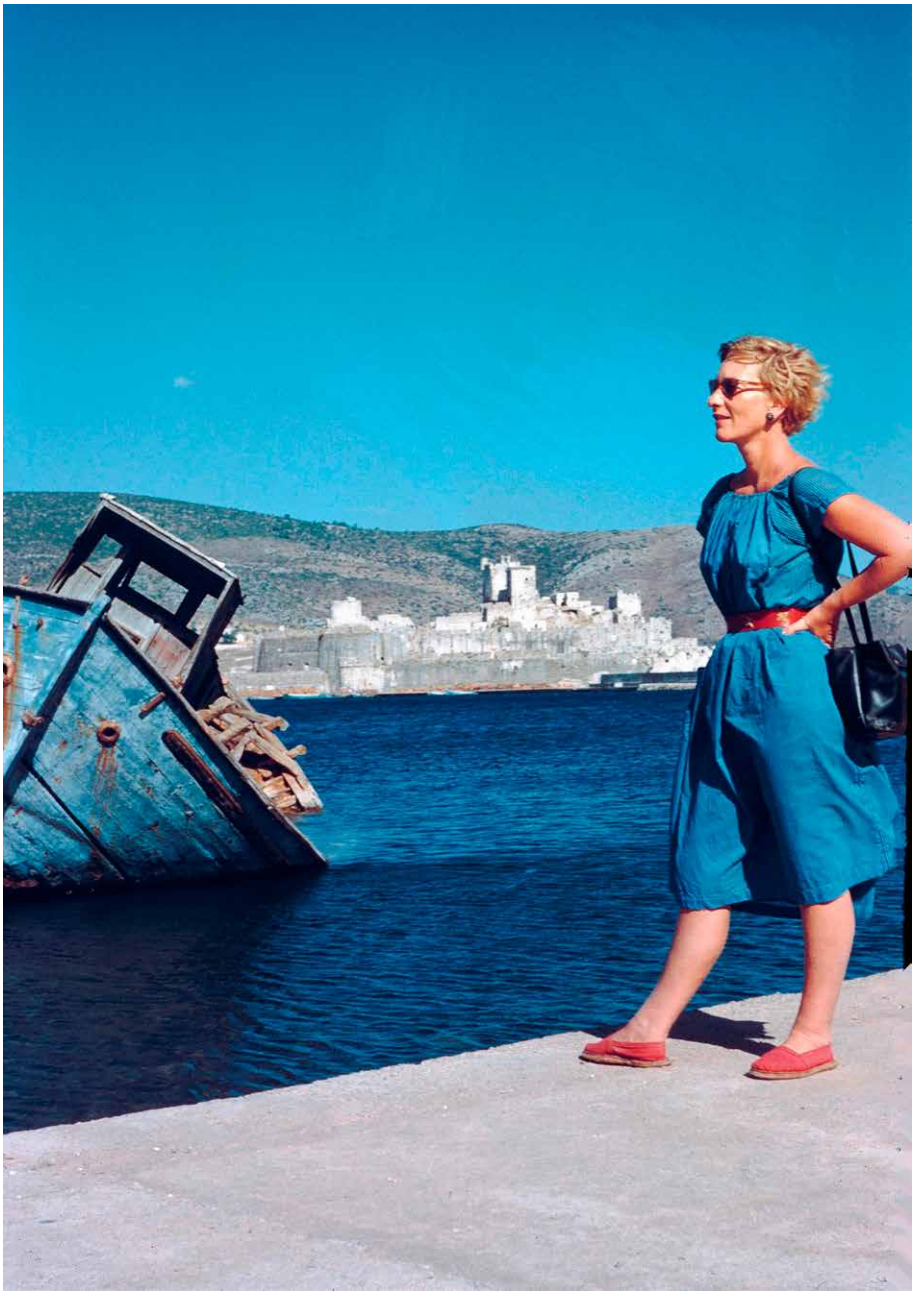


Figure 10. Honor Frost in Bodrum (1958-1960). (Photo P. Throckmorton, © INA).

wreck of the Chrétienne A, were never out of her mind, but she felt it was important to have acquired enough experience in the underwater world before tackling this, the third pillar of maritime archaeology that was indispensable to definitively establish the nascent discipline.

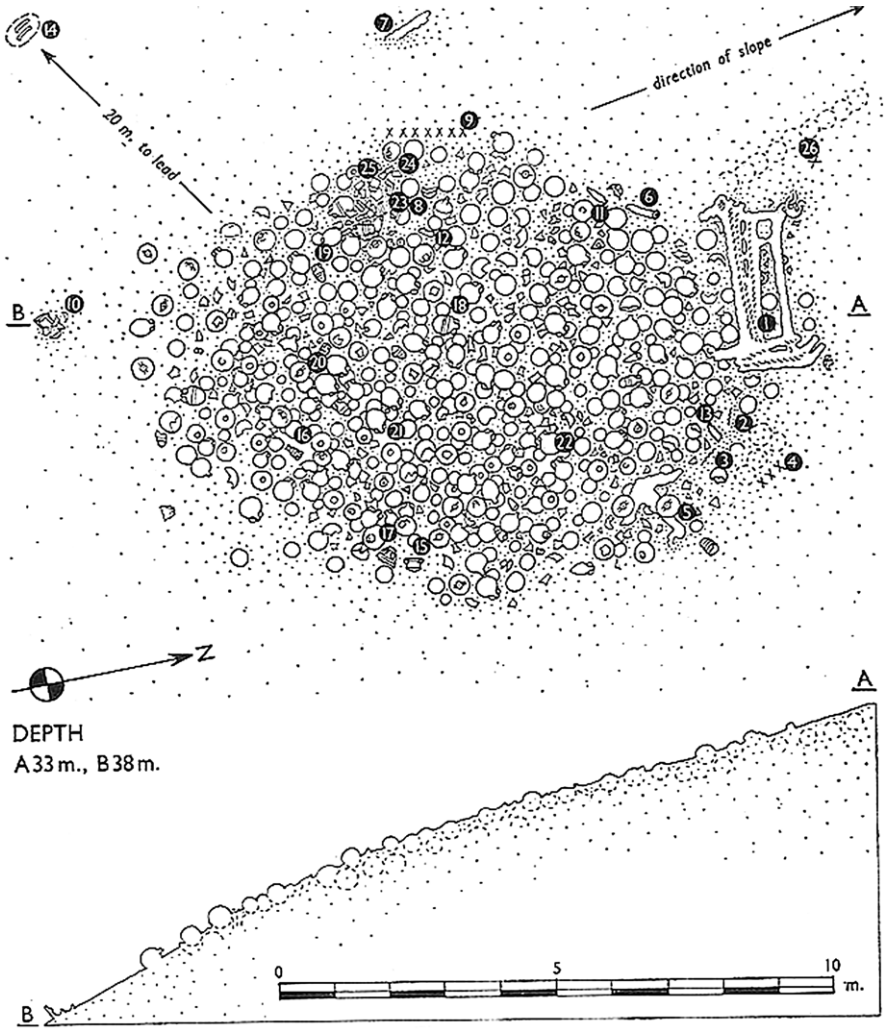


Figure 11. Yassi Ada Byzantine wreck. Overall map and section drawing by H. Frost (1958). (From Frost, 1963 a: 166, fig. 33).

After hearing that Bodrum, ancient Halicarnassus, was an important centre for sponge fishermen where an ancient bronze bust of the goddess Demeter had been recovered, she had visited there as early as 1958 (Fig. 10). In Bodrum she met photographer-diver Mustapha Kapkin and his friend Captain Kemal Aras, who owned a sponge-fishing boat. The latter introduced her to an American journalist-photographer who was also interested in shipwrecks, Peter Throckmorton. Embarking on Captain Aras' boat they went to the islet of Yassi Ada where they dived on several shipwreck sites, including the famous Byzantine wreck that was subsequently excavated between 1961 and 1964 by George Bass. In 1958, Frost made the first overall map of the wreck, under the title 'Karabagla Island Wreck' or 'Globe Wreck' and drew several of its objects and amphorae (Fig. 11). The experience was stimulating and the following year, in 1959, Frost returned to Bodrum. She found her

Figure 12. Honor Frost in her flat at Welbeck Street, London (winter 1959-1960). (Photo F. Dumas, © Honor Frost Archives).

friends Kapkin and Aras, who showed her several objects, including copper ingots from a wreck lying off Cape Gelidonya. While drawing these objects, she realized that they dated to the Bronze Age.

Back in Europe, Frost was contacted by Dumas who, having seen her report and drawings, invited her to his home in Sanary, near Toulon. In return, she invited him to spend the end of 1959 and the beginning of 1960 in London at her house on Welbeck Street (Fig. 12). It was the beginning of a profound friendship based on a shared passion for scuba diving and a shared interest in ancient wrecks. The exchange was fruitful. Dumas brought to Frost his deep knowledge of the underwater world and wrecks, for which he theorized formation processes and developed some excavation methodologies. Frost impressed him with her qualities as an illustrator, her ability to perform underwater surveys, her great historical culture and the overall vision of underwater archaeology that she brought to serve maritime archaeology. In March 1960 in Barcelona, they both participated in the 1st Congress of the World Confederation of Underwater Activities (CMAS) and in the work of the archaeological commission of this new confederation (Fig. 13). The Congress was published under the title: *Le Plongeur et l'Archéologue* (The Diver and the Archaeologist) and Frost contributed a long paper in French entitled: 'Comment faire des relevés élémentaires pour décrire une épave aux archéologues' ('How to make elementary mappings to describe a wreck to the archaeologist') illustrated by a theoretical wreck plan very similar to the map of the Yassi Ada Byzantine wreck (Frost, 1960).

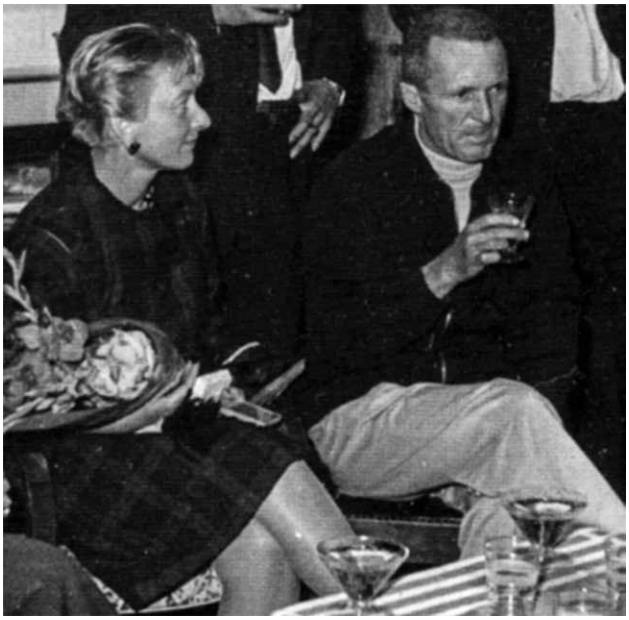


Figure 13. Honor Frost and Frédéric Dumas at the 1st Congress of the World Confederation of Underwater Activities (CMAS) in Barcelona (March 1960) (© Frédéric Dumas Archives).

In the meantime, Throckmorton contacted Professor Rodney Young, a specialist in Anatolian archaeology at the University of Pennsylvania museum, asking if he would be interested in the excavation of the Cape Gelidonya wreck. Young entrusted the project to one of his young PhD students, George Bass, who learned to dive for the purpose. In the summer of 1960, excavation of the wreck began under his direction. In addition to Bass and Throckmorton, the international team assembled comprised Dumas who, because of his fame, was asked to be chief diver on the expedition, Joan du Plat Taylor, librarian at the University Institute of Archaeology of London, Claude Duthuit, a French diver friend of Throckmorton and, of course, Frost. She was particularly responsible for ensuring mapping and recording of the wreck and drawing the artefacts. At the beginning of May 1960, Frost and Dumas travelled to Turkey – via Italy and Greece as the excavation was momentarily held up due to a delay in obtaining the administrative permit. They went to Rome and Athens, where they visited the archaeological museum to see the marbles from the Antikythera wreck, then visited Crete and the great Minoan sites. Finally, at the end of May, they met up with Joan du Plat Taylor in Athens and, the permit having been finally signed, embarked for Bodrum (Fig. 14) and Cape Gelidonya. The installation of a secluded beach camp at the foot of the cliffs was rudimentary (Figs 15-16). And the working conditions on a fully concreted wreck, lying at a depth of between 26 and 28 m, were difficult. But the wreck proved to be that of a Bronze Age ship of the late 13th century BC, carrying a cargo of copper and tin ingots and bronze objects. The heavily concreted cargo was removed in separated blocks, which were then reassembled ashore to be thoroughly excavated (Bass, 1967). The excavation was a double landmark: on the one hand, it was the first rigorous recovery of an entire cargo constituting the whole of the deposit; and on the other, it was the first excavation led by an archaeologist-diver.

The following year, Dumas returned to the Chrétienne A wreck and discovered with sadness that the site had been regularly plundered. The hull, and in particular

Figure 14. Bodrum: From left to right: Captain Kemal Aras, Honor Frost, and Joan du Plat Taylor (1960). (Photo F. Dumas).

Figure 15. Cape Gelidonya. From left to right: Peter Dorrell, George Bass, Peter Throckmorton, and Honor Frost working on the maps of the wreck. (P. Throckmorton collection, © INA).

Figure 16. Cape Gelidonya. Honor Frost working on drawings of the wreck. (Photo P. Throckmorton, © INA).

the keelson-mast-step, had been uncovered by the anarchic removal of many of the amphorae. He decided to resume the study of the wreck with particular interest in the hull-remains of the vessel. The result of his study and the fruit of his experience of ancient wrecks were then published under the title *Épaves Antiques* (Dumas, 1964), which, together with Frost's contemporary *Under the Mediterranean,* is one of the founding books of underwater archaeology at the service of the study of ancient wrecks. Between the summer and the autumn of 1961, Frost travelled to Anthéor to assist Dumas, and undertook drawings in plan and cross-section of areas of the hull, the ceiling planks, frames, and planking (Fig. 17). The same year, still alongside Dumas, she dived on a wreck discovered near the Chrétienne A and undertook the first mapping of this site (Fig. 18). It was a medieval wreck dated to the late 15th or early 16th century AD, which was then called the Barbarossa wreck. The 'Committee Barbarossa' was formed at a meeting in Anthéor, intent on promoting its excavation. It included those who had discovered the wreck, Jack and Jane Issaverdens, and Dumas, Frost, Michel Mollat du Jourdin, professor of maritime history at the Sorbonne, and Paul Adam, secretary of the International Maritime History Commission (Machu, 2017: 358-359). However, the project failed to progress and was finally abandoned. This close collaboration between Frost and Dumas is found in the last part of *Under the Mediterranean* that is devoted to wrecks, in which she refers extensively to Dumas' work, especially on the famous Grand Congloué wreck, where she dived and made drawings in 1960 (Fig. 19), and on the Chrétienne A. Furthermore, she also translated Dumas' *Épaves Antiques* into English under the title *'Deep Water Archaeology'* (Frost, 1962).

In 1967, at the request of the National Museum of Malta, Frost travelled to the island to carry out soundings and mapping on an ancient wreck located on the north-east coast

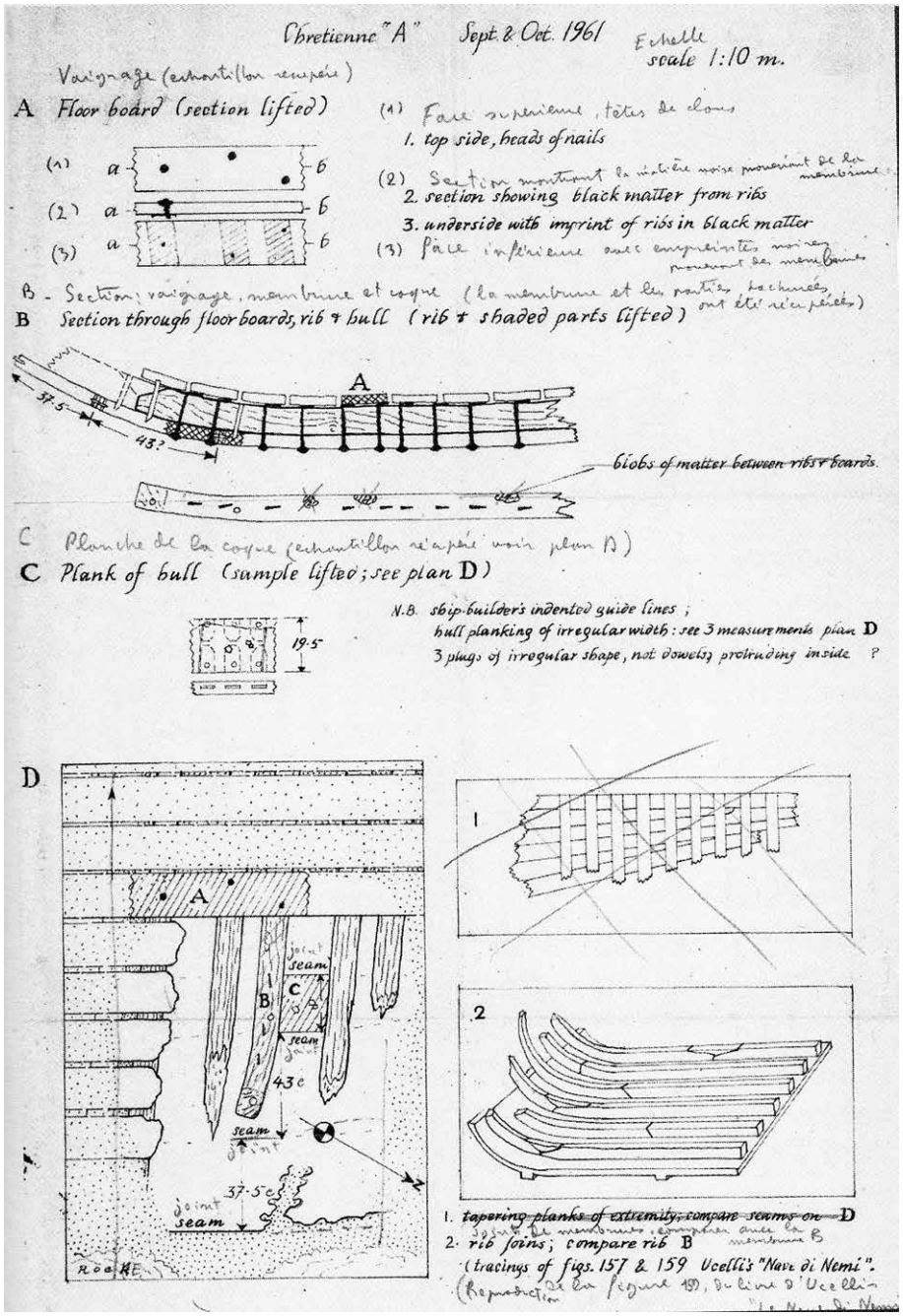


Figure 17. Chrétienne A. Drawings and recordings of detail of the wreck by Honor Frost. French translations of the annotations by Frédéric Dumas. (Drawing H. Frost, Frédéric Dumas Archives).

at Mellieha Bay. This bay was located at the point where, according to legend, Saint Paul was shipwrecked during his trip from Caesarea to Rome in AD 60. But the wreck is later, dating from the 3rd century AD, and it included, in particular, alongside a load of amphorae, a cargo of mortars from Italy that gave their name to the wreck, baptized

Figure 18. Barbarossa wreck. Honor Frost drawing and mapping the site. (Photo F. Dumas).

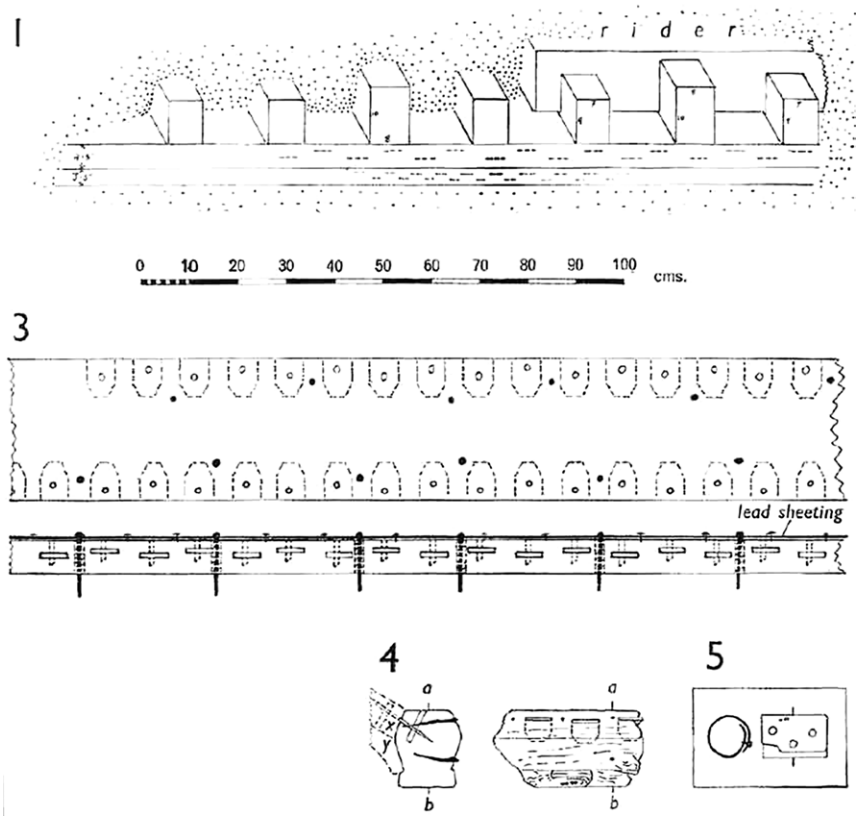


Figure 19. Grand Congloué wreck. Detailed drawing of wood elements from the hull. (Drawing H. Frost, 1963 a: 244, fig. 48).

Figure 20. Honor Frost in Malta, on the terrace of her house in Senglea with Valetta behind. (© Honor Frost Archives).

by Frost in her publication of 1969: *The Mortar Wreck* (Frost, 1969 a). She found the cabin area with the onboard equipment and she noted balls of Egyptian blue on a wreck for the first time. Since then, such dyes have been found on several wrecks, notably Planier III, where they were part of the cargo, and Madrague de Giens (Tchernia, 1969; Tchernia *et al.*, 1978), where they were stored for onboard repairs. It is probably from this visit that Frost's passion for the island of Malta began. Shortly after, she acquired a house across the bay from Valletta, in Senglea, which she visited regularly and made, according to *IJNA* book review editor and science writer Angela Croome, 'her Mediterranean headquarters' (Croome, 2014) (Fig. 20).

The excavation of the Punic wrecks of Marsala, Sicily, was the greatest venture of Frost's life and remains a major contribution to underwater and, more particularly, nautical archaeology. In 1969, as a result of dredging works modifying the balance of the sandy seafloor, the remains of wrecks were brought to light off Mothya, at a depth of 2-6 m (see Alagna, this volume). Alerted to events, Frost visited the site and, once again, she immediately grasped its importance. After a preliminary campaign in 1970, research was entrusted to Frost on behalf of the British School of Rome. From 1971 to 1974, she directed the complete excavation of the main wreck, of which only the aft part is preserved, 10 m in length and 3 m in width (Fig. 21).

In 1973, a second wreck was found in the immediate vicinity of the first. Corresponding to the bow area, the second wreck, called the 'Sister Ship', was excavated during the final campaign in 1974. Once again, Frost demonstrated the full extent of her talents by conducting a thorough survey accompanied by high-precision recording with only a small team. While the study of the hull-remains and its construction were

Figure 21. Marsala, Punic Ship. Diver recording frames during the 1972 excavation campaign. (Photo H. Frost).

Figure 22. Marsala, Punic Ship. Punic marks painted on the keel. (Photo and drawing H. Frost, Frost et al. 1981: 232, fig. 146).

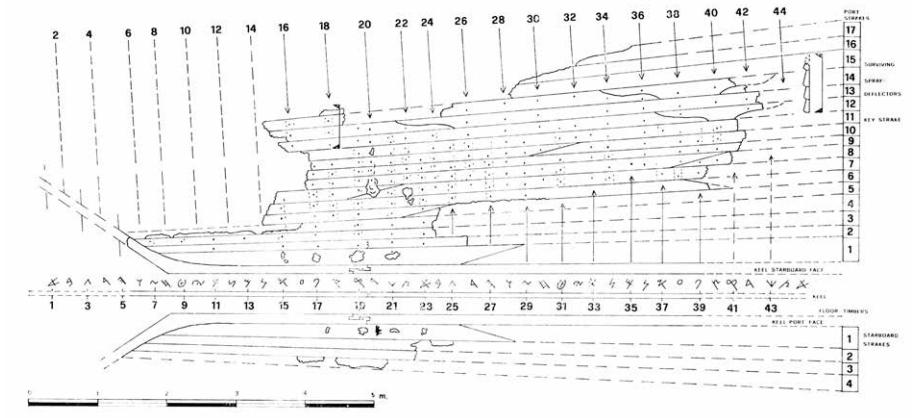


Figure 23. Marsala, Punic Ship. Hull plan with the distribution of the Punic marks. (Drawing H. Frost, Frost et al. 1981: 196, fig. 113).

her primary interest, she nevertheless attached great importance to all the details and objects that could provide information about life on board (for example, a broom and a basket containing cannabis), the origin, and the date of the wreck. But above all, her acute observational skills enabled her to discover construction marks painted on the hull – something that had never been seen before and that remains unique for this period to this day. She thus distinguished epigraphical marks and traces of painted marks that correspond to the construction phases of the vessel and, above all, marks made by the shipwrights using letters of the Punic alphabet (Figs 22-24). The semantic study of these marks, entrusted to Professor William Johnstone of the University of Aberdeen, in combination with Frost's observations on their distribution within the hull, allowed her to form the totally original hypothesis of a form of prefabricated vessel using partially pre-assembled hull elements. The reconstruction of the hull lines – that was the

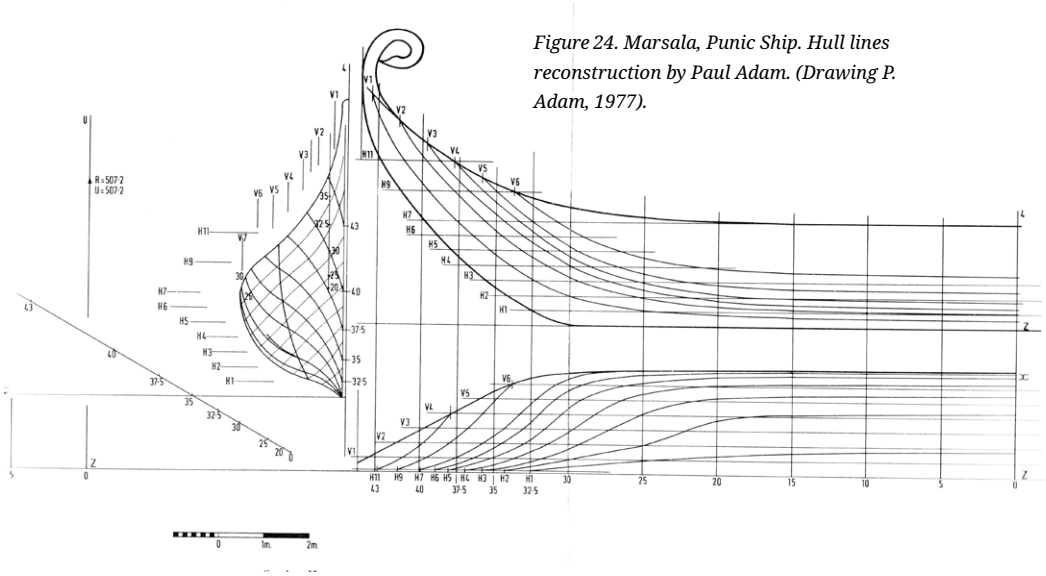


Figure 24. Marsala, Punic Ship. Hull lines reconstruction by Paul Adam. (Drawing P. Adam, 1977).

precursor to the current digital restitution process – was initially entrusted to her friend Paul Adam (Adam, 1977; Fig. 24) and then to the naval architect Austin Farrar, and led to the reconstruction of a long battleship, with the 'Sister Ship' providing an example of the unusual ram system. The ships are clearly Punic, as indicated by the construction marks, and their dating around the middle of the 3rd century BC suggests that they sank during the naval battle of the Egadi Islands, which pitted the Carthaginians against the Romans in 241 BC during the First Punic War. However, Frost had to face a new controversy again echoed in her articles published in the *Mariner's Mirror* (Frost, 1975, 1981). Because the hull of the Punic vessel was encased in lead sheathing, classicist and maritime historian Lionel Casson contested its interpretation as a war vessel (Casson, 1978). Basch argued her side, demonstrating that her interpretation was not incompatible with the evidence presented (Basch, 1979).

But another much more difficult battle awaited Frost concerning, this time, the second life of the boat as a museum artefact and its conservation for presentation to the public. From the end of the excavation in 1974 until 1978, the timbers of the carefully dismantled wreck were subject to conservation treatment thanks to the effective assistance of Dr Pietro Alagna, who lent his facilities for the process (see Alagna, this volume) (Fig. 25). Then, from 1979 to 1980, the hull was reassembled in a space assigned to its exhibition, the Baglio Anselmi. Unfortunately, the building required extensive repairs that were continually delayed, to the detriment of the ship, which was left in a precarious situation (Fig. 26). Frost's final publication of the wreck, in 1981, in the *Notizie degli Scavi di Antichità* (vol. 30, 1976) of the Accademia Nazionale dei Lincei, did nothing to change the situation (Frost *et al.*, 1981). At the end of the 1980s, several petitions signed by members of the international community of nautical archaeologists were followed by an assessment mission entrusted to Ole Crumlin-Pedersen and Kirsten Jespersen – experts recognized for their work with conservation and presentation of the Viking ships at the Roskilde Museum in Denmark – relaunched the conservation and restoration project. Unfortunately, the funds allocated for this purpose by the parliament of Sicily were withdrawn in 1995. After several years of exemplary excavation and 20 years of fighting to ensure the conservation

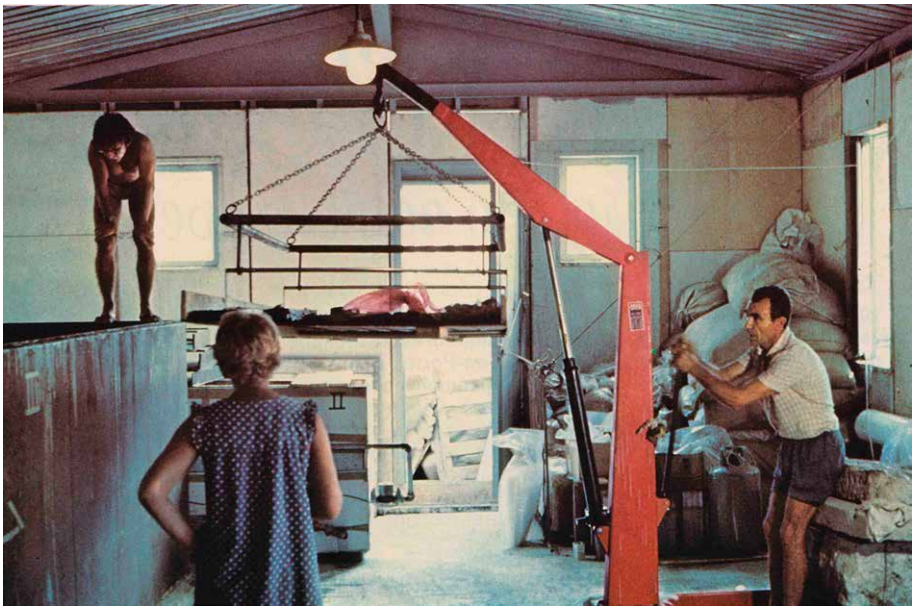


Figure 25. Marsala, Punic Ship. Conservation treatment of the wood of the hull by Honor Frost (back) with the assistance of Dr Pietro Alagna. (© Honor Frost Archives).

Figure 26. Marsala, Punic Ship. Honor Frost and Lucien Basch under the reassembled hull. (© Honor Frost Archives).

and presentation of the wreck, in 1997 Frost published 'The Marsala Punic Ship: An Obituary' in the *Mariner's Mirror* (Frost, 1997).

Fortunately, the announcement of the second demise of the boat was premature. A new mission by Crumlin-Pedersen along with Giulia Boetto, who was then a nautical archaeologist at the Centre Camille Jullian, reopened the project for a second time. Despite divergent opinions on the proposed solutions, the restoration and presentation work were eventually completed. Thus today, after a long battle that testifies to Frost's will and strength of character in what was an exemplary but most difficult enterprise, it is possible to admire the restored wreck of the '*nave Punica*', a vessel that remains unique and exceptional, in the superb buildings of Baglio Anselmi (see Giglio, this volume).

Despite limited technical means, the excavation of the Marsala wreck was exemplary and remains a model. It testifies not only to Frost's personal qualities in her mastery of drawing and her skills of observation, but it also expresses the sum of the accumulated experiences gained throughout her career, from recording the tombs of Jericho to mapping many wrecks. While Frost was a practitioner producing precise measurements on the ground, she was also a theorist who was able to conceptualize her experiences and transform them in a methodological reflection of her discipline. Her article 'When is a wreck not a wreck?' introducing the series 'Mediterranean Hull Types Compared', published in 1976 in the *International Journal of Nautical Archaeology*, is another significant example (Frost, 1976). Beyond the limits of underwater archaeology – which is merely a technique of investigation applied to the particular underwater field – Frost, from the outset, placed her research in the general context of a true historical approach. By associating within the same research the study of anchors, ports and harbours, and wrecks with their cargo and the remains of their hulls, without excluding the use of iconographical and textual data, and by seeking to establish the links between these different elements, the whole of human activities at sea became her subject. That is to say, the very definition of maritime archaeology as it was to be formulated in 1978 by Muckelroy. But within this field of research, the study of wrecks always occupied a special place in Frost's work, of which the Marsala wreck is the most accomplished example. Thus, having made a major contribution to the creation of maritime archaeology as a specific field of research, Frost also established nautical archaeology as a full-fledged discipline within maritime archaeology.

Despite not having an academic background, Frost did not neglect the institutions and publication. With her friend Joan du Plat Taylor, she participated in the creation of the Council for Nautical Archaeology in Britain in 1964 and of the *International Journal of Nautical Archaeology and Underwater Exploration* (*IJNA*) in 1972. In addition to the works already cited, she published regularly in numerous scientific journals, but chose particularly the *Mariner's Mirror* and the *IJNA*. Widely recognized and appreciated by the scientific community, she was invited to numerous international conferences, where she had many friends. She participated very regularly in the 'International Symposium on Boat and Ship Archaeology' (ISBSA), and 'TROPIS International Symposium on Ship Construction in Antiquity', organized by her friend Harry Tzalas for the development of nautical archaeology in the Mediterranean (Fig. 27) (see Tzalas, this volume). Her pioneering work and the quality of her scientific endeavours earned her many distinctions. She was a member of the Society for Nautical Research and a fellow of the Society of Antiquaries, and a Golden Trident member of the International Academy of

Figure 27. Athens. From left to right: Patrice Pomey, Honor Frost, and Lucien Basch at TROPIS IV (1991). (Photo E. Linder).

Underwater Sciences and Techniques of Ustica (Sicily). She was also distinguished by the French government for her work at Alexandria and, in 1999, she received from Tzalas the 'TROPIS Award' on the occasion of the seventh symposium, held in Pylos, Greece.

Through her considerable work, Frost also leaves behind the memory of an endearing personality endowed with a strong and independent spirit and an uncompromising will. Her resolve was primarily expressed physically. Tireless, Frost did not recoil before any effort and was often difficult to keep up with. In 1993, at the TROPIS V symposium of Nauplia, she wanted to dive on the Bronze Age shipwreck of Point Iria despite having recently undergone a double hip operation. Unable to put on the heavy tanks on shore, she asked me to help her to put her scuba diving bottles in the water before accompanying her to the site, which I did with some anxiety caused by the 30-m-deep dive. And all the participants of the TROPIS X symposium, in 2008, remember Frost confronting the steep alleys of Hydra with determination despite real difficulties. Her morale stayed strong. Without this energy, the wreck of Marsala would never have survived. Her strong and independent spirit and her free thinking relieved her of preconceived ideas, and allowed her to suggest the most original proposals – their originality was evident from the polemics to which she was subjected. From the outset, she called on the work of geomorphologists for her port studies and thus showed her sense of multi-disciplinary collaboration. In this regard too, the list of scientific collaborators to whom she appealed for her study of the Marsala wreck is impressive and significant.

Figure 28. Venice. From left to right: Lucien Basch, Joseph Needham, and Honor Frost in Locanda Montin (1983). (Photo S. Basch).

Faithful in friendship, she possessed a great charm that was difficult to resist when one had the chance to be counted among her friends (Fig. 28). She welcomed a few privileged friends to her house in Welbeck Street, London, which she had inherited from her guardian Wilfrid Evill, of whom Lucien Basch and Paul Adam were among the most faithful. In the midst of a refined decor, where works of contemporary painters mingled with antique furniture, china, and Wedgwood porcelain, she received her friends with the utmost refinement. To have the honour and the privilege of living there was something never forgotten.

She also created a network of friends along the road from Malta and Marsala to London, routes that she regularly travelled in her so-called 'turbo car' for many years, with Paul Adam, Annie Caubet, Marguerite Yon, the Wolrich family, the excavation of Madrague de Giens and then Aix-en-Provence serving as links in this chain. The Madrague de Giens was one of her favourite staging posts and, from 1972 until the last excavation campaign in 1982, she never failed to stop to dive on the wreck. It was on the occasion of one of her visits that the idea came to me to invite Dumas, who had retired nearby, to Sanary. And so, in 1975, I had the pleasure of taking them to dive together on the wreck. It had been a good ten years since they had last seen each other or dived together!

In the light of her life, Frost appears to have been a figure of paradoxical and complex character. At once, woman and diver, and diver and archaeologist, at a time when these terms rarely co-existed. Self-taught, she was recognized by the academic community. She was a woman of action and the field, but also a theorist of maritime archaeology.

Despite all the testimonies and accounts you will read in this volume, whole sections of her life remain unknown. Her vast culture, the diversity of her work

Figure 29. 'Our Lady of the Anchors'. (© Honor Frost Archives).

and experiences give the impression that she lived several lives – which only adds a measure of mystery to her charm.

In her work and personality, Honor Frost was not only 'Our Lady of the Anchors' as she was known (Fig. 29) but also and above all 'The Great Lady of Underwater Archaeology' as described to me in an excellent and accurate observation made by her friend Lucien Basch.

Acknowledgements

I would like to thank the Honor Frost Foundation, and the organizers of the 'Under the Mediterranean' conference, Dr Stella Demesticha (University of Cyprus, Maritime Archaeological Research Laboratory) and Dr Lucy Blue (University of Southampton, Centre for Maritime Archaeology) for inviting me to present this keynote introductory lecture. The preparation of such a presentation requires archival research and abundant documentation. So, I express my gratitude to the Honor Frost Foundation, and particularly to Alison Cathie, Chair of the HFF's Trustees, Dr Lucy Blue, Maritime Archaeological Director of the HFF, and to Karen Robson and Sarah Maspero in charge of the Frost archives, Special Collections at the University of Southampton Library.

I would also like to thank especially Sophie Basch for the fruitful exchange of information and documents about Honor Frost. And finally I thank, for sharing their photographic documentation: Sarah Arenson, David Blackman, Annie Caubet, Jean-Yves Empereur, the INA, Frank Machu, Juliette Dumas-Tilquin and Harry Tzalas. Claire Calcagno, Lucy Blue and Miranda Richardson were willing to read and correct the English of this article: let them be sincerely thanked.

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Honor Frost, True to Herself

From art and ballet design to underwater archaeology

*Sophie Basch**

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This volume is published to honour the memory of a pioneer of underwater archaeology. But respect for her legacy also requires us to trace the first part of Honor Frost's life. What I present here is the submerged part of the iceberg. Frost left so much by way of paintings, watercolours, drawings, and etchings, all of which are invaluable for art history, the history of ballet scenography, the decorative arts, and, more generally, for the history of women, of whom she was a most singular and accomplished representative. I am grateful to Alison Cathie, Chair of the HFF's Trustees, who let me consult Frost's personal and artistic archive, before donations were made to the Tate Gallery, the Victoria and Albert Museum, and the Royal Opera House; donations which supplement her archaeological archive now kept at the University of Southampton. It occurred to us, spontaneously and by mutual agreement, that Frost would not have wished to see her life detailed as a narrative, even though her life was, in many ways, as extraordinary as a novel. Having known Frost since my childhood, for 40 years, I deeply regret not having collected the stories she confided in me about her artistic life. Her influence on my own life and career has been considerable. Now that Frost's story belongs to History, I'll try to recreate the first part of her existence in the spirit she always encouraged in my own research. Frost's life was not only extraordinary but in many aspects exemplary because of her talent and courage.

After the publication of Frost's obituary in the *Independent*, Jane Shore Nicholas, founder-member of the Sadler's Wells Theatre Ballet, wrote to the editor on 11 November, 2010:

> One aspect of Honor Frost's distinguished career was missing from your obituary on 8 November [...]. In the mid-Forties she designed a ballet, *Khadra*, which was choreographed by Celia Franca for the Sadler's Wells Theatre Ballet to music by

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 39-90. Leiden: Sidestone Press.

> Sibelius. The company had been founded by Ninette de Valois to fill the gap left when the original Sadler's Wells company moved to the Royal Opera House in 1946. The ballet portrayed a mischievous young Persian girl and a princess and many other characters. The set and costumes were most beautifully designed on the lines of Persian miniatures, vibrant with colour. The company was full of young dancers early in their careers and we all loved it. In 1947 Frost collaborated again with Franca for *Bailemos*, a ballet on a Spanish theme. This second work was not so successful but Arnold Haskell, the doyen of dance critics at the time, felt that 'the combination of Franca and Frost was capable of producing work of great depth and beauty'.

When in 1954 Frost dived for the first time in open water, near Cannes on the ancient wreck Chrétienne A, and met Frédéric Dumas, her world didn't change as radically as one might think: two years later, in 1956, Jacques-Yves Cousteau, with young film-director Louis Malle, would adapt for the screen the book he published with Dumas in 1953, *Le Monde du Silence* (*The Silent World*). The pre-title sequence of the famous documentary, which won the Palme d'Or at Cannes Film Festival, is unforgettable: a spectacular underwater ballet of divers bearing torches.

In 1954 Frost was 37 years old. Close friends, those who had the chance to be her guests in the enchanted world of Welbeck Street, London, where she lived, and who received her exquisite Christmas postcards (Fig. 1), knew something of her early life; she had attended the Central School of Art in London, where she met Lucian Freud, and studied at the Ruskin School of Art in Oxford. They also knew that she designed decors and costumes for the Sadler's Wells Theatre Ballet. But I'm afraid that none of us really had a measure on how bright an achievement was Frost's artistic career. The dancer Jane Shore Nicholas was right when she concluded:

> Had she not been diverted into a diving and archaeological career, I am sure she would have had a very successful life as a designer for the theatre (2010).

And yet, there are many indications that Frost never really diverted from her initial passions. It is because Frost is one and indivisible that she was unique. All her achievements demonstrate the same qualities, her mark – a mix of a practical mind and fantastical imagination. In *Under the Mediterranean*, her second book – I will of course present the first book below – Frost cites astonishing references, all French, which say much about her background and personal environment.

The first relates her sensations when she dived for the first time in a well in Wimbledon. She compares herself to the *Acrobat Miss Lala at the Cirque Fernando* by Degas, himself the painter *par excellence* of dancers:

> Had those on the surface been nervous, there was nothing they could have done, beyond trying to draw me up by the rubber tube, like Degas' lady acrobat, who hangs by her teeth and a string from the Big Top. I touched the walls of the well, air bubbles, like quicksilver, adhered to the undercut surfaces. (Frost, 1963: 4)

More surprising at first sight, is a reference to Charles Péguy (Péguy, *La tapisserie de Notre Dame*, 1913; Frost, 1963: 5-7). The title of the poem (*Notre Dame au Grand Galère*

Figure 1. Christmas card, (c.1950). (H. Frost).

instead of *Paris double galère*) is slightly misremembered, but Frost felt a certain coquetry towards being dyslexic and she often quoted from memory.[1] In the early 1960s, Péguy was quite outdated in France (he has been rediscovered since as a major poet and writer): this reveals not only the depth and extent of Frost's literary awareness, but that poetry was still part of her life 24 years after she had illustrated poems by Stephen Spender and Walter de la Mare, as we will see. In this poem, Péguy describes Notre Dame seen from the Seine as a sunken ship. As Frost was also fond of Debussy, I cannot help

1 In 1947, after having sung her praises as a ballet designer, a journalist reported what can only be a confidence: 'It is refreshing to learn, though, that she has one failing: for the life of her, she can't spell.' (Chanticleer, 1947).

but connect the citation with the prelude *The Sunken Cathedral* composed by Debussy in the same period, and to associate it with a ballet at the Mercury Theatre to Debussy's *Colloque sentimental*, for which Frost designed the decor and costumes.

The Mercury Theatre is closely linked with Frost's first diving experience, as previously noted, in a well in Wimbledon. She slipped from one well to another, since 'the name of Sadler's Wells dates from the discovery in 1683 of a mineral water well in the grounds of the then "musick house" owned by a Mr Sadler' (Leith, 1951). In an interview for the BBC in 1993, Frost describes this first underwater experience late on a snowy night after rehearsals at the Mercury Theatre, and some months before diving on the Chrétienne A wreck (MacGregor, 1993). Since she visited the Chrétienne A in spring, 1954, and her last work for the Mercury Theatre was the costume designs for *The Dong with a Luminous Nose*, created in 1952 and performed until the end of 1953, we may suppose that this 'initiation ceremony' (to use the title of *Under the Mediterranean*'s opening chapter) took place during the winter of 1953.

So strong was her response to her first experience of wearing a mask in the sea that, just this once, Frost inserts an extract from her personal diary in *Under the Mediterranean* that is both radiant and dark and unusually lyrical since her trademarks were clarity, exactness, objectivity, even a certain dryness:

> Glancing through jottings in an old diary, I find my first account of wearing a mask in the sea. It brought me what Proust calls '*cette qualité inconnue d'un monde unique*' and happened just after the war, in Italy. It also somehow convinced me that time spent on the surface was time wasted, though the unique quality is apparent even to one who floats face down looking through a mask and breathing through a tube. I conclude from these jottings that it is easier to dive than to write about it:
>
> 'Masked under water is like going home to a forbidden land. The body, being horizontal, is somewhere behind; out of sight out of mind. No module to measure by. Surrounded by creatures with which one can have no contact. Peace! Fish look [you] coldly in the eye … are they larger or smaller than oneself? Suspended above a landscape of forests, massives and sandy plains. The forests sway, but there is no wind against one's flesh. Progress slow as in a dream. Like being drunk underground or in a smoky night club … no, because it's clean. Reluctance to raise my head; [the] contrast of worlds too violent. Prefer steering by the landscape below. Things enlarged by a quarter because of [the] mask. Not pleasant to feel like Gulliver. Nearest thing to life after death…' (Frost, 1963: 5)

A quotation again, from *À la recherche du temps perdu*, kept in French, introduces the remembrance of things past: obviously, even though Charles Kenneth Scott Moncrieff had marvellously translated Marcel Proust in the 1920s, Frost read the original version. It is no surprise that the quotation comes from *La Prisonnière* (*The Captive*), that '*cette qualité inconnue d'un monde unique*' to which she refers, originally applies to music, an art indissociable from ballet (Proust, 1923, vol. 2: 218). The references to the 'forbidden land' of fairy tales, here to Gulliver, on other pages to Peter Pan, increases the impression of 'worrying strangeness'. The Freudian concept is not misplaced, since Frost confided to several friends that when she was a little child in Cyprus her mother and her nannies

Figure 2. Honor Frost at the Eastbourne School of Arts (second seated from right), (c.1935).

forbade her to swim. So, diving was literally 'going home to a forbidden land'; a revenge on life, a way to be on the winning side. Like Alice, Frost passed through the looking glass and found herself. Now, let's lift the curtain on the past, and follow Honor Frost in the footsteps of Honor Frost.

The Eastbourne years (1932-1937)

In her splendid entry for the Oxford Dictionary of National Biography, Angela Croome wrote that 'in the late 1930s Frost moved to England,' after her schooling at the École Vinet in Lausanne, to attend the Central School of Art in London (Croome, 2014). Actually, after attending the Swiss school in 1930-1931, as evidenced by her personal papers and by her marvellously illustrated childhood diaries, Frost came to England, and more precisely to the very Victorian seaside resort of Eastbourne, East Sussex, in 1932.[2] From 1935, her name is regularly mentioned in the local press, which highlighted the performances of a theatrical society of local amateurs founded in 1932, 'The Eversley Players' (Fig. 2).

As a child in Cyprus, aged nine, Frost had already performed at the Papadopoulos Theatre in Nicosia as Titania, Queen of the Fairies, in a performance of *The Tedious Brief Scene of young Pyramus and his love: This be very tragical mirth from a Midsummer Night's Dream by William Shakespeare* … As a student at Eastbourne High School, young Frost featured in several plays, in 1935 *The Scarlet Pimpernel* by Baroness Orczy (*Eastbourne Gazette,* 1.5.1935: 8; *The Stage*, 9.5.1935: 7) and *Yellow Sands* by Eden and Adelaide Phillpotts (*The Stage*, 19.12.1935: 6); in 1937 she played the role of Lady Hamilton in a historical re-enactment (*Eastbourne Gazette*, 12.5.1937). Even though she had left the resort before the end of the 1930s, Frost also distinguished herself as an artist on the eve

2 The use of information from Frost's personal papers is intended solely to rectify inaccurate data in her biographical notes, or to illuminate her pioneering career.

of the Second World War in an exhibition at the Eastbourne School of Arts and Crafts, later destroyed by bombing:

> The exhibition of the work of the students of the Eastbourne School of Arts and Crafts, formally opened by the Mayor (Alderman A. E. Rush) on Saturday, is housed at the Towner Gallery, and it will remain open to the public until the end of the month. It is an encouraging show of high-quality work which fills three galleries and overflows on to the walls of the landing and stairway.
>
> The first display to catch the eye of the spectator will be the attractive panel-series of wood-engravings in the long gallery, entitled 'Stations of War'. The idea of this series – one in parallel to the 'Stations of the Cross' familiar to Roman Catholic Churches emanated from Mr H. B. Faulkner; A.R.C.A. (Lond.) F.R.C.A., Principal of the school, the drawings being carried out by Honor Frost. This is a powerful and painful reminder of the horrors of modern warfare, as the titles to the pictures suggest – 'Weary', 'Compassion', 'Suffering', 'Despairing', 'The Burial', and so on, the inspiration coming from Mr Faulkner's own war experiences. (*Eastbourne Herald*, 11.2.1939: 20)

After the war, Frost's name was cited among those who might possibly restore the town's historic heritage:

> Mr. H.B. Faulkner, principal of the School of Art, speaking at the exhibition of students' work at the Towner Gallery on Saturday morning, referred to the many documents and records regarding the School which were lost when the old building was destroyed by enemy actions. […] He appealed to the then Mayor, making the suggestion that the Town Council should from time to time commission young students to paint panels dealing with important events in the town's history. […] As we now know his appeal fell on deaf ears. […] Names of outstanding past students which came at random to his mind were John Towner, the late Eric Revillious [*sic*, for Ravilious], John Lake, David Evans, Grace Matthews, Frank Wootton, Frank Archer, Honor Frost and Elisabeth Tanner. (*Eastbourne Gazette*, 14.1.1948: 2)

Eastbourne was proud of its brilliant pupil and Frost was not ungrateful. Obviously attached to the place, she didn't forget Eastbourne at the hour of her own triumph at Sadler's Wells and returned in 1947 when the amateur theatre-group took to the stage again:

> After the final curtain on Monday evening Mr Matthews introduced Miss Honor Frost, a former Eversley Player and now a designer at Sadler's Wells, who, having congratulated the company in felicitous terms, made way for the Mayor (Alderman E. C. Martin), who briefly but aptly commended the good cause and paid his tribute to the merits of the performance. (*Eastbourne Gazette*, 28.5.1947: 3)

In a less emotional way, Miss Gunnery, head-mistress of Eastbourne High School, pointed to her former student as an example at the prize giving ceremony of June 1946:

> Every girl had begun a two-year course in housecraft, and Miss Johnston, ably supported by Miss Chapman, had worked miracles in art and craft. Speaking of Miss Johnston's work, they would be interested to know that Honor Frost who designed the setting and costumes for *Khadra* at Sadler's Wells, was an old girl. (Applause.) (*Eastbourne Herald*, 29.6.1946: 9)

Inadvertently piquant, the passage is particularly striking since an 'old girl' of Eastbourne College she was, but Honor was no 'old maid' having married in March 1945 Captain Edward Boyce Barrow Cunning, whom she felt obliged to leave a few weeks later.

University artist: *Clare Market Review* & *Linden Broadsheets* (1938-1940)

Married or single, Frost had blazed a trail in the artistic world, while Eastbourne waited in anticipation for her stage successes:

> Miss Honor Frost has been highly praised for the designs for costumes and decor of *Khadra*, the new ballet of the Sadler's Wells. Miss Frost was a student of the Eastbourne High School and then for three years was a full-time student of the Eastbourne School of Art, devoting most of her time to painting and illustrating. People who remember the Christmas festivities before the war will recall the lively sketches which formed part of these festivities, several of which were written and produced by Miss Frost. (*Eastbourne Herald*, 1.6.1946 a: 13)

Figure 3. Underground station, London. *Clare Market Review, vol. 34, N°2, March.*

All these sketches, alas, have disappeared, but, happily, another comic endeavour survives in a series of cartoons, as witty, diverse and lively as the theatrical ones no doubt were, and on a par with those published by the famous cartoonists Osbert Lancaster in the *Daily Express* at the end of the 1930s or Ronald Searle in *Punch* in the following decade. These artworks were mainly published in the *Clare Market Review*, the oldest student journal in the United Kingdom, based at the London School of Economics and established in 1905 (Beveridge, 1960). Illustrious collaborators such as George Bernard Shaw, William Beveridge, and Bertrand Russell contributed to the journal, while Karl

Figure 4. Soviet Culture. *Clare Market Review, vol. 34, N°2, March 1939: 12.*

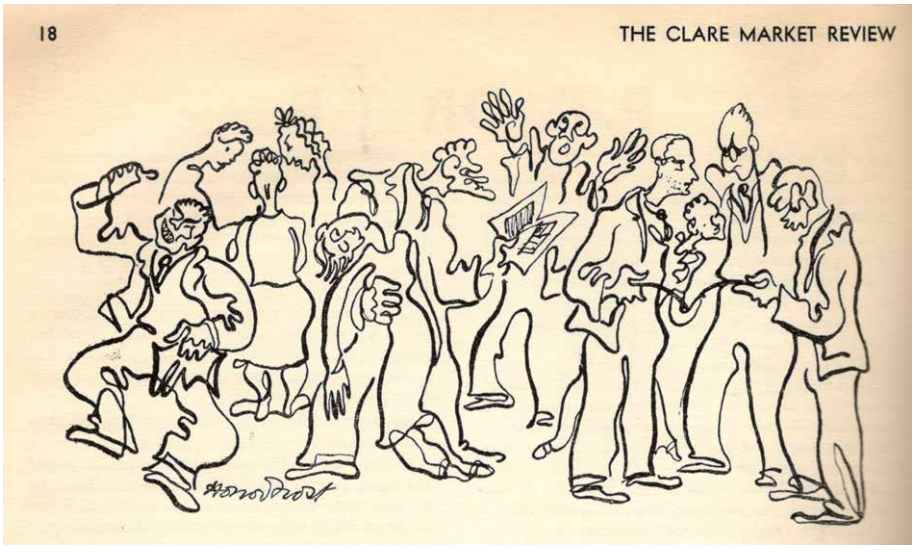


Figure 5. Student Life. *Clare Market Review, vol. 34, N°2, March 1939: 18.*

Popper counted among its readers. Between 1938 and 1940, Frost was responsible for the layout and illustrations of three issues: she alone drew the sketches and the cartoons, some hilarious, some with a touch of melancholy (Figs 3-13). She animalized Hitler and Stalin with an incisive brush for *Adolph's Fables* (Fig. 14).

The sharpness of her insights doesn't preclude the expression of an unexpected tenderness for humankind. In looking at her work, one is immediately aware of the rare steadiness of Frost's hand. Her inquiring mind is reflected not only in her drawings but in the typography, revealing a comprehensive vision and expertise in the organization of space that her future archaeological surveys would confirm. The firmness of her pen

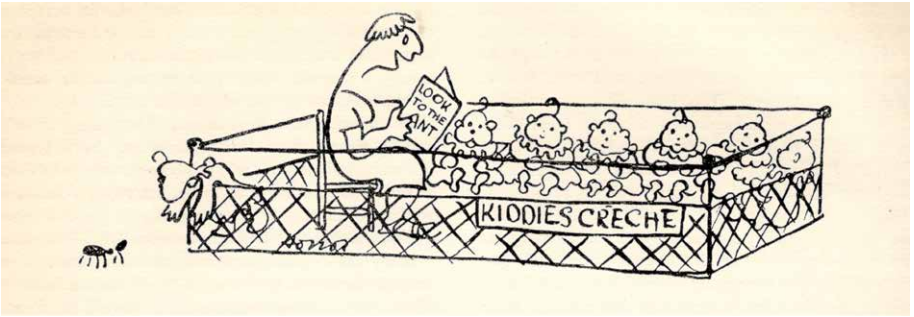


Figure 6. Kiddies Crèche. *Clare Market Review, vol. 34, N°2, March 1939: 13.*

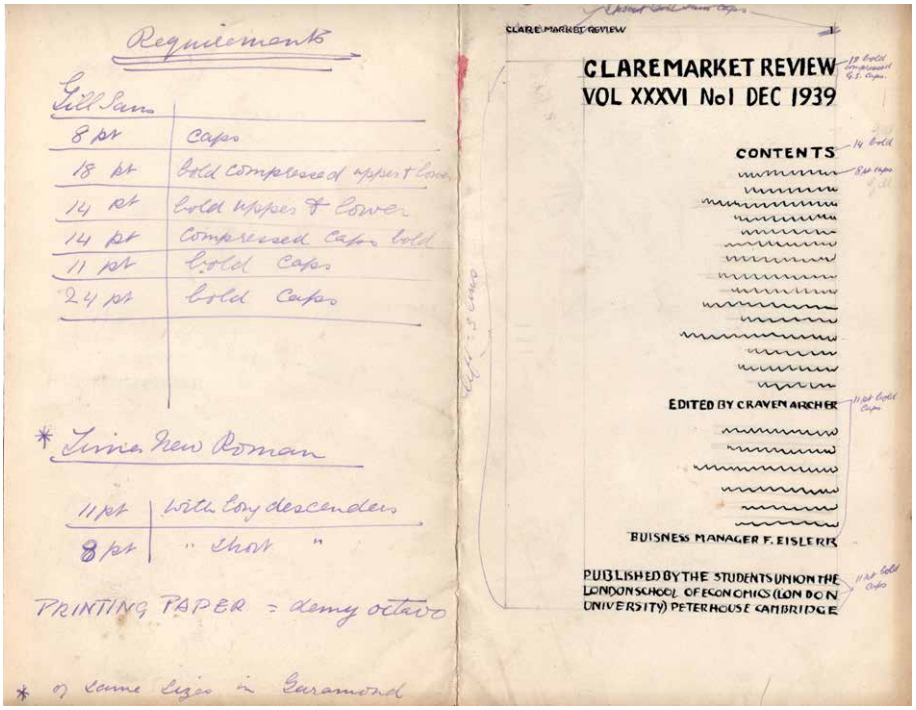


Figure 7. Clare Market Review, vol. 35, N°1, March 1940: layout (for the vol. 36, N°1, 1939, which ultimately appeared as vol. 35, 1940).

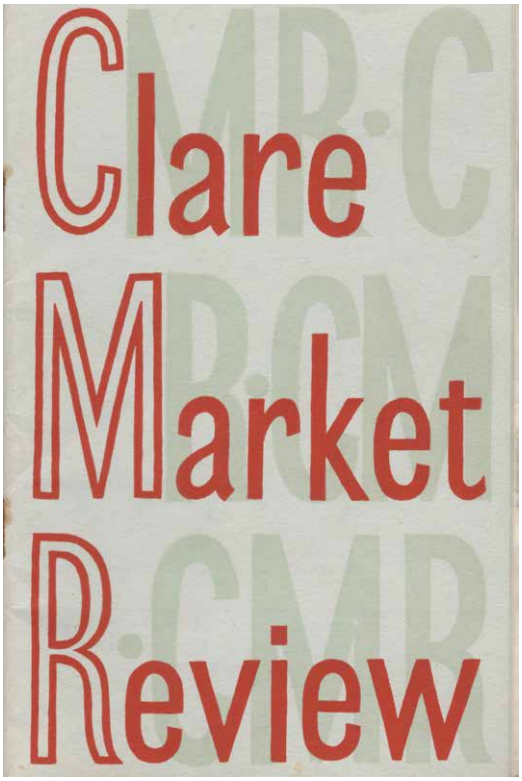


Figure 8. Clare Market Review, vol. 35, N°1, March 1940. Front cover.

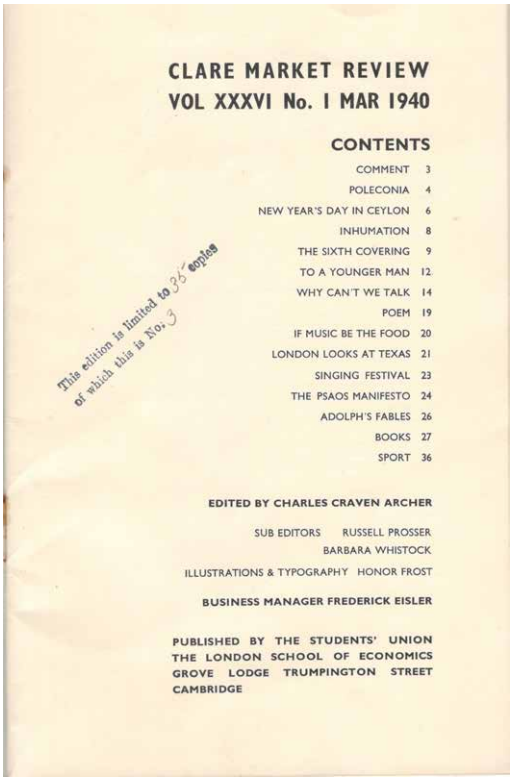


Figure 9. Clare Market Review, vol. 35, N°1, March 1940. Table of contents.

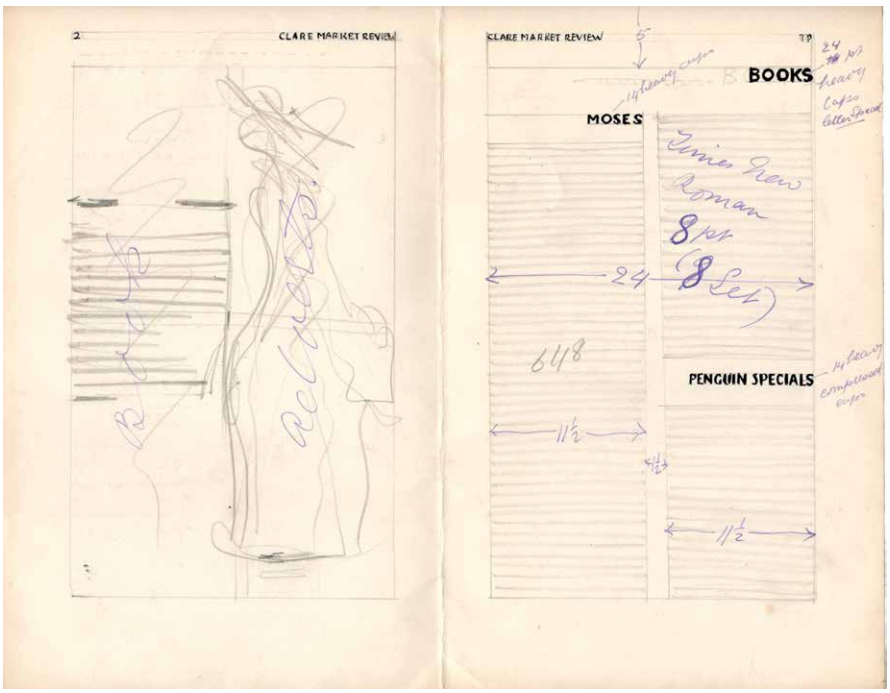


Figure 10. Clare Market Review, vol. 35, N°1, March 1940: layout by Honor Frost.

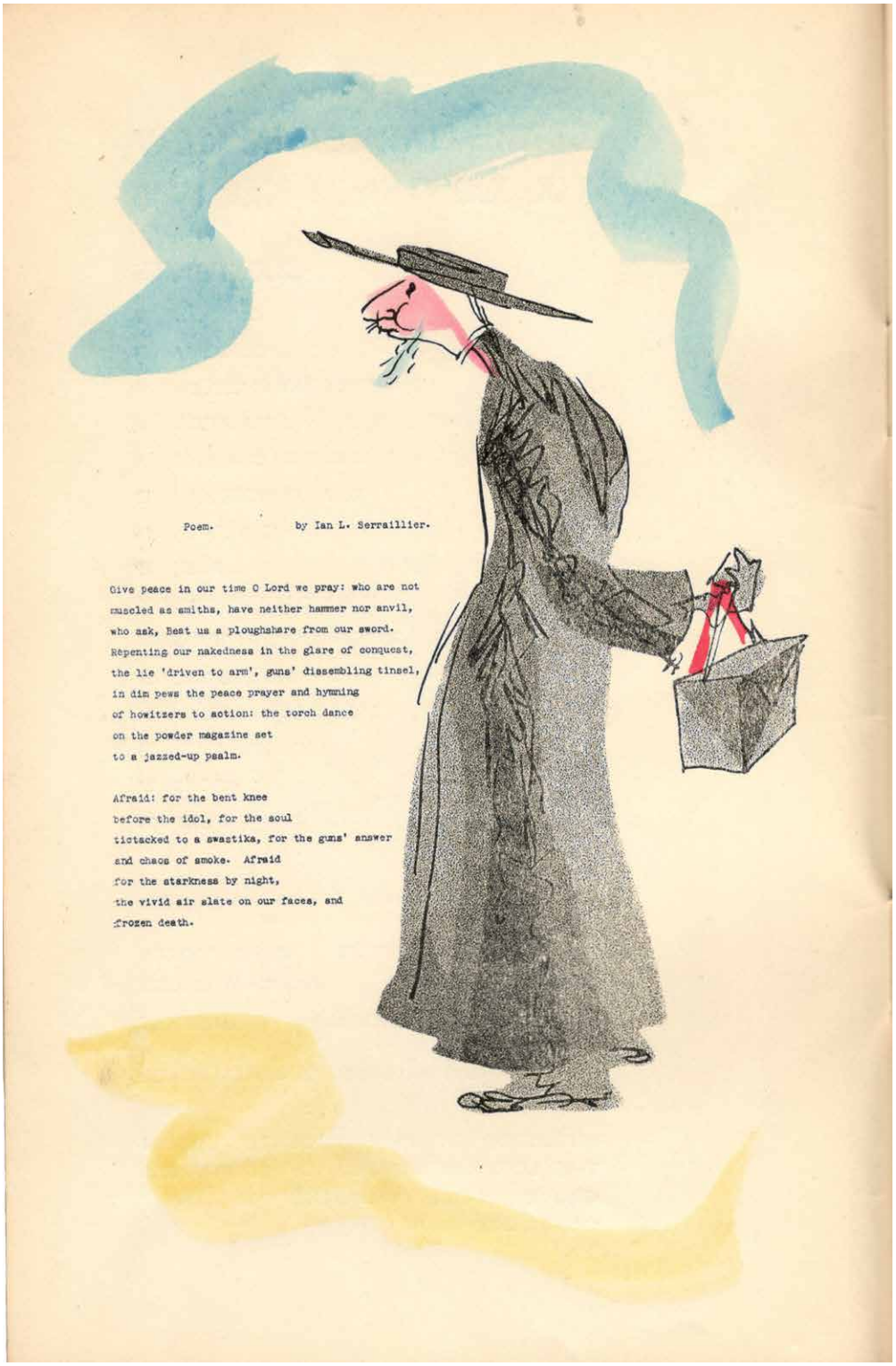


Figure 11. Priest. *Clare Market Review, vol. 35, N°1, March 1940: 2.*

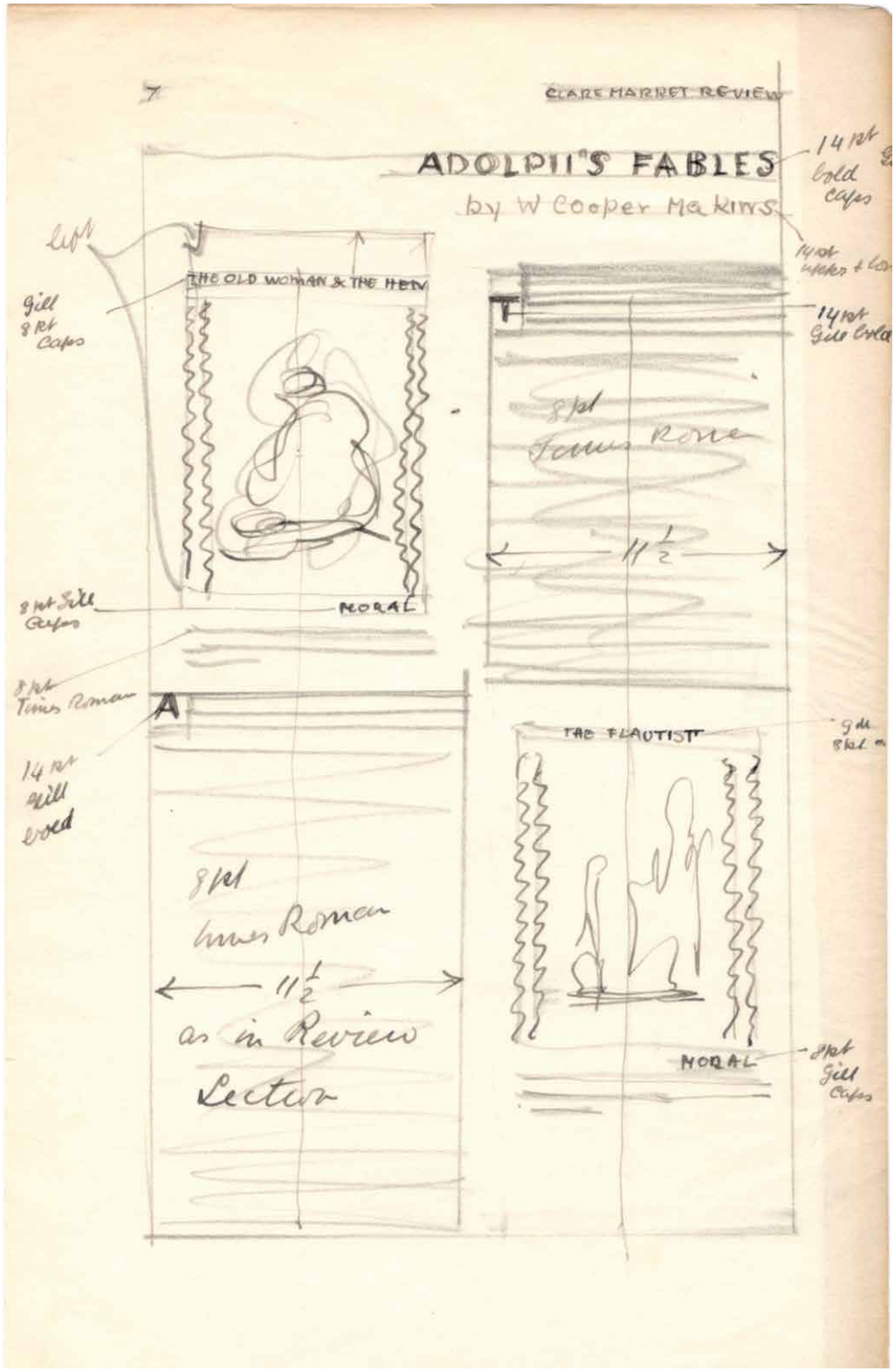


Figure 12. Clare Market Review, vol. 35, N°1, March 1940: layout by Honor Frost.

ADOLPH'S FABLES

THE OLD WOMAN AND THE HEN

A CRAZY vain Old Woman, famous for her love of all sorts of trinkets, had a Hen which she fed mainly on gun-butter and iron filings, because she had been told that iron was good for the constitution. It is said that the Hen laid one iron and highly explosive egg a day on this ration, though why it did so no one knows. The habit seemed reasonable enough to the Old Woman, however, who further argued: "If I double the quantity of iron filings, surely the hen will lay two eggs a day." (She loved iron eggs.) So she changed the diet and the Hen expired at her feet.

MORAL: Figures are not always facts.

THERE was once a Mad Bad Baron of the Rhineland who had a Henchman famous for his performances on the flute and as a salesman of wine. "Go now to the rivers of England as my court fisherman," said the Mad Bad Baron one day, "For I would fain know if the fishes of England dance." So the Henchman left home and beside the best rivers of England he played his flute for all he was worth, but the fishes did not dance. "Some of the Most Influential Fishes of England have told me that they don't dance to Rhineland music there," the flautist reported to the Mad Bad Baron when he came home. "That surely means," said the Baron, "that I can throw my net as I please and catch all the fishes which get into it, for they will not leap and frolic back into the river." So he threw his net and drew it to the surface of the river, and was so surprised when the fishes danced that most of them escaped.

THE FLAUTIST

MORAL: Don't send a flautist to report on fish, even if he can sell wine.

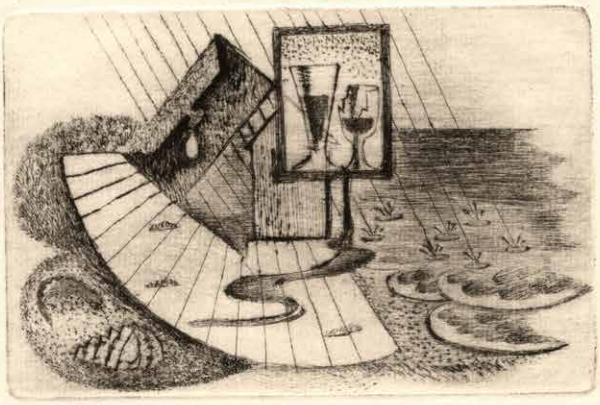
W. Cooper Makins illustrations by Honor Frost

Figure 13. Adolph's Fables. *Clare Market Review, vol. 35, N°1, March 1940: 26.*

Figure 14. Suicide. *Clare Market Review, vol. 35, N°1, March 1940: 18.*

LINDEN BROADSHEET

NUMBER I



RECIPE FOR A PICTURE

One whitened urchin shell, jag-split, dull sand-buried:
rain on yellow foaming sea, rain on blue grass shore.
Two smashed glasses by the beach-hut window:
three spots of spittle on the beer-soaked floor:
& a drop, a drop, a gleaming drop of water,
hanging on the handle of the gape-propped door.

AUTHOR *Peter Green* · ARTIST *Honor Frost* · TYPOGRAPHY *Shelley Fausset*

Figure 15. Frost's 'Recipe for a Picture' *by Peter Green. Typographer Shelley Fausset. Linden Broadsheet N°1, [1940].*

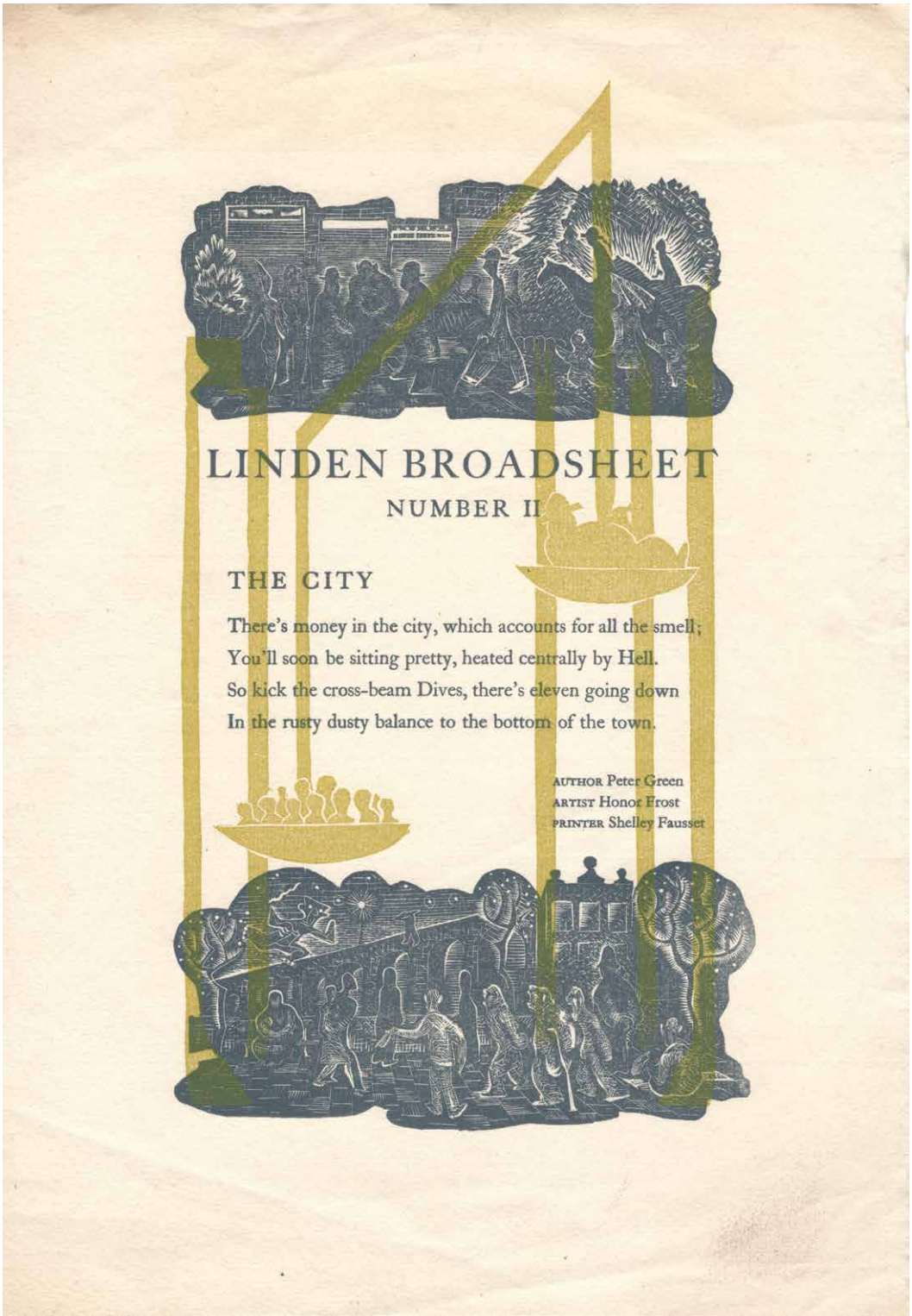


Figure 16. Frost's 'The City' *by Peter Green. Typographer S. Fausset. Linden Broadsheet N°2, [1940].*

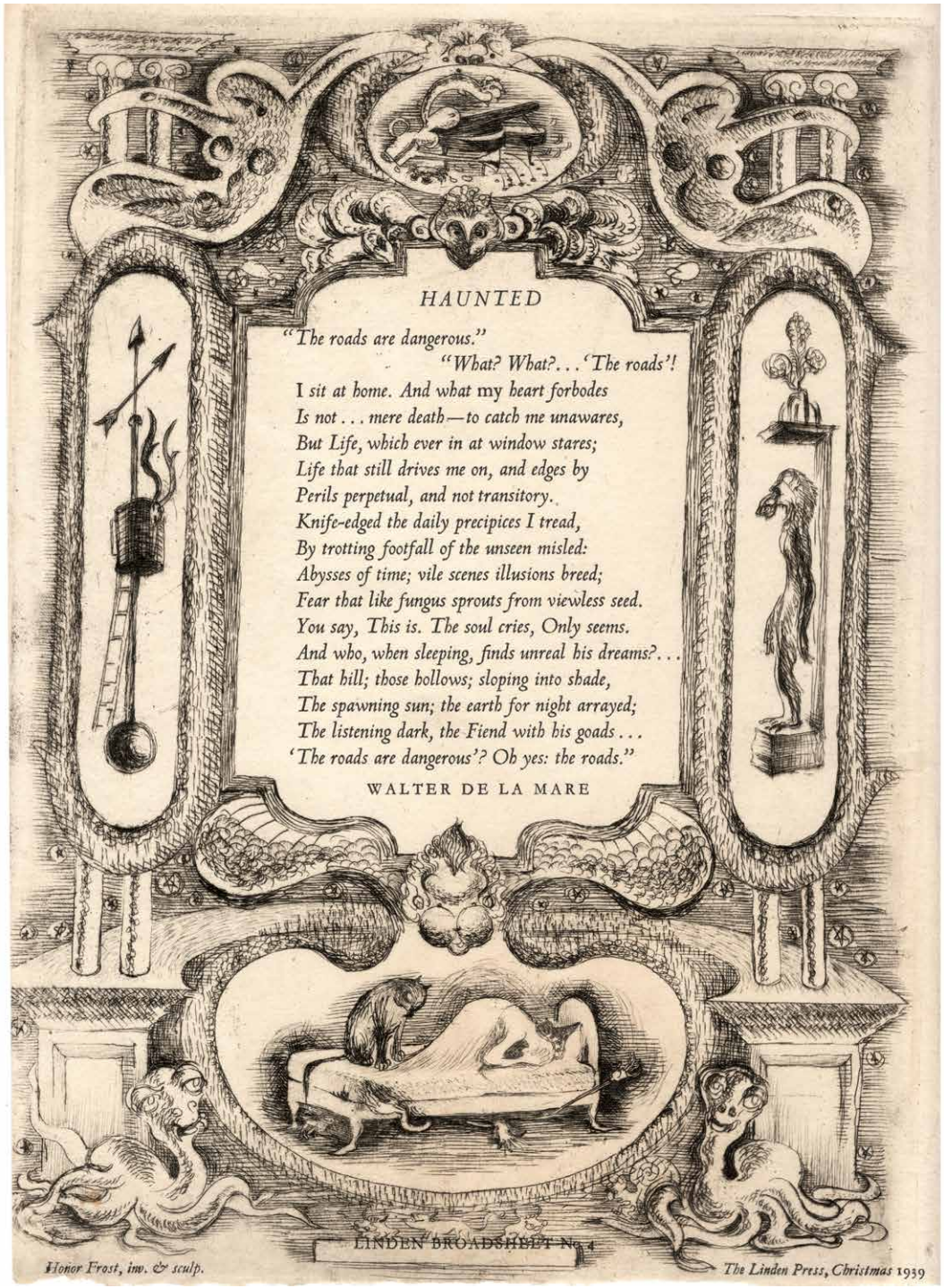


Figure 17. Frost's 'Haunted' *by Walter de la Mare. Linden Broadsheet N°4, Christmas 1939.*

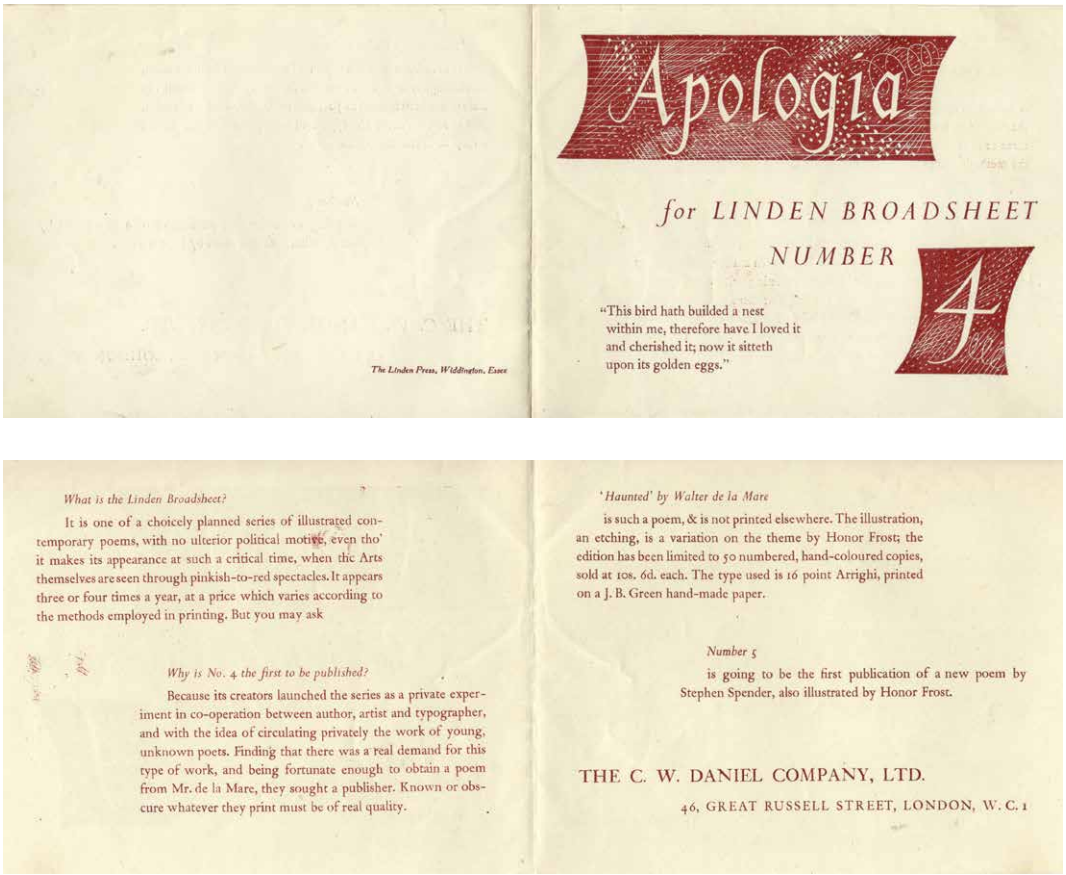


Figure 18. Apologia for Linden Broadsheet N°4 (recto & verso).

is impressive and there is no doubt that Frost was the woman for the job when, nearly 20 years later, she joined Kathleen Kenyon as an archaeological draughtsman in Jericho.

Simultaneously, in 1939, Frost exhibited at Cambridge, in Round Church Hall, with various university artists: 'Among others whose work should be noted are J.G. Drew, Peter S. Boston and Honor Frost.' (*Cambridge Daily News*, 14.2.1939: 5). She also engraved four etchings and woodcuts for the *Linden Broadsheets*, issued in 1939 and 1940 by the Linden Press established at Widdington, Essex, printed by Shelley Fausset, Henry Moore's assistant sculptor, then tutor at Saint Martin's School of Art. Her illustration of the work of two major poets and outstanding intellectuals of the time, Walter de la Mare and Stephen Spender, are particularly remarkable for their mastery and what they reveal of Frost's depth of understanding (Figs 15-19). A flyer titled *Apologia* states that *Haunted* by Walter de la Mare

> ...is not printed elsewhere. The illustration, an etching, is a variation on the theme by Honor Frost; the edition has been limited to 50 numbered, hand-coloured copies, sold at 10 s. 6 d. each. The type used is 16-point Arrighi, printed on a J. B. Green hand-made paper.

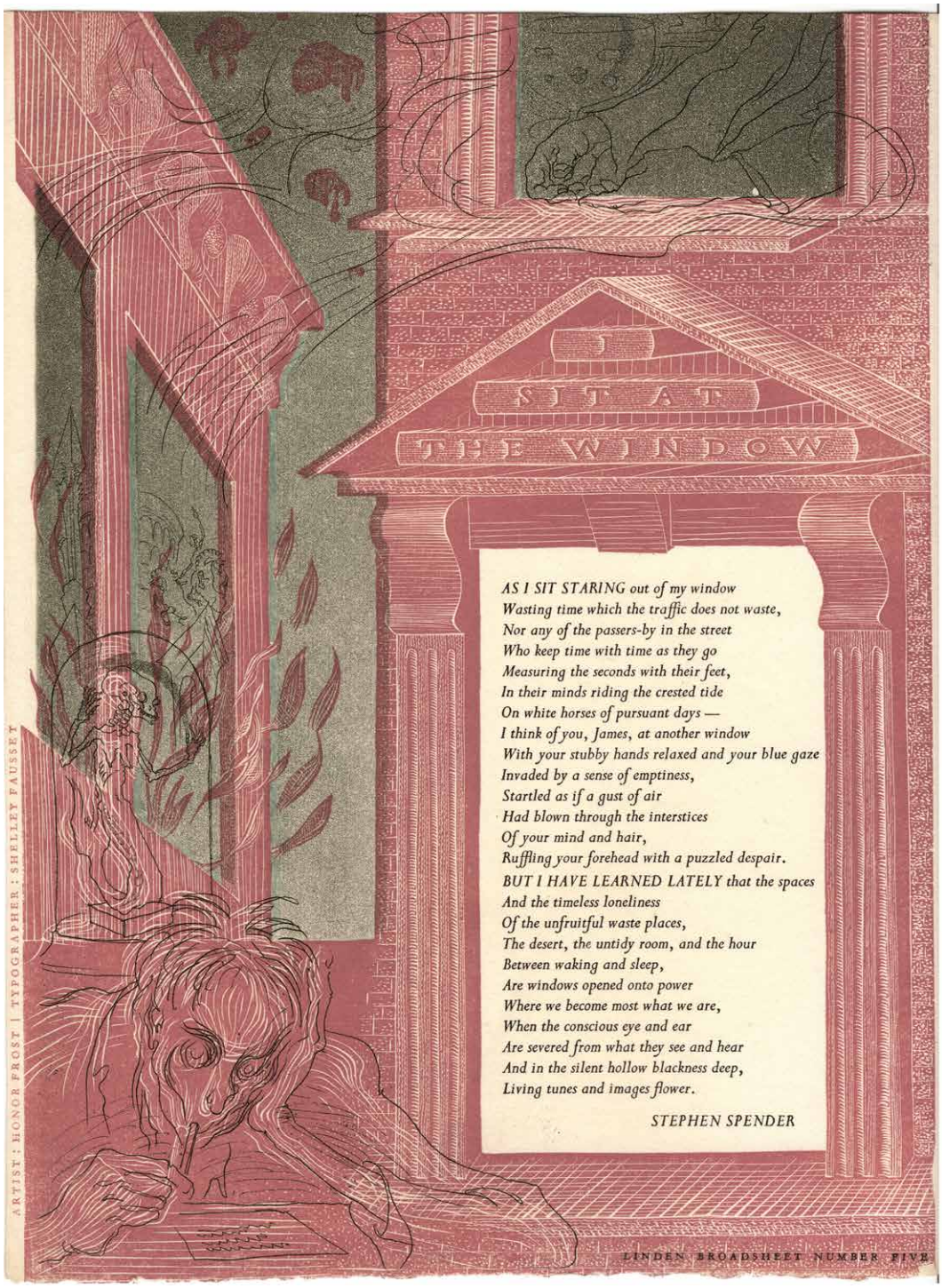


Figure 19. Frost's 'I Sit at the Window' *by Stephen Spender. Typographer S. Fausset. Linden Broadsheet N°5, [1940].*

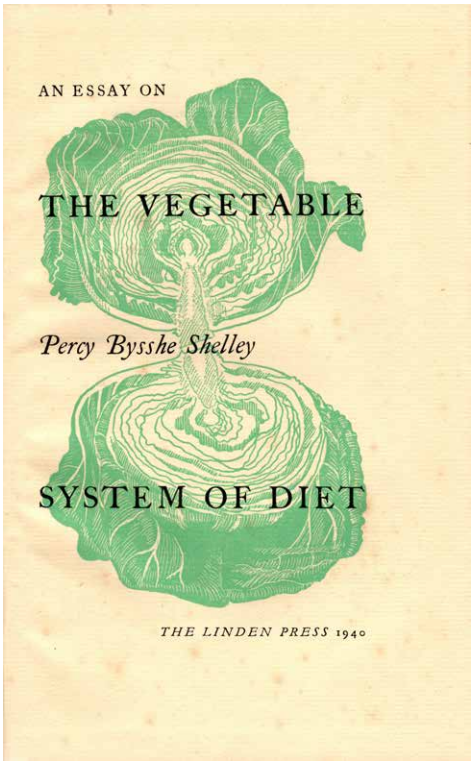


Figure 20. Percy Bysshe Shelley's 'The Vegetable System of Diet', Widdington, (The Linder Press, 1940). Frontispiece by Honor Frost.

As for *'I Sit at the Window'*, it was 'the first publication of a new poem by Stephen Spender, also illustrated by Honor Frost'. Once again, in 1940, she drew the frontispiece illustrating a rare essay by Percy Bysshe Shelley, *On the Vegetable System of Diet* (1814-1815) for the Linden Press: a dancing fairy emerging from a lettuce as the diver emerges from the deep sea (Fig. 20).[3]

An advertisement in the *Clare Market Review* acts as a bridge between the cartoons and the engravings for the *Linden Broadsheets*: it announces the publication of *Horizon*, a review of literature and art founded in 1940 by Cyril Connolly with Stephen Spender as associate editor (Sutherland, 2005: 256-259). These names help to define Frost's circle, an influential artistic *milieu* of distinguished and burgeoning talents. They expressed themselves for the happy few, in refined magazines and broadsheets with small circulations, while they displayed great ambition and generosity in their conception of a total art that embraced both the visual and performing arts and that connected the poets of the younger generation to their elders. Frost's personal papers, which include portraits of Connolly from her own pen, confirm that this community was a direct descendant of the Bloomsbury Group. Most of their members were leftists and pacifists, such as the famous anti-fascist poet David Gascoyne, of whom Frost painted several portraits.

The war years

From a press review of the Sadler's Wells performance of *Khadra* in 1946, we learn that

> …after "years in the Middle East", Miss Frost, during the war, was a lorry driver for a firm of furniture removers. Then she did three years with the N.F.S. [National Fire Service] and became the one woman lecturer among 60 men lecturers. Until recently she worked in the Arab section of the B.B.C. (*Evening Telegraph*, 1946 a: 5).

3 This essay had previously been edited by John C.E. Shelley-Rolls and Roger Ingpen in *Verse and Prose from the Manuscripts of Percy Bysshe Shelley*, London, privately printed (at The Curwen Press), 1934. The Linden Press edition was limited to 120 copies.

Figure 21. Porphyria's Lover, poem by Robert Browning, ballet by Sally Gilmour and Walter Gore, programme of the University Ballet Club, designed by H. Frost, 1941.

In addition to these activities, Frost was already involved with ballet, as shown by her stunning illustrations: she designed, for instance, the decor for *Porphyria's Lover*, a ballet by Walter Gore based on Robert Browning's poem, performed by the Oxford University Ballet in October 1941 (Fig. 21): she brushed shoulders with illustrious choreographers, such as George Balanchine and Frederick Ashton. Frost also created the cover page of an historic programme, produced in 1943 by the Oxford University Ballet Club: *Arabesque. A Special Review of English Ballet. Proceeds to be devoted to Mrs. Churchill's Aid to Russia Fund* (Fig. 22). The quality of the paper is poor but the graphic, which evokes Picasso's one-line drawings, is amazing: a female dancer jumping as high as Nijinsky, crowned by an incandescent candlestick. Even though Frost's style is unique, particularly her humour, her referencing the *Ballets Russes* is obvious.

Her many charitable activities, some heroic, did not stop her prolific production, as evidenced by many brilliant etchings that link Frost to the Blitz artists and especially to Henry Moore's Shelter Drawings inspired by the spectral people sleeping in the London Underground in 1940-1941 (as well as by the engravings of London by Gustave Doré)

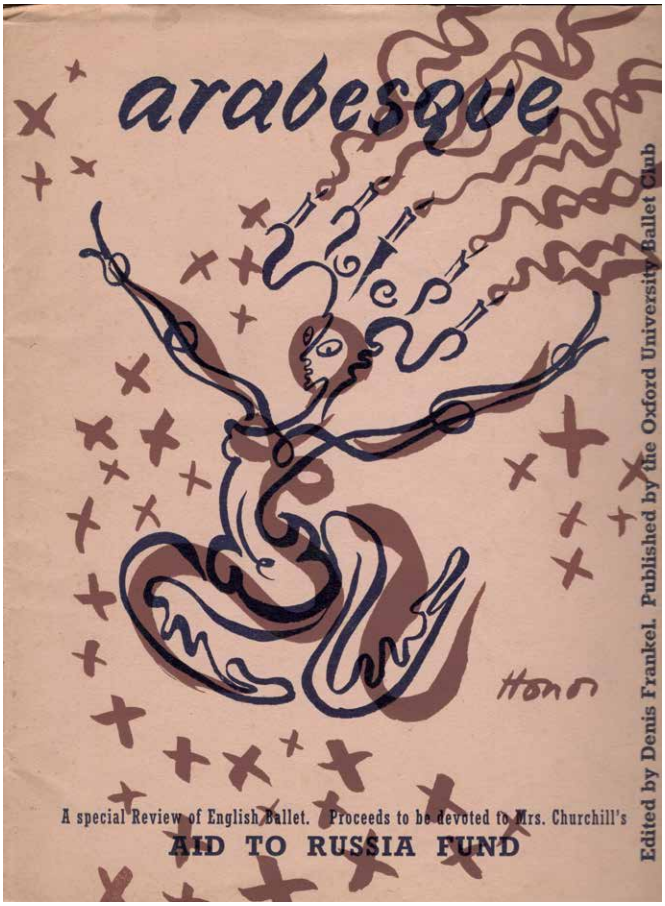


Figure 22. Arabesque. A Special Review of English Ballet. Proceeds to be devoted to Mrs Churchill's Aid to Russia Fund (1943). Front cover by H. Frost.

(Figs 23-25). One of her most impressive works represents a chamber music concert performed by refugees at Great Ormond Street Hospital. The dark, expressionist, and fantastical vein, already present in many of her pre-war etchings, reveals an affiliation with Thomas Rowlandson, George Cruikshank and, in some cases, the William Hogarth of *Gin Lane* and *Beer Street*, and should be recorded in the history of British modern art so dear to Frost's guardian, Wilfrid Evill. One of the most fascinating faces at the bottom left of the engraving is identified thanks to a caption added by Frost: 'Tambimuttu *et al.*' (Fig. 25). Meary James Thurairajah Tambimuttu was a famous Tamil poet and publisher who published David Gascoyne's *Poems 1937-1942*, illustrated by Graham Sutherland. He founded in 1939 the literary magazine *Poetry*, where Stephen Spender published his poem *I Sit at the Window*, previously illustrated by Frost for the Linden Press; in 1942, the first edition of Henry Moore's *Shelter Sketch-Book* was also published by Poetry Editions. All these names help to recreate Frost's considerable network in the years when London was a prodigious intellectual hub, especially because of the immigration of Jewish intellectuals from Austria and Central Europe. Among Frost's friends it is also important to mention the poet David Wright, the second Oxford graduate to become a Gregory Fellow in Poetry, contributor to *Poetry* and future director of the influential *Nimbus: A Magazine*

Figure 23. Frost's Blitz in London. Copper engraving.

Figure 24. Frost's Group. Copper engraving.

Figure 25. Frost's 'Chamber music by Refugees at Great Ormond Street'*, (1940), with 'Tambimuttu et al.'*

of Literature, the Arts, and New Ideas, where Frost would later publish a translation of Stendhal.

After the War, 1946-1953: Tate Gallery & Sadler's Wells

At the end of 1946, Frost joined the Tate Gallery as Director of Publications:

> An attractive young woman is 27-year-old Miss Honor Frost, newly appointed Director of Publications at the Tate Gallery, London.
> She controls the selection, printing and sale of postcards and other reproductions which are a big factor in making a living artist internationally famous. Through her, too, Britain will get to know the young generations of modern painters.
> Although still a student when the war began, Miss Frost is well qualified for her new job. When she was only four she was drawing seriously. At ten she was put under a drawing master in Florence and at 13 was studying art history at Lausanne University.
> Although her new job takes up most of her time, Miss Frost does not intend to give up stage design. Her first venture, the ballet *Khadra*, proved so popular in the Sadler's Wells repertoire while the company was touring that it will be played on the first night when they return to London this month. (*Evening Telegraph*, 1946 b: 3)

Figure 26. Honor Frost at the Tate, 1946-1947. Proof. (Probably by Roger Wood).

Meanwhile, the *Star* of 1 February, 1947 presents Frost as 'Agent No. 1' and headlines in capital letters: 'She "televises" the Tate' (probably because one of her tasks was to select coloured postcard reproductions). These sensationalist reports, illustrated with beautiful portraits, are nothing compared to the catchy and paternalist article, full of inaccuracies and clichés, published by the *Evening Standard* on 1 January, 1947. Titled 'Girl who sits in the Gallery: Honor, the Madonna of the Tate', it compared the young woman, indeed of breathtaking beauty, with the actress Veronica Lake (then at the height of her glory), dressed her in extravagant clothes, attributed to her ideas that she never held, and subordinated her intellectual activities to her advantageous physique (Figs 26-29). Far from being flattered by this flashy presentation, Frost felt humiliated and considered attacking the publication in court: 'My main objection to this article is its general prurient tone of innuendo which is likely to damage my reputation in my job.'[4] It was precisely because what was intolerable resided in insinuation more than the falsification of facts that the solicitors advised Frost to give up. The sequence of events would confirm how right she was to rebel and how, in this field as in so many others, she was a pioneer.

At the Tate, Frost did not only select coloured reproductions, but also oversaw the publications. It is in this context that she probably met the future Nobel Prize in Literature, Elias Canetti, who had moved to England in 1938 to escape Nazi persecution.

4 Frost's personal papers, quoted by courtesy of Alison Cathie.

Figure 27. Honor Frost at the Tate, 1946-1947. Proof. (Probably by Roger Wood).

Figure 28. Honor Frost at the Tate, 1946-1947. Proof. (Probably by Roger Wood).

Figure 29. Honor Frost at the BBC, 1946-1947. Proof. (Probably by Roger Wood).

A very strange letter from Elias' wife Veza Canetti to her brother-in-law Georges (a reputed doctor and biologist established in Paris), reports a meeting with Frost on August 27, 1947:

> One day the very sweet secretary [sic] from the Tate Gallery called up. They are publishing a volume of reproductions in which the picture on each page is compared to a great novel, and one page in it has *Autodafé*. And since she lives just round the comer, she asked, 'How many hundred fleas have you got?' And I learn that this whole neighborhood gets invaded by fleas in the summer because all the buildings are so dilapidated. I looked at my stockings. My legs were swollen, and there they sat and are sitting still. I have not a dozen fleas, or twenty, but hundreds, and they spray every day, and whoever tells you that DDT is good against fleas – they love it, my nephew says. They sell it because the fleas like it so much. To console me, Miss Frost sent me a picture from the Tate Gallery: 'Ghost of the Flea', a man, like a ghost, covered with fleas! (Lauer and Wachinger, 2010: 320-321)

Neither *The Ghost of a Flea* nor any excerpt from *Auto-da-fé* appeared in the anthology *Painters and Writers*, prefaced by Carlos Peacock and published by the Tate in 1949 with an elegant front cover by Barnett Freedman, but two other reproductions of William Blake's work – a painter who certainly inspired Frost's own artistic work – confront extracts from Dante's *Inferno* and *Purgatorio*.

If Veza diminished Frost's status by calling her a 'secretary', Elias was obviously fascinated by (if not in unrequited love with) the young Director of Publications, as can be deduced from a letter, written in Paris on April 4, 1948, to his brother Georges:

> On my very first day here, I ran into Honor Frost. She was delighted, and that night, we went to Nissim's theater together. [...] On Wednesday at 2:30, Honor left by plane for London. The night before, we went for a five-hour walk – until 4 a.m. – through the darkened streets of Montmartre. It was wonderful: the buildings, the solitary trees, the stillness, and that terribly unhappy girl (a very lovely creature with a death mask) to whom I never can get any closer. When I'm with her, it always feels like I'm walking beside a drowned woman. (Wachinger & Wachinger, 2010: 370-371)

Obviously, this period was not the happiest of Frost's personal and professional life. But the two night-owls seem above all to belong to incommunicable worlds. The 'drowned woman' perhaps refers to the famous mask of '*L'Inconnue de la Seine*', cherished by all artists, but it prefigured above all, quite surprisingly, the fate of Frost who triumphed over the sea. When Canetti's biographer, Professor Sven Hanuschek, met Frost in London in 2003, she told him that she became friends with Canetti through his mistress-novelist Friedl Benedikt (who published three novels as Anna Sebastian), and that she had served as an intermediary between the Austrian sculptor Fritz Wotruba (a friend of Canetti) and the Tate. She remembered perfectly well the long walk in Paris at night, followed by many other nocturnal walks in London in search of quirky cafes. Keen to point out that she had never been Canetti's 'pupil' – she described him as a 'funny mythomaniac' – she considered that his famous book *Crowds and Power* was in many ways a 'mess' (alluding

Figure 30. Frost's portrait of Elias Canetti. Ink. (After 1947).

to the original title, *Masse und Macht*) (Hanuschek, 2005: 421-422, 429-430, 434). But she apparently did not show Hanuschek the astonishing portraits in ink she made of Canetti, in the manner of the ancient humorous Zen paintings (Fig. 30).

In the margins of this thrilling intellectual life, Frost encountered incredible injustice at the Tate. The *Evening Standard* affair announced the end of Frost's mission at the Tate Gallery, an event that deserves to be prominently featured in the history of Women's Studies. From a letter to Graham Sutherland (Tate Trustee and Wilfrid Evill's friend), dated 22 April 1949, an unidentified solicitor reveals the reason why Frost was forced to resign: she did her job too well! It must be read to be believed:

> All that further transpired was that the Director was told to convey to Frost that her services would not be needed after the 31st of July 1949. The reason obviously given was that the creation of a big and prosperous department was not what the Trustees wanted, that she had been too successful and that a turnover of 16,000 pounds filled the Trustees with apprehension. Surely a very strange reason.

The author concludes ironically a few lines further: '…all conduct bears more relation to the Papal Curia in the 15th century than to a Gallery Committee in the XXth century.'[5] Apparently the Chairman of the Trustees had sought to conceal the irrational behaviour of his nephew, Humphrey Brooke, appointed Deputy Director of the Tate Gallery in 1948, later diagnosed with manic depression, which Brooke was convinced contributed to his intellectual abilities as he later explained in a letter to the *Observer* (Brooke, 1982; Monuments Men, nd).[6] Brooke's mental illness was an open secret. The solicitor's letter specifies that 'Brooke possessed by what I believe is correctly described as obsessional mania, went to Downing Street and launched charges against Honor and the Director.' Although he also suffered the same defamation, the Director of the Tate, John Rothenstein, could not defend Frost – probably as a result of intimidation.

Although morally harassed and unfairly dismissed, Frost did not have the mentality of a victim (Figs 31-32). Happily, she had never given up her commitment to ballet design and the London press unanimously welcomed the originality of *Khadra*, a highly acclaimed piece among the new repertoire performed by the Sadler's Wells:

> The new Sadler's Wells ballet *Khadra*, a combination of Persian settings and music by Sibelius is to have its premiere on May 27.
> Its creators are lithe, black-haired, grey-eyed Celia Franca and Honor Frost, fairhaired and trousered.
> Miss Franca, who is producing the ballet, wrote the story and did the choreography. Miss Frost designed decor and costumes. It is their first production.
> Working 16 hours a day, they save time by sharing a flat. They snatch sandwich meals and sit up until 1 a.m., sewing costumes. Buzzing with ideas, they are experimenting with new materials. Some of the 17 dancers' coats are made of horse hair. Other are made of straw. *(Evening Telegraph*, 27.4.1946: 5)

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5 Frost's personal papers, quoted by courtesy of Alison Cathie.

6 The Tate Gallery Archive keeps the correspondence between Humphrey Brooke, Honor Frost and the Publications Department in 1948-1949.

Figure 31. Honor Frost at work designing ballet decor, c.1947. Proof. (Probably by Roger Wood).

Figure 32. 'My chilly studio'. Honor Frost painting in a courtyard, (c.1947).

Arnold Haskell – one of the most influential dance critics and father of the renowned art historian Francis Haskell – immediately recognized the challenges, both of its subject and its treatment:

> *Khadra* to Sibelius' *Belshazzar's Feast*, brings a new-comer to choreography in Celia Franca. She has tackled a difficult problem, the Orient; difficult because for so long it seemed as if Bakst and Fokine had said the last word, difficult because the dangers of the Oriental bazaar approach, so obvious and so tempting. Together with Honor Frost, who designed costumes and setting, she has avoided all those difficulties, going straight to the Persian miniature for inspiration and making a really successful translation into ballet. […] The important feature of the production is the extraordinary partnership between choreographer and designer that makes their work into a whole, something that has been rare in our ballet to date. (Haskell, 1946: 106-107)

No one could imagine the association of two more contrasting backgrounds: Frost, only child of a banker, ward of discerning collector and wealthy solicitor Wilfrid Evill, and Celia *née* Franks in the East End, daughter of a tailor from a family of Polish Jewish immigrants (Bishop-Gwyn, 2011: 7-27).[7]

The Sadler's Wells Theatre Ballet was initially the experimental branch of the main company which, after a few years, 'established itself as a complementary organisation of first-class creative importance' (Haskell, 1952: 5-6).

> The repertoire consists mostly of contemporary ballets by young artists, for the grant which the Arts Council makes to Sadler's Wells each year is specifically intended for the encouragement of young painters and musicians as well as young choreographers. The Sadler's Wells Theatre Ballet gave its first performance on 8th April 1946, at Sadler's Wells, dancing in *Promenade*, *Assembly Ball*. […] Later a new ballet by Celia Franca, *Khadra*, was staged in striking decor by Honor Frost, and this brought forward another talented youngster, Sheilah O'Reilly'. (Clarke, 1955: 311-313)

Khadra's novelty conquered the critics:

> The Sadler's Wells Junior Ballet last night gave the first performance of a new ballet called *Khadra*. It is new and original in every sense of the word. The prelude to the performance was Romance in C by Sibelius and the incidental music from his *Belshazzar's Feast* was very apt for this exotic Eastern feast of colour and movement. It was evident from the enthusiastic reception that is going to be a popular ballet. Miss Celia Franca, the dancer, was the choreographer, and Miss Honor Frost was the creator of some brilliant stage design. (*Lancashire Daily Post*, 1946: 1)

The choice of Sibelius was not made by chance. In the 1930s Sir Thomas Beecham, a great admirer of the Finnish composer, regularly conducted Sibelius with the Royal Philharmonic Orchestra. As for Constant Lambert, Founder Music Director of the Royal Ballet, he considered 'Sibelius not only the greatest composer of today but the most inspiring to the younger generations of composers' (Lloyd, 2014: 159). Sibelius composed *Belshazzar's Feast* in 1906 and extracted from the longer work a popular suite in four

movements, elected by Franca and Frost for their short ballet (15 minutes). Even though earlier than *The Rite of Spring* (1913) by Stravinsky, the incidental music by Sibelius, contemporary with Finland's struggle against the domination of Russia, is infused with exotic orientalism that perfectly suits a ballet clearly influenced by the *Ballets Russes*.

The decors and the costumes left no one indifferent:

> For the latter Miss Franca is greatly beholden to Miss Honor Frost whose costumes are in every way delightful. (*Nottingham Journal*, 29.5.1946: 2)

The sumptuousness of the sets and costumes was partly due to shortages: Frost explained in a Swiss magazine her difficulties in obtaining materials while everything related to clothing was rationed (Fig. 33). These obstacles only inflamed her imagination (Senn, 1947: 12). *Khadra*'s particularly imaginative costumes were cut from recycled materials. The design is so impressive that some critics feared that it overwhelmed the ballet itself:

> The curtain rises on a dazzling feast of Oriental colour, the decor by Honor Frost being influenced by Persian miniature painting. The first effect is exciting but I am not sure that it is not too detailed and fussy a background to dance against: but the choreographer, Celia Franca, has cleverly arranged to concentrate on grouping her dancers in geometrical masses like cave stalagmites rather than to display their individual virtuosity. *(Scotsman*, 1.6.1946: 6)

Figure 33. Frost and Franca selecting accessories for Khadra. *Photo Roger Wood.*

Many years later, the dancer Peter Wright spoke of being spellbound by Frost's masterpiece: 'The ballet was like a fragment of a Persian sculptural frieze coming to life' (Wright, 2016: 333) (Fig. 34). Last but not least, Richard Buckle, the prominent ballet critic, wrote a slightly ironic review, partly amused, partly appreciative, undoubtedly under the spell of the two young creators:

> The choice of Sibelius' music was certainly a happy one, and some of the fantastic Persian dresses were splendid – though the intricate scenery was ill-conceived; there were some good groupings and movements, which seemed to derive partly from Fokine's mock Oriental dances for the Queen of Shemakkan; but the general effect was one of romantic chaos. For most of the quarter of an hour which the ballet lasts, the stage is full of people, all dressed differently and all performing different movements; in spite of Khadra's smile and of the languors of Leo Kersley and Anne Heaton, the white-clad lovers, the works lacks accent and construction. […]
> In all honesty I must say that after I have seen *Khadra* twice or three times, and now that I have read my programme, I may give a more favourable or at any rate a different report on it. More fortunate than the patrol leader, I get a second chance; and nothing much hangs on what I say one way or the other.
> *Khadra* was applauded with greater enthusiasm and noise than any other production of the recent French ballet at the Adelphi. I am interested in applause. Apart from the applause due to the several merits of Franca's work, the ovation accorded to *Khadra* was no doubt due partly to the 'Happy Family' game traditionally played at Sadler's Wells, partly to the variety of bright colours in the designs of Honor Frost, but chiefly, I am sure, to the sudden appearance of handsome Miss Franca and pretty Miss Frost, hand in hand, wearing striking evening dresses, and bowing humbly as they received a shower of bouquets. (Buckle, 1946: 5-8)

Khadra was so successful that it was performed for two consecutive years, in 1946 and 1947. In 1948, Frost published her first book, *How a Ballet is Made* (Figs 35-37). Richard Buckle was clairvoyant when he alluded to the Russian choreographer Fokine and to Romanticism. In the foreword, Frost refers to Théophile Gautier, major critic of Romantic ballet, and to Jean-Georges Noverre, precursor of the narrative ballet of the 19th century (Frost, 1948: 1). These references were quite up to date. Noverre's *Lettres sur la danse et les ballets* were translated in 1930 by Cyril Beaumont, fervent admirer of the *Ballets Russes* and author of numerous books on ballet, among which is *Ballet Design: Past and Present* (1946). *How a Ballet is Made* is part of the great revival of ballet design:

> The author has taken as her example the ballet *Khadra*, and has shown how the ballet was conceived and built up. She describes the work of the choreographer (Celia Franca) and the décor and costume designer (herself). In her own words, 'an attempt to coordinate the parts and record the making of a simple, short, straight-forward ballet – to make a blue-print of its machinery'. (*Illustrated Sporting and Dramatic News*, 17.11.1948)

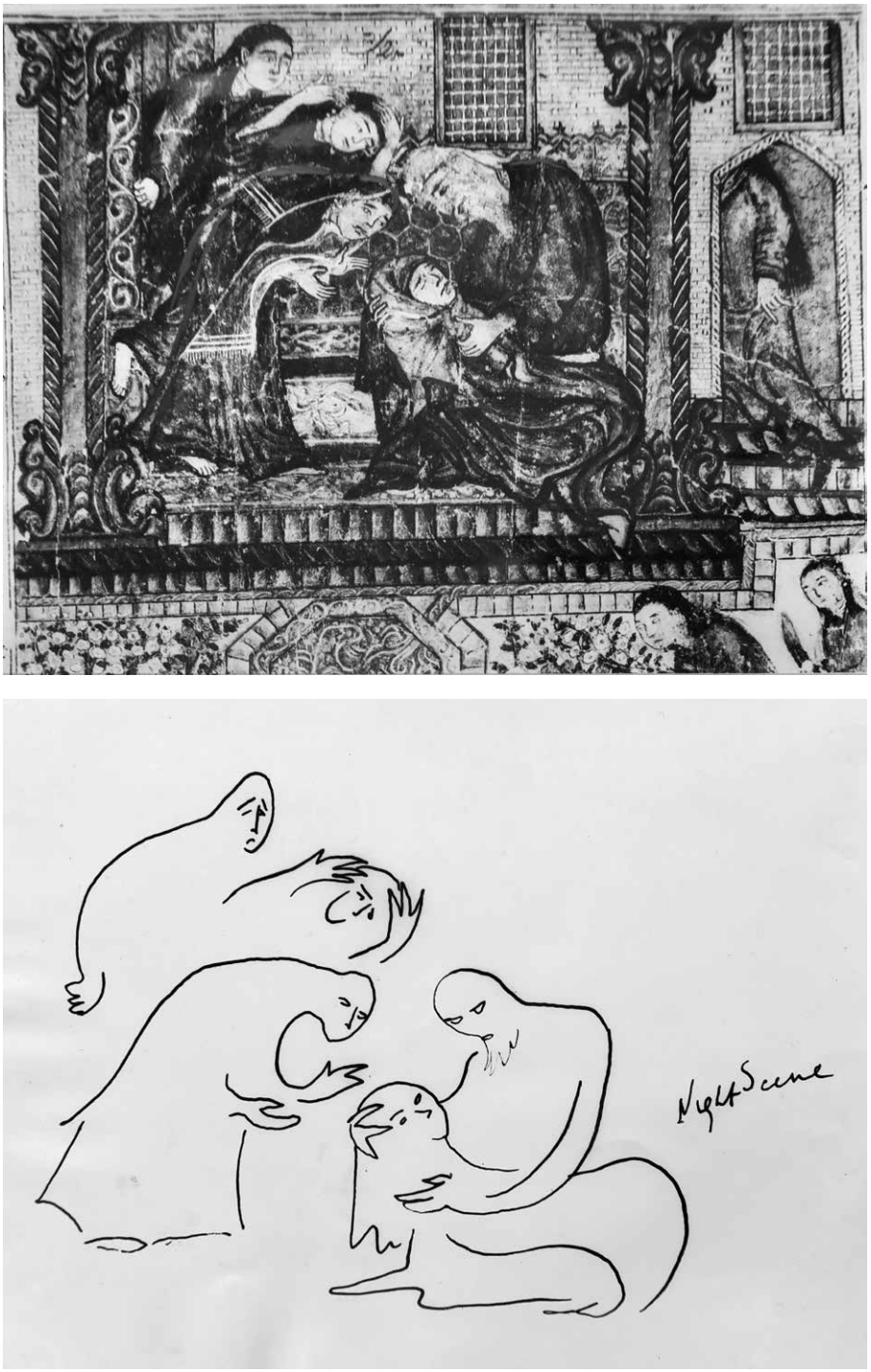

Figure 34. Preparatory sketch for Khadra *after a Persian miniature.*

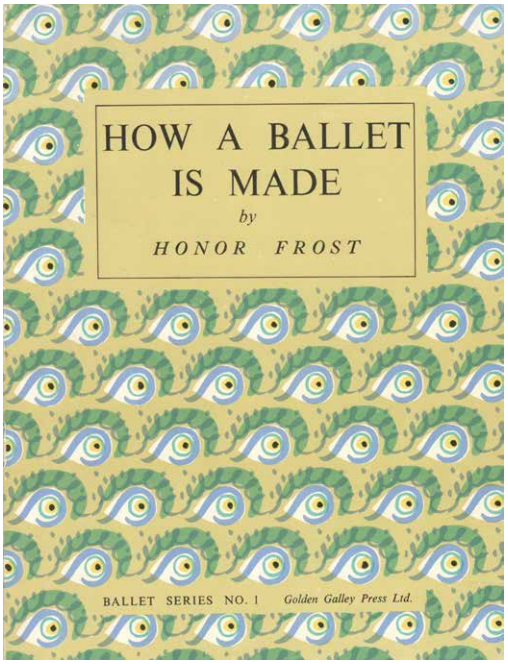

Figure 35. Frost's How a Ballet is Made *(1948), Front cover.*

Figure 36. Frost's How a Ballet is Made*, Decor.*

Some critics are puzzled by the lapidary style: 'An unfortunately general title for the illustrated story of the Sadler's Wells ballet *Khadra*' (*The Sketch*, 10.11.1948: 266). The general feeling is frustration:

> Enthusiasts, of whom there are an ever-increasing number in the North of Ireland, will be interested in *How a Ballet is Made* by Honor Frost, Ballet Series, No. 1 (Golden

Figure 37. Frost's How a Ballet is Made*, silhouettes of the dancers.*

> Galley Press, 10 s 6 d). But they will think it is much too short: which indicates at once its attractiveness and its insufficiency. The authoress is concerned with one only slight work, *Khadra*, choreography by Celia Franca, music by Jean Sibelius. She sets out the elements of this clearly but briefly. She attempts 'to make a blue-print of its machinery, in the hope that this information may help to throw some light on other more complicated works.' Whereas we feel any discussion of a really complex subject, such as the English character, or cookery – as understood by Mrs. Beeton – or ballet, should be more discursive and leisurely. This volume, however, at least contains several provocative remarks and some charming photographs, and will be a useful addition to that particular shelf. (*Belfast News-Letter*, 25.9.1948: 3)

Perhaps more lyricism was expected by the readers and by the balletomanes used to flowery speeches. Their expectation was unfulfilled. 'Diving reminds one of ballet,' Frost subsequently wrote in *Under the Mediterranean* (Frost, 1963: 17-18). But the analysis of a ballet as a machine heralded diving in its rigour, its precision, and by the importance of technical details and environment:

> There were two main problems to solve in designing the costumes for *Khadra*. The first was the general problem of designing costumes to show movement, and the second was to evoke the figures in Persian paintings. (Frost, 1948: 25).

Frost would reason and react exactly the same way when the time came to decide on the context of shipwrecks and anchors. How would she bring to life the world of antique ships and sailors? Her approach to an orientalist ballet was quite similar:

> ‘How can I bring to life on the stage the world of the Persian miniatures?’ My qualifications for this task were familiarity with Persian art and with the life of the East, where I was born and brought up. Though my training has been European, I have never been able to use colour in the European way. Colour only exists for me in its crudest forms as used in patterning; I don’t think I could paint a good watercolour landscape. (Frost, 1948: 24)

Incisive, dense, practical, direct, Frost’s style never really changed. She hated pomp and bombast. Her designs belong to an artistic wave illustrated, in various modes, by artists as disparate as Chagall, Foujita, Ronald Searle, Cecil Beaton, Pavel Tchelitchew, and of course by Cocteau, Christian Bérard, Boris Kochno, and Marie Laurencin for the programme for the Ballet des Champs-Élysées Tour at the Adelphi, in 1946. In the spring of 1947, her drawings for *Khadra* were exhibited in an art gallery at Mayfair, Gimpel Fils, for a retrospective titled *Background to Ballet*, devoted exclusively to the art of designing decor and costumes for ballet. Frost’s works were exhibited with those of Michael Ayrton, James Bailey, Cecil Beaton, Edward Burra…: some of the best painters and scenographers of the time. Her archive reveals that her work for ballet never detracted from her passion for drawing and sculpture: photographs of Benno Elkan’s great *Menorah* in his London studio confirm that, as she had confided to friends, she contributed to facilitating the gift from the Parliament of the United Kingdom to the Knesset. In addition to this anthology, one would not want to lose sight of her highly personal wardrobe, enhanced by the marvellous creations of her friend the fashion designer Thea Porter, that matched so well with Frost’s natural elegance and inventiveness.

A second ballet, an ‘espagnolade’, *Bailemos*, less successful and less well documented, was performed in 1947 (Fig. 38):

> On Tuesday last the governors of Sadler’s Wells, in association with the Arts Council, presented the Sadler’s Wells Opera-Ballet, under the direction of Ninette de Valois, in a new ballet with music from Massenet’s *Le Cid*, choreography by Celia Franca and scenery and costumes by Honor Frost, entitled *Bailemos*.
> According to Honor Frost, Spain swelters under a buttercup-yellow sky, relieved by occasional silver clouds. Black dominates the dress of the populace, whether they be nobility or peasantry. It is black cleverly used to accentuate daring touches of colour introduced by sashes, gloves, and necklaces of semi-precious stones. It contrasts with the golden glory of the heavens. […] The ballet is a delightful addition to the rapidly growing repertory of this young company. (*The Stage*, 6.2.1947: 7)

Ballet workshop at the Mercury Theatre and last programmes (1951-1953)

When interviewed for the BBC in 1993, Frost didn’t say precisely when she gave up ballet for diving: ‘I did design for a ballet, yes; but I gave that up when my choreographers went abroad and then, I don’t know, then I gradually … I turned over to this other interest’ (MacGregor, 1993). An event occurred in 1951, which coincided with this: Celia Franca left London for Toronto to establish the National Ballet of Canada. The last trace of their

Figure 38. Bailemos *at Sadler's Wells (1947) stage picture. (Probably by Roger Wood).*

collaboration I found is a programme from the Mercury Theatre of 21 October 1951. It sounds like a farewell:

> *Colloque sentimental*. Poems by Verlaine set to Music by Debussy. 'Two lovers try to join a "Fête galante" and recapture the spectre of their own past love – but only their memories remain.' Choreography: Celia Franca. Decor and costumes: Honor Frost.

After Celia's departure, Frost designed several ballets for the Ballet Workshop at the Mercury, an art house pocket theatre of 150 seats, for the Ballet Rambert at Notting Hill Gate, founded in 1933 by author and playwright Ashley Dukes (Marie Rambert's husband) – it appears in Powell and Pressburger's film, *The Red Shoes* (1948). As a workshop for '*Art et Essai*' productions, verse drama and plays by T.S. Eliot, W.H. Auden, and Christopher Isherwood were performed there. The aim of Ballet Workshop, a stage for 'plays by poets' as remembered in the blue plaque on the building in Ladbroke Road, unveiled by Angela and David Ellis (Marie Rambert's daughter and son-in-law), was to give 'choreographers, composers and designers a chance to do the work upon which large profit companies refuse to risk money' (Barnes, 1951: 6-7). It gave its first performance at the Mercury Theatre on January 14, 1951. Frost collaborated with various artists and renowned choreographers, such as Peter Darrell and Michael Hobson:

> On July 8, at the Mercury, Ballet Workshop presented their programs for Sundays in July, consisting of a revival of *Midsummer Watch* by Peter Darrell; *Fantasm (Episosodia Glorianae)*, with choreography, décor and costumes by Harry Cordwell to music by Michael Hobson; and two ballets by Jan Cieplinsky, *Divertissement* to music by Mozart,

Figure 39. The Dong with a Luminous Nose*, Mercury Theatre (1952), stage picture.*

> with costumes by Honor Frost, and *The Golden Disc*, to music by Saint-Saëns, with décor and costumes by Laszlo Szilvassy. (*The Stage*, 12.7.1951: 4)

In 1952, Frost designed the costumes for an adaptation of Edward Lear's tale, *The Dong with a Luminous Nose* (Figs 39-40):

> On Sunday next the Ballet Workshop programme at the Mercury will consist of *Dances from Israeli Life*, with choreography by Nachum Yehuda, mounted on traditional music; *Overture*, with choreography by Jack Carter, music by Ernest Bloch and décor and costumes by Norman MacDowell; and *The Dong with a Luminous Nose*, with choreography by Michael Holmes, music by Alexander Walton, and décor and costumes by Honor Frost. (*The Stage*, 4.12.1952 a: 8)

The media welcomed Frost's genius:

> I am sure that Edward Lear would have been delighted with Ballet Workshop's presentation of his *The Dong with a Luminous Nose*, for in this new ballet Michael Holmes has absolutely captured the spirit of Lear's whimsical nonsense, and Honor Frost has designed just the right kind of madly fantastic costumes and fairy tale-like set. (Browse,1952: 16)

Figure 40. The Dong with a Luminous Nose*, Mercury Theatre (1952), stage picture.*

Surrealism was familiar to Frost, who was close to the poet David Gascoyne, deeply influenced by the French movement. *The Dong with a Luminous Nose* ran until June 1953 (*The Stage*, 1953 a: 8; 1953 b: 6). Frost would collaborate once again with the Mercury Theatre, in autumn 1953:

> *Trio*, choreographed by Peter Darrell to music by Vivaldi with pleasantly designed décor and costumes by Honor Frost, was well danced by Beryl Goldwyn, Noreen Sopwith and Alexander Bennett, whose styles suited the dance arrangements excellently. (*The Stage*, 1953 c: 12)

During all that time, Frost never stopped drawing, as evidenced by a book and ballet project titled *Tom Scarecrow* (a curious descendant of the Wizard of Oz and of the scarecrows dear to Stanley Spencer) (Fig. 41), by incisive caricatures (Fig. 42), by enchanting watercolours (Figs 43-44), and by several dust-jacket projects (Figs 45-47). The simple fact that in 1947 Frost was chosen to illustrate the first issue of *Ballet Annual*, the record and year-book of the ballet world edited by Arnold Haskell, is significant: the issue brought together Arnold Haskell himself, Marie Rambert, Cyril Beaumont… the cream of the crop in the field (Fig. 48).

In the same year, Frost sketched an amazing sort of Greco-Buddhist silhouette for the second issue of *Covent Garden Books* (season 1947-1948) (Fig. 49). She also presented, selected, and translated 'Stendhal on the Writing of Libretti from the *Lives of Haydn, Mozart and Metastasio*' (Frost, 1954). Last but not least, Frost drew the cover of the Sadler's Wells Theatre Ballet programme for its American Tour in 1951-1952: a unicorn,

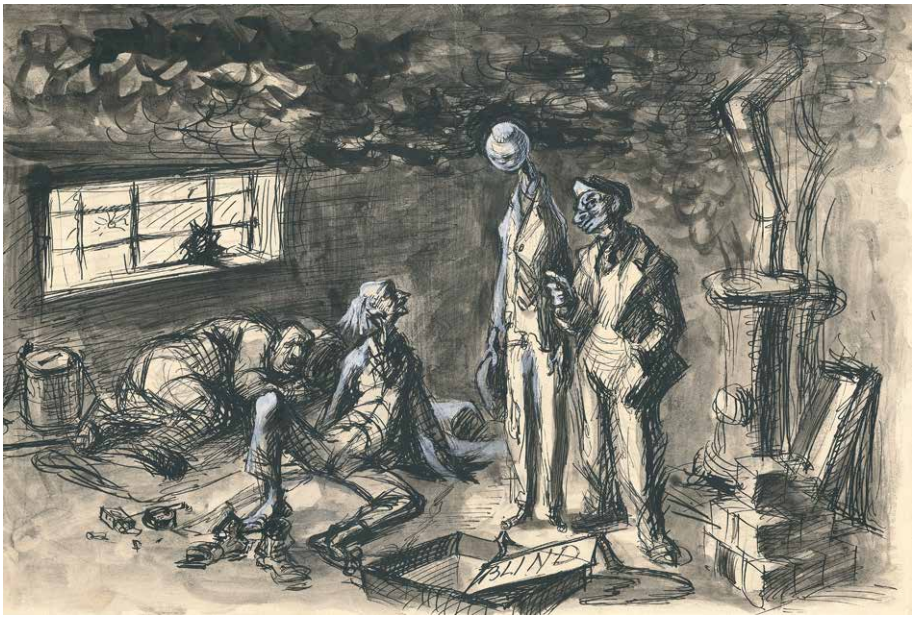

Figure 41. Sketch for the book Tom Scarecrow *(c.1953).*

Figure 42. Caricature of two ladies at the restaurant Grand Véfour, Paris, Christmas 1950.

Figure 43. The Apotheosis of the Fat Man. *Ceiling in blue.*

Figure 44. The Fairwell (sic) of the Fat Man. *Ceiling in rose.*

Figure 45. Joy Street. *Cover project (probably in the 1950s).*

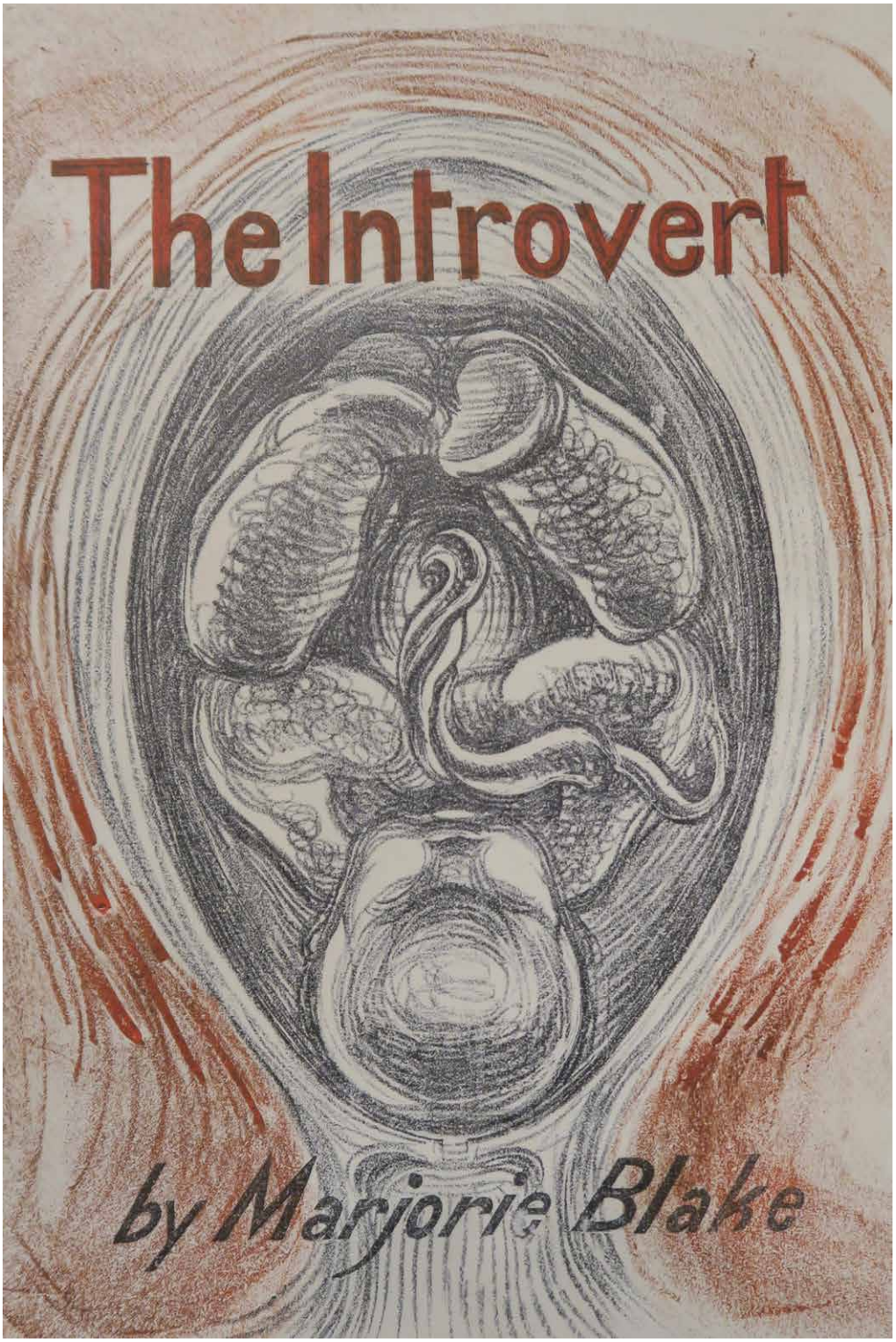

Figure 46. The Introvert. *Cover project (probably in the 1950s).*

Figure 47. Two Hearts in a Cage. *Cover project (probably in the 1950s).*

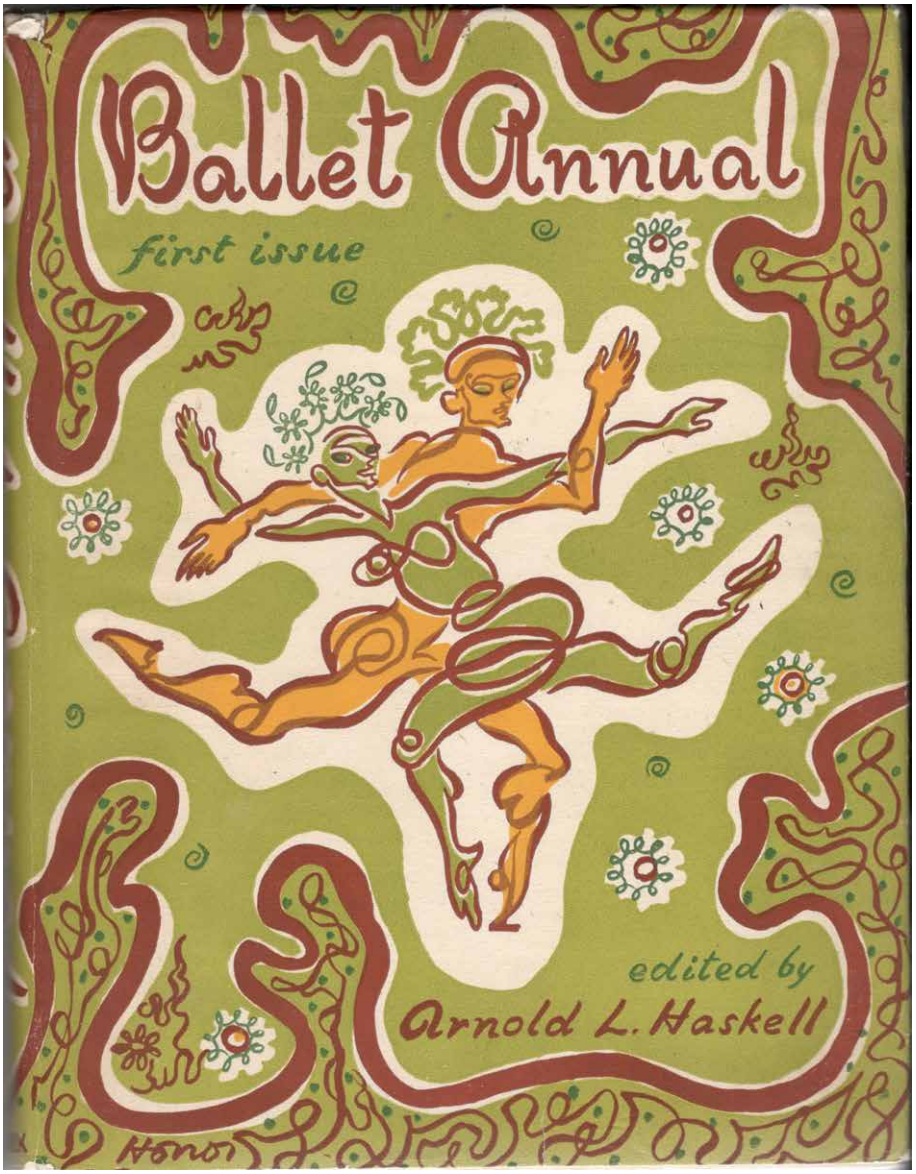

Figure 48. Ballet Annual*, 1947. Front cover by Honor Frost.*

Figure 49. Covent Garden Books N°2, *1947-1948. Front cover by Honor Frost.*

Figure 50. Sadler's Wells Tour Programme, 1951-1952. Front cover by Honor Frost.

a lion, and a dancing figure stylized in the middle of a richly coloured flame on a black background, Frost's way perhaps of burning her ties with the life she had adored for so many years (Fig. 50) – even if, in April 1958, in Lebanon, she still found time to illustrate the programme of Gilbert & Sullivan's *Iolanthe*, interpreted by the Beirut Orpheus Choir. In the meantime, Frost had become 'the diving diva,' according to archaeologist John Carswell's felicitous phrase (Carswell, 2012).

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1985-2008: TROPIS International Symposia on Ship Construction in Antiquity

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> As with Trade Fairs, the success of Symposia is measured by the volume of goods or information exchanged. (Honor Frost, 'Pyramidal Stone Anchors: an inquiry', TROPIS I, Piraeus, 1985)

On the morning of 22 June 1985, *Kyrenia II*, the full-scale replica of the ancient ship of Kyrenia, was launched in Greece, at Manolis Psaros Yard in Perama, near Piraeus, in the presence of Melina Mercuri, the Greek Minister of Culture. Many European ministers and officials attended the ceremony, because the event was set within the framework of 'Athens First Cultural Capital of Europe'. I had also proposed, and it had been accepted, that a large exhibition titled 'Greece and the Sea', with exhibits extending from the early prehistoric attempts at navigating in the Greek seas up to modern supertankers, was organized in Piraeus.

The original Kyrenia vessel dated to the end of the Classical era. During the four years required for the construction of the 15-m-long *Kyrenia II,* I realized that, although theoretically a great deal was known about how ancient hulls were assembled, there were numerous practical questions and problems still to be elucidated. Not only were there questions about the shell-first construction method but also much remained to be learned about the use of the ship's equipment. Dick Steffy – the world specialist on ancient ship construction who had reassembled the Kyrenia ship hull after its conservation, and with whom I cooperated closely – had posed many questions, as had Michael and Susan Katzev, the excavators of the ancient shipwreck. But there were also questions as to how a square sail or the two steering oars would have been used. So, I suggested to the Greek Ministry of Culture that a conference on 'Ship Construction in Antiquity' focusing on the construction and navigation of ancient Mediterranean seacrafts be organized. The date was set for the 30 August 1985, the launch date of the TROPIS symposia.

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 91-94. Leiden: Sidestone Press.

The Hellenic Institute for the Preservation of Nautical Tradition, which I had formed in 1981, and which had been responsible for the construction of *Kyrenia II*, organized that first three-day conference in Piraeus. Leading scholars in the field of nautical and underwater archaeology were invited. Twenty-six papers were presented, some by world pioneers such as George Bass, Peter Throckmorton, Honor Frost, Lucien Basch, John Morrison, Gerhard Kapitän, Thomas Gillmer, Michael Katzev, François Salviat, Charalambos Kritzas, and Lionel Casson. Many authors of reference books on ancient ships also attended this first TROPIS conference.

TROPIS I was followed two years later by TROPIS II, held in Delphi (1987), then TROPIS III in Athens (1989), and TROPIS IV in Athens again (1991). TROPIS V was held in Nauplia (1993), TROPIS VI in Lamia (1996), TROPIS VII in Pylos (1999), TROPIS VIII in Hydra (2002); Agia Napa, Cyprus, hosted TROPIS IX (2005), and finally Hydra hosted TROPIS X (2008). The 26 contributions to the first conference were contained in a three-day meeting; five full days were required for the 77 papers of the last TROPIS symposium.

The topic of nautical experimental archaeology of the Mediterranean – a novelty at the time – was dealt with at length and on many occasions at the TROPIS meetings, and numerous papers were presented about the first three experimental projects conducted in Greece: *Kyrenia II*, *Papyrella,* and the Athenian trireme *Olympias*. Patrice Pomey, who subsequently successfully built *Gyptis*, an excellent full-size replica of one of the two Greek ships excavated at Place Jules Verne, Marseilles (Pomey and Poveda, 2018), as well as our late friend Yaakov Kahanov, the builder of the *Ma'agan Mikhael II,* a full-scale replica of the Ma'agan Mikhael Ship (Cvikel & Hillman, forthcoming), were both assiduous participants at the TROPIS meetings.

Honor Frost contributed to all the TROPIS symposia and was a loyal member of its organizing committee. It is well known that Frost was a specialist of ancient stone anchors; a book offered to Frost by the Greek Minister of Culture Melina Mercuri carries the dedication πότνια αγκυρών; 'To Honor Frost goddess of anchors'.

I had met Frost years before the TROPIS symposia; she was introduced by a dear friend, Peter Throckmorton. Peter had a 46-foot motorsailer, the *Stormy Seas*, that was well equipped for diving surveys and was based at the yacht marina of Zea in Piraeus, where I also had my office. It was Throckmorton who first told me of Frost's underwater research in the 1960s on the submerged site of the Pharos of Alexandria, firstly with Kamel Abul-Saadat and later with Jean-Yves Empereur (see Empereur and Hairy, this volume). As I was born in Alexandria, and spent the two first decades of my life there, I was extremely interested in getting first-hand information of the prestigious discoveries made in the area where the Pharos once stood.

Years later I obtained a permit from the Egyptian authorities to undertake research in Alexandria. As a result, since 1998 the Greek Mission has performed 29 underwater archaeological and geophysical surveys of the eastern littoral of Alexandria. A moving moment came in 1999 when I invited Frost to take part in our second survey. At the age of 82 she dived again in the waters of Alexandria on the site of Ibrahimieh where some 50 stone anchors lay entangled in the cavities of a reef. For several days she taught our young archaeologist-divers how to draw stone anchors on the seafloor.

A year later and up to the end of 2003, Frost faced serious problems with the Punic Ship. The remains of a Phoenician warship had been found in 1969 in Marsala, Sicily and

Frost had been asked to lead a team of archaeologists from the British School at Rome to excavate this unique find (see Alagna, this volume). For reasons difficult to understand and explain, the archaeological authorities of Marsala who were responsible for the find did not give adequate attention to its conservation and, as a result, the remains of the only known ancient warship of the Mediterranean were being badly neglected. Frost was desperate. We exchanged extended correspondence and, at her request, I repeatedly wrote to the Italian Archaeological Authorities concerned as well as to the Centro Regionale di Restauro in Palermo. I travelled to Sicily and then published a long article of protest in the Athenian daily paper *Kathimerini*. Frost was a fighter and, as in several other instances, she finally won and achieved the proper conservation of this unique ship (see Giglio, this volume).

Recently, the Director of the Piraeus Ephorate of Antiquities, Dr Stella Chryssoulaki, showed me a dugout found recently in an ancient marshy site near the Athenian bay of Phaleron. It had been used for a 6th-century-BC burial. Because it was found in a muddy environment it is well preserved and one can see ancient repairs made using mortises and tenons. The unique find is now being treated by conservators of the Ministry of Culture of Greece. At the site, I recounted the story of the Marsala ship, and Frost's insistence and success in its proper conservation, to the Ephor and the restorers who had gathered around the desalination tank. Ancient remains made of wood are extremely rare as, unlike stone and pottery, wood is highly perishable – and thus it is the excavator's responsibility and obligation to fight for their proper conservation.

For more than two decades the TROPIS symposia were a meeting point for scholars specializing in the history and archaeology of the ancient Mediterranean ship. Among the hundreds of contributors, I will only mention, in alphabetical order, the names of those who are no more among us: Lucien Basch, Polyxeni Bouya, Peter Calligas, Lionel Casson, John Coates, Federico Foerster-Laures, Honor Frost, Octávio Lixa Filgueiras, Thomas Gillmer, Alain Guillerm, Thomas Jacobsen, Yaakov Kahanov, Gerhard Kapitän, Michael Katzev, Elisha Linder, John Morrison, John Phillipson, Avner Raban, Richard Steffy, Peter Throckmorton, and Tassos Tzamtsis.

But the TROPIS conferences have also always been open to the younger generation and some of the students who have attended through the years are now leading scholars in the field: many were present in Nicosia in 2017 to celebrate with the older generation the centennial of Frost's birth. Another aspect of those symposia was that I was able to encourage the participation of both Israeli and Egyptian scholars. Starting with the Pylos meeting of 1999, participants from Egypt and participants from Israel, in ever-increasing numbers, sat side-by-side sharing information on the topic of their common interest – the ancient Mediterranean ship.

A total of 540 papers were presented at the ten TROPIS conferences, adding invaluable information to our appreciation of ship construction and nautical archaeology in antiquity. It is much regretted that our last meeting, in 2008, coincided with the beginning of the severe financial crisis that Greece has been facing since; the TROPIS symposia had to be discontinued due to a lack of state and municipal funds. But when we met ten years ago in the beautiful, picturesque island of Hydra we did not know that this would be the last of the TROPIS series; nor did we know that the paper given by Frost would be her last presentation. In fact, I was not aware that she had never been to Hydra before and, as I had not met her since the previous TROPIS, I did not

know that she had some problems with mobility. She could walk, but needed the help of a wheeled mechanism from time to time. Hydra, with its narrow, cobbled streets, its complete lack of any transportation except for mules and donkeys, was certainly not the right place for her. But she did not complain, she never accepted any preferential treatment, she stubbornly insisted on attending all events and meals, even when this meant a prolonged effort to climb to an inland taverna. She was 90 years old. When she returned home after the conference she wrote me a letter saying that it had been her first visit to Hydra and that had she been aware of the difficulties with those primitive paths she would never have come…and she added, 'but I would have lost a unique opportunity to see that unique island, so I am glad I did it'. That was the last letter I received from my very special friend, a very special scholar, and a very special person.

In conclusion, I would like to warmly congratulate the Trustees of the Honor Frost Foundation, chaired by Alison Cathie, for their initiative and Lucy Blue and Stella Demesticha for their tremendous efforts to make a dream come true by reuniting at the 'Under the Mediterranean' conference so many scholars and friends of Honor who had diligently participated at our TROPIS meetings.

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Arwad, Tyre, Sidon, and Byblos

Honor Frost's impact on harbour studies in the Levant

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From the 1960s onwards, Honor Frost wrote a series of papers focused on underwater archaeology in the Levant. She not only tackled the archaeology of the famous Phoenician city ports of Tyre, Sidon, Byblos, and Arwad, but with her innovative approach she raised the fundamental issues of relative sea-level changes and maritime palaeo-landscapes, all 30 years before the development of harbour geoarchaeology. She was a pioneer, so the tools that are now used almost systematically were not available to her, but she applied a truly interdisciplinary approach that is still used today in ancient harbour archaeology in the Levant and beyond. This paper aims to place her impact within the historiographical context of harbour geoarchaeology and to focus on the relevance of the questions she raised.

Keywords: Ancient harbours, Arwad, Tyre, Sidon, Byblos, geoarchaeology.

Between the late 1950s and the early 2000s, Honor Frost investigated the Phoenician ports of the Levantine coast, especially Arwad in Syria and Tyre, Sidon, and Byblos in Lebanon (Fig. 1). She explored the seafloor and she analysed submerged harbour infrastructures using recently developed methods of underwater archaeology and, in addition, she integrated geological and geomorphological data at a time when these were not frequently applied to archaeological analysis. She adopted a truly interdisciplinary approach and employed geoarchaeological tools even though they were not well developed. On the one hand, she operated in the archaeological context of the time, following the work of her predecessors, particularly that of Antoine Poidebard, another pioneer in underwater archaeology (1937; 1939; Poidebard & Lauffray, 1951). On the other hand, because Frost never limited her work to well-built harbour infrastructures and because of a lack of dating evidence, she extended harbour archaeology beyond

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 95-108. Leiden: Sidestone Press.

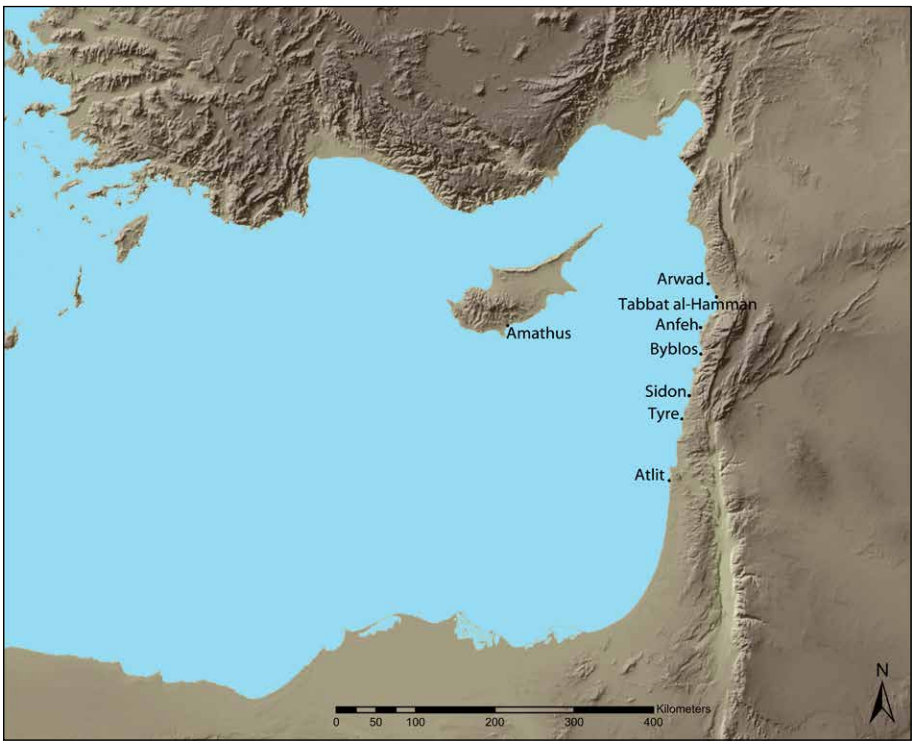

Figure 1. Location map showing Arwad, Tyre, Sidon, Byblos, and other Levantine sites mentioned in this volume.

the common field of research. Firstly, she went beyond the physical limits of ancient harbours, then commonly thought to be located within breakwaters and moles; and secondly, she looked outside of the Classical archaeological methods. Scientific curiosity brought her to the offshore reefs of the Levantine coast and the emerged or submerged floors of ancient coastal quarries to explore, record, and analyse archaeological remains and natural features in order to understand the natural processes and the anthropic pressures that gave the coast its current aspect.

From her first works at Arwad, during the 1960s, she knew – or she felt – that to understand ancient ports and harbours, especially the earliest, from the Bronze Age to the end of the Iron Age, she had to assess all the evidences at her disposal: historical, archaeological, geographical, and geological. This was an extremely uncommon approach at the time, and is detailed within the three papers she published that focused on Arwad in 1964, 1966 and 1970 (Frost, 1964; 1966; 1970). She emphasized the peculiar nature of the remains she found there and she did not limit herself to underwater archaeological remains; she also used ancient sources, contemporaneous testimonies, geological studies, maritime charts and, of course, previous archaeological work, especially that of Ernest Renan (1864) and Raphael Savignac (1916).

One fundamental point is her recognition of harbours as part of a bigger entity: 'Harbours being functional units, it is impossible to understand their component parts without seeing a blue-print of the entire mechanism' (Frost, 1966: 14). In the European Research Council's current project Portus Limen – Rome's Mediterranean Ports, we use

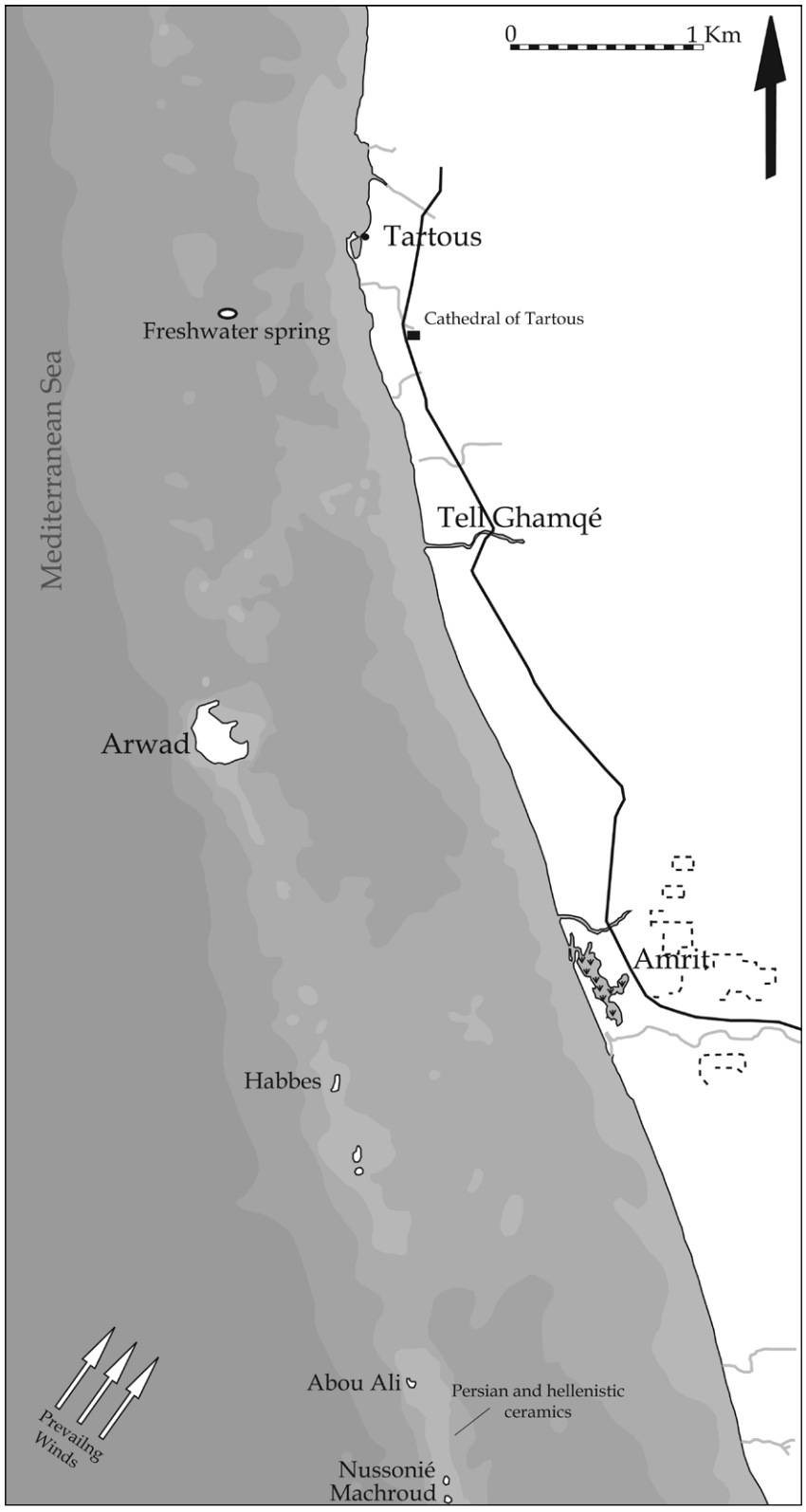

Figure 2. The reef of Arwad. (After Frost, 1964).

the notion that harbour basins or harbour structures are components of a whole – the harbour system (Carayon *et al*., 2018). Similarly, Frost realized that she had to focus on all the components of this system for a better understanding of its mechanism in terms of anthropic activities and environmental processes. At Arwad, she recognized the island as the northern extremity of a quaternary dune reef of sandstone (Fig. 2). Thus, she extended her survey all along this reef, from Machroud in the south to Arwad in the north, and located the remains of several human activities, especially quarries but also cargoes from shipwrecks on or next to the islets of the reef. In this manner she was able to emphasize the importance of the reef to Arwad's port activities: the sandstone reef shelters a huge area of water from winds and waves and is a roadstead used for anchoring and transhipment activities.

At the southern extremity of the reef, she located a 'couple of tons of pottery dating from about the 5th century BC to the 6th century AD' (Frost, 1966: 27). It was enough for her to relate these cargoes to shipwrecks and to locate a landing stage in the vicinity, which had been used up to the 5th century BC, according to the date of the earliest ceramics found. She assumed that after the abandonment of the reef as a harbour facility it was no longer visible and that ships started to run aground there. Next to these cargo deposits, she recognized quarries and 'man-made rock cuttings' on the islet of Machroud and submerged around it (Frost, 1966: 22-27; 1964: 71; Renan, 1864: 98). The characterization of the 'man-made rock cuttings' reflects the innovative aspect of her research as seen in this passage:

> Those who have never themselves seen submerged structures tend to explain them as natural phenomena. This [is] understandable, as virtually no comparative material has been published… My own conviction is based on ten years' Mediterranean diving experience and two seasons' research along the Arwad reef. I have never seen analogous formations along either the Syrian or Lebanese coast. (Frost, 1966: 24-25)

However, it's very interesting to note that she related their depth, 9 m below the current mean sea-level, to an ancient sea-level contemporaneous to the rock cuttings. In the papers published in 1964 and 1966, she used archaeological features, or what she supposed to be 'man-made rock-cuttings', as a tool to recognize palaeo sea-levels and emphasized the necessity of understanding sea-level change to place archaeological coastal features in the right context.

On the island of Arwad (Fig. 3), she understood very quickly that she had to undertake the study of all the artificial remains and the natural features in and around the island, on land and underwater, in order to fully understand and interpret the maritime landscape. To this end, she used photogrammetry (Frost, 1966), still more evidence of her interest in new methods of investigation, and started the very difficult analyses of the peripheral quarries, the sea wall that protects the quarry from the sea, and the esplanade cut into the rock. Although she benefited from the description of the monumental remains of the sea wall provided by Savignac, published in 1916, she focused especially on the quarries and the esplanade as structural features.

For Frost, the quarries are the key to understanding the island. She tried to elaborate a relative chronology of the peripheral area, stipulating that the earliest development was the quarrying, and that it had been undertaken in order to create a large, flat

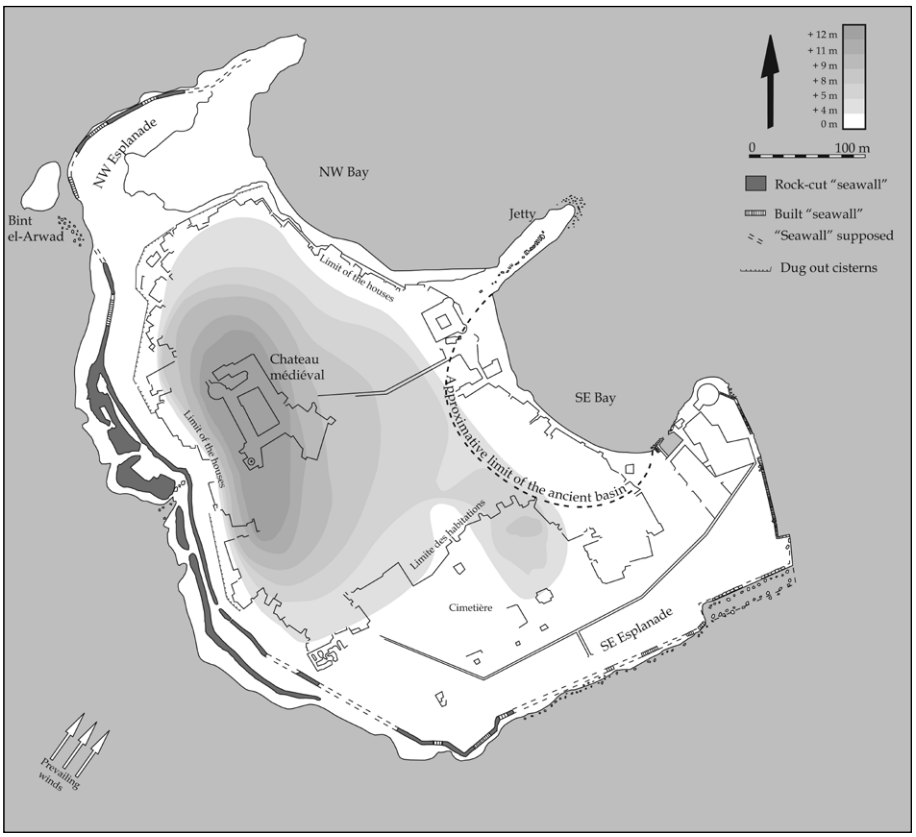

Figure 3. The island of Arwad. (After Frost, 1964).

area, the esplanade, which was then used as a storage area linked to the harbours – which were protected by a monumental and complex 'sea wall' (Frost, 1966; 1964). Thus, all the visible repairs on the 'sea wall' are then later than the sea wall itself and the quarrying. She tried to date these repairs by using size (*e.g.* Persian blocks) or the shape of blocks (*e.g.* Hellenistic blocks) (Frost, 1966: 17-20). In preliminary concluding remarks, she supposed that the sea wall and the esplanade were established before the Persian period, and she tried to link this development to the Late Bronze Age. As she had done for the reef, she used changes in sea-level to define the relative chronology. At the southern part of the island, she recognized an alignment of blocks belonging without any doubt to an early stage of the sea-wall collapse. This alignment is now submerged under a few decimetres of water and she assumed, rightly, that this part of the wall must be linked to an ancient sea-level lower than the present sea-level. It's very interesting to see how she related the palaeo sea-level to the collapse of the wall and to a fissure visible under water. For her, it was clear that the wall was built when the sea-level was lower and the fissure indicates that a tectonic event, some type of earthquake, caused both the wall collapse and the submergence of this part of the island. Behind the collapsed wall, a line of undated stretcher blocks could represent rebuilding of the wall after this tectonic event and the rise of the relative sea-level. To the north, she explained, using the same evidence, that Bint el-Arwad islet was at one time linked to the main island (Frost, 1966).

In addition, Frost recognized the silting up of the double bay, which had acted as the main harbour in antiquity. Renan, in *Mission de Phénicie*, had mentioned progradation within the southern bay (Renan, 1864: 22-25). According to local testimonies, Frost also suggested the possibility of a quay located under the modern houses, which allowed her to locate the ancient coastline within this harbour (Fig. 3). To this assessment, she also integrated horizontal modifications of the coastline, erosion, and/or progradation.

In these works carried out in the 1960s the vertical movement of the sea-level is used as a tool to explain the submerged anthropic, 'likely anthropic', or natural features. Frost relates the 9-m 'man-made rock-cut' feature called 'the road' to an ancient sea-level that had not been recorded elsewhere in Syria or Lebanon (Frost, 1966: 25). According to the global sea-level rise, such a low level cannot be dated after the maximum transgressive, *c.*6000 BP, well before the first example of quarrying (Pirazzoli, 2005). Therefore, only a tectonic event, not previously recorded in the area, could explain this discrepancy (Dalongeville *et al.*, 1993; Sanlaville *et al.*, 1997). We must keep in mind that these papers were written before the development of geoscientific studies of sea-level change. And we must then forgive Frost some short and simplistic syntheses of the general movement of the sea, such as:

> After the deposition of the Arwad dune, the sea continued to retreat far beyond its present level. It came back towards the end of the Iron Age to a height of three or four metres above its present level. It then retreated again to its present level (Frost, 1966: 25).

Nevertheless, the method is present and Frost emphasized in a prophetic passage the need to develop it:

> The pressing need in marine archaeology is to evolve a method of dating which will be equivalent to stratigraphy on land. This is no easy task, as several disciplines are involved. Indications of changing sea-levels pertain as much to marine biology as to geology. *Vermetus trottoirs*, for instance, because they are biogenic in origin could theoretically be dated by Carbon 14 (Frost, 1966: 25).

Today, the *Vermetus* platforms are a commonly used proxy for dating Holocene sea-levels in the Levant (Morhange *et al.*, 2006).

At Tyre and at Sidon in the 1970s, Frost benefited from the previous works of Poidebard and Jean Lauffray on the harbour structures (Poidebard, 1939; Poidebard & Lauffray, 1951). In addition, she benefited from the hoped-for progress in sea-level studies and dating, especially the work of Paul Sanlaville (1970, 1973). She applied the same methods she had used at Arwad: surveying the offshore reef, listing all the man-made features and trying to reposition them in their natural context according to the sea-level changes.

At Tyre (Fig. 4) she emphasized the important role of the roadstead within the Tyrian harbour system (Frost, 1971) (see Noureddine, this volume). Her results have been confirmed more recently by the geoarchaeological cores taken at Tyre and analysed and published by Nick Marriner (2009; Marriner *et al.*, 2007), who confirmed the reef was more extensive and the shelter provided was more efficient in antiquity than

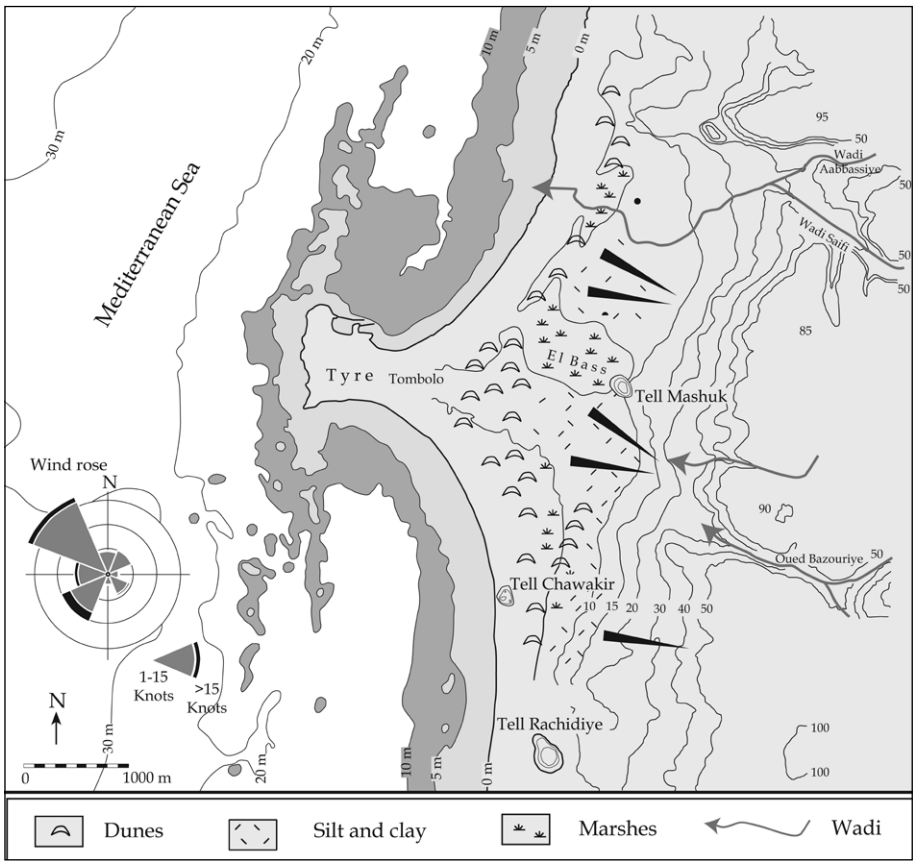

Figure 4. Geomorphological map of the Tyrian peninsula and the Tyrian harbour system. (After Marriner, 2009).

today. Moreover, Frost (1971) surveyed part of the Northern mole, already observed by Poidebard (1939), and noticed it had subsided since it was built. Her observations have since been confirmed by underwater excavations (Castellvi *et al.*, 2007). In the south, she disagreed with Poidebard's identification of the so-called Southern Port. She argued firstly that the two entrances to the basin identified by Poidebard were not suitable for a sailing boat – the southern entrance faces the prevailing wind from the south and the west – and secondly that it has a chicane that would not have been practicable for ancient ships. Thus, Frost brought practical sailing and knowledge of local weather patterns to the question. The interdisciplinary survey realized in 2002 in the area of the Southern Port confirmed her suggestion (El Amouri, 2004; Carayon, 2012: 78-82). This area had never been a harbour basin. It was built in Roman times as part of the city including walls and quarries and was subsequently submerged due to a phenomenon of subsidence in late antiquity.

At Sidon, Frost focused on the island of Zire, which is part of an offshore reef running parallel to the coast (Figs 5-6). To the north of the main settlement, as at Arwad and Tyre, it sheltered a roadstead that was an important part of the harbour system (Frost, 1973; 1999). She started a detailed survey of the island, above and below water, and recognized

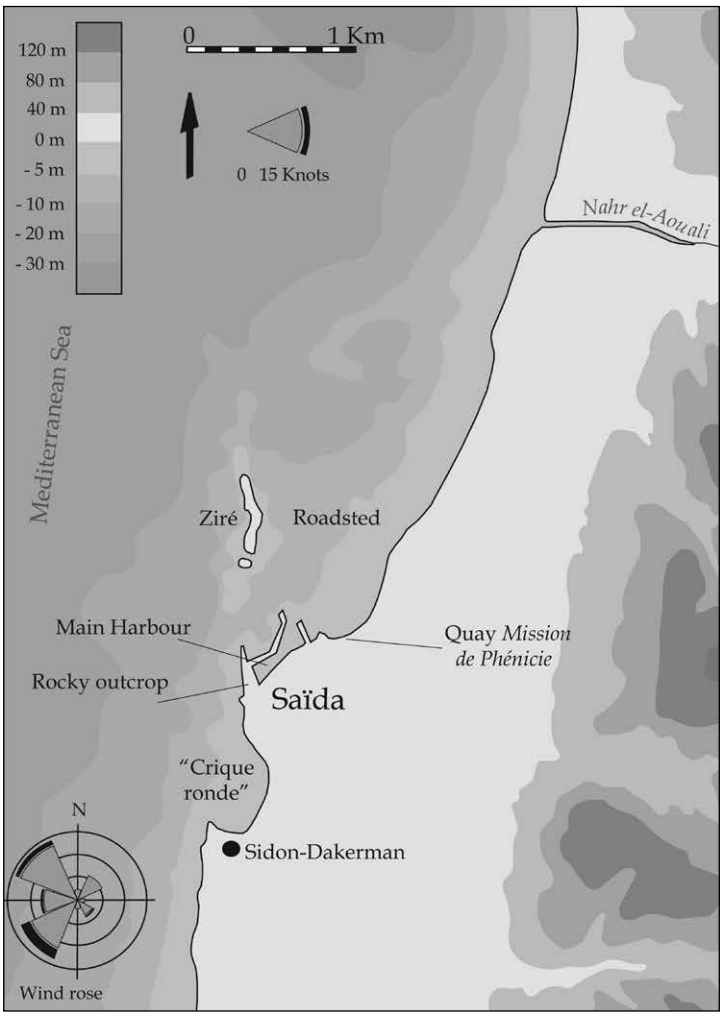

Figure 5. The harbour system of Sidon. (After Carayon, 2012).

a paleo sea-level 1 m higher than the current level, dated to the Roman period (Marriner *et al.*, 2006; Carayon, 2003: 113). She discovered a jetty projecting into the sea northward from the eastern side of the island and parallel to a similar structure emerging a few centimetres above the sea-level that had been described by Poidebard and Lauffray (Frost, 1973; Poidebard & Lauffray, 1951: 73-74). These authors dated the structure to the Roman period because of the presence of concrete. Only the foundation blocks were preserved from the original jetty (Frost, 1973: 79). By comparing the size and shape of these blocks and their mortises to those of the Persian podium of the Eschmoun temple at Bostan esh-Cheikh, she dated the first construction phase of the jetties on Zire to the Persian period. On the emerged part of the island, she started to record all the visible rock-cuts. The island was used as an insular quarry and the exploitation of sandstone allowed the development of a rock-cut quay on the lee side of the island and a sea wall that protected the quay from the waves. The relationship between quarrying activities and harbour structures, that Frost underlined, is still a current and fundamental research question in Lebanon (Frost, 1995). The study of the island of Zire is still in

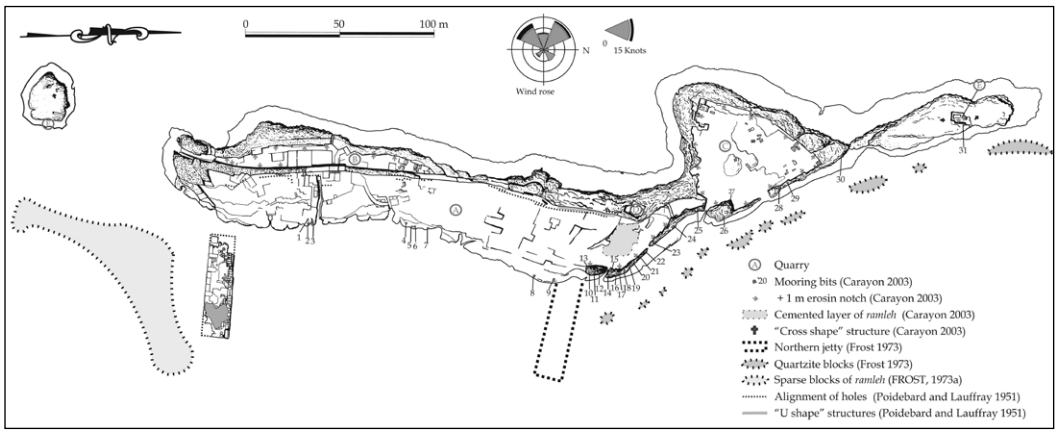

Figure 6. The island of Zire at Saïda (ancient Sidon). (After Poidebard & Lauffray, 1951, Frost, 1973, and Carayon, 2003).

progress. Adding new data to Frost's previous work was one aim of my own fieldwork in 2003 (Carayon, 2003), and a research project focusing on underwater survey led by Eric Gottwales and funded by the Honor Frost Foundation is ongoing.

The results Frost published about Byblos (Fig. 7) represent the sum of the methods she had developed over the previous 40 years working in the Levant. She made some preliminary observations in the late 1950s (Frost, 1963: 96-98) but most of her work at Byblos, apart from the publication of the stone anchors (Frost, 1969), was published in the late 1990s and the first years of the 21st century (Frost, 1998; 2001; 2002 a; 2002 b). Her impact on the study of the port of Byblos is huge: she totally changed perceptions of the maritime potential of the site. When she first wrote about Byblos in 1963, the potential harbour was limited to the creek north of the tell, still in use by fishermen. Now, as in Arwad, Tyre, and Sidon, this small creek is regarded as only one component of a larger harbour system more appropriate to the important city-port Byblos was in the Late Bronze Age. A few kilometres offshore, she recognized the submerged reef of Daaret Martine as an anchorage (Frost, 2002 b) where ships could moor. Anchors have subsequently been found in the area confirming her suggestion (Collina-Girard *et al.*, 2002). South of the tell, she supposed the Bay of El-Skhiny (El-Skhyneh) was the principal harbour basin in the system. Her interest in geoarchaeology and coastal geomorphology, already observed at Arwad, is particularly apparent here. She collaborated with Christophe Morhange (Frost & Morhange, 2000) to undertake a geomorphological study of this bay. The recent coring campaign carried out within the framework of the 'Byblos & the Sea' project has confirmed her hypothesis (Francis-Allouche *et al.*, 2017; see also Stefaniuk *et al.*, 2005; Francis-Allouche & Grimal, this volume). Another fundamental aspect of her legacy at Byblos is the integration of the sea front of the tell within the proposed harbour system, having surveyed all the coastal rock-cut remains. She established a true geoarchaeological map of the sea front and tried to relate each structure and each natural feature to former ancient sea-levels (Frost, 2001). Finally, she suggested the 'Tower-Temple' on the tell was used as a beacon for ships arriving at the Southern harbour (Frost, 2002 a). Her interest in harbour beacons and visibility appears, at least to me, as yet more evidence of Frost as a visionary researcher; as

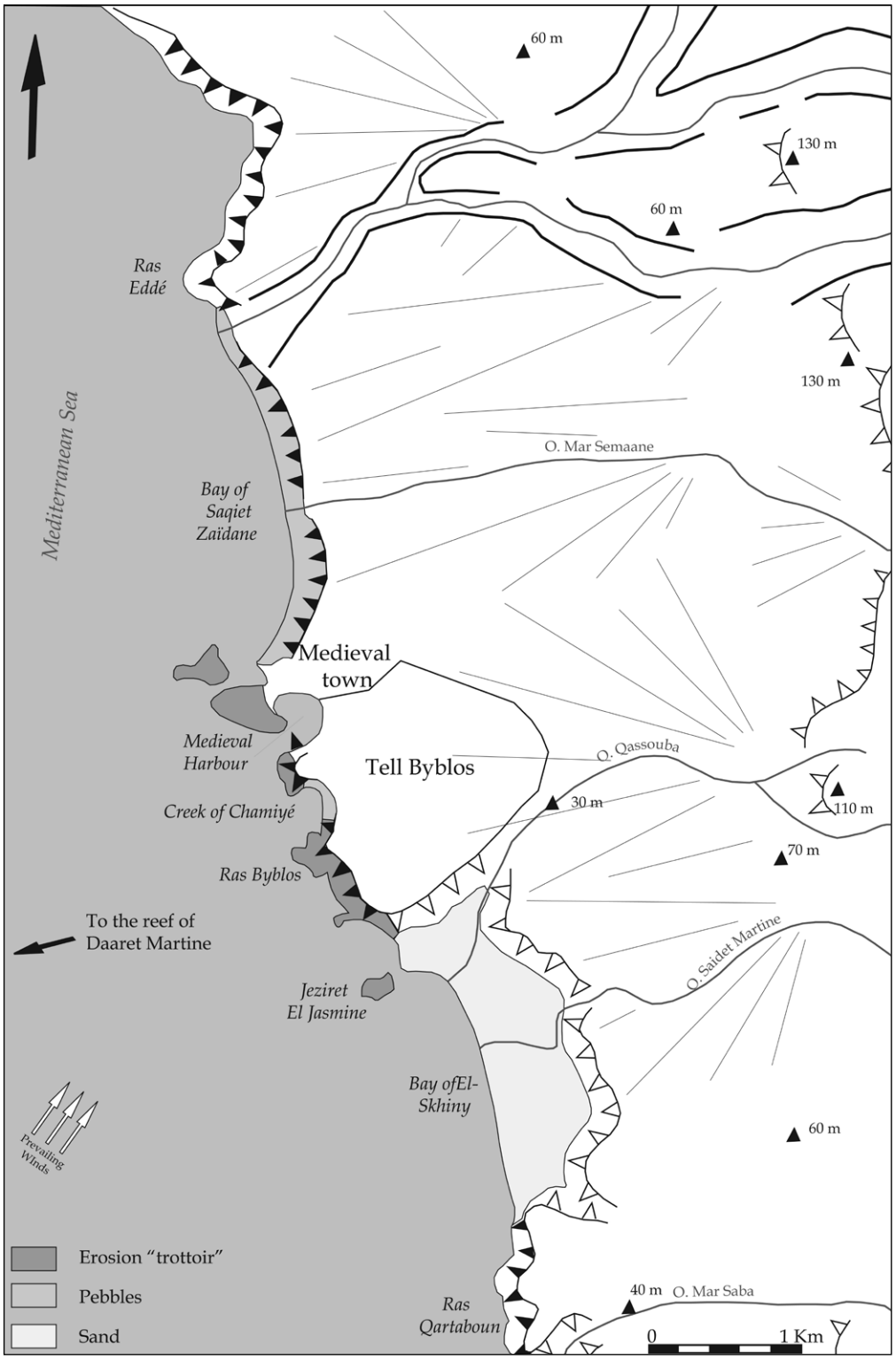

Figure 7. Geomorphological map of the Byblos area and the Byblian harbour system. (After Frost & Morhange, 2000).

with geomorphology, she started asking questions about the visibility of ports from the sea. Geographical Information Systems (GIS) are now being used in harbour and port archaeology to answer yet another question first posed by Frost.

Frost changed our knowledge of ancient ports considerably, notably by introducing, without naming it, the notion of harbour systems: she initiated a method now used systematically all around the Mediterranean Sea. She is well known as a pioneer of underwater archaeology, but her impact in geoarchaeology is also fundamental. She opened the gate to systematic interdisciplinary research, mixing history, geography, geomorphology, terrestrial and underwater archaeology in ancient harbour studies. She tried constantly to understand ancient harbours in their geomorphological context, in a dynamic, changing environment. Her work at Arwad in the late 1950s and early 1960s is particularly indicative of her impact. She posed fundamental and innovative questions without at that time having the tools or the methods to answer them. By raising these questions, she initiated the need for archaeologists to develop new means of investigation. Thus, she contributed to the development of new methods and a new discipline now widely adopted: the geoarchaeology of ancient harbours. Thus, her impact is broader than the understanding of the Phoenician ports in the Levant.

Acknowledgements

This paper is part of ERC Rome's Mediterranean Ports (ROMP) project (FP7-IDEAS-ERC, project reference: 339123) from the University of Southampton. The author also benefited from an Honor Frost Foundation scholarship to attend the 'Under the Mediterranean' conference, Nicosia in October 2017.

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Honoring the Lady of Byblos

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At the beginning of the 3rd millennium BC, Byblos became a fortified city-state, founded to accommodate a millennia-long timber trade, mainly to ancient Egypt, as mentioned in numerous historic sources. From the late 1950s until the dawn of her passing in 2010, maritime Byblos was explored and surveyed by the British pioneer in marine archaeology, Honor Frost. Since then, a multi-disciplinary investigation programme 'Byblos & the Sea', has taken up the reins of Frost's research, under the direction of Martine Francis-Allouche and Nicolas Grimal. Funded by the Honor Frost Foundation, this archaeological research programme has, to date, conducted ten field missions, reinvestigating the entire coastline of Byblos and its maritime approaches, primarily focusing on identifying the ancient harbour of the city. In 2013, the location of a harbour basin was finally confirmed at the southern foot of the city.

Keywords: Byblos, maritime archaeology, timber trade, Egypt, ancient sources, ancient harbour installation.

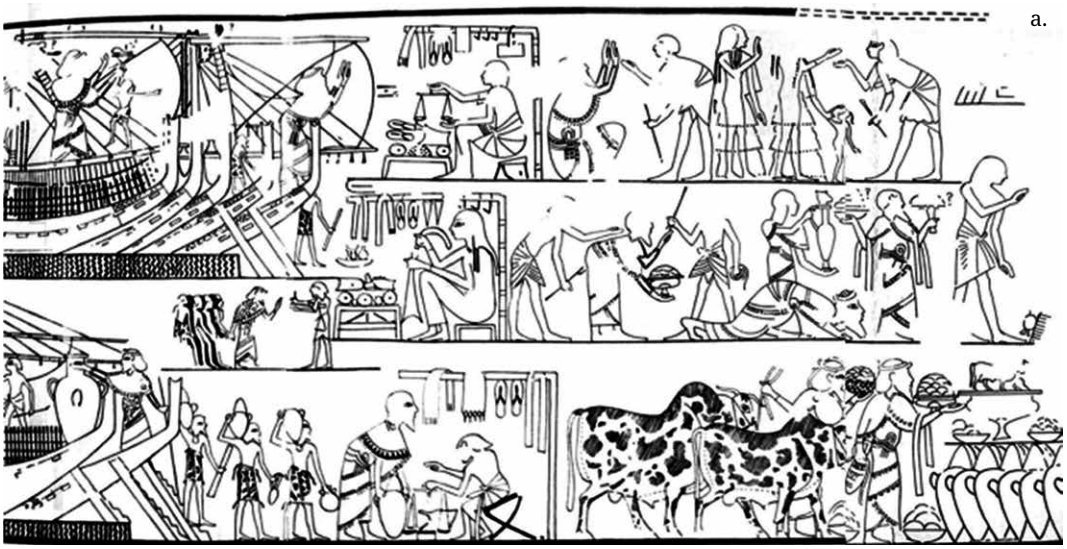
Maritime trade between Levantine coastal cities over the millennia is attested in numerous ancient sources (Elayi, 2007: 14-41). Both textual and iconographic works describe timber being felled in the hinterlands and traded, mostly between Byblos and Egypt (Gardiner, 1932: 61-76; Wreszinski, 1934: 86-87, Pl. 35; Kees, 1938: 3-4; Briquel-Chatonnet, 2001: 43). It started in the 5th millennium BC, during the Neolithic period, when fishermen settled on the Byblian headland (Dunand, 1950: 55-60; Jidejian, 1971: 13) in simple shelters which evolved into more sophisticated, circular domestic houses during the Chalcolithic period (Jidejian, 1971: 16).

By the middle of the 4th millennium BC, a prosperous and rich Bronze Age city rose on the foundations of the Chalcolithic settlement; explained by economic growth (Grimal, 2009: 339-360; Breyer, 2010: 67-100). Ancient Byblos, called *Gbl* in Phoenician,

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 109-138. Leiden: Sidestone Press.

Gubla in Akkadian, and *kpn* in Egyptian (Jidejian, 71: 1-2), traded and exchanged goods with every part of the Mediterranean Sea. Towards the end of the 3rd millennium BC, and more specifically in the 2nd millennium BC, Byblos played an important role in the trade network of ancient Egypt (Breyer, 2010: 67-100): archaeological artefacts found in the excavations of Byblos provide evidence of the commercial connections that the Bronze Age city entertained with Egypt (Grimal, 2009). From the 2nd millennium BC, textual and iconographic testimonies are even more abundant; these sources attest the

a.



b.

Figure 1. a) Syro-Canaanite merchants unloading goods on Egyptian land, Qenamon tomb, mid 2nd millennium BC; b) The 'chiefs of Lebanon' cutting trees for Sethi I, temple of Amon in Karnak, bas-relief on the outer northern facade of the hypostyle room. (Photos N. Grimal).

exploits and the conquests of the powers that ruled over the Levant. Generally, they describe the ancient sea trade (Sauvage, 2012: 265-266), the ships, the traded goods, and, more particularly, the exploitation of the hinterland forests and the export of timber from the Levant to ancient Egypt, the kingdom of Israel, or to the Assyrian and neo-Babylonian kingdoms.

In the annals of Thoutmosis III (1490-1436 BC), we find a description of the land as well as the goods that were imported to Egypt, and the ships and missions sent to fetch them (Bardinet, 2008: 120). The ships and the nature of the goods traded in the 2nd millennium BC are represented in iconographic sources such as the Kenamon Tomb dating to the XVIII Dynasty, depicting seagoing ships with Syro-Canaanite merchants unloading goods on Egyptian land (de Garis Davies, 1963: pl. XV) (Fig. 1a). Another important iconographic source is the bas-relief on the facade of the Temple of Sethi I, on the North Wall of the Temple of Amon at Karnak (1294-1279 BC). This shows dignitaries from Lebanon cutting wood to be offered to Sethi I (Pritchard, 1969; Linder, 1986: 27-281; Salvini, 1995: 15-45) (Fig. 1b). These iconographic representations are evidence of commercial transactions between the Levant and Egypt.

In the 1st millennium BC, a literary text confirms the existence of a harbour installation in ancient Byblos itself: the Pushkin Papyrus 120 tells the story of Wenamon, an Egyptian high dignitary who had been sent to Byblos by Ramses XI to buy wood to repair Amon's sacred vessel in the temple of Thebes (Lefebvre, 1976). This account of this expedition (1075 BC) is the most explicit and vivid evidence for the existence of a harbour installation in Byblos. After a difficult sea journey, which led Wenamon from Upper Egypt to Byblos, the Egyptian envoy faced difficult negotiations with Tjekerbaal, the Prince of Byblos, who agreed, at last, to the felling of trees and their transport to the harbour of Byblos where ships would be loaded with the timber that Wenamon was charged with bringing back to Egypt (Gardiner, 1932: 61-76).

In spite of such abundant testaments to commercial maritime activity in Byblos, archaeological investigation remained exclusively land-based (Renan, 1864; Dunand, 1939; Montet, 1962; Lauffray, 2008) until the 1960s when Frost undertook a long-term maritime survey programme, looking mainly for the well-attested Bronze Age harbour of the city.

Frost's investigations at Byblos

From the 1960s on, Frost travelled regularly in her Volkswagen Beetle from London to discover the history of the Levantine coastline (Fig. 2a-b). She had taken onboard research by Antoine Poidebard, Jean Lauffray, and René Mouterde in southern Lebanon (Poidebard *et al.*, 1951; Nordiguian & Salles, 2000: 232; Lauffray, 2008), where she explored the ancient harbours of Tyre and Sidon up to the 1975 Lebanese Civil War. This was also the start of Frost's interest in stone anchors (see Votruba, this volume), which led her, much later, to work at Byblos. Researching maritime Byblos was among her most important projects; it was there that she pursued maritime research till the dawn of her passing.

In Byblos, besides studying stone anchors unearthed from excavations carried out in 1960, in 1998 Frost resumed an investigation of the sea front: this area, prior to the Civil War, had remained *terra incognita*. She started by looking for any significant marks

a.

b.

Figure 2. a) Temple of Ba'al Eshmun, Sidon. Honor Frost, Maurice Dunand, Director of the French Archaeological Mission in Lebanon (right), and an attendant (1960). (© Honor Frost Archives); b) Honor Frost on the roof top of the medieval castle during her last visit to Byblos (2008). (M. Francis-Allouche).

or indications along the coastline and in the sea that could lead her to locate the city's main Bronze Age harbour installation (Frost, 1998: 29). Up to this point, the scientific community had taken for granted that the smaller, medieval harbour cove had served this purpose (Dunand, 1939; Montet, 1962: 79-83; Lauffray, 2008: 27).

Figure 3. Aerial view of the southern maritime approaches of Byblos (Photo C. Tannouri). Circled in red is the location of the so-called 'proto-lighthouse' overlooking the south and (inset) the votive anchors forming a step in a flight possibly leading to the roof of the building. (Photo M. Francis-Allouche).

Frost carried out five campaigns at ancient Byblos, as distinct from the medieval Jbeil, for the Directorate General of Antiquities. These started in 1998 as a result of a UNESCO plan to protect the medieval harbour of Byblos and the Byblian coastline, not least in the face of recurrent threats of modern development. For example, in 1970 a jetty was built to be developed into a fully fledged marina, just outside the medieval harbour mouth. The limits of the protected area at sea also needed to be defined. Frost was called upon because she had studied the Levantine coast from Tyre to the Turkish frontier before the Lebanese Civil War, when she was based at the Institut Français d'Archéologie, initially under the scientific direction of Henri Seyrig.

The first campaign in 1998, on land, was a search for a long-forgotten building, called the 'Tower-Temple' by French archaeologist Maurice Dunand. Several indications led Frost to describe it as a 'proto-lighthouse' (Frost, 2002: 52-57), primarily its situation in a commanding position overlooking the southern Egyptian approaches to Byblos (Fig. 3). She drew a comparison between the Byblian 'Tower-Temple' and the temple of the weather god Ba'al at the site of Ugarit in Syria (Frost, 1991; 2002; 2004). Both Bronze Age structures yielded pierced stone anchors, which have a symbolic aspect at Byblos, as proven by other anchors found in the Sacred Enclosure and in the Obelisk Temple (Frost, 2000). At Ugarit, stone anchors were found inside the 'Tower-Temple' and in Byblos, they formed the first steps of a flight of stairs (Fig. 3) that possibly led up to the roof of that very structure; the association of such votive anchors, combined with the discovery of an Ugaritic clay tablet mentioning sacrifices on temple roof tops – the fire or fumes of which possibly served as navigation signals or sightings – led scholars to believe that such tower-like structures were sited at Bronze Age proto-harbours, leading seafarers into safe moorings (Yon, 1984; Callot, 1987 b; Frost, 2000, 2002: 52-55).

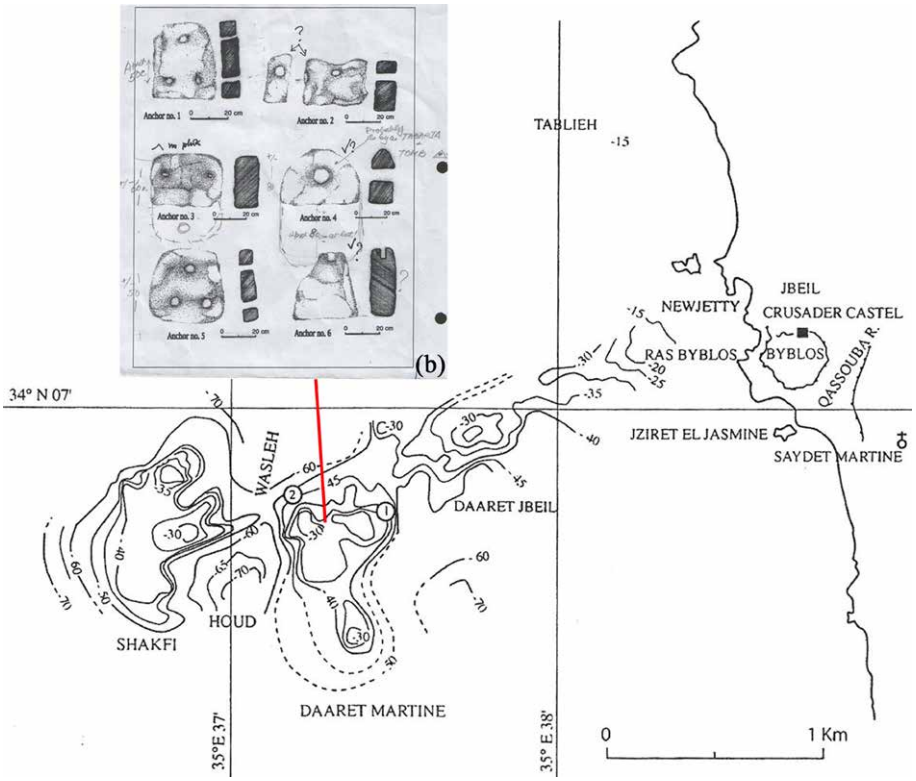


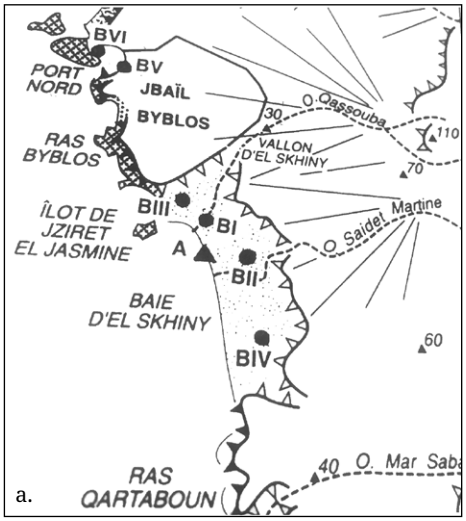
Figure 4. The offshore submerged reefs of Byblos, charted by J. Collina-Girard in 2002; inset: A series of pierced stone anchors located on 'Dahret Martine'. (Collina-Girard et al., 2002).

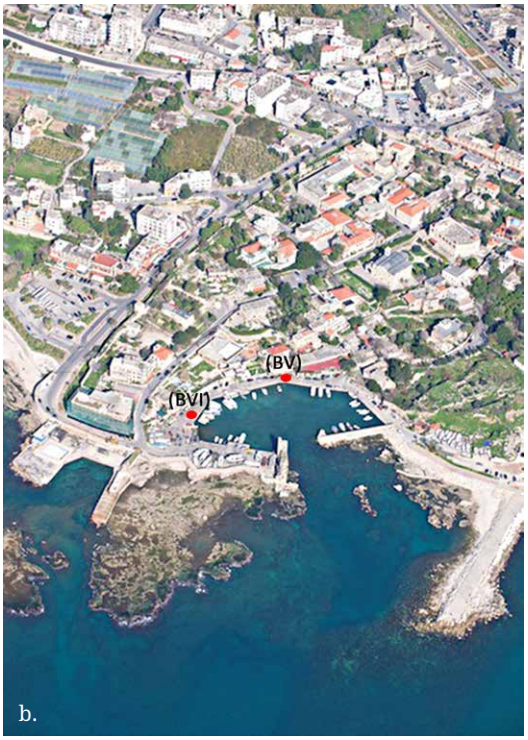
Also in 1998, while searching for the ancient harbour in the vicinity of the headland, Frost requested the involvement of French geomorphologist Christophe Morhange to study possible indicators of sea-level change. He undertook a survey along the Byblian coastline to the mouth of the Fidâr river, south of Byblos (Morhange, 1998: 261-265).

Since Bronze Age engineers had not yet invented substantial harbour installations, Frost generally believed that vessels were anchored offshore along the Levantine coast, since the shore presented a rather straight and rocky strip lacking safe shelters and was therefore unsuitable for mooring larger commercial vessels (Frost, 1995: 1-21; Frost, 2004: 322-324). Therefore, the third part of the 1998 campaign was dedicated to a first exploratory offshore survey (Frost, 1998 b: 21-23), in collaboration with one of the present authors, marine archaeologist M. Francis-Allouche, who assisted Frost in subsequent research seasons at Byblos and to whom Frost was both mentor and inspiration.

The maritime survey consisted of diving and filming the seascapes of a series of underwater reefs (Frost, 2004: 333). These three deep reefs or shallows, lying between two and three kilometres offshore, still used as fishing grounds today, are known as 'Dahret Jbeil', 'Dahret Martine' and 'Al-Chakfi'. Lying today at an approximate depth of 30 m, these reefs had never figured on any marine chart. In 2002, Frost launched a marine survey, directed by geologist Jacques Collina-Girard, to chart these three

Figure 5. a) Location of six cores taken during the Project CEDRE. (Schematic plan by H. Frost & C. Morhange after Sanlaville, 1977); b) aerial view of the medieval harbour basin of Byblos with core locations marked. (Photo C. Tannouri); c) view of the southern bay of El-Skhyneh. (Photo M. Francis-Allouche).





offshore shallows using a Global Positioning System (Fig. 4), in order to provide the basis for future archaeological research (Collina-Girard *et al*., 2002: 317-324; Frost, 2002: 309-316; Frost, 2004: 334). For Frost, there was a particular interest in understanding these shallows and if they served ancient Byblos as an offshore mooring. A series of seven stone anchors was identified scattered on one of the shallows, 'Dahret Martine', possibly indicating an ancient anchorage (Fig. 4).

As alluded to before, archaeologist Dunand – like Egyptologist Pierre Montet – believed the Bronze Age harbour of Byblos was located in the same position as the medieval harbour, the fishermen's harbour of Byblos, and that the earlier Bronze Age harbour had been built over by the medieval harbour basin (Dunand, 1939; Montet, 1962: 79-83). The quest to verify this began in 2000, within the 'Opération Cèdres' (CNRS-L), in collaboration with Frost, Morhange, and Mountaha Saghieh-Beydoun; a series of core samples (Fig. 5a) was taken to try to locate the much-attested Bronze Age harbour of the city (Frost & Morhange, 2000: 101-104; Morhange and Saghieh-Beydoun, 2005). The two first auger cores (BV and BVI) drilled across the quay of the medieval harbour of Byblos (Fig. 5b), north of the Byblian headland, finally confirmed an unprotected, shallow, narrow, rocky cove, unsuitable for mooring larger vessels. Additional core samples (BII, BIV) were taken across the sandy El-Skhyneh Bay (El-Skhiny Bay) (Fig. 5c), south of the headland, confirming it to be a shelterless open bay with no possible moorings.

According to Frost, cedar logs and other conifers were floated down from the hinterland on the Qassouba river, nowadays just a trickle of water (Frost, 2002: 342) located at the southern foot of the headland. To verify this theory, another auger core (BI) (Fig. 5a) was extracted from what used to be the riverbed within the Qassouba

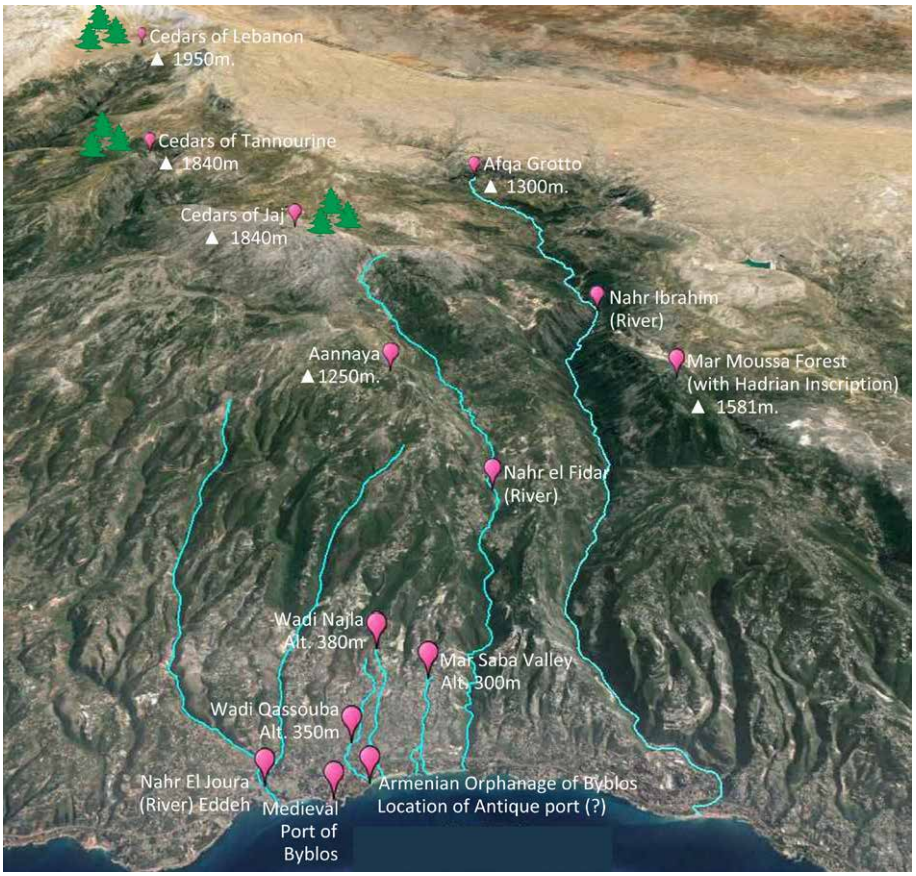


Figure 6. The main river courses and altitudes of forest areas in the hinterland of Byblos. (Francis-Allouche & Grimal, 2014).

valley. The core sediments included a large amount of river pebbles, flattened by erosion, indicating the existence of quite a large riverbed to the south of the city of Byblos in antiquity (Frost, 2004: 341-342). Frost's proposal has since been revised, subsequent field investigation has put limits on the use of this river for two practical reasons: a) the course of its riverbed is rather rough and bumpy, and it presents narrow turns that would have hampered driving down timber logs; and b) the upper course of the Qassouba river only reaches 325 m, an altitude too low for cedar and juniper trees to grow. Of course, smaller-sized goods may have been transported on the river. An alternative important role the Qassouba river may have played during antiquity was the provision of a fresh-water supply to the harbour basin and more generally to the coastal area.

However, further to the south are the seasonal river of the El-Fidâr valley and the Nahr Ibrahim or Ibrahim river (Bardinet, 2008: 23-49) (Fig. 6), two other rivers that reach the high plateaux of the hinterland of Byblos, where evergreens are prevalent. The cedar tree, for instance, needs higher mountains of no less than 1000 m, and ideally 1500 m, such as the high plateau of Jaj (or Arz Jaj) and the Jabal Mar Moussa Forest, where an inscription by Emperor Hadrian confirms this hypothesis (Abdul-Nour, 2001: 64-95). This engraved inscription was aimed at protecting four species of evergreens, which still grow at these altitudes.

Further research conducted in 2004 in the valley of the El-Fidâr river revealed traces of human activity such as rock-cuttings along the riverbanks (Dalix & Chaaya, 2007: 11-15). The study discusses the use of rivers as a means of transportation, floating logs downstream from the felling sites to the river mouth using a method in which logs are assembled in rafts that are then steered down on the current, as depicted in the Khorsabad bas-relief of the Palace of Sargon II (722-705 BC) (Linder, 1986: 271-281; Fontan, 2001) (Fig. 7). Clearly, all rivers and streams of the Byblian area may have been used for the transportation of goods from the hinterland to the coast; however, only the streams immediately to the south of ancient Byblos are taken into consideration here because the sea currents, which flow predominantly from the south-west, would have guaranteed the flotation of logs up the coast to the harbour facility that was located in the direct vicinity of ancient Byblos, according to Wenamon's report.

In the quest to locate any vestiges of an artificial harbour construction (Frost, 1998 b), one last coring session (BIII) was carried out at the southern foot of the ancient city, in a plot that now houses the Armenian Orphanage of Byblos (Frost & Morhange, 2000: 101-104). However, after an unfortunate loss of the finer core sediments, and judging from the remaining coarse ones, it was agreed by Frost and Morhange to discard the area as a possible location for a harbour facility (Stefaniuk *et al.*, 2005: 19-41). Another reason that made Frost pull away from this southern area as a possible maritime installation was the underwater configuration of the Jouret Osman Bay (Fig. 8), just in front of the Armenian Orphanage plot, which today has the appearance of a rocky, shallow cove.

It was at this point, when Frost had eliminated all contenders for the location of the ancient harbour along the coastline of Byblos, that she adopted the offshore-anchorage theory, where large commercial vessels would anchor at sea and wait for smaller service-crafts (*kpnt)* to commute from the sandy bay of El-Skhyneh, towing logs from shore out to the cargo vessels at sea for shipping to Egypt (Frost, 2002).

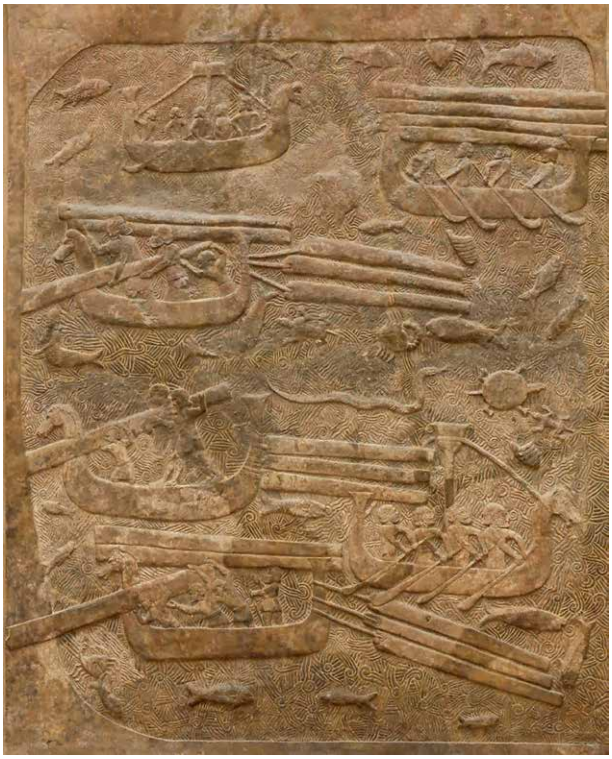


Figure 7. A bas-relief from the palace of the Assyrian king Sargon II, Khorsabad (721-705 BC), depicting different methods of timber transportation, towing of assembled rafts, and loading of logs on ship.

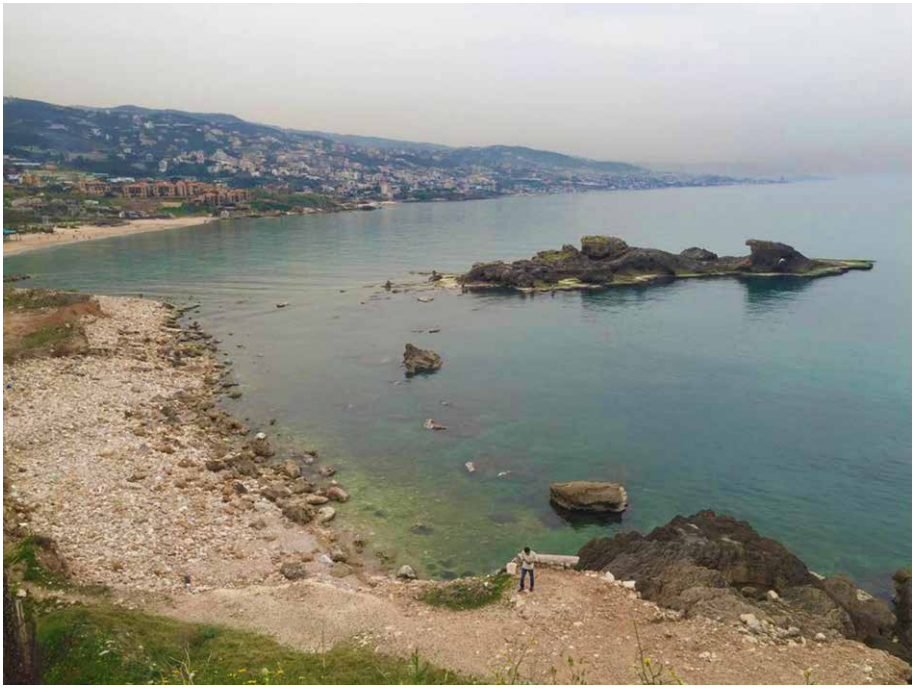


Figure 8. The bay of Jouret Osman in front of the Armenian Orphanage plot, showing the island of El-Yasmine protecting the bay from the predominant south-west currents. (Photo M. Francis-Allouche).

In 2001, the town's seafront, which had never been investigated, needed to be surveyed to understand any possible connection between the city on the headland and its shore. A basic topographical survey of the seafront, from the medieval harbour area to the island of El-Yasmine, was undertaken by by Hugh Barnes, assisted by Francis-Allouche (Frost, 2001: 195-217; Frost, 2004: 335-340). Interesting man-made rock-cut features such as a trench complex, a fish tank, and door jambs, appeared along the coastal strip. The most notable discovery, however, was the remains of a necropolis with rock-cut single graves, which have become increasingly eroded over the years, weathered by the elements. Other rock-cut chamber tombs appeared at the back of a restaurant bordering the medieval harbour: these were measured, recorded, and included in Frost's general plan (Frost, 2001: 195-217; Frost, 2004: 335-340). A photographic record was also made of the surveyed area, under water and on land.

In 2003, a fifth campaign took place on the Byblian headland, to update the stone anchor study that Frost had started in 1969 and revise the first catalogue of votive temple anchors she had published *The Stone Anchors of Byblos, Revised and Compared* (1969, and in press). Frost classified the many stone anchors unearthed in urban contexts or extracted from the sea according to different functional types corresponding to their use in different seascapes (Frost, 2004: 329-331).

Between 2004 and 2006, the five archaeological research missions conducted by Frost on coastal Byblos were reviewed with the aim of producing texts for panels to mark significant historic features along the rocky base of the headland for a coastal tourist trail of Byblos for the Lebanese Directorate General of Antiquities. After 2006, the insecure political situation put a hold on Frost's research in Lebanon. After her unfortunate passing her team, led by the authors, resumed work in 2010 within the framework of the 'Byblos & the Sea' project, in collaboration with the Lebanese Directorate General of Antiquities. Funded by the Honor Frost Foundation, 'Byblos & the Sea' has conducted ten field investigations to date as part of her legacy, striving to explore and progress her work as she would have done herself.

Byblos & the Sea: taking on Frost's agenda

The 'Byblos & the Sea' project's main objectives are to link the antique city to its seafront, to understand the maritime approaches to Byblos, and finally to locate the harbour installation that provided the stimulus for the economic growth of the city in antiquity. All the data from previous scientific research was gathered in an attempt to synthesize the different approaches. The field study covered the entire coastal rocky strip of Byblos and its maritime approaches from the medieval harbour to the bay of El-Skhyneh, at the southern foot of the ancient city, and reaching out to sea some 3 km.

Topography and mapping

The different options that Frost had considered as possible Bronze Age harbour locations have been reconsidered one by one within the 'Byblos & the Sea' field survey, with the objective of confirming or invalidating former results, in order to progress research.

The first 'Byblos & the Sea' field mission, conducted in 2011, delivered a complete topographical survey of the coastline of Byblos, establishing its different zones; a baseline requirement to understanding the functionality of the exploited areas as well

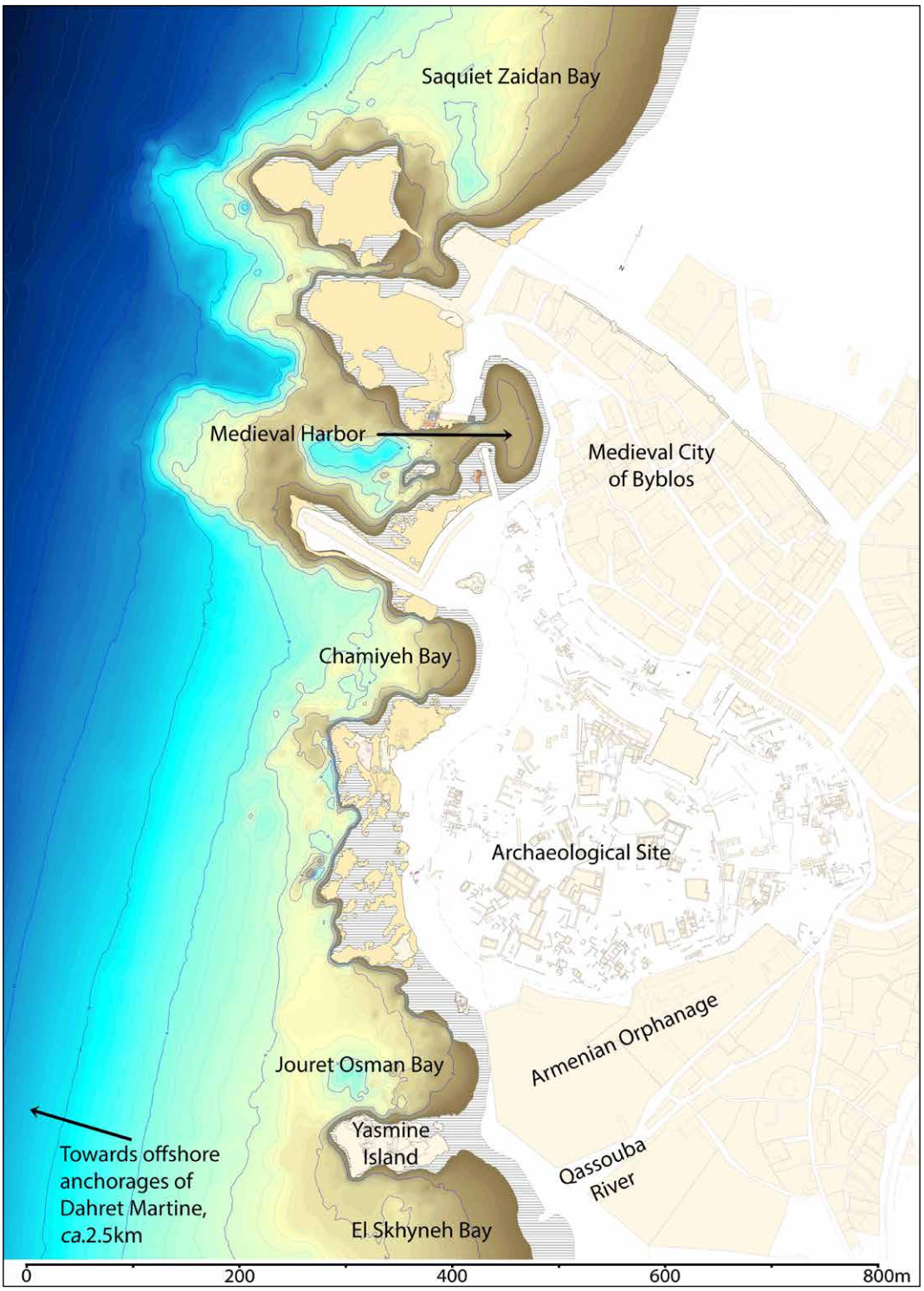


Figure 9. Topographical plan of the coastal area of Byblos and bathymetric survey of the near shore area. (Francis-Allouche & Grimal, 2014).

as potential harbour configurations. This first step resulted in an overall master plan of the land, which was later enlarged to cover the maritime area of Byblos through a bathymetric mapping survey conducted in 2014 (Fig. 9).

Potential harbours revisited

Byblos' northern coast

In 2014, a bathymetric survey in the nearshore maritime area of Byblos confirmed former results, invalidating the northern part of the coastline of Byblos as a potential harbour location; whether it is the northerly Bay of Saquiet Zaidan, the medieval harbour, or the Bay of Chamiyeh.

Saquiet Zaidan today presents an unprotected, open, and straight pebble stretch, bordered by steep cliffs and exposed to major sea currents.

The medieval harbour of Byblos, prior to the construction of the modern harbour in 1968, presented rocky outcrops and geological terraces at mean sea-level inside the basin, as seen from a 1930 photograph (Fig. 10a); the basin was subsequently deepened and enlarged to accommodate larger boats. In 2014, the medieval basin area was reinvestigated: an underwater bathymetric survey revealed an unsuitable underwater configuration for mooring ships inside the medieval harbour basin, confirming former auger-coring results (Projet CEDRE, Frost & Morhange, 2001). Moreover, the bathymetric map showed rocky and shallow maritime approaches to the harbour mouth. It further confirms that larger vessels had to moor elsewhere (Fig. 10b-c).

The Bay of Chamiyeh, located south of the medieval harbour, presents the same intricate underwater configuration; this third location would also have been too rocky and shallow for the manoeuvring of larger cargo vessels in antiquity.

Based on these indications, the 'Byblos & the Sea' project has enabled any hypothesis of an ancient anchorage in the northern zone of Byblos to be ruled out, at least for use by large cargo ships. The field investigation therefore confirmed Frost's hypothesis that the ancient harbour was most likely located towards the south of the city, in the sandy bay of El-Skhyneh.

Figure 10. a) The medieval harbour of Byblos in the 1930s, a natural cove with geological outcrops visible at mean sea-level inside the basin. (Courtesy of the Max Van Berchem Foundation).

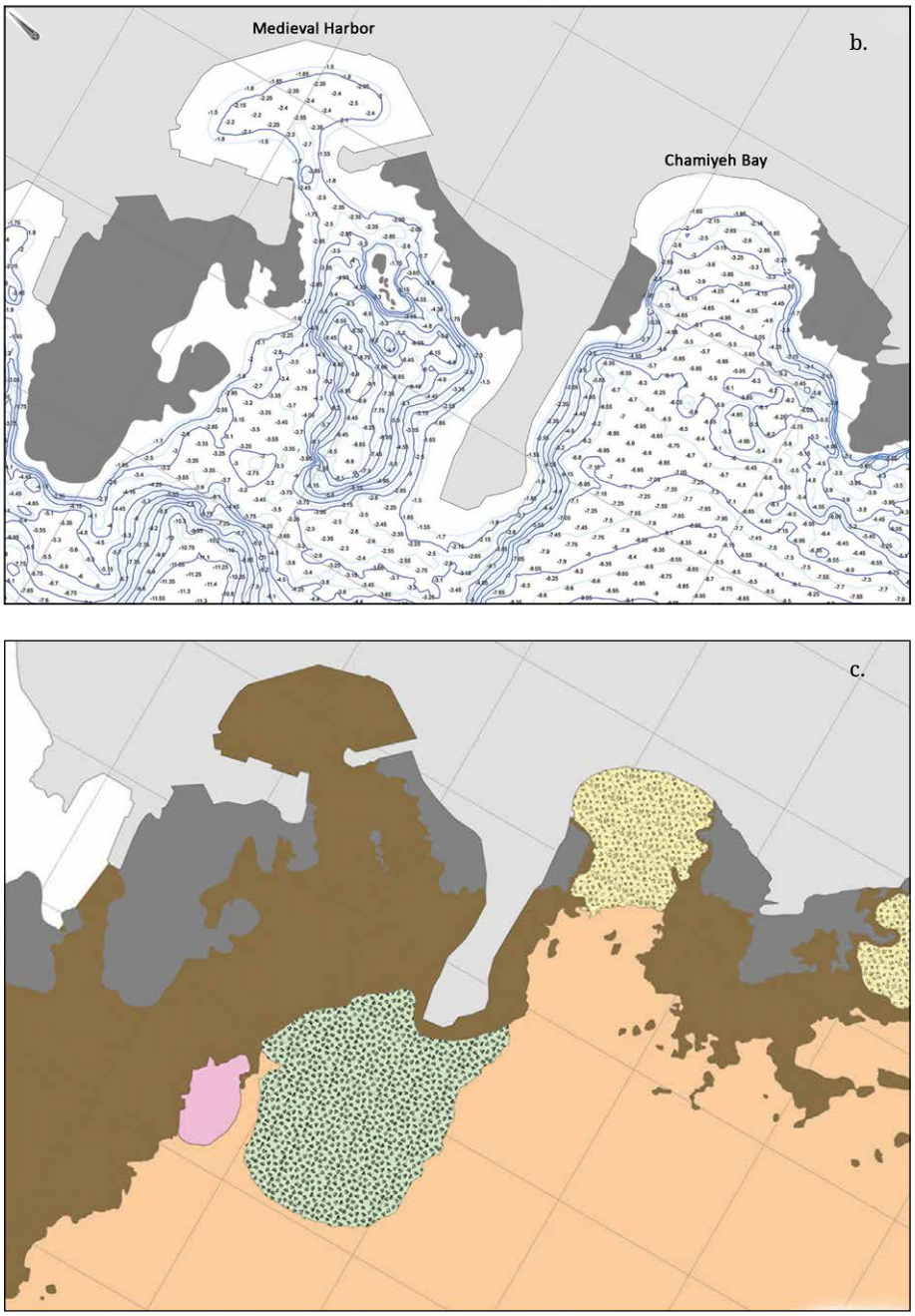


Figure 10. b) Bathymetric survey of the medieval harbour area, indicating shallow and narrow seaward approaches; c) seabed composition of the medieval harbour area, showing in brown the shallow rocky seabed, making mooring difficult for large vessels. (Francis-Allouche & Grimal, 2014).

Byblos' southern area

Despite the fact that Frost had finally ruled out the southern sandy area of Byblos as a possible mooring for large vessels and adopted instead the offshore-anchorage theory,

as explained above, 'Byblos & the Sea' opted to reconsider her initial idea, which was the immediate area to the south of the archaeological tell of Byblos. Primarily, the main reason for discarding the offshore-mooring theory was the exposure of the three reefs to seasonal winds. Mooring and loading are not easy tasks to perform in exposed conditions, specifically loading long logs, as mentioned in the ancient annals and as illustrated in the Cheops pyramid (Nour *et al.*, 1960; Jenkins, 1980). Therefore, the 'anchorage at large' theory had to be revised. Nevertheless, the pierced stone anchors which were found scattered on the reef known as 'Dahret Martine', as mentioned (Fig. 4), may indicate a possible temporary anchorage for cargo ships waiting to moor in the harbour basin of ancient Byblos, as explicitly described in Wenamon's account (Egberts, 1991: 57-67). Wenamon's account also gives an indication of the nature of the location where the timber was stored before it was loaded on to ships:

> I went to the seaside, where the timber logs had been piled up, and I saw 11 boats
> (ỉwꜣỉ šỉ nꜣỉ <ḥr> spr <n> pȝ ywm r pȝ nty nȝ ḫt ỉm wȝḥ, ỉwꜣỉ nw r 11 n br)
> (Wenamon: 2, 62-63).

The storage area seems to have been close to an important mooring basin, since Wenamon saw 11 boats. Another conclusive indication about the existence of a harbour facility, is the recurrent references to the word *mrỉt*, meaning a built harbour (Fig. 11), which is differentiated from the word *spt*, which means seashore (Gardiner, 1932). It is a space in which ships are moored: 'The harbour of the sea (*n pȝ ywm*)' (Wenamon: 2, 74); 'the sea shore of the harbour of Byblos', 'Are there not 20 ships (*mnš*) here, in my harbour' (1, 33 etc.). Within the same text, the same terms are used for the city of Dor, where the location of the harbour has been clearly identified (Carayon, 2008: 1022-1023). References to the harbour of Dor are the following: 'I was robbed in your harbour' (1, 13); 'I spent nine days moored in your harbour' (1, 21-22), and 'wait until you have left the harbour' (1, 27).

Not only is it clear that Bronze Age Byblos had a built harbour with a dock along which at least 20 cargo ships (*mnš*) could be moored simultaneously, but it seems to have been located in the immediate vicinity of the Byblian city, itself nested on a 25-m-high promontory.

When he reached Byblos, Wenamon installed a tent on the seashore of the harbour (probably meaning outside the mooring basin) waiting for the Prince of Byblos to give him audience.

> When the morning came, he [the prince] sent someone to escort me to the top [to the city which lay on top of the promontory], leaving the statue of the God Amon in the tent where he had been at seashore. I found him [the prince] sitting at his desk, his back to the window: the waves of the large Syrian Sea were unfolding up to his neck [probably an optical illusion]. (Wenamon: 1, 13-16)

Based on these first indications, 'Byblos & the Sea' pursued the investigation in the quest for the ancient harbour location in this southern area of Byblos.

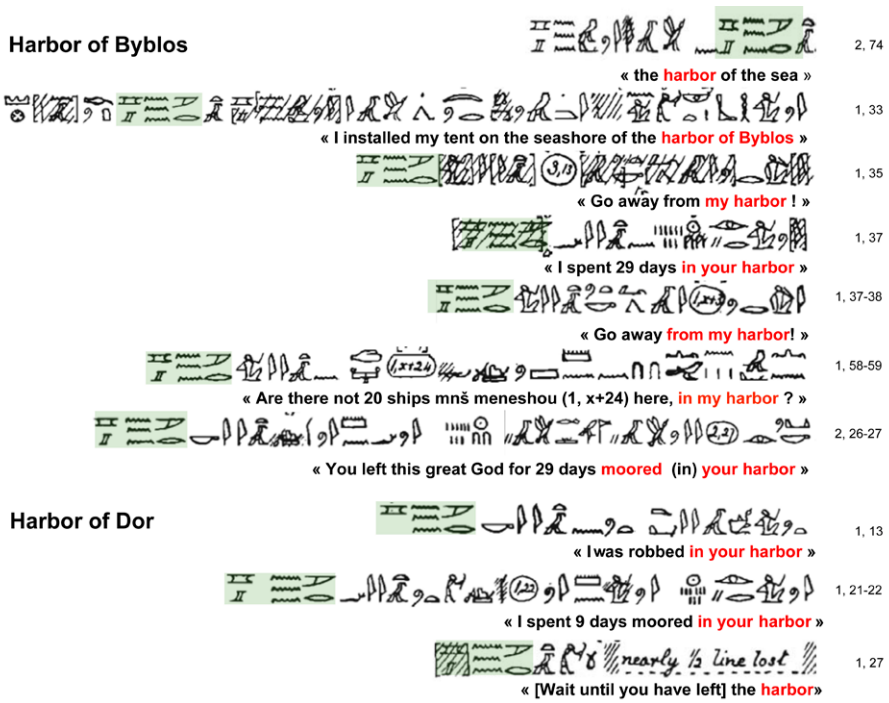


Figure 11. The use of the word mrîṯ for 'harbour' in Wenamon's report. (Translation by N. Grimal).

Exploring the southern foot of the Byblian tell

Several additional reasons reoriented research to the area immediately south of the ancient city of Byblos, based on the following data: a) the proximity of the ancient city of Byblos; b) the area at the foot of the ancient tell presented a deep inward gulf prior to silting and subsequent construction; c) the protection the Island of Yasmine offers to the area; d) the location of the two main rivers to the south of Byblos, enabling the predominant south-westerly sea currents to carry towed logs or rafts northwards to this possible harbour location (as described above); and e) as mentioned, the significant references in Wenamon's account that the Prince Tjekerbaal of Byblos could see 20 boats moored in the harbour from his office on the headland (Wenamon: 1, 33).

Geophysical survey

Prior to any invasive intervention on the ground, a geophysical resistivity survey was conducted in October 2013 on the lower plot of the Armenian Orphanage by geophysicist Tomasz Herbich (Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw, Poland). The grid was set by the topographer Damien Laisney (Maison de l'Orient et de la Méditerranée, Lyon). The data was processed by Herbich. The main objective of the survey was to locate possible buried harbour structures. The results were quite outstanding; the geophysical readings (2D images) allowed the detection of a silted-up basin buried under this plot, with an ancient shoreline 100 m further inland (Fig. 12) (Francis-Allouche & Grimal, 2014: 54-59). The result of the survey produced a good basis for further research: verification by auger coring was necessary at this point.

Figure 12. Results of the resistivity survey conducted by Tomasz Herbich (insets) on the Armenian Orphanage plot, revealing a buried basin with a paleo-shoreline c.100 m inland (Francis-Allouche & Grimal, 2014).

Auger-coring survey

To verify the results of the geophysical survey readings, an auger-coring mission was carried out under the scientific direction of sediment specialist Nicolas Carayon (CNRS UMR 5140: Archéologie des Sociétés Méditerranéennes, Montpellier-Lattes, France) in the Armenian Orphanage plot (Fig. 13). The 2014 mission added to the core samples taken in 2000 in the framework of the Project CEDRE (Francis-Allouche & Grimal *et al.*, 2017).

As a result, the existence in the past of a body of water was confirmed, and a silted-up harbour cove was corroborated. The nature of the sediments filling this harbour cove have been analysed in the laboratory and all 29 core samples attest that this area, at the foot of the ancient city, offers adequate conditions to afford a well-protected harbour basin (Francis-Allouche & Grimal *et al.*, 2017). In fact, based on the analyses of the extracted sediments, the process of transformation from a natural coastal space to a man-made artificial installation can be understood through the several different phases traced, almost recreating the harbour space. The construction of artificial harbour structures, built to protect the confined space from the sea currents, transformed the nature of the sediments from very coarse, transported by the sea, to very fine and silty sediments that were trapped in the basin. Such changes in the nature of sediments typically occur in confined spaces and indicate very clearly a protected harbour space (Goiran & Morhange, 2001; Carayon, 2013).

According to the different units (layers) found in the core samples, the basin below and to the south of the Byblian promontory was large enough (*c.*8000-12,000 m^2) and of sufficient depth (1.5-4 m) to accommodate a fleet of commercial boats, as stated in the

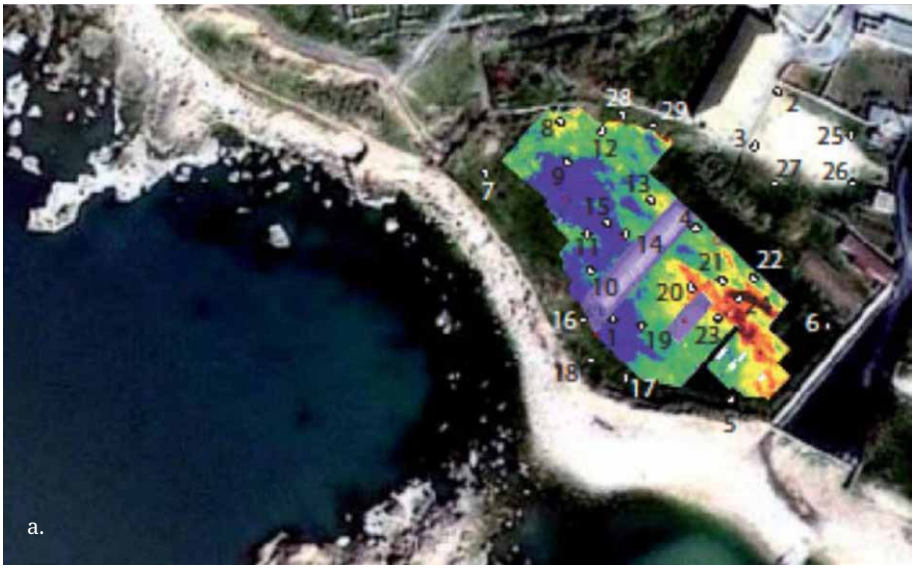


Figure 13. a) Location of auger cores collected in the Armenian Orphanage plot (Nicolas Carayon, 2014); b) auger in action: 291 kg of sediments were cored with 80 kg sampled, processed and analysed in the laboratory. (Photos M. Francis-Allouche & N. Grimal).

ancient Egyptian annals and in Wenamon's account (Fig. 14) (Francis-Allouche & Grimal *et al.*, 2017). Several phases of seashore modification have been identified: two paleo-shorelines were located, showing a progradation exceeding 100 m since the maximum rise in sea-level (marine *transgression*) around 6000 BC (Goiran & Morhange, 2001). Such silting could have occurred as a result of the abandonment of possible structures that protected the harbour from the swell and from major winds, which would have caused rapid silting of the basin, leading to a rapid progression of the ancient shoreline, totally integrating the basin and original shoreline into the urban tissue.

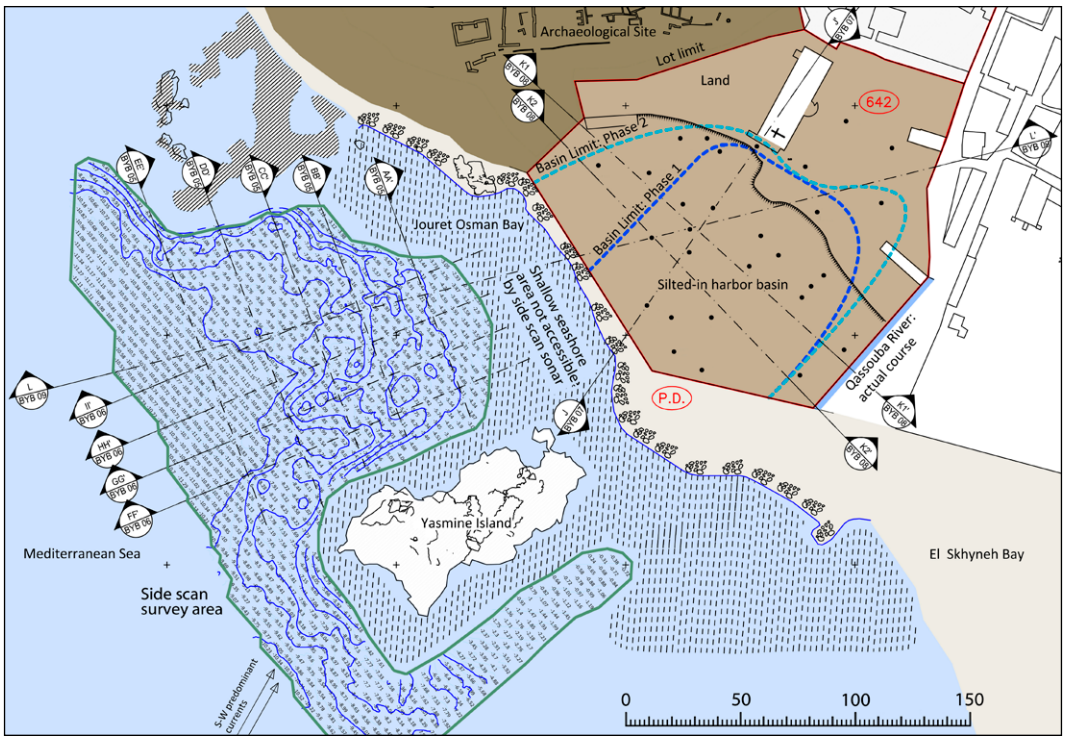


Figure 14. General plan showing the Armenian Orphanage plot and the core survey; the extent of two phases of siltation in the harbour basin (areas of 8000 m² and 12,000 m²); and the transects recorded on land and at sea. (After Francis-Allouche & Grimal, 2014).

Bathymetric survey

An extensive marine remote-sensing survey was also conducted within the framework of the 'Byblos & the Sea' research project by the marine geology department of Patras University in Greece, directed by Prof. George Papatheodorou (Papatheodorou *et al.*, 2014) (Fig. 15). The maritime approaches to Byblos were surveyed, covering a total area of 8 km² with a total track-line length of 250 km, from the medieval harbour of Byblos to the El-Fidâr River canyon south of El-Skhyneh Bay, for the nearshore area (Fig. 9), and reaching the offshore shallows of Dahret Jbeil, Dahret Martine and Al-Chakfi (Fig. 16).

The survey resulted in: a) a bathymetric map of the actual seabed; b) a paleo-bathymetric map of a deeper-lying seafloor; c) a seafloor composition map; and d) a target map, identifying anomalies for future investigation.

In Jouret Osman Bay (Fig. 8), results of this bathymetric survey indicated an extremely shallow and rocky seabed with a shoreline practically linked to Yasmine Island, almost forming a headland. However, further investigations located a paleo-bathymetric level – that is, a deeper seabed – buried beneath the present one. A 5-m-thick layer of loose sediments accumulated over years covers the deeper, earlier seabed (Fig. 17).

Moreover, the depth of this buried seabed perfectly matches the depth of the inland silted-up harbour basin on the Armenian Orphanage site, meaning that the entire profile of the Qassouba valley seems to have been much deeper, and perfectly suited to mooring boats (Fig. 18).

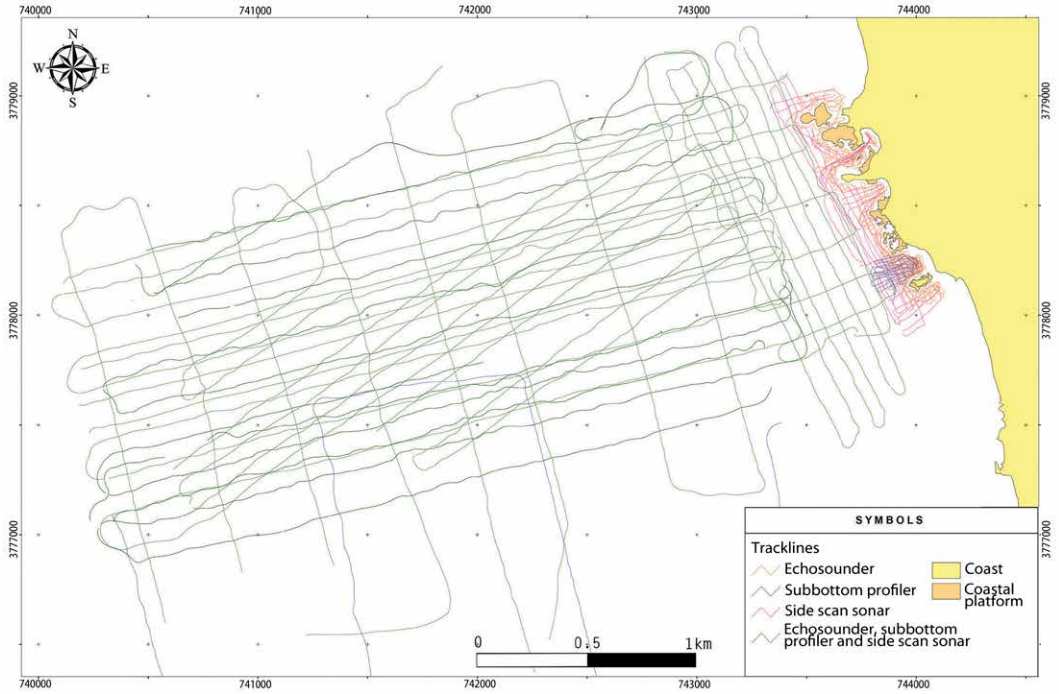


Figure 15. Marine remote-sensing survey (George Papatheodorou, Patras University, Greece).

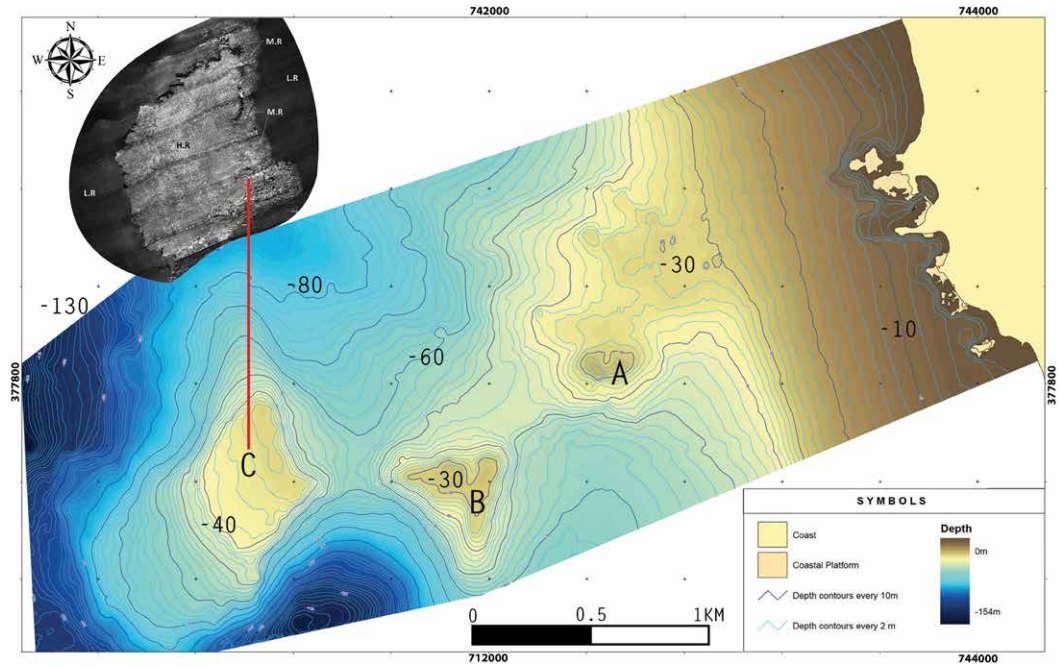


Figure 16. Detailed bathymetric map of the offshore anchorages c.2-3 km off the coast of Byblos. (Francis-Allouche & Grimal, 2014).

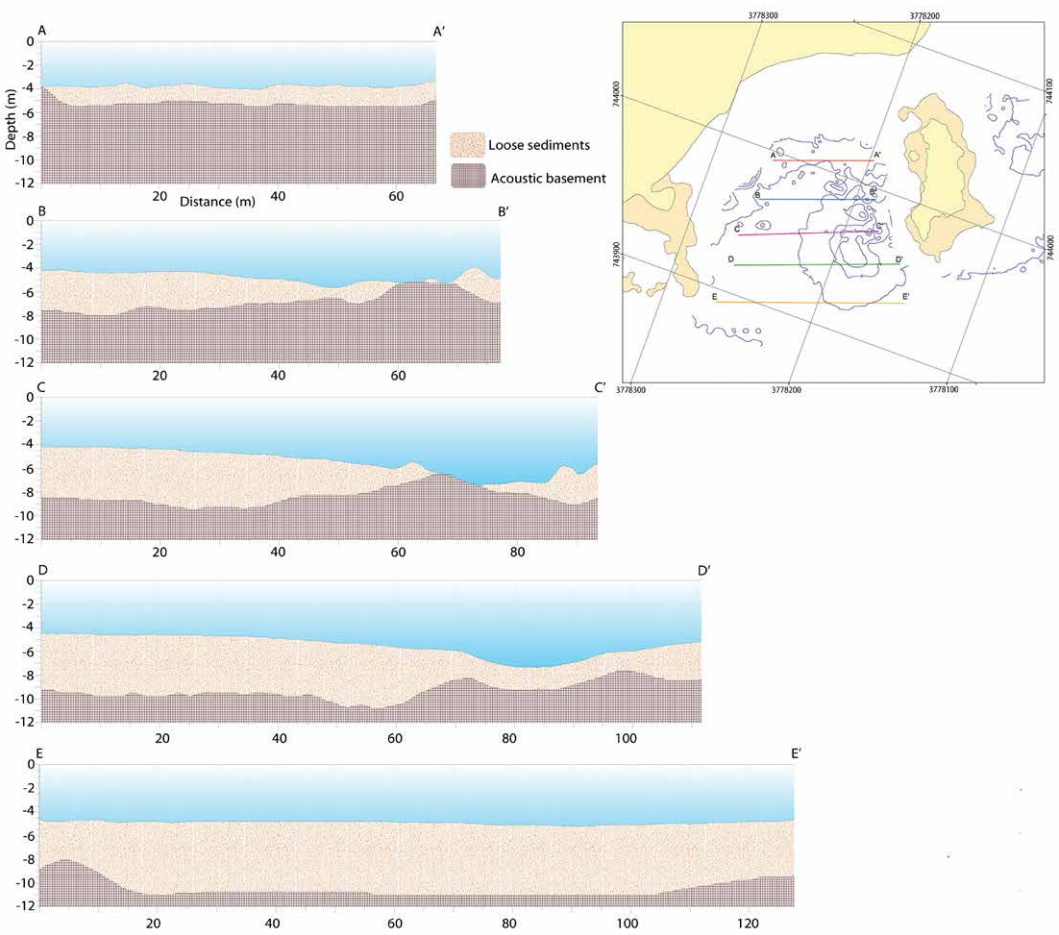


Figure 17. Cross-sections in the Jouret Osman Bay, showing a 5-m-thick layer of loose sediments covering a deeper seabed. (Papatheodorou et al., 2014).

Geophysical mission

In March 2015 a second survey was carried on the Armenian Orphanage site by geophysicists Vivien Mathé and Adrien Camus (University of La Rochelle, France). In the framework of Byblos and the Sea, the objective of this last mission was to survey the areas that are outside the harbour basin: a) to fine-tune previous results obtained by the geophysical resistivity survey; and b) to identify possible man-made structures possibly associated with harbour structures. This tomography survey included 13 parallel north-east/south-west and north-west/south-east pseudo-sections across the land, giving results in section and elevation (Fig. 19), whereas former resistivity results had provided only two-dimensional images or plan views. These highly efficient and complementary techniques were used to optimize results by cross-referencing them to present a three-dimensional image of the harbour basin (Fig. 20) (Francis-Allouche & Grimal, 2017: 54-59).

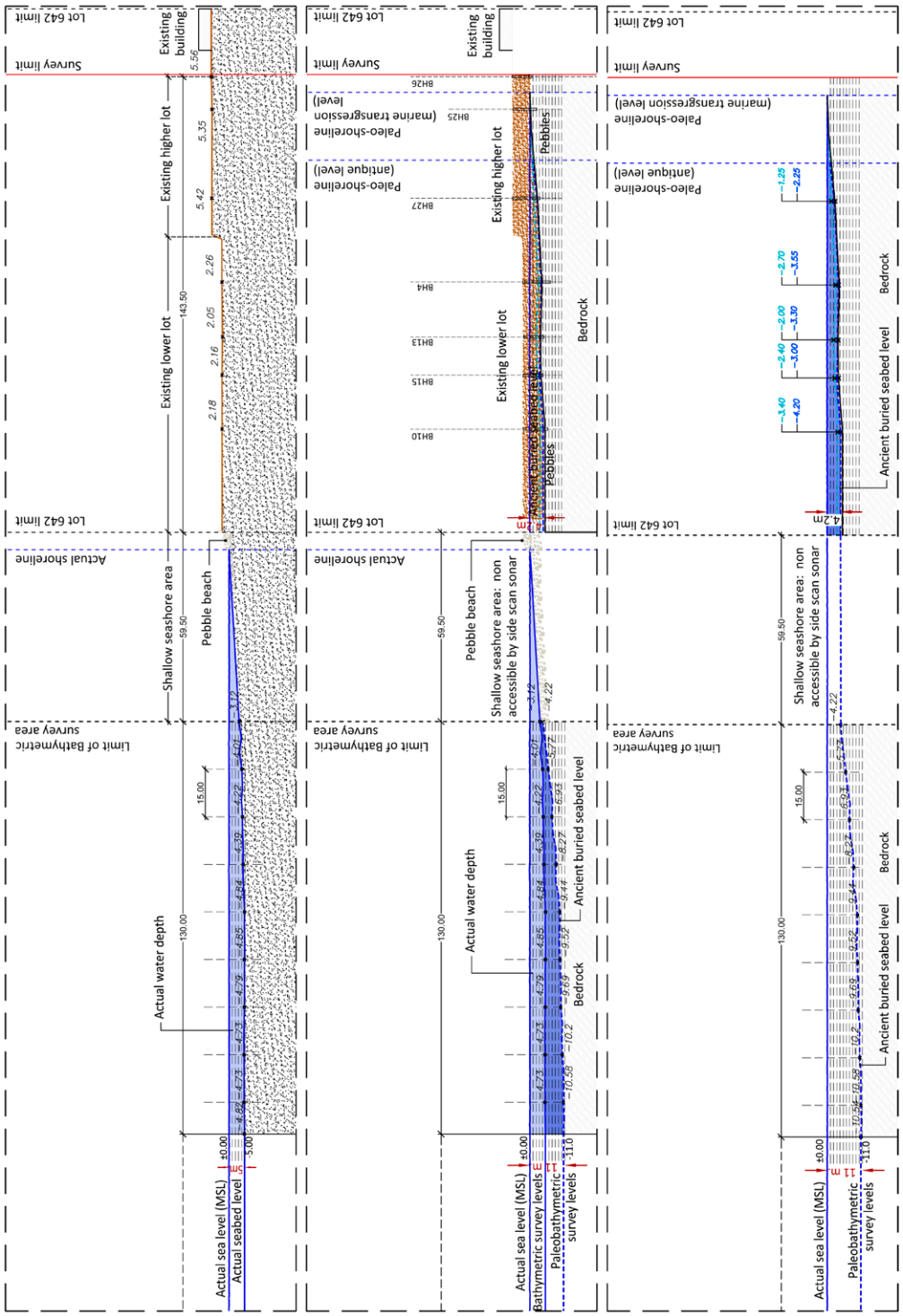


Figure 18. NE-SW general section, reconstituting the water depth of the ancient basin buried in the Armenian Orphanage plot and extending into the sea beneath the bay of Jouret Osman: a) current configuration; b) the survey area; and c) the antique configuration of the basin. (Francis-Allouche & Grimal, 2014).

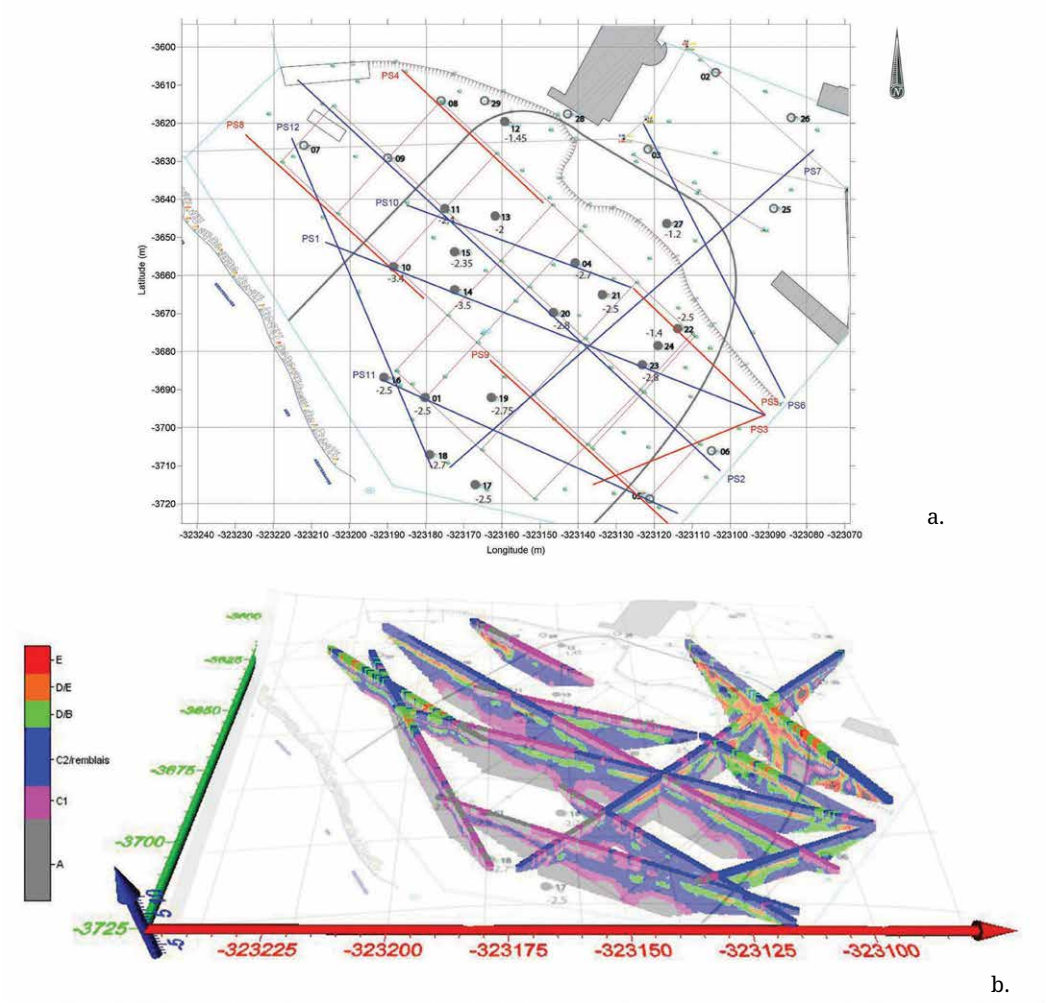


Figure 19. a) Tomography survey performed by geophysicists Vivien Mathé and Adrien Camus across the Armenian Orphanage plot covering the buried harbour basin area south of ancient Byblos; b) Thirteen parallel N-E/S-W and N-W/S-E pseudo-sections resulting in a 3D N-S view of the basin: the grey colour represents the bedrock; magenta and blue represent the buried basin, the red and orange tones represent possible structures. (©Byblos et la mer, 2015, Vivien Mathe).

Archaeological soundings

Based on the results of the last geophysical mission, some archaeological soundings and trenches were undertaken in 2015 by the Lebanese Directorate General of Antiquities on the Armenian Orphanage plot (Fontan, 2015). A team of archaeologists confirmed the existence of a silted-up basin in the lower part of the plot. However, deeper archaeological layers, contemporaneous with the harbour basin, were only reached in one of the test excavations, confirming an old shoreline with finds such as a mooring weight and a series of typical copper ship nails. Anchors were also found in the harbour vicinity (Francis-Allouche & Grimal *et al.*, 2017) (Fig. 21).

In the upper area, excavation validated the high resistivity readings obtained by the tomography survey, unearthing a concentration of medieval and Roman structures.

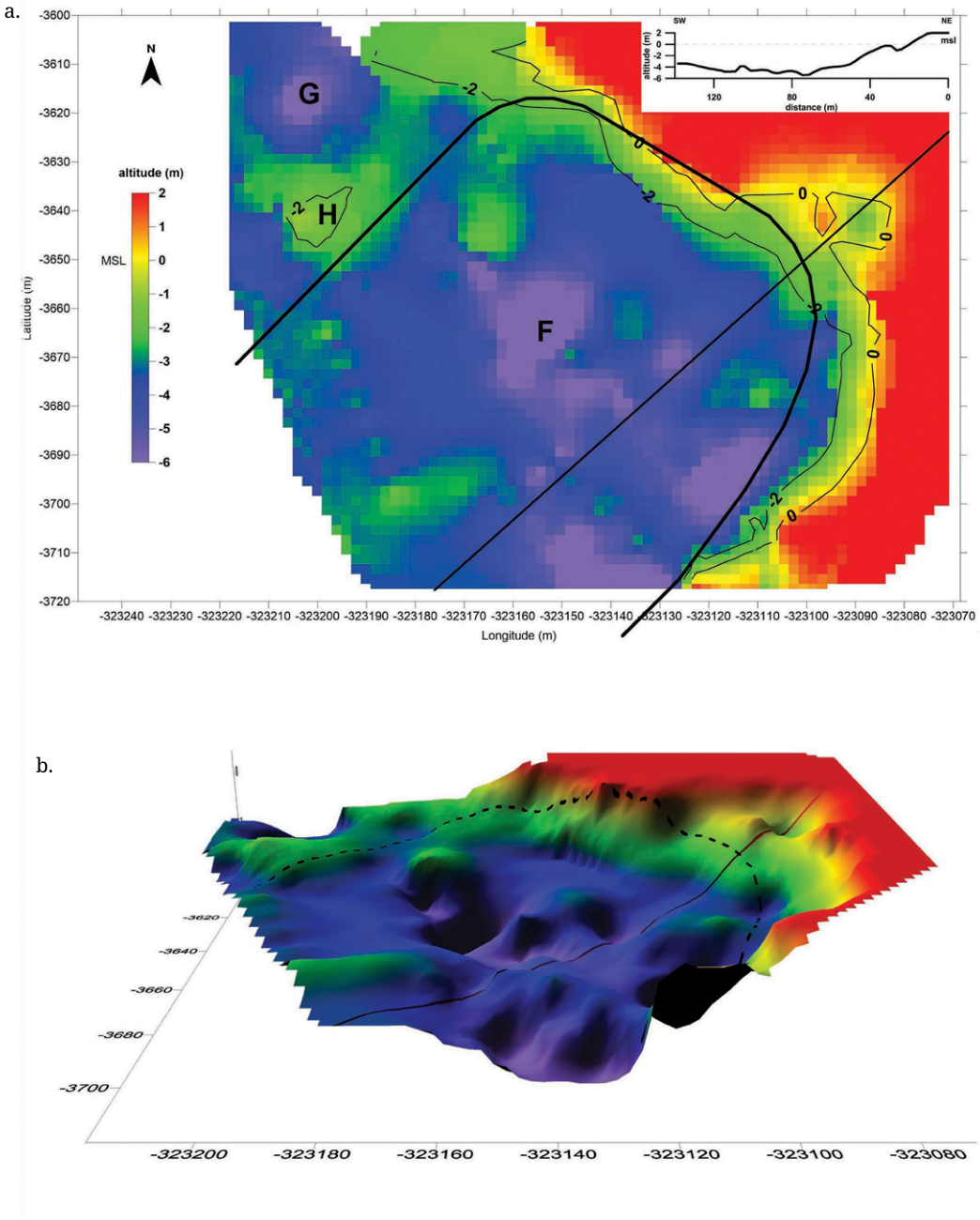


Figure 20. The tomography survey resulting in a) a 2D image of the silted-up harbour basin and b) 3D reconstitution of the harbour basin, without the siltation. (©Byblos et la mer, 2015, Vivien Mathe).

However, no older harbour structures have as yet been located. What might be expected? Would these be rather spectacular structures, or should we expect a natural cove enhanced with lighter installations, perhaps only a simple dock?

At last, after 17 years of recent research into maritime Byblos, Frost's quest is nearing fulfilment through the use of different scientific approaches that indicate the possible

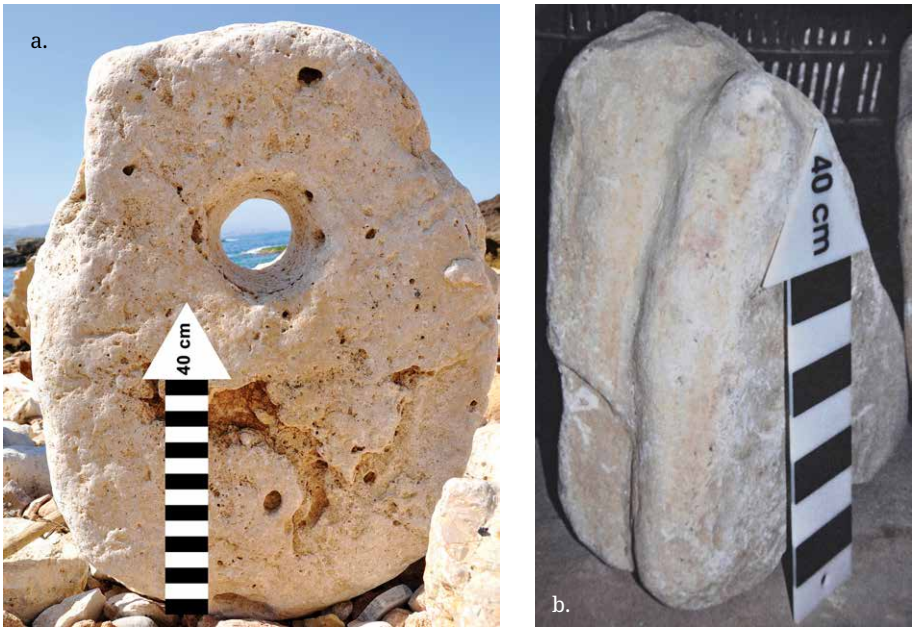


Figure 21. a) A stone anchor found in Jouret Osman Bay, the presumed antique harbour of Byblos, and b) an anchor weight found on the Byblian shore. (Photos M. Francis-Allouche).

Figure 22. Aerial photograph of ancient Byblos nested on top of the headland, showing the maritime approaches, its harbour installations, and harbour gates to the city. (© Byblos et la mer, 2017, drone photography by Rami Yassine).

location of the Bronze Age harbour at the southern foot of the ancient city. Further archaeological investigations have to be conducted at this location to understand the overall configuration of the harbour installation, define the limits of the basin, and unearth possible harbour structures.

In conclusion, the present study has shed new light on the overall configuration of the historical city of Byblos. Substantial progress has been made over the years to understanding the maritime approaches to the city. One can affirm today that Bronze Age Byblos was endowed with two harbours. One is a smaller fishermen's cove, which is still in use today, lying at the northern foot of the promontory. This small harbour was connected to the Bronze Age city via the north-western 'maritime gate', so-named by Dunand (Dunand, 1939; Jidejian, 1971). A second much larger harbour is also hypothesized, that could have served the well-attested maritime timber trade between ancient Byblos and Pharaonic Egypt over millennia. Today this large harbour lies completely silted up at the southern foot of the promontory (Fig. 22). Current investigations conducted in the southern area of the archaeological site of Byblos within the framework of the 'Byblos & the Sea' project (2010-2018), have established and defined the existence of a southern Bronze Age monumental gate overlooking the basin area (work ongoing), most certainly the access point to and from the antique harbour to the city of Byblos on top of the Byblian Peninsula (Fig. 22).

Acknowledgements

Professor Nicolas Grimal and Martine Francis-Allouche would like to thank the Lebanese Directorate General of Antiquities, particularly the former Minister of Culture, Mr Salim Wardy, who entrusted us with the research project 'Byblos & the Sea' from its inception in 2011, and for his unfailing support and encouragement ever since. Special gratitude is also expressed to former Minister of Culture, Mr Raymond Araygi, who supported and valued our work throughout 2015 to 2017. Our gratitude extends of course to the Director General of Antiquities, Mr Sarkis El-Khoury, for ongoing support and personal involvement in our project and as much to Ms Tania Zaven, to whom we owe particular thanks for her kind and unfailing help in our daily efforts and for her trust and friendship throughout the years. Very special thanks and appreciation are also due to the different teams, many colleagues and friends in Byblos (too numerous to name individually) who have conducted or contributed to the many surveys within our multi-disciplinary research project. Not only has the work been remarkable but collaboration has been friendly with each and every one of them; our achievements have been made possible only by joining forces.

Last but not least, we are unendingly grateful and indebted to the Honor Frost Foundation and the honourable Trustees for their constant support of our ongoing research campaigns in Byblos, none of which would have been possible without generous and continuous HFF funding. Personal gratitude is extended to Ms Alison Cathie for her trust, her personal support, and her friendship.

Finally, it is heart-warming to think that 'Byblos & the Sea' was able to complete a quest that was first set by Honor Frost with the means that she generously provided after her passing. This achievement is dedicated and much indebted to Honor, the Lady of Byblos.

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Harbour Installations at Tyre North

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This paper focuses on the first underwater investigation of Tyre harbour since Honor Frost's early works. Frost advised on scientific and historic principles during the 2001 season of investigations within the northern harbour at Tyre and subsequently provided guidance. The Phoenician harbour of Tyre has been the focus of interest of many scholars for more than a century. This paper will shed light on the historical background of Tyre, previous investigations, the 2001 and later investigations, and future projects.

Keywords: Phoenician harbour, Sea Peoples, headers, Tyre.

The local name of the city of Sour (*Sur*) has it roots in Phoenician times; it was also called *Suru* in Akkadian. The name Tyre is derived from the Latin *Tyrus*. The first certain record of the island settlement comes from the texts of curses made by Asian princes in the 19th century BC (Pritchard, 1969: 239). The city reappears in sources in the Late Bronze Age, especially during the reign of Abimilki in the mid 14th century BC, when a regular correspondence with Amenhotep IV is found within the Amarna letters (Moran, 1992: EA 144: 232, EA 155: 241) and in a letter sent by Rib-Hadda of Byblos (Moran, 1992: EA 89), which emphasize the power of Tyre.

Initially, the historical settlement of Tyre encompassed the small island located between 500 and 700 m from the continental shoreline, and the mainland settlement known as Ushu. Later, during the siege of Tyre by Alexander in 332 BC, a mole or causeway was constructed connecting the island to the mainland (Fig. 1).

Following this period, both the mainland settlement and the former island community were known collectively as Tyre. Archaeological evidence suggests the mainland settlement extends back to the Early Bronze Age (Bikai, 1978), with textual evidence also suggesting the island was occupied during this period. Despite rumours of attack by the so-called Sea Peoples at the end of the Bronze Age (1200 BC) (Neumann & Parpola, 1987:

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 139-150. Leiden: Sidestone Press.

Figure 1. Image of Tyre, 1934, showing how the former Island of Tyre is connected to mainland. (Poidebard, 1939).

161-182; Ward and Sharp, 1992: 208; Yakar, 2006: 33-51), Patricia Bikai, who conducted a major archaeological excavation of this site down to bedrock, clearly documented that there was no widespread destruction at that time (Bikai, 1978). On the contrary, there was a clear continuity of strata, indicating the local society continued to live in the same way through the Late Bronze Age and into the Phoenician Early Iron Age period.

During the reign of Zimredda of Sidon, Abimilki's major foe, Tyre was mentioned in several of the Amarna letters (EA 77, 92, 101, 114). Also, Tyre had a close relationship with the kingdom of Ugarit, under the influence of the Hittites. Indeed, Tyre replaced Ugarit as the commercial capital in the eastern Mediterranean in the 11th century BC (Aubet, 2000: 70-120). We also learn from Papyrus Anastasi III, dated to the end of the 13th century, the role that Tyre probably played in Asiatic campaigns and how it supplied troops to Seti I of Egypt (1318-1304 BC) (Pritchard, 1969: 258-259). Tyre was mentioned in the Wenamon report, even though the Egyptian envoy did not stop there (Pritchard, 1969: 25-29, Katzenstein 1973: 71).

During the 8th century BC, the Assyrian Empire began to assert control over the northern Levantine coast. The Assyrian ruler Tiglath-Pileser III (744-727 BC) demanded tribute from the King of Tyre Hiram II, and influenced the maritime commercial enterprises of the Phoenicians. Maritime enterprises connected to the port of Tyre continued to flourish into the 7th century BC. The influence and prominence of Tyre's maritime activities can be interpreted from the Assyrian 'Treaty with Ba'alu of Tyre' (Langdon, 1929: 189-194). Historical and archaeological sources suggest Tyre continued to be identified as an important settlement throughout the Hellenistic, Roman, Byzantine, and later periods

(Le Lasseur, 1922; Rey-Coquais, 1977; Noureddine and el-Hélou, 2005). Today, the city of Tyre still incorporates both the former island and mainland settlement, with the causeway connecting them.

The maritime context of Tyre, and hence its harbour, was certainly very active throughout the ages as a result of the island's location. Since the Late Bronze Age, its dependence vis-à-vis the mainland is highlighted in the Amarna letters (Moran, 1992: EA 148: 235), the Ras Shamra tablets, and the Papyrus Anastasi I, which also evokes the richness of fish in the waters of 'Tyre-the-Harbour' (Pritchard, 1969: 475-479). During the Iron Age, the Assyrian annals of Shalmaneser III (858-824 BC) describe that tribute from Tyre and Sidon was transported by sea (Pritchard, 1969: 276-281). The scene was depicted on the doors of his palace at Balawat (Bunnens, 1983: 10; Basch, 1987: 305-306). The annals of Esarhaddon (680-669 BC) once again emphasize Tyre's dependency on the mainland (Pritchard, 1969: 289-294).

Summary of investigations

Historical documents suggest that, like other Phoenician cities, Tyre would have possessed both a northern and southern harbour installation (Frost, 2005). The northern shore of the island was traditionally identified as the 'Sidonian' harbour, with the southern coast known as the 'Egyptian' harbour (Frost, 1971).

While the potential existence and possible location of the southern harbour structure was advocated by Antoine Poidebard (1939), a brief study of the sediments, along with underwater archaeological survey carried out in 2002 was not able to confirm any physical evidence indicating a man-made harbour structure in this area (El Amouri et al., 2005: 91-110). This may suggest the southern 'harbour' identified in historical records (Poidebard, 1939: 5-75; Frost, 1971: 103-111) constituted an offshore anchorage rather than a physical man-made harbour installation close to, or connected to the island of Tyre (Frost, 2005). In contrast to the southern coast of Tyre, the existence of a harbour installation on the northern side of the island was documented in the 19th century by Jules de Bertou (Bertou, 1843), John Kenrick (Kenrick, 1855) and Ernest Renan (Renan, 1864), who may have observed several courses of the structure extending above the water-line. In the early 20th century, Poidebard began his exploration around the area of Tyre using aerial photography (Poidebard, 1939). While his conclusions regarding the southern harbour may have proved inconclusive, his documentation of the appearance of a submerged jetty structure on the northern side of Tyre provided more favourable results (Fig. 2). Although the underwater structure identified by Poidebard could not be confirmed as man-made at the time, it did provide the impetus for further investigations into the nature of the feature and surrounding underwater landscape.

Beginning in the 1960s, Frost initiated investigations aimed at identifying the existence of harbour installations around the coast of Tyre. While her initial exploration focused on the southern side of the former island, she also identified the significant archaeological potential for harbour facilities along the northern coast of Tyre (Frost, 1971). Later, she encouraged me to continue this research and mentored me when I was appointed by the Directorate General of Antiquities (DGA) in 2001 to undertake the first underwater investigations. The underwater survey and mapping conducted by our team confirmed the existence of a man-made structure within the northern harbour

area of Tyre, in addition to confirming the high potential for the existence of significant submerged archaeological resources in the surrounding area (Noureddine & el-Hélou, 2005). Based on subsequent research and underwater investigations in 2004, which included the excavation of a test pit on the southern facade of the southern wall of the structure (ARESMAR-DGA) (Castellvi, 2007) and further mapping in 2005 (Noureddine, 2008), this underwater structure has been interpreted as representing a harbour jetty installation estimated to date to the Iron Age period. This is based on several attributes, including comparable construction methods and materials used for Phoenician harbours identified at Tabbat al-Hammam and Atlit (see below).

Between 2005 and 2013 no further archaeological investigation of the northern harbour was carried out, with the exception of underwater site reconnaissance visits which consisted only of a number of scuba dives to assess the preservation and structural integrity of the archaeological features associated with the ancient jetty structure. In 2013, a further survey season at the northern harbour of Tyre was supported by the Honor Frost Foundation. All fieldwork was completed under an archaeological permit issued by the DGA. There is a high risk of disturbance from treasure hunters to the submerged jetty at the northern harbour at Tyre, which could result in the significant loss of valuable archaeological knowledge and data. Therefore, excavation is recommended to document the archaeological integrity and significance of the site, as well as additional investigations to explore the structure's relationships to surrounding potential and known historic features.

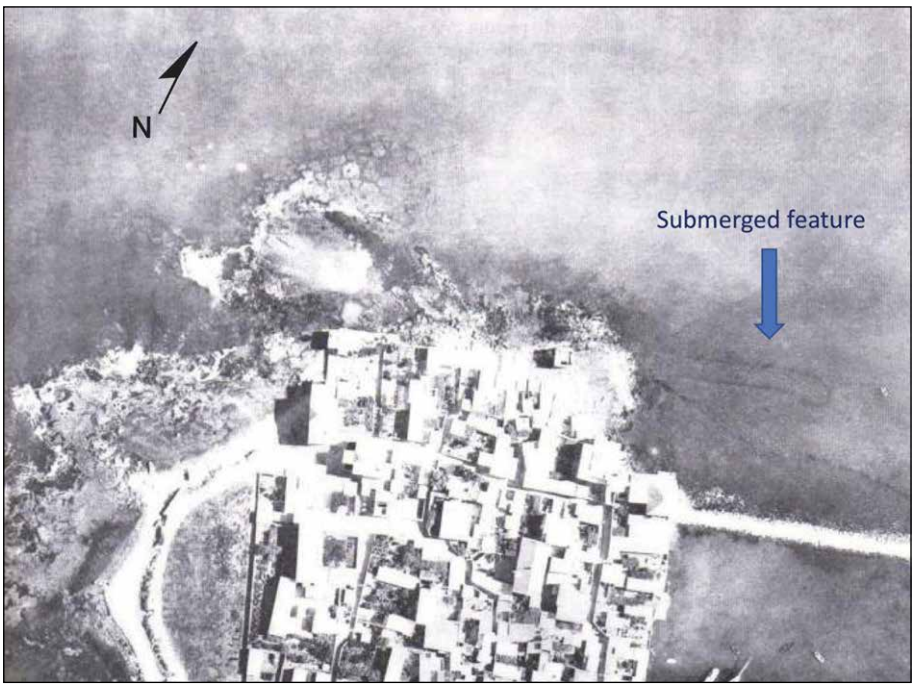

Figure 2. Aerial photograph of the northern harbour at Tyre, Lebanon. (Poidebard, 1939).

Site description

The ancient jetty is oriented in an east-west direction, 57 m north of a modern jetty that has a similar orientation (Fig. 3). Three walls related to the ancient jetty structure were observed, with two walls oriented east-west, and a connecting north-south wall at the eastern end of the existing structure. Each wall consisted of one horizontal row

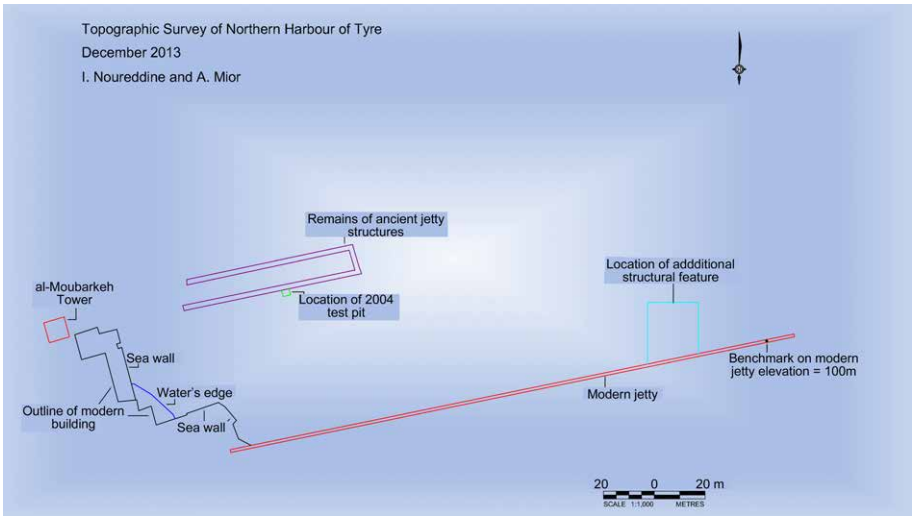

Figure 3. Topographic map depicting features in the northern harbour of Tyre, 2013. (I. Noureddine & A. Mior).

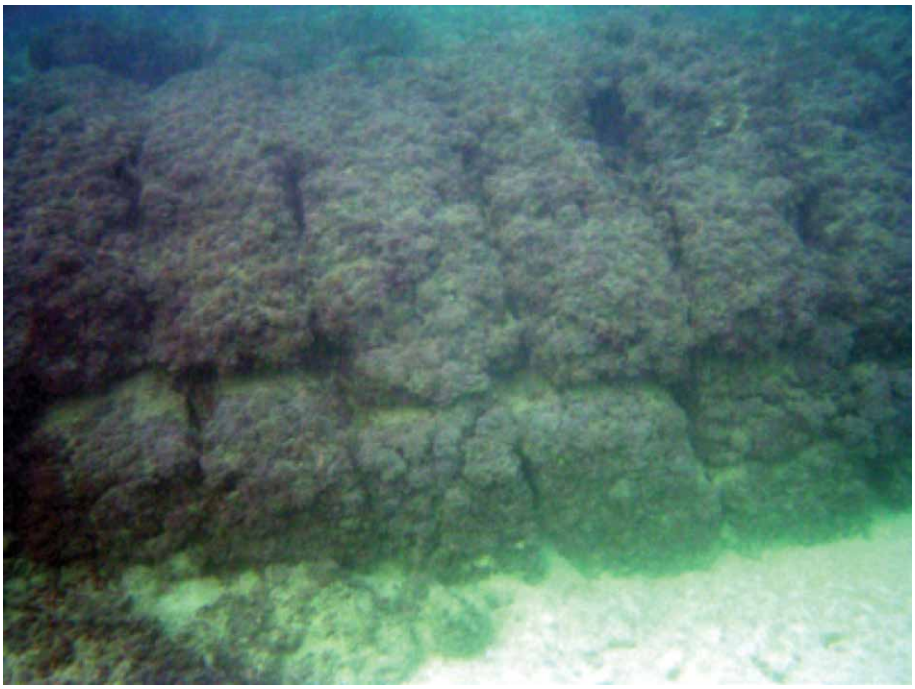

Figure 4. Limestone blocks laid as headers used for the construction of the southern wall of the jetty, looking north. (Photo A. Mior).

of roughly hewn, rectangular limestone blocks, varying slightly in size. On average, the blocks measure 1.86 m long (maximum 2.25 m), 0.30 m wide (maximum 0.45 m) and 0.45 m deep (maximum 0.60 m). All three walls exhibited the same construction techniques with the limestone blocks laid as 'headers' (Fig. 4). Only two courses of stone were visible along most of the length of the feature although in some areas a third course could be discerned protruding above the sediment. The outside facade of the northern wall measured 66.8 m in length, the visible portion of the southern wall measured 71.3 m, and the outside face of the eastern north-south oriented wall measured 11.8 m. The surveyed portion of the southern wall extended the furthest towards the modern shoreline and it lies at a distance of 27.4 m from the existing concrete structure forming part of the modern sea wall to the west.

The shallow depth of the site facilitates easy access to the submerged archaeological resources at the northern harbour of Tyre. While this benefits the archaeological investigation of the area, it also creates a problem as the archaeological site is also accessible to those interested in carrying out illicit and illegal activities. Crowbars used to move the stones in the hope of finding 'treasures' have been found on site on several occasions throughout the years of investigations from 2001 to the present day.

While additional archaeological investigations are required to realize the full importance of this site, the Tyre jetty also has the potential to provide comparative data that can be utilized to study harbour structures around the Mediterranean.

Discussion and conclusions

The closest parallels to the sunken jetty at Tyre are the jetties at Tabbat al-Hammam and at Atlit. The Phoenician jetty at Tabbat al-Hammam, 17 km south of Tartous, consists of one header-built wall, oriented east-west facing the waves, backed by a mixture of ashlars and rubble fill. It is dated to the 9th century BC based on an analysis of the stratigraphy (excavated on land) (Braidwood, 1940; Marriner & Morhange, 2007), and this dating has been accepted by several other authors (Frost, 1973; Raban, 1995). The Phoenician jetty at Atlit, 30 km south of Haifa, appears to be a smaller version, but built in the same manner as the jetty at Tyre with its two, parallel, header-built walls and a third wall of headers at their end, enclosing ashlars and rubble. At Atlit this provided a breakwater against the northern winds (Raban & Linder, 1993: 117-120). The headers are the same size as those at Tyre, with an average length of 2 m, 0.45 m width and 0.6 m depth, but the width of the whole structure at Atlit is only 9.8 m, in contrast to about 13 m at Tyre. The Atlit jetty has been dated to the 9th-8th century BC by radiometric dating of wooden fragments held between courses of the jetty (Haggai, 2006: 43-60).

Since the jetties at Tyre and Atlit both indicate technological advances over that of Tabbat al-Hammam, with a more sophisticated construction method using larger blocks and a double wall, the Tabbat al-Hammam jetty could provide a *terminus post quem* for their construction dates.

Moreover, since Atlit was either a Tyrian or a Sidonian colony (Johns, 1993: 112-117), and since the two jetties are constructed in the exact same manner, it would be reasonable to estimate that both were constructed around the same period.

To the west, a similar construction method is provided by the Hellenistic harbour at Amathonte or Amathus, Limasol, Cyprus. The jetty was built with the same header

technique, but using substantially larger blocks (3 m in length), showing that this method of construction was used at least until the end of the 4th century BC (Kozelj, 1988: 3-80; Empereur & Kozelj, 2017: 5-172).

Masons' and quarrying marks

As revealed by the excavation of a test pit in 2004 (ARESMAR-DGA) (Castellvi, 2007: 57-102), the headers at Tyre have some quarrying and masons' marks on their sides (Figs 5-6). Attempts to date the marks stylistically have not yet provided clear results with suggested dates ranging from early Phoenician to Hellenistic periods (Jidejian, 2001: 143; Castellvi, 2007: 75-102; Noureddine, 2010: 180-181). A funerary stele found during the American University

Figure 5. Quarrying and masons' marks on the inner facade of the southern wall. (Photo I. Noureddine).

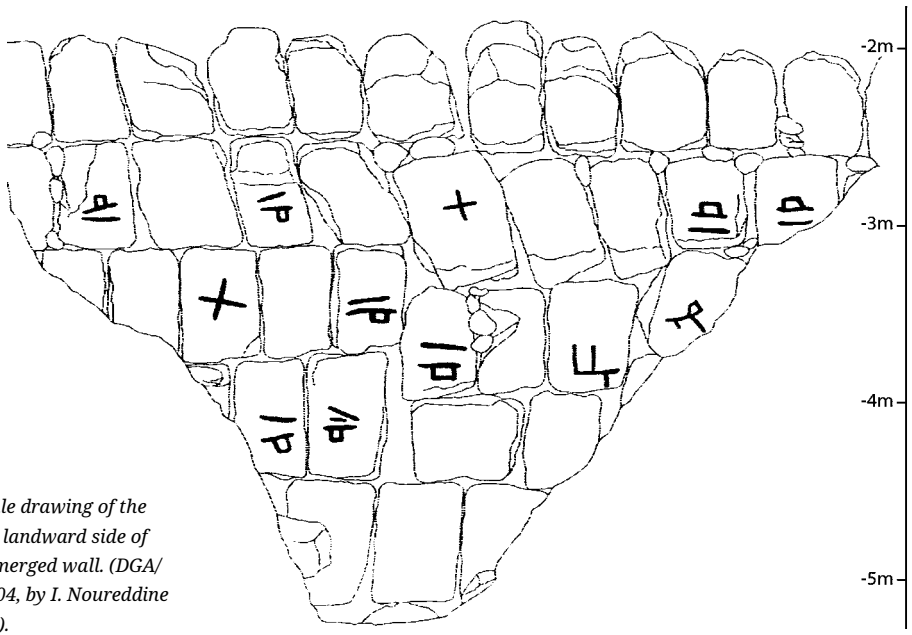

Figure 6. Profile drawing of the test pit on the landward side of the inner submerged wall. (DGA/ ARESMAR 2004, by I. Noureddine and M. Salvat).

of Beirut's excavation at Tel El Burak dated back to the mid 7th to mid 6th century BC (Sader, 2005: 22-24 and 53), does, however, have similar marks to those found on the jetty blocks (Fig. 6). Further study and observation of these markings could provide important data on the Phoenician building techniques and on dating this jetty.

According to Carayon *et al.*'s study of the geomorphology, no harbour-works dating from the Phoenician period can be confirmed with respect to the north harbour jetty at Tyre (Carayon *et al.*, 2011: 46-47). They suggest the relative absence of sediment from this period is due to considerable dredging operations dating from the Phoenician period onwards. Yet, they consider the jetty at Tyre to date at least from the Hellenistic period and possibly earlier (Carayon *et al.*, 2011: 49). In a recent study Marriner *et al.* suggested the possibility that the jetty could be Romano-Byzantine, based on a bio-stratigraphical study that showed a sharp increase in lagoonal species, consistent with hyposaline basins (Marriner *et al.*, 2014). However, it is also suggested repeatedly that chronostratigraphic and sedimentological evidence from Tyre shows extensive coastal dredging from the 4th century BC onwards (Marriner & Morhange, 2006: 164-171; Morhange & Marriner, 2008: 23; Marriner *et al.*, 2014: 6). The contribution of direct archaeological evidence to solving the dating issue has remained problematic, since research revealed a gap in the sediment sequence caused by dredging activities (Morhange *et al.*, 2015: 252).

To conclude, we should take into consideration several factors:

1. The suggested considerable dredging operations would have removed sediment archives dating from the Phoenician period, thus preventing the geomorphological studies from confirming a Phoenician date for the structure. The lack of sedimentary evidence does not negate the fact that the header-built structure at Tyre could date from the Iron Age period, as seen at Atlit and Tabbat al-Hammam. As yet no excavation has been conducted of the ashlars or the rubble fill between the two header-built walls; this is where dating evidence was located at Atlit where an Iron Age date was confirmed (Haggai, 2006: 43-60). Moreover, Carayon *et al.* suggested that the northern harbour at Tyre dates at least from the 4th century BC or earlier (Carayon *et al.*, 2011: 2).

2. During the survey conducted in 2001, published in BAAL in 2005, hydraulic mortar was identified on some of the scattered blocks that may have been fallen from higher courses in the structure, which belong to later periods – that is, Roman or Byzantine (Oleson *et al.*, 2004; Noureddine & el-Hélou, 2005: 111-128; Castellvi, 2007: 57-102). This does not date the origins of the jetty to the Classical period, however, since the blocks with hydraulic mortar were not seen within the header-built structure. The header-built walls were built with no cement or mortar, as seen at the Atlit jetty.

3. If the harbour is dated to the Phoenician period (7th-8th century BC) (Noureddine, 2010: 176-181), this does not negate its use in the Roman and Byzantine period (Noureddine & el-Hélou, 2005).

4. Finally, the symbols found on the jetty's blocks are possibly early Phoenician writing (Jidejian, 2001: 143; Castellvi, 2011: 104), however Georges Castellvi makes the argument that these writings confirm the identity of the masons but not the time the jetty was constructed (Castellvi, 2011: 115).

It is suggested that the parallel walls at Tyre are the remains of an Iron Age Phoenician jetty, dated approximately to the 8th century BC. Unfortunately, geoarchaeological studies revealed a lack of sedimentation, likely due to later dredging, so sediments cannot be used to confirm the date of construction of the jetty (Marriner & Morhange, 2006; Morhange & Marriner, 2008; Marriner *et al.*, 2014). Despite these problems, it is important to stress that among the three Levantine jetties mentioned in this paper, Tyre, Atlit, and Tabbat al-Hammam, the Tyre jetty is the largest in size and was built with double walls, suggesting Tyre was a substantial and busy harbour that could handle large cargo vessels.

Acknowledgements

I would like to thank several people who helped me generally through my career, and specifically in this research. I would like to express my gratitude to the Honor Frost Foundation for the great opportunity to present this work at the 'Under the Mediterranean' conference in Cyprus, 2017. And to Dr Jeanine Abdul Massih, professor at the Lebanese university and a specialist in rock quarrying. I would also extend my thanks to the Directorate General of Antiquities for continuing their support and trust and for providing logistical assistance. Finally, I would like to express my gratitude to the late Prof. Albert Naccache.

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Preserving the Landscape of Anfeh

A maritime heritage site in north Lebanon

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This paper considers the maritime cultural landscape of Anfeh, until recently an understudied coastal site in North Lebanon. It seeks to provide an appreciation of Anfeh's maritime heritage, past and present, describing how an important site that played a role in the economy of the northern Levant from the Early Bronze Age to the Ottoman period is being researched, surveyed, and excavated and, more importantly, how it is being protected and conserved against all odds.

Keywords: Anfeh, landscape, seascape, maritime heritage, cultural conservation, sustainable development.

Honor Frost's pioneering archaeological work in the Mediterranean is best known for her research into anchors, shipwrecks, and harbours. However, a closer examination of her work reveals an avid interest in maritime cultural landscapes long before the term was coined by Christer Westerdahl in the 1980s (Westerdahl, 1986, 1992). By putting coastal and underwater archaeology in context at Lebanese sites such as Byblos, Sidon, and Tyre, by considering sea-level change and its archaeological signatures, environmental dynamics, and site-formation processes; and, finally, by appreciating the tangible and intangible aspects of maritime material culture, Frost paved the way for local archaeologists to hermeneutically perceive a seamless sea-to-land transition.

To follow in the footsteps of Honor Frost is to engage with the concept of maritime cultural landscapes or seascapes, that, in sum, considers the material and immaterial ways in which past and present human communities actively engage with the sea. In doing so, the Anfeh Research Project (ARP) led by the Department of Archaeology and Museology (DAM) at the University of Balamand, explores ways of

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 151-164. Leiden: Sidestone Press.

preserving the natural and the cultural assets of Anfeh, through a multi-disciplinary approach tackling both the tangible and intangible aspects of material culture of a region, which have long been neglected and undermined by the local community and governmental institutions.

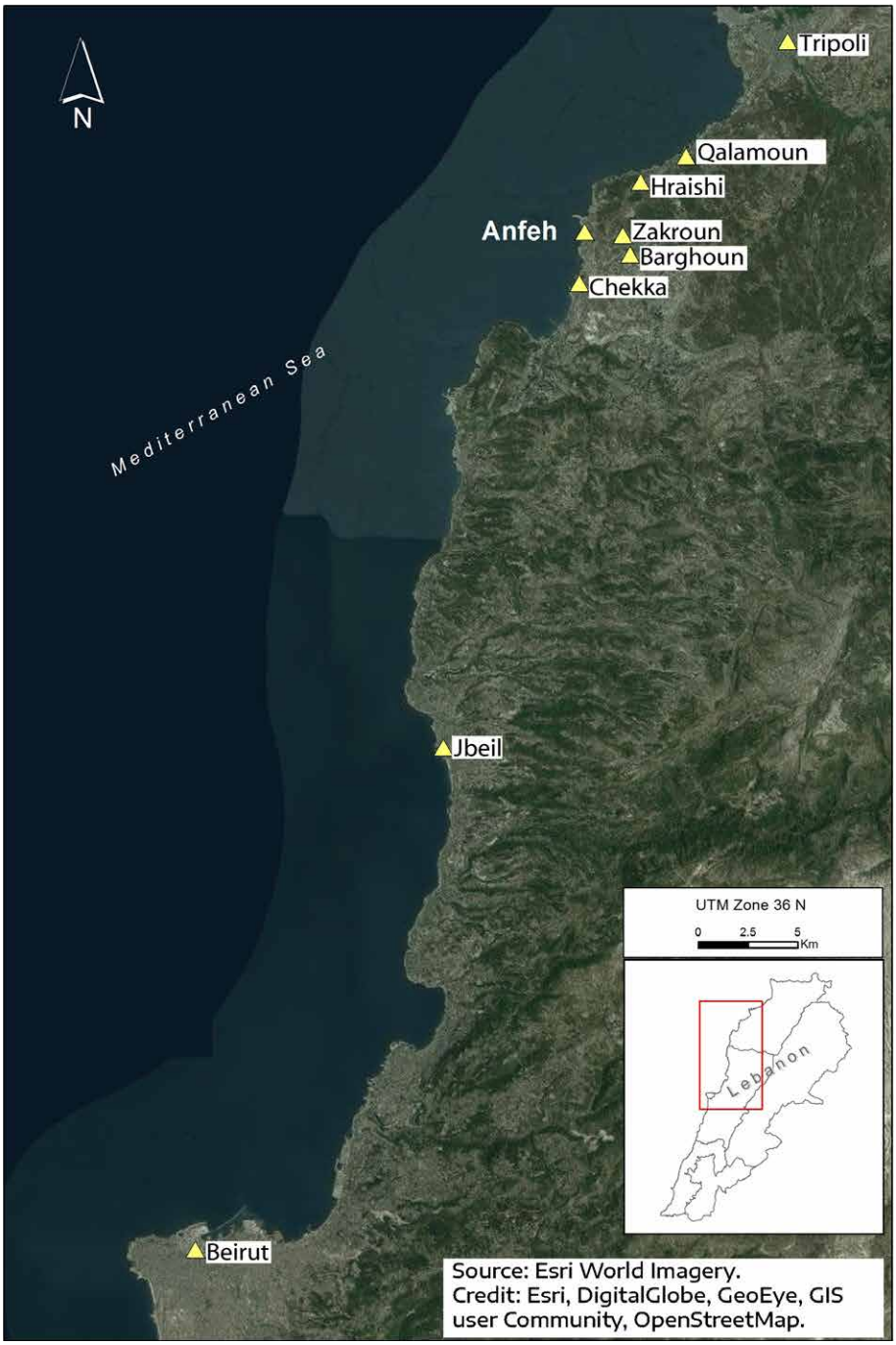

Figure 1. A map of the location of Anfeh and neighbouring areas. (Map Crystal Safadi).

Another major focus of this project is to reconstruct the history of the site by combining archaeological data from surveys and excavations, both on land and under water, with an in-depth study of ancient epigraphic and literary sources, as well as ethnographic data collected from oral histories (Panayot Haroun, 2015). The ultimate objective is to design an ecotourism scheme that would protect the heritage and archaeological resources of the coastal town. To that end, a multi-disciplinary methodology which includes an assessment of the geographical, environmental, cultural, and socio-economic assets of Anfeh has been adopted and systematically implemented. This has constituted the base for designing a sustainable programme for effective management, protection, and conservation of Anfeh's maritime cultural heritage.

Anfeh's physical setting

Often dubbed 'Little Greece', with its rustic blue and white chalets on the seafront, the coastal town of Anfeh is located in the Kurah district of North Lebanon, 70 km north of Beirut and 15 km south of Tripoli (Fig. 1). It is extended to the west by a promontory called Ras al-Qalaat, 400 m long and 120 m wide, which is oriented on an east-west axis (Fig. 2).

Anfeh's geology is quite unique for the Quaternary and Holocene periods (Elias, in press). Moreover, Anfeh's coastline presents caves, erosion platforms with the presence of vermetid, limestone, and sea grass. Twenty-seven marine habitats have been identified on the littoral fringe, reflecting its ecological diversity. As a result, there is a very rich biodiversity in Anfeh, where sea turtles thrive: this is also due to the high quality of

Figure 2. Aerial image of Ras al-Qalaat extending westwards into the Mediterranean Sea. (Photo Rana Tanissa).

water in that area according to recent publications by the CNRS-L, which suggest that Anfeh should be classified as a Protected Maritime Area on the Lebanese coast (El Shaer *et al.*, 2012). The site is home to 650 species of sea and littoral plants and 950 species of marine animals including fish, marine mammals, crustaceans, and reptiles to name but a few (Ramos-Esplá *et al.*, 2014).

The socio-economic setting

Throughout the 20th century, the main socio-economic practices of the maritime communities of Anfeh were intertwined with angling, commercial fishing and salt extraction alongside agrarian practices such as olive-oil production. Today, however, the beach front of Anfeh is devoured by mass tourism and its unsustainable encroachment on the seaside scenery. As Anfeh has become more of a backdrop to tourism and less of a taskscape, this has led to the loss of the traditional ways in which Anfeh's inhabitants engage with the sea. One of the ARP's research axes is to consider the development of these social practices through time which, by the same token, mirrors one of Honor Frost's interests. Indeed, anyone familiar with Frost's writings can fathom the extent to which she minutely observed and reported the maritime practices of the fishermen, sponge divers, and mariners she encountered throughout her multiple research projects (*e.g.* Frost, 1963; 1998: 252; 2002: 313-314; 2003: 58).

In Anfeh, one of the waning maritime social practices is salt production (Fig. 3). Salt was traditionally considered the town's 'white gold' and was a major source of income for the local community between 1943 and 1990. However, in the early 1990s Egyptian salt was imported to Lebanon exempt from taxes, which caused the regression of the once-flourishing local salt production in Lebanon and more particularly in Anfeh. This

Figure 3. Anfeh. The salt pans at Deir al-Natour. (Photo Rita Kalindjian).

government-backed measure dissolved the significant socio-economic legacy of Anfeh, which in turn has caused environmental problems and loss of the social character and identity of the region. Recognizing the importance of recording this vanishing social practice, the ARP undertook an ethnographic campaign in the village in 2013. The study revealed that only 11 salt producers are still active today, while the rest of the inhabitants expressed their wish to restart their presently suspended salt production, if a market was secured (Kalindjian, in press). Even though abandoned salt marshes present a desolate scene nowadays, they have preserved the buried archaeological layers and have become a safe haven for migrating birds.

Another maritime source of income for the local community at Anfeh has always been, and still is, fishing. Hence, a second ethnographic campaign, coupled with a fieldschool, was conducted in 2014, with a particular focus on fishing practices and the local fishing community. This study collected the lived experiences and contemporary understandings of both tangible and intangible maritime heritage while exploring the community's engagement with the sea (Jansen van Rensburg & Kalindjian, in press).

In conclusion, political and economic considerations have negatively impacted the activities of Anfeh's coastscape. The ARP aims, therefore, to document and preserve the maritime cultural heritage of the area through an interdisciplinary methodology that considers biodiversity, geomorphology and historical, archaeological, and ethnographic enquiries.

The historical, archaeological and cultural setting

The archaeological surveys and excavations on land and under water undertaken by DAM, since 2011 and 2013 respectively, have revealed the existence of several archaeological remains that need further exploration and which confirm that Anfeh and its hinterland is a rich and promising site (Figs 4-5).[1] The results have identified four major occupation levels underneath the salt pans dating back to the Chalcolithic period, which is evidenced by two funerary jars uncovered *in situ* at the western end of the promontory. This predates the conventional Late Bronze Age occupation phase of Anfeh, which was previously known from the 14th-century-BC Tell El Amarna letters. In these letters, Anfeh is traditionally identified with *Ampi* and is mentioned six times (Freyha, 1972: 6; Salâmé-Sarkis, 1999: 78). In his correspondence with the Pharaoh, the king of Byblos, Rib-Addi, who was a faithful subject of the Amarna court, mentions the Ampi fleet, telling the Egyptian monarch that the enemy ships of Arwad have reached the city and are 'stationed' in its waters (EA 71, 72, 76, 95, 102; Collon & Cazelles, 1987: 296; Salâmé-Sarkis, 1999: 78).

The third occupation level of the site dates to the Late Byzantine period where a strong religious presence is represented by a cluster of religious spaces in Anfeh such as the chapel of Saydet El Rih (Our Lady of the Wind), which was excavated by DAM in 2011 and 2012. The chapel was first built during the Late Byzantine period

1 The limits of the land survey equate to 13 km^2, extending from Hraishi and the promontory of Ras Al Natour in the north to the Barghoun River in the south, and from the foothills of Jabal Jawz in the east to the sea in the west. The limits of the underwater survey follow the same north and south limits, while extending from the coastline to the east to 600 m from the tip of Ras al-Qalaat.

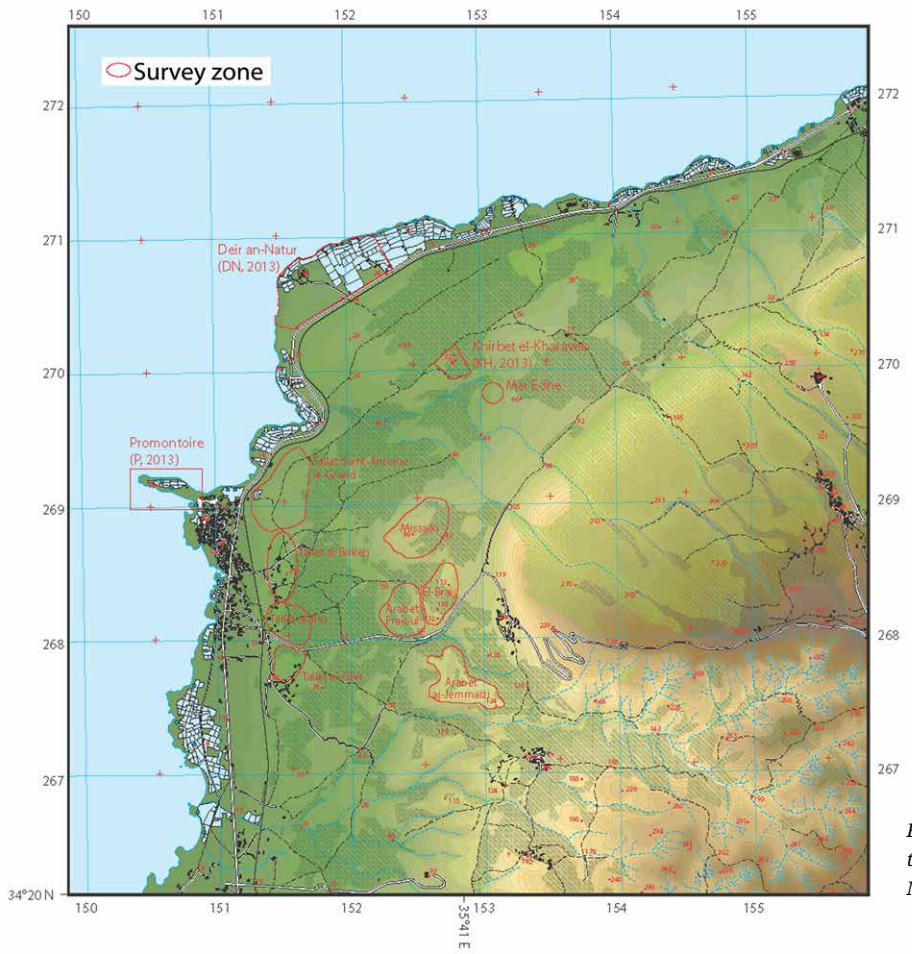

Figure 4. Limits of the terrestrial survey. (Map Martin Sauvage).

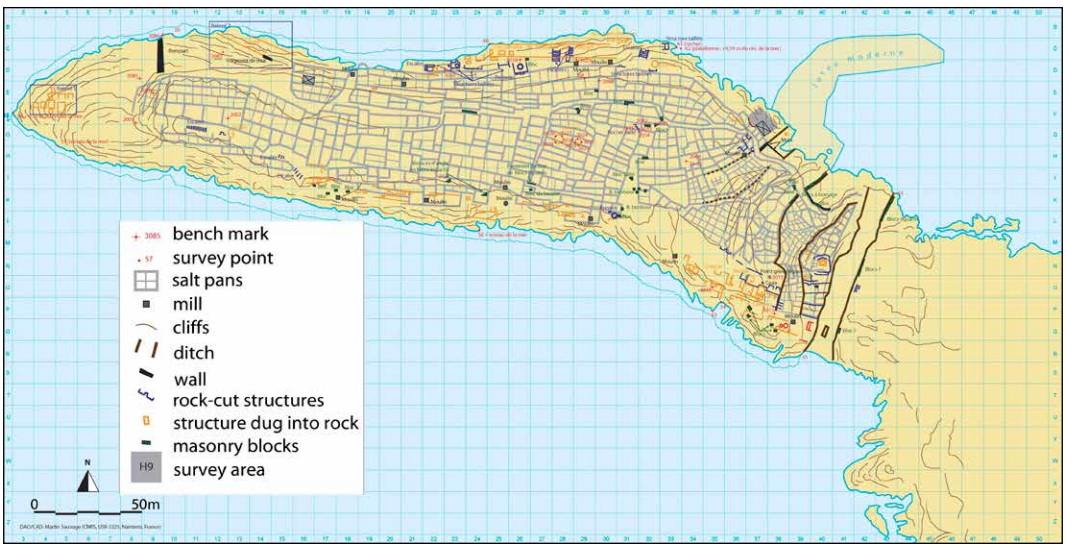

Figure 5. Archaeological remains on the promontory. (Map M. Sauvage).

(6th-7th century AD). This new evidence justifies the oral tradition of calling Saydet El Rih the oldest chapel in the Levant dedicated to the Virgin Mary. The chapel was enlarged during the Medieval period (12th-13th centuries AD) with the addition of a northern and western extension.

During the Crusader period, Anfeh was known under the name of *Nephin* and later during the Mamluk period as *Anafah*. It was a well-fortified village famous for its wines, also traditionally known as 'the Citadel', and is confirmed by DAM's excavations on Ras al-Qalaat. These have uncovered parts of the pavement of the medieval fortress, among other structures. The peninsular fortress was cut off from the rest of the village by two moats. The German traveller Burchard of Mount Sion described the citadel after his visit to the region in 1283 AD as: 'equipped with twelve towers with its feet in the water'. Several ramps provide access to the water directly facilitating transportation of goods such as wine and olive jars to a nearby harbour or anchorage.

Historical and archaeological evidence as well as ethnographic practices have testified to the intrinsic links that the coastal town had, and still has, with the sea. As explained above, the multi-disciplinary research advocated by Frost and adopted by DAM is key to studying Anfeh's seascape in a holistic way, which reflects the seamlessness of the maritime space. To that end, several fieldwork seasons have targeted the study of the coastal and underwater material cultures of the area (Panayot Haroun, 2016; Panayot Haroun *et al.*, 2016).

Coastal and underwater investigations

In 2015, the Honor Frost Foundation (HFF) granted DAM a post-doctoral fellowship for Lucy Semaan to look at Anfeh's seascape through studying how people in the past have modified and used the coast and the sea for their maritime needs. Several fieldwork campaigns have taken place since including underwater visual, geophysical, and photogrammetric surveys, together with a study of maritime offordances, as well as studies of the relative sea-level change and how this has impacted the archaeology. This research has helped assess and interpret the coastal and underwater cultural heritage of the area and has built on a previous preliminary underwater visual survey that was undertaken by DAM in 2013, which was also supported by the HFF (Semaan, 2016; Semaan *et al.*, 2016).

In order to better understand the maritime affordances of the site, a systematic walk-by coastal survey took place in September 2016 (Semaan & Carayon, 2016). It stretched across the survey area granted to DAM (Figs 4-6) and constituted a straight distance of slightly more than 2 km. Several harbour interfaces were identified including bays, coves, landing places, moorings, anchorage points and potential rock-cut quays (Semaan, in press). This coastal walk-by survey was accompanied by a snorkelling survey that was conducted all along the northern and southern facades of Ras al-Qalaat to locate and record any submerged wave-cut notches and platforms that would indicate past sea-levels. Only one underwater notch was located to the north of the peninsula, while the southern underwater reefs presented a much-eroded facade due to being exposed to the dominant south-westerly winds.

The underwater cultural heritage was studied through visual survey in the waters around Ras al-Qalaat and off the north and south coastal stretches of the modern town. Using such a method permitted a rough appreciation of the underwater topography and submerged

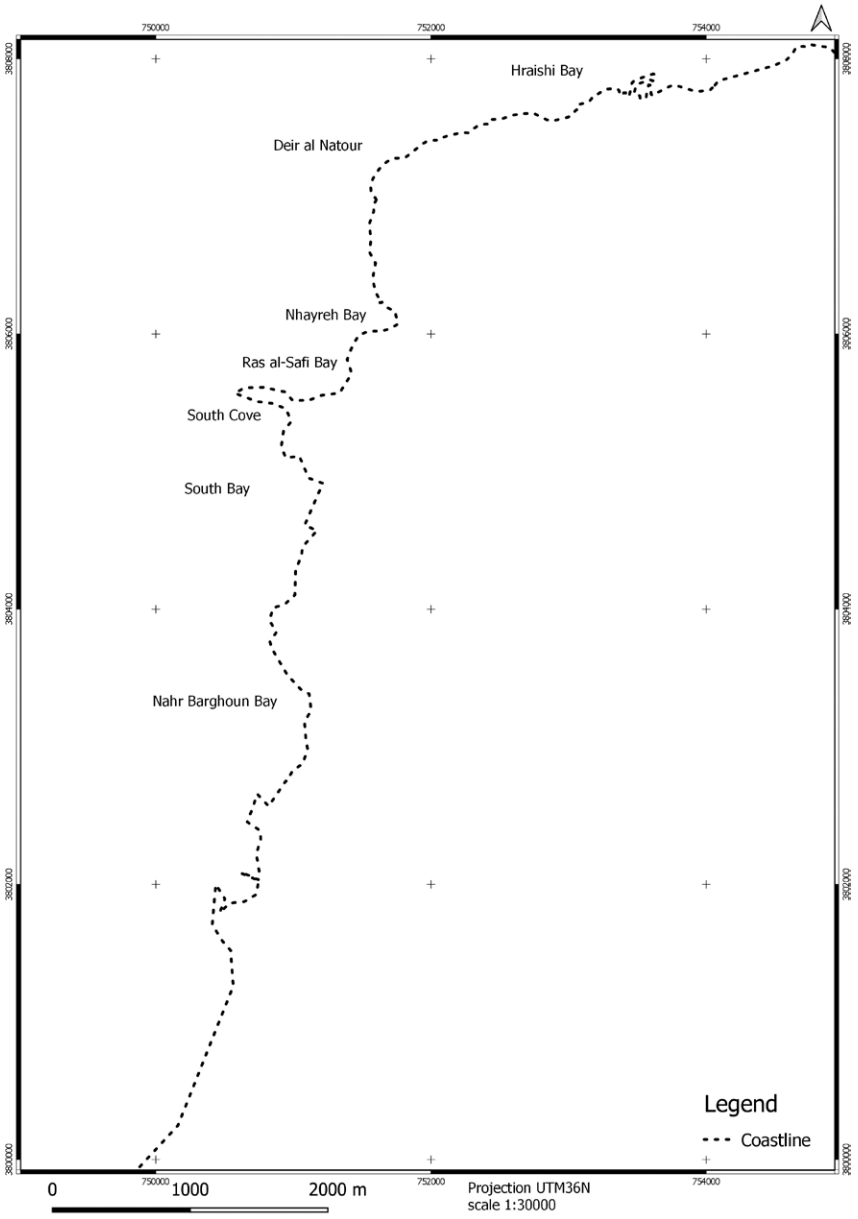

Figure 6. Map of the coastal features surveyed as harbour interfaces (Map Enzo Cocca).

material culture (Semaan, 2016; Semaan *et al.*, 2016) that was subsequently followed by a more systematic and rapid appraisal of the resource through marine remote sensing.[2]

2 In June 2017, the Department of Archaeology and Museology at UOB in collaboration with the University of Patras, Greece (UOP) undertook a remote-sensing survey at the site of Anfeh. The team was composed of six people from the Laboratory of Marine Geology and Physical Oceanography at the Geology Department of the UOP. The team from UOP comprised Prof. George Papatheodorou, Dr Maria Geraga, Dr Dimitris Christodoulou, Dr Elias Fakiris, Xenophon Dimas, and Nikos Georgiou; and the team from the DAM-UOB was composed of Dr Lucy Semaan and Mario Kozaily.

The rich coastal and underwater material culture was also documented through multi-image photogrammetry that recorded anchors, masonry blocs, and slipways. The method and its application, benefits and challenges go beyond the scope of this paper and have been argued elsewhere (Semaan & Salama, 2019). The final products included scaled 3D models of these artefacts and features from which we could extrapolate orthogonal projections, sections, plans, and drawings. In addition, the association between the georeferenced 3D models and their environment is recorded in a GIS platform that renders the connection between submerged material and on-land archaeological signatures more comprehensible and coherent. Finally, photogrammetric documentation allows close monitoring of submerged and coastal archaeological material at Anfeh that is quite exposed to looting and the impacts of urbanization, and acts as a means to mitigate potential losses.

Meanwhile the remote-sensing survey established the underwater topography and characterization of the seabed, as well as the paleogeography of the area and changes in sea-level. It also identified and assessed the underwater cultural heritage at the site through detecting surface and subsurface targets of potential archaeological interest. Four different systems were deployed: a Bathyswath interferometric multibeam system; dual frequency side-scan sonar with a 272TD tow fish, and a digital recording unit Edgetech 4100P; a digital single-beam hydrographic echosounder Elac Nautik Hydrostat 4300; and a high-resolution Kongsberg GeoPulse Plus Chirp sub-bottom profiler; and a Hemisphere V100 GPS system. Visual inspection of some of the identified targets was accomplished during ground-truthing that was carried out using a SeaViewer underwater tow camera. The use of these different techniques greatly enhanced our understanding of the maritime aspects of culture at Anfeh.

One of the research enquiries also includes 'anchorology', as Frost used to call the study and typology of stone anchors. Fifty-eight anchors from the waters of Anfeh can be added thus far to what Frost referred to as the *Corpus Ancorarum* (Frost, 1997: 122). These are currently under study but a few observations can be made here. These anchors are of three types with single, double, and triple holes. The weights of the anchors vary greatly from more than 300 kg to as little as 9 kg. This reflects the diversity in boat types and tonnage as larger ships require heavier anchors than do small freighters (Galili *et al.*, 1994: 106; Frost, 1997: 121-122). However, the size and weight of an anchor does not always correlate with ship size, as argued by Christopher Monroe (2007: 3). Some of the anchors at Anfeh were found in clusters, which might indicate a group of anchors belonging to the same vessel. The spatial distribution of some of the anchors suggested the presence of commonly used anchorage locations on the southern reefs running parallel to Ras al-Qalaat (Fig. 7) and further north at Hraishi Bay (Fig. 8). It is hoped that further study on the underwater material culture at Anfeh will help in providing a deeper understanding and appreciation of the seascape at Anfeh.

In conclusion, the past century has seen construction development on a massive scale that is dramatically altering the environmental and sociological landscapes of the Near East. According to the Mediterranean Environmental Technical Assistance Program, METAP/World Bank report issued in 2011, there is a high risk of total urbanization of the narrow Lebanese coastal corridor which would host more than 85% of the Lebanese population by 2025, endangering both the natural and the cultural coastscape. Thus, academic archaeologists need more than ever to integrate 'the needs

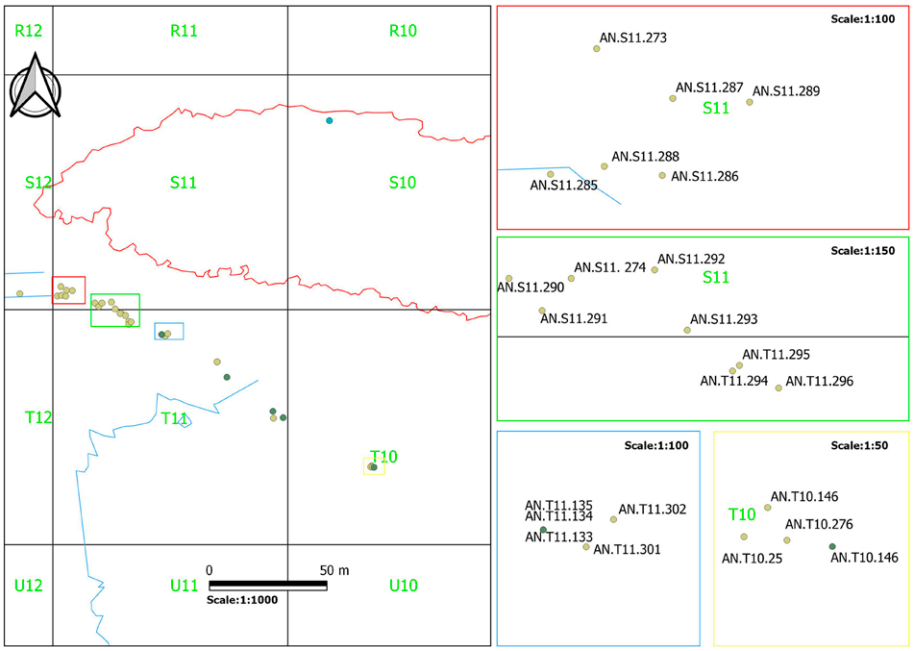

Figure 7. Map locating the anchors at the foot of the southern reef of Ras al-Qalaat (Map Enzo Cocca).

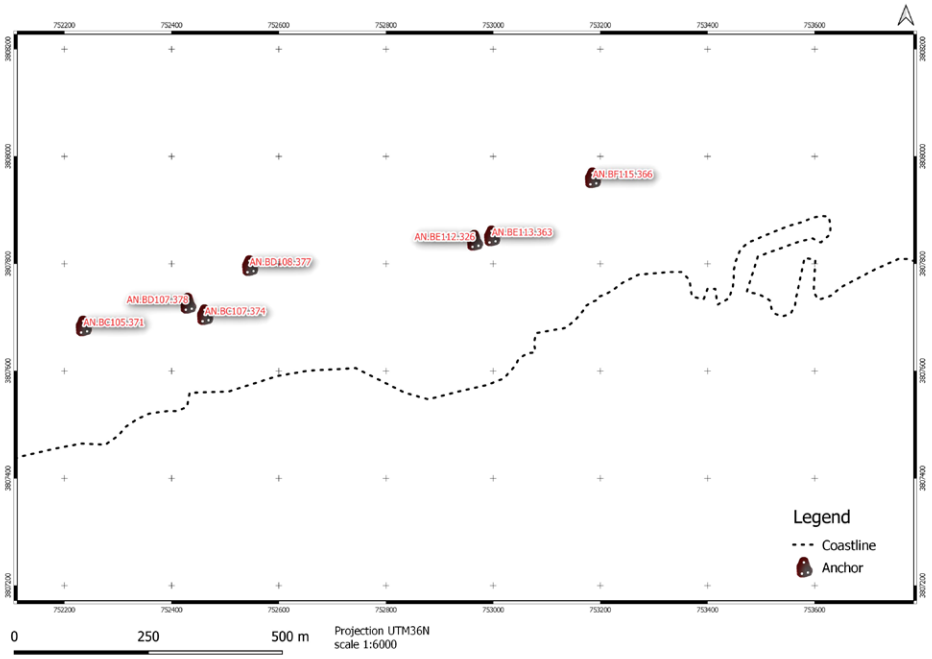

Figure 8. Map showing the location of anchors at Hraishi Bay (Map E. Cocca).

of cultural conservation' and 'the potential of their work for promoting ecotourism' into their research designs (Levy & Najjar, 2009: 1). Levy argues, indeed, that issues of conservation and ecotourism have become an ethical responsibility that practising archaeologists need to address when dealing with cultural resources which encompass, among other things, archaeological sites. The HFF has already embraced such a vision by supporting preventive measures to ensure the preservation and conservation of Near Eastern maritime cultural landscapes. Comprised within this perspective, archaeologists must ensure the implementation of ecotourism initiatives that would positively contribute to 'the sustainable development of a country while at the same time protecting natural and cultural resources as well as giving local populations pride in their traditional cultures' (Levy & Najjar, 2009: 2-3). Management of archaeological sites can provide long-term economic benefits for the ecotourism industry of a country and preserve its cultural heritage (Panayot Haroun *et al*., in press).

DAM has been building rapport and awareness with the local community since 2011 through several actions: giving regular talks about our archaeological finds to different groups in the town and internationally; allowing the community to help the archaeologists in their field work through specific programmes such as 'Be an Archaeologist for a Day', a highly popular family-oriented activity, and kids' pottery workshops. These first steps have been followed up with educational documents and exhibitions about this promising work aimed at the academic and wider public, to disseminate information about maritime archaeology in Lebanon and the region. In September 2017, DAM hosted and organized the first Nautical Archaeology Society field school in Lebanon, which was generously funded and supported by the HFF, as a step forward in building local capacity in underwater archaeology. Ten students participated, mainly students of archaeology as well as archaeologists and diving amateurs who came from all regions of Lebanon and attended lectures along with dry and wet practical exercises.

Lastly, following our relentless dedication to promoting and developing sustainability, on 22 September 2017 the municipal council of Anfeh signed the Hima accord with the SPNL (an association for the protection of nature in Lebanon). Hima means 'protected area' in Arabic; it is a community-based approach used for the conservation of sites, species, habitats and people in order to achieve the sustainable use of natural resources. This will help us implement the conservation of both nature and maritime archaeological heritage and integrate these into ecotourism schemes for a positive impact on an area with a low income that is rich in its diverse heritage.

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Three Decades of Adventures with Honor Frost in Crete

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This article describes the author's relationship with Honor Frost over 30 years, particularly their first visit to the archaeological site of Phalasarna, West Crete. Emphasis is placed on the finds of the 2015-2017 excavation seasons, which include a new section of the quay, a slipway, two new towers, a mechanism to support a chain that closed the harbour, and a merchant's house. Underwater excavations of a Classical shipwreck at Alonnesos, Northern Sporades, and a Minoan shipwreck at Pseira, East Crete, are also briefly described. Honor Frost was involved in all these projects.

Keywords: Phalasarna, Hellenistic, harbour, Honor Frost, Pseira, Alonnesos.

I met Honor Frost in the 1970s when I was a student in England trying to settle on a career. I knew it should combine history and the sea, but I had no role models for what I could become, until I met Frost. She was a diver, travelled the world, made discoveries, and was fearless. She became the most important influence on my professional life. We often travelled together, exploring archaeological sites, diving, or attending conferences together in places such as England, France, Bulgaria, and Cyprus (Fig. 1). I not only gained knowledge of diving archaeology from her, but I learned to share her lifelong passion for ships and harbours.

There are the three main lessons I learned from Frost: 1. Help the younger generation. 2. Be fearless and passionate. 3. Do serious and lasting work.

The harbour of Phalasarna

To illustrate some of these points, I will begin with the story of a day I spent with Frost in 1984. At this point we met regularly; I would stop off to see her in London when I flew to America where I was pursuing my PhD and she visited me in Greece in the summers.

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 165-182. Leiden: Sidestone Press.

Figure 1. The author with Honor Frost, Dokos Island, Greece (1991). (Photo K. Jachney).

When she came to see me in Chania in Crete in 1984, we decided to visit Phalasarna, a site located on the far western shores of the island. Phalasarna was an ancient town that Skylax described as an old city that had an artificial port and a temple dedicated to the goddess Artemis. I was settling on a topic for my dissertation. I had read Honor's articles on the Phoenician harbour-works along the coast of Lebanon at Tyre, Sidon, and Arward (Frost, 1972, 1973) and, after several brief trips to Phalasarna, I suspected I saw similar elements there in the uplifted and silted-up port – although most archaeologists at the time doubted there was a harbour there at all.

It was a very long day. We started by visiting Grambousa, an island off the north-western tip of Crete topped by a magnificent Venetian castle. An old fisherman agreed to take us out but, on the way back, the motor on his small boat broke and we had to row the rest of the way. Eventually, after four hours, we got back to Phalasarna. At that time nothing had been excavated but graves, and Frost was no more convinced than most other researchers that the harbour was in the location I had identified. It was marked then by nothing but small hills covered with bushes and carob trees. When we got back to the village, a few of the locals who had gathered around told us they hated archaeologists and said if we ever came back, they would shoot us. If anything, Honor found this amusing, and she proposed we have coffee with them. Death threats were not something to deter one of the world's first female divers, and the first female diving archaeologist.

That day became the starting point of the work I have been doing at Phalasarna ever since. There were many important lessons learned that day. One was to refuse to be governed by fear of operating in a hostile environment. Another was that archaeological work does not happen in isolation: it deeply affects people in the

Figure 2. Altar dedicated to the Phoenician goddess Astarte. (Photo E. Hadjidaki).

surrounding community and unless one becomes part of that community the work may not be possible. A third lesson was that it is one thing to suspect one has, say, found a Greek port with Phoenican influence, a *kothon*, and quite something else to prove it. This effort took many years.

I have continued to work at Phalasarna for three decades. All along, as the discoveries were slowly progressing, Honor's reaction was simultaneously intense scepticism and intense support. She challenged me to prove my suspicion that the Phalasarna harbour resembled a *kothon*, but she also encouraged me in the strongest terms to keep at it and never give up. Her extraordinary personal knowledge of archaeological sites and monuments was of great value. When she saw the 'throne' of Phalasarna (Fig. 2) she recognized it as an altar dedicated to the Phoenician goddess Astarte, for she had seen many similar altars along the Syro-Palestinian coast. Meanwhile, I argued it was dedicated to Poseidon since Poseidon's trident, and a dolphin, are the symbols depicted on Phalasarna's coins. Eventually she published her interpretation, and she was right as always (Frost, 1995: 19).

The evidence for the location of the harbour of Phalasarna is now overwhelming. Figures 3 and 4 provide overviews of the site. The discoveries of fortification towers and other elements of the harbour were described in Hadjidaki (1988) and Frost and Hadjidaki (1990), evidence of the Roman destruction was summarized in Hadjidaki (2001), and detailed evidence for a massive earthquake that raised the harbour more than 6.5 m above the sea is in Pirazzoli *et al.* (1992) and Dominey-Howes *et al.* (1999). I will review some of the most important finds with an emphasis on the three most recent seasons, 2015 to 2017.

Figure 3. Uplifted harbour of Phalasarna as it appeared in autumn 2017. (Photo Panagiotis Partsinevelos).

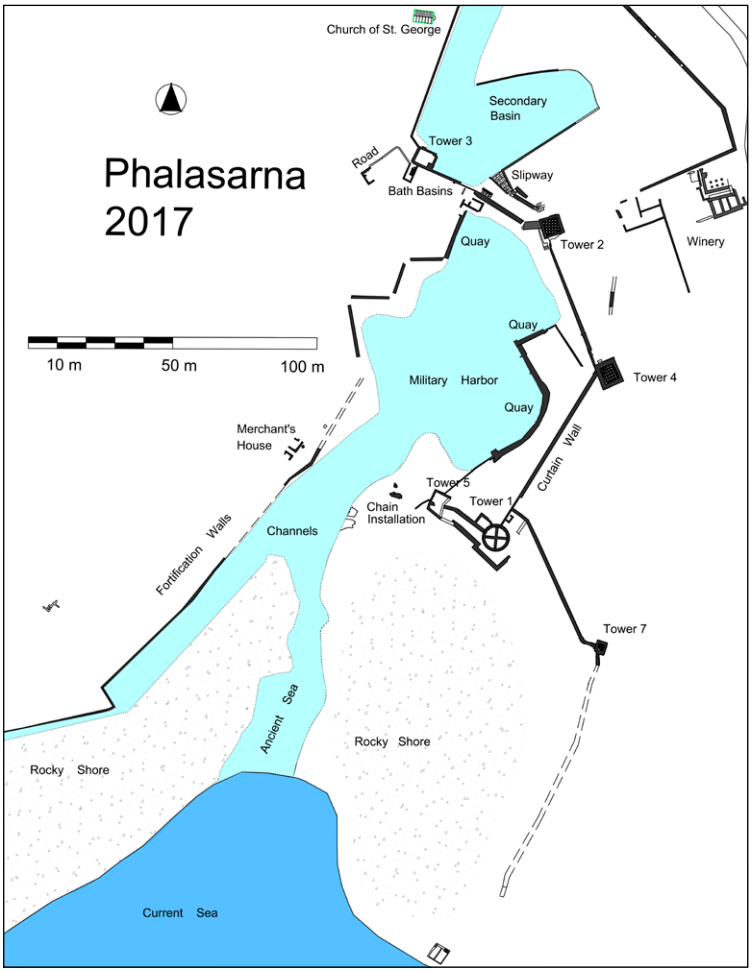

Figure 4. Plan of Phalasarna harbour site. (Drawing N. Hadjidakis & Michael Marder).

Harbour and defensive towers

Excavation at the harbour of Phalasarna began two years after that first visit with Honor, in the summer of 1986. In the very first excavation season we established the shape of the port and identified the fortification walls that defended it. It was exactly as Skylax had described it, 'a closed port' (*limen kleistos,* Skylax 47*),* it was encircled by the city's fortifications and had a long artificially cut channel connecting the basin to the sea that could be closed off with a chain. The depth of the sea water in the basin was around 1.8 m.

We uncovered the lower 5 m of a magnificent round tower with a decorative moulding around the third course, *kymation*, reminiscent of an Ionian column. It was constructed during the third quarter of the 4th century BC, was originally around 18.4 m tall, and guarded the entrance to the port (Hadjidaki, 1988). As the 1980s proceeded, we found the lower courses of more towers that had been part of the fortification walls forming a ring around the harbour (Frost & Hadjidaki, 1990; Hadjidaki, 2001). The new towers were rectangular in shape and, in addition to the *kymation*, the stones were decorated with drafted edges, *periteneia*.

As the years passed, more and more towers and other monumental structures were uncovered, all in the impressive style of elaborate Hellenistic public buildings. In the excavation seasons of 2015 to 2017, two new towers were uncovered. One of the towers adjoined the north-east fortifications of the harbour, and we refer to it as the North East Tower or Tower 4. This North East Tower guarded the northern quays thus protecting the most important part of Phalasarnian daily life – their ships and their cargoes. It has so far been excavated to a depth of three courses below modern ground level. A bottom

Figure 5. Base of Tower 4, showing carved moulding and entranceway. (Photo M. Bendon).

layer of headers is followed by a layer of stretchers and then by an uppermost layer of headers (Fig. 5). Its eastern side measures 7.9 m and its northern side 9 m. The stones measure up to 2 x 1.5 x 0.5 m, and the interior has a heavy rubble fill which provided good mechanical stability. We estimate that the height of the tower was approximately 18.4 m, with three chambers and three windows. An angled stone from the roof was recovered, indicating a pitched roof with gables. Stones from a crenellated parapet were also found. As in the case of previous towers, the stones had drafted edges and a large

Figure 6. Marble pediment from fill of Tower 4. (Photo M. Bendon).

Figure 7. Overview of Tower 7. (Photo Angelos Nakasis).

number of fragments from the *kymation* course were recovered scattered inside and around the collapsed structure.

One of the most impressive finds was lying inside the rubble fill. It belonged to a part of a carved marble pediment originally made for a large 5th-century-BC funerary monument (Fig. 6). The artistry shows obvious signs of Attic influence, and the pediment is likely to have come from an earlier funerary stele, which had been dismantled during the hasty 4th-century-BC construction of the tower. Thucydides describes this process concerning the Athenians in 478 BC, after the Persian defeat:

> In this way the Athenians fortified their city in a very short time…many pillars taken from tombs and fragments of sculpture mixed in with the rest…sparing nothing.' (1.89.93)

This emphasizes that although the architectural remains we find today date from around 333 BC and later, this city-state had bloomed centuries before as an economic power with a rich artistic tradition.

The second tower is connected to the seaside fortifications at the south-western end of the port, and we refer to it as Tower 7 (Fig. 7). It is rectangular, measures 7.2 x 6.2 m, and was constructed directly on flattened bedrock from local sandstone. The interior of this tower, unlike the others, did not have an extensive rubble fill, but rather cross walls built of stones of varying sizes, with some rubble in between. The tower is the meeting point of two lines of fortifications – one that runs parallel to the coast and then encircles ancient quarries on the outskirts of the town, and one that heads straight towards the sea.

It seems doubtful that what we see today is the structure built on this spot in the 4th century BC. The construction is much rougher, the stones of varying sizes, and refined architectural features are missing. The overall dimensions are smaller than the other rectangular towers. A tower originally built on this spot may have been completely destroyed, and later hastily rebuilt from some of the remaining intact stones.

What this structure allows us to observe is the flattened bedrock that served as the foundation for the towers. This was observed in places for other towers where the rubble fill was removed, but it was not possible to see in its entirety. This tower will make it possible to study that feature of ancient engineering more completely.

Quays

The most convincing response to those who doubted the location of the harbour of Phalasarna was the discovery of three lines of stone quays surrounding the eastern side of the port. The first 17-m-long segments, called the northern quay, were found in the 1990s (Hadjidaki, 2001) and additional portions have been located in successive excavation seasons.

One of the new segments, the eastern quay, is 36 m long and was built on top of an earlier construction in a semi-circular shape reminiscent of an amphitheatre (Fig. 8). Three bollards protrude from this quay and have carved rectangular holes, unlike the northern quay where the bollards have round holes (Hadjidaki, 2015). Furthermore, the whole eastern quay was built at an elevation 0.5 m higher than the earlier northern quay, indicating that the sea-level in the 2nd century BC had risen, possibly due to subduction of western Crete (Pirazzoli *et al.*, 1992; Dominey-Howes *et al.*, 1999).

Figure 8. Semi-circular quay. (Photo Nike Marder).

Figure 9. North-east quay with post hole. (Photo Koula Borboudaki).

Figure 10. Arrowhead inscribed with monograph BE. (Photo E. Hadjidaki).

The last section of the quays along the eastern side of the port was excavated in 2016 (Fig. 9). It is 10.5 m long and seems to have been connected to Tower 4 by means of a wall, still unexcavated. No bollards existed here, but five post holes were found in the seabed, near the foundations of the quay. Many copper nails, charcoal, and catapult stones with Roman numerals within the same stratigraphic layer, suggest the existence of a wooden platform perhaps burned by the Romans in 69 BC, when they destroyed the city of Phalasarna. The length of the wooden jetty must have been *c.*9-10 m. and its width 3.5 m.

Many bronze artefacts have been recovered from the ancient seabed at the base of the quays including arrow heads, coins, and nails. One arrowhead is inscribed with the monogram BE, of Queen Berenice II, wife of Ptolemy III Euergetes, possibly commemorating her marriage to the Egyptian king *c.*245 BC (Fig. 10)(Guarducci, 1939: 221-222; Sekunda, 2017: 88). Cretans were famous as mercenaries and archers; this arrowhead likely belonged to someone who served in the Ptolemaic army and brought it home. The profession of mercenary Cretan archers reached its peak during the Hellenistic period as they served the powerful Hellenistic kingdoms, but their reputation goes back centuries before.

Ceramic artefacts were also recovered from the same areas of the ancient seabed, many belonging to local and imported transport vessels from most of the Aegean wine production centres, such as the islands of Thasos, Samos, Chios, Kos, Rhodes, Skopelos, and Corcyra, as well as the coastal regions of the north Aegean, western Anatolia, south Italy, Sicily, and north Africa (Valle, 2015). This fact illustrates the breadth of Phalasarna's maritime trading network and gives support to the declaration found in an inscription of a peace treaty between Phalasarna and the strong neighbouring city-state Polyrrhenia that 'Phalasarna rules the seas' (Markoulaki, 2000).

Channel entrance and chain

Two artificially carved channels connected the harbour to the sea, one for the passage of ships, and the other for desilting. In 2015, we uncovered a pair of rock outcrops with holes carved in them near the main channel entrance. Because of the location of the stones and the configuration of the holes, we believe they constituted part of the mechanism for opening and closing the harbour. An attempt to explain the mechanism is illustrated in Figure 11: the chain comes from the channel, wraps around a groove and passes through a hole in the leftmost boulder, wraps around a groove in the second boulder, passes through a second hole, and from there winds around a thick vertical wooden pole, for which the socket is preserved. Green metallic residue is still visible

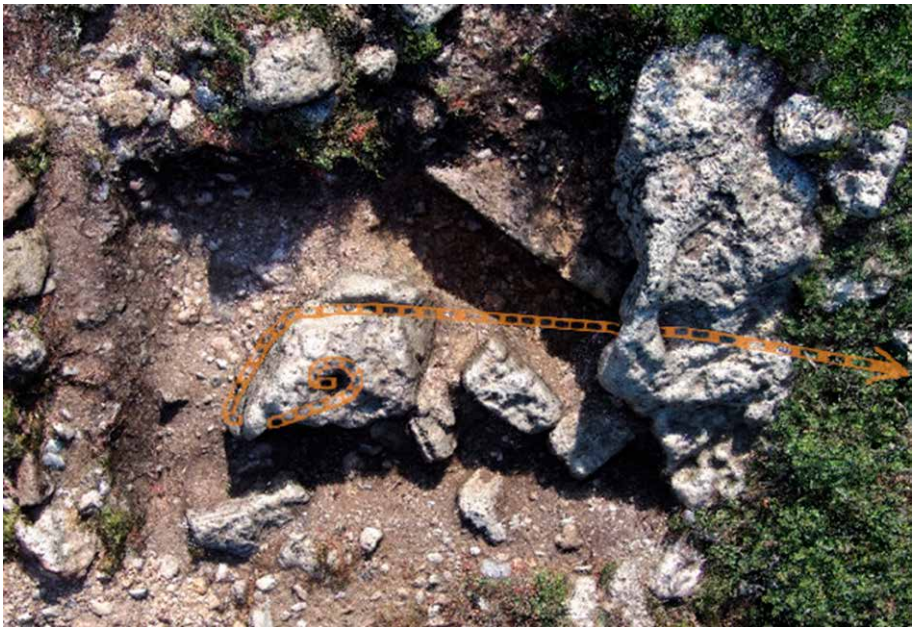

Figure 11. Rock outcrop carved to support the chain that closed the harbour. (Digital image, G. Liestøl and M. Marder).

within the grooves on the boulders. Whether the harbour was closed by a chain that could be lowered into the channel, or instead by a wooden gate that opened and closed, has not yet been determined.

Dock

Behind the military port to the north, separated by a wall, lies a smaller secondary basin. Pirazzoli *et al.* (1992) used carbon dating of organisms that live at the sea water's edge to determine sea-level over time. The story is complex; in 330 BC, when the currently existing harbour facilities were built, the harbour sea-level was around 5.5 m higher than present but rose gradually to 6.5 m higher than present by 365 AD, after which the sea dropped nearly to its current level during an enormous earthquake. The secondary basin was below sea level when the port was built, flat and ringed by walls, most of which are still unexcavated. Thus, we associated it with docking facilities and slipways. Part of a long, supporting sea wall was excavated in the 1990s that exhibited erosion and watermarks from the ancient sea-level (Hadjidaki, 2015).

Excavations in 2016 and 2017 uncovered the rest of the sea wall, which was constructed of blocks of uniform size and shape (isodomic style), 1.5 m high and 35 m long (Fig. 12). The south-eastern end of the wall adjoins a large stone structure which we believe to have been a slipway. The slipway is around 10 m long and 5 m wide at the base where it met the sea. The base would have been around half a metre under water in the Hellenistic period, but the structure slopes upwards at 13˚ so the top end was half a metre above the water. The slope is created by a series of broad steps; each of the stones that comprises it is laid flat. Wooden beams would have been laid on these steps to make them function as a slipway. A curious feature of the slipway is that it narrows as

Figure 12. Slipway and docking facility. (Photo E. Hadjidaki).

Figure 13. Sandstone pediment carved with Triton and a dolphin. (Photo E. Hadjidaki).

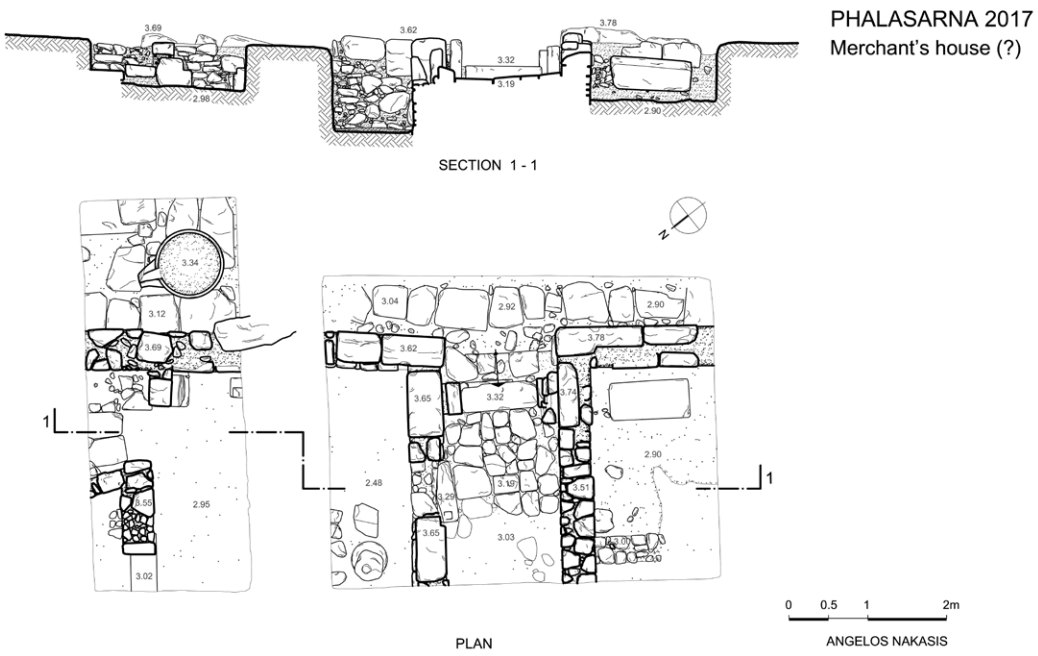

Figure 14. Plan of merchant's house. (Drawing A. Nakasis).

it goes up, and at the top it is only 2 m wide. It is not completely clear whether this was a feature of the original construction, or whether it is due to a wall being put down on it at an angle at a later period. Most indications are that this is the original construction, in which case the most likely explanation is that the prows of the ships would have fitted onto the slipway, allowing goods and passengers to be loaded and unloaded from the platforms on either side.

The slipway was deliberately covered with rubble at some point in antiquity, and on top of the rubble were tsunami deposits (Pirazzoli *et al.*, 1992), from within which in 2017, we excavated a magnificent sandstone pediment (Fig. 13). It measured 1.27 × 0.87 × 0.47 m and the interior was carved with an image of Triton and a dolphin. It is an original piece dating to the 4th century BC, and it is likely it came from a nearby altar, the rest of which has yet to be found.

Merchant's house

In the summer of 2017 during an attempt to locate Tower 6, a building was uncovered on a slope near the channel entrance (Fig. 14). Excavation is still ongoing, but what has been uncovered so far suggests these were the living quarters of a rich merchant. The building comprised at least two rooms divided by a passageway, each more than 4 m in extent, with a paved courtyard. Among the artefacts recovered were a large stone mortar, a large press for wine or olive oil, over 20 bronze and silver coins, both local and foreign, three engraved rings, elegant tableware, large storage jars, and Phoenician stamped amphoras. Most of the finds date to the 4th and 3rd century BC, but it is likely that earlier material will be found in the deeper stratigraphic layers.

Situated simulation

In 2010, chance brought Gunnar Liestøl, a professor at the University of Oslo, as a tourist to Phalasarna. His specialty is situated simulations, which is a novel form of 'mixed reality' (Liestol & Morrison, 2013; Liestol & Hadjidaki, 2019). Using an iPhone or iPad, simulations are constructed that show a reconstruction of an area of a site that adjusts according to the orientation of the user, as if one had a window onto the past. To perform this task, the software makes use of all the cell phone sensors, including GPS, magnetometer, accelerometer, and gyroscope, plus video-game tools for realistic simulation. This technology was particularly interesting for Phalasarna, since the combination of Roman destruction and massive earthquakes in AD 66 and AD 365 makes the remains difficult for the casual visitor to understand (Pirazzoli *et al.,* 1992).

After years of exceptionally productive and respectful collaboration, a first release of a Phalasarna application is freely available on the Apple Store (Phalasarna, 2018). The simulation only opens and operates when a user is situated within the archaeological site, where it makes three historical layers available. The first layer shows the present, but with the addition of icons that a visitor can tap to hear a narration, as if from a virtual tour guide. The second layer provides a reconstruction of Phalasarna in 333 BC, when the harbour had just been built and the city was at its peak. The third layer shows the city in 69 BC surrounded by Roman soldiers, and includes a simulation of the Roman attack (Fig. 15).

I wonder how Frost would have reacted to this attempt to use technology to make Phalasarna comprehensible. She was one of the world's earliest adopters of scuba diving technology, and her book *Under the Mediterranean*, published in 1963, was aimed squarely at a popular audience. However, she once told me that she took a rather dim view of her early efforts to communicate with a wider audience and dismissed it years later as a product of youthful ambition. So, on balance she most likely would have

Figure 15. Situated simulation showing virtual reconstruction of Roman attack on Phalasarna. (Digital image G. Liestøl).

Figure 16. Amphora mound from the Classical shipwreck at Alonnesos. (Photo S. Piskardelis).

scoffed at this method of presentation, which does not yet embody the same level of accuracy that is customary in the best academic work.

Underwater projects

During the 1990s, as the Director of the Department of Maritime Antiquities in Greece, I started excavating a large Classical shipwreck off the coast of Alonnesos, in the Aegean, that had a cargo of some 4000 amphoras (Hadjidaki, 1996; Fig. 16). Frost was the first to arrive at the site and excavated daily with me. The excavation of the Alonnesos ship was never finished, but nevertheless it taught the world that large ships carrying over 150 tons of cargo of wine, oil, pottery, and other products for export, were possible. History records ships carrying battle towers constructed in Athens in the 5th century BC called '*myrioforoi*', which means that they carried a burden of 10,000 talents or 250 tons. We read in Thucydides (VII 25.6) that the Athenians used these ships in their naval assault against Syracuse's forces during the Peloponnesian War, but we could not prove it. The Alonnesos shipwreck was a cargo ship, not a military vessel, but it leaves little doubt that ships of the size described by Thucydides were possible.

In 2005, I started excavating a Minoan shipwreck near the ancient harbour town of Pseira island in the Mirabello Bay, east Crete (Hadjidaki & Betancourt, 2006). Honor had been there many years before, participating in a 1955 survey of underwater remains together with a team from the British School in Athens (Leatham & Hood, 1959). She wrote an account in *Under the Mediterranean* (Frost, 1963: 103-104) and we often discussed her impressions of the collapsed sunken town that was lying on the seabed in this region. I never imagined during those discussions that years later I would return to Pseira, find and excavate the first-known Minoan shipwreck (Bonn-Muller, 2010).

Figure 17. Pseira amphora. (Photo L.R. Martin).

The ship appeared to have capsized, and there were no wooden remains, which is not uncommon for prehistoric ships. However, the total of 140 ceramic transport vessels that we recovered make the largest collection for the Middle Minoan IIB period. The collection included 46 oval-mouthed amphorae, 41 spouted jugs, and 11 hole-mouthed jars, most of them homogeneous in type, fabric and date (Hadjidaki & Betancourt, 2006; Hadjidaki *et al.*, forthcoming) (Fig. 17). In addition, we found various vessels that belonged to the crew, such as 14 cups, three cooking tripods, ten stone tools, and fishing weights. We also found a rock-cut quay under water near the Pseira land site. Altogether, finds from the shipwreck and from the nearby shore confirm the existence of a daring society that sailed around northern Crete and across the Aegean, and built rock-cut harbour-works, as Honor always maintained. There is abundant evidence of Minoan trade with Egypt and the Levant (Watrous, 2005) and with western Anatolia (Betancourt, 2003). Thus, there can be little doubt that the Minoans constructed a fleet of ships that enabled them to connect extended domestic and international trading networks (Hadjidaki *et al.*, forthcoming).

Conclusions

Honor Frost did not measure what she did in terms of formal educational degrees or conventional recognition. She wanted a life of adventure and I never heard her express any interest in an academic position. Maybe this is why some academics did not fully accept her or her findings. But when it came to knowledge in the field, she was unmatched.

Each new generation has to make its own way. It can be difficult to recognize or appreciate the contributions of those who came before. But there is a right time for it, and this is the time for me to express my thanks and gratitude to the world's pioneering female diving archaeologist, a person who inspired me to study harbours and hunt for the first Minoan shipwreck. When the ship was found in 2005, she was already 88 years old, her health was failing and, despite her insistent desire to visit the wreck, I did not let her dive to see it as it lies at the depth of 45 m. Five years later, my mentor and my friend, Honor Frost, died, but she will live in my heart forever.

Acknowledgements

I particularly want to thank recent collaborators at Phalasarna, Dr Michael Bendon, Nike Bichaki, Koula Borboudaki, Dr Tatiana Frangopoulou, Dimitra Goula, Michalis Milidakis, and Dr Pasquale Valle. The perceptive eye of professor Nick Sekunda noticed the monogram BE on the arrowhead, and has for many years influenced our understanding of the history of Phalasarna with his expertise. Professor Panagiotis Partsinevelos kindly contributed aerial photos taken from his drone.

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Honor Frost and the Pharos: the lighthouse of Alexandria

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In 1968 Honor Frost was engaged by UNESCO to carry out a survey of the underwater site of the monumental pharos of Alexandria. She was accompanied by the geologist Wladimir Nesteroff, Kamel Abul-Saadat, who had discovered the site, and architect Samir Amir, all of whom were divers. Bad weather conditions and poor visibility limited them to only six dives. Frost mapped the site with the limited means available to her, producing a remarkably precise plan. Her comments and descriptions of the site were published in 1975 in a short note titled 'Alexandria, the Pharos site'. In 1995 Frost brought the plans she had drawn back to Alexandria to help in the excavation of the lighthouse, which had started in 1994. These pages are intended to underline the fundamental contribution that Frost made to our knowledge of the site.

Keywords: Honor Frost, underwater archaeology, Egypt, Alexandria, lighthouse, Pharos, CEAlex (Centre d'Études Alexandrines).

The 'Under the Mediterranean' conference, held in Nicosia in 2017, marked not only the centenary of Honor Frost's birth, but also 40 years of our friendship, *writes Jean-Yves Empereur*. In the mid 1970s, as a young member of the French School in Athens, I first learned about underwater excavation on the wreck of Madrague de Giens, directed by André Tchernia and Patrice Pomey. There, I made Frost's acquaintance when she arrived for her annual visit (at the wheel of her car, nicknamed 'Turbo'), a stop *en route* to Marsala and her excavation of the Punic Ship wreck (see Pomey, Alagna, this volume). I took pleasure in seeing her thereafter from the first of the TROPIS meetings in Delphi organized by our friend Harry Tzalas (see Tzalas, this volume), and in London at her home in Welbeck Street.

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 183-198. Leiden: Sidestone Press.

a.

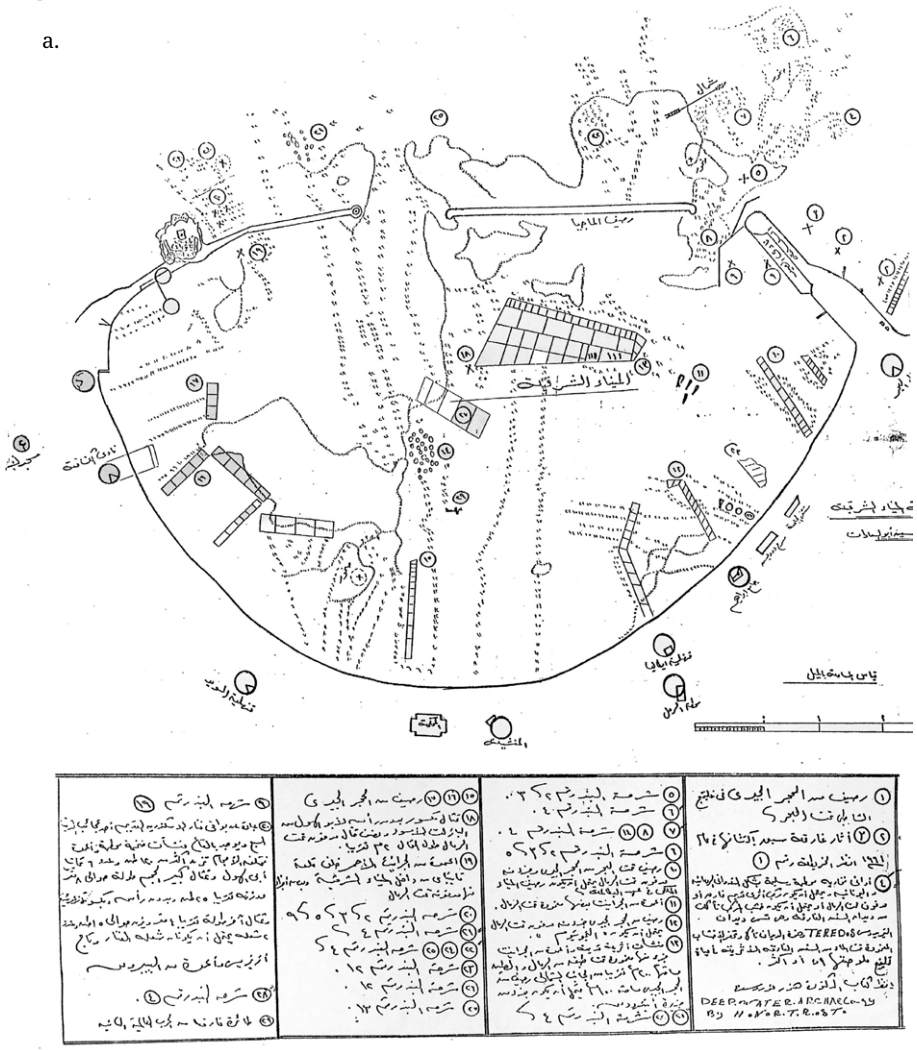
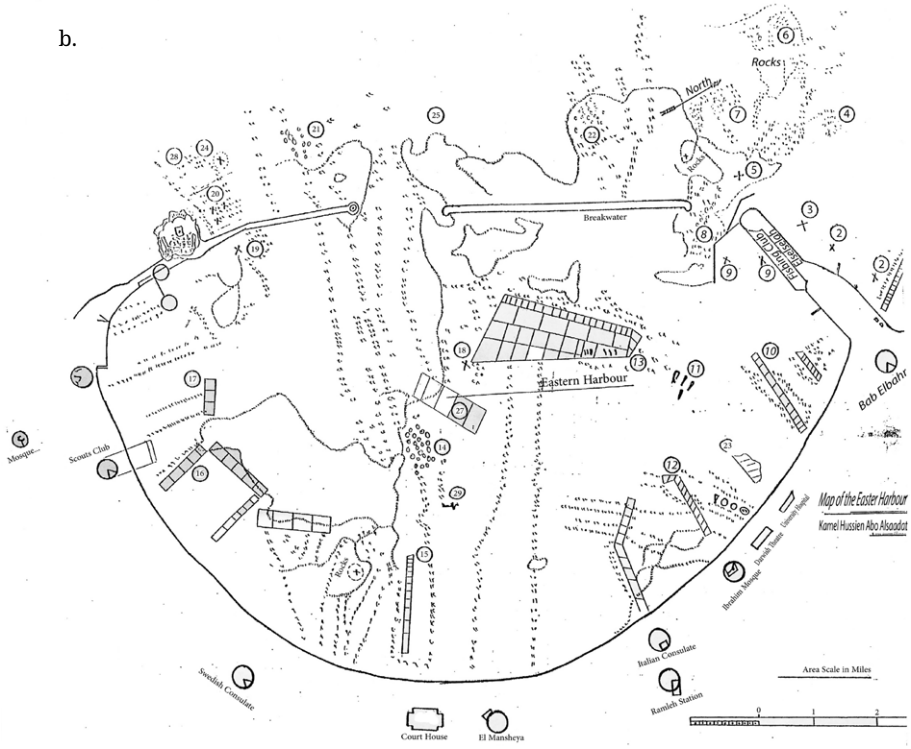


Figure 1. a) Original drawing by Kamel Abul-Saadat showing the location of his underwater archaeological discoveries at Alexandria, with Arabic annotations dated 1961 and later additions. At the bottom right is marked 'Deepwater Archaeology by Honor Frost'. This document was brought to the CEAlex by Honor Frost in 1995. (© Archives CEAlex/CNRS) b) (Opposite page) English translation of annotations by Ziad Morsy.

In 1968, Frost was engaged by UNESCO to carry out an assessment of a site at Alexandria, to examine the underwater ruins first signalled by the pioneer of Egyptian underwater archaeology, Kamel Abul-Saadat. Over the course of a series of dives, Frost made measured plans and published a description of the site in an *IJNA* note titled 'The Pharos site, Alexandria, Egypt' (Frost, 1975). When, in 1992, the Egyptian authorities asked me to undertake a rescue excavation at the foot of Qaitbay Fort in Alexandria, I naturally turned to Frost. She accepted my invitation and dived with our team in 1995: thanks to her prodigious memory, she was able to describe in detail the state of the site prior to the placement of a second series of modern

b.



(1) Limestone underwater mole inside Elshatby Bay. (2,3) Underwater archaeological remains that was discovered in 1961 (look map 1) (4) Broken pottery sherds and complete Greek and Roman containers. Probably an ancient shipwreck that was sunk with the wooden remains either buried under the sand or eaten away by the Teredos which is a type of shipworms that eats away wood in salt water with ppt 0.9 or more. for more information (Honor Frost's book, Deepwater archaeology by Honor Frost)	(5) same as (2,3). (6) same as (4). (7, 8, 14) same as (4). (9) same as (2, 3, 5). (10) Limestone structure partially buried under the sand, likely to be the jetty of the Ptolemy's Royal Harbour. (11) Granite columns partially buried under the sand. (12) Limestone mole partially buried under the sand, probably "the Timonium". (13) Archaeological structures and granite columns partially buried under a layer of sand and mud with an approximate area of 200 square meters, on the Northern side a limestone mole with an area approximately 100 square meters probably a part from Antirrhodus Island. (21, 22) Same as (4)	(15, 16, 17) Limestone jetty. (18) A headless broken statue of a Sphinx, black basalt, and a half statue buried under the sand with a length of 2 meters. (19) Red Granite column behind the Citadel of Qaitbay and inside the Eastern Harbour, parts of it buried under the sand. (20) Same as (2, 3, 5, 9). (21) Same as (4). (22, 24, 25) Same as (4). (23) Same as (12). (26) Same as (12). (27) Same as (13).	(9) Same as (19). (20) Remains of the ancient Alexandria lighthouse, one of the seven ancient world's wonders. Huge broken constructions and columns from all sizes are on the seabed, weighing more than 120 tons, 6 Sphinx shaped statues, a headless pharaonic statue 8 meters high, weighing approximately 25 tons. Another 4 meter tall statue, weighing about 15 tons. 2 "Burner crown?!" probably were used for the lighthouse light. Osirian crown, and papyrus columns/capitals. (28) Same as (4). (29) Sunken WWII aircraft.

concrete blocks in 1980. She was kind enough to return to Alexandria several times, bringing with her unpublished notes and reports. In 1997, I entrusted architect and diver Isabelle Hairy with responsibility for creating a Graphical Information System for the Pharos site, a project that she now directs. In the following lines we will illustrate the essential contribution that Frost made to our knowledge of the underwater site of the Pharos of Alexandria.

A predecessor, Kamel Abul-Saadat

A native Alexandrian, Kamel Abul-Saadat (1933-1984) discovered the underwater site at Qaitbay in 1961. He was an amateur diver who, with no institutional support, made many truly remarkable discoveries at Alexandria, which earned him the title of 'founder

of underwater archaeology in Egypt'.[1] He recorded his observations on three maps drawn up over the years with a series of updates (often misdated) which he never published: they were held for some time in the archives of the Greco-Roman Museum of Alexandria (which has been closed for renovation since 2005) and are now conserved by the Underwater Archaeology Unit of the Egyptian Ministry of Antiquities. Two of these plans have been recently published (Seif el-Din, 2014: figs 1-2), alongside a French translation of the Arabic legends. The third, the most complete, is presented here (Fig. 1). Kamel Abul-Saadat marked a series of submerged archaeological sites on this plan – the site at the foot of the Qaitbay Fort, and at least three others in the Eastern Port, as well as the sites of Silsileh and Chatby to the east of the port (Halim, 2000; Seif el-Din 2014: 102-103).

At the underwater site at the foot of the Qaitbay Fort, the diver noted the presence of two large statues, an immense sphinx, sarcophagi, and granite and marble columns (Morcos, 2000: pl. 4), all scattered among an impressive number of ancient stone blocks distributed over a wide area, which he believed belonged to the Pharos of Alexandria. Following this initial survey, in 1962 the Egyptian National Marines raised one of the colossal statues made of pink Assouan granite from the sea. It is a female statue, now exhibited in the Maritime Museum of Alexandria (Laqany, 1966: 28). As for its paired male statue, it was raised by the Centre d'Études Alexandrines (CEAlex) in 1995.

Frost's visit to Alexandria, 1968

Working conditions

In 1968, Frost and Wladimir Nesteroff were asked by UNESCO to survey the site (Fig. 2).[2] Nesteroff is rarely mentioned in scientific literature, and even less in archaeological circles. He was a geomorphologist and Director of Research at the Centre National de la Recherche Scientifique (CNRS). He had accompanied Jacques-Yves Cousteau in his expeditions around the world aboard *Calypso* and, as a pioneer in radiocarbon dating beach-rock, published several scientific reports in the 1960s.[3]

In fact, no record of Nesteroff's part in the project has been found to explain how he and Frost organized their work together, but he probably dived on his own in search of clues that might explain why the site was submerged in antiquity.

The season in October and November was not optimal for underwater survey; Frost wrote of her six dives that 'photographic coverage was doomed in the choppy, cloudy, autumn sea' (Frost, 1975: 127), elsewhere noting that the site is particularly exposed to the north-west wind that stirs up the town's sewage. During her fieldwork the water was

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1 Kamel Abul-Saadat was regularly cited during the 'Alexandria International Conference on Maritime and Underwater Archaeology' which was held in Alexandria, 31 October-2 November 2016, to celebrate the 20th anniversary of the Egyptian Underwater Archaeology Department. His work has also been the subject of a study by Halim (2000, see also Morcos, 2000; Abd el-Maguid, 2000: fig. 3; Abd el-Maguid, 2001; Khalil and Abd el-Maguid, 2002: fig. 3.1.2; Darwisch and Abd el-Maguid, 2002: fig. 2; El Sayed, 2013).

2 *Wladimir* Nesteroff (with a '*W*') not *Vladimir*, as his name is erroneously spelt by Frost in her article and reports, and all recent literature.

3 An internet search reveals several underwater geological studies in Nesteroff's name (for example Nesteroff, 1972).

Figure 2. Honor Frost at Qaitbay Fort in 1968. (courtesy St Millière, © Archives Gédéon).

clear on only one day which, in our experience, signifies there was a southerly wind, which is rare in the region.

The discoveries

Frost writes at the beginning of her *IJNA* note that she had sought out the statue first seen by Abul-Saadat in 1961 and lifted by the Egyptian navy in 1962; she includes a photograph of it lying on the ground in the Serapion Gardens (Frost, 1975: 126, fig. 1), with what appears to be a pharaoh's crown (a second crown was lifted from the seafloor by CEAlex in 1995). She continues that Abul-Saadat also found 'the remains of submerged buildings that may represent the lost Palace of Alexander and the Ptolemys (supposedly the final resting place of a glass sarcophagus containing the body of Alexander the Great)'! (Frost, 1975: 126-127).

In the second part of her report for UNESCO, Frost details 'Recommendations' for the personnel and equipment required to carry out an excavation campaign that she foresaw between August and October. Other than her insistence on the necessity of stopping the pollution of the site with sewage (for which no solution has yet been found…), she gives a detailed list of possible participants, including her friends Abul-Saadat and the architect Amir Amir; she furnishes the names of French and Cypriot companies that would be able to lift the heaviest blocks, and provides a detailed budget – in the French francs of the time – for an underwater excavation and for lifting the blocks necessary to continue work in the following years (Frost, nd). This unpublished report, as well as her hand-drawn plan of the underwater site (Fig. 3) was sent to UNESCO. A copy can be found in the Honor Frost archive (MS 439 HFA/1/3/3) now housed at Southampton University Special Collections, and another was given to us by Frost in 1995.

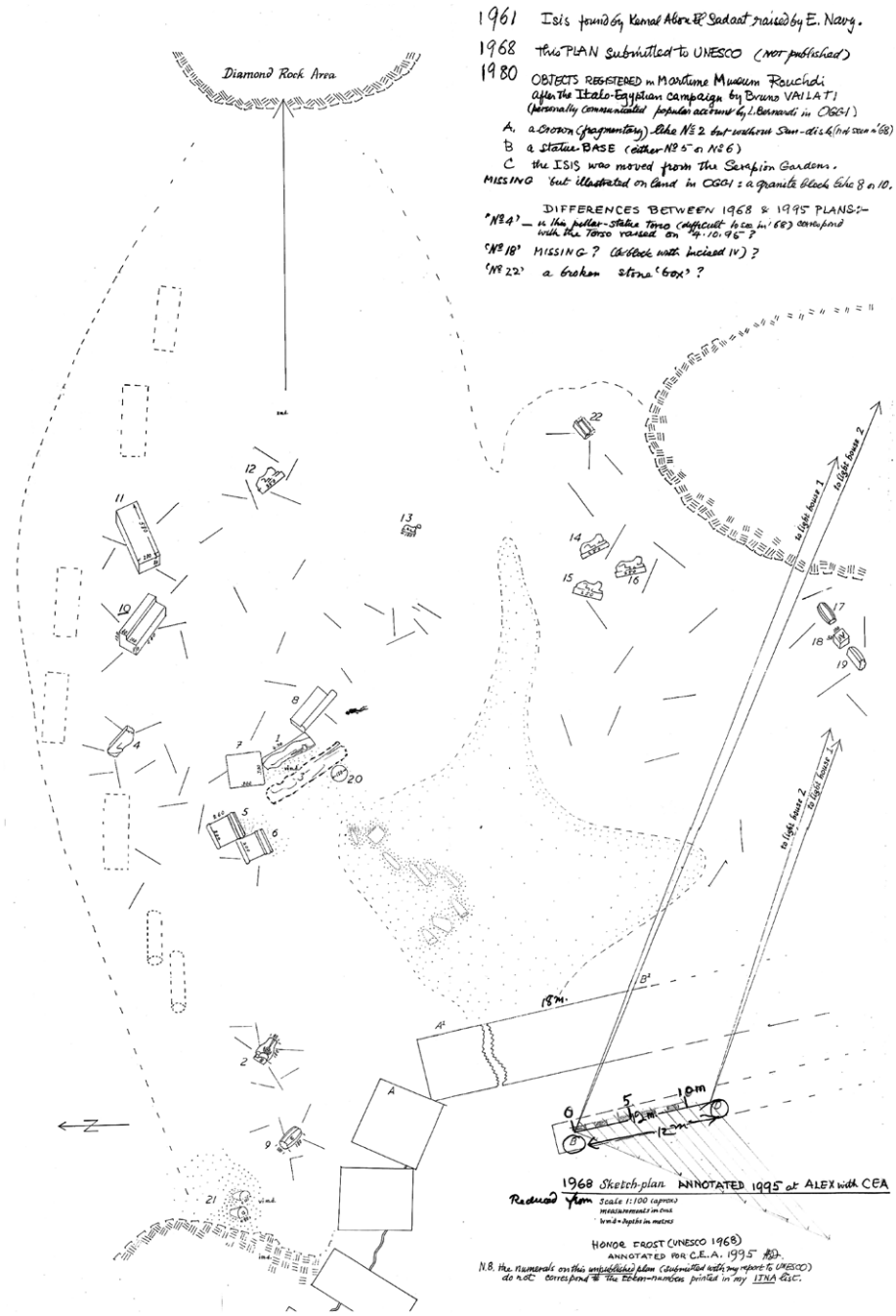

Figure 3. Frost's plan drawn in 1968 and given to the CEAlex, on which she added annotations in 1980 following Bruno Vailati's mission, and in 1995 while revisiting the site (H. Frost, © Archives CEAlex/CNRS).

Comparison of 1968 and CEAlex plans					
Frost 1968			CEAlex		
N°	Dimensions (cm)	Description of blocks	N°	Dimensions (cm)	Description of blocks
1	470	Colossal Statue	1001	450*100*100	Colossal statue in pink granite
2	180*100	Hathoric crown	1017	190*105*96	Hathoric crown in pink granite
3	?	Colossal Statue	1077/1861	647*150*110	Female colossal statue in pink granite
4	?	Reworked Sphinx	1064	240*110*95	Reworked sphinx in pink granite
5	260*200	Statue base	1062	260*240*240	Statue base in pink granite
6	250	Statue base	1024	260*246*246	Statue base in pink granite
7	300*300	Square block	1035	320*295*80	Pink granite slab
8	?	Architrave	1003	595*210*140	Pink granite lintel from a monumental doorway
9	180*100*40	Fragment of papyriform column	1254	182*103*42	Fragment of a 'fût fasciculé (4 tiges)' in pink granite with a Ramses II cartouche
10	440*180*120	Corniche	1028	436*210*140	Pink granite abutment from a monumental doorway
11	520*2??*80	Long building block	1025	535*275*90	Slab of granite rose
12	250	Sphinx in grey Assouan stone	1011	200*130*60	Sphinx in grey granodiorite
13	120	Sphinx with head broken off at the neck	1671/1672	120*60*60	Sphinx body in yellow quartzite with head broken off at the neck
14	250	Sphinx	2499	130*120*80	Fragment of a sphinx in grey granitoid
15	250	Sphinx	2002	245*100*67	Fragment of a sphinx in greywacke
16	250	Sphinx	2003	180*120*70	Fragment of a sphinx of Sésostris III in yellow quartz
17	?	Fragment of papyriform column	2176	213*84	Fragment of papyriform column inscribed with the name of Ramesses II in pink granite
18	100*100*50	Granite block inscribed with a Roman figure IV	?	-	-
19	?	Fragment of papyriform column	2180	315*102	Fragment of papyriform column in pink granite with a cross decoration
20	150	Column base?	5177	35*142	Pink granite column base
21	80	Column or fragment	?	-	-
22	150	Fragment of granite sarcophagus	2405	135*109*25	Fragment of pink granite sarcophagus

Table 1. Comparison between architectural stone blocks and statuary recorded by Honor Frost in 1968 and those planned by the CEAlex.

Frost's plan

Only when Frost's plan, made more than 50 years previously, was superimposed on the plan made by the Centre d'Études Alexandrines from 2012 onwards could the great precision of her work be appreciated (Figs 4-5), especially considering the short time she had on site, and the diverse methods used for measuring both distances and angles, *writes Isabelle Hairy*. The plan provides reliable information about the changes that have occurred in the state of the site since 1968. Nearly all the blocks seen in 1968 can still be identified in the locations indicated, which suggests the site has remained relatively stable over the past 50 years (see Table 1). Only one block has moved significantly: the Hathoric crown moved by 15 m to the north-east between 1968 and 1995, the date at which it was recorded prior to lifting. The reasons for the relocation of this 5-ton block are difficult to discern: we could suggest either the storms that lash the Alexandrine coast each winter – the most violent of which cause a devastating swell capable of moving weights up to 6 tons – or the disorder created by the sinking of concrete blocks for the modern sea wall installed in 1980. But the most likely, and the most coherent given that no other blocks from the zone recorded by Frost in 1968 have moved, is that it was intentionally moved by the divers of the Egyptian navy in 1962 when the colossal statue of Isis, to which it belongs, was lifted, supposing that this second crown was originally located close to the statue and hindered its retrieval. This second crown was raised by CEAlex in 1995 and is now exhibited in the Open Air Museum at Kôm el-Dick archaeological site; while the crown lifted by the army in 1962 lies on the ground in the Maritime Museum, as seen by Frost.

Once the stone blocks marked on Frost's plan had been identified, the most recognizable were used as fixed points to position the plan on the CEAlex map. This revealed a discrepancy between the orientation of the western section and the eastern section of Frost's map. Her field notes helped to resolve the situation. The western zone was first area to attract the attention of the divers on 28 October 1968, and it was there they worked with the greatest precision. More precisely, it was the area in which the two big pedestals and the male colossus were found, near to where the female statue had been raised by the Egyptian navy, as well as the lintel of a monumental door. This assemblage of blocks was recorded very precisely using two theodolites between 6 and 8 November 1968. This part of the 1968 plan was thus fixed. The eastern part was drawn up separately, then attached to this part. Frost's fieldnotes revealed that the blocks in the eastern area were mapped based on measurements taken directly by the divers, rather than using the theodolites. The divers used the first group of blocks to measure in (while swimming) and orientate (using a compass) the blocks to the east. Moreover, it appears that these were not immediately transferred to the main map, as the orientation recorded under water was mistakenly inversed.

In the eastern area the divers defined a first group made up of two sphinxes. The sphinxes were added to the main 1968 map to the southeast of the main group, while they were mapped in 2006 by CEAlex to the northeast. Using sphinx N.13 (on Frost's map) as a fixed point and comparing the position of fragments No. 1671 and No. 1672 (CEAlex) – as the sphinx was already in two parts in 1968, head and body lying side-by-side – it was possible to reposition this part of Frost's plan. This realignment is confirmed by the position of the second sphinx mapped by Frost (Fig. 4).

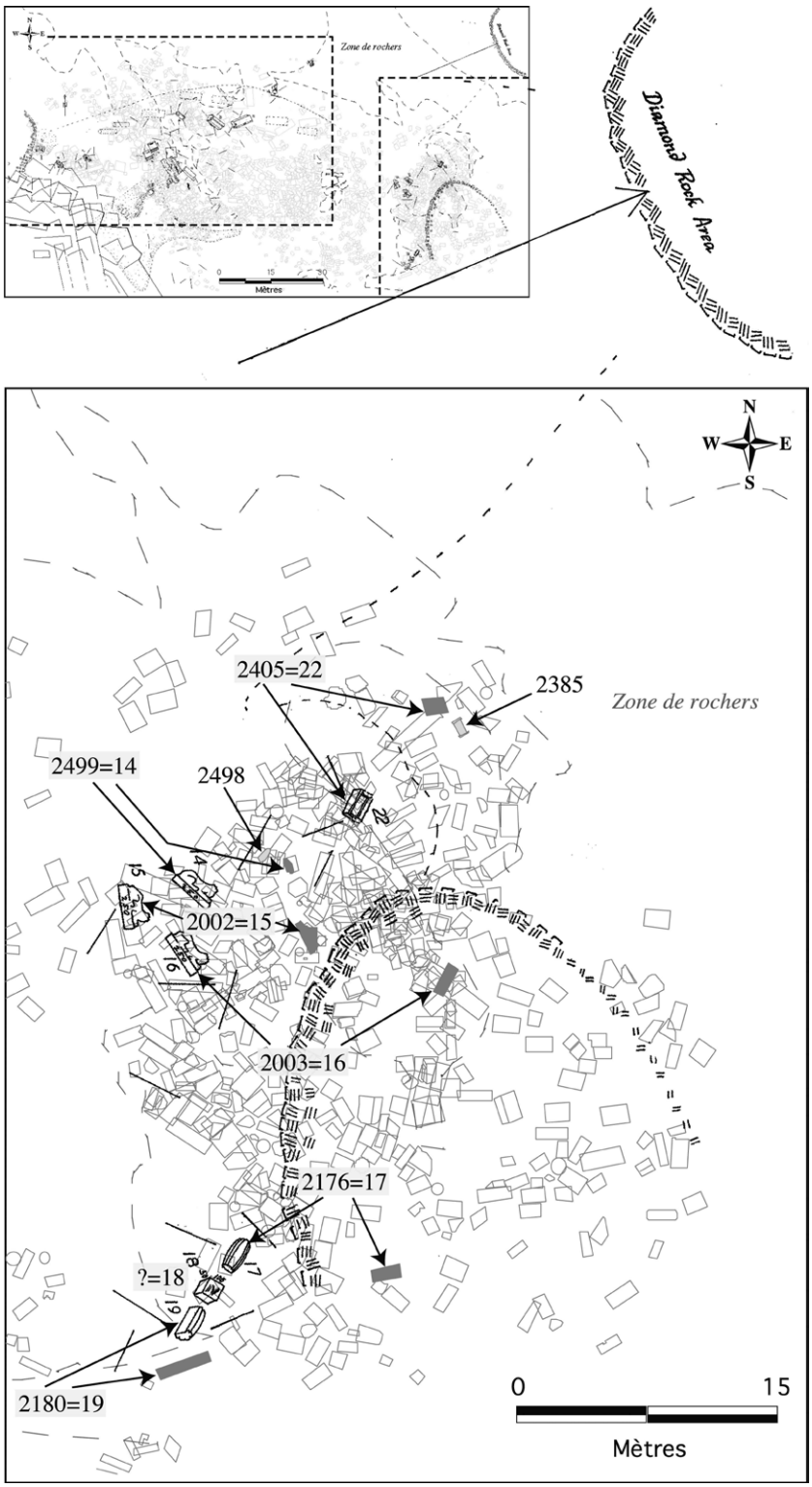

Figure 4. Frost's plan of 1968 superimposed on the CEAlex, zone west. (I. Hairy, © Archives CEAlex/CNRS).

Comparison of 1968 and CEAlex plans				
Frost		CEAlex		
N°	Description of blocks	N°	Dimensions (cm)	Description of blocks
-	Base	2385	125*70*65	Pink granite statue base
-	Sphinx	2498	113*70*38	Yellow quartzite sphinx
A	Long building block	1010	518*209*140	Pink granite abutment from a monumental doorway
B	Long building block	1009	648*214*140	Pink granite abutment from a monumental doorway
C	Long building block	1026	475*279*91	Large slab of pink granite
D	Long building block	1029	472*210*120	Big block of pink granite
E	Long building block	1048	390*210*140	Pink granite abutment from a monumental doorway

Table 2. Comparison between architectural stone blocks and statuary recorded by Honor Frost in 1968 and those mapped by the CEAlex.

Work carried out during the dives from 28 October to 7 November, 1968, provided the outline of the site as it still remains, particularly the part of zone two situated below the eastern platform. A fragment of a basin, the base of the statue (not recorded on the plan), as well as four sphinxes, and two papyriform columns where found there. The configuration provided by Frost's team matched exactly in terms of the distribution, the number of elements, and the orientation of the group in relation to the zone marked 'Diamond Rock Area' on Frost's plan. It reconfirms the realignment carried out by the CEAlex team, although the block with an inscribed Roman numeral recorded by Frost (1975: 130: fig. 4) was never relocated. Table 2 shows how the blocks recorded by CEAlex correspond to those noted in Frost's fieldnotes as located to the north-east and south-west of the sarcophagus fragment. These, although not noted on the 1968 plan, again validate the realignment proposed. On Frost's plan (Fig. 3) there are seven blocks drawn with dotted lines that are not numbered. They are aligned east to west above the main group and marked 'long building blocks/*longs blocs de maçonnerie*' some of which could also be matched to elements recorded by CEAlex (see Table 2).

The extent of the site as well as its irregular geometry, linked to the natural relief and the accumulation of ancient blocks (in several layers in some places) encouraged a programme of photogrammetric recording to create a digital model of the site's surface. This innovative programme started in 2014 with the support of the Honor Frost Foundation. This means of data acquisition was implemented across the whole site. The method was inspired by aerial photogrammetry using a drone; one difference being that the longitudinal and lateral overlaps between photographs were 70-80 %, which is greater than that classically used in aerial data acquisition. This level of overlap reduces false readings by increasing the number of images combined and cross-matched. Each diver-photographer swam transects, which were maintained by fixing their trajectories visually using the local topography of the seafloor including a multiplicity of ancient blocks and the slope of the fort, and ranging rods were placed every 4 m in the zone covered. The zone was also delimited

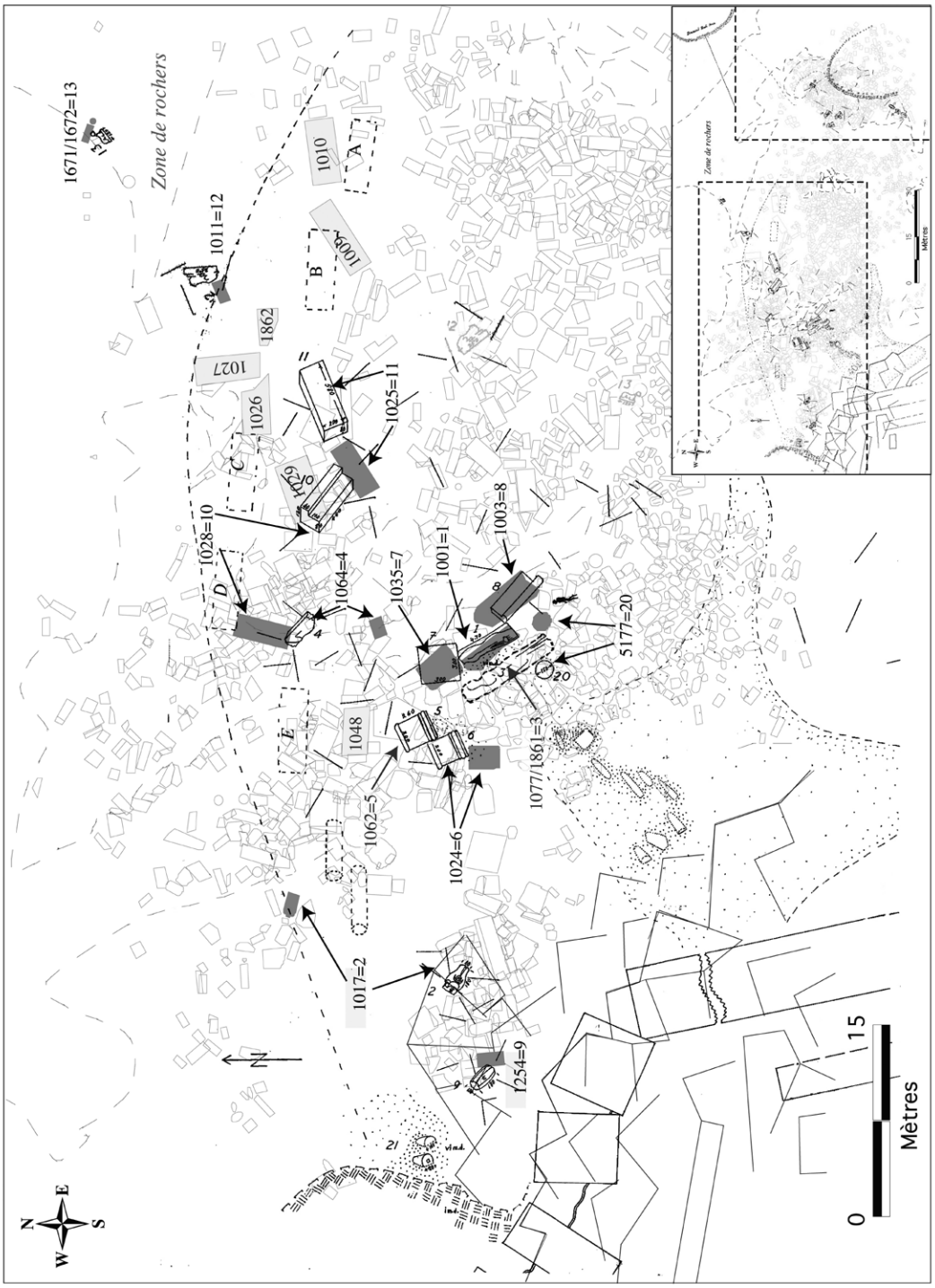

Figure 5. Plan drawn from a photomosaic laid over the GIS map of the site of the Pharos. (I. Hairy, © Archives CEAlex/CNRS).

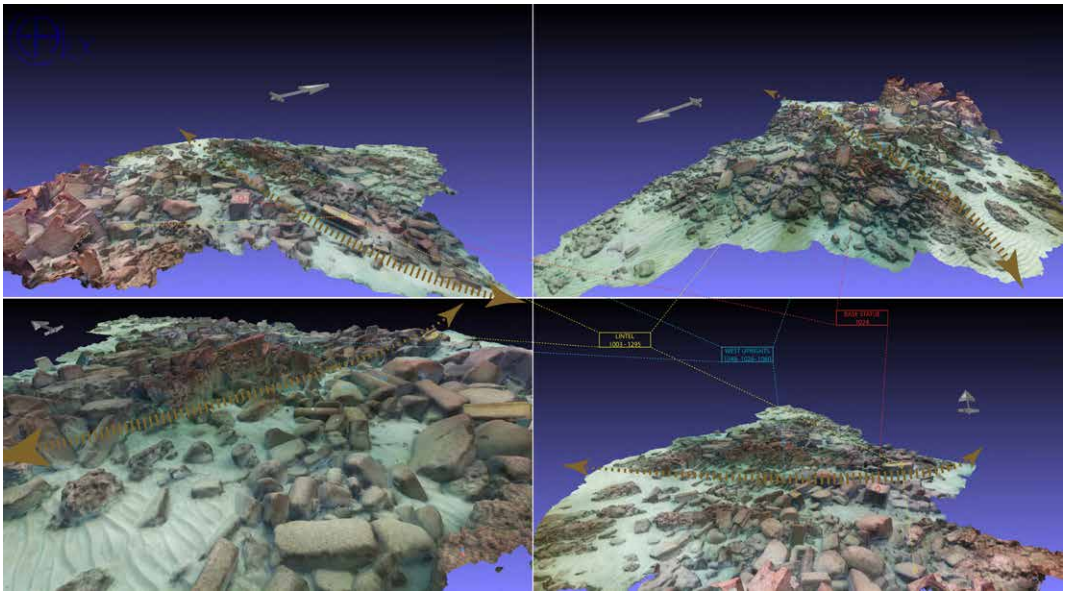

Figure 6. Extract of the high-definition photomosaic plan (Mohamed Abdelaziz, Mohamed El-Sayed, I. Hairy © Archives CEAlex/CNRS).

by measuring tapes. The main difficulty encountered during photogrammetric data acquisition was the abrupt and major changes in elevation of the seafloor (plus or minus 5 m). In order to georeference the digital model, fixed points marked with pegs, or Ground Control Points, were placed underwater in the area covered by the photographer. These points were then mapped using a theodolite linked to a total station by the CEAlex team. The photographs were then georeferenced within Photoscan. Since 2013, 28 weeks have been dedicated to the photographic survey with 50,152 photographs used in the creation of the 3D model of the seafloor, covering 8200 m^2 of the 13000 m^2 site formed by the ancient stone blocks (Fig. 5)

After five years of data acquisition nearly two-thirds of the surface covered by blocks had been recorded. The plans and models produced provide a new perspective of the site and exemplify the revolution in methods used to record large underwater sites. The photomosaic created from the 3D textured model provides a global view of the layout of the blocks in their natural environment. It provides a view of the site even the diver does not have, as the virtual visitor is not troubled by the vagaries of weather and visibility. Immense detail is captured in the seafloor model; the viewer is fully immersed (Fig. 6). These recording techniques open a new route to studying the site, which remains to be fully explored.

Future perspective and archive

These pages were intended to explain the decisive contribution made by Frost to our understanding of the underwater site of the Pharos of Alexandria, *writes Jean-Yves Empereur*. With very limited means and in difficult weather conditions, she was able to greatly improve on the maps made by Kamel Abul-Saadat and produce a levelled

Figure 7. a) Alexandria. Honor Frost preparing to dive with J.Y. Empereur on the Pharos site (1995); b) Honor Frost beside the colossal statue of Ptolemy I as Pharaoh (1995). (courtesy St Millière, © Archives Gédéon).

plan indicating the precise position of statues and blocks that were relocated during the excavations carried out in 1992.

A second stage in recounting Frost's work on the Pharos of Alexandria site will be possible when her archives are sorted and classified. The notes and sketches that she made during her visits to Alexandria and her unpublished report made to UNESCO, dated 2 November 1968 (not seen), will no doubt throw more light on the state of the

site as she saw it in 1968. The archives including her reports and correspondence will enable us to better understand both the scientific and the personal relationships that Frost had with the team of divers with whom she collaborated during this project: Nesteroff, the geomorphologist whose part in the project is so little known; Abul-Saadat, the founder of underwater archaeology in Alexandria, who Frost thanked for his help, notably during diving, and for Hala Halim's study, which she mentioned in the friendly letters she sent him, and which are now kept by his family; and Bruno Vailati, an Italian born in Alexandria and another colourful character. Vailati was part of the Resistance during the Second World War, and was a childhood friend of Abul-Saadat, providing him with diving equipment when it was so difficult to come by in Egypt. Vailati played an important role in the development of scientific diving in Italy and made numerous underwater films including one on the Pharos of his home town. Frost was also in contact with him, as shown by her second report to UNESCO (Frost, nd).

Frost continued to update her original plan made in 1968, adding to it up to 1995, as shown by her annotations in the map legends (Fig. 3). In 1995, when she revisited Alexandria, Frost was extremely pleased to find that her plans, although drawn in 1968 using basic equipment and methods, fitted well with the new plan made with modern equipment for the 1994 lighthouse excavations. For our part, we appreciated her extraordinary ability to recall the site as if the quarter of a century that separated her visits had taken no toll on her memory. No doubt, Frost would have been pleased to contribute to the discovery of new technologies, notably the use of photogrammetry to produce 3D georeferenced plans of extraordinary precision that render time-consuming and less-precise hand-drawings obsolete. For the lighthouse underwater archaeological site, which had been so disturbed by seismic activity, subsidence, and violent storms, as well as human actions – notably by placing modern concrete blocks to protect the Mamluk fort of Qaitbay – there is no doubt that Frost's actions were decisive and that we owe much to her for our better understanding of the site (Fig. 7).

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Early Priorities and New Perspectives in Harbour Research

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Harbour studies are no longer the 'poor relation' in maritime archaeology. Besides the stimulus of new discoveries and collaboration with geoarchaeologists, there is a readiness to review existing evidence, applying new analytical and dating methods. Frost's work and interests – not only anchors – encouraged this development, as did Gerhard Kapitän's. The Colston Symposium on Marine Archaeology marked an important stage. Working with Frost always contained the unexpected. She always asked questions. I mention some of mine.

Keywords: harbour studies, Colston Symposium, anchors, sea-level change, arsenals, Muslim navigation.

In the autumn of 1962 John Morrison asked me, alongside the research which I had started on the Athenian navy, to provide him with all the evidence that I could find for the dimensions of ancient warships; this appeared as a short chapter in his book, *Greek Oared Ships* (Morrison & Williams, 1968: 181-186). Then in the autumn of 1963 I started a year at the British School at Athens but found that I had no access to the inscriptions that I wanted to study – the records of the Curators of the Athenian Dockyard. Thus it was that I concentrated increasingly on the study of ancient harbours in general. I received a generous permit from the Turkish Department of Antiquities, negotiated for me by Michael Gough, the then Director of the British Institute of Archaeology at Ankara, to visit ancient harbours on the coast of Turkey (excluding the Straits). This went well until a crisis over Cyprus in June 1964 led to the suspension of my permit (and other British permits); I am glad to record that my fieldnotes were used by Nic Flemming in his 1971 study of evidence for sea-level change in the region (published as Flemming *et al.*, 1973).

What I cannot now remember is when I first met Honor Frost – certainly we had met by 1964. But I know that I bought and read *Under the Mediterranean* very early on (Frost,

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 199-212. Leiden: Sidestone Press.

Figure 1. Honor Frost and Gerhard Kapitän, in Kapitän's house in Viale Tica, Syracuse (1986) (Photo Marcello Guarnaccia).

1963); and it influenced me greatly. Harbour studies were of growing importance for me since I could not dive deep, and her interest and discussions in this respect encouraged me to continue in the pursuit of this research, which eventually led to the publication of one of the first comprehensive overviews of harbour studies (Blackman, 1982).

Back in the UK in late 1964, I attended one of the first meetings of what became the Committee for Nautical Archaeology, convened by Joan du Plat Taylor and Peter Marsden; here Frost played an important supporting role.[1] In what were my formative 'early career' years, talking to and corresponding with Frost was a great experience. She also discovered that I had a pedantic editorial eye and was willing to look at her texts in draft; her dyslexia was known to a small circle of friends.

I had also met her good friend and colleague Gerhard Kapitän in 1964, and went to visit him in his modest home with its beautiful garden in inner-suburban Syracuse, and hence formed another friendship.[2] I thus witnessed some of their long series of debates on anchors (Fig. 1). I remember vividly, when organizing the Colston Symposium on Marine Archaeology in Bristol in 1971, how concerned I was about the possibility of an accident when Kapitän demonstrated his 'one-armed anchor' model, casting it during the conference coffee breaks (Fig. 2) (see Kapitän, 1973; Frost, 1973).

It was a memorable symposium (the first on the subject in the UK, and published in Blackman, 1973 a), enriched by the participation of many of the pioneers of marine archaeology: the speakers included Peter Throckmorton, Elisha Linder, Helena (Laina) Wylde Swiny and Jeremy Green. Laina, Jeremy, Pat Baker, and Brian Richards were present also 46 years later at the 'Under the Mediterranean' conference held in Nicosia to honour the centenary of Frost's birth.

The friendship of Frost and Kapitän is now well recorded and I am glad that the Frost archive now housed in a new Special Collections archive dedicated to maritime archaeology at the University of Southampton Hartley Library will be more accessible

1 There were several initiatives in 1964, which came together and led to the launch of the CNA in early 1965. See Marsden, 1986; Croome in Redknap & Croome, 1987: 141-150; on the CNA's campaign for wreck protection legislation, see, among others, Firth, 2002.

2 In October 2008 I visited Gerhard again to collect the illustrations – all A4 prints and scale drawings – for his monograph on watercraft from Sri Lanka (Kapitän, 2009).

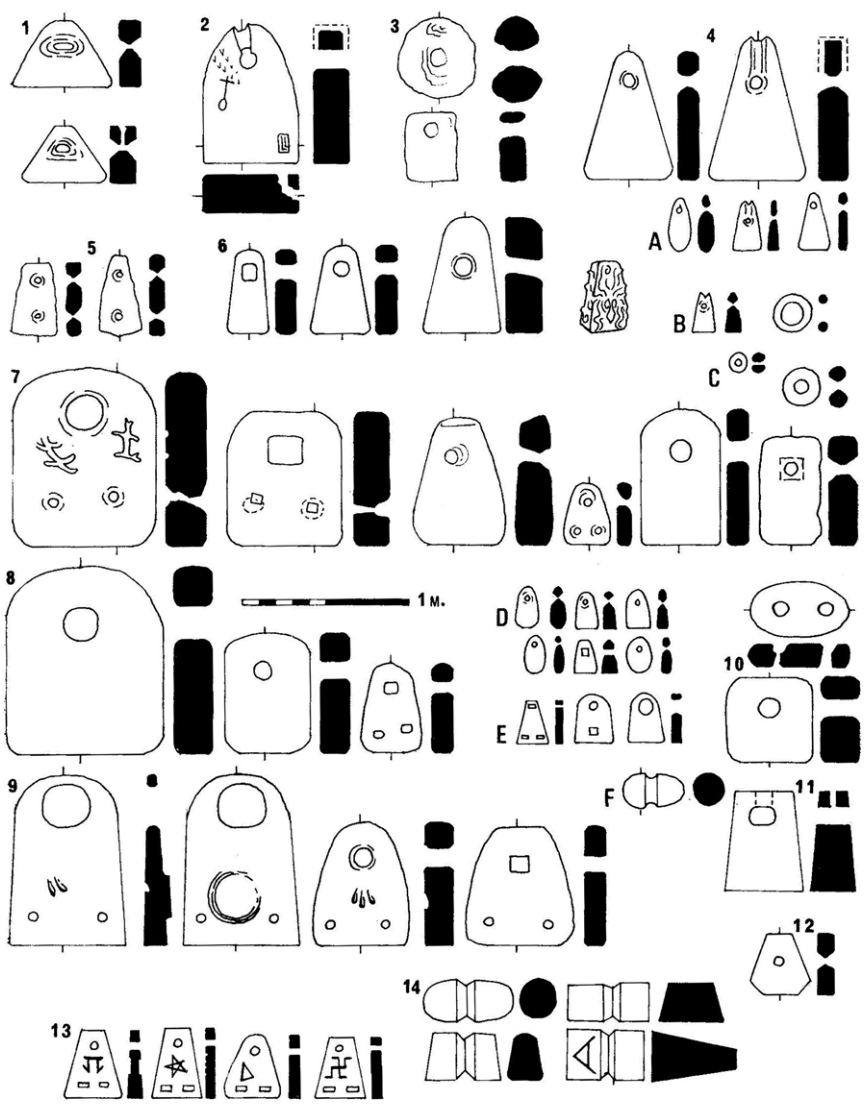


Figure 2. Honor Frost's illustration ('pierced stones') at the Colston Symposium (Frost, 1973: fig. 1).

than the Kapitän archive! My relationship with Frost was also as one of her circle of 'Sicilian friends': she sent me copies of many trenchant letters about the fate of the Marsala wreck. And she also encouraged my harbour studies: she was very good at asking the simple, basic, critical questions; she would often stress that she was not affiliated to any institution – she simply had the direct, on-site experience.

She was very supportive of the launch of the *International Journal of Nautical Archaeology:* I remember a crisis meeting in her house with Angela Croome, when there were hitches over the publication of the first volume. At the time, the Editor, Joan du Plat Taylor, was digging at Gravina in southern Italy, incommunicado: there were no mobile

a.

b.

Figure 3. a) Honor Frost asking the Ephor for permission to sample stone anchors in Piraeus Archaeological Museum; b) the Ephor, George Steinhauer, declines. (1991) (Photos D. Blackman).

telephones in those days. That is when I saw for the first time some of the remarkable paintings on Frost's dining-room wall! (See Giglio, this volume: fig. 2)

Frost did not appear at all shocked when I went off into European politics in 1976. She was a natural European, at home in France, Malta, and Cyprus, and also in Brussels, where she came regularly to visit her good friend Lucien Basch. Several times she came across to visit us on the other side of town: she was totally accepting of my new career and was happy that I did some 'archaeological politics': we were trying to achieve a European Convention for the Protection of the Underwater Cultural Heritage, a forerunner of the UNESCO Convention (Roper, 1978; Blackman, 2013).

Frost also urged me not to forget archaeological research (so too did John Morrison) and I listened to those siren voices! My memory is vivid of our meeting in Piraeus in late August 1987, where we attended the 'baptism' of the *Olympias* (bishops, holy water, and Melina Mercouri – then Minister of Culture) (see Tzalas, this volume). It was on a later visit to Piraeus, during the TROPIS IV Conference of 1991, that Frost pursued her interest in anchors in the Piraeus Archaeological Museum, which had a number of fine pyramidal stone anchors in the courtyard. She wanted to take a sample, since the stone was not local and she wanted to identify the source. Our friend the Ephor, George Steinhauer, was embarrassed when faced with Honor's determined but slightly menacing smile, with penknife at the ready. Unfortunately, samples could not be taken

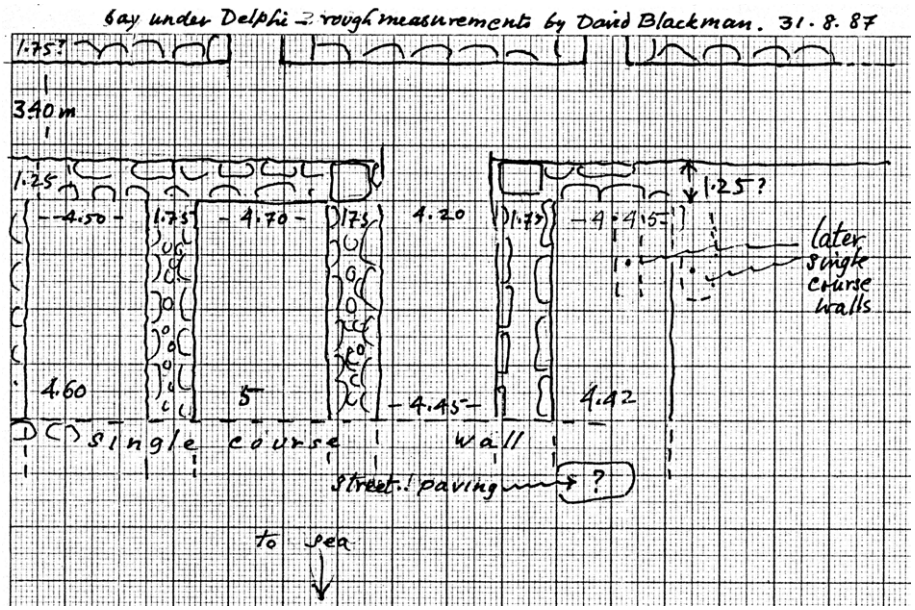


Figure 4. Plan of remains at Kirrha (HF and DJB: 31/8/87).

without a Ministry permit. Since the 'Under the Mediterranean' conference, I have retrieved my photos of that memorable event (Fig. 3).[3]

After the 'baptism' of the *Olympias,* I had the experience of travelling to Delphi in her VW Beetle for the TROPIS II Conference. At the end of the conference (we can date it precisely to 31 August 1987) Frost said 'Let's go down to the sea!' So we went down to ancient Kirrha, port of ancient Delphi; and in half an hour we planned the remains of a site that had been thought by its excavator to be 'shipsheds'. This sketch-plan remained in my files, misplaced, so that I rediscovered it just too late for publication in our book

3 Frost and I discussed this case at a conference: see Frost, 1988: 212-214 with Blackman's comment p. 225. She had already noticed both types of pyramidal anchor in 1959 (Frost, 1963: 48 and fig. 10.1). She was researching where the Punic ships had been built, and looked for parallels elsewhere; the idea in Greece, following a suggestion by Lucien Basch, was that Athenian shipbuilders went to Macedon (a source of ship timber) and built triremes there, picking up anchors on the way south. She developed the idea in Frost, 1989; 1990; for Tzalas' reply see Tzalas, 1999. Has the source of the stone ever been confirmed, scientifically? I have checked with the Honor Frost Archive: the relevant file (2.1.5) contained no photo, but there are references in several files to thin sections of six stone samples from the Maritime Museum in Piraeus (see also file 2.1.8), now held by the British School at Athens. The thin sections (illustrated by Frost in 1989: fig. 9) are of white stone, not the dark-grey stone that particularly interested Frost in 1991, since she thought its provenance to be historically significant. There is further research to be done here: Honor notes on some slides (8.3.8, box 6) 'Black stone: Halkidiki'; Capt. Tzamtzis provided some slides of anchors from Volos (cf. Frost 1988: fig. 2). The white stone samples were studied by Stathis Styros for Tzalas, and confirmed to be of Attic or Saronic Gulf origin (Tzalas, 1999: 438). It would be good to have analyses of samples of the dark-grey stone anchors which particularly interested Frost.

on ancient shipsheds (Blackman, Rankov *et al.*, 2013).[4] I show it here (Fig. 4), to add it to the archive of her draughtsmanship.

Frost and I were, I think, among the first archaeologists to appreciate fully the importance of sea-level change for the study of coastal sites and harbour construction in antiquity. I should add that the other important influences on my research were friendship with Nic Flemming (since 1958), also a pioneer of research into Holocene sea-level change and impact on coastlines and coastal features (Flemming, 1969, 1972, 1973, 1978); and my work with German colleagues (Jörg Schäfer and the late Helmut Schläger) in the 1960s-1970s on sites in Greece (Anthedon: Schläger *et al.,* 1968) and Turkey (Phaselis: Schäfer *et al.*, 1981). Avner Raban's (1985) early research into harbour palaeogeography should also be mentioned here, particularly his statement that:

> 'Harbours, havens and anchorages of every type and technical quality are located at the water-line. The water-line is in a constant state of flux: almost everywhere along the east Mediterranean seaboard, the present waterfront is not the same as in the past, and it will change again in the future.' (Raban, 1995: 139)

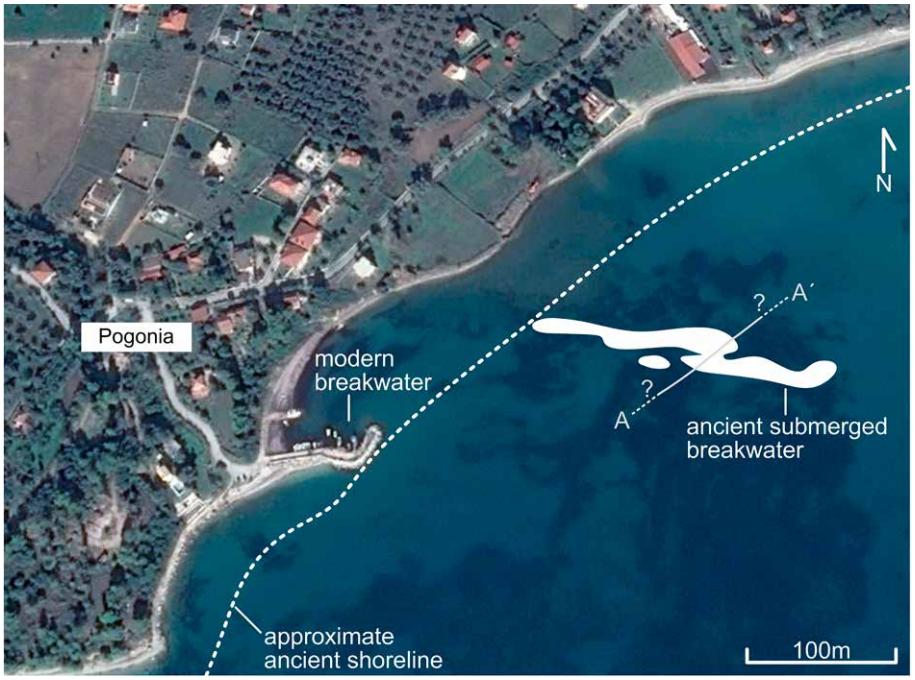
In fact, it was Frost (1972) and Raban (1991) who first drew scholarly attention to some of the earliest harbour systems. Frost even coined the term 'proto-harbour' based upon her pioneering work into harbours, particularly rock-cut harbours of the eastern Mediterranean (Frost, 1972: 95-97; see also Carayon in this volume).

I *believe* in fact, that it was Frost who first introduced me to the word *Vermetidae*: she said to me: 'We have to understand what "these people" are up to: they can provide dates for sea-level indicators! We must work with them.' This was a long time ago, before the groundbreaking work of Christophe Morhange, Nick Marriner and colleagues (Marriner & Morhange, 2007; Morhange *et al.*, 2015), who have created an impressive school of maritime geoarchaeologists. We have tried to keep up with their debates, and also to provide them with new evidence: in my case, from Rhamnous (Blackman, forthcoming a).

Another of the processes about which we archaeologists learned with respect to the changing landscape of harbours, was 'liquefaction' as a cause of vertical dislocation, particularly in areas of unconsolidated sediments such as river deltas, for example the Nile Delta (as our colleagues have found at Herakleion: Stanley, 2007). This obviously means that one has to be cautious in assessing sea-level indicators. What I have learned recently is that seismic dislocation and liquefaction can also cause *horizontal* dislocation. Stathis Stiros has studied a curious ancient breakwater in the harbour of Palairos in Akarnania, a very active earthquake area of north-west Greece (Stiros & Saltogianni, 2016; fig. 5a). The 'sigmoid' shape of the breakwater, with two segments, had puzzled both archaeologists and geologists. Recently Stiros heard of a modern phenomenon in the harbour of Barcelona, where the Prat Quay failed in 2007 due to static liquefaction, which produced lateral offsets of up to 90 m (Fig. 5b). A similar event in antiquity, probably after faulting during an earthquake, could have produced the strange shape

4 See the brief account by Blackman with Kalliopi Baika in Blackman, Rankov *et al.*, 2013: 572-573, with a bibliography of earlier research, and digital publication of the drawing. The drawing had been marked 'Itanos', I think by Honor Frost. The original of the plan has a further correction, in red, to 'Kiriaki Bay'; and a note 'copy sent DB 26.11.87'; I received it then, without the corrected toponym, and reproduce it here. See Honor Frost Archive, file 6.2.5.2.

a.



b.

Figure 5. a) Palairos harbour and b) Barcelona mole. (Courtesy of Stathis Stiros).

of the breakwater at Palairos, with later wave action probably increasing the damage. I enjoyed working with Stiros on the evidence for uplift presented by the remains of shipsheds in the military harbour of Rhodes (Stiros & Blackman 2014; unfortunately, no longer with our old sparring-partner Paolo Pirazzoli, who died in 2017: another great influence on sea-level change indicators: Pirazzoli, 1987).

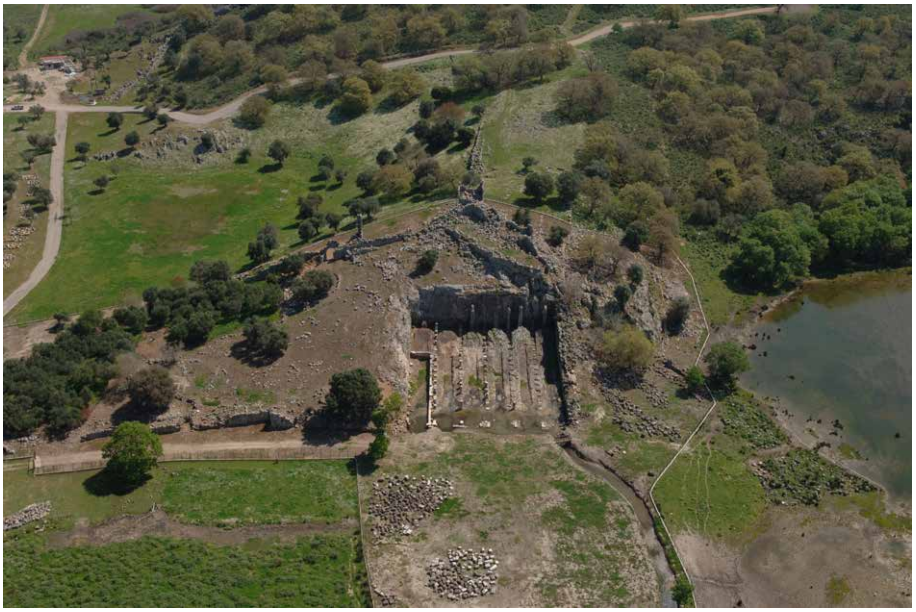


Figure 6. Oiniadai: aerial photograph of slipways. (Photo courtesy Ephorate of Antiquities, Mesolonghi).

The ROMACONS Project has made a great contribution to Roman harbour studies, and we now have a fine final publication (Oleson *et al.*, 2014). We must remember that if construction in shallow water was possible, we must be cautious in arguing for sea-level indicators from sites in shallow water. Following seminal work at the Roman harbour of Caesarea Maritima (Holum *et al.*, 2008; Vann, 1992; Raban *et al.*, 2009), Simon Keay and his colleagues continue the study of Roman harbours. At Portus and Ostia, the ports of ancient Rome, as well as other Roman ports of significance in the Mediterranean, new insights into Roman harbour technology and trade continue to be revealed (Keay *et al.*, 2005; Keay & Paroli, 2011; 5, Keay, 2012). Not only have harbour studies moved forward with respect to our understanding of technology, space, and connectivity but also with respect to the social role and relationships of ports and harbours and the people that inhabited them (see Rogers, 2013).

Related to harbour studies are of course the buildings that were constructed to house the great vessels of ancient warfare (Blackman & Rankov *et al.*, 2013). But can we find sea-level indicators in shipsheds? It would be good to know what was the minimum depth of water that is needed at the foot of a slipway, in order for the slipway to be operational: this may provide some clues as to relative sea-level; it would also be of benefit to have more examples where the exact length of the slipway can be determined. I am optimistic that the current study of the slipways at the site of Oiniadai in Greece may help (Fig. 6): we wait for reports from Lazaros Kolonas and Jari Pakkanen on their recent investigations (see Gerding, 2013, and references there).

At Sicilian Naxos, although we were able to excavate all that survives of the ancient Greek dockyard, we could not reach the foot of the slipways because of overlying modern construction (Fig. 7) (see Lentini *et al.*, 2013 and references there). One day I hope that excavation will be possible at Elaia, the port of ancient Pergamon. Here

there were perhaps shipsheds for 14 ships of the Hellenistic Pergamene royal fleet, although the historical sources indicate that none were larger than a *penteres* (Pint *et al.*, 2015: especially 352-353 and fig. 4; Pirson *et al.*, 2015: especially 32-34 and fig. 5; Feuser *et al.*, 2018: especially 97-99 and fig. 7). There remains also the inner harbour of Lechaion, which certainly contained shipsheds in the Classical period; a major project concentrating on the outer harbour and the Roman installations is now under way at the site, directed by Bjørn Lovén and Dimitris Kourkoumelis, with impressive results (Lovén *et al.* forthcoming). In general, the question of the location of shipsheds for the larger warships of the Hellenistic period still remains to be solved.

Frost always asked questions which made one stop and think: 'why?' and 'how?'. So in my closing thoughts I am encouraged to mention briefly some of mine:

First, how did the ancient mariner manage without books on 'network theory'?! Or to put it less mischievously, how did he learn what he needed to know? His main concerns were probably weather and sea conditions, water supply, and market conditions in the next port. How early were there handbooks or *portolani* for him to read? Or was he relying on oral transmission of knowhow?

Secondly, can we always distinguish between civilian and military harbours? (See discussions in Blackman, 1982, 193-195; 2008, 654-646; Baika in Blackman and Rankov *et al.,* 2013, Ch. 10.)

Thirdly, what were the standard methods of mooring? And what was the standard quay height? I have been asking these questions since 1971 (Blackman, 1973 b; also 1988; 2005).

Fourthly, we now see the evidence for light construction methods, found in the excavations at Myos Hormos (Peacock & Blue, 2006: especially 68-74 and fig. 5.9 for the 'hard' created with amphorae); and Naukratis. When comparing these quay structures with amphorae and timber piles studied by Bernal at Los Cargaderos in the Bay of Cadiz and Carteia on the Bay of Algeciras (Bernal Casasola *et al.,* 2005; Bernal Casasola 2012, 235-237), one asks were such methods of shoreline consolidation only used in deltaic, lagoonal and riverine contexts, or were they more widespread? Was availability of timber and/or stone a key factor?

With my fifth and final question I go beyond my own periods of study (Classical Antiquity): can we start to fill in, even slowly, the gap in the tradition of harbour engineering between Late Antiquity and the Renaissance? I will start the discussion with a type of site where I have at least the advantage of knowing the ancient evidence fairly well – the shipshed: *neorion*; *navale*; *tersane*; *atarazana; arsenale*. What evidence do we have for such structures in the gap between the Roman period and the 13th-century *arsenali*? More evidence on this subject may be starting to appear – in the 'Far West'. Seville has been famous as the main base for the Spanish fleet in its glory years, after the Christian conquest from the Moors in 1248. The remains of the Royal Dockyards (*atarazanas reales*, built by Alfonso X in 1252) have been uncovered, and are in the process of conservation (and thus frustratingly inaccessible at present).[5]

5 In our 2005 conference at Ravello on ancient and Mediaeval arsenals (Blackman and Lentini, 2010), I have to admit that we concentrated too much on the Italian *arsenali*, and did not take account of the *atarazanas* in Spain, notable those at Barcelona and Seville: on the latter see Amores Carredano and Quiros Esteban, 1999, who already discuss possible 'Precedentes Islámicos': 44-47.

Figure 7. Naxos shipsheds: a) view and b) (opposite page) plan. (Plan courtesy Maria Costanza Lentini).

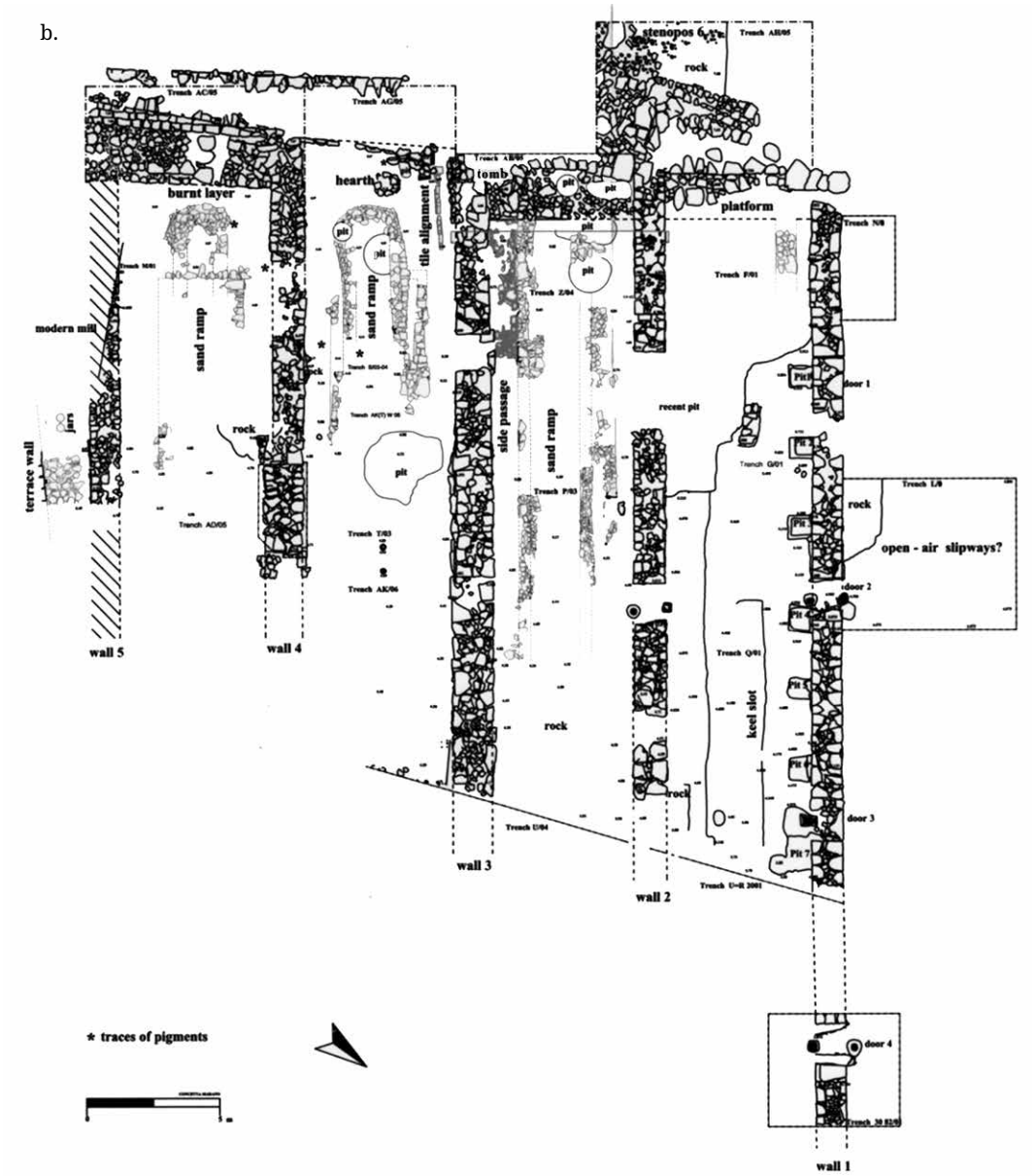
However, recent study has indicated the presence of an Islamic predecessor: this exciting development will be the theme of the paper by Carlos Cabrera Tejedor and Fernando Amores Carredano (Cabrera Tejedor & Amores Carredano, forthcoming; see already Cabrera Tejedor, 2016; Blackman, forthcoming b), that begins to produce the archaeological evidence for Muslim arsenals, and shed light on the references to 'arsenals' by Muslim chroniclers.

Conclusion

In my lifetime it has been an exciting and inspiring experience to observe and learn from the pioneers of the new discipline of maritime archaeology, in particular harbour studies, among whom Honor Frost was a pre-eminent figure. I hope that we succeed in conveying that excitement and inspiration to the next generation, who clearly see the importance of research into ancient harbours.

Acknowledgements

I am grateful for my recent warm welcome by Karen Robson and the staff of the Honor Frost Archive in the University of Southampton Library; this archive will be a treasure-store for future researchers. My thanks too to John and Debi Bennet for finding in the British School at Athens and restoring to me part of my photo collection; and to Ian Cartwright for help with photographs. I am grateful for the loan of a slide by Ross Thomas of the hard at Naukratis.



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Building upon Honor Frost's Anchor-Stone Foundations

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Synthesis of the evidence and theories of Honor Frost and colleagues regarding stone-based anchors of the prehistoric Near East, substantiated by statistical analysis of a corpus of anchor object finds, illuminates elements of the early history of the tool. In the Near East pierced stone anchors were employed by seagoing sailors from at least the 3rd millennium BC. Stone-frame staked anchors likely first appeared around the 15th century BC on Cyprus and were possibly the primary tradition employed by Cypriot sailors until the close of the Bronze Age. However, pierced stone anchors continued to be employed by Levantine sailors into the 1st millennium BC, with their dominance ending only with the invention of the stock-anchor.

Keywords: Pierced stone anchor, planar stone-frame staked anchor, Prehistory, Cyprus, Levant, Egypt.

While Honor Frost's pioneering investigations into harbours and ships are influential, her greatest efforts were arguably with anchors and particularly prehistoric pierced anchor-stones. This paper is an overview and substantiation of Frost and her colleagues' work from the Mediterranean and Near East concerning the design and reconstruction of these anchors and their nautical contexts. It also addresses the reasons for the contemporaneous presence of two distinct types of anchor in the Near Eastern Late Bronze Age: the stone anchor and stone-frame staked anchor. This investigation is facilitated by employment of a diachronic, spatial, and object-characteristic database populated with published information from the Mediterranean and Near East, compiled by the author in a manner that Frost promoted (1973; 1986; 1997; see Appendix and Fig. 1).

In order to approach this topic and related complex questions, it is necessary to define chronological and geographical boundaries. As an expedient, the term 'prehistoric' refers here to the period prior to the 5th century BC, while 'historic' is

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 213-244. Leiden: Sidestone Press.

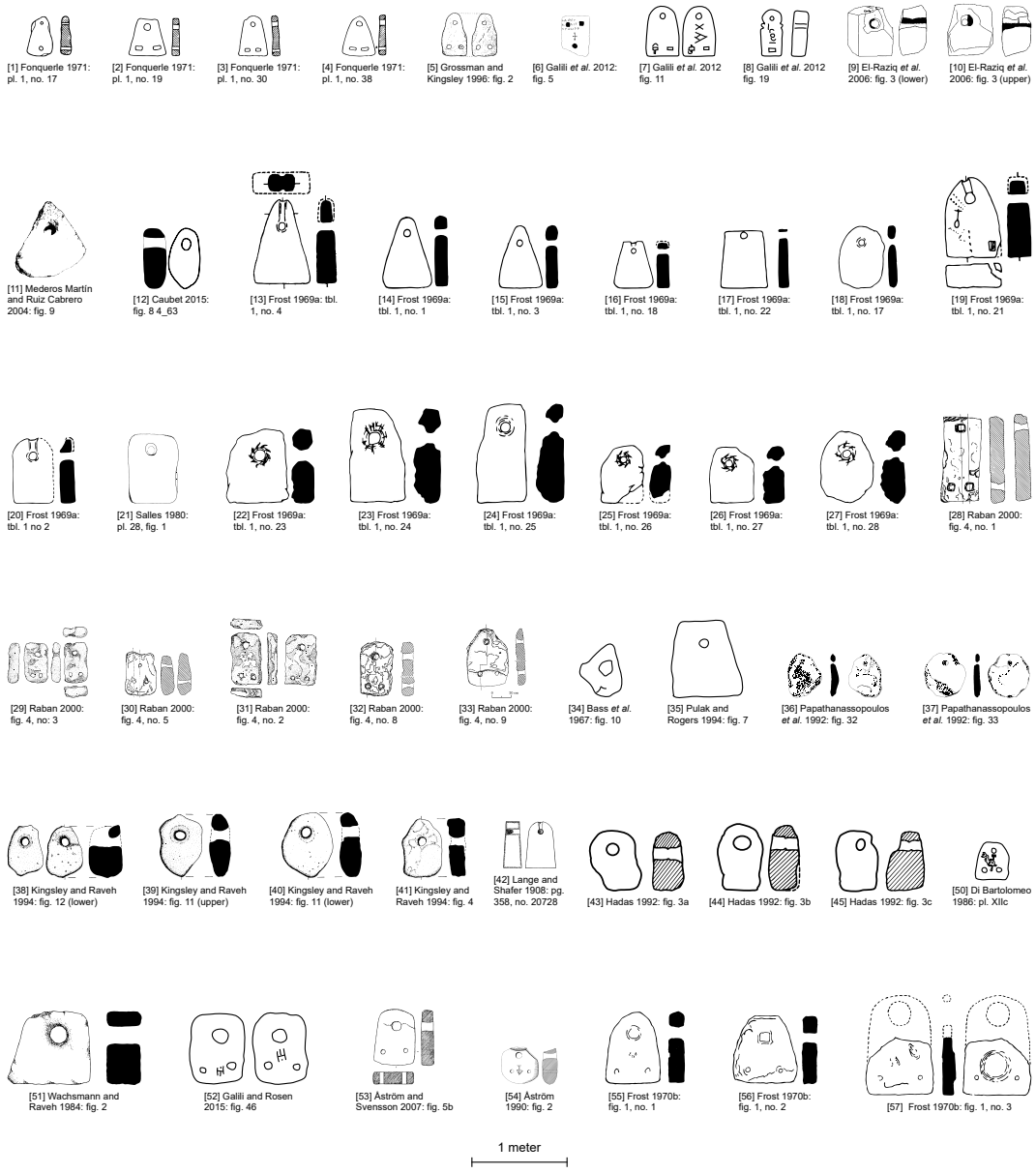

Figure 1. Tracings of anchor-stone illustrations. For full references see Appendix. (G. Votruba).

used for the 5th century BC and later. Because prehistoric finds are in focus here, the discussion and statistics presented relate to those objects with date ranges confined to 500 BC or earlier. Only those historical dating or ethnographically recorded finds that aid in hypothesis development for the prehistoric period are incorporated where relevant. Specifically, later-dating items are used to provide information about the organic superstructure for prehistoric reconstruction hypotheses and to contribute to setting the prehistoric finds in their diachronic economic nautical context. Contextual dating such as stratigraphic is considered, while several examples are also dated by

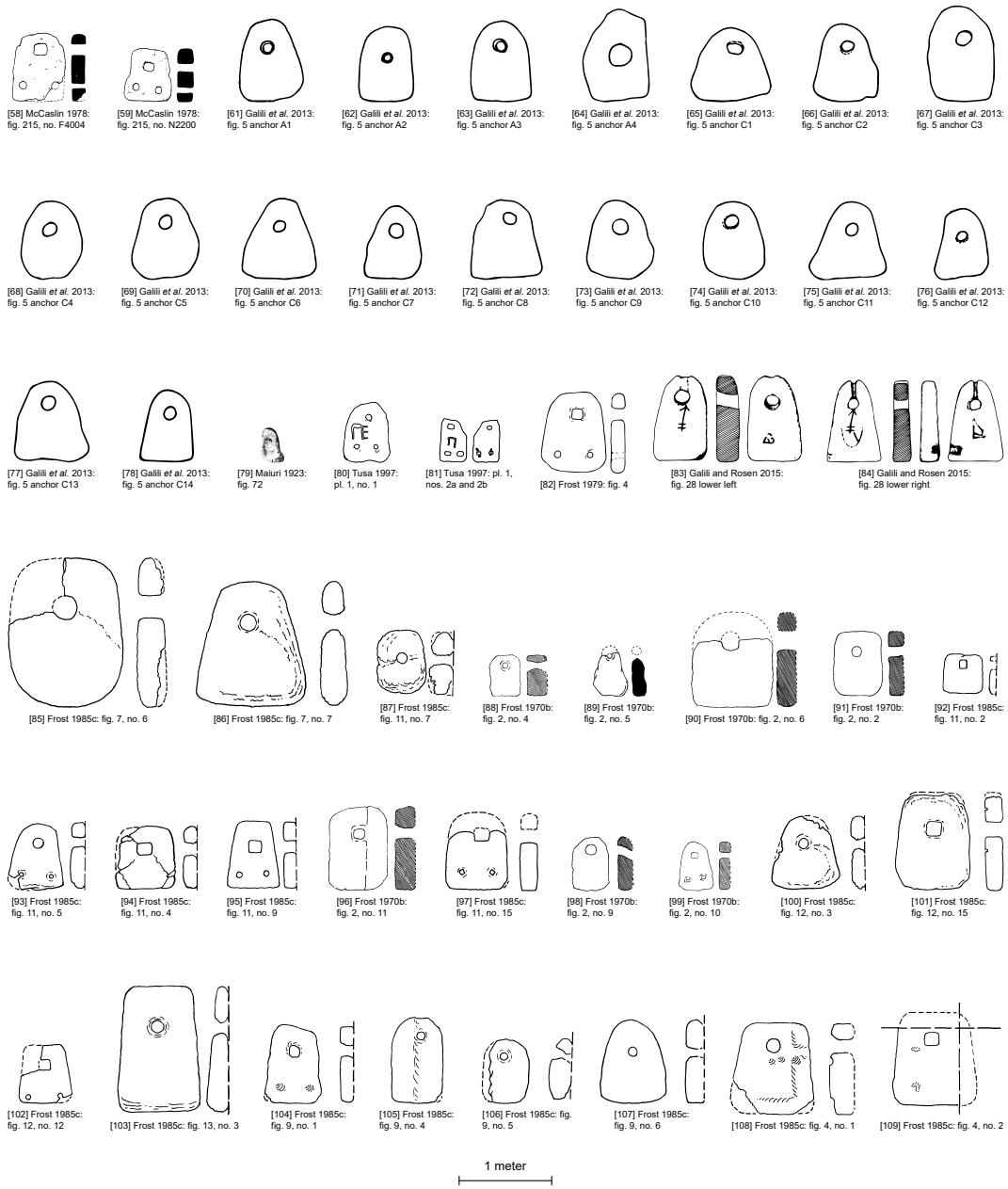

Figure 1. Continued.

object-specific features, or scientific analysis (inscriptions, C14 dating, etc.); the dates as published for each artefact are used here.

The 263 objects discussed are each identified by a catalogue number (in square brackets in the text). The catalogue consists of citations for each object and the scaled tracings of published illustrations, ideally line drawings, with at least frontal view and precise scale (Fig. 1). Because the publications related to these objects vary greatly in nature, quality, and comprehensiveness, and not all are illustrated to these

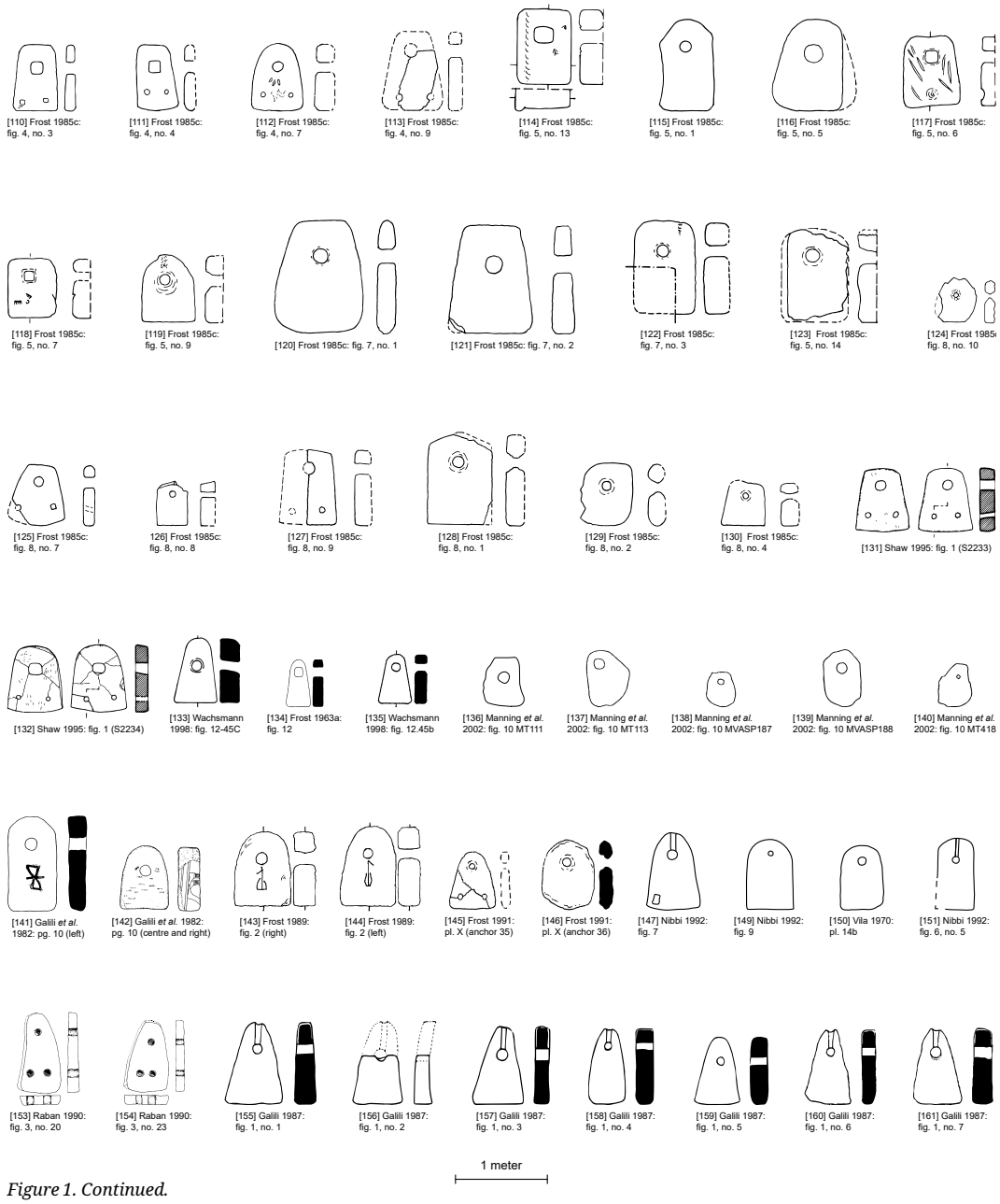

Figure 1. Continued.

specifications, the illustrations are not exhaustive. In the absence of an established typological sequence, dating based on similarity in overall form is avoided here.[1] Only those finds published and uncontested as anchor objects are considered. This study

1 The sole exception to this limitation is the wreck assemblage of the Neve Yam C which lacked datable associated finds. The importance of this assemblage renders a typological comparison necessary, fortunately displaying clear Middle Bronze Age dating parallels (Galili, 1985: 147 and 149; Wachsmann, 1998: 272-273).

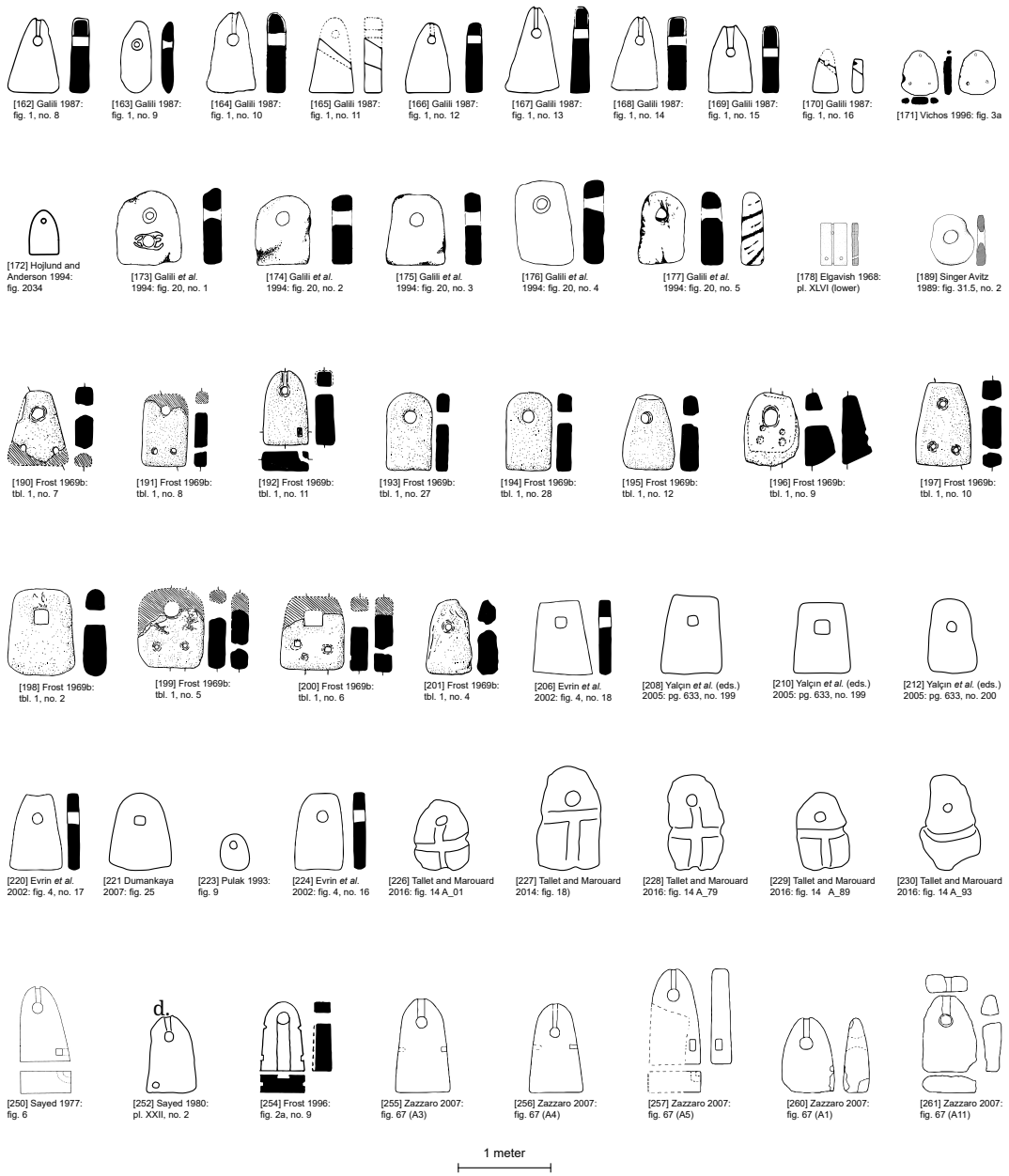

Figure 1. Continued.

focuses on three primary regions represented by uniquely large numbers of finds in datable contexts: the Egyptian Red Sea, the Levantine coast, and the island of Cyprus.

To simplify discussion, it is necessary to establish a system of acronym nomenclature (Fig. 2). A refined approach to the terminology of 'stone anchors' is taken here. The term 'anchor' refers to an object attached to the ship's (or other floating object's) cable as a tool to increase resistance opposite to the ship's momentum, regularly to hold it in a position. The only anchors that are here considered 'stone anchors' are those that consisted solely of stone when employed. These can be a 'pierced stone anchor' (PSA),

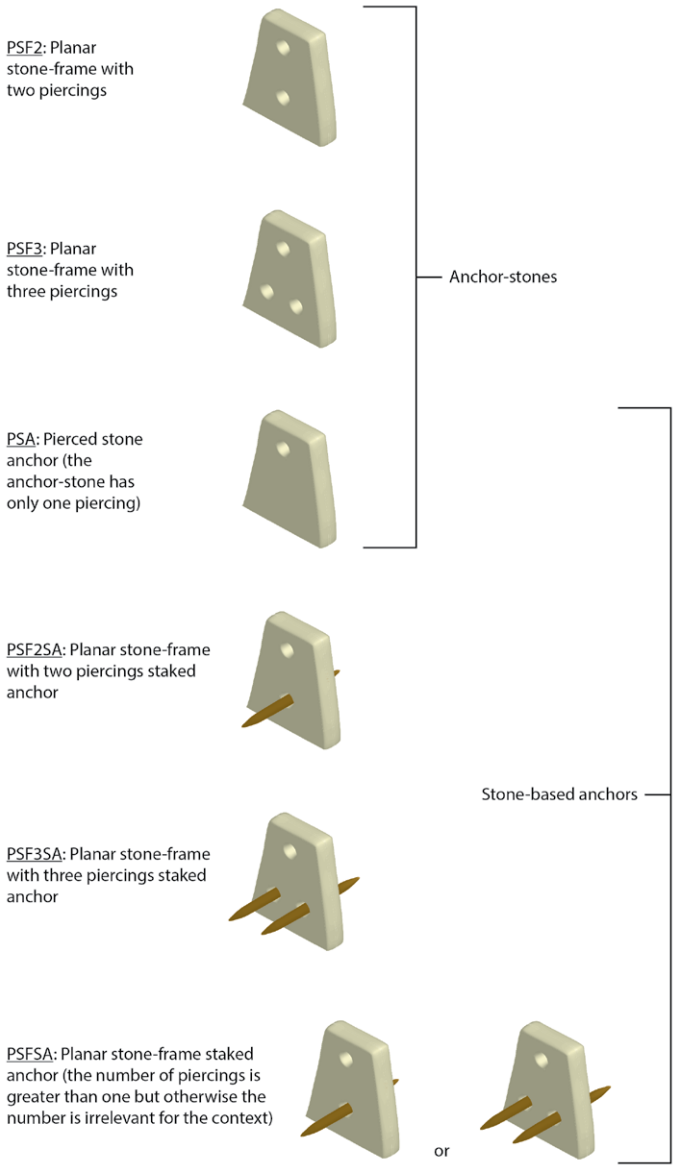

Figure 2. General terminology, acronym definitions and clarifying illustrations. (G. Votruba).

with a single piercing ('eye'; Fig. 3), intended to be run through by the cable directly or, rather, accommodate an eye-loop, or a waisted or grooved anchor, carved to allow the attachment of the cable. An unworked stone skilfully wrapped on all faces with a rope (or directly by the cable) would be termed a 'stropstone' (van Nouhuys, 1951: 20-21). There is no evidence for the use of 'stropstones' in the ancient Mediterranean, but this may be because of the difficulty in identifying them once the rope has disintegrated.

Those finds with pierced holes that would have held stakes, in addition to the eye, are here considered stone frames for anchors (henceforth 'stone-frames'). A rigged example would be rather a 'staked anchor' or, more precisely, a 'stone-frame staked anchor'. The elongated frustum-like variety known from medieval, primarily Indian

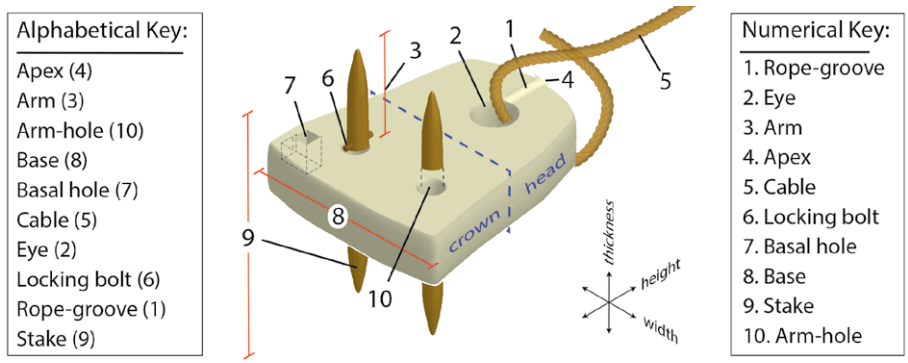

Figure 3. Generic illustration of pierced stone anchor (PSA) and planar stone-frame staked anchor (PSFSA) terminology. (G. Votruba).

Ocean contexts (see for example Gaur *et al.,* 2004), with the arm-holes running at right angles to each other, should be distinguished from this planar, broadly flat, prismatic variety with the arm-holes pierced through the same face. These are termed 'planar stone-frame', or 'planar stone-frame staked anchor' (PSFSA) in reconstruction. Where there is more than one piercing, the number (including the eye) is present within this acronym (PSF2SA or PSF3SA). Stone-frames with four or more piercings are absent from both the archaeological (cf. Frost, 1993: 452) and ethnographic anchor record. Stone-frame examples attributed to the prehistoric period are (currently) only of the three-hole type.[2] Possibly two arms engaged were understood to be better than one, both because of increased anchor resistance and also because two stakes would prohibit rotation, which would cause destructive abrasion of the arm.

It should be clarified that several prehistoric PSA also have an additional piercing called a 'basal hole', since they are located near the base (see Fig. 3, Table 3). The holes, which are roughly angular or L-shaped, exiting on adjacent faces, would not be fitted with stakes but were subsidiary rope attachment points for a location-marking buoy or trip-rope to remove an anchor when stuck (Wachsmann, 1998: 259; Frost, 2004: 329). Due to this distinct function, basal holes do not change the identity of the anchor-stone from a PSA to a stone-frame. Besides PSA and PSF3SA, only stock-type anchors have been positively identified for the prehistoric period, and then only in its final century. Stock-anchors are treated here only in relation to their significance to the prehistoric PSA and PSF3SA narrative.

This paper follows a micro to macroscale progression. It first discusses the design and reconstruction of these tools, independent of what they originally would have been anchoring (fishing apparatus, a ship etc.). Subsequently, the substantial evidence for their nautical employment is addressed. Finally, hypotheses are proposed regarding the distinct employment of prehistoric PSA and PSF3SA chronologically and spatially in the eastern Mediterranean.

2 Two illustrated pierced stones that have been interpreted as PSF2 from Pantelleria are the only such dated to the prehistoric period (Orsi, 1899: 463-464 and figs 13 and 14); however, each having a long-side broken edge and residential-terrestrial context, renders their identification problematic.

Design of prehistoric PSA and PSF3SA

Most prehistoric-dating PSA and PSF3 are reported to be made of limestone with sandstone being the second most common material (Table 1). These stones allowed for a functional hardness and weight but could still be worked with a chisel. The relative absence of igneous stones is feasibly the result of their excessive hardness, particularly considering the commonality of accessible basalts in Lebanon and Syria (Mascle, 1991: 373).

The eye is regularly pierced near the apex of the stones so that the distance between them was not so close as to be friable but still close enough to easily bend the cable to the anchor. This also created a centre of gravity distant from the eye so that, when suspended (or being dragged laterally), the anchor would orient itself head-up (or broadly shipward), and generally limit the rotation of the stone, which would have contributed to cable/eye-loop chafing. For the prehistoric period, eyes regularly appear large enough to insert a wooden beam sufficiently strong to act as a lever to carry the stone (cf. Wachsmann, 1998: 290), and to fit a durable, robust cable portion or eye-loop. Feasibly a large hole would also allow a second anchor to be attached to the same cable when needed, which might require the hole to be of a diameter greater than twice that of the cable. A slack portion of the cable already being employed (with one end attached to the first anchor, the other to a bit, for example) could be bighted and pushed through the eye of a second anchor to be reattached to itself with a lashing.

Due to the PSA/PSF3SA's suspended orientation, often the head of the PSA or PSF3 was rounded (Fig. 4 a), the overall frontal shape was generally triangular (or isosceles trapezoidal, Fig. 4 b) or at least the corners of a flatish head are rounded or angular (Table 2). These expedients benefited the raising of the anchor, whether from the hold or retrieval to the ship, so that its head portion did not catch, minimizing any potential damage to the hull. The profiles of PSA and PSF3 were typically flat or slab-like (planar; with a profile thickness ratio measured at the eye and at the base between 0.8 and 1.2), which would facilitate stacking and stowage. This would have been particularly the case

	Number	Catalogue Nos
Limestone	144	12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27, 36, 37, 42, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 82, 83, 84, 85, 88, 89, 91, 95, 96, 97, 98, 99, 102, 104, 105, 106, 108, 109, 110, 111, 112, 114, 124, 126, 128, 129, 131, 132, 141, 142, 143, 144, 145, 146, 147, 149, 151, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 173, 174, 175, 176, 177, 189, 190, 192, 198, 200, 201, 204, 223, 226, 228, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 255, 256, 257, 258, 259, 261. 'chalk' – 191, 193, 194
Sandstone	47	18, 35, 52, 81, 92, 94, 100, 101, 116, 117, 118, 119, 120, 121, 122, 127, 133, 134, 135, 148, 150, 152, 196, 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 224, 225, 227, 229
Granite	2	21, 260
Basalt	2	195, 197
Conglomerate	7	86, 87, 90, 107, 125, 171, 199
Gneiss	1	220

Table 1. Published geology of anchor-stones.

for stone-frames, which were required to be narrow to enable piercing the arm-holes. A fairly flat-cut base is also common. This would have allowed for some temporary stability when stood upright, which would help when tying the cable through the eye and rigging the stakes through the arm-holes of PSF3 prior to deployment, for instance.

Since practically no organic fittings of prehistoric PSA and PSF3SA anchors have been preserved, their original form and rigging must be interpolated from parallels. Both ethnographic and historical evidence of PSFSA demonstrate the fitting of stake(s) within the arm-hole(s) accompanying the eye. The sole PSF3SA in the ethnographic record derives from Spain or its vicinity and has two wooden stakes fitted into the two

	Number	Catalogue Nos
Rounded head	86	10, 19, 20, 42, 55, 56, 58, 62, 63, 66, 67, 71, 72, 76, 77, 78, 83, 84, 88, 93, 94, 96, 97, 98, 105, 106, 112, 115, 119, 126, 127, 131, 132, 141, 142, 143, 144, 147, 148, 149, 150, 151, 172, 173, 174, 175, 177, 192, 193, 194, 196, 209, 212, 215, 218, 221, 225, 226, 227, 228, 229, 232, 233, 234, 236, 237, 238, 240, 241, 242, 243, 244, 245, 246, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 260, 261
Approximately triangular face	87	13, 14, 15, 16, 35, 42, 56, 59, 61, 63, 65, 66, 69, 70, 71, 72, 75, 76, 77, 81, 82, 86, 89, 93, 95, 99, 100, 101, 102, 104, 107, 108, 110, 116, 120, 121, 125, 131, 132, 133, 134, 135, 144, 145, 147, 148, 155, 157, 158, 159, 160, 161, 162, 164, 166, 167, 168, 169, 195, 197, 201, 203, 205, 206, 207, 208, 209, 210, 212, 215, 216, 218, 219, 220, 221, 224, 225, 231, 235, 240, 244, 246, 255, 256, 257, 260, 261
Rounded/ angled corners at the head	17	21, 22, 23, 24, 25, 26, 51, 52, 53, 92, 111, 117, 122, 128, 130, 183, 198
Flat/slab-like (profile thickness ratio between 1.2 and 0.8)	87	9, 10, 11, 12, 13, 14, 15, 20, 26, 27, 35, 51, 52, 53, 54, 55, 75, 76, 78, 80, 81, 83, 84, 85, 86, 87, 88, 90, 91, 93, 94, 95, 96, 97, 98, 99, 100, 101, 104, 106, 107, 108, 110, 111, 112, 113, 114, 120, 121, 122, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 140, 143, 144, 145, 146, 172, 173, 174, 175, 176, 177, 178, 189, 206, 208, 210, 212, 220, 224, 250, 251, 252, 254, 255, 256, 257, 261
Wide base (profile thickness ratio between 0.8 and 0.56)*	23	22, 23, 24, 25, 36, 37, 42, 62, 63, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 77, 89, 171, 260
Flat(ish) base	185	10, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 35, 42, 51, 52, 53, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 72, 75, 76, 77, 78, 81, 82, 83, 84, 86, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 125, 126, 127, 128, 130, 131, 132, 133, 134, 135, 141, 142, 143, 144, 145, 147, 148, 149, 150, 151, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 172, 173, 174, 175, 176, 177, 179, 183, 186, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 212, 213, 215, 216, 218, 219, 220, 221, 224, 225, 226, 227, 228, 229, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 260, 261
Base not flat or ambiguous	40	9, 11, 12, 18, 27, 34, 36, 37, 46, 47, 48, 49, 54, 73, 74, 79, 85, 87, 123, 124, 129, 136, 137, 138, 139, 140, 146, 152, 171, 180, 181, 182, 189, 211, 214, 217, 222, 223, 230, 247

Table 2: Diagnostic features of illustrated anchor-stones.
** These are primarily represented by two groups. One with a median date prior to the 3rd millennium BC, as possibly indication of early indifference. The second is more anomalously the Late Bronze Age Hishuley Carmel wreck assemblage.*

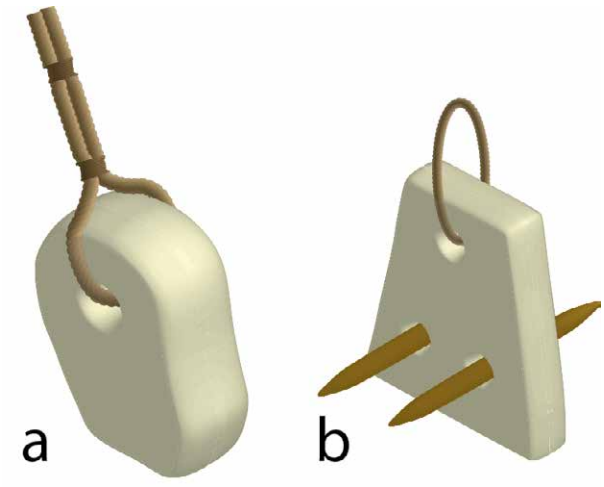

Figure 4. PSA (a) and PSF3SA (b) as recorded with associated organic portions. The PSA is based on two Hellenistic dating finds from the Dead Sea ([43] and [45]). The PSF3SA derives from the record of expendable fishing-vessel anchors from Spain or its vicinity (Rodríguez Santamaría (1923: 665-667). (G. Votruba).

arm-holes pierced crownward from the eye (Fig. 4b), while an eye-loop runs through the eye. Correspondingly, only single stakes are seen with PSF2SA,[3] the eyes of which can either be fitted with an eye-loop or accommodate the cable directly.[4] An incompletely excavated stone-frame staked anchor [60] from the Nile Delta silt, with a date range that could include the prehistoric period, has a wooden stake in the one exposed arm-hole (Rodríguez Santamaría, 1923: fig. 479). One Byzantine find from Yenikapı, Turkey, has two wooden stakes through the crown and a fragment of its binding rope running through the eye [262], while detail of another also has a rope fragment through the eye [263]. To this, several other ancient PSF3 ([81] 6th century BC), [5] 12/13th century AD) or undated stone-frames (PSF3: [2], [3], [4], [6] and PSF2: [1]) have been found with fragments of wood preserved only in the crownward piercings. Similarly indicative are concretions derived from iron locking bolts originally run perpendicularly through the arm and projecting at both sides flush with the stone-frame, used to hold the stake in place ([81] 6th century BC, [50] 'Roman'; [7] 6th to 7th century AD; [6] Roman or later: all PSF3). These also are of relatively later date. If such fastening mechanisms were used in the Bronze Age, they could have been made of wood, which would not have left a trace (Fig. 3, No 6). Only one side of the stake would need to be bolt-locked because it would be shaped to taper, or had a projecting step that would keep the stake from sliding further than necessary. Alternatively, carefully inserted wedges tight between the stake and arm-hole edge may have been an option.

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3 Rodríguez Santamaría (1923: fig. 479) illustrates a PSF2SA with only the crownward piercing accommodating a wooden stake. Only single-stakes are also reported from PSF2SA from the Middle East: Persian Gulf (Dickson, 1959: 482 (a); Bowen, 1957: 289-290; Frost, 1994: fig. 6); Syria (Frost, 1993: 453 and fig. 3; and 1995: 170, figs. 5 and 6).

4 Bowen claims that the eye of PSF2SA could be fitted with either a chain loop or the cable itself (1957: 289-90); while an example illustrated by Frost has a chain-loop (1994: fig. 6). The PSF2SA example from Syria has the looped-cable directly run through the eye and subsequently run through its loop. It may be relevant that all those ethnographically reported from the Persian Gulf have the eye running transversely, *i.e.* through the narrow edges; a logical expedient for avoiding rope abrasion, but one not seen dated to the prehistoric period.

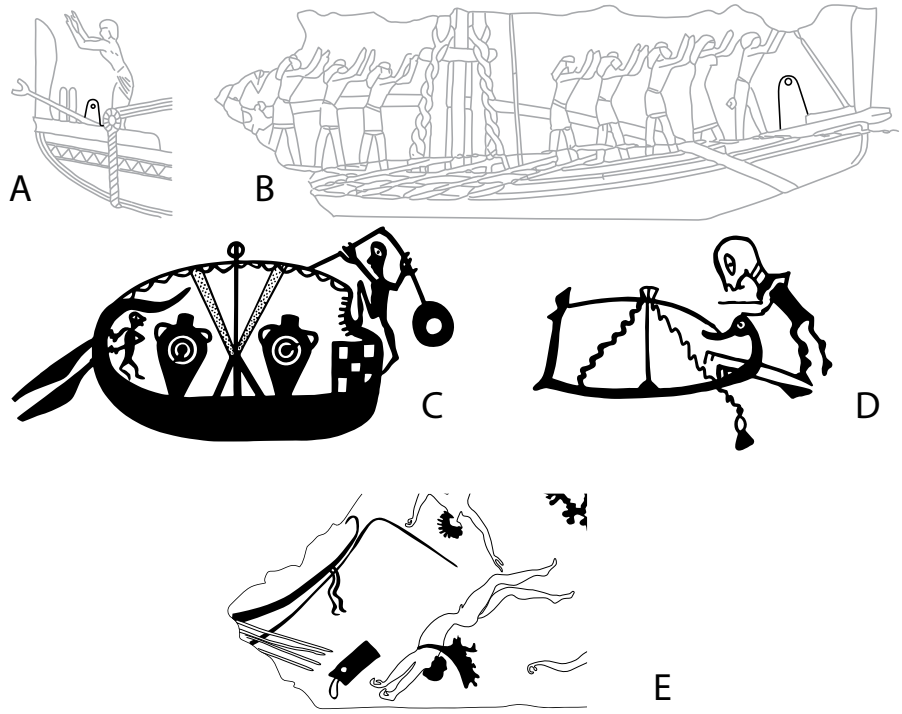

Figure 5. Prehistoric iconography illustrating PSA. a) Stone relief of one of the ships in the funerary complex of Pharaoh Sahure. (5th dynasty; c.2500 BC; Frost, 1985 a: fig. 1; Basch, 1987: fig. 72); b) stone relief of a ship of the pyramid of the Pharaoh Ounas. (5th dynasty, c.2400 BC; Hassan, 1955: fig. 2; Frost, 1979: pl. 1); c) painting on a c.7th century BC Cypriot 'Bichrome IV' jug. (Karageorghis & Des Gagniers, 1974: 122); d) painting on a c.7th century BC Cypriot 'White Painted IV' jug. (Karageorghis & Des Gagniers, 1974: 123); e) detail of a violent naval scene fresco fragment from the destruction of Thera of the mid-2nd millennium BC. (Marinatos, 1974: pl. 7; Papò, 2008: 59 and fig. 44).

The form of the wooden arms can be straight and whittled to fine ends, according to the Nile Delta [60] and Yenikapı [262] examples. In neither case is arm length precisely measurable, but these and a Spanish ethnographic PSF3SA sketch (Rodrígues Santamaría, 1923: fig. 521) suggest that arms could project a significantly greater distance (several lengths greater than the thickness of the stone-frame) than the stubby ethnographic examples illustrated from the Levant and Persian Gulf. As the frontal form of stone-frames generally narrow towards the head, the crownward placement of the arm-hole(s) would ensure that the stake(s) was located at a relatively ballasted position for greater seafloor friction, while also sufficiently distant from the eye, base, and sides to minimize stone-frame fragility.

Regarding PSA, two historically dated examples from the Dead Sea were found with the cable run through the eye and continuing through to be tied to itself some 1.40 m back ([43], [45] 3/2nd century BC; Fig. 4a). The portion where the rope ran parallel to itself was bound by a fine lashing near to the PSAs' apex and at several other locations along the rope's length. This technique would have thickened the leading portion of the cable, which was particularly susceptible to chafing on the seafloor. The PSA depictions on

	Number	Catalogue numbers
With a basal hole	12	19, 84, 147, 192, 250, 251, 252, 253, 255, 257, 258, 259
Eye shape round	162	9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 34, 35, 36, 37, 42, 46, 47, 51, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 83, 84, 85, 86, 87, 88, 89, 91, 98, 100, 105, 106, 107, 108, 115, 116, 119, 120, 121, 122, 123, 124, 126, 128, 129, 130, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 146, 147, 148, 149, 150, 151, 152, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 166, 167, 168, 169, 170, 172, 173, 174, 175, 176, 177, 179, 180, 183, 184, 189, 192, 193, 194, 195, 196, 201, 203, 204, 206, 209, 211, 212, 215, 218, 220, 222, 224, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 249, 250, 251, 252, 253, 254, 255, 256, 257, 260, 261
Eye shape polygonal	22	90, 92, 94, 96, 101, 109, 114, 117, 118, 198, 202, 205, 207, 208, 210, 213, 214, 216, 217, 219, 221, 225
With rope-groove		13, 16, 19, 20, 42, 83, 84, 147, 148, 150, 151, 155, 157, 158, 160, 161, 162, 164, 166, 167, 168, 169, 192, 250, 251, 252, 253, 255, 256, 257, 260, 261

Table 3. PSA features.

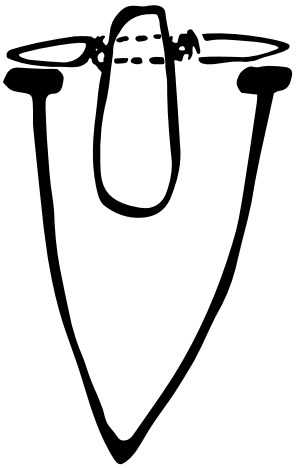

Figure 6. Sketch of a single-hole pierced stone with a stake placed through the eye from the Gilbert Islands (after Grimble, 1924: fig. 18 upper right). Originally accompanied by the handwritten text: 'Anchor stone pierced by "palm" of wood slung in place across gunwales'.

the Thera fresco (Fig. 5e) and a 7th-century-BC Cypriot jug (Fig. 5d) seem, like Rodríguez Santamaría's PSF3SA record, to have an eye-loop.

A stake placed through the eye, producing two arms, would conceivably have increased the potential anchor-holding friction (Kapitän, 2001); however, whether a stake was also inserted through the eye, along with the cable (or cable-loop), is not clear. An example of such an anchor has been sketched from the Gilbert Islands in profile (Grimble, 1924: fig. 18 upper right) (Fig. 6). It indicates that the bind to the ship is made by tying the cable to both projecting arms rather than running the rope through the eye along with the stake. Nikolaou and Catling (1968: 229) have suggested that the polygonal (square) eye, occasionally seen on both PSA (*c.*12%) and PSF3, would better accommodate a wooden beam (Table 3). However, as Frost expounded (1986: 358-359; 1991: 362; 1996: 883), the difference between a polygonal and round hole may merely be that between employing a chisel or a drill. Several prehistoric finds have rope stabilizing and protecting rope-grooves running around the apex and

carefully chiselled until the eye, giving the impression that the cable (or eye-loop) would have run through the hole. However, such grooves conceivably would also have been beneficial for a bind similar to that indicated from the Gilbert Islands example mentioned above.

It might, however, be emphasized that the Gilbert Islands example may be exceptional. Ethnographically, in its neighbouring broader island region bound by the continent of Asia and Australia, PSA and stropstones are widespread and far better represented (Van Nouhuys, 1926: 272-273; Sarasin, 1938: 11-28). Correspondingly, only PSA (without arms) are apparent within the five known examples of prehistoric iconography (Fig. 5). Additionally, the only ancient (Hellenistic) single-holed stone examples found in conditions allowing organic preservation were PSA [43] and [45]. PSA's absence of projecting portions would facilitate stowage as clearly relevant for the ships that held numerous examples such as the Neve Yam C (16; Galili, 1985, 1987; Marcus, 2007: 156, n. 55), Uluburun (24; Wachsmann, 1998: 281-283; Pulak, 2008: 210-211, 299, 306-307) and Hishuley Carmel (18; Galili *et al.*, 2013: 4-6), while any conceivable relative inefficiency resulting from the armless form would be accommodated by deploying more PSA as conditions dictated.[5] Nevertheless, in contrast to the robust ethnographic and historical period evidence that two- and three-holed stone-frames would only have been fitted with stakes in the crownward holes, the evidence is less substantial for one-hole stones.[6] Therefore, while the bulk of the evidence suggests that single-pierced anchor-stones were likely PSA (that is, accommodating only the cable's attachment – or eye-loop – in the single piercing ('eye'), resulting in the preference here to identify them as such, it cannot be confidently concluded that a ground-resisting stake was never fitted through the eye.

In summary, it is most likely that the eyes of prehistoric PSA and PSF3 would have been left for the cable-bind only, be it with an eye-loop or run through with the cable directly. Stones with two or more piercings would have wooden stakes through the arm-hole(s) located at the wider portion of the face, near the base. It appears that prehistoric PSA would produce holding resistance deriving primarily from their weight in conjunction with whatever surface friction they produced (as examined by WAREP, see Votruba and Erkurt, 2017). If PSA were less efficient in holding power, they would have had the added benefit of being readily stackable and better distributable as ballast when inboard. They could also more effectively be employed to slow the momentum of the ship, when approaching shore for example, just as pierced stones (λίθος τετρημένος) were employed at the stern for Nilotic vessels travelling downstream, as observed by Herodotus (*II*, 96).

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5 The suggestion of multiple PSA/PSF3SA regularly deployed together and attached in a chainlike manner by Wallace (1964) and Green *et al.* (1973: 173) is feasible. However, as Frost clarified (1982 a: 263-265), we lack clear oriented lines of pierced stones of sizes typical of prehistoric anchors on the seafloor.

6 One might suspect that the form of the piercings of the objects could help identify the intended fittings within them. For example, perhaps bi-cupular holes would be more suited to rope, whereas straight holes support stakes more easily. Presumably, three-holed stones would be most clear in this regard having both holes for rope and stakes. However, as illustrated, all examples of three-holed stones seem to have a single hole shape, be it bi-cupular, straight, or something in between.

Nautical contexts

Frost was the first to synthesize the evidence that heavy pierced stones found terrestrially and on the seafloor in the eastern Mediterranean were originally prehistoric PSA or PSF3 for anchoring ships (1963 a, 1963 b).[7] Later discoveries have largely demonstrated the validity of this nautical attribution despite their illogical design in comparison to modern anchors. Several PSA of the Old Kingdom period were found in position where ships had been anchored within a Red Sea harbour, at Wadi al-Jarf, protected by a breakwater (Tallet *et al.,* 2012: 422-423 and n. 88, 90, 93, figs 9, 30, tbl. 2; Tallet and Marouard, 2012: 5 and 2016: 141, fig. 4 upper; Tallet, 2013: fig. 7, 2015 b: 63 and 2015 a). A similarly early Red Sea Egyptian PSA find [9], excavated at Ayn Soukhna, had a preserved painted hieroglyph including a portion meaning 'ship' (Tallet, 2006: 27). These are testimony to Frost's attribution of 5th Dynasty murals illustrating pierced anchors in position for use from the bows of seagoing ships (Fig. 5a and b).[8]

Regarding ships themselves, PSA have been found among the 2nd millennium BC shipwreck assemblages of the Neve Yam C, Uluburun, Hishuley Carmel; and, likely, Cape Gelidonya A (Bass, 1967: 45; 1999: 23; Pulak and Rogers, 1994: 20). The large number of anchors found on the first three of these sites suggests that many would regularly have been employed as anchors but also as ballast when stowed (Erkurt, 2005: 328). Large marine PSA and stone-frame concentrations that have been found off the 2nd-millennium-BC Cypriot sites at Kouklia-Achni (Howitt-Marshall, 2012) and Maroni (Manning *et al.,* 2002), have been interpreted as indicating anchorage activities.[9]

For the final three centuries of the prehistoric period, multiple PSA have been identified in the 8th-century-BC Phoenician Tanit and Elissa wreck assemblages in the open sea, off Ashkelon (Ballard *et al.,* 2002). These wrecks are paralleled by two 7th-century-BC Cypriot jug depictions displaying PSA cast from ships, one manipulated by a sailor at the bow (Fig. 5c), and another of a ship in distress likely overseen by a protecting deity (Fig. 5d). Frost (1982 b) suggests this ship was identifiably in distress because of the zig-zag form of the cable and what she perceived to be a protecting deity, along with a nearby swastika, which she considers a distress symbol based on nautical Dipylon painted scenes. A PSA was found at Bamboula/Kition in a 7th/6th-century-BC context, which was accompanied in an immediately subsequent stratigraphic layer by a stone-stock in the same sacred area (Caubet, 1984: 112, 115-117, 144-146, 285; figs 8.4, 63; Frost, 1982 a; Brody, 1998: 51-52, n. 64).[10] As Frost highlighted, this is illustrative of the change in anchor design occurring *c.*600 BC with the appearance of the stock-anchor.

As at Bamboula, it is particularly characteristic for Frost to highlight the anchor finds made terrestrially, demonstrating that they are often in the vicinity of sacred areas. At Byblos, several PSA are said to have been found in sacred contexts at the end of the Early Bronze Age 'Tower-Temple' and Middle Bronze Age 'Temple of the Obelisks'

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7 Dunand was identifying PSA as such from excavated prehistoric levels at Byblos as early as 1954.

8 cf. Moll (1918: 357); For conclusion to debate regarding the small triangular objects at the bows of Nile-going vessels, that they are dedicatory bread loaves rather than anchors, see Doyle (2002: 313-317) and bibliography there.

9 The practice of permanent moorings appears to be a modern phenomenon (Rose, 2003), while for Mediterranean seagoing-ships habitual beaching was atypical at best (Votruba, 2017).

10 For stone stocks generally and the probable 7th/6th century BC appearance of the stock-anchor see Gianfrotta (1977) and Kapitän (1982).

precincts (Frost, 1969 a)(see Francis-Allouche & Grimal, this volume); the latter, Aaron Brody proposes, was attributed to a divine patron of sailors connected with Melqart (1998: 44-45, n. 26). Supplementing these, there are numerous finds in sacred contexts or in the vicinity of temple structures at Kition (Frost, 1985 c). Several of these temples have depictions of ships inscribed on their masonry (Basch & Artzy, 1985; Brody, 1998: 50). In the courtyard of one, a PSA-like object (treated as one here, [124]) was found standing upright on a mudbrick plinth surrounded by horns and cranium fragments of animals. For Ugarit, Frost demonstrated that PSA and PSF3 are clustered around the temple of the storm god Ba'al, as opposed to the nearby land god Dagon's temple (Frost, 1991). Therefore, these are feasibly *ex-voto* dedications to deities. The Cypriot jug with a ship in distress and 'deity' (Frost, 1982 b) could be Ba'al himself, overlooking a ship that has deployed a PSA in the hope of slowing its storm-tossed progress. Frost further highlighted the textual testimony for sacred anchor dedication of Apollonius of Rhodes (*Argonautica*, *I*, 955-960), Arrian (*Periplus Maris Euxini*, X) and Pausanias (*Description of Greece*, 1.4.5; *e.g.* Frost, 1970 c: 56-57, cf. Brody, 1998: 76). Therefore, the commonly sacred terrestrial context of many of the finds is reasonably a reflection of the sailors dedicating them after believing they had been protected while sailing (or also possibly in veneration prior to a daunting journey), and as further evidence for a nautical connection.

While the evidence for nautical employment of these stones is robust, other uses cannot be excluded, particularly for fishing and oil-pressing industries. While employment within fishing industries, as net anchors or other fishing purposes, must be considered, ethnographic evidence for the use of stones employed in the Mediterranean suggests that these stones would have been significantly smaller. Frost reports that stones weighing about 10 kg (1984: 125) are employed with contemporary fishing apparatus, while those of 2-7 kg were used for fixed-line fishing (1985 b: 170; 1991: 365; cf. De La Blanchère, 1868: 121-124). Wachsmann illustrates a cobble with a maximum length of *c.*15 cm serving as a weight for a contemporary fishing net at Acco, Israel. The stone was attached to the net by a small hole (1998: 273 and fig. 12.35), and a similar net on a boat in Lebanon is published by Frost (1985 b: fig. 79a). Regarding ancient evidence, Frost highlights an Egyptian Old Kingdom image of a fishing net with apparently modest, waisted, stone-like objects attached (1985 b: 170). For the Roman period, Oppian, within his substantial discourse on fishing techniques, describes a τρητὸν λίθον 'pierced stone' anchoring a wickerwork fish trap supported by cork, used for an unidentified flat fish (*Hal. 3.371-375*). Recorded free-diving stones appear similarly light (Frost 1969 a: fig. 10, pl. 4 upper; 1982 c: fig. 1). Van Nouhuys (1926) cites a 17th-century text describing pierced stones used for diving weighing *c.*25 kg, while a descriptive poster of the occupation by an E.L. Ettman and Co. dated 1897, informs us that they weigh *c.*18 kg. Ultimately the evidence for employing stones for fishing suggests they would weigh under 30 kg.

Similarly, it is easy to recognize the usefulness of many single-pierced stones found terrestrially as press weights, most commonly for olive-oil production, but for fish oils and other pressed products as well. However, while oil weight stones are regularly as heavy as ship's anchors, they are commonly designed differently (Hadjisavvas, 1992; Callot, 1987 a). They have large, wide bases so that they are stable when standing upright (and for pressing the olive baskets), or otherwise display considerable asymmetry to precisely fit the contours of the pressing vat (Frost, 2001 a: 199).

	Type	Catalogue Numbers
Anchor-stones with illustrations and published weights		7, 9, 10, 28, 29, 30, 31, 32, 33, 36, 37, 38, 39, 43, 44, 45, 52, 55, 80, 81, 83, 84, 88, 99, 131, 132, 143, 144, 146, 153, 154, 171, 174, 175, 176, 206, 208, 210, 212, 220, 224
Anchor-stones with directly calculated volumes	PSA	9, 10, 11, 12, 13, 14, 15, 20, 22, 23, 24, 25, 26, 27, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 51, 62, 63, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 85, 86, 87, 88, 91, 94, 96, 98, 100, 101, 107, 114, 120, 121, 122, 126, 129, 130, 133, 134, 135, 136, 137, 138, 139, 143, 144, 146, 172, 173, 174, 175, 176, 177, 189, 206, 208, 210, 212, 220, 224, 250, 251, 252, 254, 255, 256, 257, 260, 261
	PSF3	5, 7, 28, 29, 30, 31, 32, 33, 52, 53, 54, 55, 80, 81, 95, 99, 110, 111, 112, 125, 131, 132, 145, 153, 154, 171, 178
	PSF2	8
Anchor-stones with volume estimated by recorded weight	PSA	35, 202, 203, 204, 205, 207, 209, 211, 213, 214, 215, 216, 217, 218, 219, 221, 222, 223, 225

Table 4. 'Informative' anchor-stones (See Fig. 7).

A further possible approach to recognizing stones used as anchors is to examine their dimensions and weights in detail – specifically, examining the diachronic pattern of change in the volumes of identified PSA and stone-frames (a relative approximation of stone weight)(Fig. 7). Volumes have been calculated primarily using published dimensions (Fig. 8, Table 4).[11] Their weights are derived from the density trend produced from illustrated anchors whose weights have also been published. In absence of published drawings, the volumes of Uluburun and Cape Gelidonya A PSAs, and PSF2 or PSF2SA ethnographically testified by Bowen for the Persian Gulf (1957: 289-90) are based on their published weights in relation to this density trend. Using this information, the size of anchor-stones from the 1st millennium BC appear noticeably small compared to those typical of the two previous millennia, and sparser, although detailed data from the first few centuries of the 1st millennium BC are unfortunately lacking (Fig. 7). A closer examination reveals a further historical pattern of gradual decline in the size of anchor-stones. It seems that seagoing ships, at least those from *c.*600 BC, were abandoning pierced stone-based anchors for the new stock-anchor design. The gradual decline indicates the slower adoption of stock-anchors by provincial vessels: increasingly, only smaller vessels were employing PSA or PSFSA[12]. Conversely the pattern of known shipwrecks demonstrates a remarkable increase in both seafaring and the size of the largest ships from the 6th century BC into the Roman period (Parker,

11 Calculation of volume for PSA see Fig. 8: (([A] x (([B]+[D]+[E]+[F])/2) x (([J]+[I]+[G])/3))-(((((π) x ((((([C]+[D])/2)/2) x ((([C]+[D])/2)/2))) x [I])+(((π) x (([H]/2) x ([H]/2)))) x [I])/2). For PSF3: ([A] x (([B]+[D]+[E]+[F])/2) x (([J]+[I]+[G])/3))-(((((π) x ((((([C]+[D])/2)/2) x ((([C]+[D])/2)/2))) x [I])+(((π) x (([H]/2) x ([H]/2)))) x [I])/2)-(((((π) x ((((([K]+[L])/2)/2) x ((([K]+[L])/2)/2))) x [M])+(((π) x (([N]/2) x ([N]/2)))) x [M])/2)-(((((π) x ((((([P]+[Q])/2)/2) x ((([P]+[Q])/2)/2))) x [M])+(((π) x (([O]/2) x ([O]/2)))) x [M])/2).

12 Bowen (1957: 290) ethnographically records that PSF2SA anchors were 'used only on smaller craft and are favoured by fishermen and pearlers… The smaller anchors run around 50 lb (23 kg), while the larger ones may weigh over 100 lb (45 kg)'. Frost gives comparable weights to those she observed in use in the Mediterranean '*i.e.* 20-30 kg' (1982 c: 281), and '… in the order of 20kg' (1995: 170). These weight ranges are compatible with the general pattern of decrease in stone-frame (and PSA) size seen from the 1st millennium BC (Fig. 7).

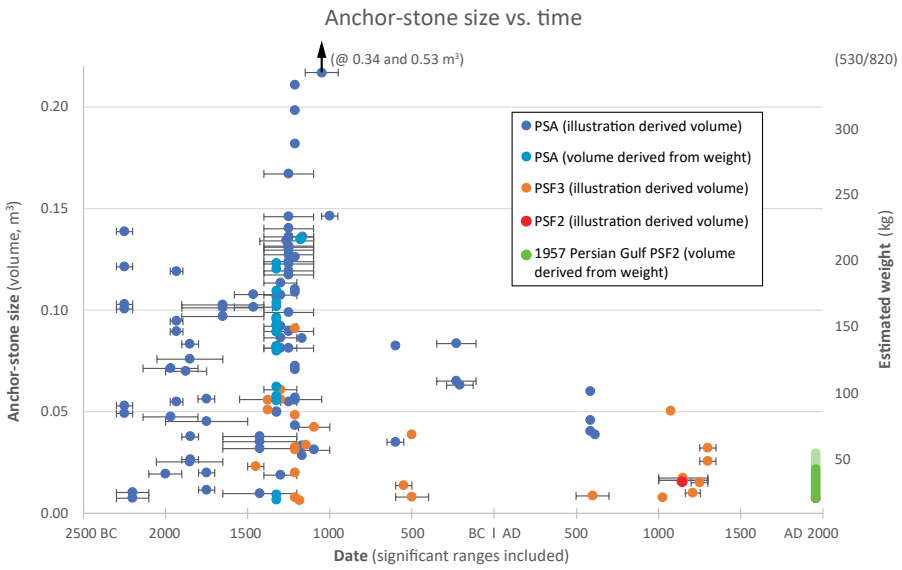

Figure 7. A synthesis chart of 'informative' anchor-stones from the Near East. 'Informative' is defined here as those published finds that have been dated with an accuracy of five centuries or less and well enough illustrated or otherwise described for their volumes to be broadly calculated (see Table 4).

1992; Wilson, 2009: 219-229). This increase would have been reflected in an increase in anchor-stone frequency and size if PSA and staked anchors had continued to be primary types employed on seagoing ships. Ultimately, it can be hypothesized with reasonable confidence that pierced stones weighing 30 kg or more discovered on the seafloor or in sacred terrestrial contexts, with the forms and characteristics described above, were originally anchors (PSA), or were parts of an anchor (stone-frame), for a boat or ship.

There remains, however, the issue of how such heavy and dangerous objects would have been stowed and manipulated. Considering deployment, the Cypriot jug with the ship in distress depiction, described above, seems to display a PSA being deployed with its cable running through the masthead and back down to the hull. This would be a logical means of retrieving them since the masthead is already designed to raise and lower the sail and boom (Ballard *et al.*, 2002: 164). The stone might be kept away from the hull on retrieval, for instance, by running the seaward cable through a fitting at the end of the boom or perhaps by employing a separate mast-derrick (Frost, 1995: 168-172).

Regarding stowage, a remarkable pattern is the several prehistoric PSF3 twins, closely matched in size and shape, that have been found together terrestrially at Kommos ([131], [132]) and Kition ([110], [111]), allowing the impression that the two anchors could have been employed together in the sea. This theory is substantiated by the PSA distribution found on the Neve Yam C, Uluburun, and Hishuley Carmel wreck assemblages in which two (possibly four for the Uluburun) PSA are interpreted to have been situated on the foredeck separated from the main cluster(s) that would have been in the bottom of the hull (Galili, 1985; Pulak, 2008: 306-307; Galili *et al.*, 2013: 17). The position of such anchors in the bow is also substantiated by three iconographic documents (Fig. 5 a-c). Additionally, twin PSA from the seafloor at Megadim ([143], [144]; Steiglitz, 1972: 75), each with opposite facing rudder hieroglyphs, have been interpreted

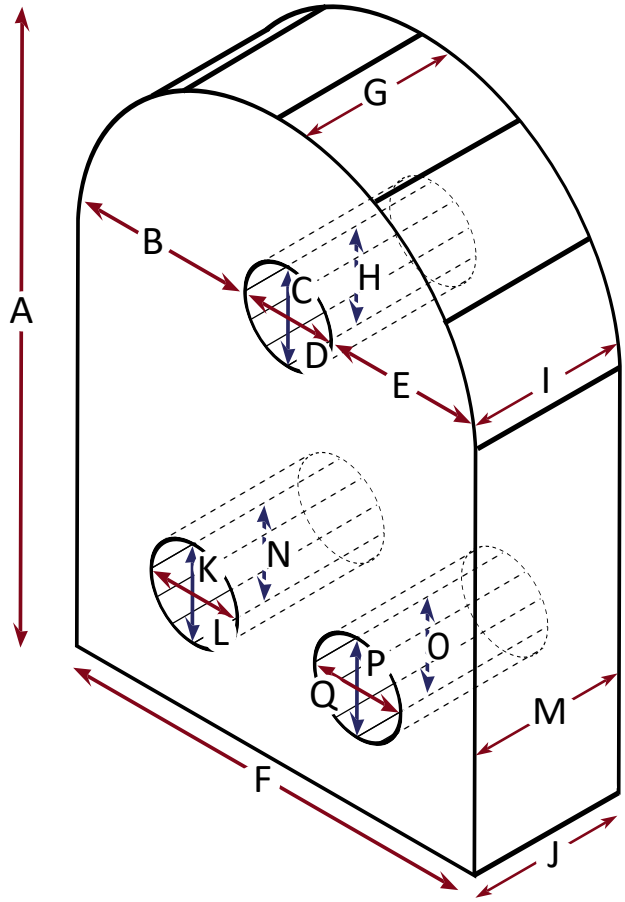

Figure 8. An isometric sketch of a generic PSF3 (also PSA) illustrating the measurements taken for the anchor-stone calculations employed.

as indicating port and starboard. Two other PSA ([83], [84]) from Kfar Samir also have practically identical prehistoric inscriptions. It seems that a pair (or more) of anchors would have been prepared for employment on each side of the bow from where they could be cast by manhandling over the side, while, at least for ships carrying PSA, a reserve group would be available in the hold distributed as ballast. These latter could be raised when needed, employing the mast for leverage.

Distinct employment of PSA and PSF3SA

While Frost's overall identification of these pierced stones as remains of anchors for ships is well-supported by a variety of evidence, there is an important aspect of her theory that requires reconsideration. Frost outlined that the two distinct designs were a factor of the type of seafloor on which the anchor would be employed (Frost, 1963 a: 7-9; 1963 b: 49-50; 1993: 449-451; 2004: 329). Specifically, PSA were for rocky seafloors while PSFSA were intended primarily for use on sandy seafloors. Frost reasonably considered that an anchor with arms would produce greater friction within sand than

a PSA of the same weight, while the projecting arms would get problematically stuck in the gaps in a rocky substrate.[13]

While the idea that sailors used different anchor designs for different types of seafloor is reasonable and possible to an unmeasurable extent, patterns in the archaeological record suggest that there were other important factors involved. Firstly, all seven prehistoric shipwreck assemblages found with two or more anchors have only PSA: Dhokós [36], [37]; Neve Yam C (Galili, 1985; 1987; Marcus, 2007: 156, n. 55), Uluburun (Pulak, 2008: 210-211, 299, 306-307; Wachsmann, 1998: 281-283 and citations there), Hishuley Carmel (Galili *et al.*, 2013: 4-6), Cape Gelidonya A (Bass, 1967: 45; 1999: 23; Pulak and Roger, 1994: 20), Tanit and Elissa (Ballard *et al.*, 2002). Feasibly, additional PSFSA could originally have been part of the complement for all of these ships but were lost during the voyage prior to the wreck event but, at least for those assemblages with numerous anchors, this seems to be unlikely. Frost rectified the discrepancy in her theory with the Uluburun's wholly PSA assemblage by hypothesizing that it planned a route where anchoring would only have been necessary upon a rocky substrate (1991: 368). Rather, in absence of mixed complements, it is likely that these ships were employing their PSA independent of the consistency of seafloor.

It appears, furthermore, that there is a chronological distinction in the first use of PSA and PSF3 in the archaeological record (Figs 7 and 9). Through the middle of the 2nd millennium BC, PSA were the sole anchor design employed with seagoing ships in the Near East. The earliest certain date for the use of PSA being the first half of the 3rd millennium BC in the Red Sea ([226], [227], [228], [229], [230], [231], [232], [233], [234], [235], [236], [237], [238], [239], [240], [241], [242], [243], [244], [245], [246], [247], [248], [249]), providing the earliest 'late-dates' of their date ranges), while the earliest certain dating from the Mediterranean is the second half of the 3rd millennium BC at Byblos, along with the Dhokós wreck assemblage ([22], [23], [24], [25], [26], [27], [36], [37]). However, for the PSF3SA, both the earliest certain dating of PSF3, as well as its date-probability histogram pattern, indicate a 15th-century-BC appearance (Fig. 9). It seems that Near Eastern sailors were employing PSA for a millennium or more prior to the invention of the PSFSA.

However, the appearance of the PSF3SA should not be interpreted as an indication of linear evolution of anchoring technology since subsequent to the 15th century BC, PSA remain the dominant type as far as the quantity of dated finds indicates (87 of the anchor-stones dating within the period of between the 14th and 11th centuries BC are PSA, while only 19 are PSF3, see Table 5). Furthermore, PSA may also be the sole form to continue into the 1st millennium BC, whereas PSF3SA feasibly go out of use in the 2nd millennium, by the early 12th century BC (Fig. 9). This would explain why in the first half of the 1st millennium BC in the Near East only the PSA stone-based anchor design is attested both physically and iconographically. We should therefore see the appearance of the PSF3SA in the later 2nd millennium BC rather as a diversification of anchoring culture, and possibly even a limited one, lasting only about two or three centuries, with its statistical floret being in the 13th and 12th centuries (Fig. 9).

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13 However, Dickson reports the Arabian '*sinn*' (PSF2SA) to be of particular use on rocky bottoms (1959: 482, a), while Bowen purports to its functionality on 'flat muddy bottoms' (1957: 290).

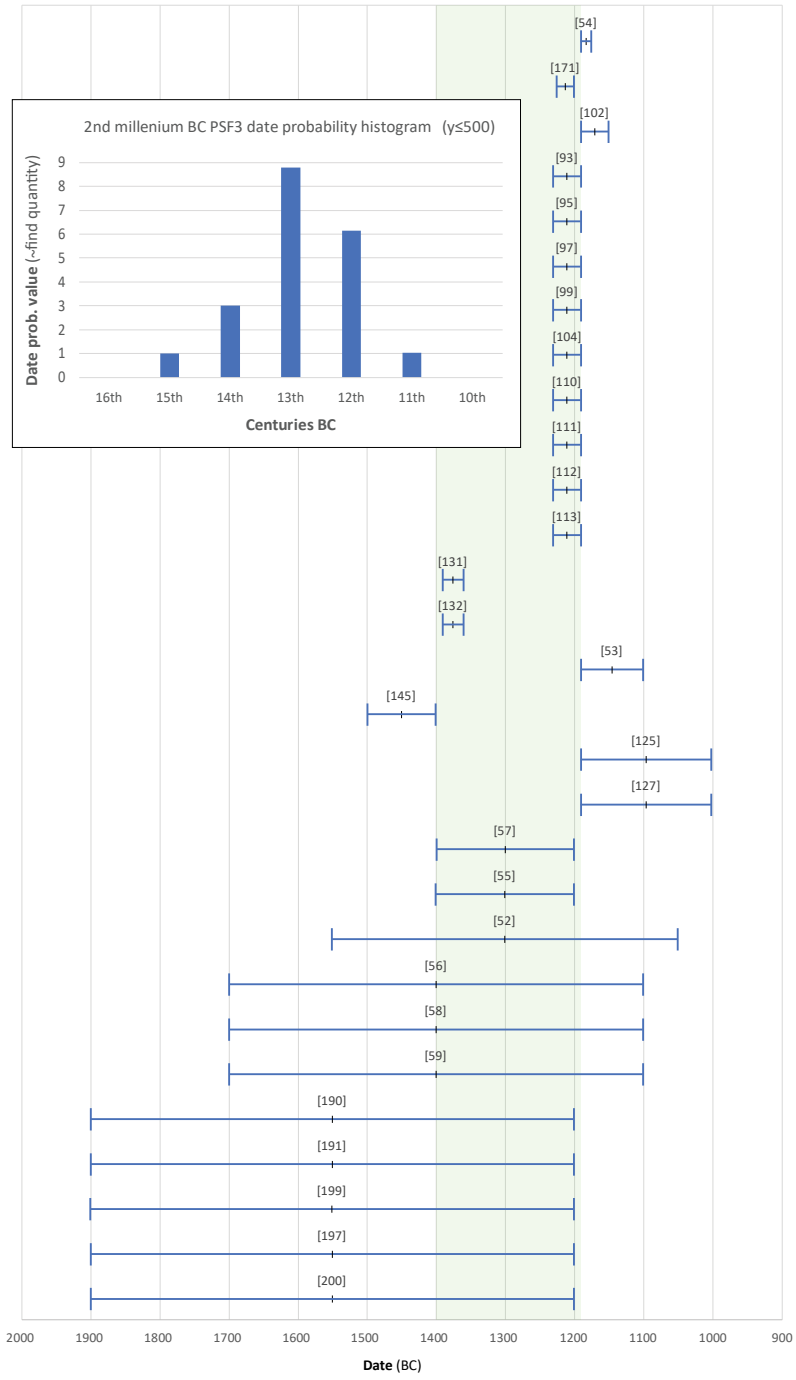

Figure 9. Date distributions of 2nd millennium BC PSF3 dated finds along with their date-probability histogram (inset, illustrating statistical floret), the latter only including those objects with maximum five centuries or less date ranges. The green highlight represents the period of statistical certainty of the existence of PSF3 (the late 15th to the early 12th century BC) defined by the find with the earliest late-date of its date range [145] and those with the latest early-dates of their date ranges ([53], [54], [102], [125] and [127]).

	Number	Catalogue Nos
PSA	83	34, 35, 51, 61, 62, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 87, 88, 89, 90, 81, 94, 103, 247, 248, 249, 250, 273, 275, 276, 289, 109, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 126, 128, 129, 130, 146, 173, 174, 175, 176, 177, 183, 189, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225
PSF3	17	53, 54, 57, 93, 95, 97, 99, 102, 112, 111, 113, 110, 125, 127, 131, 132, 171

Table 5. Anchor-stones dating 14-11th centuries BC.

Furthermore, temporal distinction of PSA and PSF3SA may also be matched by geographic variation. Particularly, the number of PSF3 dated to the 2nd millennium BC is significantly higher west of the Levant (73%):[14] suggesting that there is a 'west of the Levant' connection.[15] Particularly remarkable is the number found at Cyprus, specifically 2/3 of the whole assemblage. To this a PSF3 from Israel is inscribed with a Cypro-Minoan symbol ([52]; no. 102 of Masson's classification, 1974: fig. 4).[16] Correspondingly, McCaslin (1980: 47) and Raban (1988: 287) also connect the markings of a PSF3 from Ugarit [199] to Cypro-Minoan script.[17] Basch argued that the form of another PSF3 example [82] from Egypt matched well with a find from Hala Sultan Tekke and another example from a sacred dedication context at Kition (1978: 120-121). Ultimately, three-quarters of the 2nd-millennium-BC datable PSF3 are either found on Cyprus or arguably attributable to the island.[18] The remaining finds all derive from Ugarit or its out-port Minet-al Baida, sites known to have uniquely strong connections

14 22 (Cyprus [53], [54], [55], [56], [57], [58], [59], [93], [95], [97], [99], [102], [104], [110], [111], [112], [113], [125], [127]; Greece [131], [132], [171]) vs eight (Egypt [82]; Israel [52]; Syria [145], [190], [191], [197], [199], [200]).

15 Raban had previously proposed that the PSFSA was an innovation brought with the Sea Peoples in the 13th century BC (1988: 284-288 and 293). However, Shaw (1995: n. 12) argues that the Sea Peoples may not be the agents of PSFSA importation since there are eastern Mediterranean PSF3 finds dating prior to the 13th century BC (see Fig. 9, taking the normative notion that the Sea Peoples have an Aegean origin). Additionally, in context of the near absence of stone-frames and PSA in the second half of the 2nd millennium BC Aegean, Wachsmann's suggestion that anchoring culture there was based on a largely wooden anchor type, with a ballast stone that is as yet unidentified in the archaeological record, is viable at least for the 2nd half of the 2nd millennium BC (1998: 275, 279; 2000: 815-820). Toth's suggestion (2002: 86, 92) that the staked anchor can be traced to Harappan India lacks a demonstrated supporting example.

16 Cypro-Minoan text is regularly identified with Cypriots specifically (*i.e.* Nikolaou & Catling, 1968: 229; Wachsmann, 1998: 61).

17 Specifically, these authors cite a small pierced stone from Enkomi with similar markings that had been identified by Dikaios as such (1969: 205; cf. Frost, 1991: 366 and 377). Frost (1991: 377) further reports a personally communicated comment by Dr Olivier Masson that the sign might be Aegean in origin.

18 Several investigations have been made on stone samples, primarily at Kition and Ugarit, in an attempt to provenance them. While provenancing sedimentary stones remains speculative, the great majority have been compatible with nearby sources (Mascle, 1985: 320-321; 1991: 373-374). Frost, accordingly, proposed that terrestrially dedicated PSA and PSF3 would regularly have been made on site, rather than transporting them from the ship (1991: 371-372). The geologic analysis from the two PSF3 found at Kommos ([131], [132]), Crete, suggested a provenance in Malta or east of Crete. That they were found with Cypriot and Levantine sherds, along with an absence of ancient stone-frames from Malta, supports the latter option (Shaw, 1995).

with Cyprus. It can therefore be postulated that Cyprus in the second half of the 2nd millennium BC, particularly, is connected to the PSF3SA.

It is possible to further isolate this phenomenon by limiting the data sample used to those anchors with date ranges wholly within the statistically certain period in which the PSF3SA existed: the late 15th through to the early 12th centuries BC (Fig. 9). These examples suggest that PSA continued to be the primary design employed along the Levantine coast during this period. Terrestrially, only PSA have been exposed (Tel Abu Hawam ([184], [185], [186], [187], [188]), Tel Michal [189] and Minet el-Beida [146]). Added to this, the Uluburun ship, with its PSA, is believed to have originated just north of the Carmel coast (Pulak, 2008: 299 and 303). The PSA identifying the Kfar Samir ship assemblage were found nearby.[19] In comparison, all the PSF3 of this same chronological limitation are found on Cyprus (Hala Sultan Tekke [54], [55], [57]) and Kition ([93], [95], [97], [99], [104], [110], [111], [112], [113]) or further west at Kommos, Crete ([131], [132]); while the only relevant shipwreck, the Point Iria, identified as Aegean, albeit with an important portion of its cargo being Cypriot, carried a PSF3 ([171]).[20] In this light it is also compatible that all six relevant anchor-stones identified with Cypro-Minoan symbols are PSF3 ([52], [54], [55], [57], [112], [199]), and none PSA. One PSF3 from Cyprus had the eye completed while the two arm-holes were incomplete [104] suggesting that at least the arm-holes were being drilled on the island. Ultimately, for the Bronze Age broadly, it appears that the culture of PSA use is attributable to the continental Near East, while the Late Bronze Age PSF3SA use is attributable specifically to Cyprus.

However, complicating this pattern are 24 PSA examples found on Cyprus within this date range, incidentally all terrestrially at Kition ([90], [91], [92], [94], [96], [100], [105], [106], [107], [108], [109], [114], [115], [116], [117], [118], [119], [120], [121], [122], [123], [128], [129], [130]). This is a significant number considering that only 12 PSF3 are known from this date range on Cyprus ([54], [55], [57], [93], [95], [97], [99], [104], [110], [111], [112], [113]). One factor for this discrepancy may be that PSA may be more likely than PSF3 to be exposed on land due to being more conspicuously functional as secondary building stone (that is a stone with three piercings is likely more fragile than a stone with only one). Another possibility is that PSA were indeed commonly employed also by Cypriot sailors. Perhaps Cypriots employed both types in their anchor complements, in a manner such as Frost suggested, and we merely lack a supporting Cypriot wreck assemblage to demonstrate this. Alternatively, one might consider that the Late Bronze Age Levantine sailors would have had particular incentive to sail to Cyprus, not least for its copper resources. Since it was a difficult, uniquely open-sea voyage, they were particularly pleased to arrive safely and therefore likely to dedicate

19 Although potentially dating a generation later than the confined dating considered here, two PSA ([34], [35]) from the Cape Gelidonya A assemblage deserve note, being a mainland Levantine derived vessel that took on cargo in Cyprus before wrecking upon the Anatolian coast.

20 This PSF3's small size and uniquely symmetrical form is remarkable. See note 15 for suggestion that anchoring culture in the Aegean at this time was rather based on an as yet unidentified (and therefore distinct) form, so that the remains of the ship's anchors – apart from the PSF3 example – were not recognizable during excavation. In this regard, three stones found close to the Point Iria PSF3 separated from the main ceramic assemblage are intriguing but unfortunately not illustrated (Vichos, 1999: 78).

an anchor in veneration. It is therefore also conceivable that the PSA found at Kition were made and originally dedicated by specifically Levantine sailors.

In conclusion, throughout the 2nd millennium BC, PSA remained the anchor type preferred by Levantine sailors. Cyprus, on the other hand was relatively economically isolated from the mainland through the first half of the 2nd millennium. For the second half, even contemporary material culture of well-published and well-connected Kition and Ugarit display profound distinctions (Brody, 1998: 50). While Cypriot anchor-stone anchoring culture was logically influenced by the neighbouring Levantine PSA tradition, its relative isolation proved fertile ground for the development of their own variation, one incorporating additional piercings and stakes. This is not to say that PSA could not regularly have been employed by Cypriot sailors in the late 2nd millennium. At least it seems that the PSF3SA played a more important role on Cyprus than in the Levant during its period of use, possibly limited to the 15th through to the 12th centuries BC. Conversely, there is no specific detail among the robust Levantine anchor evidence that Late Bronze Age Levantines ever adopted the staked anchor, so the anchor tradition distinction could well have been absolute. The implications for our understanding of Late Bronze Age Cypriot and Levantine interconnections is that they were rare enough to promote conspicuous distinction in anchoring tradition. These regions were, after all, separated by a formidable open-sea voyage.

Between an 11th/10th-century-BC dated PSA [101] from Kition and the early 8th-century-BC Tanit and Elissa wrecks we have a lacuna of anchor evidence,[21] and can merely interpolate that only PSA continued in regular use by both Levantine and Cypriot sailors into the 6th/7th century BC. It is conceivable that the Iron Age PSA usage in Cyprus was influenced by the inhabitant Phoenicians, a culture that developed in the Levant. By the time the Phoenicians established themselves on the island, the Cypriot PSF3SA culture may long have disappeared, coinciding with the general decline of the Bronze Age economy. Alternatively, the Phoenician establishment on Cyprus may itself have been the cause of the loss of the staked anchor-stone tradition there. Whatever the case, the archaeological reappearance of the PSF3 by *c.*500 BC[22] could testify to a reinvention of the PSFSA at a time when the stock-anchor was also novel.

21 A PSA [103] from broadly dated 'Phoenician' context at Kition must also be mentioned, particularly considering that its large size (*c.*0.2 m^3) is uncharacteristic for the historic period (Fig. 8).

22 The 6th century BC at Isola delle Femine [81] and/or 5th century [80], and another [178] encompassing these dates from Shiqmona… and feasibly contemporary to Atlit. The several stone-frames and PSA recovered from within Atlit's harbour basin (McCaslin, 1980: 39-44; Raban, 1988: 288 and 1996: 504-506) are more likely to be from the later centuries of the harbour's employment (active between the 9th/8th through the 4th century BC, Haggi, 2006: 54) due to the absence of sealing stratigraphy along this high-energy sandy coast, and heavy recovery activity occurring in active harbours generally.

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The Archaeological Mission of Marsala: the Punic Ship Project

Pietro Alagna

This paper discusses the research that Honor Frost, a great woman and a dear friend, undertook in Marsala, Sicily. Frost's excavation there of the Punic Ship was supported by the author and his company, Cantine Pellegrino winery. The Punic vessel was discovered quite by chance. In 1969 the Sicilvetro Glass Company of Marsala had decided to create a new line of bottles; to do so, they planned to collect sand off the coastline of Marsala and, more specifically, the sand from around the Isola Grande of the Stagnone Lagoon. Dredging began around Punta Scario, which led to the discovery of ship timbers that were quickly recognized as having been fashioned in an unfamiliar way when compared with the local wooden boats and ships used at the time.

The captain of the dredger, Diego Bonini, brought these unusual timbers to the attention of some archaeologists who were staying at the time on the island of Mothya, property of the Whitaker family. They included the German archaeologist Gerhard Kapitän, who knew Frost and her studies of the ancient ports of the Near East. He thought she would be the right person to provide the appropriate expertise to determine the origins of those shipwreck timbers. Kapitän told Frost of the discovery and invited her to Mothya. Frost gladly accepted and she too was welcomed by the property owner, Delia Whitaker.

Frost was a perfect candidate to explore the area and conduct high-level scientific work. She immediately recognized that the timbers came from an ancient shipwreck, and made plans to explore the territory where the dredger had been operating. At first it was not certain which timbers belonged to which ship, since initial surveys in that area identified more than 16 different ancient wrecks. The Punic Ship of Marsala was discovered at the end of the following season, in August 1970, and was studied and recovered over the next three years.

Being respectful of the archaeological importance of the discovery and mindful of the requirement to secure the necessary permits from the Ministry of Cultural Heritage, the British School at Rome obtained a permit for archaeological research naming Frost as director of the Punic Ship Project. The Archaeological Superintendency of

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 245-248. Leiden: Sidestone Press.

Palermo, which was responsible for this part of Sicily, did not participate directly in the excavation, but monitored the work being conducted at the site over the course of several fieldwork seasons.

Once authorization had been granted, Frost returned to Marsala. With the help of Edoardo Lipari, a wine-making expert and bailiff administrator for Whitaker at Mothya, she obtained from the local branch of the Guardia di Finanza (finance and customs police), the use of an old, abandoned building situated near the beach where the first wreck remains had been found. Frost used the building as a base from which to organize her first survey mission. Although the building was in the optimal location it lacked facilities: there was no drinking water, no electricity, and access was difficult. Despite these challenging conditions, Frost and her colleagues kept the work going with considerable success.

I was first informed about the shipwreck investigation by Lipari in the late summer of 1971, and my collaboration with Frost began at the end of the second field season at Marsala. My involvement was not only administrative, but had important technical and material aspects as well, given the scarcity of means and financial resources at the project's disposal.

Firstly, I made available a villa located in Santa Venera, in the suburbs of Marsala. It had wide, open spaces and storage rooms, where Frost started planning the following season, and where she developed the framework for the project's complex organization.

She searched for staff to participate in the excavation, sending out invitations to all the interested archaeologists, professional and non-professional alike. Forty people came from every part of the globe. Among them were William Culican, an Australian archaeologist and expert in ancient ceramics, a young Canadian woman who specialized in making plaster casts, and the Sicilian archaeologist and illustrator Francesco Lombardo, as well as several underwater photographers.

Contrary to what many people might have expected, the recovery operations took time.

First of all, Frost needed to conduct the research under water: she wanted to document everything found on the seabed with photos and meticulous drawings as her team proceeded with cleaning the site through the removal of seaweed and sand, and before everything was brought to the surface.

Many professionals abandoned the project: only the most dedicated and passionate remained.

After the underwater documentation was completed, the recovery of the ship timbers began. Together with Lipari, we provided Frost and her team with a barge that was normally employed for transporting salt between the saltworks of Trapani and Marsala. We also provided the assistance of a seaman, Stefano Passalacqua, who participated for the entire duration of the mission over several years.

The ship's timbers were retrieved and desalinated with clean running water, using vats that Pellegrino winery workers had built specifically for the purpose. Initially, these were located at Santa Venera and at our house in Via del Fante in Marsala; later on, they were kept at the Archaeological Superintendency in Via Bara, Palermo.

Once the wood had been desalinated, conservation treatment was carried out. For this purpose, a new storage room was built at Santa Venera. Following the instructions of Michael Katzev from the Kyrenia project, and with the assistance of technicians from Cantine Pellegrino, Frost set up a wood conservation treatment system using

polyethylene glycol (PEG). This water-based wax solution was carefully monitored as the concentration and temperature of the solution was progressively increased over time. The process involved several stainless-steel vats, provided with an oil heating system that was automatically regulated with thermostats. There were several small centrifugal pumps installed inside the vats to allow the circulation of the PEG solution. The timbers were lowered into the vats with the help of small hydraulic cranes. After about three years, the wood was removed from the vats and placed on designated shelves inside the storage room to dry.

The Archaeological Superintendency of Palermo would have preferred the assembly and reconstruction of the vessel to take place in Palermo, but the project team and local citizens were determined to keep the vessel in Marsala. To achieve this goal, it was necessary to find a local building that could be completely dehumidified. The decision was made to convert the Baglio Anselmi, an abandoned warehouse along the sea front, into the Museum of the Punic vessel. In order to adapt the large room into an exhibition space, we bought an industrial dehumidifier, which was installed and worked for several years. Later on, the Superintendency fitted the building with an air-conditioning system (see Giglio, this volume).

I have been linked to the Punic Ship Project by 50 years of memories. It has been a stimulating adventure that has enriched me not only on a cultural level but also on a personal one. My family is bound to Honor by 50 years of sincere and mutual friendship, and also of deep regard and affection.

The History of Marsala's Shipwreck Exhibition: from its beginnings to the present

*Rossella Giglio**

**Soprintendenza per i beni culturali ed ambientali, Trapani*

I first met Honor Frost in Marsala, Sicily, during the excavation of the Punic Ship wreck (1971-1974). The project was a massive undertaking for which Frost was awarded the Honourable Citizenship of the city by the Sicilian community. The international scientific community also recognized the importance of the discovery – and the well-deserved tribute.

Frost originally accepted me with some reservations; I was too young to participate in the British mission, but I began to learn about the work of the archaeologist, which I would subsequently choose as a profession. At the time, I was president of a large group of Archaeoclub volunteers, and was able to liaise between the government institutions and the public to encourage the valorization of the wreck remains and the work then underway.

I would first like to briefly share a few episodes from my personal memories with my 'old' friend Honor, and the long days that we spent by the sea and the afternoons with a cup of tea or a glass of Marsala (Fig. 1). Honor was the kind of woman who spoke frankly. She told me thousands and thousands of stories: about the Mediterranean and underwater activities, about Cyprus and Lebanon, anchors and relics, about people and the novelties of underwater research. I was warmly welcomed in her homes in London and Malta, and spent holidays with Honor and her friends in Kent, where we visited some of her beloved spots.

I remember the magnificent dining-room at Welbeck Street, and the strange and unusual shapes that looked down at us from the great paintings by Graham Vivian Sutherland, among others, some of which are now hanging in the Tate Gallery (Fig. 2). In the 1950s, as a guest of Sutherland in Venice, Honor met Carlo Levi, a painter of the neo-realist group, on the Lido beach: Levi carved an owl-shaped octopus 'bone' for her, which now enriches my own collection.

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 249-258. Leiden: Sidestone Press.

Figure 1. Honor Frost and Rossella Giglio in Athens, 1991. (Photo R. Giglio).

Figure 2. Honor Frost and Rossella Giglio at 31 Welbeck Street (1982) in front of Untitled 7 *by Stanley Spencer. (Photo R. Giglio).*

Honor gave both useful and difficult-to-obtain gifts: tools, bijoux, and books. She sent bibliographic references from all over the world, alongside the latest news, delivered in regular correspondence over 35 years (Fig. 3). There are handwritten letters and postcards filled with minute writing, which I have kept meticulously, in which she tells of her scientific activities around the world, as well as ordinary daily activities, including the exhausting maintenance of her old and beautiful London home.

I remember her recounting important scientific gatherings in Palermo, Rome, and Athens, the last of these for TROPIS, the International Symposium on Ship Construction in Antiquity, where she met up with her friends Harry Tzalas, Michael Katzev, George F. Bass, and Lucien Basch and discussed a variety of research topics with them.

Figure 3. Honor Frost's correspondence to Rossella Giglio. (Photo R. Giglio).

Figure 4. Honor Frost and Rossella Giglio at Calatafimi-Segesta (2009). (Photo R. Giglio).

In January 2009, I visited her in London; she talked of visiting Marsala the following Easter, when she would photograph the 1st-century-BC carved ship rams found at Calatafimi-Segesta for her friend Lucien Basch (Fig. 4). The last time we met was in London in February 2010.

Shipwreck

Let us return to raising the Marsala shipwreck, off Isola Grande, Sicily. The scientific research that was conducted between 1971 and 1974 included *in situ* data collection, wood recovery using innovative methods, and the immediate conservation of the timbers – operations that are still relevant today.

After the wreck remains were raised, between 1975 and 1978, the wood was kept in tanks and treated with PEG (polyethylene glycol) (see Pomey, this volume, fig. 25). Experiments were carried out with various concentrations of PEG in the water and at different temperatures, until a sufficient degree of consolidation of the wooden structure was achieved. The slender shipwreck is preserved to a length of about 10 m and is 3 m wide, representing the stern and part of the port side. It was discovered in close proximity to the supposed location of the naval battle that, in 241 BC, ended the First Punic war fought off the Egadi Island of Levanzo, Sicily.

The recovered hull-remains enabled the original length of the ship to be estimated at 35 m, with a width of 4.80 m, and tonnage of 120 (Frost *et al.*, 1981). It could have carried a crew of 68 rowers, 34 per side, to operate the 17 oars located on each side. The hull is made with a single layer of planking supported internally by a skeleton of regularly alternating framing timbers; the exterior of the planking was coated and protected by lead sheathing fastened with copper nails.

One of the most exceptional attributes of the Punic shipwreck find is the presence of carpenter's guide lines and letters of the Phoenician-Punic alphabet, scored and painted on the frames in two sequences (Frost *et al.* 1981: 232, fig. 146; Frost, 1993; Johnstone, 1983; Pomey, this volume, fig. 22). These would have aided the assemblage of different elements shaped separately using predefined templates. The marks and letters enabled the procedures, construction techniques, and phases followed by the Punic shipbuilders to be reconstructed. The shell-based ship was built at a remarkable speed, almost in series according to what ancient sources such as Polybius tell us (Histories, 20).

The freshness of the wooden frames, as well as the presence of tool marks, indicates that the ship was new and was built in a hurry. In fact, the resin used to fill the voids between the sheathing and planking did not have time to harden (Frost, 1972: 263-265).

The ram at the bow was reconstructed thanks to the discovery and retrieval of a 'sister ship', a second wreck located about 70 m from the Punic Ship, that retained this element (the starboard tusk, plated in bronze) (Frost, 1975; Basch, 1996).

Rams

To place the Marsala finds in context, at present 19 rostrums or rams have been recorded since 2005 in underwater archaeological research into the battle of the Egadi Islands – conducted by the Soprintendenza del Mare in conjunction with RPM Nautical – using deep-water survey equipment in the sea east of Capo Grosso, the northern-most tip of

Figure 5. Some of the Egadi rams and rostrums on display at the former Florio Tuna Fish Plant in Favignana and Formica. (Photo R. Giglio).

Levanzo Island (Tusa, 2005; Tusa and Royal, 2015). A number of these rams are exhibited in a new display organized by the Superintendency of Trapani in the former Florio Tuna Fish Plant in Favignana and Formica (Fig. 5). These important finds begin to give a real insight into the dynamics of the Egadi battle. Some of the rams bear inscriptions: Egadi 1 has a Latin inscription in four lines (*gnoli*); Egadi 4 bears an inscription in two lines topped by a decorative winged Victoria (*Oliveri*) in relief; Egadi 3 displays a Punic expression to ward against enemies. The Latin inscriptions were intended to ensure the congruity of the operation that had produced the weapon, and probably also to check their weight: 'C. Sesto, son of Publius, and Q. Salonio, son of Quinto, sevires, carried out rostrum testing', or the 'Quaestors C. Paperius, son of Caius and M. Populicius son of Tiberius has approved'. The Carthaginian ram displays instead a curious curse formula.

Museum history

In 1986, the Baglio Anselmi, Lilibeo Museum in Marsala, a 19th-century industrial building that was built as a wine factory, was dedicated to housing the wreck of the Punic Ship, under the jurisdiction of the Superintendency of Trapani. The ship has remained there ever since (Figs 6-7).

Following the conservation treatment, the Punic Ship timbers needed to be kept in an air-conditioned environment to remain stable. In an attempt to achieve this, the ship was covered with a large tent during the long renovation process of the museum building (Clarke, 1985; Basch, 1997; Farrar, 1989; Frost, 1997; Giglio & Boetto, 1999). In May 1999, the building restoration work was completed and the exhibition area could be fully air conditioned. Honor Frost had ensured that the hull fragments were displayed from 1978, however: the hull timbers were mounted on a metal frame assembled in 1978 by local technicians, the Bonanno brothers, according to the hull lines suggested by engineer Austin P. Farrar, to give the impression of the original hull shape.

Figure 6. The Baglio Anselmi, Lilibeo Museum in Marsala. (Photo R. Giglio).

Figure 7. Honor Frost and Rossella Giglio at Baglio Anselmi, Lilibeo Museum in Marsala (1983).

In recent years, the museum has become a major tourist attraction. As well as the ship remains, it offers a comfortable conference room and has well-equipped stores for the conservation and restoration of excavated finds. Many artefacts from excavations in the area are stored here and the Superintendency of Trapani uses the space for scientific and cultural activities.

As advised by Frost in 1990, the Superintendency of Trapani carried out a series of preliminary studies and measurements and commissioned Ole Crumlin-Pedersen and Paul Jansen of Roskilde Museum, Denmark, to investigate the stability of the hull and to help with the construction of a new metal hull support (Fig. 8).

In the following years cultural initiatives, exhibitions, and research projects of national interest have been promoted at the museum. They included the 'Study of the Chemical Transformation of Synthetic and Natural Polymers in the Conservation of Wooden Materials' project, the European project Navis I, which includes a catalogue of all the European museums exhibiting ancient wrecks (http://www.waterland.net/navis/),

Figure 8. The team of Paul Jansen, Ole Crumlin-Pedersen, Rossella Giglio, Pietro Alagna, and Giulia Boetto beneath the ship in 1992.

Figure 9. The Punic Ship in the renovated Baglio Anselmi, Lilibeo Museum in Marsala. (Photo R. Giglio).

and a national conference on 'Diagnostics and Conservation of Wooden Artefacts', organized by the Interuniversity Network between Palermo, Pisa, Genoa, and Milan Bicocca universities.

The exhibition is now housed in a newly renovated museum (2017) with modern facilities (updated wiring, fire and intrusion detectors, air conditioning, security and video surveillance), all carried out by the Superintendency of Trapani (Fig. 9). The

exhibition halls have been re-designed and previously unexhibited finds from Frost's excavations and others carried out in the region have been added to the display. New displays provide updated information, and a suspended, transparent walkway has been constructed around the hull, allowing visitors a close-up view of the ship timbers, as had always been Frost's intention. The wood has also been cleaned, thanks to sponsorship by the Cantine Pellegrino (see Alagna this volume).

Cases display the onboard ceramics and a variety of materials (ropes, spatulas, nets, baskets, twigs of *phylleria* and *Cannabis sativa*, a brush made of esparto, and cork stoppers) and metal objects. Of specific significance are the elements that come from the wreck itself, the nails and elements of metal, now exhibited to the public for the first time. These finds, along with the epigraphic data and radiocarbon analysis, date the ship to the middle of the 3rd century BC: most likely it sank on 10 March, 241 BC, during the naval battle that ended the First Punic war and which was fought in the Egadi seas between fleets at the command of the Carthaginian Annone and the Roman Lutazio Catulo.

The richness of the archaeological deposits of this area of the Mediterranean have been confirmed by the presence of other wrecks now housed in the Marsala Museum such as the 'A' wreck discovered in 1983 near the Lido Signorino beach, Marsala (dated to the second half of the 7th century AD), and the late Roman wreck of a cargo ship found off Marausa beach in 1999 (Tiboni and Tusa, 2016), as well as a wide range of amphorae that can be traced back to several production centres from a long chronological period. Also on display are the chance finds of the statue of a warrior (a Roman copy made in the Severian period of a Greek statue) that was found 200 m from Capo Boeo in 1957 and, more recently, the golden treasure of jewels found in excavations at Marsala in the 1950s and 1960s that date to the Hellenistic period.

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The Second Life of a Phoenix

Honor Frost's unpublished chronicles of a Punic ship in Sicily

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> How many times can a phoenix rise? The creature of which I tell emerged from waves not flames, resuming its shape only to face another, perhaps final threat of destruction. […] You will have guessed that beneath this word-play lurks the Punic Warship and 'Phoenix' alludes not only to its resurrections, but to its lineage as well. (Honor Frost, Phoenix ms, p. 1)

These are the words with which Honor Frost begins her account of the Punic Ship Project in an unpublished book manuscript that we discovered in 2013 among her archive papers, then temporarily stored in London. To the community of archaeologists and ancient historians, the Punic Ship Project is familiar as a mid-3rd-century-BC longship found in 1971 off the western coast of Sicily near Marsala, by a team led by Frost; a wreck that was fully excavated, conserved and made ready for museum display by Frost during the 1970s and early 1980s (Frost, 1971; Frost *et al.* 1981). As illustrated so beautifully in Pietro Alagna's paper included in this volume, the success of the project could not have been accomplished without an array of serendipitous encounters and dovetailing coincidences, of people and places. And, as Rossella Giglio recounts in her paper (see Giglio, this volume), the vessel's surviving remains can be visited today in a newly revamped exhibition at the Museo Archeologico Regionale Lilibeo-Baglio Anselmi, the archaeological museum of ancient Lilybaeum (modern Marsala). Nevertheless, the story of this ancient vessel and its recovery, and the people involved in its care and preservation to the present day, is decades-long and complex.

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 259-272. Leiden: Sidestone Press.

Now, just over 40 years since Frost completed the final excavation report in 1976, we see that the phoenix-boat rises yet again in the form of a popular book that she began writing entitled *The Second Life of a Phoenix. Portrait of a Punic Ship Resurrected in a Sicilian Town* (hereafter: *Phoenix*).

To come across a manuscript of Frost's, one that was apparently kept closely under wraps for many years, is an important event for scholarship and for researchers interested in the history of archaeology. As we also hope to show, it is particularly valuable as a source of insight about Frost, her community of friends and colleagues, and the respect and affection that she inspired among the people who knew and worked with her most closely in western Sicily.

In this paper we present preliminary research, conducted under the auspices of the Honor Frost Foundation, on Frost's unpublished and unfinished manuscript about the Punic Ship Project and its environs. We offer a snapshot of the manuscript's contents, and an outline of how we would like to place the story in its historical and cultural context. And we share some discoveries from our related oral history research, which has taken us from Marsala to London and beyond, reaching out to project participants in order to collect their particular and unique perspectives on the experience and its meanings over time. The challenge now is to untangle the history of the manuscript and to determine how this previously unknown work of Frost's would best be valorized and showcased, as she herself would have wanted.

The rediscovery of the *Phoenix* manuscript

Elena Flavia and I found the manuscript in March 2013 while on a quick stopover in London following a research trip to Marsala, as part of our first historiographical project on the Punic Ship (funded by the Honor Frost Foundation; Castagnino & Calcagno, 2013). We had travelled to Sicily and Rome to review several archives, and to begin collecting videotaped testimonies from research project participants. During our visit to Marsala, thanks to the generosity of the Alagna family, we were able to host a day-long reunion and seminar with former members of the excavation project at the Cantine Pellegrino, with the aim of sharing and collecting stories, memories, and mementoes of the Punic Ship Project. A few days later in London the Honor Frost Foundation kindly gave us access to a selection of materials related to the Punic Ship Project, at its offices in the British Academy.

Among all the boxes and binders that we perused, many with handmade labels decorated with Frost's own distinctive sketches, there was one green box mysteriously labelled 'PHOENIX'. It contained a three-ring binder of typed pages; the very first words, reproduced at the beginning of this paper, immediately revealed what the find was about. It is hard to describe the thrill that we felt: a deep connection to Frost who was reaching out to a broad audience. And it would seem that we were among the first – certainly in a long time – to read her words.

The PHOENIX box also contained several folders of research notes, text revisions, additional chapter outlines, lists and copies of illustrations, bibliographies, and correspondence with potential publishers. It was a collection of papers relating to a publishing project that clearly covered several years of Frost's life. In May 2017 we were once again granted access to the Frost archives to expand on our first, brief read-

through. By this time the collection had been professionally catalogued to archival standards – a great gift to scholarship for future generations, accomplished thanks to the vision and generosity of the Honor Frost Foundation – and was being stored at the RESTORE warehouse facilities in Upper Heyford, Oxfordshire. Since June 2018, the Honor Frost Archive Collection is permanently stored at the University of Southampton Special Collections, Hartley Library (Honor Frost Archive MS 439).

The manuscript

The binder comprised the first seven chapters of Frost's book in 139 pages. These covered the project from Frost's very first visit to western Sicily in the summer of 1969, at the invitation of her friend and colleague Gerhard Kapitän, through to the end of the third archaeological fieldwork season, in 1973. The chapters appear to be almost completed drafts, with occasional handwritten corrections and amendments that at times become fairly dense. Apparently Frost stopped writing before she had tackled the last excavation season, which took place in 1974.

In this book draft, Frost provides context for ancient Lilybaeum's place in the central Mediterranean world, from its Phoenician connections to its environmental surroundings, which directly impacted the nature and process of shipwreck discovery in the area. In addition to her account of the project's evolution and the people who made vital contributions over the years, she also writes about the history of archaeology in the region, including the enduring English connections to western Sicily, both in archaeology and in the wine industry. Once survey-finds recovered during fieldwork begin to point to a possible link to the sea battles of the Punic Wars, which had taken place nearby, among the Egadi Islands, Frost provides a scholarly review of the evidence to date.

While anyone can read a chronology of events in the official *Lilybaeum* excavation report, published by the Accademia dei Lincei in the *Notizie degli scavi di antichità* series in 1981, the *Phoenix* manuscript goes into detail of how serendipitous Frost's arrival in Sicily – let alone the discovery of the famous Punic Ship – actually was. She had initially planned to conduct anchor research in Crete during the summer of 1969, but a change of plans led her to accept Gerhard Kapitän's invitation to visit Mothya and its *kothon*, an ancient artificial basin of enigmatic function. While somewhat curious about Mothya, as she confesses, Frost had little interest in the western branch of the Phoenician seafarers: her heart belonged to the Levant. Frost recounts that it was during this visit to Marsala that the dredger captain Diego Bonini and Edoardo Lipari, the bailiff at Mothya, approached Kapitän and her with the news that ancient ship timbers had been found in shifting sands near Marsala. After recognizing that there were the remains of several vessels of interest, including a Roman ship carrying a cargo of tiles, Kapitän and Frost returned with permits in 1970 to conduct their first underwater field survey. In fact, that tile cargo was never found again – re-hidden beneath the shallow shifting sands (or perhaps falling prey to local thieves). They proceeded to conduct surveys of the area, coming across several artefacts that pointed to possible Punic connections, but little that seemed substantial. It was only towards the end of the second field season, during a line survey in August 1971, that the team photographer, David Singmaster, went off course to retrieve a lost marker, and discovered the stern of the Punic Ship jutting up from the

Figure 1. Honor Frost with Punic Ship Project team members including David Singmaster (with black beard) (Summer 1971). (Source: Honor Frost Foundation, original Frost archive slide collection, accessed 2013).

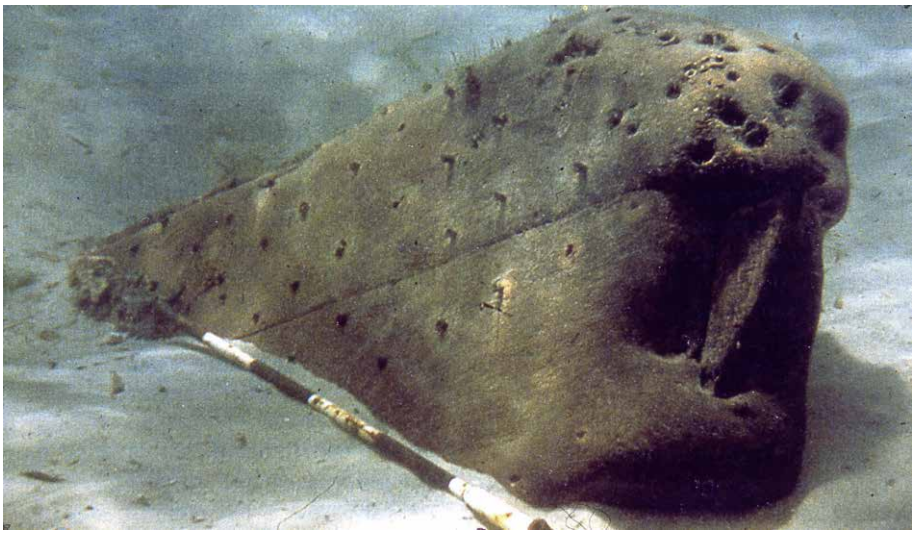


Figure 2. One of the first views of the Punic shipwreck jutting up from the sandy seabed, as found in August 1971. (Source: Honor Frost Foundation, original Frost archive slide collection, accessed 2013).

sandy bottom (Figs 1-2). This is all written up in the *Lilybaeum* excavation report – but in the *Second Life of a Phoenix* it is described much more picaresquely.

In fact, as part of our oral history project, we had the good fortune to track down David Singmaster to hear his own account of what that initial moment of discovery was like (Figs 3-4). We were the first archaeologists to have contacted him since 1971; he kindly agreed to an interview, which will soon become part of the Honor Frost

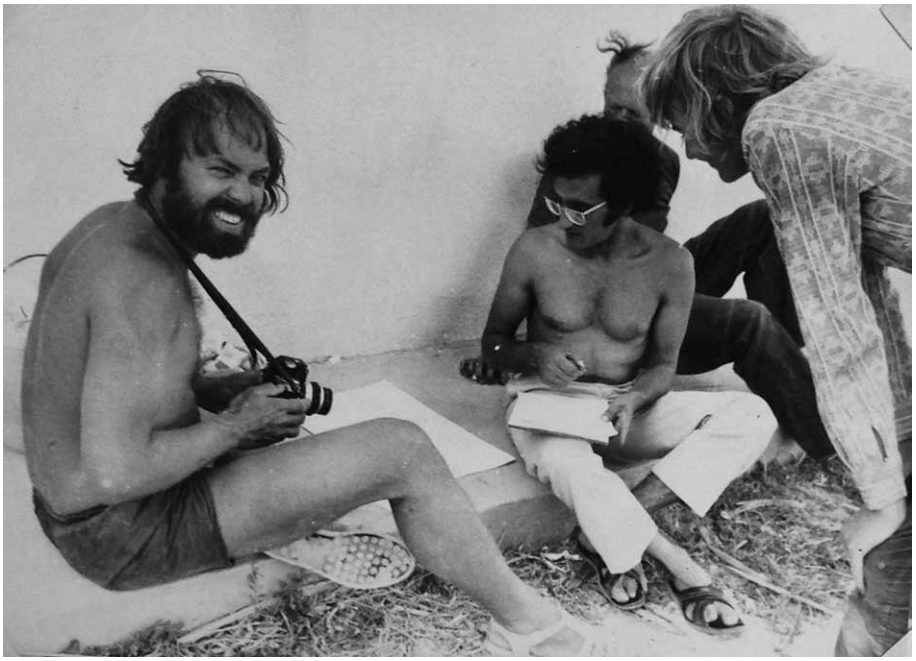


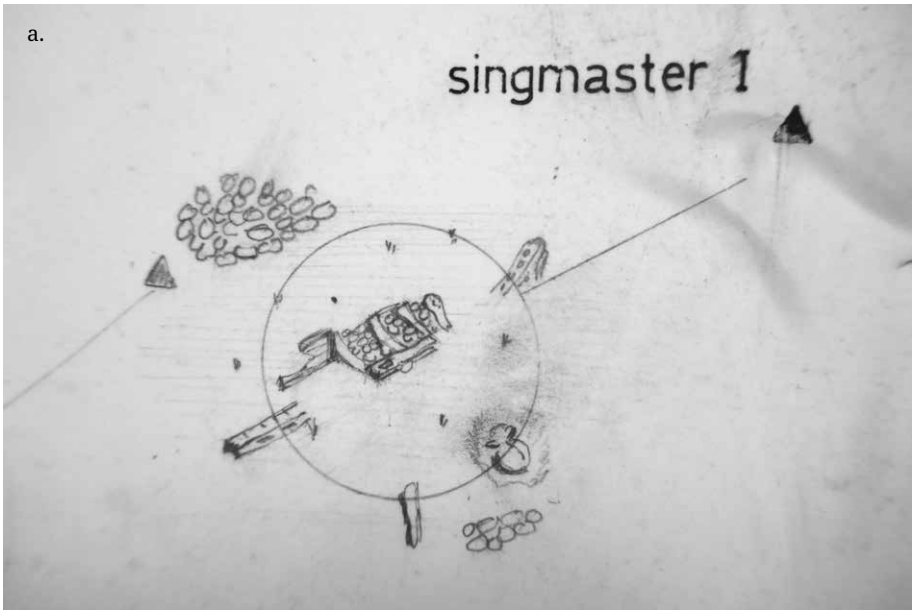
Figure 3. David Singmaster photographing the recovered artefacts at the campsite during the 1971 archaeological field season. From a binder of project snapshots. (Source: Honor Frost Foundation, original Frost archive, accessed 2013).

Foundation *Soundings Project* collection of oral histories, maintained with her archive collection at the University of Southampton (Calcagno & Blue, 2017). Today Singmaster is a retired mathematics professor; he is renowned in maths-puzzle circles for having provided the first correct mathematical analysis of the Rubik's Cube, as well as one of the first published solutions.

Among Frost's notes, in addition to the binder, we came across draft tables of contents, with detailed chapter summaries. These also include outlines for subsequent chapters that hint at what Frost may have intended to cover beyond the first seven chapters. Topics not yet written about include the last field season in 1974, and the discovery of the 'ram' of the so-called 'sister ship'; the several years of conservation lab work up through 1977; the requisition of the Baglio Anselmi building for a museum space in 1978; and concerted efforts by the local Marsalesi to prevent the ship's remains from being removed from their city. By that time, as Frost writes in cursory notes intended for future chapters, the ship had become a totem, likened by locals to 'the Saviour's cross'.

Also, by that time Pietro Alagna had been awarded the Order of the British Empire by Queen Elizabeth II (thanks to Frost's strong endorsement), in recognition of his decades of crucial support of the British research project in Sicily. And, around that same time, Frost had been elected Honorary Citizen of Marsala, for her tireless efforts to valorize the city's ancient heritage and protect it in place. In each case, a foreigner was honoured for making a unique contribution to national cultural heritage in the arts and sciences.

a.



b.

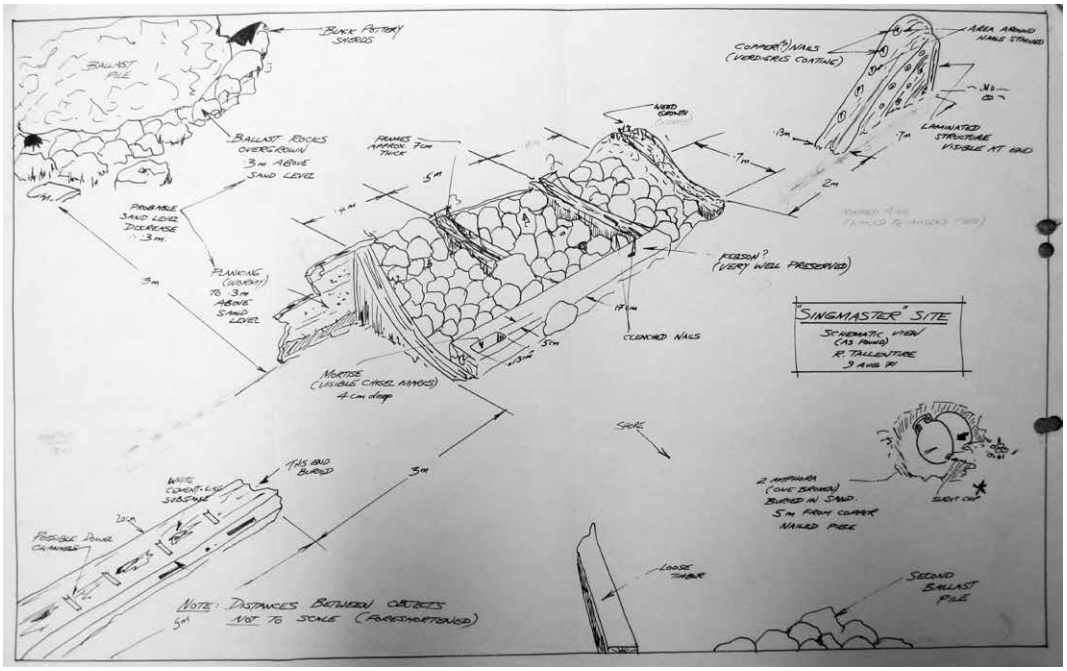


Figure 4. a) Sketch-plan of the so-called 'Singmaster site' as found on 7 August 1971; b) more detailed plan of the site by project draughtsman Roger Tallentire. (Source: Hartley Library, University of Southampton MS 439 [HFA/1.11.10.9]).

The text of the *Second Phoenix*

Anyone who has had the pleasure of reading Frost's 1963 book *Under the Mediterranean* will be familiar with her style, wit, and erudition. Her manuscript of *The Second Life of a Phoenix* is written in the same vein, clearly intended for a broad and interested

Figure 5. Project handyman and seaman Stefano Passalacqua of Marsala mans the dive boat; behind him is an experimental instrument for underwater profiling designed by Honor Frost. (Source: Honor Frost Foundation, original Frost archive slide collection, accessed 2013).

audience. Each chapter is headed with an apposite epigraph, ranging from Cicero to T.S. Eliot, and from Polybius to Alphonse Daudet, which sets the stage for what the chapter will cover. The writing is both scholarly – citing sources in footnotes for whomever might wish to follow a lead – and personal, as Frost shares the trajectory of her own learning curve, as a newcomer to Sicily and as an archaeological director adapting and innovating fieldwork techniques with the limited resources available in challenging circumstances (Fig. 5). In a more pragmatic vein, she shares the perpetual struggle to raise funds, and acknowledges that the often-*ad hoc* procedures used gave her the freedom and independence so necessary in pioneering ventures.

The following story is an amusing and illuminating example of the practical struggles Frost and her team had to contend with. Frost writes about how she needed to ensure that fieldwork photographs of the day's work be processed immediately, to make sure proper records existed before finds were raised from the seabed; here, she describes how Edoardo Lipari, who had become the local point-man for the foreign team, managed to provide essential and creative assistance.

> Lipari had brought us a huge generator that had once lit all of Favignana, the largest of the Egadi Islands [a few n.m. NW of Marsala]. This was another 'bestia' [beast] of truculent disposition which, when coaxed into action nearly beggared us by its gargantuan appetite for expensive oil. Exhausted by that struggle, we got ourselves wired to the generator of the hospitable campsite nearby, switching on for a few hours per day to power the machines and by night living by candle light. (Honor Frost, *Phoenix* ms, p. 64)

Frost also provides insights into her intellectual philosophies and priorities, citing on the second page of her manuscript the dictum she attributes to her mentor Kathleen Kenyon, that 'excavation without publication is destruction'. With all that she was challenged by the Academy for her eclectic and non-traditional education in archaeology, Frost's actions proved that her scientific standards were well above those of a significant number of academically trained archaeologists who even today neglect to publish what they destroy in the process of excavation.

As a scholar Frost maintained the highest academic standards: regular season reports on the Marsala work were published in various academic journals in both English and Italian, starting with her first season report in the inaugural issue of the *International Journal of Nautical Archaeology* (Frost, 1972 a), and in the *Notizie degli scavi di antichità* (Frost, 1972 b). She also made sure that project news was made available through the popular press and regular lectures in both languages, over the years. Her 'Final Report', submitted in 1976 and published in the *Accademia dei Lincei* in 1981, remains a standard in the field (Frost *et al.*, 1981).

Frost was particularly keen to ensure that her team's work and progress was shared directly with the local population of Marsala. The public exhibition she set up in the local middle-school, Scuola Vincenzo Pipitone, which she dubbed the 'Mini-Museum', featured project photographs and the 1:1 plaster casts of the ship timbers that Pietro Alagna had made possible by providing both technical expertise and funding (Fig. 6).

Figure 6. Honor Frost with local dignitaries, including Pietro Alagna to her right, at the Punic Ship Exhibition displayed at the local middle-school Scuola Vincenzo Pipitone in Marsala, in 1974. The 'mini-museum' exhibition featured 1:1 plaster casts of the ship timbers and photographs of the excavation seasons. (From a photograph in a binder of project snapshots. Source: Hartley Library, University of Southampton MS 439 [HFA / 1.11.6.3.2]).

These events took place in the mid 1970s, and certainly represented a novelty in that region at the time by committing to public engagement.

This leads us to consider another very important find among the archive papers: a copy of the first chapter of the *Phoenix* manuscript translated into Italian by a Sicilian friend. This discovery makes it quite clear that Frost herself intended to make her book available to her Sicilian and other Italian friends and colleagues as well as to the English-speaking community. Over the 30-plus years that she visited Sicily on one mission or another, she was often hosted at the homes of her former staff members and labourers – from shipwrights to boat captains, from local mechanics to doctors and photographers. It is intriguing to envision Frost navigating such a different social environment in that era and region – but this was one of her particular skills – to move unfettered by language or traditional cultural boundaries and find ways to communicate with people.

The chronology of the *Phoenix* book project

Much like the mythical bird that Frost chose to symbolize the entire project (Fig. 7), the history of her *Phoenix* manuscript reflects the vicissitudes of the ancient ship itself. It soon became clear, as we sifted through her notes and outlines, that we needed to determine, if possible, how Frost's intentions for the book may have shifted over time.

From our initial study of the manuscript and its related papers it appears that there are two main chronological phases of Frost's *Phoenix* book project. The first phase, likely begun in the early 1980s, comprises the first seven chapters and covers the project events up to and including 1973. It seems that Frost abandoned her book project, after essentially completing those chapters, in 1986 – a date which coincides with her resignation as director of the project through the British School at Rome. She appears to have resurrected the book roughly a decade later, at a time when there was renewed interest and indications of financial commitment for the care of the ancient vessel. But then it seems she abandoned the book a second time, very shortly afterwards. Further careful study is required to properly determine the chronology of the book project, as is planned for a later phase of this research project.

In addition to the difficulties of managing a complex archaeological project in a region with relatively modest amenities at the time, Frost had to contend with an increasingly intractable combination of local

Figure 7. Sketch by Honor Frost of a phoenix rising from the waves, intended as a possible cover illustration for her book The Second Life of a Phoenix. Portrait of a Punic Ship Resurrected in a Sicilian Town. *(Source: Hartley Library, University of Southampton MS 439 [HFA / 1.11.9.4.9]).*

and national bureaucratic hurdles, over the course of several decades. But the later travails of this unique ancient artefact are public – we only have to read Lucien Basch's factual and eloquent article titled 'The Punic Ship: an obituary' published in the *IJNA* (Basch, 1997) to understand the impassioned stance of the international community. Contemporary local and national newspapers document over the years the extent to which the people of Marsala fought to protect what had become for them an evocative and precious artefact.

Conclusion

Frost intended to share her experience of discovering a unique Punic vessel beyond the academic realm. *The Second Life of a Phoenix. Portrait of a Punic Ship Resurrected in a Sicilian Town* was only her second archaeology book intended for an educated, popular audience, after *Under the Mediterranean* was published in 1963. Our discovery of the unpublished manuscript in 2013 was both a shock and a marvellous revelation. We have tried to determine who, if anyone, knew about its existence; it has been unnerving that no one seems to recall conversations or references to the manuscript over the years – neither Frost's former colleagues, nor her friends. The discretion, not to say secrecy, in itself becomes part of the broader narrative. Clearly Frost had been in touch with publishers in London as she prepared the first iteration of her book in the 1980s, sending draft outlines and having the first chapter translated into Italian for future publication. Her second attempt to make progress with her book in the late 1990s remained at the level of notes, and there does not seem to be evidence that these notes were shared.

Figure 8. Honor Frost in the laboratory building during the 1976 conservation season, with John Wood and another unidentified project volunteer. (Source: Honor Frost Foundation, original Frost archive slide collection, accessed 2013).

Why does it matter to relate the community stories and individual contributions to an archaeological project like the Punic Ship Project, as Frost intended to do in her book? It matters because discoveries and innovations in our field are closely intertwined with cultural, economic, and even political influences, often at the individual level. As explorers of the past we aim to reach an understanding of how people lived and worked, and perhaps how they thought; and we do well to acknowledge how our contemporary perspectives and personal experiences, even during the processes of discovery and recording, can affect our interpretations as well. The true maturity of a discipline is revealed by the existence of a critical historiography about its origins and evolution. Maritime archaeology can surely benefit from further self-reflection in this realm.

The story of the Punic Ship of Marsala is deeply – in fact, viscerally – connected to the development of maritime archaeology in the Mediterranean region. Consider that the PEG wax used to conserve the Marsala ship timbers was the very same PEG that had previously been used to conserve the Kyrenia ship in Cyprus (Katzev, 1969, 1974). Frost had appealed to the ship's excavator Michael Katzev, of the American Institute of Nautical Archaeology (AINA), for advice on how to treat and conserve waterlogged ship timbers (Figs 8-9), based on his team's experimental efforts. Katzev collected the leftover PEG supply that had been used in the Kyrenia timbers and sent it on to Sicily to be recycled in the timbers of the Punic longship. When the conservation treatment was completed, Frost sent what remained of that PEG, and related conservation equipment, by truck from Sicily to Bodrum in Turkey to the AINA conservation lab there. Who knows what other ancient Mediterranean vessels subsequently excavated by AINA have been so intimately connected, on a cellular level, with the wax that helped preserve the Kyrenia and Marsala ships?

Ever the erudite writer, Frost quotes Voltaire's definition of history as 'a myth that is generally accepted' and asserts that indeed 'it rings very true in this antique land [of Sicily]' (*Phoenix* ms., p. 8). Let us see if the mythical phoenix of ancient Lilybaeum can be made to rise once again.

Figure 9. Honor Frost discusses the conservation treatment of the Punic Ship timbers, during which she employed recycled PEG previously used in the Kyrenia Ship timbers conservation process conducted by Michael Katzev. (Feb. 14, 1974) (Photo M. Katzev). Source: Honor Frost Foundation, original Frost archive slide collection, accessed 2013).

Postscript: In Honor's Footsteps

How did it happen that we traced Honor's footsteps back to the town of Marsala and the Punic Ship Project in the first place? Both maritime archaeologists with research interests focused on the central Mediterranean region, we had encountered Honor individually many years ago. We came to be engaged in the historiography of the Punic Ship Project from different perspectives, and feel privileged to offer contributions to Honor's legacy.

Claire writes:

As an aspiring archaeologist and experienced diver, I had visited the Punic Ship museum in Marsala, not far from my family's summer residence on the island of Favignana in the late 1980s; although it was hidden by a protective tent inside the Baglio Anselmi at the time, the vessel's story intrigued me. I also came across Honor's book *Under the Mediterranean.* So I wrote to Honor in the summer of 1988, enquiring if she might be able to offer advice on how to go about entering the field of maritime archaeology. I was thrilled when Honor responded immediately with a long, handwritten letter in which she encouraged me above all to build up archaeological fieldwork experience, and pointed to useful literature. I eventually embarked on postgraduate studies in the UK and the US; we exchanged occasional correspondence over the years that followed, and crossed paths at conferences. I will always remember with gratitude the generosity with which Honor shared her time and thoughts with me when I was a wide-eyed novice. And, in recent years, having become very familiar with Honor's work-life and community of colleagues and friends, through her own writings and others' testimonies, I am also grateful today for the opportunity to participate in the Honor Frost Foundation's mission to make her multifaceted achievements – in archaeology, as well as in art and dance – accessible, to inspire many others as well.

Elena Flavia writes:

I feel privileged to have first met Honor in the summer of 1996 while diving off the tiny Sicilian island of Ustica, and since then to have had the privilege of sharing a friendship with her over many years. And finally, to discover, along with Claire, the hand-typed *Phoenix* manuscript written by such an extraordinary woman: Honor remained forever a firm mentor for me, a reference point both professionally and socially. When I was a PhD student at Bristol University in the UK, I often used to consult her outstanding library at her elegant Georgian house on Welbeck Street in Marylebone, London. She was always very welcoming, motivating, and encouraging. When knocking at the door using her distinctive 17th-century dolphin-shaped bronze knocker, one immediately sensed that Honor's home was going to be unique (Fig. 10). Archaeological conversations and fabulous parties were a frequent highlight of being invited to Honor's home, where close friends would gather in one of the grand bow-windowed rooms, or in the gorgeous library filled with memories and records which drew together books, photos, and drawings from archaeological sites all around the Mediterranean Sea.

Honor taught me about hard work and self-respect, about persistence, and about how to be independent. She was a great role model of strength and character. We've laughed together; her humour and friendly irony allowed me to laugh, and lightened my perspective, forever. Indeed, the discovery of the mysterious green box labelled

Figure 10. The brass dolphin door-knocker at 31 Welbeck Street, Honor Frost's home in London. (Photo E.F. Castagnino Berlinghieri).

'PHOENIX' was like a little gem for me, an exceptional gift left behind by Honor, a secret treasure recounting little-known facets of the history behind the scenes of the Punic Ship Project. We had the serendipitous good fortune to uncover this treasure, and feel a deep commitment, with the support of the Foundation, to facilitating Honor's wishes in sharing her Sicilian story with a wide audience. For all of this, I cannot thank Honor enough. I am forever grateful. Thank you Honor!

Acknowledgements

We would like to thank the Trustees of the Honor Frost Foundation for their continued support and for the opportunity to present our current research. We also wish to thank Pietro Romano Alagna and his family, whose invitation to study the family archives related to the Punic Ship Project first brought us to Marsala. Our gratitude extends to the local community of Marsala and the international community of maritime archaeologists: over several decades they have persevered with their efforts towards the preservation and valorization of the Punic Ship, which remains to this day a unique artefact from the ancient world. And finally, we wish to thank and congratulate Lucy Blue and Stella Demesticha for the phenomenally successful and inspirational conference that they organized in Nicosia in October 2017 to celebrate the centenary of Honor's birth.

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The Honor Frost Foundation

Aims, achievements and future perspectives

*Alison Cathie**

**Honor Frost Foundation Trustee*

'Know where you're going before you start,' Honor Frost is quoted as saying and she really did know. Her will was characteristically clear in its instructions to her trustees as to what she wished done by a Foundation established in her name, and these objectives are all clearly outlined on the Honor Frost Foundation website. However, what she was unaware of as she wrote it was the scale of the prices that would be achieved at the auction of her art collection following her death. The sale achieved a figure far beyond the auctioneers' estimate, and therefore the money that was available for her Foundation to fund maritime archaeology in the eastern Mediterranean in her name was far greater than she could have ever dreamed.

Our achievements to date

A cursory scan of the Honor Frost Foundation website demonstrates the extent of the Foundation's achievements since 2011. Much of our focus is on education, working not only with academic institutions but also with scholars. It's only by funding education that we can build the basis for maritime archaeology going forward. And we have discovered that there is a severe shortage of trained maritime archaeologists in the region, and, with the exception of the Republic of Cyprus, limited government regulation relating to the protection of maritime archaeological heritage – indeed a real lack of appreciation of the subject beyond the academic community…so the time is right for development!

In Cyprus, the Foundation has supported students studying Maritime Archaeology at Masters level at the University of Cyprus; in Lebanon, we have funded a three-year Post-Doctoral Research Fellowship at the University of Balamand, and we have recently signed an agreement with the American University of Beirut to finance a Minor Undergraduate programme in Maritime Sciences and Culture, starting in

In: Blue, L. (ed.), 2019, *In the Footsteps of Honor Frost. The life and legacy of a pioneer in maritime archaeology,* 273-276. Leiden: Sidestone Press.

September 2019. The Foundation also funds Masters students at the University of Alexandria and two students from Syria at the University of Aix Marseille, as well as Masters and PhD students at the Centre of Maritime Archaeology at the University of Southampton, UK, and PhD students at the University of Oxford, UK, and Flinders University in Perth, Australia.

As well as training and education, the Foundation wants to appreciate exactly what the maritime archaeological resources are in Cyprus, Lebanon, and Syria. So, we are in the process of forging an agreement with the Department of Antiquities in Cyprus for the first part of what is hoped to be a longer-term project, to do a desk-based assessment of their maritime archaeological resource with the aim of creating a database: this would lead to a sustainable management plan for the maritime archaeology of the Republic. In Syria, we have just completed a benchmarking study of the maritime archaeological resource from available data, led by Colin Breen, Kieran Westley, Nicolas Carayon and Lucy Blue. In Lebanon, we have undertaken a major marine geophysical remote-sensing survey project with the CNRS-L to map the underwater areas off Sidon and Tyre, and we have recently started a rescue mission with the Directorate General of Antiquities (DGA) to map coastal and near shore underwater sites under threat of destruction, and we plan to build on the desk-based assessment of the whole Lebanese coast, compiled by Lucy Semaan. It is the Foundation's intention to be available to help the DGA to tackle threats to maritime archaeological sites, and also to be ourselves aware of where the next urban developments are happening so we can at least record the resource and mitigate the impact in advance of construction. We believe that these collaborative networks are absolutely crucial to our understanding of the resource and will help us to formulate future strategies.

Another key part of our activities is supporting research, particularly long-term research projects. To this end, we have made agreements in Egypt with Centre d'Etudes Alexandrines, and with the British Museum for research at Naukratis, as well as with the Centre for Maritime Archaeology and Underwater Cultural Heritage at the University of Alexandria; in Lebanon, we support research at Byblos; and in Cyprus, the University of Cyprus for their work on the Nissia and Mazotos shipwrecks.

We make small grant awards twice a year to researchers. To date, we have made over 120 such awards; and, in addition, we offer a number of small grants through the British Academy, to support maritime archaeological research beyond our region.

Following the 'Under the Mediterranean' conference in Cyprus in October 2017, to mark Honor Frost's centenary, we have established a publications department whose first volume appears in 2019 – this paper and this volume is the first example. All publications are Open Access and thus freely available to all.

Honor Frost left a very significant archive of her maritime archaeological work, and this is now housed in the Hartley Library of the University of Southampton's newly developed Special Collection of Maritime Archaeology, and is available freely to scholars.

Our aims

First and foremost, we aim to increase awareness of maritime archaeology.

To this end, we support a steering committee in the UK, under the chairmanship of Sir Barry Cunliffe, of which one of the primary aims is to pursue the adoption of the

UNESCO 2001 Convention for the Protection of Underwater Cultural Heritage by the British Government.

The Foundation also intends to continue to support education, our resource for the future, so we are funding scholarships and bursaries, research and education, and Developing the Discipline Awards, to encourage the development of maritime archaeology and the protection of underwater cultural heritage more broadly, focusing on new technologies and methodologies. The Foundation will publish and disseminate research work arising from our conferences or from the grants we have supported. We will continue to provide grants to museums and galleries to assist in displaying exhibitions relevant to the study of maritime archaeology, and to sponsor lectures and seminars on the subject. We will support excavations of archaeological sites including ports, harbours, offshore anchorages, ancient anchors, and shipwrecks relevant to the archaeology of the eastern Mediterranean. We will continue to support conservation work in the region, and offer training for conservation of artefacts recovered from maritime archaeological sites in the region as much as we can.

We are very supportive also of bigger projects like the exciting exploration of the Akrotiri Peninsular of Cyprus, where maritime cultural landscapes including shipwrecks and coastal settlements, within a dynamic changing landscape, are ripe for discovery.

We are also interested in funding films about important maritime archaeological finds and discoveries to raise the profile of the subject.

Conclusion

The Honor Frost Foundation is very excited to be able to support many maritime archaeological research projects in the eastern Mediterranean region, and would be delighted to hear from all applicants with interesting possibilities for future exploration.

Appendix

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[1]	Agde, Herault River general	Fonquerle, 1971: 215, tbl.	Fonquerle, 1971: 215, tbl., pl. 1, no.17, annexe; identifier: '1062'	Yes
[2]			Fonquerle, 1971: 212, 214, no. 1, 215, tbl., fig. 13, no. 2, pl.1, no. 19, annexe; identifier: '429'	Yes
[3]			Fonquerle, 1971: 212, 214-215, tbl., figs 12-13, no. 1, pl.1, no. 30, annexe; identifier: '541'	Yes
[4]			Fonquerle, 1971: 214, no. 1, 215, tbl., fig. 11, pl. 1, no.38, annexe; identifier: '610'	Yes
[5]	Apollonia-Arsuf	Galili *et al.*, 1993: 63, fig. 4; Grossmann & Kingsley, 1996: 49, figs 1, 3	Grossmann & Kingsley, 1996: 49-53, figs 1-3; Raban, 2002: 643; identifier: N/A	Yes
[6]	Ashkelon North, survey	Galili *et al.*, 2012: 121, tbl. 1	Galili *et al.*, 2012: 121, tbl. 1, figs 3-8; Galili & Rosen, 2015: 66-67, tbl.1, fig. 33; identifier: N/A	Yes
[7]			Galili *et al.*, 2012: 121, tbl. 1, figs 11, 36-37; 2016: fig. 9; Galili & Rosen, 2015: 68-69, tbl. 1, fig. 36; identifier: N/A	Yes
[8]			Galili *et al.*, 2012: 121, tbl. 1, fig. 19; Galili & Rosen, 2015: 71-73, tbl. 1, fig. 44; identifier: N/A	Yes
[9]	Ayn Soukhna	el-Raziq *et al.*, 2006; Tallet, 2006: 27, figs 1-2, 6, 14	el-Raziq *et al.*, 2006: 5, figs 2-3; Tallet, 2006: 27, fig. 14; identifier: N/A	Yes
[10]			el-Raziq *et al.*, 2006: 5, figs 2-3; Tallat, 2006: 27, fig. 14; identifier: N/A	Yes
[11]	Bajo de la Campana	Mederos Martín & Ruiz Cabrero, 2004	Mederos Martín & Ruiz Cabrero, 2004: 271-272, fig. 9; identifier: N/A	Yes
[12]	Bamboula/Kition, Floor 293	Frost, 1982a: 268, fig. 5; Caubet, 1984: 112, 116-117; 2015: 285; Brody, 1998: 49-52	Frost, 1982a: 265-266, figs 1-2; Caubet, 1984: 112; 2015: 285, figs 8, 4-63; Brody, 1998: 51 no. 64; identifier: 'K 80-1648'	Yes
[13]	Byblos, Context 1 Temple of the Obelisks	Dunand, 1958: pl. XXII, XXIII, XXIV; Frost, 1963a: 9, figs 2-5; 1963b: 41-42, figs 2-3; 1969a: 429-431, fig. 4, pl. 2; 1970a: 383-384, pl. 1b; Brody, 1998: 44, n. 26, fig. 33	Dunand, 1958: pl. XXII, XXIII, XXIV; Frost, 1963a: 11, figs 2-5; 1963b: 46; 1969a: tbl. 1, no. 4, pl. 2; 1970a: pl. 1b; Landström, 1970: fig. 200; identifier: N/A	Yes
[14]	Byblos, Context 2 Temple of the Obelisks	Frost, 1963a: 9, figs 2-5; 1963b: 41-42, fig. 2; 1969a: 429, figs 1, 3; 1991: 359; Brody, 1998: 44-45, n. 26	Dunand, 1954: 569; Frost, 1969a: tbl. 1, no. 1; 1970a: fig. 3b; identifier: '13035'	Yes
[15]			Dunand, 1954: 569; Frost, 1969a: tbl. 1, no. 3; identifier: '13036'	Yes
[16]	Byblos, Sacred Enclosure	Frost, 1969a: tbl. 1, figs 18, 22; 1970a: 381, 383; Brody, 1998: 45, fig. 33	Dunand, 1958: fig. 827, no. 14395; 1954: 690; Frost, 1969a: 439, tbl. 1, no. 18; 1970a: 383; identifier: '14395'	Yes
[17]			Dunand, 1954: 691-692; Frost, 1969a: tbl. 1, no. 22; identifier: '14415'	Yes
[18]			Dunand, 1958: fig. 827 no. 14414; 1954: 691-692; Frost, 1969a: 439, tbl. 1, no. 17; identifier: '14414'	Yes
[19]	Byblos, Sacred Enclosure entrance to vestibule	Dunand, 1958: pl. XIV, no. 1; Frost, 1969a: 430, n. 1; 1979: 149; 1991: 379; Brody, 1998: 45, fig. 33	Dunand, 1958: pl. XIV, no. 1; 1954: 59; Frost, 1969a: 431, 434, n. 20, tbl. 1, no. 21, pl. V; 1969b: 241; 1970a: 380, fig. 1a, pl. 1a; 1991: 379; Nibbi, 1975: fig. 2; Wachsmann, 1998: fig. 12.7; identifier: '7027'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[20]	Byblos, Temple of the Obelisks other	Dunand, 1958: fig. 767, pls XXII, XXXV, no. 2; Frost, 1963a: fig. 2; 1963b: fig. 2, no. 2; 1969a: 429, fig. 2, pl. 1; 1970a: 383-384; Brody, 1998: 44, no. 26, fig. 33	Dunand, 1958: pl. XXII, XXXV, no. 2; Frost, 1963a: figs 2-5; 1963b: 429, fig. 2, nos1-2; 1969a: tbl. 1, no. 2, pl. 1; 1970a: 383, fig. 3e; identifier: none	Yes
[21]	Byblos, Tomb chamber K9	Salles, 1980: 11-14, pl. 5	Salles, 1980: 12, pls 28, fig. 1, IVA; Brody, 1998: 90 no. 10; identifier: none	Yes
[22]	Byblos, Tower Temple step	Frost, 1969a: 429-430, tbl. 1, figs 23-28, pls 3-4; 1970a: 383-385; Brody, 1998: fig. 33	Frost, 1969a: 429-430, tbl. 1, no. 23, pl. 3; 1970a: 383; identifier: none	Yes
[23]			Frost, 1969a: 429-430, tbl. 1, no. 24, pls 3-4; 1970a: 383; identifier: none	Yes
[24]			Frost, 1969a: 429-430, tbl. 1, no. 25, pls 3-4; 1970a: 383; identifier: none	Yes
[25]			Frost, 1969a: 429-430, tbl. 1, no. 26, pl. 4; 1970a: 383; identifier: none	Yes
[26]			Frost, 1969a: 429-430, tbl. 1, no. 27, pls 3-4; 1970a: 383; identifier: none	Yes
[27]			Frost, 1969a: 429-430, tbl. 1, no. 28; 1970a: 383; identifier: none	Yes
[28]	Caesarea Maritima, Area 17, CCE/96, stratum 3	Raban, 2000: 265	Raban, 2000: 261-262, 265 fig. 4, nos 1, 5; identifier: none	Yes
[29]	Caesarea Maritima, Area LL, stratum 4	Raban, 2000: 265	Raban, 2000: 262-265, fig. 4, no. 3; identifier: none	Yes
[30]	Caesarea Maritima, Area TN2	Raban, 2000: 265, fig. 1	Raban, 2000: 265, fig. 4, no. 5; identifier: none	Yes
[31]	Caesarea Maritima, Areas SW and TN	Raban, 2000: 265, fig. 1	Raban, 2000: 261-265, figs 3-4, no. 2; identifier: none	Yes
[32]			Raban, 2000: 261-265, fig. 4, no. 8, 6; identifier: none	Yes
[33]			Raban, 2000: 261, 265, figs 3-4, no. 9; identifier: none	Yes
[34]	Cape Gelidonya A	Bass, 1967: 45; 1999: 23; Bass *et al.*, 1967: figs 6, 27, 37; Pulak & Rogers, 1994: 20	Bass, 1967: 45; Bass *et al.*, 1967: figs 10, 27; identifier: none	Yes
[35]			Pulak & Roger, 1994: 20, fig. 7; Bass, 1999: 23, pl. 5b; identifier: none	Yes
[36]	Dhokós	Papathanassopoulos *et al.*, 1992: 16-17	Papathanassopoulos *et al.*, 1992: 15-16, figs 28, 30, 32; Vichos & Papathanassopoulos, 1996: 522; identifier: 'A144'	Yes
[37]			Papathanassopoulos *et al.*, 1992: 15, figs 29, 31, 33; Papathanassopoulos, 1996: 522; identifier: 'A155'	Yes
[38]	Dor/Tantura, DW4/ Dor D	Raveh & Kingsley, 1992: 312-313, figs 1-2; Kingsley & Raveh, 1994: 5-11; Kingsley, 2002: 85-86, fig. 18	Porat, 1996: 95; Kingsley, 2002: 9, fig. 21; Kingsley & Raveh, 1994: 8-10, figs 12-13, pl. 64; identifier: 'AN 023-1'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[39]			Kingsley & Raveh, 1994: 9-10, figs 11, 13; Porat, 1996: 95; Kingsley, 2002: 9-10, fig. 20; identifier: 'AN 023-2'	Yes
[40]			Kingsley & Raveh, 1994: 9-10, figs 11, 13; Porat, 1996: 95; Kingsley, 2002: 9-10; identifier: 'AN 023-3'	Yes
[41]	Dor/Tantura, DW6/ Dor F	Raveh & Kingsley, 1992: 312-313, figs 1-2, 6; Kingsley & Raveh, 1994: 2-4, 11, no. 2; 1996: fig. 46	Raveh & Kingsley, 1992: 313-314, fig. 6; Kingsley & Raveh, 1994: 8-10, figs 4-5; 1996: pl. 70; Porat, 1996: 95; identifier: 'AN 018-1'	Yes
[42]	Egyptian Museum	Lange & Schäfer, 1908: no. 20728; Frost, 1991: 360; 1994: 106; 1996: 882; 1991: 361	Lange & Schafer, 1908: 358-359, no. 20728; identifier: '20728'	Yes
[43]	Ein Gedi	Hadas, 1989-1990: 80-81; 1992: 55, fig. 1	Hadas, 1992: 55, no. 3, figs 2-3a; Shimony *et al.*, 1992: 58, fig. 2; identifier: 'Anchor A'	Yes
[44]			Hadas, 1992: 55, fig. 3b; identifier: 'Anchor B'	Yes
[45]			Hadas, 1992: 55, fig. 3c; Shimony *et al.*, 1992: 58, fig. 1; identifier: 'Anchor C'	Yes
[46]	*Elissa*	Ballard *et al.*, 2002: 151, 155, 157, 164-165, figs 1, 5	Ballard *et al.*, 2002: 162-163, fig. 5; identifier: none	No
[47]			Ballard *et al.*, 2002: 162-163, fig. 5; identifier: none	No
[48]			Ballard *et al.*, 2002: 162-163; identifier: none	No
[49]			Ballard *et al.*, 2002: 162-163; identifier: none	No
[50]	Gaeta	Di Bartolomeo, 1986: 210	Di Bartolomeo, 1986: 210, pl. XIIc; identifier: none	Yes
[51]	Hahotrim A	Wachsmann & Raveh, 1981; 1984: fig. 2; Wachsmann, 1998: 288, fig. 12.54	Wachsmann & Raveh, 1981: 160; 1984: 169, fig. 2; Wachsmann, 1998: 228, fig. 12.54b; identifier: none	Yes
[52]	Haifa South Beach, survey	Galili & Sharvit, 1999: 15-17, fig. 25/IV; Galili & Rosen, 2015: 73-74, tbl. 1	Galili & Sharvit, 1999: 17, figs 28, 46; 25/iv/assemblage 9; Galili & Rosen, 2015: 73-75, tbl. 1, 14th, fig. 46; Galili *et al.*, 2016: 96; identifier: none	Yes
[53]	Hala Sultan Tekke, Area 8, fill layer	McCaslin, 1978: 125, 138, fig. 216; Hult, 1981: fig. 134; Åström & Svensson, 2007: 31, fig. 1	McCaslin, 1978: 123, 138, fig: 215, nos F1254, 216, 283; Hult, 1981: 42, figs 134-135, 140, no. 26; Åström & Svensson, 2007: 31, figs 1, 5a-b; identifier: 'F1254'	Yes
[54]	Hala Sultan Tekke, Area 8, Room 72	Åström, 1990: 81, fig. 1; Åström & Svensson, 2007: 39, fig. 1	Åström, 1990: 81-83, n. 8, figs 1-2; Åström & Svensson, 2007: 39, fig. 1; identifier: none	Yes
[55]	Hala Sultan Tekke, Surface	Nikolaou & Catling, 1968: 228-229; Karageoghis, 1968b: 4, fig. 2; Åström *et al.*, 1976: 1, fig. 1; Hult, 1977: 148; McCaslin, 1978: 122, 124, 138; Åström & Svensson, 2007: 43	Nikolaou & Catling, 1968: 228-229, pl. XXXIVb; Karageorghis, 1968a: 278; 1968b: pl. 2, no. 2; Frost, 1970b: fig. 1, no. 1; Quilici, 1971: pl. 2, no. 1; Bass, 1972: fig. 25; Steiglitz, 1972-1975: n. 1; identifier: '1967/VIII-9/1, 2a'	Yes
[56]			Nikolaou & Catling, 1968: 228, pl. XXXIVa; Karageorghis, 1968a: 278; 1968b: pl. 2, no. 3; Frost, 1970b: 17, fig. 1, no. 2; Quilici, 1971: pl. 2, no. 2; identifier: '1967/VIII-9/1, 2b'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[57]			Karageorghis, 1968b: 11, pl. 2, no. 1; Frost, 1970b: 17, fig. 1, no. 3, pl. VI, nos 2-3; 1982b: pl. 6, no. 3; Åström & Svensson, 2007: 43; identifier: '1968/V-18/1'	Yes
[58]			McCaslin, 1978: 123, 138, figs 215, 282; Åström, 1976: pl. 10, fig. 10; Åström & Svensson, 2007: 43; identifier: 'F4004 or N4004'	Yes
[59]			McCaslin, 1978: 138, figs 215, 281; Åström & Svensson, 2007: 45; identifier: 'N2200'	Yes
[60]	Heracleion-Thonis, Shipwreck 43	Fabre, 2011: 17, 19, 25-26, no. 50, fig. 1.17	Fabre, 2011: 25-6, fig. 1.17; identifier: '10411'	No
[61]	Hishuley Carmel	Galili *et al.*, 1986: 33-35; 2013; 2016: 128, figs 2, 3	Galili *et al.*, 1986: 33; 2013: 5, figs 5, 10, no. 1, tbl. 1; identifier: 'A1'	Yes
[62]			Galili *et al.*, 1986: 33, figs 9-10, no. 2; 2013: 4b, figs 3-6, tbl. 1; identifier: 'A2'	Yes
[63]			Galili *et al.*, 1986: 33, fig. 10, no. 3; 2013: 5, figs 3, 4a, 5, tbl. 1; 2016: fig. 3; identifier: 'A3'	Yes
[64]			Galili *et al.*, 1986: 33, fig. 10, no. 4; 2013: 5, tbl. 1, figs 3, 5; identifier: 'A4'	Yes
[65]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1, identifier: 'C1'	Yes
[66]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C2'	Yes
[67]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C3'	Yes
[68]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C4'	Yes
[69]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C5'	Yes
[70]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C6'	Yes
[71]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C7'	Yes
[72]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C8'	Yes
[73]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C9'	Yes
[74]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C10'	Yes
[75]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C11'	Yes
[76]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C12'	Yes
[77]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C13'	Yes
[78]			Galili *et al.*, 2013: 5, fig. 5, tbl. 1; identifier: 'C14'	Yes
[79]	Ialysos, Tomb 27	Maiuri, 1923-1924: 150-151	Maiuri, 1923-1924: 150, fig. 72; Buchholz & Karageorghis, 1973: 48, no. 430; identifier: none	Yes
[80]	Isola delle Femine	Tusa, 1961: 77, fig. 1; 1973: 423	Tusa, 1997: 65, 72, fig. 2, pl. 1, no. 1; identifier: none	Yes
[81]			Tusa, 1997: 69-73, fig. 4, pl. 1, nos 2a, 2b; identifier: none	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[82]	Karnak, Temple	Basch, 1978: 118-121; Frost, 1979: 157	Basch, 1978: 118-121, figs 32-3; Frost, 1979: 157, fig. 4; 1996: fig. 2b, no. 15; identifier: none	Yes
[83]	Kfar Samir, south of Scarab Group	Galili *et al.*, 1994: 95, figs 1, 9; Galili & Sharvit 1999: 16, fig. 25	Galili *et al.*, 1994: 95, 97, 102, tbl. 1, figs 7-8; Galili & Rosen, 2015: fig. 28 identifier: none	Yes
[84]			Galili *et al.*, 1994: 95, 102, tbl. 1, figs 7-9; 2016: 128; Galili & Rosen, 2015: 61, fig. 28 identifier: none	Yes
[85]	Kition, City Wall, floor 1	Frost, 1985c: 303; Karageorghis & Demas, 1985: plan 2	Frost, 1985c: 303, fig. 7, no. 6, pl. C, no. 10, K, no. 3; Mascle, 1985: 321; identifier: '5123'	Yes
[86]			Frost, 1985c: 303, fig. 7, no. 7, pl. C, no. 11; identifier: '5123A'	Yes
[87]	Kition, Room 12, floor II	Frost, 1970b: 17-19; 1985c: 309; Buchholz & Karageorghis, 1973: 138; Karageorghis & Demas, 1985: plan 2	Frost, 1970b: fig. 2, no. 3; 1985c: 309, fig. 11, no. 7, pl. F, nos 1, 2; identifier: '941'	Yes
[88]			Frost, 1970b: 18, fig. 2, no. 4; 1985c: 309, 311, fig. 11, no. 6, pl. H, no. 8; identifier: '942'	Yes
[89]			Frost, 1970b: fig. 2, no. 5; 1985c: 289, 331, fig. 11, no. 8, pl. H, no. 9; Mascle, 1985: 321; identifier: '943'	Yes
[90]	Kition, Room 12, floors III and IIIA	Frost, 1970b: 17-19; 1985c: 289, 309, pls E, nos 6, 10, F, nos 1, 3; Buchholz & Karageorghis, 1973: 138; Karageorghis & Demas, 1985: plan 2	Frost, 1970b: fig. 2, no. 6; 1985c: 289, 389, fig. 11, no. 1, pl. E, no. 6; identifier: '947'	Yes
[91]			Frost, 1970b: 18, fig. 2, no. 2; 1985c: 309, fig. 11, no. 3, pls M, no. 2, F, nos 3, 6; Mascle, 1985: 321; identifier: '940'	Yes
[92]			Frost, 1985c: 309, fig. 11, no. 2, pl. E, no. 10; identifier: '942A'	Yes
[93]			Frost, 1985c: 309, fig. 11, no. 5, pl. E, no. 8; identifier: '5038'	Yes
[94]			Frost, 1985c: 309, fig. 11, no. 4, pl. E, no. 9; identifier: '5038A'	Yes
[95]	Kition, Room 14, floor IIIA	Buchholz & Karageorghis, 1973: 138; Frost, 1985c: 311, pl. F, no. 4; Karageorghis & Demas, 1985: plan 2	Frost, 1985c: 311, fig. 11, no. 9, pl. F, nos 4, 5; identifier: '1097'	Yes
[96]	Kition, Room 15, floor IIIA	Karageorghis, 1967: fig. 110; Frost, 1970b: 17, 19, 24; 1985c: 311, pl. F, no. 10; 1991: 378; Buchholz & Karageorghis, 1973: 138; Karageorghis & Demas, 1985: plan 2	Frost, 1970b: 19, fig. 2, no. 11; 1985c: 311, fig. 11, no. 13, pl. F, no. 10; Karageorghis, 1967: fig. 110; identifier: '944'	Yes
[97]			Frost, 1985c: 311, fig. 11, no. 15, pl. F, nos 9, 11; identifier: '2603'	Yes
[98]	Kition, Room 16, floor II	Frost, 1970b: 17, 19, 24, fig. 2, no. 9; 1985c: 313, pl. G, nos 2, 5; Buchholz & Karageorghis, 1973: 138; Karageorghis & Demas eds, 1985: plan 2	Frost, 1970b: fig. 2, no. 9; 1985c: 313, fig. 12, no. 6, pl. G, nos 2, 5; identifier: '2609'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[99]	Kition, Room 16, floor III	Frost, 1970b: 17, 19, 24, fig. 2, no. 9; 1985c: 311, 313; Buchholz & Karageorghis, 1973: 138; Karageorghis & Demas, 1985: plan 2	Frost, 1970b: fig. 2, no. 10; 1985c: 311, fig. 12, no. 1, pl. G, no. 1; Mascle, 1985: 320; identifier: '2608+945'	Yes
[100]			Frost, 1985c: 311, fig. 12, no. 3, pl. G, nos 2, 3; identifier: '2605'	Yes
[101]	Kition, Temenos A, floor 1	Frost, 1985c: 314; Karageorghis & Demas, 1985: plan 2	Frost, 1985c: 314, fig. 12, no. 15, pl. H, no. 14; identifier: '949'	Yes
[102]	Kition, Temenos A, floor II	Buchholz & Karageorghis, 1973: 138; Frost, 1985c: 313; Karageorghis & Demas eds, 1985: plan 2	Frost, 1985c: 313, fig. 12, no. 12, pl. G, no. 7; identifier: '2648'	Yes
[103]	Kition, Temenos B, floors 2-3	Frost, 1985c: 314; Karageorghis & Demas, 1985: plan 2	Frost, 1985c: 290, 314, fig. 13, no. 3, pl. G, no. 9; Mascle, 1985: 321; identifier: '5173'	Yes
[104]	Kition, Temple 1, floor IIIA	Frost, 1985c: 305, pl. E, nos 1, 4, fig. 9.4; Karageorghis & Demas, 1985: plan 2; Brody, 1998: 50	Frost, 1985c: 305, fig. 9, no. 1, pl. E, nos 1, 3; Mascle, 1985: 321; Wachsmann, 1998: fig. 12.43; identifier: '2625'	Yes
[105]			Frost, 1985c: 305, fig. 9, no. 4, pl. E, no. 4; Mascle, 1985: 321; Wachsmann 1998: figs 12-43, right; identifier: '2627'	Yes
[106]			Frost, 1985c: 305, fig. 9, no. 5, pl. N, no. 1; Mascle, 1985: 321; identifier: '2628'	Yes
[107]			Frost, 1985c: 305, fig. 9, no. 6; identifier: '5174'	Yes
[108]	Kition, Temple 2, floors III and IIIA	Buchholz & Karageorghis, 1973: 138; Frost, 1985c: 295-256, pl. A, nos 2, 4, 6; 1989: fig. 1; Karageorghis & Demas, 1985: plan 2; Shaw 1995: fig. 9	Frost, 1985c: 289, 295, fig. 4, no. 1, pl. A, no. 2; Mascle, 1985: 320; identifier: '5170'	Yes
[109]			Frost, 1985c: 295, fig. 4, no. 2, pl. A, no. 1; Mascle, 1985: 321; identifier: '5172'	Yes
[110]			Frost, 1985c: 296, fig. 4, no. 3, pl. A, nos 5-6; Shaw, 1995: fig. 9; identifier: '4972'	Yes
[111]			Frost, 1985c: 296, fig. 4, no. 4, pl. A, no. 6; Mascle, 1985: 321; Shaw, 1995: fig. 9; identifier: '4973'	Yes
[112]			Frost, 1985c: 296, fig. 4, no. 7, pl. A, nos 7-8; 2001b: fig. 14; Mascle, 1985: 321; Åström & Svensson, 2007: 45; identifier: '2618'	Yes
[113]			Frost, 1985c: 296, fig. 4, no. 9; Mascle, 1985: 321; identifier: '2618A'	Yes
[114]	Kition, Temple 4, floors III and IIIA	Buchholz & Karageorghis, 1973: 138; Frost, 1985c: 291, 298-299, fig. 6, pls B, nos 7, 11, C, nos 1, 6-8; Brody, 1998: 50; Karageorghis & Demas, 1985: plan 2	Frost, 1985c: 289, 299, figs 5, no. 13, 6, pl. C, nos 3-4; Mascle, 1985: 321; identifier: '5137'	Yes
[115]			Frost, 1985c: 298, figs 5, no. 1, 6, pl. B, nos 7, 11; identifier: '5126'	Yes
[116]			Frost, 1985c: 298, figs 5, no. 5, 6, pl. B, nos 7, 11; Mascle, 1985: 321; identifier: '5128'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[117]			Frost, 1985c: 289, 298, fig. 5, no. 6, 6, pl. B, nos 7, 10; identifier: '5140'	Yes
[118]			Frost, 1985c: 298, figs 5, no. 7, 6, pl. B, no. 9; identifier: '5131'	Yes
[119]			Frost, 1985c: 289, 298, figs 5, no. 9, 6; identifier: '5132'	Yes
[120]			Frost, 1985c: 299, fig. 7, no. 1, pls K, no. 2, C, no. 7; Mascle, 1985: 321; identifier: '5138'	Yes
[121]			Frost, 1985c: 299, fig. 7, no. 2, pls K, no. 2, C, nos 7, 9; Mascle, 1985: 321; identifier: '5138A'	Yes
[122]			Frost, 1985c: 299, fig. 7, no. 3, pl. C, nos 6, 8; identifier: '5139'	Yes
[123]			Frost, 1985c: 298, 290, fig. 5, pl B, no. 8, no. 14; identifier: '5142'	Yes
[124]	Kition, Temple 5, floor 1	Karageorghis, 1976: 875-880, fig. 70; Frost, 1985c: 305, pl. D; Karageorghis & Demas, 1985: plan 2	Karageorghis, 1976: 875, 879-880; Frost, 1985c: 289, 305, fig. 8, no. 10, pl. D, nos 4, 7; Mascle, 1985: 321; identifier: '4199'	Yes
[125]	Kition, Temple 5, floor II	Karageorghis, 1976: 875-880, fig. 70; Frost, 1985c: 303, 305, pl. D, nos 2, 3, 6; Karageorghis & Demas, 1985: plan 2	Karageorghis, 1976: 877, fig. 71; Frost, 1982b: fig. 3; 1985c: 303, fig. 8, no. 7, pl. D, nos 2, 3, 6; Mascle, 1985: 321; identifier: '4978'	Yes
[126]			Frost, 1985c: 303, fig. 8, no. 8, pl. D, no. 3, 6; Mascle, 1985: 321; identifier: '4978A'	Yes
[127]			Frost, 1985c: 305, fig. 8, no. 9, pl. D, no. 6; identifier: '5166A'	Yes
[128]	Kition, Temple 5, floors III and IIIA	Buchholz & Karageorghis, 1973: 138; Karageorghis, 1976: 875, figs 70-71; Frost, 1982b: fig. 3; 1985c: 303, pl. D, nos 2, 3, 6; Karageorghis & Demas, 1985: plan 2	Karageorghis, 1976: 875, figs 70-71; Frost, 1985c: 303, fig. 8, no. 1; Mascle, 1985: 321; identifier: '5166'	Yes
[129]			Karageorghis, 1976: 875, fig. 70; Frost, 1985c: 303, fig. 8, no. 2, pl. D, no. 5; Mascle, 1985: 321; identifier: '4979'	Yes
[130]			Karageorghis, 1976: fig. 71; Frost, 1985c: 303, fig. 8, no. 4, pl. D, nos 1, 2; Mascle, 1985: 321; identifier: '4977'	Yes
[131]	Kommos, Building P	Shaw, 1995: 279-280; 2014, fig. 2	Shaw, 1995: 279-281, 288, tbl. 1, figs 1, 3a-c, 6, 11a; 2006: 95; 2014; Wachsmann, 1998: fig. 12.46C; identifier: 'S 2233'	Yes
[132]			Shaw, 1995: 280-281, 287, tbl. 1, fig. 1, 4a, b, 11b; 2006: 95; 2014; identifier: 'S 2234'	Yes
[133]	Malia, Maison Ea, La	Pelon, 1970: 141, pl. VII, no. 1; Wachsmann, 1998: 270, fig. 12.45	Pelon, 1970: 141, pl. VII, no. 2; Davaras 1980: fig. 1; Wachsmann, 1998: fig. 12.45; identifier: none	Yes
[134]	Malia, Quartier Mu	Frost, 1963a: 10-11, fig. 12, pl. fig. 2; 1963b: 46; 1973: 401; Poursat, 1980: 235-238, fig. 315	Frost, 1963a: 11, fig. 2 opp. pg. 10; 1963b: 46, figs 2, 12; 1973: 401; Poursat, 1980: 237; identifier: none	Yes
[135]			Frost, 1963a: 10-11, pl. fig. 2; 1963b: 46; 1973: 401; Poursat, 1980: 237; Wachsmann, 1998: fig. 12.45b; identifier: none	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[136]	Maroni *Tsaroukkas*, terrestrial other	Manning *et al.*, 2002: 114	Manning *et al.*, 2002: tbl. 1, fig 10; identifier: 'MT.111'	Yes
[137]			Manning *et al.*, 2002: tbl. 1, fig 10; identifier: 'MT.113'	Yes
[138]			Manning *et al.*, 2002: tbl. 1, fig 10; identifier: 'MVASP 187'	Yes
[139]			Manning *et al.*, 2002: tbl. 1, fig 10; identifier: 'MVASP 188'	Yes
[140]	Maroni *Tsaroukkas*, Trench H/20	Manning *et al.*, 2002: 114, fig. 9	Manning *et al.*, 2002: fig. 9, tbl. 1, figs 9-10; identifier: 'MT.418'	Yes
[141]	Megadim, North	Galili & Raveh, 1988: 41-42, 46, fig. 2; Wachsmann, 1998: 266; Galili *et al.*, 2016: fig. 6a	Galili *et al.*, 1982: 10; 1994: tbl. 1; 1996: fig. 10; 2016: 95, fig 6a; Galili & Raveh, 1988: 42-46, tbl. 1, figs 3b, 4b, pl. V, no. 5; Frost, 1991: 383; Wachsmann, 1998: 266; Galili & Rosen, 2015: 61, 63, fig. 30; identifier: 'A-15 8210355'	Yes
[142]			Galili *et al.*, 1982: 10; 1994: tbl. 1; 1996: 96, fig. 10; Galili & Raveh, 1988: 42-6, tbl. 1, figs 3a, 4a, 5, 6, pl. V, nos 1-4; Wachsmann, 1998: 266; Galili & Rosen, 2015: fig. 30; identifier: 'A-16 8210364'	Yes
[143]	Megadim, South	Stieglitz, 1972-1975; Wachsmann, 1998: 266	Steiglitz, 1972-1975: 42-43, fig. 1a, pl. 6, no. 1; Linder & Raban, 1975: 81; Ronen & Olami, 1978: 27; Nibbi, 1984: 259; Bravo Pérez, 1988: fig. 1, no. 18; Frost, 1989: fig. 2; Galili *et al.*, 1994: tbl. 1, fig. 16; 2016: 92; Wachsmann, 1998: 255-256, 266, fig. 12.21; Raban, 1993: 959; Galili & Rosen, 2015: fig. 31a; identifier: '34'	Yes
[144]			Steiglitz, 1972-1975: 42-43, fig. 1b, pl. 6, no. 2; Nibbi, 1984: 259; Frost, 1989: fig. 2; Galili *et al.*, 1994: tbl. 1, fig. 16; 2016: 93; Wachsmann, 1998: 255-256, 266, fig. 12.21; Galili & Rosen, 2015: fig. 31b; identifier: '35'	Yes
[145]	Minet el-Beida, ritual encosure/brothel	Schaeffer, 1933: 106-108, pl. XIII, no. 1; Frost, 1991: 386, pl. X, no. 35a	Schaeffer, 1933: pl. XIII, no. 1; Frost, 1991: 386, pls IV, no. 32, X, no: 35a; identifier: 'CS 64.G'	Yes
[146]	Minet el-Beida, unnumbered burial	Schaeffer & Dussaud, 1929: pl. LVIII, no. 4; Schaeffer, 1939: fig. 1; 1978: 371; Frost, 1970a: 387-388; 1991: 386-387, pl. X, no. 36a; Salles, 1980: 12	Schaeffer & Dussaud, 1929: LVIII nos 3-4; Frost, 1991: 386-387, pl. X, no. 36; Brody, 1998: 92, no. 20, figs 46, nos 36, 47; identifier: 'RS 83.8 = 63.20'	Yes
[147]	Mirgissa	Vila, 1970: 188-190, fig. 1, pl. 14a; Nibbi, 1992: 260, figs 5-6; 1993: 12; Basch, 1994: 223-226	Vila, 1970: pl. 14a; Nibbi, 1992: tbl. 1, figs 5, 7; identifier: 'No. 1'	Yes
[148]			Vila, 1970: pl. 14a; Nibbi, 1992: tbl. 1, fig. 5; identifier: 'No. 2'	No
[149]			Vila, 1970: pl. 14a; Nibbi, 1992: tbl. 1, figs 5-6, 9; identifier: 'No. 3'	Yes
[150]			Vila, 1970: pl. 14a-b; Nibbi, 1992: tbl. 1, fig. 5-6, 8; identifier: 'No. 4'	Yes
[151]			Vila, 1970: pl. 14a; Nibbi, 1992: tbl. 1, figs 5-6; identifier: 'No. 5'	Yes
[152]			Vila, 1970: pl. 14a; Nibbi, 1992: tbl. 1, fig. 5; identifier: 'No. 6'	No
[153]	Na'ama Wreck	Raban, 1972-1975: fig. 2a-b; 1990: 299-302	Raban, 1972-1975: 35, fig. 5b pl. IV, fig. 3; 1990: 299-300, fig. 3; Raban, 2000: fig. 12; identifier: 'No. 20'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[154]			Raban, 1972-1975: fig. 5a, pl. IV, fig. 1; 1990: 300, 302, fig. 3, no. 23; 2000: fig. 12; identifier: 'No. 23'	Yes
[155]	Neve Yam C	Galili, 1985; Marcus, 2007: 156, no. 55; Galili *et al.*, 1996: fig. 2	Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 1'	Yes
[156]			Galili, 1985: 149, tbl. 2; 1987: 167, fig. 1; identifier: 'no. 2'	Yes
[157]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 3'	Yes
[158]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 4'	Yes
[159]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 5'	Yes
[160]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 6'	Yes
[161]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 7'	Yes
[162]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 8'	Yes
[163]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 9'	Yes
[164]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 10'	Yes
[165]			Galili, 1985: 147, 149, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 11'	Yes
[166]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 12'	Yes
[167]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 13'	Yes
[168]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 14'	Yes
[169]			Galili, 1985: 145, 147, tbl. 2, fig. 4; 1987: 167, fig. 1; identifier: 'no. 15'	Yes
[170]			Galili, 1985: 147, 149; 1987: 168, fig. 1; identifier: 'no. 16'	Yes
[171]	Point Iria	Vichos, 1996: 17; 1999: 78, 83-85; Vichos & Lolos, 1997: 327; Vichos 1999: figs 1, 16	Vichos, 1996: 17-8, figs 1, 3a; 1999: 78, figs 2, 16; identifier: none	Yes
[172]	Qala'at al-Bahrain, Trench A	Højlund & Andersen, 1994: 405, fig. 2034, plan 3	Højlund & Anderson, 1994: 405, fig. 2034, plan 3; identifier: '520.ACB'	Yes
[173]	Scarab Group, Kfar Samir	Raban & Galili, 1985: 326; Galili & Sharvit, 1999: 16, fig. 25; Galili & Rosen, 2015: 61-63	Raban & Galili, 1985: 326-327, fig. 5; Galili & Rosen, 2015: 61, 63, fig. 29; Galili *et al.*, 1994: tbl. 1, fig. 20, no. 1; 2016: 91, 127; Wachsmann, 1998: 267; identifier: none	Yes
[174]			Galili *et al.*, 1994: tbl. 1, fig. 20, no. 2; identifier: none	Yes
[175]			Galili *et al.*, 1994: tbl. 1, fig. 20, no. 3; identifier: none	Yes
[176]			Galili *et al.*, 1994: tbl. 1, fig. 20, no. 4; identifier: none	Yes
[177]			Galili *et al.*, 1994: tbl. 1, fig. 20, no. 5; identifier: none	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[178]	Shiqmona	Elgavish, 1968: pl. 46; Wachsmann, 1985: 483; 1998: 270	Elgavish, 1968: 34-5 pls 16, no. 1, 46; identifier: none	Yes
[179]	*Tanit*	Ballard *et al.*, 2002	Ballard *et al.*, 2002: 163, fig. 3, bow; identifier: none	No
[180]			Ballard *et al.*, 2002: 162-3, fig. 3, amidships; identifier: none	No
[181]			Ballard *et al.*, 2002: 162-3; identifier: none	No
[182]			Ballard *et al.*, 2002: 162-3; identifier: none	No
[183]	Tel Abu Hawam, Iron IA	Balensi *et al.*, 1993: 14	Balensi *et al.*, 1993: 14; identifier: none	No
[184]	Tel Abu Hawam, Stratum V	Hamilton, 1935: 11-13, pl. 11; Wachsmann, 1998: figs 12.26, 12.27	Hamilton, 1935:13, pl. 11; Wachsmann, 1998: fig. 12.26, loc. 53; identifier: none	No
[185]			Hamilton, 1935:13, pl. 11, near loc. 57 upper; identifier: none	No
[186]			Hamilton, 1935:13; pl. 11, near loc. 57 right; identifier: none	No
[187]			Hamilton, 1935:13, pl. 11, near loc. 57 left; identifier: none	No
[188]			Hamilton, 1935:13, pl. 11, near loc. 57 lower; identifier: none	No
[189]	Tel Michal	Singer-Avitz, 1989: 355, tbl. 1.1, fig. 31.5, no. 2	Singer-Avitz, 1989: 355, fig. 31.5, no. 2, pl. 76, no. 9; identifier: '9630/50'	Yes
[190]	Ugarit, South of Temple of Baal	Frost, 1969b: 242, tbl. 1, figs 7-8, 11; 1970a: 387; 1991: 361, 380-381; Schaeffer, 1978: 375; Brody, 1998: 46-47, 50	Frost, 1969b: tbl. 1, fig. 7; 1991: 380-381, fig. 1b, pls IV, VI, XIV; identifier: 'RS 83.2=63.7'	Yes
[191]			Frost, 1969b: 240-1, tbl. 1, fig. 8; 1991: 381, fig. 1b, pl. IV, VI; identifier: 'RS 83.24=63.8'	Yes
[192]			Frost, 1969b: 238, 241, tbl. 1, fig. 8; 1970a: 282; 1991: fig. 1b, pl. IV; Schaeffer, 1978: 371-9, figs 2, 9; identifier: 'RS 83.1=63.11'	Yes
[193]	Ugarit, Tomb No. XXXVI	Schaeffer, 1939: 55, fig. 45; 1978: 375, figs 6-7; Frost, 1969b: 235, 242; 1970a: 387; 1994: 106; 1991: 360-361, 382, pl. 1a; Brody, 1998: 91	Frost, 1969b: 240, tbl. 1, fig. 27; 1991: 382; Schaeffer, 1978: 374-375; identifier: 'RS 63.27 & 28'	Yes
[194]			Frost, 1969b: 240, tbl. 1, fig. 28; 1991: 382; Schaeffer, 1978: 375; identifier: 'RS 63.27 & 28'	Yes
[195]	Ugarit, Wall of dependency S-W of Temple of Baal	Frost, 1969b: 242; 1991: 379; Schaeffer, 1978: 375, fig. 1; Brody, 1998: 46-47, 50	Frost, 1969b: tbl. 1, fig. 12; 1991: 379, fig. 1b, pls IV, V; Schaeffer, 1978: fig. 1; identifier: 'RS 83.23=63.12'	Yes
[196]	Ugarit, Wall of dependency west of Temple of Baal	Frost, 1969b: 242, tbl. 1, fig. 9; 1991: 363, 378; Schaeffer, 1978: 371, 375, figs 3, 8; Brody, 1998: 46-47, 50	Frost, 1969b: 241, tbl. 1, fig. 9; 1991: 363, 378, fig. 1b, pls IV, V; identifier: 'RS 86.202=63.9'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[197]			Frost, 1969b: tbl. 1, fig. 10; 1991: 378, fig. 1b, pls V, XIII; Schaeffer, 1978: fig. 3; identifier: 'RS 81.100=63.10'	Yes
[198]	Ugarit, West Entrance of Temple of Baal	Schaeffer, 1931: 9; 1978: 375, fig. 5; Frost, 1969b: 242; 1970a: 387, pl. 2b; 1991: 360, 375, pls 1a, 1b, III, VI; Callot, 1987b: fig. 51; Brody, 1998: 46-47, 50	Frost, 1969b: 241, tbl. 1, no. 2; 1970a: 383, 387, 2b; 1991: 376, fig. 1b, pl. III; Schaeffer, 1978: 380, fig. 5; identifier: 'RS 83.101=63.2'	Yes
[199]			Frost, 1969b: 241-242, tbl. 1, no. 5; 1970a: 383, 387, pl. 2b; 1991: 376-377, fig. 1b, pls IIb, III; Schaeffer, 1978: 371; McCaslin, 1980: 47; Raban, 1988: 287; identifier: 'RS 83.13=63.5'	Yes
[200]			Frost, 1969b: 241-242, tbl. 1, fig. 6; 1970a: 383, 388, pl. 2b; 1991: 373, fig. 1b, pl. III; Schaeffer, 1978: 380, fig. 11; identifier: 'RS 83.26= 63.6'	Yes
[201]			Frost, 1969b: 244, tbl. 1; 1991: 375-376, fig. 1b, pl. III; Schaeffer, 1978: 371 fig. 5; Mascle, 1991: 373; identifier: 'RS 83.22=63.4'	Yes
[202]	Uluburun	Wachsmann, 1998: 281; Lin, 2003: 36, 71-94, figs 2.7, 3.1, 3.11, 7.2; Wachsmann, 1998: 338; Pulak, 1998: figs 4, 25; 1999: 210-211, fig. 1; 2008: 299, 306-307, figs 97, 100	Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 145'	No
[203]			Lin, 2003: 71, 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 1603'	No
[204]			Pulak, 1993: 9; 1999: 210; 2008: 306; Wachsmann, 1998: 286-288; Lin, 2003: 71, 75, fig. 3.1; identifier: 'KW 2339'	No
[205]			Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 2597'	No
[206]			Evrin *et al.*, 2002: 265, tbls 2-3, fig. 4; Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 2916'	Yes
[207]			Lin, 2003: 71, 75, 90, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 2917'	No
[208]			Lin, 2003: 75, 86, figs 3.1, 3.9; Yalçın *et al.*, 2005: 633; Pulak, 2008: 306; identifier: 'KW 2920'	Yes
[209]			Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 2921'	No
[210]			Lin, 2003: 75, 86, figs 3.1, 3.9; Pulak, 2008: 306; identifier: 'KW 3330'	Yes
[211]			Lin, 2003: 75, 90-91, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 3332'	No
[212]			Lin, 2003: 75, 90-91, fig. 3.1; Yalçın *et al.*, 2005: 633; Pulak, 2008: 306; identifier: 'KW 3331'	Yes
[213]			Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 3333'	No
[214]			Lin, 2003: 75, 86, figs 3.1, 3.9; Pulak, 2008: 306; identifier: 'KW 3334'	No
[215]			Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 3335'	No
[216]			Lin, 2003: 71, 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 3336'	No

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[217]			Pulak, 1992: 8; 2008: 306; Lin, 2003: 75, fig. 3.1; identifier: 'KW 4001'	No
[218]			Pulak, 1992: 8; 2008: 306; Lin, 2003: 75, fig. 3.1; identifier: 'KW 4002'	No
[219]			Pulak, 1992: 8; 2008: 306; Lin, 2003: 75, fig. 3.1; identifier: 'KW 4009'	No
[220]			Pulak, 1992: 8; Evrin *et al.*, 2002: 265, tbls 2-3, fig. 4; Lin, 2003: 75, 90, fig. 3.1; identifier: 'KW 4010'	Yes
[221]			Pulak, 1992: 8; 2008: 306; Lin, 2003: 75, 86, 88, figs 3.1, 3.9; Dumankaya, 2007: fig. 25; identifier: 'KW 4011'	Yes
[222]			Pulak, 1992: 8; 2008: 306; Lin, 2003: 75, fig. 3.1; identifier: 'KW 4012'	No
[223]			Wachsmann, 1998: 286; Pulak, 1993: 9, fig. 9; 1999: 210; 2008: 306; Lin, 2003: 75, 83, fig. 3.1; identifier: 'KW 4418'	Yes
[224]			Evrin *et al.*, 2002: 265, tbls 2, 3, figs 4, 8b, 9b; Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 4588'	Yes
[225]			Lin, 2003: 75, fig. 3.1; Pulak, 2008: 306; identifier: 'KW 4589'	N0
[226]	Wadi al-Jarf, Building 1 deposit	Tallet & Marouard, 2014: 11-12, figs 15-18; 2016: 147-149, figs 8, 14; Tallet, 2015b: 63, 73-5, figs 38-9	Tallet & Marouard, 2014: 17; 2016: figs 8, 13, 14; identifier: 'A01'	Yes
[227]			Tallet & Marouard, 2014: fig. 18; identifier: 'A02'	Yes
[228]			Tallet & Marouard, 2016: figs 8, 14; Tallet, 2015b: fig. 39; identifier: 'A79'	Yes
[229]			Tallet & Marouard, 2014: fig. 17; 2016: figs 8, 13-14; Tallet, 2015b: fig. 39; identifier: 'A89'	Yes
[230]			Tallet & Marouard, 2014: fig 17; 2016: 149, n. 14, figs 8, 14; identifier: 'A93'	Yes
[231]	Wadi al-Jarf, harbour basin	Tallet & Marouard, 2012: 5; 2016: 141, fig. 4; Tallet *et al.*, 2012: 422-423, nos 88, 90, 93, figs 9, 30; Tallet, 2015a: 90-2; 2015b: 63	Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'A'	No
[232]			Tallet & Marouard, 2012: 5; Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'B'	No
[233]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, figs 9, 30; identifier: 'C'	No
[234]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, figs 9, 30; Tallet, 2013: fig 7; identifier: 'D'	No
[235]			Tallet *et al.*, 2012: tbl. 2, figs 9, 30; identifier: 'E'	No
[236]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'F'	No
[237]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'G'	No
[238]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'H'	No
[239]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'I'	No

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[240]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, figs 9, 30; identifier: 'J'	No
[241]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, figs 9, 30; identifier: 'L'	No
[242]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'N'	No
[243]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'O'	No
[244]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'P'	No
[245]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 30; identifier: 'Q'	No
[246]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 30; identifier: 'R'	No
[247]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 30; identifier: 'S'	No
[248]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'T'	No
[249]			Tallet *et al.*, 2012: 422-423, n. 89, tbl. 2, fig. 9; identifier: 'U'	No
[250]	Wadi Gawasis, Ankhow Monument	Sayed, 1977: 157, 174, maps 1, 3, figs 2-4, pls 13d, 14c; 1978: 70-71, no. 7; 1980: 154; Nibbi, 1984: 258; Frost, 1985c: 321; 1991: pl. IV; 1996: 877-879, 882-883, figs 1, 2a, 3, pl. 1	Sayed, 1977: 163, figs 5, 6, pl. 14c; 1978: 71 n. 7; 1980: 154-155, fig. 1, pls XXI, no. 2, XXII, no. 1; Frost, 1979: 149; 1991: pl. IV: 1996: figs 2a, 9; Wachsmann, 1998: 257, fig. 12.3 B; identifier: none	Yes
[251]			Sayed, 1977: pls 14a, b, d; 1978: 71 no. 7; 1980: 154-155, fig. 1; Frost, 1979: 149; 1991: pl. IV; 1996: figs 2a, 9; identifier: none	No
[252]			Sayed, 1978: 71 no. 7; 1980: 154-155, fig. 1, pl. XXII, 2; Frost, 1979: 149; identifier: none	Yes
[253]			Sayed, 1978: 71 no. 7; 1980: 154-155, fig. 1; Frost, 1979: 149; identifier: none	No
[254]	Wadi Gawasis, Antefoker Monument	Sayed, 1977: 157, 169, 174, 173 no. 21, maps 1, 3, pls 15d-f; 1980: 156; 1983: 3; Frost, 1979: 154; 1985c: 321; 1994: 878; 1996: 881-882, figs 1, 4, pl. 1	Sayed, 1980: 156, fig. 2; Frost, 1996: figs 2a, 9; identifier: none	Yes
[255]	Wadi Gawasis, Cave 2 entrance	Zazzaro, 2007: 155-157, no. 6; Bard & Fattowich, 2010: 7	Zazzaro, 2007: 155-7, figs 67-68, tbl. 5; identifier: 'A3'	Yes
[256]			Zazzaro, 2007: 157, tbl. 5, fig. 67; identifier: 'A4'	Yes
[257]			Zazzaro, 2007: 157, tbl. 5, fig. 67; identifier: 'A5'	Yes
[258]			Zazzaro, 2007: 157, tbl. 5; identifier: 'A6'	No
[259]			Zazzaro, 2007: 157, tbl. 5; identifier: 'A8'	No
[260]	Wadi Gawasis, Cave 3 entrance	Zazzaro, 2007: 155, 157; Bard & Fattovich, 2010: 7	Zazzaro, 2007: 156-157, tbl. 5, fig. 67; identifier: 'A1'	Yes

Number	Context Name	Context Citation	Anchor-stone Citation	Illustrated Votruba, Fig. 1
[261]	Wadi Gawasis, Wadi Bed WG 36	Zazzaro, 2007: 155	Zazzaro, 2007: 158, tbl. 5, fig. 67; identifier: 'A11'	Yes
[262]	Yenikapı, harbour basin	Gökçay, 2007: 120-121, 125; Çölmekçi, 2007: 237, 239-240	Gökçay, 2007: pg. 122 lower fig.; Çolmekci, 2007: fig. 2	No
[263]			Çölmekçi, 2007: 239-240, fig. 3 states: 'Stone anchors are often encountered on the seabed during underwater excavations and because their wooden parts have decomposed, they are difficult to date.'	No

IN THE FOOTSTEPS OF HONOR FROST

Maritime archaeologist Honor Frost (1917-2010) was a pioneer in her field. She left a rich legacy through her innovative research conducted in the eastern Mediterranean on the remains of ports and harbours, sea-level change, shipwrecks and ship construction, and ancient anchors.

This volume provides an appreciation of Frost's work and gives a point-in-time assessment of current projects in the region that are in effect a continuity of Frost's work. As such, it provides an insight into the development of the discipline of maritime archaeology in the region from its infancy to the present day. The subjects covered include Frost's long-term research into the port infrastructures of the Levantine coast, particularly at Byblos, Tyre, Sidon, and Arwad, which heralded harbour geo-archaeology by addressing sea-level change and maritime paleo-landscapes. Also, her excavation and analysis of the ships relating to the archaeological remains of the Punic wars that she excavated from 1971 off the coast of Marsala, Sicily. This work is examined both through her underwater investigation at the time, the creation of a museum in Marsala to house the remains, and through a recent discovery in Frost's archives. Frost's survey of the lighthouse at Alexandria, on which all later work has been based, is also included. Her contribution to the establishment of research into stone anchors is examined within the context of current projects.

Two seminal articles are offered. One with respect to Frost's life before she became a maritime archaeologist: as artist and set and costume designer for ballet productions. The other one provides a detailed overview of her maritime archaeological career.

HONOR FROST FOUNDATION
GENERAL PUBLICATION 1

Sidestone Press
ISBN: 978-90-8890-830-9