

The Lateen Sail in World History

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AT the time of the Great European Excursion in the sixteenth century, the sail known as the lateen was in use in three different regions of the world. In the orthodox view, its existence and distribution are a matter of importance for several reasons. First, sails as an artifact have not demonstrated very great human inventiveness,¹ and since the lateen requires some ingenuity to conceive, its distribution is likely to be the result of diffusion, reflecting historical contacts between ancient societies. Second, the lateen is generally considered a sail that gives great power and also allows a vessel greater maneuver-ability than simpler sails, and therefore is widely given the credit for the European accomplishments of the age of discovery.² Third, the lateen sail was the immediate ancestor of the fore-and-aft sails that were typical of nineteenth-century schooners and clippers and that culminate in the modern rig of racing and pleasure yachts.³ All three statements are open to question, and lying behind all three is the common but equally questionable belief that this sail was one of the great contributions of Arab civilization to world history.

“Lateen” sails are triangular and are fundamentally different from “square” sails in functional principles. A square sail catches a following wind and is dragged along by it; the lateen sail is slung obliquely to present a curved surface to the wind and derives its motive force from the pressure differential between the convex and concave sides of the

¹ H. H. Brindley, “Early Pictures of Lateen Sails,” *The Mariner’s Mirror* 12 (1926): 13.

² See, for example, Joseph Needham, *Science and Civilisation in China*, 6 vols. (Cambridge, 1971), 4:3:509.

³ Harry Morton, *The Wind Commands: Sailors and Sailing Ships in the Pacific* (Vancouver, 1975), p. 225.

sail. This is the motive principle of fore-and-aft sails generally and is the basis for the idea that the lateen was the ancestral fore-and-aft sail. The advantages of the lateen sail are that it offers less drag, can be used effectively in lighter winds, and allows a vessel to sail much closer to the wind than a simple square sail. For these reasons alone, its invention was an important event.

In contrast to the simple principle of the square sail, which is easily grasped, the principle of the fore-and-aft sail is sophisticated and seems to presuppose either theoretical knowledge of aerodynamics or considerable experience of sailing in conditions that are sufficiently safe to allow experimentation, and sufficiently diverse or hazardous to encourage it. The square sail—or at least a sail that acts on the “square” or “drag” principle, though it need not be square in shape—would therefore seem to be a prerequisite, and most authorities postulate the evolution of the triangular sail from one kind of square or another.

The most likely sequence from square to triangular is argued clearly and convincingly by Richard LeBaron Bowen, whose extensive research has placed all later scholars in his debt.⁴ Starting from a square sail, sailors would soon have discovered that when the wind is not perfectly from behind, the sail’s efficiency can be enhanced by turning the sail so that its axis is kept perpendicular to the wind (fig. 1). When this technique is combined with a keel and/or steering device, the sailor has wider course options than simply sailing directly downwind. If a wind comes more from the beam than the stern, this technique of rotating the sail on the mast becomes less effective, but the declining power can be partially recovered if the edge (or luff) of the sail is pointed toward the wind. This does not work well, however, unless the sail edge toward the wind can be kept taut, a result most effectively achieved if the sail is canted so that the yard (or spar) holding the top of the sail slopes downward and into the wind (fig. 2).

A sailor using a square sail in such a manner is well on the way toward inventing the lateen sail, especially one constructed like that used in the western Indian Ocean, probably by the intermediate step of the lug sail (fig. 3). The particular shape of the Indian Ocean lateen⁵ enhances the plausibility of this hypothetical sequence, the short luff on the leading edge being perhaps a vestige of the original square sail edge.

⁴ Richard LeBaron Bowen, “Eastern Sail Affinities, Part II,” *The American Neptune* 13 (1953): 185–87.

⁵ The Indian Ocean lateen is not, strictly speaking, a triangle since the apex is shorn off. It is thus quadrilateral, but for the present discussion the difference is unimportant. See note 24 below.



FIGURE 1. Square sail.

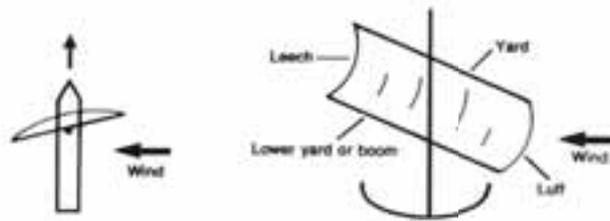


FIGURE 2. Canted square sail.

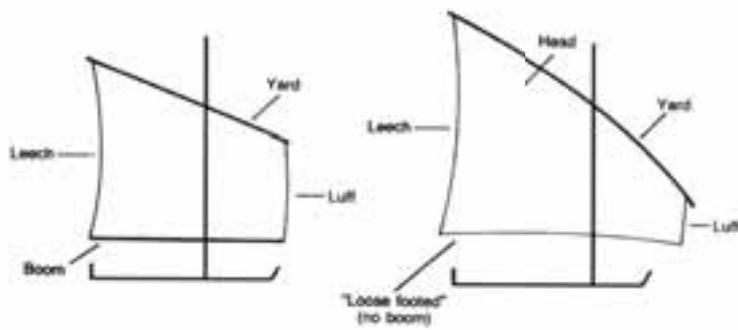


FIGURE 3. Lug sail (left) and west Asian lateen sail (right).

The sequence can only be postulated, however, not proven, and attempts to reconstruct the origin and spread of the sail must depend on both typology and chronology. Indeed, the Pacific—southeast Asian lateen clearly developed along different lines, as will be explained below. The contrasting paths of evolution demonstrate that the lateen had at least two independent origins and possibly three. The Pacific Ocean-southeast Asian lateen certainly had a separate ancestry from the Indian Ocean lateen, and it now seems possible (though less likely) that the Mediterranean and Indian Ocean lateens also developed independently.

THE QUESTION OF ARAB ORIGIN

In the debate about whether the lateen sail was of Mediterranean or Indian Ocean origin, and its diffusion from one area to the other, the point chiefly at issue was one of priority.⁶ The consensus eventually settled on Indian Ocean priority on the insecure grounds that the sail was universally known as the Arab sail, the borrowing of which by Europeans led to the enormous expansion of Western marine capability, and that there was no evidence of the sail in the Mediterranean until the late ninth century A.D., two centuries after Arab fleets began operating there.⁷ In Bowen's argument that the lateen derived from the square sail, referred to above, the Indian Ocean is a more likely home for the lateen because a variety of sails, including all the likely intermediate steps between square and lateen, is to be found there. In contrast, there seem to be no surviving possible antecedents of the lateen in the Mediterranean. This implies that the sail was imported in its mature form from the Indian Ocean. Indeed, the lateen is widely regarded as characteristically the sail of Arab seafarers, and its distribution is considered largely Muslim.⁸ Its diffusion elsewhere is therefore plausibly attributed to the boldness and expansionism of so-called "Arab" sailors.⁹

But there are difficulties in linking the antiquity of the sail to the

⁶ Bowen, "Eastern Sail Affinities," p. 191.

⁷ The argument is well put by George F. Hourani, *Arab Seafaring in the Indian Ocean in Ancient and Early Medieval Times* (Princeton, 1951), pp. 100, 103.

⁸ Richard LeBaron Bowen, "Arab Dhows of Eastern Arabia," *The American Neptune* 9 (1949): 92.

⁹ For example, J.H. Parry (*Europe and a Wider World, 1415-1715* [London, 1949], pp. 22-24), who describes the sail as "the special contribution of the Arabs to the development of the world's shipping" in an otherwise excellent and reliable discussion. Also George F. Hourani, *Arab Seafaring*, pp. 103-104.

Arabs. Ancient sources refer to “Arabs” in commerce in the Indian Ocean and Red Sea long before Islam. Whether they were mariners as well as merchants is unclear, but there is no evidence for their use of the lateen sail. Although he supported an Indian Ocean origin for the sail, Bowen rejected the notion that the Arabs invented it. He argued that the Arabs were too late in taking to the sea to have invented such a sail and that they derived their maritime knowledge from the Persians who were sufficiently nautical to send an expedition to Yemen in the seventh century. Therefore, he maintained, when they attempted naval exploits, the Arabs borrowed their sail and much else from the Persians, together with the vocabulary of navigation. Then, as a result of the Arab intervention, the sail was introduced to the Mediterranean and was first recorded in Mediterranean art in the ninth century.¹⁰

However, this ninth-century date for the appearance of the lateen sail in the Mediterranean was converted from its proper meaning of “not later than” to a supposition but pragmatic “probably not much earlier than.” Conversely, it must not be supposed that the presumed seventh-century Persian influence implies a development around that time. Indeed, if the sail was invented in the Persian Gulf, as Bowen argued, it might have been invented at any time during or since the second millennium B.C. And if diffusion into the Mediterranean is a fact, then it might have occurred at any time during that span, although the most likely times would probably be the period when the Persian empire under Cyrus reached the shores of the Aegean (sixth century B.C.) or the Hellenistic period after Alexander had taken Greek influence as far as the Indian Ocean (fourth–first centuries B.C.).¹¹

The chief difficulty is that the arguments for an Indian Ocean origin of the lateen sail are entirely a priori. There seems to be no unequivocal evidence for the date of the first use of the lateen sail in the western Indian Ocean. The sail used by the Persian navy in the seventh century A.D. is unknown, and the otherwise informative

¹⁰ Bowen, “Eastern Sail Affinities,” pp. 191–98. Also Frederick van Doorninck, “Byzantium, Mistress of the Sea: 330–641,” in *A History of Seafaring Based on Underwater Archaeology*, ed. George F. Bass (London, 1972), p. 146. The pictorial representation referred to is dated at about 880. Van Doorninck writes, “In these representations we see for the first time the triangular, as opposed to the quadrilateral, lateen sail. It is quite likely, however, that the triangular lateen had already been in general use for some time, for manuscript illuminators worked with stereotyped traditional forms and rarely allowed innovative features to intrude into their art.”

¹¹ But, as an anonymous reviewer of this paper pointed out, the former suggestion is not likely, as the Persians of Cyrus’s time were not seafarers.

Periplus of the Erythraean Sea (composed in the first century A.D.) is silent on the matter, as are the other classical writers on commercial matters, Pliny and Strabo. Indeed, the great growth in maritime commerce between Egypt and India in Roman imperial times was in typically Mediterranean cargo ships, which were characteristically square sailed.¹² Bowen acknowledged the difficulty in an early paper in which he argued that there was no evidence for the use of the lateen in the western Indian Ocean before Portuguese times.¹³ He later modified this view in light of research by Lionel Casson and suggested that the lug sail (a possible precursor of the lateen) was introduced into the western Indian Ocean by Greek merchants in Roman times for the India trade. He then suggested that the lateen evolved from the lug in either the Mediterranean or the Indian Ocean during the next few centuries, in time for the Arabs to spread it around during their great expansion.¹⁴

Notwithstanding the attractions of this hypothesis, even the exhaustive research of George F. Hourani failed to find either literary or pictorial evidence of any type of sail used in the western Indian Ocean before the fifteenth century. But Hourani concluded that because the lateen was “characteristically Arab” and in universal use in the region, it was safe to assume that “the Arabs” (whoever they might have been) had used the same sail in “ancient” times. Literary evidence is restricted to several ninth- and tenth-century poetic images, which liken “a ship’s sail seen from a distance to the fin of a whale or a whale’s spout.” Hourani cautiously interprets this as suggesting a lateen rather than a square sail,¹⁵ but since whales do not have dorsal fins and their spouts are more like a rising cloud of steam than anything else (and therefore of indeterminate shape), the image must be understood as purely romantic, giving no clue at all to sail shapes.

Even the late fifteenth-century navigational writings of Ibn Majid are vague; inasmuch as he refers to sail types at all, he implies a luff:leech ratio of 3:4 or 10:13.5.¹⁶ Such a sail is almost square—more a lug than a lateen. While this supports Bowen’s later suggestion about the lug being a step toward the lateen, it undermines the case for Arab diffusion of the lateen to the West.

¹² Lionel Casson, *Ancient Trade and Society* (Detroit, 1984), pp. 184–88.

¹³ Bowen, “Eastern Sail Affinities,” pp. 191, 198.

¹⁴ Richard LeBaron Bowen, “The Earliest Lateen Sail,” *The Mariner’s Mirror* 42 (1956): 241.

¹⁵ Hourani, *Arab Seafaring*, pp. 100, 103.

¹⁶ Translated and published as G. R. Tibbetts, *Arab Navigation in the Indian Ocean before the Coming of the Portuguese* (London, 1971), p. 52.

In any case, the idea of a desert people introducing a new sail to a maritime people deserves skeptical scrutiny. But just how much the Arabs did contribute to maritime history depends partly at least on the definition of "Arab." The traditional view of the Arab as an accomplished seafarer contributing to both practical seamanship and theoretical navigation is almost certainly incorrect and derives from a confusion of terms. If "Arab" means desert Bedouins who erupted from the Arabian plateau in the seventh century A.D. and later received, absorbed, and preserved classical learning and transmitted it to the West, then the term is misused. It is probable that "Arab" was used by ancient sources as loosely as "Greek" was used of any Hellenized person, or as loosely as "Frank" was and is used in the Middle East for people from northern and western Europe. The "Arabs" in the Red Sea trade in the fifteenth century included Egyptians and possibly Persians;¹⁷ the Arab maritime vocabulary is derived from Persian;¹⁸ and "Arab" vessels were built in India.¹⁹ In the context of maritime affairs, therefore, it seems reasonable to denationalize and to describe the lateen sail, the sewn vessels, and the monsoon sailing strategy (the latter pioneered by Greeks) simply as "west Asian."²⁰ The Arabs of the conquest were not particularly successful on either the Mediterranean Sea or the Indian Ocean in war or commerce. If they had been, then Mediterranean civilization would surely have become Muslim. On the contrary, the Mediterranean continued to be controlled by Christians, but those seafarers on its eastern and southern shores (and to a lesser extent the western) became Arabized. These peoples more than likely knew the lateen sail before they became Arabic-speaking Muslims.

At the very least, therefore, the evidence casts doubt not only on the attribution of the lateen sail to the Arabs, but also on the Arabs as the agents of its diffusion. The lateen sail can therefore no longer be described as an innovation that Europe owes to the Arabs.²¹ On the

¹⁷ W. H. Moreland, "The Ships of the Arabian Sea about A.D. 1500," *Journal of the Royal Asiatic Society* (1939): 174.

¹⁸ Bowen, "Arab Dhows," p. 95.

¹⁹ Moreland, "Ships of the Arabian Sea," pp. 173-74.

²⁰ A.R. Lewis stresses the multinational character of Indian Ocean shipping and commerce, and warns that "Moor" and "Muslim" should not necessarily be taken to mean Arab. A.R. Lewis, "Maritime Skills in the Indian Ocean, 1368-1500," *Journal of the Social and Economic History of the Orient* 16(1973): 246-47.

²¹ I am suggesting here merely that the sail is not an indigenous Arab artifact and that its presence in the Mediterranean predates the Arabs. Whether the first Portuguese to hoist a lateen sail got the idea immediately from an Arab, a Genoese, or a Venetian is neither known nor material. The point is that its use was universal in the Mediterranean by Renaissance times.

contrary, the lateen in the Mediterranean had a continuous history of more than 1,500 years before it was adapted to the needs of Atlantic exploration by the Portuguese.

THE MEDITERRANEAN EVIDENCE

It seems increasingly likely that the lateen may have originated in the Mediterranean where the missing link between the square and triangular sails was the brailed square sail. Brails were ropes that ran from the foot of the sail, up the front of it (fastened at various holding points) and over the upper yard to the deck.²² By pulling on the ropes sailors could wholly or partly furl the sail, and they could shorten one side of it more than the other merely by adjusting the lengths of the various brail ropes. The process is similar to adjusting horizontal venetian blinds. This was an important innovation in allowing sailors to adjust the amount of sail surface area exposed and in trimming the sail to wind conditions. Sails brailed on one side could be tilted toward the wind to further increase efficiency. A remark by Aristotle suggests that partially furled sails were used in a fore-and-aft manner by the fourth century B.C.²³ This suggestion establishes the typological "missing link." Moreover, Casson argues that only Greco-Roman sailors used the system of vertical brails and that only in the manner described could a square sail have been set to resemble a lateen. Developing a lateen sail from a square sail that was brailed up on one side would seem fairly straightforward and would be consistent with a sail that was eventually triangular, the head stabilized by a long yard and apex fastened at the bow of the ship.

Casson further argues that the Mediterranean lateen had priority and that its presence elsewhere is due to diffusion, probably, he concedes, by the Arabs.²⁴ The evidence for Mediterranean—indeed, northern Aegean—priority is epigraphic. Tombstone representations of lateen sails have been found from as early as the second century A.D.²⁵ Other fore-and-aft sails (not lateens) were in use by the second

²² Lionel Casson, "The Origin of the Lateen," *The American Neptune* 31 (1971): 49–51.

²³ *Ibid.*

²⁴ A detail that cannot be overlooked, though its significance is not at all clear, is the difference in the shape of the Mediterranean lateen, which is triangular, and the so-called "Arab" lateen of the Indian Ocean, which is quadrilateral. The difference might indicate either different origins or merely different adaptations from a common ancestor.

²⁵ Lionel Casson, "Fore-and-Aft Sails in the Ancient World," *The Mariner's Mirror* 42 (1956): 3–5. Needham (*Science and Civilisation*, 4:3:609) professes himself unconvinced by

century B.C. Most of the examples of these early sails known to Casson were from the northern Aegean, a geographically suitable area to serve as a sailing nursery. More recent evidence of mausoleum graffiti from Alexandria depicting boats has led a later scholar, Lucien Basch, to suggest that an inclined yard was often used with a square sail in the manner of a proto-lateen. He argues that lateen sails were in use by the third or second century B.C.²⁶

Such a date would take the antiquity of the lateen sail back one thousand years earlier than its previously known age and much earlier than would be necessary to demonstrate that it was not invented by the Arabs of the Muslim era. Moreover, throughout the sixteen or so centuries between its first recorded use and its adoption and adaptation by the Portuguese, the sail was in continuous use, indicating that not even its diffusion was an Arab accomplishment. A second-century stele shows a quadrilateral lateen sail, and a fourth-century mosaic shows a triangular one.²⁷

The lateen sail seems not to have been used by merchant vessels after classical times, but depictions of warships—typically long, straight-sided galleys relying mostly on oar power—using a triangular lateen sail recur during the late Roman imperial and Byzantine periods. A reference by Procopius in *The Vandalic War* (sixth century) to the upper angle of sails appears to make sense only if he was referring to lateen sails.²⁸ Indeed, the lateen-sailed warships of the Italian Renaissance city-states were direct descendants of the Roman war galleys of more than a thousand years earlier, structurally, functionally, and in their sails; they remained substantially unchanged after the ninth century.²⁹

The lateen sail therefore predates the Muslim invasions of the Mediterranean shores, but this does not prove that some Arabs did not already have it. However, their maritime role before then was so confined that they seem unlikely agents for either its invention or its diffusion. Although Arabs were engaged in east African trade in the first century A.D., and others in the region of the Persian Gulf were

both Casson's evidence and his argument. His reconstruction is unequivocally diffusionist for all sails and favors an Eastern origin. Later evidence favors Casson.

²⁶ Lucien Basch, "The Way to the Lateen Sail," *The Mariner's Mirror* 75 (1989): 328–32. Technically, the sail Basch refers to sounds more like a lug sail, but the difference is one of degree, not substance, and of form rather than function.

²⁷ Peter Throckmorton, "Romans on the Sea," in *History of Seafaring*, ed. Bass, p. 77.

²⁸ G. Percival Kaeyle, "The Lateen Sail," *The Mariner's Mirror* 42 (1956): 154. Also van Doorninck, "Byzantium," p. 135.

²⁹ Enrico Scandurra, "The Maritime Republics: Medieval and Renaissance Ships in Italy," in *History of Seafaring*, ed. Bass, pp. 207–208.

reported to be seafarers in the third century, these were probably engaged in local navigation only. As late as the sixth century, when trade to Sri Lanka and beyond was conducted by Persian-speaking mariners, there is no mention of Arabs, who were clearly “playing no noteworthy part on the high seas.”³⁰

Such Arabs as were mariners were south Arabians; the center of affairs in Arabian history abruptly swung to the northern Arabians on the eve of the Muslim outburst, and these people were emphatically not seafarers.³¹ Thus, when strategic opportunism impelled the Arabs to venture onto Mediterranean waters, they did so in Byzantine-style galleys, built and manned by Copts of Alexandria in their accustomed fashion, and in this way they won the great naval victory of Dhat al-Sawari in 655.³² Hourani assumes that the sails (if any) used by these galleys were square, on the presumption that the lateen was unknown in the Mediterranean for another two centuries. As Casson and others have since shown, however, the lateen was already well established as the auxiliary motive power for the Byzantine *dromones*. It follows that the Arabs learned their naval craft from the Copts and acquired the lateen sail in the same way. Copts, indeed, continued to supply the bulk of naval personnel for the Arabs in the Mediterranean for centuries.

The lateen sail did not entirely bypass Italian merchant shipping. The basic pattern of the merchant ship in the Mediterranean in the early centuries of the second millennium was a tubby vessel descended from the Roman *oneraria*. By this time it had been converted into a lateen-rigged vessel carrying up to three masts, which was practically identical to the later Portuguese caravel supposedly adopted from the Arabs. Indeed, since the Arabs never had a commanding position in Mediterranean commerce comparable to that of the Italians, it is unlikely that the Italians procured the sail from them. This would suggest that the gift of the lateen sail to Atlantic maritime history could well be Italian rather than Portuguese.

Then in the fourteenth century came a new merchant vessel, the “great galley.” The early Italian war galleys carried a single mast with a lateen sail. Later, a second mast was added and a small square top-sail superimposed on the lateen. The success of this combination led directly to the fourteenth-century great galley of Venice and Genoa. This ship was primarily a merchant vessel, combining galley and

³⁰ Hourani, *Arab Seafaring*, pp. 33–34, 38, 43.

³¹ *Ibid.*, pp. 44–46.

³² *Ibid.*, pp. 57–58.

roundship features: larger and wider than a war galley, faster than a round ship. It had two or three masts, all lateen rigged, and used oars for auxiliary power.³³ The great galley was popular from the fourteenth to the sixteenth century; the caravel was developed in the fifteenth and superseded in the sixteenth.

During the heyday of the lateen among the Italian commercial city-states, the square sail is believed to have been quite eclipsed. It seems scarcely credible that so useful and obvious a sail as the square became extinct in the Mediterranean, yet several authorities assert that it was introduced or re introduced there from northern Europe in the early fourteenth century.³⁴ Still, it can hardly be doubted that when northern European seamen brought their cogs into the Mediterranean in the fourteenth century, they were introduced to a variety of traditional sails and to the long and creative maritime tradition of the Mediterranean's northern shores. Some of the strangers from the North Sea are known to have added a mizzenmast for a lateen sail in the Mediterranean:³⁵ hence the carrack, the equivalent of the Portuguese *caravela redonda*, both of which sound very much like a great galley without the oars.³⁶

It seems, therefore, that there is no longer any basis for deriving the European fore-and-aft sail from the Arab expansion into the Mediterranean Sea. The fact is that in both the Mediterranean and the Indian Ocean, the Arabs learned the use of the lateen sail from those who were on the sea before them.

THE EASTERN LATEEN

On the other side of the Indian Ocean a separate tradition produced a similar artifact, but on morphological grounds alone neither sail appears to have had any influence on the other.

³³ Scandurra, "Maritime Republics," pp. 207, 208, 211.

³⁴ R. C. Anderson, "The Bowsprit and the Sprit Sail," *The Mariner's Mirror* 43 (1957): 238-39.

³⁵ *Ibid.*, pp. 214-15.

³⁶ The *caravela redonda* is said to have evolved from the caravel with the addition of square sails. As used by the Portuguese, who are commonly supposed to have copied it from the Arabs in north Africa, the caravel was a decked vessel with two lateen-rigged masts. The *caravela redonda* was supposed to have evolved from the caravel by combining the square rig of northern Europe with the lateen rig of the Arabs. It usually had three masts, the first two with a single large, square sail, and the aftermast or mizzen carrying a lateen sail. The carrack, a northern European vessel commonly described as having evolved from the cog with the addition of a mizzenmast for the lateen, is substantially the same as a *caravela redonda*. The caravel hardly seems to be a necessary evolutionary step.

At the time of first European contact with southeast Asia, commerce with India and farther west was well established and had been conducted for more than 1,000 years. Muslim traders had been preceded by Hindus and by Persian merchants who were visiting Sri Lanka regularly by the sixth century A.D., and even China not long afterward.³⁷ Sails putatively suggestive of the lateen pattern are shown in the stone carvings of Borobudur in Java of the eighth or ninth century A.D., but whether the sails depicted were exotic or indigenous is unknown. The indigenous sailing tradition goes back long before this, however, to the so-called Austronesian colonization of the region at least 4,000 years ago by people whose characteristic watercraft were rafts and outrigger canoes. The outrigger canoe is unique to this cultural group and was taken by its carriers westward into the Indian Ocean as far as Madagascar, and eastward into the Pacific as far as human colonization reached: Hawai'i, New Zealand, Easter Island, and possibly even South America.³⁸

As with the Aegean Sea, the insular environment, indented coasts, and variable winds of the southeast Asian archipelagoes provided a suitable environment for experimentation, resulting in a wide variety of sails in the immediate area and among the related cultures of the Pacific Ocean. Amid this variety of sail types, the square sail was not significant, despite its preeminence with the Chinese.³⁹

Throughout this region there is little evidence of the square sail on either the Mediterranean or Chinese pattern (that is, respectively a square sail hanging from a horizontal yard or supported between two vertical masts), either in its historical use or in sails that appear to derive from it. The simplest sail is also the one with the widest distribution, implying that it was probably the earliest. Instead of being supported from above, this sail is supported by light spars on each side. These spars have previously been referred to as sprits in the literature of indigenous sailing craft in the Pacific. This is misleading, as the term *spritsail* in the European sailing tradition means a sail supported by a sprit running across the sail, usually diagonally. These are the earliest documented forms of fore-and-aft sails in the West. The use of the

³⁷ G.F. Hourani, "Direct Sailing between the Persian Gulf and China in Pre-Islamic Times," *Journal of the Royal Asiatic Society* (1947): 157–60; O. W. Walters, *Early Indonesian Commerce* (Ithaca, 1967), pp. 63, 72–74, 145.

³⁸ The complicated taxonomy of Pacific Ocean sails and watercraft has been dealt with comprehensively in the magisterial work by A. C. Haddon and James Hornell, *Canoes of Oceania*, 3 vols. (Honolulu, 1936–38; reprinted as one volume, Honolulu, 1975). The following discussion is based largely on Haddon and Hornell's data.

³⁹ Needham (*Science and Civilisation*, 4:3:615–17) disagrees, deriving virtually all sails, east and west, from a square sail in southeast Asian waters.

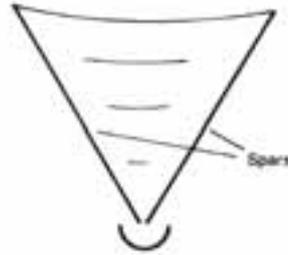


FIGURE 4. V-shaped “square” sail.

same term to describe an entirely different sail is unfortunate, but it is now too well established to change. An important feature of the Oceanic-southeast Asian spritsail is that it is or was mastless. The sail was usually but not always lashed to the supporting spars. Each spar was braced with guy ropes, and when the sail had to be lowered, the whole assembly was taken down.

Such a sail is functionally a “square” sail, although mostly they were V-shaped, the spars coming together at the base in the narrow hull of the canoe (fig. 4). The evolution of a fore-and-aft sail from this primitive “square” sail is easily imagined. Indeed, such a sail is as easily mounted fore and aft in a canoe or raft as transversely, and this would be accomplished as soon as experience and circumstances demonstrated the possibility to the sailors. The use of such a sail, with the inevitable instability that would result in a small craft, is very likely the immediate cause of the invention of the outrigger—a device that, however obvious for small craft it seems in retrospect, is unique in the history of technology.

With the passing of time and the wide dispersal of the “outrigger canoe people,” the basic sail was modified to suit different conditions in ways that became established local traditions. In some places, notably in the Society Islands and Hawai‘i, one of the sail-supporting spars became thicker and taller and more vertical so as to resemble a mast. The other spar then worked like a slanted boom, and the sail overall could be used either as “square” or “fore-and-aft” like an inverted modern Marconi or gaff sail (fig. 5). As long as the sail was lashed directly to the vertical pole, however, the pole remained technically a spar, not a mast.⁴⁰

The next evolutionary step was to substitute a true mast for this pole, so that it did not need to be taken down when the sail was low-

⁴⁰ See G. S. Parsonson, “The Nautical Revolution in Polynesia” (unpublished typescript in the Hocken Library, Dunedin, New Zealand, 1975), p. 6.

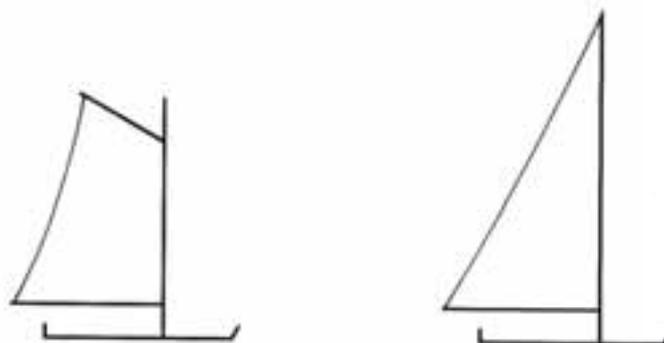


FIGURE 5. Gaff sail (left) and Marconi sail (right).

ered. The sail continued to be supported by two spars, but now one of the spars was attached to the mast, facilitating raising and lowering, and possibly simplifying trimming the sail to the wind.⁴¹ A later development was to modify the shape of the sail, giving it additional height for greater efficiency, but narrowing it so that it resembled a crab claw, to prevent the instability that comes with having the center of effort too high. It was in this manner that the most highly developed sails of eastern Polynesia—the so-called “claw” sails—were developed (fig. 6). This innovation took place after the Polynesian dispersal,⁴² as is shown by the sail’s distribution, which is restricted to the Society and Marquesas islands. The Hawaiian sail is clearly a variant and probably represents an earlier form that became superseded in the Society Islands.⁴³ Such sails were in common use in these areas at the time of European contact in the eighteenth century.

Sails in Melanesia (Mailu in particular) similar to the Hawaiian version are often interpreted according to a diffusionist model. This interpretation, however, either requires some improbable direct con-

⁴¹ Parsonson (“Nautical Revolution,” p. 7) cites a Fijian example. See also J. C. Beaglehole, *The Voyages of Captain James Cook*, 3 vols. (Cambridge, 1955–67), 2: figs. 30, 38; and 3:1183 for Tahitian and Hawaiian examples.

⁴² The prehistoric footprints of the Polynesian people imply a common ancestry with Micronesians and some Melanesians, and a virtually simultaneous colonization of northern Melanesia and western Polynesia (Fiji, Tonga, and Samoa) in the middle of the second millennium B.C. Eastern Polynesia—the Society and Marquesas islands—was settled about the beginning of the present era, Hawai‘i and Easter Island probably by about 400, and New Zealand probably by 800. Fuller discussions can be found in I. C. Campbell, *A History of the Pacific Islands* (Berkeley, 1989); P. V. Kirch, *The Evolution of the Polynesian Chiefdoms* (Cambridge, 1984); and, in greater detail, Geoffrey Irwin, *The Prehistoric Exploration and Colonization of the Pacific* (Cambridge, 1992).

⁴³ Haddon and Hornell, *Canoes of Oceania*, p. 120.

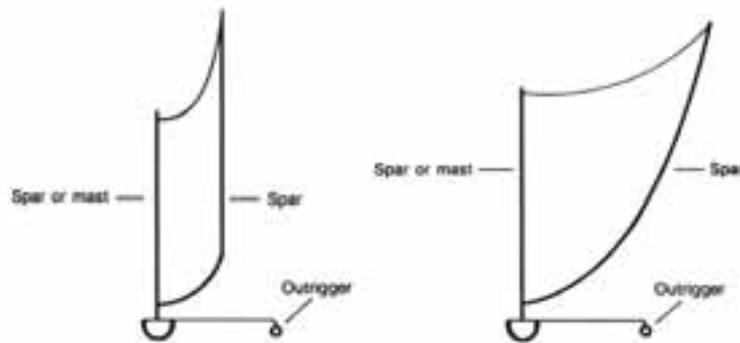


FIGURE 6. Tahitian claw sail (left) and Hawaiian claw sail (right).

tacts or presupposes that the sail could be an isolated relic artifact. Neither possibility has any supporting evidence. The mechanism of invention in these sails—the quest for greater power through greater height and the retrieval of control by cutting out part of the sail—seems an obvious course of experimentation for people who already had the V-shaped sail.

The Oceanic lateen developed from another path of evolution in the southeast Asian homeland, after the primary dispersal of the “outrigger canoe people” throughout the Pacific. The intermediate step in this case was not the invention of the mast from one of the sail supports, but the addition of a prop. A larger V-shaped sail with heavier spars would represent an obvious attempt to propel larger and more heavily laden craft. At some stage sailors here also evidently found that increasing the size of a vertical sail transferred the center of effort higher above the vessel with accompanying instability and difficulty of handling. Some peoples solved this problem by reducing the sail area at the top, as explained above, but the “Indonesians” (for want of a better name to identify these people) found that power could still be increased and the center of effort kept low if the sail leaned backward: the apex (or “tack”) at the bottom was moved forward in the canoe, and the spars that supported the edges of the sail now became functionally upper and lower yards. In this new position they could not hold the sail up, and so a prop was added (fig. 7). This produced the sail that A. C. Haddon and James Hornell call the proto-Oceanic lateen sail, which at the time of European contact was known and used as far east as Tonga and Samoa.

At this time, however, a further development was in the process of adoption: the canted mast. This mast is morphologically and functionally similar to the prop—indeed, it is simply the prop enlarged, but

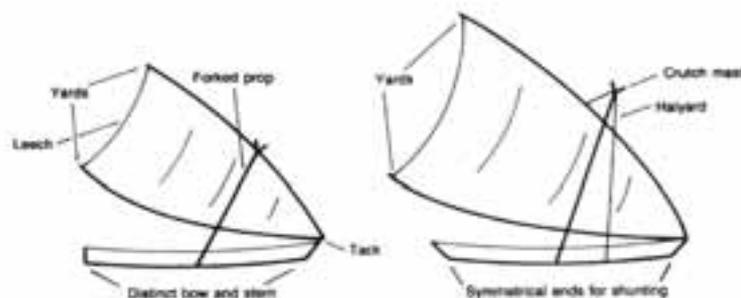


FIGURE 7. Pacific proto-lateen sail (left) and Oceanic lateen sail (right).

with the sail actually being suspended by a halyard that passes over a crutch at the masthead to about the central point on the upper yard of the sail. The most refined and efficient form of this sail was in the islands of Micronesia, where it was used to propel racing canoes at speeds that astonished European seamen; even large voyaging canoes could manage seven knots.⁴⁴ Haddon and Hornell cite a speed of twelve knots for a Fijian voyaging canoe carrying 200 men.⁴⁵

Hull modifications were developed in Micronesia and diffused with the sail and mast. The new craft had hulls of unequal sizes and asymmetrical cross-sections, and the smaller hull was always kept to windward. Such a vessel needed to be double-ended so that going about could be done keeping the wind on the same side of the vessel. Earlier vessels with identical twin hulls tacked like European fore-and-aft-rigged vessels.

There were thus two steps in the evolution of the Oceanic lateen. First, the sail was invented somewhere in the Indonesian archipelago at an unknown date, but necessarily later than the middle of the second millennium B.C.⁴⁶ This sail was supported by a prop, and its use spread from Indonesia northeastward into Micronesia, where it eventually became universal. From there it was transmitted southward through the Gilbert Islands to western Polynesia and parts of Melanesia. In both places it was grafted onto existing craft and used alongside earlier sails. Later, somewhere in Micronesia, the sail's full potential was attained by converting the prop into a mast, modifying the hulls to help control the enormous force of the sail, and developing new handling techniques.

⁴⁴ David Lewis, *We, the Navigators* (Wellington, 1972), pp. 266–68.

⁴⁵ Haddon and Hornell, *Canoes of Oceania*, p. 326.

⁴⁶ In other words, at any time within a period of about 3,000 years. On distributional grounds one may suppose it to have been invented nearer A.D. 1000 than 1000 B.C.

These consequential changes were in the process of being assimilated in western Polynesia at the time of European contact in the eighteenth century. The Fijians built the greatest canoes—or ships, really—in the entire Pacific, but the Tongans were the most wide-ranging seamen using vessels obtained from Fiji. The new technology soon reached southern Melanesia, downwind from Tonga and Fiji, and isolated specimens were found upwind in the far east, in the Tuamotu archipelago. Not so far to the east, in the Northern Cook Islands (Manihiki), the new sail and its functional principles had been adopted, but in that timber-short region old double canoe hulls were fastened bow to stern rather than being discarded in favor of the asymmetrical and unequal hulls.

The evidence of the evolution of this sail in the surviving sail types of Oceania is sufficient proof of its separate history from the west Asian lateen of the Mediterranean Sea and Indian Ocean. The distinction was demonstrated long ago by Bowen on morphological grounds. The differences may be summarized as follows:

1. The west Asian lateen is quadrangular with a short luff at the leading edge. The Oceanic triangular lateen comes to an apex at the tack where the upper and lower yards meet.
2. The west Asian lateen has a yard at the head only, but the Oceanic lateen has a yard at the head and at the foot (a boom). In fact all Oceanic sails, regardless of shape, have a spar on two sides.
3. Because of the luff, the head of the west Asian sail is much longer than its foot. The head and foot of the Oceanic lateen are virtually the same length.
4. The seams of the west Asian lateen are parallel to the yard. The seams on the Oceanic lateen are parallel to the leech.
5. The west Asian lateen uses a vertical, fixed mast held in place by ropes. The Oceanic lateen uses a mast that is canted, must be able to move, and is often supported by a wooden prop.
6. The west Asian sail is “loose footed,” that is, tethered by a rope. Most Oceanic lateens have the tack secured directly to the hull, fitted into a socket.⁴⁷

An important and conclusive distinction between the two sails is the different manner of their use. For sailing upwind, no lateen-rigged vessel can tack: the “Arabs” (i.e., sailors of the western Indian Ocean) responded by “wearing ship,” the Pacific Islanders by “shunting.” These terms and the methods are explained below.

Any further suggestion of possible influence of one sail on the other is rendered more unlikely by the distribution of each. Just as the

⁴⁷ Bowen, “Eastern Sail Affinities,” pp. 187–88.

outrigger was diffused both east and west from southeast Asia, so were the sails associated with it. Southeast Asian-style sails (in particular, the proto-Oceanic V-shaped spritsail) were to be found in Sri Lanka, Madagascar, and Aden.⁴⁸ The Pacific Ocean lateen (called in this context the Indonesian lateen by Bowen) was used on twin-hulled vessels (catamarans) as far west as the east coast of India, while traders from the Arabian sea reached as far east as Java. Nevertheless, the two sails retained their separate, distinctive features, except that the apex of the Indonesian sail in the Indian Ocean was sometimes replaced by a short luff similar to the Arab lateen.⁴⁹

Despite humanity's supposed lack of inventiveness in relation to sails, the lateen appears therefore to have been invented at least twice and possibly three times, if one allows separate development for the Mediterranean and Indian Ocean lateens. Indeed, in all regions where a sailing tradition is well established, experimentation with a variety of sails is evident, and all regions show numerous permutations of the basic styles. The conservatism inherent in the retention of the basic types over long periods of time is not due to a lack of imagination or inquiry. Rather, it is the result of the best solutions having been found, after which continued experimentation does not yield a worthwhile return.

USING THE LATEEN

If the lateen was as remarkable and efficient as reputed, why has it been so difficult to establish its antiquity and origins? Why is there more evidence of the use of square sails in antiquity than of lateen sails? The answer lies in the misapprehension by historians of the merits of the lateen. This sail has been widely assumed to be generally superior because of the weight of authoritative opinion that the Great European Excursion depended on and followed its adoption by the Atlantic nations. Even Casson describes it as "the triangular type that became the sail *par excellence* of the Mediterranean in later ages."⁵⁰

The perception that the lateen is a superior sail has obscured the fact that the two sails are functionally different, and each has its own advantages and disadvantages. There was no question of a lateen being

⁴⁸ Ibid., p. 85.

⁴⁹ Ibid., pp. 110–11.

⁵⁰ Lionel Casson, "The Lateen Sail in the Ancient World," *The Mariner's Mirror* 52 (1966): 199–200.

substituted for a square when the latter was more suitable. Square sails were retained on merchant ships in the Mediterranean because there was no particular advantage to be gained from a faster sail when distances were relatively short and when sea transport was already so much safer, cheaper, faster, and more reliable than land transport. Peter Throckmorton describes the Roman square rig as “efficient and practical.” As to the question of speed, he claims that a *perama* (a traditional vessel of the Aegean, probably similar to those used in ancient times) rigged in the Roman (square-sail) fashion would “undoubtedly outsail” the same ship with a modern schooner (fore-and-aft) rig, “given the wind abaft the beam.”⁵¹

The disadvantage of the lateen is that it makes the vessel less stable, requires a larger crew, and is less easily handled than a square sail. Unlike the square sail, its size is not easily adjusted to cope with different conditions. No lateen was capable of being furled or reefed or brailed, so lateens had to be lowered when winds became too strong for the sail area being carried. The lateen was more suitable where it was in fact mostly used: as an auxiliary sail to the oar-powered galleys. Additional maneuverability for entering and leaving harbor was given to the square-sailed merchant vessels by the use of spritsails, whose use goes back to at least the second century B.C. in the Aegean.⁵²

The popularity of the lateen is commonly ascribed to its superior windward performance compared with a square sail. In historic times the west Asian seamen took no significant advantage of this feature. They used the sail as a “downwind” sail and would defer sailing rather than set out with the wind on an inconvenient quarter.⁵³ These sailors were reluctant to sail on alternating reaches, that is, sailing upwind by taking the wind first on one quarter and then turning through the wind to take it on the other.⁵⁴ This is a sailing tactic usually called tacking, which cannot be done with a lateen except at great risk and difficulty because the long yard extending both fore and aft of the mast prevents the sail being moved to the other side of the mast. Instead, it is necessary to “wear ship”—that is, turn downwind instead of upwind, loosen the sail and carry it forward of the mast, bring the yard into an upright position in front of the mast, and then reset the sail on the

⁵¹ Throckmorton, “Romans on the Sea,” p. 77.

⁵² Casson, “Fore-and-Aft Sails,” pp. 3–5; Lionel Casson, “The Sprit Rig in the Ancient World,” *The Mariner’s Mirror* 46 (1960): 241; also Richard LeBaron Bowen, “Fore-and-Aft Sails in the Ancient World,” *The Mariner’s Mirror* 43 (1957): 160–64.

⁵³ Bowen, “Arab Dhows,” pp. 123–29.

⁵⁴ Lewis, “Maritime Skills,” pp. 252–53.

other side of the vessel. This is a difficult and dangerous procedure and the principal reason for the limited use of the lateen sail.

The Oceanic lateen of course suffers the same disadvantage, but the method of dealing with it was different. The vessels that used this sail were double ended, and when it became necessary to tack, the sail was loosened, taken along the side of the vessel instead of around the forepart, and reset in what was formerly the stern. The stern then became the bow, and the vessel set off on its new course. This is the reason for the mast not being fixed: it must be reset to support the yard in its new position. This is why the evolution of the canted mast was an enormous improvement on the former prop, with which such a maneuver was impractical. As with the Indian Ocean sail, shunting (as this maneuver is called) is cumbersome and dangerous, and it requires a large crew and comparatively clear decks. In both cases, the handling difficulty is an incentive to sail mostly when the winds are steady, so that changes of direction will not be necessary.⁵³

In this respect, the lateen in either form was not superior either to the Western square sail or to the V-shaped sail that was giving way to the lateen in various parts of the Pacific in the seventeenth and eighteenth centuries. The older vessels, whether outrigger canoes or twin-hulled voyaging canoes, had distinct bow and stern and went about by tacking in the conventional manner. Indeed, so recent was the spread of the lateen that in Tonga, for example, the new sail was reported being used on the old hulls, and the sailors tacked with the inevitable disadvantage of having the boom and sail forced against the mast, with the sail's contour broken and pocketed by the mast.⁵⁶

THE LATEEN'S PLACE IN SAIL EVOLUTION

The limited utility of the lateen sail is evident in its history in the Mediterranean-Atlantic culture area. Despite its long history, it did not become the sail in common use except for a period in the early second millennium among the Italians. It did not become the main means of shifting the war galleys because it could not compete with the speed and maneuverability of oars in battle conditions, useful though it was as an auxiliary power source. In ancient times other

⁵³Haddon and Hornell, *Canoes of Oceania*, p. 265.

⁵⁶Beaglehole, *The Voyages*, 2:448. Also Haddon and Hornell, *Canoes of Oceania*, p. 265. Cook adds the interesting comment that "when they want to sail large, or before the wind, the yard is taken out of the socket and squared."

forms of fore-and-aft sail, the spritsail in particular, were used to give the round ship maneuverability when entering and leaving harbor.

When Atlantic seamen adopted the lateen sail, they did so particularly to meet a navigational need. According to J. H. Parry, this was to provide maneuverability for exploring foreign, inshore waters, and especially harbors and estuaries.⁵⁷ More to the point, it facilitated the return to Portugal against the trade winds for those first explorers who pushed southward down Africa's northwestern coast.⁵⁸ Hence Bartolomeu Dias's choice of the caravel for his exploration of the African coast. Yet Dias's achievement and great contribution to Atlantic exploration was to leave the coast and sail across open ocean. Having done so, moreover, he chose and supervised the building of the vessels for Vasco da Gama's great voyage. He selected not the supposedly superior and handy caravel, but the *caravela redonda*, a three-masted ship rigged with square sails on the fore and mainmasts, and a lateen sail only on the mizzen or aftermast.⁵⁹ Columbus rerigged his unsatisfactory caravel as a *caravela redonda* during his first trans-Atlantic voyage and found that it answered the need perfectly. And when Magellan set forth on his global circumnavigation in 1519, he sailed with five ships, not one of them a caravel.⁶⁰

Thus, almost as soon as the lateen was incorporated into European shipping, it was reduced to an auxiliary status, where it proved most useful for stern and beam winds in the same manner as the square sails that continued to provide most of the sail area. In a little-known, unpublished paper, G. S. Parsonson possibly overstated the essential point in saying that the Mediterranean lateen is not a true fore-and-aft sail,⁶¹ but most historians have overlooked the fact that the lateen sail is a modified square sail, adaptable and well suited to beam winds, but not the ancestor of the true fore-and-aft sails.

This is not to say that the lateen sail did not improve the windward ability of ships.⁶² Rather, its awkwardness limited its usefulness. The lateen is not the "ultimate sail." It is better described as a blind alley on the evolutionary trail: highly specialized, very effective for certain

⁵⁷ Parry, *Europe and a Wider World*, pp. 22–23.

⁵⁸ Needham, *Science and Civilisation*, 4:3:509, 513.

⁵⁹ E. G. Ravenstein, *A Journal of the First Voyage of Vasco da Gama, 1497–99* (London, 1898), app. D, p. 159. A caravel was a two-masted roundship rigged with a lateen sail on each mast.

⁶⁰ J. H. Parry, *The Discovery of the Sea* (New York, 1974), p. 153.

⁶¹ Parsonson, "Nautical Revolution," p. 5.

⁶² Needham (*Science and Civilisation*, 4:3:593) estimates that the addition of a mizzenmast lateen enabled a square-rigged ship to sail one point closer to the wind: from seven points (80 degrees) to six points (69 degrees).

limited uses, but not solving the principal problems of navigation and not leading to other solutions.

Far from being a link between square sails and fore-and-aft sails, it represents an unsuccessful adaptation that was soon superseded by true fore-and-aft sails, which have a longer history than the lateen. During the seventeenth or eighteenth century, the mizzen lateen sail disappeared from Atlantic shipping, to be replaced by the gaff sail, which is believed to have been a fifteenth-century Dutch invention. It is unlikely that the gaff evolved from the lateen sail, though Harry Morton calls it a lateen with the section before the mast removed.⁶³ The precursors of the gaff sail are more likely to have been the sprit-sails long used in the North Sea, also commonly attributed to Dutch inventiveness in the fourteenth century.⁶⁴ It remains unclear whether, like the lateen, the spritsail had a continuous existence from ancient times, or whether the Dutch sail represents a separate tradition or independent invention. Either way, a spritsail is more obviously converted into a gaff sail than is a lateen.

The jib and staysail are less easily related to any previous sail because of the absence of a yard of any kind to indicate the evolutionary trail. For all practical purposes a jib and staysail are the same thing: the former is strung between the foremast and the prow (or bowsprit) and the latter is strung between masts. Their invention and widespread adoption by the mid-eighteenth century probably required a greater leap of imagination than any of the other developments, because the yard (whatever it was) had to be discarded entirely and replaced by rope. These sails also are attributed to the Dutch.⁶⁵

In this form the evolution of the fore-and-aft sail reaches its culmination in economy of design and simplicity of use, but also in distinctness from those other fore-and-aft sails that can be used when occasion requires, quite successfully, as "square" sails.

⁶³ Morton, *The Wind Commands*, pp. 225–26.

⁶⁴ Needham says that the Dutch invented the gaff in the sixteenth century and that it was adopted by the English late in the seventeenth century. Bowen says it was invented in the fourteenth century, but the luff was not laced to the mast until the seventeenth; Casson says it was invented in the fifteenth or sixteenth century. The difficulty in dating is not simply lack of clear pictorial evidence, but that in the evolution of a sail it is not always clear at which stage one form can be said to have passed into another. See Needham, *Science and Civilisation*, 4:3:611; Bowen, "Eastern Sail Affinities," p. 83; Casson, "Fore-and-Aft Sails," p. 3.

⁶⁵ Morton, *The Wind Commands*, pp. 232–33; Bass, *History of Seafaring*, p. 288, figs. 6–7, and p. 290, fig. 10. According to Alan Moore ("Rig in Northern Europe," *The Mariner's Mirror* 42 [1956]: 17, 21), the staysail was invented in the seventeenth century, and the jib was officially adopted by the Royal Navy in 1705.

CONCLUSION

The history of the lateen sail is both more complicated and less significant than has generally been supposed. Its origins continue to be uncertain, even though better known now than half a century ago. Its role in linking the major culture areas of the world is less than was formerly thought. It seems now too much to say that the lateen sail allowed navigators to achieve what was previously unattainable. Non-lateen sails were sufficient. This is not to deny the importance of sail evolution but rather to suggest that credit should be attached to the much underrated square sail—and to the true fore-and-aft sails with which the lateen has been too long confused.