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# Schiffe und ihr Kontext

Darstellungen, Modelle, Bestandteile – von der Bronzezeit bis zum Ende des Byzantinischen Reiches

Heide Frielinghaus · Thomas Schmidts · Vasiliki Tsamakda (Hrsg.)



WissenschaftsCampus Mainz  
**Byzanz zwischen  
Orient und Okzident**

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Veröffentlichungen des Leibniz-WissenschaftsCampus Mainz



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Römisch-Germanischen Zentralmuseums und der Johannes Gutenberg-Universität Mainz

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# Vorwort

Schifffahrt ist ein Ausdruck hoch entwickelter Kulturen und spielt bis heute sowohl im privaten wie auch im wirtschaftlichen und militärischen Bereich eine zentrale Rolle. Noch größer war die Bedeutung der Schifffahrt in der Antike und im Mittelalter. Die der Schifffahrt inhärenten Möglichkeiten sicherten nicht nur die Versorgung von Großstädten (wie z. B. Rom oder Konstantinopel), sondern erleichterten auch überregionale Kriegsführung und waren Voraussetzung für die Ausbildung und Bewahrung von Großreichen im Mittelmeerraum und in angrenzenden Meeren. Die Entwicklung von Fernhandelsrouten unterstützte zudem die Ausbildung weiträumiger Kulturkontakte.

Dementsprechend spielten Schiffe und Schifffahrt in der antiken und mittelalterlichen Vorstellungswelt eine beachtliche Rolle, was sich sowohl in schriftlichen Äußerungen als auch in der materiellen Kultur niederschlug. Die Wichtigkeit des Themas in der antiken und mittelalterlichen Lebenswelt verdeutlichen nicht nur die Zahl und die Verschiedenartigkeit verzierter oder beschrifteter Objektgattungen, sondern auch die Vielschichtigkeit der Kontexte, in denen die schriftlichen und materiellen Zeugnisse verortet waren – Schiffe spielten u. a. eine Rolle in den verschiedenen Feldern privater und öffentlicher Repräsentation, im weiten Feld religiöser Praktiken sowie im technisch-organisatorischen Bereich der Handwerker oder der Öffentlichen Hand.

Obwohl materielle Reste von Schiffen, Schiffsdarstellungen oder Schriftzeugnisse zu Schiffen in Vereinzelung oder kleinen Gruppen immer wieder in der Forschung behandelt wurden, ist eine systematische, nach Epochen und Verwendungszweck differenzierende Auseinandersetzung mit dieser Quellengruppe noch immer ein Desiderat. Die vom Arbeitsbereich Klassische Archäologie und der Abteilung Christliche Archäologie und Byzantinische Kunstgeschichte der Johannes Gutenberg-Universität Mainz in Kooperation mit dem Kompetenzbereich Antike Schifffahrt des RGZM gemeinschaftlich initiierte Tagung wurde vom 24. bis zum 25. Mai 2013 im Vortragssaal des RGZM in Mainz abgehalten. Sie verfolgte folgendes Ziel: Unter Einbeziehung ikonographisch-ikonologischer Methoden, semiotischer und mentalitätsgeschichtlicher Ansätze sowie einer breit angelegten Kontextualisierung sollte anhand eines sorgfältig ausdifferenzierten Materialspektrums ausgelotet werden, welche Aussagen durch verschiedene Quellengattungen ermöglicht werden. Hierzu gehörten nicht nur Aussagen zur Verwendung und Bedeutung

von Schiffen und Schiffsdarstellungen, sondern auch solche zu den technischen Gegebenheiten realer Schiffe. Der Fokus lag zum einen auf Aussehen, Konstruktion, Vorkommen und Verwendung verschiedener Schiffstypen, zum anderen auf der Bedeutung von Schiffsdarstellungen in unterschiedlichen Kontexten (privates Wohnen, Grab, Heiligtum, öffentlicher Raum, staatliche Repräsentation etc.), und zwar unter Beachtung von Anbringungsort, Material und Darstellungsform.

Ein Hauptziel war es, in den genannten Bereichen einen ersten epochen- und kulturübergreifenden diachronen Überblick zu gewinnen, um in differenzierter Weise Kontinuitäten und Wandel, Verbindungen und gegenseitige Einflüsse über einen längeren Zeitraum herauszuarbeiten und verfolgen zu können. Der geographische Fokus der Untersuchungen lag auf dem Mittelmeerraum als Zentrum der griechischen, römischen und oströmisch-byzantinischen Kultur. Der chronologische, die Grenzen der einzelnen altertumswissenschaftlichen Disziplinen überbrückende Rahmen umfasste die Zeit von der Bronzezeit bis zum Ende der byzantinischen Epoche.

Die 18 hier versammelten Beiträgen beleuchten die »Schiffe und ihre Kontexte« in vielerlei Facetten über den gesamten genannten Zeitraum hinweg. Sie behandeln Materialgruppen mal gesamtheitlich, mal exemplarisch; auch schiffbauliche und nautische Entwicklungen werden über z. T. lange Zeiträume evaluiert, ebenso Werkzeuge der Schiffbauer oder Rekonstruktionen von Wasserfahrzeugen. Im Gegensatz zu anderen archäologischen Themen bleibt die systematische Erforschung von Schiffsdarstellungen ein Desiderat, zu dessen Fortschreiten diese Publikation einen Beitrag liefern möchte.

Die Herausgeber danken der Inneruniversitären Forschungsförderung der Johannes Gutenberg-Universität Mainz, dem FSP Historische Kulturwissenschaften (JGU), dem Leibniz-WissenschaftsCampus Mainz: Byzanz zwischen Orient und Okzident sowie dem Generaldirektor des RGZM, Falko Daim, für die finanzielle und organisatorische Unterstützung bei der Durchführung der Tagung und den Druck des Tagungsbandes. Ebenso möchten wir Claudia Nickel und Marie Röder vom Verlag des RGZM danken, die zum Gelingen dieses Bandes beigetragen haben.

*Mainz, im Dezember 2016*

*Heide Frielinghaus  
Thomas Schmidts  
Vasiliki Tsamakda*





# Ancient Depictions as a Source for Sails and Rigging

The shipping that sailed in large numbers upon the waters of the ancient and early-medieval Mediterranean is seemingly well documented from archaeological and historical sources. Shipwreck remains provide us with a vivid physical insight into the details of the construction of such vessels<sup>1</sup> while numerous literary sources<sup>2</sup> provide accounts of sailing on board such vessels. Meanwhile, archaeological finds from a broad cross-section of terrestrial contexts, distributed across the Mediterranean have allowed us to develop a detailed picture of the wide range of goods that were carried aboard ancient vessels, the routes that they may have taken and the people that conducted such exchanges. Added to this formidable corpus of evidence is the iconographic record that this volume is concerned with addressing (e.g. **fig. 1**). Many thousands of images of ships from all periods survive in a wide range of different media<sup>3</sup> and such depictions probably represent the single most common source for the ships and boats of the ancient Mediterranean, surviving as they do from very early periods and increasing in abundance throughout the period that we are concerned with here.

Despite the wealth of evidence just outlined, the rigging and sailing practices that were used by such vessels are an area of study that is relatively underdeveloped when compared to our understanding of ship construction, trade routes, etc. Although there are recent published accounts of the archaeological remains of rigging components<sup>4</sup>, wider analyses based on such finds have been difficult because of the problem associated with attempting to generalise from a very limited evidence base. This paper seeks to address the difficulty of accessing the wider view from an archaeological perspective by setting out the usefulness, or otherwise, of the iconographic evidence in establishing some general points concerning sail and rigging development in the ancient Mediterranean. It is then possible to look a little deeper at some depictions and explore how we may really use the strength of iconographic evidence to develop a picture of the long-term development of rigging and sails in the ancient world. Moving on from this, it is possible to begin to address the wider implications, derived from iconographic sources, of some specific examples of technological change; namely the

introduction and use of the lateen sail and the sprit-sail in the Mediterranean.

The period under discussion throughout this paper ranges broadly from the middle of the 1<sup>st</sup> millennium BC to the middle of the 1<sup>st</sup> millennium AD. The reason for this is quite deliberate; it is from this period that we can really explore the value of iconographic depictions, because we have other sources, such as direct archaeological remains, to compliment it and to highlight its failings. This is not the case in earlier periods, for example the Mediterranean Bronze Age, where we are often reliant on iconographic evidence alone. The ability to validate theories in this way, using direct physical remains, must be a central part of developing methods for using iconographic evidence for understanding past maritime technology. An understanding that is ground-truthed in this way can then perhaps be extended further back in time into periods where the comparative archaeological evidence is less abundant, or entirely lacking.

## The study of ancient sailing rigs

The study of ships through the archaeological and historical record can perhaps be usefully considered by dividing the ship itself into several main areas which have been the focus, to different degrees, by Academia;

- **Cargoes:** From an archaeological perspective the study of shipwreck sites has a strong emphasis on the cargo remains that are present during excavation. The information that such remains can provide in the context of trade routes, goods of trade and the wider economic systems that are in operation often means that the cargo is the main subject of archaeological investigation.
- **Hull construction:** Such study may also incorporate the motives of the ship-builders and ship-owners that commission the building of the vessel in the first place. This can give further insights into related social, economic and geographical factors that might be influencing the construction of ships or wider trends in contemporary society. The prevalence of surviving hull material over other areas of the

1 See the wide range of examples given in Pomey/Kahanov/Rieth, *Transitions*.

2 See examples provided by Casson, *Seamanship*.

3 For example Basch, *Musée*.

4 For example see Ximénès/Moerman, Laurons; Wild/Wild, Berenice; Beltrame/Gaddi, Grado; Whitewright, *Rigging*.

vessel, particularly in the ancient Mediterranean means that it is often a main focus for archaeological investigation.

- **Rigging:** The technological element that gives a sailing ship its propulsion and moves it from point A to point B. Such information can be used to establish the performance of vessels, including their possible speed and ability to travel on certain trade routes.
- **Crew:** The seafarers/mariners that lived and worked on board the ship and whose primary interaction with the vessel is through its sailing rig. This is the study the day-to-day use of the ship itself and also potentially any internal social dynamics that might be present on board.

With these main areas of existing research in mind, it is reasonable to state that the detailed study of sailing rigs and the implications that arise from this study are quite neglected within the field of maritime archaeology and history. This will be backed up by a quick browse through most general publications concerning ships and boats, and the ancient world is no exception to this. However, as the preceding discussion has hinted, there are perhaps some fundamental reasons, both macro-scale and micro-scale, why it is very important to continue to try to build and develop our research into sailing rigs and these may usefully be repeated here. At the most basic of levels, we cannot claim to be attempting to fully understand the watercraft of the ancient world unless we study the sailing rigs that propelled those vessels, as well as the way they were built and the cargoes that they carried. This understanding can be seen to occur on two levels, now discussed.

Firstly, on a larger, macro-scale, we should be able to develop an overall chronology of general rig-types. In doing this we can begin to infer useful information about ancient vessels once the general type of rigs in use has been established. This might include an ability to estimate the possible performance that vessels could have achieved, the angles to the wind that could be sailed and to comment on the sailing times between ports in conjunction with any seasonal restrictions to such sailing. This kind of information would seem to be fundamental to our wider understanding of the mechanisms of ancient trade which lie at the heart of studies of shipwreck cargoes and other traded goods. Likewise, there is the clear potential to record broad changes to maritime technology within a specific society or region. Understanding such changes might help us to understand other change for which there is less evidence or where the possible conclusions that can be drawn are much less clear cut.

Secondly, on a more detailed, micro-scale level we can seek to record and catalogue the detail of the sailing rigs. Doing this can help us to understand the aspects of sailing related to the crewing and operation of vessels and in turn to begin to suggest something about the interaction between

sailing vessels and wider society. Such considerations might include how society might have perceived or visualised sailing rigs, how many crew may have been required on a vessel and what the living and working conditions might have been like on board. In addition to this, the limited archaeological evidence is increasingly indicating that there are potentially significant regional/cultural traditions within the rigging of the ancient world<sup>5</sup>. This in turn might allow us to trace the movement of maritime cultures, or to identify the presence of people from one region/culture within another region or culture. By addressing all of these areas we can perhaps begin to investigate some of the factors that encourage people to change the maritime technology that they use, and upon which their lives and livelihoods depend.

Finally, I am content to state that as a maritime archaeologist I am interested in studying the activity of seafaring. It is an unavoidable fact that the most direct route to understanding the sailors and mariners of the ancient world is to understand the material culture that they created, utilised, maintained and changed on a daily basis throughout their lives, during their time at sea. In my opinion the best example of this is the sailing rigs that they used to propel the ships that they sailed upon. Although obviously contentious, it can perhaps be observed that by studying shipbuilding, we are largely committing ourselves to a study of people who stayed on the land, albeit firmly within a maritime context and culture. The abundance of available archaeological evidence dictates that the study of such terrestrially based practice is clearly useful for understanding the range of factors that can impact upon the creation and choice of maritime technology<sup>6</sup>. However, only by studying the sails and rigging of such vessels, both in their creation and use, do we begin to study the people who went to sea, within the daily context that they worked.

## Sources of evidence

The sources of evidence that we utilise for the study of ships and boats in the ancient world, including rigging, are well-established and can be said to generally comprise; direct archaeological evidence, iconographic depictions and literary descriptions. In addition to this, we can also utilise second-hand material in the form of ethnographic and experimental archaeological research, where appropriate. These sources invariably have identifiable strengths and weaknesses, the discussion of which is outside the scope and space of this paper but which are well covered elsewhere<sup>7</sup>. However, it is worth spending a little time considering the merits of using depictions of ships to understand ancient rigging, versus the possibility of using direct archaeological remains. Specifically, it is worth trying to set out what existing research informs us

5 Whitewright, Rigging 291.

6 For example see the work of Adams, Ships.

7 Tzalas, Iconography. – Calcagno, Iconography. – Houston, Ports.

we can, and cannot, discover or understand from the use of these two sources in particular. Doing this will then allow the remainder of this paper to explore some case studies in a little more detail as a means to illustrate these ideas.

The archaeological record itself is clearly of great value in understanding rigging from any period because it can tell us what was actually present on an individual vessel, or was being used by the vessels visiting a particular harbour or site in the case of terrestrial finds. The archaeological remains provide us with an insight into the detailed exactness of the material culture used in the day-to-day working of the ships and boats that we seek to understand. Through this it is possible, sometimes, to differentiate between sailing rigs or to identify the presence of a specific type of rig. For example, the presence of brail rings on a wreck site is an almost certain indicator of a vessel rigged with a Mediterranean square-sail<sup>8</sup>. We may also be able to identify chronological trends or regional traditions in the appearance or manufacturing technique of certain rigging components in the same way that we can create typologies of ceramics, or other artefacts. A good example of this comes from the Roman port sites of the Red Sea coast where the only significant finds of sail cloth in the ancient world have been excavated and published<sup>9</sup>. This archaeological material has confirmed the use of reinforcement strips running across the face of the sails previously suggested on the basis of iconographic analysis<sup>10</sup>. Moreover, the archaeological remains from the Red Sea have also indicated at least three contemporary methods for sail-making within a single overall rigging tradition<sup>11</sup>. This has illustrated the use of criss-cross reinforcement strips as well as reinforcement set along exclusively vertical and horizontal lines, with the seams of the sail running parallel.

Despite this undoubted potential, the archaeological record is sometimes as ambiguous as the most strangely drawn iconographic depiction. It is for example, very difficult to distinguish the archaeological record of the wreck-site of a lateen-rigged vessel from that of a square-sail vessel where the brail rings have not survived<sup>12</sup>. Added to this is the acknowledged problem that the excavation, documentation and publication of rigging components during projects is often of lower priority than other areas such as the hull or cargo remains<sup>13</sup>. As a result of this, the published, available archaeological record is probably a great deal smaller than the amount of material that has actually been excavated. This problem is potentially even more acute when »soft« components such as cordage are considered as well as the »harder« wooden elements like deadeyes or sheave blocks.

Having addressed the advantages and disadvantages of the direct archaeological evidence, we can now turn our attention to the iconographic depictions with a little more con-

textual background and begin to assess why we need to rely on iconography to fully understand the sails and rigging of the ancient Mediterranean. Essentially the question is a simple one; what can iconographic depictions tell us about rigging that other sources (archaeological, literary, etc.) cannot? But, it is of equal importance that we ask what it cannot tell us. If we can understand these two elements together then we can ensure that sensible, reasoned questions are asked of the evidence; increasing the likelihood that we will get a sensible, reasoned answer.

As noted above, it is outside the scope of this paper to discuss in detail the already well-documented problems that are associated with using iconographic material as a source of evidence. From the perspective of Mediterranean watercraft, these problems are admirably dealt with in the paper by Tzalas<sup>14</sup> that analyses the modern creation of a mosaic depiction of the Kyrenia II ship reconstruction. Bearing this in mind and building upon Tzalas' work looking at watercraft in general, in conjunction with the specific research into rigging undertaken by this author, the strengths, weaknesses and overall limitations of using iconographic evidence as an interpretative tool for understanding the rigging of ancient Mediterranean watercraft are summarised in **table 1**.

It is clear from this that iconography, as a source of evidence, is poorly suited for extracting or inferring technical detail. It is reasonable to suggest that the direct archaeological evidence, where it exists, is much better suited for this purpose. Set against this, is the observation that the sheer abundance of ship and boat iconography dictates that it can be used as a means to establish broad, generalised trends of maritime technological continuity, or change. Something that is difficult to achieve from the sporadic nature of the archaeological record. We can therefore suggest a methodology whereby overall trajectories of rig types and more obvious technical characteristics (e.g. number of masts, general sail-plan) can be postulated from the iconographic sources. More detailed observation of smaller-scale features must then be placed onto this framework as the vagaries of the archaeological record allow. This is not necessarily a novel approach to this subject, it is simply helpful to define the parameters of what can and cannot be achieved with the various sources at our disposal.

## An overview of Mediterranean sailing rigs

As just noted, one of the clear strengths of the iconographic source material is its ability to illuminate long-term trends in the sail and rig technology of the ancient Mediterranean. It is possible to do this because the overall rig-plans are often

8 See also Whitewright, Technology 493.

9 Wild/Wild, Berenice 214. – Whitewright, Rigging 290.

10 Casson, Seamanship 68 f. 234.

11 Whitewright, Rigging 290.

12 Whitewright, Technology 495.

13 Sanders, Ropes 2 f.

14 Tzalas, Iconography.

Limitations	Strengths
Iconographic interpretation can be limited by:	Iconographic interpretation can benefit from:
Modern (mis)interpretation	An abundance of examples, relative to other types of evidence
The fact that the dimensions of rigging and sails cannot be accurately inferred	An ability to define general rig types through an understanding of sail form
Difficulties in extracting or interpreting reliable detail from most depictions of sailing rigs	The identification of phases of technological continuity, variation and change
Anachronistic features	The establishment of broad chronologies of types and technologies
Ambiguity, stylisation or inaccuracy in the manner or depiction. All of which can be deliberate, or accidental on the part of the artist	The identification of widespread artistic convention or styles allowing comparative interpretation

**Tab. 1** The limitations and strengths of using iconography as a source for understanding the sails and rigging of ancient and early-medieval Mediterranean sailing vessels. Each strength has a directly comparable limitation that should act as a counterbalance and deterrent to becoming solely reliant on iconographic evidence. Likewise, each limitation can be counteracted by an identifiable strength that allows us to continue to utilise iconographic material as a primary source of evidence.

fairly well defined by ancient artists. This, coupled with the abundance of evidence, means that it is possible to follow how the Mediterranean square-sail and other contemporary rigs, develop, vary, innovate and become abandoned during the period under discussion. This is visualised in **figure 2** and it is on this basis that the following section sets out an overview of this development based on the iconographic evidence and considered via technological features, rather than chronological sequencing. It can be reiterated, that as with much of our current understanding of the maritime component of the ancient Mediterranean this analysis builds heavily on the enduring work of Basch<sup>15</sup> and Casson<sup>16</sup>.

It is clear, and widely accepted, that from the Late Bronze Age onwards, the primary sail of the ancient world was the loose-footed square-sail, set from a single mast and furled

using a system of brails (**fig. 3**)<sup>17</sup>. It is equally clear that such vessels were still being depicted by artists in the early 7<sup>th</sup> century AD (**fig. 4**). While this might not be definitive proof of the existence of such rigs at that period, they were obviously still fresh in the minds of some people. It is thereby possible to establish a line of technological continuity that stretches right through the period under discussion here, of the use of this type of rig. As such, the single-masted, loose-footed, brailed, square-sail rig can be considered as the point of reference for other developments; direct, indirect, tangential or otherwise.

To this central line of continuity we can add the use of a small foresail, or *artemon*, from the middle of the 1<sup>st</sup> millennium BC. From the perspective of studying sailing practices, our interest in this feature is that the *artemon* is a sail whose sole purpose was to aid in balancing the interaction between

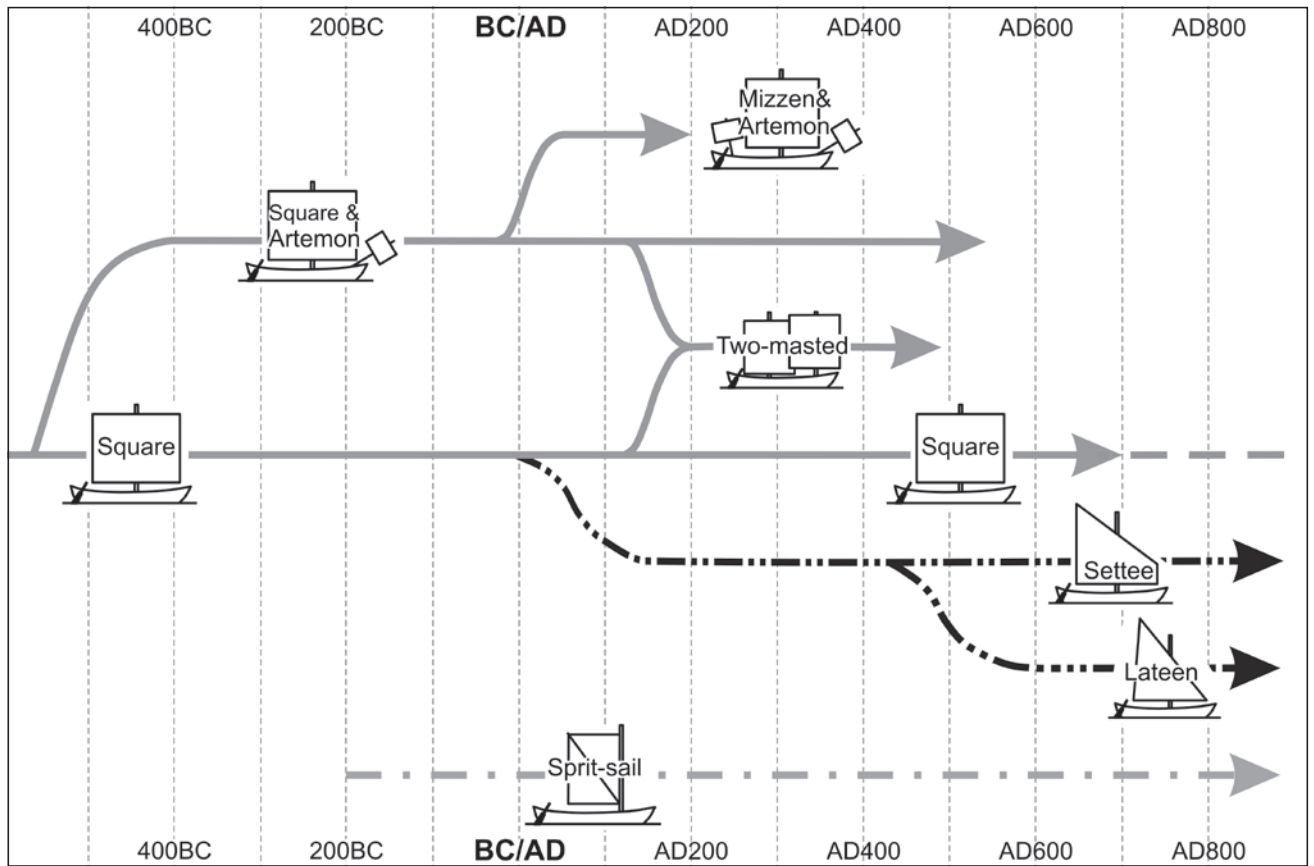
15 Basch, Musée.

16 Casson, Seamanship.

17 e.g. Casson, Seamanship 38 f.

**Fig. 1** Carved Roman sarcophagus relief dating to the 3<sup>rd</sup> century AD housed in the Ny-Carlsberg Glyptotek, Copenhagen. The relief depicts three sailing vessels at the entrance to a port, possibly Ostia, and is notable for the realism and detail of the subject matter. The central vessel carries a sprit-sail with the mast stepped far forward in the hull. The sprit is hidden behind the sail but is visible when the relief is viewed from the left. The other two vessels both carry square-sails with *artemon* foresails, and the artist has shown their sails in a very different way, with the ruffled sailcloth indicating the path of the vertical brailing-lines. – (Photo J. Whitewright).

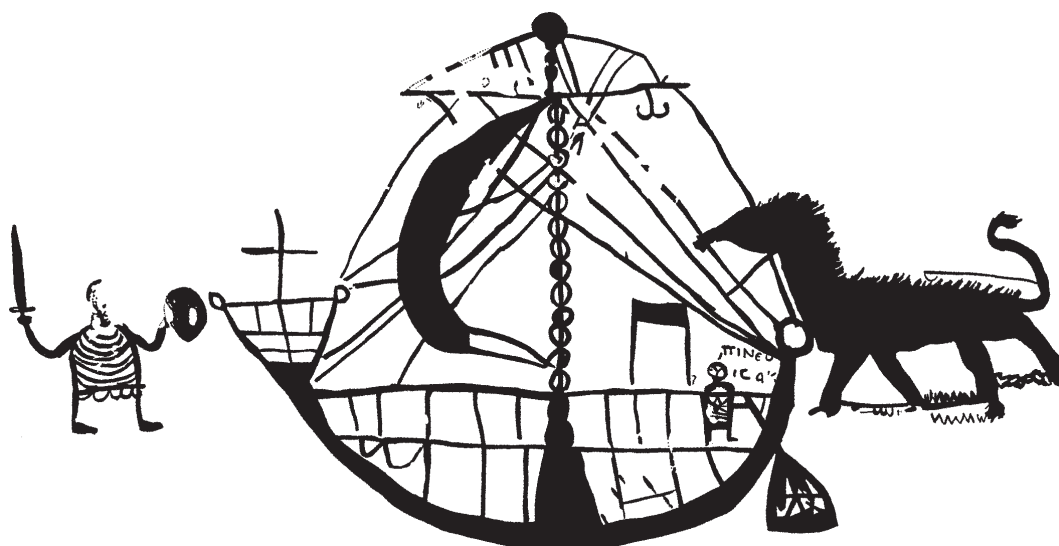




**Fig. 2** Long-term developmental trends in the rigging of ancient and early-medieval Mediterranean sailing vessels based primarily upon the interpretation of iconographic evidence in conjunction with archaeological and literary where required. Families or traditions of rigging are differentiated by different line styles. – (Illustration J. Whitewright).

**Fig. 3** Cypriot bichrome ware jug dating to 750-600 BC showing a sailing vessel carrying a single-masted, loose-footed sail. The sail is furled up to the mast and although its shape is not shown by the artist the equal distribution of the sail on either side of the mast, along with the evidence from contemporary depictions indicates it is likely to be a square-sail. The depiction of vessels with heavily down-curved yards had been a common artistic convention in the Levant from the Late Bronze Age. – (British Museum cat. no. 1926,0628.9; © Trustees of the British Museum).





**Fig. 4** Graffito of a single-masted, square-sail vessel depicted at Kellia, Egypt in the early 7<sup>th</sup> century AD. The vessel depicted is rigged with a single mast. The horizontal, symmetrical nature of the yard suggests that the sail (which is shown from the side) is a square-sail. From the lines running from the mast, yard and sail it is possible to interpret port and starboard braces, two sheets, forestay, backstay and possibly lifts. – (Redrawn by J. Whitewright from Kasser, Kellia fig. 156).

hull and sailing rig<sup>18</sup>. In this regard, it is one of the surest signs that ancient mariners were attempting to sail on courses to windward and reacting to the problems that they encountered when attempting this, in a manner more consistent than in previous centuries. The result of this was the development of a form of technology that was widely recognised enough to begin to be reflected in artistic depictions of those vessels. Like the single square-sail rig, the mainsail and *artemon* arrangement (fig. 1) endures for a considerable period of use, with unambiguous depictions surviving from Late Antiquity. As well as a refinement in the ability of vessels to be sailed to windward, there is also an identifiable development to extract more speed from a vessel's rig on other courses. This takes the form of triangular topsails that were in use in both variants of the square-sail rig just described from at least the 1<sup>st</sup> century BC.

In some depictions, admittedly rare, further refinement occurs through the addition of a third mast at the stern of the vessel; nowadays we would term this a *mizzen* mast in English nautical terminology. The depictions and supporting evidence (such as literary accounts) are relatively scarce for this sail-plan, but it is likely to have been in use from the 1<sup>st</sup> century BC. A well-known example occurs at Ostia, on the floor of the *Foro delle Corporazioni* (The Square of the Corporations) outside an office belonging to »the shippers of Sullethum«, a town on the east coast of Tunisia<sup>19</sup>. The left hand of the two depicted vessels is shown with a main-mast, *artemon* and *mizzen*. How long such a rig remained in use is difficult to tell with any certainty, because it is depicted so rarely. Like the *artemon*, the main purpose of the *mizzen* mast was to increase the ability of mariners to balance the sailing

rig and manoeuvre the vessel. Again, as with the *artemon*, the development and use of the *mizzen* tells a tale of mariners that are prepared to adopt innovative solutions to the problems of sailing to windward, or perhaps in the manoeuvring of the larger ships that other archaeological data suggests were increasingly used from the 1<sup>st</sup> century BC<sup>20</sup>.

Finally, when considering the square-sail, from the 2<sup>nd</sup> century AD we can trace a further line of development of the single-masted square-sail rig via the depiction of vessels carrying a rig of two equally sized square-sails (e. g. fig. 5). In this instance, the additional sail would have added significantly to the propulsion of the vessel as well as improving its manoeuvrability, relative to the single-masted form of rig. It is again possible to speculate about the wider implications of this development; perhaps relating to the building of vessels large enough to render a single mast impractical. Either because it could not be adequately provided for from available timber resources or could not be made secure enough through existing engineering capabilities or techniques.

The use and development of the various forms and arrangements of square-sail rig in the ancient Mediterranean is of course only part of the story, albeit it is quite a well-documented one. In addition, there is also sound evidence for the use of fore-and-aft sails in the Mediterranean. Initially, such sails are visible through the presence of depictions of sprit-sails dating from the 2<sup>nd</sup> century BC, which continue to be depicted in iconographic sources (e. g. fig. 1) until the 3<sup>rd</sup> century AD<sup>21</sup>. Secondly, in an unrelated technological development, vessels carrying lateen/settee rig (e. g. fig. 6) are in use sporadically from the 2<sup>nd</sup> century AD, eventually becoming seemingly more widespread in Late Antiquity<sup>22</sup> before even-

18 For an explanation of the concept of balance between rig and hull see Palmer, *Balance*.

19 See Casson, *Seamanship* xxiv fig. 145.

20 For discussion see Parker, *Shipwrecks* 26; Wilson, *Economics* 213-217.

21 Casson, *Sails*.

22 Whitewright, *Lateen* 103.

**Fig. 5** A marble relief, excavated from Carthage and dating to c. AD 200 showing a two-masted sailing vessel. The equally sized masts and sails suggest that the vessel is truly two-masted rather than being rigged with mainsail and *artemon*. Similarly the location of the masts is also suggestive of a balanced two masted rig. Each mast is depicted in identical fashion. Ropes are shown running from masthead to deck on either side of the mast which may represent shrouds or stays. Both sails are also depicted with braces. Sail cloth is depicted with continuous horizontal lines and discontinuous vertical lines to form a »brick-work« pattern in a style that is commonly shown in other depictions, for example **fig. 1** above. – (British Museum cat. no. 1850,0304.32; © Trustees of the British Museum).



tually supplanting the square-sail as the sailing rig of choice in the Mediterranean during the medieval period. What is of particular relevance to this paper is that the use of these sailing rigs can only be unambiguously postulated through the iconographic evidence. Archaeological and literary sources do not support their existence with any degree of certainty.

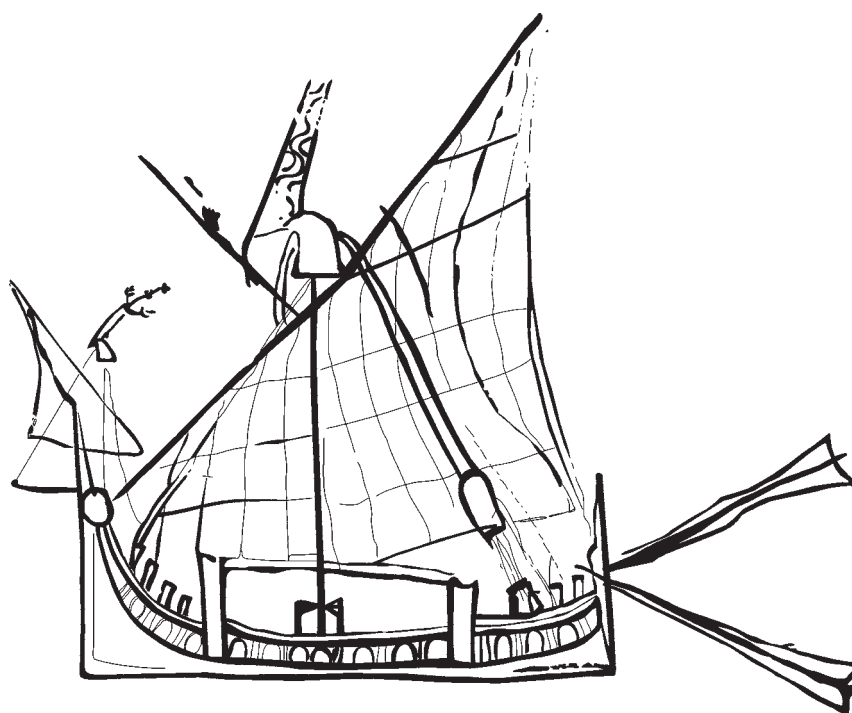
## Implications

The iconographic evidence that it is possible to assemble can be put together to illustrate the reasonably well-accepted set of developmental sequences in the sailing rigs of the ancient Mediterranean that was outlined above. If these sequences are considered a little more, then several broader implications are abundantly clear in relation to the wider story of Mediterranean sailing rigs that we are seeking to

tell via the iconographic record. These are now worthy of some discussion.

Firstly and most obviously is the fact that just within the use of the square-sail, there is a considerable amount of technological variation in what we can usefully term a single rigging tradition in the case of the Mediterranean square-sail. The development of the *artemon* and *mizzen* to address specific aspects of sailing practice illustrates the high level of understanding that ancient mariners and shipwrights had of the interaction between their vessels and the surrounding environment; both wind and water. Likewise, the use of the fully two-masted rig on contemporary shipping tells a tale of nuanced variation and an ability to respond to wider developments (economic, political, etc.) that may have been driving an increase in vessel size or limiting useable resources. The rigging of ancient sailing ships was certainly not a limiting factor in determining the sizes to which vessels could be

**Fig. 6** Graffito of a lateen rigged ship depicted at the monastic site of Kellia, northern Egypt in the early 7<sup>th</sup> century AD. The triangular form of the sail, in conjunction with a heavily inclined yard suggests the vessel is rigged with lateen sail. The mast is supported with a forestay and the artist has depicted a double halyard that runs from the yard through a prominent hook-shaped masthead before returning to a large block above the deck. The form of the hook-shaped masthead is repeated at the bow of the vessel, possibly suggesting the presence of a foremast. – (Redrawn by J. Whitewright from Basch, Kellia fig. 1).



constructed. In combination, these observations should give us cause to stop and reconsider the »traditional« view<sup>23</sup> of mariners (and Roman mariners especially) as conservative and reluctant to experiment; innovative technological variation was clearly possible within the maritime technology of the ancient world.

Secondly, and as a counterbalance to this, we must highlight the fact that while there is significant variation, the technological constant right the way through the period is the single-masted version of the square-sail rig. Although it is often seen as the precursor to subsequent developments and its use somewhat antiquated, for large parts of Mediterranean maritime society this was not the case and it seems to have been their rig of choice from the Late Bronze Age to Late Antiquity. If we accept that rather than being anachronistic, such a rig was actually perfectly suited to the needs and requirements of some elements of society then there seems every reason for it to continue in use until those needs or requirements altered. Taking this broad view in relation to the continuation of a form of technology bears interpretative fruit when the changes that can be observed to sailing rigs are considered below.

Thirdly, it is abundantly clear that the use of fore-and-aft sails is of potentially much greater antiquity than is often acknowledged. The sprit-sail in particular is present for a very long period of time, and has recently been attested to by archaeological finds from Yenikapı in Istanbul and the Yenikapı 6 shipwreck in particular<sup>24</sup>. This at the very least informs us that it was still being used in the rigging of eastern Mediterranean watercraft in the 9<sup>th</sup> and 10<sup>th</sup> centuries AD and is a part of the link in what may eventually allow its use to be acknowledged as continuing in the Mediterranean from the 3<sup>rd</sup> century BC to the present. If some consideration of the development of the lateen sail is added to our picture, it becomes clear that there was a plethora of experimentation, variation, innovation and change going on within the sphere of ancient sailing rigs, in addition to notable instances of technological continuity.

The narrative outlined above is perhaps compelling reason enough to consider the use of iconographic evidence as an extremely important tool in building an understanding of ancient sailing rigs. It clearly allows us to pick out broad scales of technological trends through the observation of repeatable features in the evidence, allied to an acceptance that our objective is the establishment of a general schema of development. Likewise, some of the implications that lie behind the trends that we can observe are fascinating to consider in more detail. Moving away from the square-sail it is to the less well-covered examples of the sprit-sail and lateen/settee

rig that we now turn as a means to consider how far we can extend our analysis of ancient sailing rigs based on the iconographic evidence that we have. As noted above, these two rigs make a useful case study in this regard, because of the difficulty in differentiating them archaeologically from contemporary square-sails.

### Case study 1: the sprit-rig

As noted above, the sprit-rig is visible in the iconographic record (e.g. **fig. 1**) from the 2<sup>nd</sup> century BC in depictions that must be considered largely unambiguous in what they are depicting<sup>25</sup>. The sprit-rig itself is of further interest to us for two interrelated reasons. Firstly, as a sailing rig the sprit-sail has little or no technological relationship to the square-sail. The way a sprit-sail is rigged and used bears no resemblance to what we currently understand about likely practices of square-sail rigging and handling in the ancient world. This in itself is of great interest because it illustrates a genuine example of original invention within the context of the ancient sailing rig. This provides a useful contrast to the continuity and variation exhibited by contemporary square-sail vessels (see above).

Secondly, of all the sailing rigs that are known to have existed in the ancient world (square, sprit and lateen/settee), the sprit-rig offers the best all-around performance, including on upwind courses<sup>26</sup>. That it does not become widely used, and subsequently depicted, indicates that upwind performance was not the dominant factor that dictated the type of maritime technology that people chose to adopt. This is contrary to the inference given by most academic commentators for whom improved windward performance is usually one of the driving »needs« behind sailing rig innovation (sprit, lateen, settee or otherwise) in the ancient world<sup>27</sup>. Instead, we may consider that the invention of the sprit-rig resulted from the same set of circumstances that gave rise to the *artemon*; as mariners began to rationalise the challenges faced by sailing on the wider range of courses that may have been a result of increasingly regularised long-distance trade routes. However, it may simply have been the case that although it offered advantages in upwind performance, ancient sailing routes and patterns of trade were already optimized for cross-wind and down-wind sailing, as were the hull forms being built. On those courses the square-sail remained dominant. The sprit-rig may have been marginalised to the small craft and river vessels that the depictions suggest utilised it.

The example of the sprit-sail offers an insight into an often overlooked aspect of ancient sailing rigs that is only

23 For example Casson, *Seamanship* 173.

24 Kocabaş/Kocabaş, *Yenikapı* 103-112.

25 Casson, *Sails*.

26 Marchaj, *Sailing* 161 figs 144-145. – Palmer, *Performance* 85f. – Palmer, *Fastest* 1390. – Palmer, *Measuring* 188-193.

27 Recent examples include Basch, *Latine* 72; Campbell, *Lateen* 2; Casson, *Seamanship* 243; Castro et al., *Ships* 347f.; McCormick, *Origins* 458; Polzer, *Toggles* 242; Wilson, *Economics* 221.

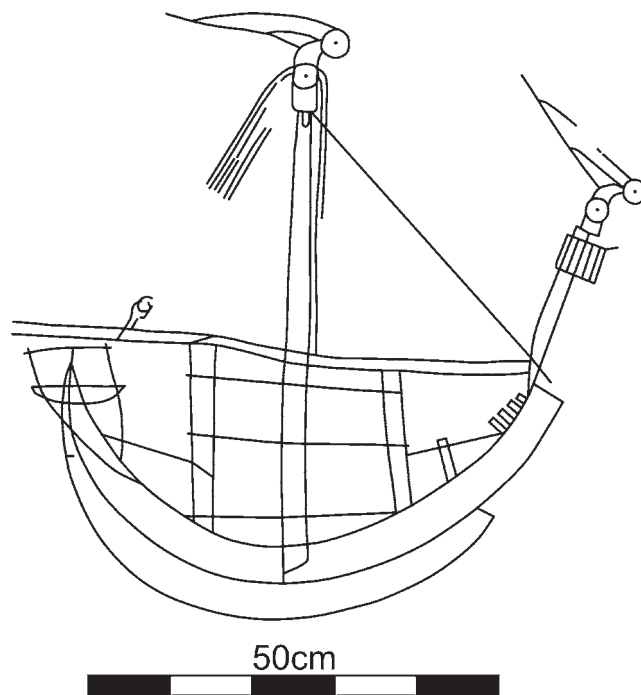


visible on the basis of the iconographic record. In this regard it re-emphasises one of the strengths of the iconographic record, previously stated above, in allowing an overview of the broad development and interrelationship of rig types to be established. Such a use for the iconography of ancient sailing rigs is given further credence when the wider implications of the appearance and use of the sprit-sail are considered, as just outlined. In this regard the iconography of the sprit-rig allows us to comment on some of the rationale that might have underpinned the invention and adoption of one example of maritime technology in the ancient world. The other main type of fore-and-aft rig in use in the ancient Mediterranean, the lateen sail, offers yet another line of investigation and can demonstrate how the sailing rigs of the ancient world can be interpreted in a way that does not rely simply on the presence of sail shapes, classified by geometric shape.

### Case study 2: the lateen rig

It is beyond the scope of this paper to address the various arguments, described elsewhere, for the chronology of the introduction of the lateen sail<sup>28</sup>. However, it is enough to say, as noted earlier that there is sporadic evidence from the 2<sup>nd</sup> century AD and possibly earlier. Yet, it is only from the late antique period that we begin to see depictions of the lateen/settee rig that carry a consistent set of characteristics in the way that the artist has chosen to depict the sailing rig. These are best signified by the hook-shaped mastheads, complex halyard tackles and organised mast reinforcements that consistently define such rigs during this period<sup>29</sup>. Our current understanding of how such early rigs were used, strongly suggest that the technical practices associated with using the lateen/settee sail developed from existing square-sail practices, but with some important refinements such as the replacement of brails with reefing lines<sup>30</sup>. It is of clear significance to our understanding of the ways in which such artistic conventions are used in the creation of iconographic material that these conventions occur across a relatively wide geographical area and in a variety of artistic media. The most characteristic of all, the hook-shaped mastheads, continue to be used until around the 12<sup>th</sup> century AD, suggesting a considerable phase of technological continuity akin to that witnessed in relation to the square-sail in previous centuries<sup>31</sup>.

For our study of ancient sailing rigs this provides a useful case study in illustrating how we can potentially track the extent of the adoption of a specific technology through the way it is depicted in the iconographic sources. Namely, that the consistent depiction of specific artistic features across a range of contexts and media may be seen as indicative



**Fig. 7** Graffito of a ship depicted at Corinth dating to the 5<sup>th</sup>/6<sup>th</sup> century AD which can be interpreted as a lateen/settee rigged vessel on the grounds of comparative rigging components. The vessel is seemingly shown with two masts, the fore much smaller than the main, each of which is depicted carrying a hook-shaped masthead. The halyard system of the mainmast is visible passing through the masthead before returning to a double line which runs the length of the vessel, representing the yard in its lowered position. – (Redrawn by J. Whitewright from Basch, Corinth fig. 8).

of the wider acceptance of such features, by maritime and non-maritime viewers as being representative of the technical reality afloat at that time. Building upon this notion can also allow us to categorise vessels that have not previously been assigned a rig-type, such as the 5<sup>th</sup>/6<sup>th</sup> century AD example from Corinth<sup>32</sup> shown in **figure 7**. In that example, many of the components seen on other lateen rigged vessels such as hook-shaped mastheads are shown, but the artist has shown the yard in a lowered situation with no indication of the sail shape. Only by understanding the wider components depicted across the spectrum of the iconographic record are we able to identify the rig used on the Corinth ship<sup>33</sup>. We can even suggest that on the basis of such depictions, early lateen-rigged vessels may have been two-masted in much the same way that their square-sail predecessors were, because of the repetition of features from the main-mast on a smaller foremast.

Taking the above discussion into account, it seems reasonable to suggest that during Late Antiquity, the lateen/settee rig was able to achieve widespread use, resulting in a standardisation in the way that it was thought about by the general populace and then contemporaneously depicted by

28 For recent discussion see Whitewright, Lateen.

29 For examples see Basch, Kellia; Pomey, Kelenderis.

30 Whitewright, Efficiency 99f.

31 Whitewright, Lateen 101.

32 For the original publication of the depiction see Basch, Corinth.

33 Whitewright, Lateen 101f.

their artists. Conversely, that this was not the case in earlier centuries implies to that the rig was not as widely used. This offers an example of how we might look for similar trends in other areas of ancient shipping and specifically to fine-tune our knowledge of when pieces of technology become widely adopted, rather than just appearing sporadically. Finally, it is important to note, that unlike the sprit-sail discussed above, the lateen sail did not offer any improvement in windward performance over the square-sail that it replaced<sup>34</sup>, further indicating that we should look for explanations beyond the traditional »need for windward performance« when attempting to explain sailing rig innovation in antiquity.

## Conclusion

At the heart of any considered interpretation of the maritime connectivity of the ancient Mediterranean must be an understanding of the shipping that facilitated the short, medium and long-distance routes that linked the coasts of the Mediterranean so effectively during antiquity. It follows, that any understanding of such shipping is not complete until the rigging of those vessels is investigated, interpreted and attempts made to elucidate the workings, performance and characteristics of such rigs. In an ideal world, this could be achieved with an abundance of well-preserved archaeological evidence, providing us with a detailed record of the physical nature of such rigging components. From this, the sailing rigs of the ancient world could be reconstructed and understood from the »deck upwards« and from on board, looking outwards.

Unfortunately, the discovery, preservation and publication of the archaeological record of ancient Mediterranean shipping has not furnished us with such a resource. The cargoes and hulls of such ships are relatively well understood, although this understanding is certainly not complete nor exhaustive in its extent. By contrast, the rigging of these ships remains frustratingly absent from many archaeological sites and overlooked on many others. Our corpus of archaeological evidence is therefore limited and requires that we look to other sources. Fortunately, some element of balance is returned to our view of these ships via the iconographic record, which, as discussed over the course of this paper can tell us much about their sailing rigs. Critically, the iconographic resource occurs in such abundance that it offers the possibility of reconstructing long-term trends that encompass both continuity and change with ancient rigging technology. Although it is often difficult to extract small detail from such material, in many cases the iconography is potentially less ambiguous than the physical remains of rigging left behind in the archaeological record.

Within this wide-angle view of the rigging of the ancient world, developed on the basis of the iconographic resource, several instances of technological hiatus and one lack of hiatus catch our eye. Firstly, we can establish the extremely long period of technological continuity that is embodied by what we can term the »Mediterranean square-sail rig«, that is, the single-masted, loose-footed sail, shortened using brails and which was in use from the Late Bronze Age until Late Antiquity. While this technological continuity is remarkable, we should not view it as technological stagnation or a reluctance to innovate on the part of ancient Mediterranean mariners. At the same time, the iconographic record tells us of the abundant variation that visibly occurs within the same broad Mediterranean square-sail tradition and is epitomised by the depiction of sail-plans incorporating *artemons*, *mizzens* and fully two-masted forms.

It is out of this picture of technological continuity and variation within an established rigging tradition that we begin to see glimpses of truly innovative and developmental approaches to rigging and sailing. These take the form of the sprit-sail and the lateen/settee sail from the 2<sup>nd</sup> century BC and the 2<sup>nd</sup> century AD respectively. From our perspective within this volume of investigating the shipping of the ancient and medieval Mediterranean via iconography, these two sailing rigs teach us two things. The first of these relates to the performance of vessels and the motivation for technological change within maritime technology. Namely that although the sprit-sail has the best all-around performance, including to windward, of the sailing rigs documented within the ancient world, it does not become widely adopted and does not displace the square-sail. This can tell us much about the fallacy of placing windward performance at the top of any list concerning sailing rig development in this region, at this time. The second conclusion is interpretative and relates to how we as archaeologists see the sailing rigs through the iconographic record. It is all too easy to look simply at the shapes of sails as the defining part of the rig. However, examples of lateen/settee sails from Late Antiquity tell a different story and highlight the need to seek out and identify the artistic conventions, based on wider societal acceptance, that underpin what features are and are not included in such depictions. In doing this, iconographic depictions that are often dismissed as ambiguous can be interpreted in a relatively objective way and subsequently be included within our generalist view of rigging development. They can in turn contribute to developing and refining many of the implications and understanding discussed across the course of this paper.

In the context of the sailing rigs of the ancient Mediterranean, the iconographic record can provide us with an impression of the over-riding technological landscape within which the square-sail, sprit-sail and lateen sail were used, developed, adopted, abandoned and maintained in use. However,

34 See Whitewright, Performance.

it is important to remember that when based on iconography alone, however rich and widespread the sources, our view of such a maritime technological landscape is likely to remain quite impressionist in nature. The iconographic record allows us to view and attempt to interpret ancient sailing rigs from the perspective given to the wider populace through the artists of the day. These artists in turn were simply interpreting from the outside, the way in which the rigging components of a given sailing vessel were arranged by its crew during its use. In drawing upon and utilising such contemporary interpretation we are, to all intents and purposes still stood on the shore, looking at the vessel from a distance. By drawing on the archaeological record, should it be available, we are able to directly address the physical components of ancient sailing rigs used by ancient mariners themselves. It is only in attempting to understand the use of such components that we can instead place ourselves on the deck of the ship and look outward. If we can gain an understanding from such archaeological remains of how the technology depicted by ancient artists was assembled and used, then we stand a far greater chance of enhancing our understanding; not just of the maritime technology in question, but also of the iconographic depictions of it that ultimately are still our most numerous source for the sailing rigs of the ancient Mediterranean.

## References

Adams, Ships: J. Adams, *A Maritime Archaeology of Ships: Innovation and Social Change in Late Medieval and Early Modern Europe* (Oxford 2013).

Basch, Corinthe: L. Basch, *Un navire marchand byzantin à Corinthe*. *Neptunia* 181, 1991, 14-81.

Kellia: L. Basch, *La felouque des Kellia*. *Neptunia* 183, 1991, 3-12.

Latine: L. Basch, *La voile latine, son origine, son évolution et parentés arabes*. In: H. Tzalas (ed.), *6<sup>th</sup> International Symposium on Ship Construction in Antiquity*. Lamia, 28-30 August 1996. *Proceedings*. *Tropis* 6 (Athens 2001) 55-86.

Musée: L. Basch, *Le musée imaginaire de la marine antique* (Athènes 1987).

Beltrame/Gaddi, Grado: C. Beltrame / D. Gaddi, *The Rigging and the Hydraulic System of the Roman Wreck at Grado, Gorizia, Italy*. *International Journal of Nautical Archaeology* 34/1, 2005, 79-87.

Calcagno, Iconography: C. Calcagno, *Aeneas' Sail: the Iconography of Seafaring in the Central Mediterranean Region during the Italian Final Bronze Age*. In: L. Blue / F. Hocker / A. Englert (eds), *Connected by the Sea*. *Proceedings of the 10<sup>th</sup> International Symposium on Boat and Ship Archaeology, Roskilde 2003* (Oxford 2006) 226-233.

Campbell, Lateen: I. C. Campbell, *The Lateen Sail in World History*. *Journal of World History* 6/1, 1995, 1-23.

Casson, Sails: L. Casson, *Fore and Aft Sails in the Ancient World*. *Mariner's Mirror* 42/1, 1956, 3-5.

Seamanship: L. Casson, *Ships and Seamanship in the Ancient World* (Baltimore 1995).

Castro et al., Ships: F. Castro / N. Fonseca / T. Vacas / F. Ciciliot, *A Quantitative Look at Mediterranean Lateen- and Square-Rigged Ships* (Part 1). *International Journal of Nautical Archaeology* 37/2, 2008, 347-359.

Houston, Ports: G. W. Houston, *Ports in Perspective: Some Comparative Materials on Roman Merchant Ships and Ports*. *AJA* 92/4, 1988, 553-564.

Kasser, Kellia: R. Kasser, *Kellia*. *Topographie* (Geneva 1978).

Kocabaş/Kocabaş, Yenikapı: I. Ö. Kocabaş / U. Kocabaş, *Technological and Constructional Features of Yenikapı Shipwrecks: a Preliminary Evaluation*. In: U. Kocabaş (ed.), *The »Old Ships« of the »New Gate«* (Istanbul 2008) 97-186.

Marchaj, Sailing: C. A. Marchaj, *Sail Performance: Theory and Practice* (London 1996).

McCormick, Origins: M. McCormick, *Origins of the European Economy. Communications and Commerce, AD 300-900* (Cambridge 2001).

Palmer, Balance: C. Palmer, *Reflections on the Balance of Traditional Sailing Vessels*. *International Journal of Nautical Archaeology* 38/1, 2009, 90-96.

Fastest: C. Palmer, *The Fastest Rig*. *Yachting Monthly* 1984 (July), 1388-1390.

Measuring: C. Palmer, *Measuring Sailing Rig Performance*. In: O. Crumlin-Pedersen / M. Vinner (eds), *Sailing into the Past. Proceedings of the International Seminar on Replicas of Ancient and Medieval Vessels, Roskilde 1984* (Roskilde 1986) 178-193.

Performance: C. Palmer, *Sail and Hull Performance*. *Wooden Boat Magazine* 92 (Jan./Feb.), 1990, 76-89.

Parker, Shipwrecks: A. J. Parker, *Ancient Shipwrecks of the Mediterranean and the Roman Provinces*. *BAR International Series* 580 (Oxford 1990).

Polzer, Toggles: M. E. Polzer, *Toggles and Sails in the Ancient World: Rigging Elements Recovered from the Tantura B Shipwreck, Israel*. *International Journal of Nautical Archaeology* 37/2, 2008, 225-252.

Pomey, Kelenderis: P. Pomey, *The Kelenderis Ship: a Lateen Sail*. *International Journal of Nautical Archaeology* 35/2, 2006, 326-329.

Pomey/Kahanov/Rieth, Transitions: P. Patrice / Y. Kahanov / E. Rieth, *Transition from Shell to Skeleton in Ancient Mediterranean Ship-Construction: Analysis, Problems and Future Research*. *International Journal of Nautical Archaeology* 41/2, 2012, 235-314.

Sanders, Ropes: D. Sanders, *Knowing the Ropes: the Need to Record Ropes and Rigging on Wreck-Sites and Some Techniques for Doing So*. *International Journal of Nautical Archaeology* 39/1, 2010, 2-26.

Tzalas, Iconography: H. E. Tzalas, *Kyrenia II in the Fresco of Pedoula Church, Cyprus. A Comparison with Ancient Ship Iconography*. In: H. Tzalas (ed.), *2<sup>nd</sup> International Symposium on Ship Construction in Antiquity, Delphi 1987*. *Proceedings*. *Tropis* 2 (Athens 1990) 323-327.

Whitewright, Efficiency: J. Whitewright, *Efficiency or Economics? Sail Development in the Ancient Mediterranean*. In: W. V. Harris / K. Iara (eds), *Maritime Technology in the Ancient Economy: Ship Design and Navigation*. *JRA Supplementary Series* 84 (Portsmouth/R.I. 2011) 89-102.

Lateen: J. Whitewright, *The Mediterranean Lateen Sail in Late-Antiquity*. *International Journal of Nautical Archaeology* 38/1, 2009, 97-104.

Performance: J. Whitewright, The Potential Performance of Ancient Mediterranean Sailing Rigs. *International Journal of Nautical Archaeology* 40/1, 2011, 2-17.

Rigging: J. Whitewright, Roman Rigging Material from the Red Sea Port of Myos Hormos. *International Journal of Nautical Archaeology* 36/2, 2007, 282-292.

Technology: J. Whitewright, Tracing Technology: The Material Culture of Maritime Technology in the Ancient Mediterranean and Contemporary Indian Ocean. In: R. Bockius (ed.), *Between the Seas: Transfer and Exchange in Nautical Technology. Proceedings of the 11<sup>th</sup> International Symposium on Boat and Ship Archaeology, Mainz 2006. RGZM – Tagungen 3 (Mainz 2009) 489-497.*

Wild/Wild, Berenice: F. Wild / J. Wild, Sails from the Roman Port of Berenice. *International Journal of Nautical Archaeology* 30/2, 2001, 211-220.

Wilson, Economics: A. Wilson, The Economic Influence of Developments in Maritime Technology. In: W. V. Harris / K. Iara (eds), *Maritime Technology in the Ancient Economy: Ship Design and Navigation. JRA Supplementary Series 84 (Portsmouth/R.I. 2011) 211-233.*

Ximénès/Moerman, Laurons: S. Ximénès / M. Moerman, Port romain des Laurons (Martigues): éléments d'accastillage antiques. *Cahiers d'archéologie subaquatique* 9, 1990, 5-25.

## Ancient Depictions as a Source for Sails and Rigging

Original rigging components are rare in the archaeological record of the ancient Mediterranean, especially when compared to remains of hulls. The interpretation of ancient rigging and sails is therefore highly reliant on the extensive iconographic record. This paper reviews the advantages and disadvantages of using iconographic sources to understand and reconstruct ancient rigging. Analytically, emphasis is placed on macro-scale processes of technological continuity and change, rather than describing the micro-scale detail of maritime technology. The development and adaptation of the lateen sail in the Mediterranean during Late Antiquity and the Early Middle Ages offer a useful case-study to illustrate this process; it represents a profound change in the conception, making, use and depiction of sailing rigs. Finally, the ability of the iconographic record to illustrate short-term and widespread technological change against the background of long-term continuity is discussed.

## Zusammenfassung / Summary

### Antike Darstellungen als Quelle für Segel und Rigg

Originale Bestandteile des Riggs sind für die Antike im Mittelmeerraum selten überliefert, was insbesondere im Vergleich zu Bestandteilen des Rumpfes gilt. Die Deutung des antiken Riggs und der Segel wird somit in hohem Maße von der ikonographischen Überlieferung bestimmt. Dieser Beitrag bewertet die Vor- und Nachteile der Nutzung ikonographischer Quellen für das Verständnis und die Rekonstruktion des Riggs im Altertum. Dabei liegt, analytisch betrachtet, der Schwerpunkt eher auf einer übergeordneten Ebene im Hinblick auf technische Kontinuität und Wandel als auf der als untergeordnet angesehenen Ebene der maritimen Technologie. Die Entwicklung und Adaption des Lateinersegels in Spätantike bzw. Frühmittelalter bietet eine gute Ausgangslage für eine Fallstudie. Es kennzeichnet einschneidende Veränderungen in der Konzeption, der Ausführung, dem Gebrauch und der Darstellung des Riggs. Schließlich wird noch die Eignung ikonographischer Überlieferung zur Darstellung eines kurzfristigen und weiträumigen technologischen Wandels vor dem Hintergrund langfristiger Kontinuitäten diskutiert.

Übersetzung: Th. Schmidts

# Verwendete Siglen

ABSA	The Annual of the British School at Athens	JbAC	Jahrbuch für Antike und Christentum
ADelt	Ἀρχαιολογικὸν Δελτίον	JbRGZM	Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz
AJA	American Journal of Archaeology	JHS	Journal of Hellenic Studies
BAR	British Archaeological Reports	JÖB	Jahrbuch der Österreichischen Byzantinistik
BCH	Bulletin de correspondance hellénique	JRA	Journal of Roman Archaeology
BEFAR	Bibliothèque des Écoles françaises d'Athènes et de Rome	JRS	Journal of Roman Studies
BMGS	Byzantine and Modern Greek Studies	LCI	Lexikon der christlichen Ikonographie
BZ	Byzantinische Zeitschrift	MGH	Monumenta Germaniae Historica
CFHB	Corpus Fontium Historiae Byzantinae	RAC	Reallexikon für Antike und Christentum
DOP	Dumbarton Oaks Papers	RE	Paulys Realencyclopädie der classischen Altertumswissenschaft
DOS	Dumbarton Oaks Studies	RIC	The Roman Imperial Coinage (London 1923-1994)
IG	Inscriptiones Graecae	ZPE	Zeitschrift für Papyrologie und Epigraphik
IstMitt	Istanbuler Mitteilungen		

