Boats and Ships of the Arabian Gulf and the Sea of Oman Within an Archaeological, Historical and Ethnographic Context

Alessandro Ghidoni and Tom Vosmer

Abstract This chapter presents a comparative analysis and synthesis of all the relevant evidence of watercraft in the Arabian Gulf and the Sea of Oman. Historical, archaeological, iconographic and ethnographic data are examined with the aim to provide a picture of the maritime technology in the region that stretches from the Neolithic to recent times, over a period of 7500 years. The study of this evidence reveals the variety of types of watercraft, the traits of their development and the ingenuity of the boatbuilders of this region, but also highlights the continuity with the past, indicated by the persistence of boatbuilding features and methodologies over a vast span of time. Lastly, the chapter describes the different types of traditional vessels that sailed in the Arabian Gulf and Sea of Oman until recent times.

Keywords Oman · Indian Ocean watercraft · Arabian Sea · sewn boats · reed boats · boatbuilding technology

1 Introduction

Maritime activity in the Arabian Gulf and Oman developed at an early date. Coastal settlements of fisher-gatherers exploiting marine resources in the fifth to sixth millennium BCE provide early evidence of Neolithic seafaring (Beech et al. 2000; Carter 2002; Biagi 2007). While this evidence suggests that inhabitants in the Gulf were the first to engage in seafaring, the communities of the eastern coast of Oman are probably the first who ventured into deep oceanic waters (Cleuziou 2003: 136). Constrained to the west by the arid interior of the Arabian Peninsula, they turned to

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the east towards the ocean and mastered the knowledge and the technology that initially enabled them to exploit their marine resources and then to venture into long-distance sailing. With the rise of civilizations in Mesopotamia, Makkran (Persia), Dilmun (Bahrein) and Meluhha (the Indus Valley) during the Bronze Age (third millennium BCE), a vibrant sea-based network developed between the coasts of Mesopotamia, the Gulf and the northwest coast of India (Oppenheim 1954).

With the advent of Islam, maritime trade flourished in the Indian Ocean, as Islamic expansion encouraged Arabs to explore every aspect of life, including travel and commerce. Arab ships were the agents of this maritime trade, the so-called Maritime Silk Route, which extended from the Arabian Gulf to the South China Sea, connecting the two largest empires of that time, the Abbasid Empire in the Middle East and the Tang Empire in China. This was the 'longest sea route in regular use by mankind before the European expansion in the sixteenth century' (Hourani 1963: 61). From Ubulla, Siraf and Sohar, using the monsoon winds, sewn ships loaded with frankincense, dates, pearls and horses would sail across the Indian Ocean, in long and perilous journeys lasting several months.

After the sixteenth century, this context changes in many ways with the appearance of European naval power, and maritime communities had to gradually transform their vessels to compete with the heavily armed ships of the foreign invaders. The main consequences of this change are the adoption of new construction methods and the development of new hull forms, which further increased the variety of craft that survived in the Arabian Gulf and the Sea of Oman until recently.

2 Terminology

Before discussing types of traditional vessel, some basic terminology and features of western Indian Ocean and Gulf boats need to be described. The following is a list of those features and terms.

Double-ended A boat is said to be 'double-ended' when it is pointed at both ends (lacking a transom).

Fashīn The *fashīn* is a tall, thin planked structure attached to the stern of double-ended vessels such as the *badan*, *baqqāra*, *battīl* and *zarūka*. The profile of the *fashīn* varies with vessel type and is a hallmark feature helping to define a specific type of vessel (Fig. 1). But the function of a *fashīn* moves beyond decoration. Firstly, it is a device from which the tall rudder is suspended. The artisanal fishing boats often had rudders that extended well below the keel, making the rudders vulnerable to striking objects underwater or snagging fishing nets and lines. Therefore a system to quickly unship the rudder was necessary. The system allowed the rudder to be pivoted clear of the water or shipped when the vessel was at anchor in shallow water. The rudders of double-ended fishing boats were suspended from the top of the *fashīn* and generally extended below the keel and were held against the aft edge of the *fashīn* by ropes that led to the hull and by the ropes that controlled the steering. The

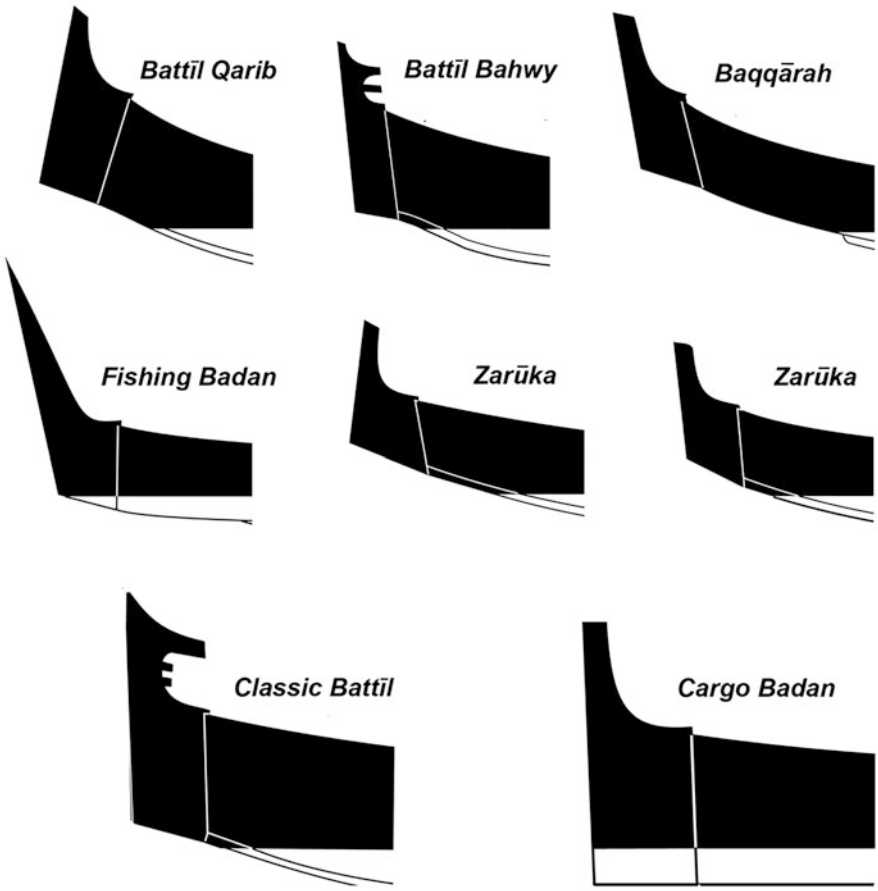

Fig. 1 Profiles of *fashīn*s of various traditional Arab boats (Image courtesy of Tom Vosmer)

fashīn provided a long edge to mount the rudder, which helped keep it in place, and its height allowed most of the length of the rudder to be out of the water, thus counteracting the buoyancy of the deep rudder. Secondly, the *fashīn* allowed the rudder to be fitted further aft of the hull, increasing its turning moment and allowing it to work more efficiently in water less disturbed by the hull. Another reason for the *fashīn* may have been its usefulness as a weather vane, keeping an anchored vessel head to wind. Such an arrangement is clear in Pâris's illustrations of fishing *badan*s in the early nineteenth century. The *fashīn* was a brilliant innovation in hydro- and aerodynamics.

Lateen sail A lateen sail is triangular in shape, with the yard suspended at an angle from near, or just forward of its midpoint. The lateen can be set as a fore-and-aft sail and hence is reputed to provide more windward sailing ability than a square sail.

Luff The forward edge of a fore-and-aft sail.

Leech The after edge of a fore-and-aft sail.

Rope steering Because of the height of the *fashīn*, it was not possible to fit a 'normal' tiller to the rudder. To solve this, boatbuilders invented a tiller that pointed aft from the rudder and was controlled by lines running from its aft end to the helmsman's position.

Settee sail The typical sail of Arab, Persian and Indian vessel is similar to the lateen but is actually a quadrilateral sail with a short luff and long leech.

Square sail The square sail is a quadrilateral sail which can be a square, a rectangle or a trapezium. It is fixed to a yard which is suspended horizontally at its midpoint and able to be rotated to some degree about the mast. The square sail was probably the first sail developed.

Transom The transom is the flat or lightly curved structure forming the stern of a transom-stern vessel.

The above will help in the understanding of the watercraft described in this chapter.

3 Neolithic and Bronze Age Watercraft

Our knowledge about the boats used during the Neolithic and the Bronze Age in the Arabian Gulf and the Arabian Sea is still very limited. Archaeological evidence is almost non-existent, and scholars have relied on different sources in an attempt to describe the shape, size, material, function and construction method of these early watercraft.

In the light of the scarcity of archaeological remains, iconographic evidence and models of boats provide information about the early vessels which sailed in Mesopotamia, the Arabian Gulf and the Arabian Sea. However, caution is always required when dealing with this set of evidence, because the representations are often obscure and crude and their stylized nature often makes the interpretation of these vessels a difficult task. Nevertheless, one can find in this evidence useful hints into the shape, structural elements, material, use and function of the watercraft.

3.1 River Craft

One primary distinction between riverine and maritime vessels emerges in the study of the iconographic evidence. Early Mesopotamian representations, such as those from cylinder seals from the late Uruk period (c. 3400–3100 BCE), generally refer to riverine vessels (Potts 1997: 136). The environment of Southern Mesopotamia,

Fig. 2 An Uruk III cylinder seal showing a reed riverine vessel (after Amiet 1961: Pl. 46.655)

consisting in wet and marshy conditions, certainly promoted the development of watercraft used to transport people and goods and for fishing and hunting. The availability of a material easy to harvest and work, such as reeds of different species, influenced the construction method and the shape of the vessels. Although the boats depicted have various forms, most of them have a flat bottom, suggesting that they were used in shallow waters, such as those of the marshlands of southern Mesopotamia. Others show a crescent shape, with their ends curved either inwards or outwards. Some are depicted transporting peoples and animals, while others were used for fishing and hunting activities in the marshes, as indicated by the vegetation depicted around the craft.

A cylinder seal from the late Uruk period, dated to the end of the fourth millennium, offers an example of a river craft used in Mesopotamia during this period (Amiet 1961: Pl 46.655; Bass 1972: 28) (Fig. 2). The vessel depicted is flat-bottomed with high ends curved inwards. Mast and sail are absent, and the boat is propelled by a figure punting at the bow and steered by a helmsman kneeled at the stern. The boat appears to be carrying a cow, a third person, much larger in size than the other two figures, and a rectangular structure near the bow. The structure interpreted as a shrine and the figure standing next to it indicate the ceremonial nature of the vessel. Most of the depictions of boats from this period show vessels transporting similar structures along with persons involved in the ritual/worshipping activity, in a tradition that dates back to the Sumerian period, a thousand years earlier (Carter 2012: 352).

3.2 Seagoing Vessels

Similar to Mesopotamia, watercraft played a vital role in the Gulf and the Arabian Sea since the Neolithic. The sea and its resources, which were plentiful in this part of the world, favoured the emergence of prehistoric communities along the coasts of the

Arabian Peninsula. Boats and specialized fishing techniques quickly developed to exploit the marine resources, which were the base of these communities' economy. Fish remains are the most significant and numerous finds in the archaeological record of these settlements, with both small and large species. The remains of large fish species like tuna, mackerel (Scombridae sp.) and jacks (Carangidae sp.) appear in different Neolithic sites along the coasts of the UAE, such as Dalma Island, in the fifth millennium BCE (Beech et al. 2000: 44; Beech and Glover 2005: 100) and Oman, in Ra's al-Hamra, in the fourth millennium BCE (Biagi et al. 1984: 49; Biagi and Nisbet 1989: 43). Although these species can occasionally swim relatively close to the coast, they generally live in pelagic waters, and their catch necessarily requires a boat and line-with-hook (Biagi et al. 1984: 49). Shellfish hook technology, enabling the prehistoric fishermen to catch these species, developed in a region stretching from the south-east coast of the Gulf, the Arabian Sea and the Gulf of Oman, between the sixth and fourth millennium BCE (Mery et al. 2008: 16–19).

During this early period, boats were not used exclusively for fishing. The fishing activity enabled the prehistoric communities to experiment with boatbuilding and to develop more complex watercraft which to be used to trade goods.

While fishing vessels, even those used in deep waters, would have been of a relatively small size, similarly to those used nowadays to catch tuna by Omani fishermen, trading vessels would have probably been larger. Although their shape could have been similar, these vessels would have required a more capacious hull to carry goods and would have been structurally more solid to endure long-distance sailing.

3.3 Trading Vessels

Evidence of maritime contacts between the Gulf and Mesopotamia dates back to the sixth millennium. Pottery of Mesopotamian origin is ubiquitous in the archaeological record of coastal Neolithic settlements of Eastern Arabia, Qatar, Bahrain and Emirates, indicating the presence of exchange networks in the region during this period (Oates et al. 1977: 222; Mery 1995: 193; Cleuziou and Mery 2002: 279–280). Boats were the agents of this exchange system, showing that the Eastern Arabian communities developed advanced boatbuilding technology and the sailing skills, which enable them to transport goods for a long distance along the coasts of the Gulf.

A small model of a boat and the remains of the hull of a vessel discovered in the sixth-millennium site of As-Sabiyah (H3), Kuwait, provides information about the Neolithic seafaring craft of the Gulf, perhaps involved in trade activities (Carter 2002, 2006, 2008) (Fig. 3). The model is similar to those from Mesopotamia and show a vessel with a flat bottom and high ends. Small notches on the sheer line in both sides may indicate the presence of thwarts lashed on the edge of the vessel, to provide strength as seen in other representations. There are no elements indicating that the model had a mast, such as a mast step or marks on the sides suggesting the use of a bipod mast. Bipod or sheer masts were employed in the papyrus boats of

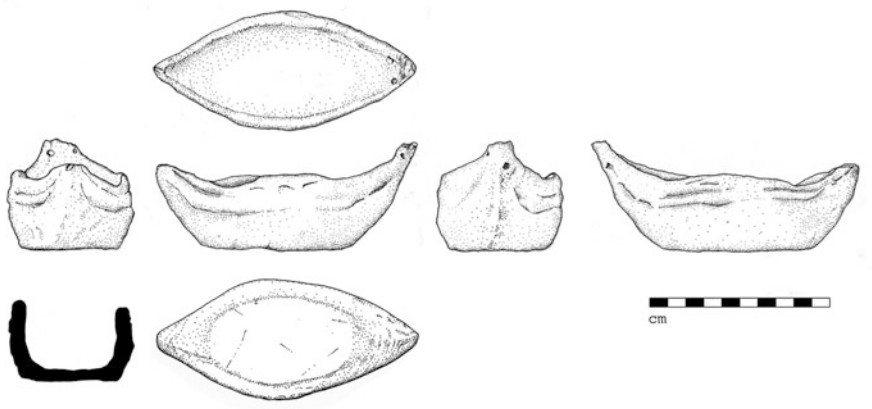

Fig. 3 The terracotta model discovered in the Neolithic coastal site of As-Sabiyah, Kuwait (Image courtesy of Robert Carter)

ancient Egypt, as indicated by boat models and depictions. A sheer mast is particularly appropriate to reed craft, where it can be installed on the sides of the hull and requires fewer rigging cables to secure it in position (Hornell 1970: 46).

One interesting feature is the presence of lines incised on both sides of the H3 model, which perhaps could be interpreted as the intersections between bundles running longitudinally to the hull or plank seams (Carter 2002: 20–21, 2006: 53). The inwardly curved sides near the edge of the model (tumblehome) are a feature visible in other Mesopotamian models and perhaps a clue of reed-bundled construction, although it also appears in wooden boats (Vosmer 1996: 225).

3.3.1 Reed Vessels

The discovery of bitumen fragments, in the site of H3, with one side bearing the impressions of reeds lashed in bundles, appears to provide further evidence for the interpretation of the H3 model as a reed boat (Fig. 4). The presence of barnacles on the surface opposite to the impressions indicates that the bitumen had been submerged in seawater and that it was used as a waterproof coating of reed vessels during this period (Carter 2002: 22–23). The bitumen, stripped from the hull of boats and stored for recycling, was an amalgam consisting of mineral and organic contents. Vegetal inclusions, such as crushed reeds and fibres, were added to the amalgam to strengthen it, make it resistant to high temperatures and reduce the amount of bitumen necessary (Connan et al. 2005: 55). The practice of using bitumen to waterproof the hull of vessels has a long tradition in Mesopotamia. Bitumen-coated boats have survived until recently (Thesiger 1954: 277; Ochsenschalger 2004: 177–185), and few of them are still in use in the marshlands (Jeffrey Rose 2016, personal communication, February 2015).

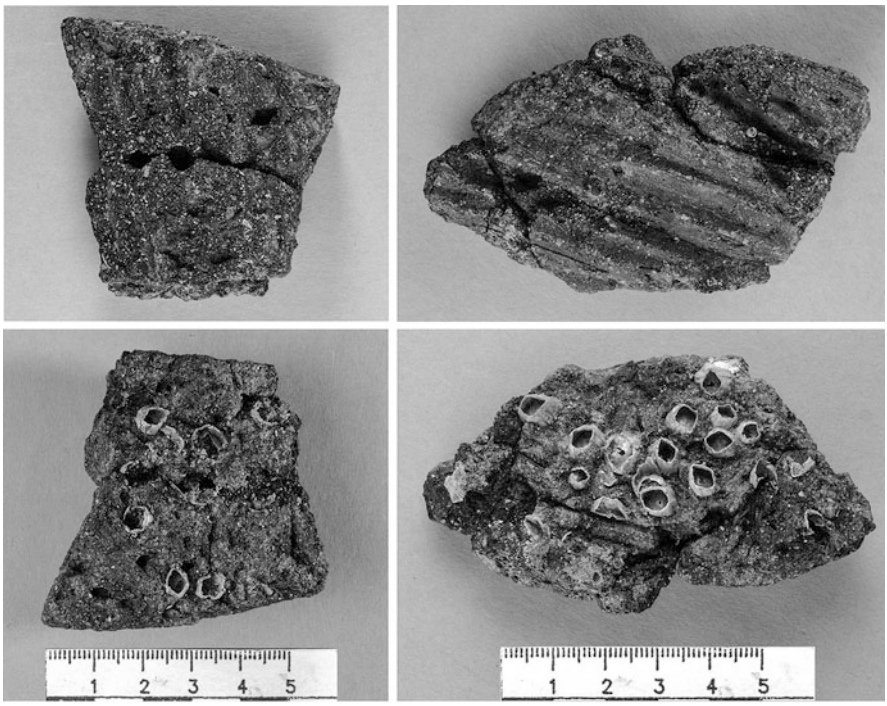

Fig. 4 The bitumen fragments discovered in As-Sabiyah showing reed impressions and barnacles (Image courtesy of Robert Carter)

The reed vessels sailing in the Gulf during this period were probably built by binding longitudinal reed bundles, the ends of which converged at the bow and the stern giving the vessel the particular crescent shape with high ends, featured in the models and glyptic from Mesopotamia. Frames and beams, or thwarts, could have been used to provide structural strength and counterbalance the flexibility of the hull. The way these vessels were propelled still belongs to the field of hypotheses, but one can speculate that craft used for coastal fishing could have been rowed, while a sail was necessary for long-distance trading. An image painted on a ceramic disc from the site of H3, interpreted as a boat with a bipod mast, seems to reinforce the idea that mast and sail were already in use during this period (Carter 2006: 55).

Impressed bitumen finds occur in many sites of the Gulf during the Ubaid period, but the most significant are those from a later period discovered at the third-millennium coastal site of RJ-2 (c. 2500–2200 BCE), Ra's al-Jinz, eastern Oman (Fig. 5). Although some of the over 300 bitumen samples exhibit similar features to those of H3, such as impressions of reeds on the inside face and barnacles on the outer surface, others show impressions of reed-woven mats and wood (Cleuziou and Tosi 1994: 750), indicating two different materials used in boatbuilding during this period. The comparison between the evidence from H3 and RJ-2 allows some

Fig. 5 A bitumen fragment from Ra's al-Jinz, Oman, bearing impressions of reed-woven mats and fibre ropes (Image courtesy of Luca Bezzi)

speculations about the material, construction technique and function of the boats between the Neolithic and the Bronze Age, in the Gulf and the Arabian Sea.

One main aspect emerging in the archaeological record is that reed-built vessels were used in the Gulf and the Arabian Sea from the Neolithic to the Bronze Age, from the sixth to the third millennium. The availability of the material certainly played an important role for the survival of these vessels. Reeds are widely available in the marshlands of Southern Mesopotamia and can be found in the coastal lagoons of the Gulf and Oman littoral, but wood for boatbuilding is relatively scarce in those regions. The fact that reeds can be harvested and worked easily made them particularly favourable for the construction of early seafaring watercraft and was documented in Southern Iraq (Thesiger 1964: 126–127). A large quantity of reeds is mentioned in the cuneiform sources reporting a list of material required for the building and repairing of Magan-type boats (Cleuziou and Tosi 1994: 746).

The comparison between the bitumen fragments from H3 and RJ2 also seems to point out different construction methods. Some of the RJ2 samples preserved impressions of mats along with their sewing ropes, while those from H3 only show bundles. The vast majority of RJ2 bitumen with traces of barnacles bears impressions of mats on the opposite surface. This suggests that mats were sewn to the hull of Ra's al-Jinz's boats before being coated with bitumen (Vosmer 2003a: 52), while in the H3 boats, bitumen was applied directly on the bundles. Whether this method is indicative of a watercraft development from the Neolithic to the Bronze Age, or rather the evidence of different boatbuilding traditions, it is impossible to determine until new archaeological data will be discovered.

The presence of material from the Indus Valley in the site of Ra's al-Jinz points out that ancient seafarers were sailing across the Arabian Sea and the Indian Ocean in the third millennium BCE (Cleuziou and Tosi 2000). Whether they sailed on reed boats is still an open question. Experimental archaeological reconstructions of three Bronze Age prototypes, the *Magan Boat Project* (Vosmer 2000a, b, 2001a, b, 2003a, b), provided some insights into the materials and technology involved in

Fig. 6 The Magan-3, a hypothetical reed-built vessel based on the archaeological evidence from Ra's al-Jinz, sailing off the coast of Sur (Image courtesy of Helen Kirkbride)

the building of these vessels but also highlighted their limits (Fig. 6). The hypothetical prototypes had different sizes and shapes which were based on the archaeological evidence from Ra's al Jinz, iconographic depictions, textual sources and ethnographic records. The hulls of the *Magan Boats* were assembled with long reed bundles of different thickness bound together and lashed to transverse reed frames. Reed-woven mats were sewn on the hull skin before the application of a thick layer of bitumen. Wooden elements, such as beams and stringers, added structural strength to the flexible hull to prevent deformation. The prototypes had two steering oars, a bipod mast and square rigging. The project has revealed essential aspects such as the variety and quantity of materials required, its properties and the skills and knowledge involved in the building of these vessels. However, the prototypes have also pointed out the limits of the flexibility of the hull these vessels, which caused the cracking of the more rigid waterproof layer of bitumen, raising doubts about the possibility that vessels entirely built with reeds could endure the rough conditions of open-sea sailing, such as the crossing of the Arabian Sea. The list of shipbuilding materials provided by the Ur-III cuneiform text from Girsu, CT 7–31, reveals a significant amount of timber required for the construction of Magan-type boats (Cleuziou and Tosi 1994: 746). Although the material listed could refer to the construction of both reed and wooden craft, it could also suggest the possibility of a hybrid construction method (Vosmer 1996: 227), combining reed bundles and wooden planks, as seen in more recent examples from the Gulf and Arabian Sea (Vosmer 1992: 28).

3.3.2 Wooden Vessels

Wooden-plank technology in the Arabian Sea appears to be established already by the end of the third millennium BCE (Cleuziou and Tosi 1994: 748–754). Before that period, our knowledge relies on the interpretation of the hulls of Mesopotamian boat models, whose smoothness is often interpreted as the evidence of planked vessels, in contrast with reed-bundled craft (Potts 1995: 125). However, the use of a thick bitumen layer as a waterproof coating even on a reed boat would make it look smooth and difficult to distinguish from a wooden boat (Johnstone 1980: 10).

Cuneiform texts mention the use of wood for boatbuilding since pre-Sargonic times (Potts 1997: 108–109). Different species of timber, as well as reeds, are mentioned in Mesopotamian sources (Umma text TLC V/5673) as the material required for the construction of a 120 gur (30 tons) ship in the dockyards of Lagash (Zarins 2008: 2014). The involvement of the Indus Valley civilization in the trade network between the Gulf, Oman and Mesopotamia made timber suitable for boatbuilding available, influencing the development of wooden vessels (Cleuziou and Tosi 2000: 66; Vosmer 1996: 231). Wooden-planked vessels would have been more suitable to endure the conditions of long-distance sailing, as the crossing of the vast body of water that separated the Arabian Peninsula and the northwest coast of India.

Two bitumen fragments from RJ-2 bear the impressions of wooden planks lashed with a series of ropes converging to a rectangular slot and closed by a wooden plug (Fig. 7) (Vosmer 1996: 231). The fastening system shares similarities with the traditional sewn-plank technique of the western Indian Ocean (Fig. 8), such as the use of ropes to hold the planks together and the presence of wooden plugs to lock the ropes in place in the stitching slot and stop the water. These similarities could be interpreted as the evidence of an early stage of what would develop into fully sewn-

Fig. 7 A cast of the bitumen fragment from Ra's al-Jinz with impressions of wooden planks fastened by ropes (Image courtesy of Tom Vosmer)

Fig. 8 A sewn *sanbūk* (locally called *kambārī*) on display at the Land of Frankincense Museum in Salalah, Oman (Image courtesy of Alessandro Ghidoni)

plank technology (Vosmer 1996: 231). Unfortunately, the bitumen fragments show only the outer surface of the hull, and what is behind, such as the presence of frames, dowels or even a wadding, is not known. Nevertheless, the method employs individual lashing in contrast to the continuous sewing appearing with the Islamic period. Texts from Girsu list a considerable amount of ropes used in boatbuilding, suggesting their use for fastening (Potts 1997: 126).

One additional evidence for the rope fastening method is perhaps found in the reference of the provision of 59,290 wooden pegs for the boatyard of Umma, during the Ur III period, which can be interpreted as mortise and tenons or dowels (Potts 1997: 127). Perhaps, they could have been used as plugs as seen in the RJ2 impressions (Carter 2012: 365; Vosmer 1996: 227).

3.4 Shape of the Boats

Unfortunately, the bitumen fragments from Ra's al-Jinz show only a small portion of the outer surface of the hull. The shape of the vessel, as well as the structural elements inside the hull, such as frames, beams and dowels, is not known.

In boatbuilding, various factors are involved in determining the final shape of a vessel. The availability of a particular material, the environment, the function and the propulsion of a vessel all contribute to the final appearance of a boat. Generally, in

Fig. 9 Failaka seals depicting a seagoing wooden vessel (Image courtesy of Tom Vosmer)

earliest watercraft, the material plays an important role in dictating the shape of the vessel.

As we have seen, reeds are the material used in the earliest boats of Mesopotamia and the Gulf. Reeds lashed in longitudinal bundles converging towards the ends create the natural profile of a reed boat, which is the crescent-moon shape with high ends, constantly recurring in the Mesopotamian models and glyptic.

The transition from reed to wooden boats, the latter technologically more complex and advanced, probably saw minimal changes in hull shape, which continued to resemble that of their reed-built ancestors. Ancient Egypt watercraft and more recent ethnographic examples, such as the *tarrada* used in the marshland of Southern Iraq (Thesiger 1954: 277, between pp. 280–281), are good examples of this development process (Casson 1971: 13).

Iconographic evidence such as those from the stamp and cylinder seals discovered in the Gulf at Failaka and dated to the early second millennium BCE provides information about the shape and the technology of the wooden boats that sailed between Mesopotamia and the Indus Valley in the late third and early second millennia BC (Johnstone 1980: 173; Potts 1995: 566). All the watercraft illustrated in the seals are double-ended (Fig. 9a–c). Some of the boats have straight ends, while others have their bow and stern curved. The mast is visible in the majority of the seals, sometimes associated with a sail, and at least two samples show the steering system consisting of two quarter rudders fitted at the stern.

One seal (Johnstone 1980: 176; Kjærum 1983: n. 351) depicts a double-ended sailing vessel with two human figures on board (Fig. 9c). The boat has the bow and the stern with the same angle. The end of the bow is curled inwards, while the stern show a structure similar to those observed in other boat representations, such as that from a seal from Mohenjo-daro (Bowen 1956: 280; Potts 1995: 566). There is a mast in the centre of the boat holding what appears to be a square sail. Four diagonal lines, two on each side, from the mast to the boat sheer, could be the cables used to fasten the mast to the beams or deck.

The sail hanging from the mast shows a pattern consisting of alternate vertical and horizontal lines, suggesting that the sail was made of sewn panels of cloth (Potts

1995: 566). That particular pattern could also resemble a woven reed or palm leaves mat (Vosmer 2007: 139). Reed mats are often associated with boats in the cuneiform sources, although not all the time it is specified their function (Goetze 1948: 178). Woven mat sails were observed by European and Arab travellers in the western Indian Ocean during the medieval period (Hourani 1963: 100), a feature that survived until the early twentieth century in the East African *mtepe* (Hornell 1941: 57). A helmsman seated on the structure at the stern seems to control the sail by holding a cable running from the top of the mast.

The shape of the boat, the presence of a seat, or structure at the stern, raised ends and a helmsman holding a cable, and governing the boat with two steering oars, are recurring features lasting for millennia in the iconographic tradition of the region, as indicated by the thirteenth century AD miniatures of the Maqamat al-Hariri (Vosmer 2007: 185).

3.5 Size of the Boats

Magan ships are indicated in the texts as a distinctive typology of boats involved in the maritime exchange activity in the Gulf. They are often called Má-gur$_8$, which is a term with various meaning ranging from ships with high ends, ceremonial ships, cargo ships and seagoing ships (Zarins 2008: 215).

Although in the cuneiform texts boats are sometimes distinguished by their geographical areas, such as boat from Magan, Dilmun and Meluhha, or associated with their cargo, Mesopotamian sources mostly describe them according to their size (Potts 1997: 128).

The size of the boat in Sumeric texts is expressed in *gur*, which is a unit of capacity (volume or mass) varying in value according to the different regions and periods of Mesopotamia (Gelb 1982: 590). The *gur* applied to the ships of the UR III period corresponded to a value between 250 (Zarins 2008: 214) and 300 kg (Gelb 1982: 589; Potts 1995: 568).

Cuneiform texts from this period mention boats used in Umma with a capacity varying between 1 and 300 *gur* (Potts 1995: 562), with 60 *gur* (15–18 tons) being the most frequent figure (Carter 2012: 361). The largest boat ever mentioned in the UR III text is 360 *gur* (83–108 tons) (Zarins 2008: 214).

Unfortunately, no textual source provides sufficient clues about whether the figure expressed by the unit refers to the absolute cargo capacity, the displacement or the actual weight of the boat or even how the size of the boat and its cargo measured in *gur* are related to each other (Gomi 1993: 41).

Considering that trading was the primary function of these vessels, the value of which depended on the goods they transported, one can assume that the number of *gur* most likely represents their cargo capacity. Hence, the displacement of a vessel could be determined by adding this figure to the weight of the boat itself, the crew, provisions and equipment (Vosmer 2008: 230).

Hypothetical (generic) hull forms, based on the Mesopotamian boat models and depictions, tested on a naval engineering computer software and combined with the data from the archaeological and textual evidence, regarding the cargo carried and the amount of bitumen required to waterproof these vessels, helps to speculate about their size. The results of the study indicate an estimated waterline length of 13 m, and an overall length ranging from 15 to 17 m, for a 60 *gur* boat and a waterline length of 16 m, and an overall length between 18 and 20 m, for a 120 *gur* boat (Vosmer 2008: 233).

4 The Islamic Period

Over millennia, the same set of considerations influenced the design and construction of boats in the region. Those factors included—but were not confined to—availability and cost of raw materials, the economic and physical environment in which the vessel operated, the intended use of the vessel, the available tools, the skill of the shipwrights, cultural and religious beliefs and personal preferences of the builders.

As we move from the Bronze and Iron Ages into the first millennium CE, then into the Islamic period, more evidence in the form of texts, iconography, ethnography and archaeology emerges. Historical texts provide hints of the nature of western Indian Ocean and Arabian Gulf sea craft, from the anonymous author of the first-century *Periplus of the Erythraean Sea* through works by European, Persian and Arab travellers such as Polybius, Al-Sufi, Ibn Battuta, Ibn Jubayr, Ma'sūdī, Al-Muqadasī, Ludovico di Varthema, Gaspar Correa, Duarte Barbosa, Jordanus, William Daniel, John of Montecorvino and Marco Polo. Ethnographic studies, when compared with historical texts and illustrations of traditional boats in Oman and the Gulf, have demonstrated a continuity in design and construction techniques over at least two centuries (Pâris 1843; Edye 1834; Vosmer 1997, Weismann 2002, 2012).

4.1 Sewn-Plank Construction

At least 2000 years ago, sewn-plank construction had displaced the lashed reed and wooden boat technology of the region. This technology dominated boatbuilding in the region well into the Islamic period, being gradually displaced by nailed construction over several centuries. The sewn-plank methodology—planking joined by continuous sewing along the plank seams—provided a more homogeneous hull than joining planks with individual discrete lashings. Hulls were assembled 'shell-first', that is, the planking was joined together first and frames were inserted afterwards. Even after the introduction of nailed construction, this shell-first methodology persisted.

The first century CE *Periplus* refers to sewn vessels in East Africa (PME 15–16) and the Arabian Sea (PME 36). Marco Polo wrote of vessels at Hormuz in the thirteenth century: 'Their ships are wretched affairs and many of them get lost; for they have no iron fastenings and are only stitched together with twine made from the husk of the Indian nut' (Yule 1871: vol. 1, 102). Ibn Battuta in the fourteenth century has a more favourable opinion of sewn boats: The Indian and Yemenite ships are sewn with them [coir ropes], for that sea is full of reefs, and if a ship is nailed with iron nails, it breaks up on striking the rocks, whereas if it is sewn together with cords, it is given a certain resilience and does not fall to pieces (Gibb 1994: 827). Bruce, writing in the early nineteenth century had a similar view: '.. . the planks of the vessel were sewed together and there was not a nail nor a piece of iron in the whole ship; so that when you struck upon a rock, seldom any damage ensued' (Bruce 1813). Near the end of the seventeenth century, William Daniel described a sewn ship from Mocha: 'one of the largest of that fashion in that sea; her keel, beams, planks and rudder being sowed and tyed together and then pitched, not having one nail or piece of iron in her; her sails being made of date leaves, matted or pleated together, and ornamented with ostrich eggs and feathers, and the vessel's stern prettily painted' (Foster 1967).

There is ample ethnographic evidence of sewn boats, but the archaeological evidence is meagre. A number of sewn boat planks have been discovered in archaeological excavations at al-Balīd (Belfioretti and Vosmer 2010), Oman and a few at Quseir al-Qadim in Egypt (Blue 2002, 2006; Peacock et al. 2011). Two sewn-plank shipwrecks displaying hallmarks of western Indian Ocean methodology have been discovered in Southeast Asia, the Belitung shipwreck and the Phanom-Surin shipwreck (Flecker 2000, 2001, 2008; First Regional Office of Fine Arts 2016).

All the archaeological discoveries complement the ethnographic data and confirm that some structural features and methodologies have survived for over a millennium. For example, on the Belitung vessel, the beams which spanned the vessel transversely and protruded through the sides of the hull (through-beams) were locked to the hull planking by joinery and sewing using a method nearly identical to the twentieth-century *battīl*s of Musandam (Fig. 10). The planks of Belitung and Phanom-Surin were edge-sewn using a pattern reflecting that used in India and Oman on sewn boats even into this century. The differences between the sewing on them and twenty-first-century Indian and Arab sewing systems are that firstly, the Phanom-Surin and Belitung ships had wadding on both sides of the plank seams under the planks sewing, rather than on just one side (Fig. 11). Coconut fibre (coir) is the normal material on Indian and Arabian vessels for both sewing cordage and wadding, while the Phanom-Surin ship—and at least some of the planking on Belitung—used sugar palm fibre (*Arenga pinnata*) cordage over what appeared to be paperbark (*probably Melaleuca leucadendra*) wadding.

Cordage for sewing and lashing boats in the western Indian Ocean could have been made from a variety of plants species such as coir (*Cocos nucifera*), the fibres of the date palm (*Phoenix dactylifera*), the leaf of the dragon tree (*Dracaena serrulata* Baker), the dwarf desert palm (*Nannorrhops ritchieana*), halfa grass

Fig. 10 Sewing of beam ends on Jewel of Muscat (after Belitung shipwreck) and on a twentieth-century *battīl* (Image courtesy of Alessandro Ghidoni)

Fig. 11 Plank seams showing wadding on both sides, outside and inside *Jewel of Muscat* (Image courtesy of Alessandro Ghidoni)

(*Desmostachya bipinnata),* reeds (*Phragmites* and *Typha* species), date palm fibre (*Phoenix dactylifera*), the bast of the hibiscus (*Hibiscus* spp.) and hemp fibre (*Cannabis* spp.). In the western Indian Ocean, coir is the preferred fibre for ship-building, although recently sewn boats have been constructed using synthetic cordage. In the eastern portion of the Indian Ocean, SE Asia, the common fibre for ship construction is from the sugar palm (Arenga pinnata).

Ethnographically, the use of wadding on both sides is relatively unknown in the western Indian Ocean and Arabian Gulf, although there are double-wadding vessels in Orissa on the east coast of India (Palmer pers comm 2019). The masula boat, as well as the Sri Lankan madel paruwa and yatra dhoni, where the wadding can be seen on inside or outside, but never both sides at once.. An engraving allegedly from 1596, however, illustrates three different types of vessel off the coast of Cochin, two of which have wadding on both sides of its planks (Green 1745). Ethnographically, the use of wadding on both sides is not widespread in the western Indian Ocean and Arabian Gulf, although there are instances, such as on the eastern coast of India in Andhra Pradesh (Kentley 2003: 141; Kentley 1985: 310–311) and Odisha (Colin Palmer, pers. comm., 16 September 2019) where double wadding has been documented. In the southern Indian masula boat, as well as the Sri Lankan madel

paruwa and yatra dhoni, the wadding can be seen on inside or outside, but never both sides at once. The sewing pattern, however, shows only vertical ('I') stitches, not the combination of 'X' and 'I' stitches of the Belitung and Phanom-Surin vessels. It should be noted, however, that variations on the sewing pattern are known throughout the western Indian Ocean.

In single-wadding systems, the usual practice is to recess sewing cordage in rebates on the side opposite the wadding side of the plank. In archaeological planks, these rebates are a tell-tale indication that the plank was sewn with a single-wadding system. No rebates in a plank strongly suggest, but do not prove that a double-wadding system was used. Examples of such planks have been found among the ship timbers discovered at al-Balīd in Oman, dated from as early as the tenth century CE (Belfioretti and Vosmer 2010).

4.1.1 Steering System

The Islamic period saw three major developments in maritime technology in the Arabian Gulf and western Indian Ocean. The first, which had occurred by the tenth century, was the transition from twin quarter rudders or steering oars to the single axial rudder, a century before the first evidence of it in Europe. We have seen the evidence for quarter rudders on numerous seals from the Bronze Age, and there are depictions of them in the illustrations in the twelfth-century *Suwar al Kawakib* (*Book of Fixed Stars*). But the *Suwar al Kawakib* also illustrates two vessels with axial rudders. Hourani (1995: 98) asserted the axial rudder was a thirteenth-century Arab invention. Writing in the tenth century, however, Al-Muqadasī describes activity on board a ship that can only be interpreted as the use of a rope-controlled axial rudder (Mott 1997: 121):

'The captain from the crow's nest carefully observes the sea. When a rock is espied, he shouts "Starboard!" or "Port!" Two youths, posted there, repeat the cry. The helmsman, with two ropes in his hand, when he hears the calls tugs one or the other to the right or the left. If great care is not taken the ship strikes the rocks and is wrecked'. This describes perfectly the use of ropes to control an axial rudder.

This quote not only indicates that the steering was controlled by ropes but also that the rig was a square sail, not the settee rig associated with Indian Ocean vessels today. A square sail is suggested by the fact that on settee rigs, it is not possible to have a 'crow's nest', as it would interfere with the rotation of the yard and sail around the mast when tacking or wearing.

4.1.2 Sail

The second development was the settee sail. It is a common misconception that the sails of Indian Ocean and Arabian Gulf vessels have always been triangular, the lateen, or more properly the settee sail, which is a triangular sail with the forward corner cut off, therefore actually quadrilateral. The misconception is so firmly imbedded in the popular psyche that modern illustrations of ancient Indian Ocean vessels invariably show them rigged with lateen or settee sails. An examination of

early European depictions of Indian Ocean ships, however, fails to find anything but square sails.

In East Africa, the earliest illustration of an Arab lateen sail is a sixteenth-century graffito from the House of Cowries at Gedi in Kenya (Garlake and Garlake 1964: 203). Contemporary and earlier graffiti in the Indian Ocean show only square sails, as well as masts and standing rigging typical of square-rigged vessels (Garlake and Garlake 1964: 201). The *Suwar al Kawakib* shows several contemporary illustrations of ships, all with square sails.

The Lopo Homem-Reinés Atlas, an illustrated map of the Indian Ocean of 1519, provides some information on the development of the settee sail. Seven of the ships on the left of the map are easily identified as Arab by their hull forms and the crescent motif on their sails. They display sails that perhaps might be interpreted as just slightly shorter on the luff in comparison to the leech. The yards, however, are slung from their midpoint, not the two-thirds aft and one-third forward configuration of the settee rig. Nor are the masts raked forward as with the settee rig, but are vertical. There is no sign of halyards leading aft. The 'crow's nest' shown atop several of the masts would be extremely vulnerable to damage by a settee yard during the manoeuvre used to come about with a settee rig. There is a large sprit projecting forwards from the bow. This movable spar (*dastūr*) was used to hold the tack of the sail forward when sailing on the wind or reaching.

A morphometric analysis of the *Lopo Homem* images comparing the length of yard to length of mast and length of ship was done by Norbert Weismann (2002: 134). It is clear that the yards on the Arab ships are not nearly long enough to support a conventional settee sail. Weismann has also examined a chart from the eighteenth century, finding that of the 14 vessels with clearly identified Arab features, 10 have square sails and only 4 have settee sails (Weismann 2012: 421–435).

The Scotsman James Bruce, writing of his travels in the late 1760s to early 1770s, describes a square sail: 'Our vessel had one sail, like a straw mattress, made of the leaves of a kind of palm tree, which they call Doom. It was fixed above and drew up like a curtain but did not lower with a yard like a sail; so that, upon stress of weather, if the sail was furled, it was so top heavy that the vessel must founder or the mast be carried away'. The doom (doum) palm is *Hyphaene thebaica* or *H. compressa* and was woven for sails in antiquity.

Illustrations from the early nineteenth century (Pâris 1843) as well as iconography and maritime graffiti from past centuries (Nicholle 1989; Garlake and Garlake 1964; Kenderdine and Vosmer 1994), manuscript illustrations such as the Lopo Homem Map (Miller Atlas 1519) and illustrations by Hogenberg and Braun from the late sixteenth to early seventeenth century depict Arab ships with square sails (Vosmer 2007: 214).

The earliest reliably dated image of a sail that is a nascent settee is a miniature from the work of Khosrow Dehlavi in Iran (Persian 641 fol. 59) dating from 1560. It possibly depicts a ship of 1530, and shows an early developmental stage of the settee, the sail having a very long luff, and the halyard fixed about a third of the distance from the forward end of the yard.

A description of a sail observed in the west coast of India in the early sixteenth century hints at the early stages of a settee sail: Portuguese sailors observed 'that the ships had not more than one large mast, and two ropes on the sides and one at the prow like a stay, and two halyards which come down to the stern and help sustain the mast. Their yards have two-thirds of their length abaft and one-third before the mast, and the sail is longer abaft than forward by one-third; they have only a single sheet, and the tack of the sail at the bow is made fast to a sprit almost as large as the mast, with which they bring the sail very far forward, so that they steer very close to the wind, and set the sails very flat' (Correa 1869: 239–41).

The settee sail, allegedly granting improved windward sailing capability, gradually became nearly universal in the region, the square-sail *mtepe* boat of East Africa being a notable exception.

4.1.3 Construction Methods

The third development was the introduction of nailed construction. Sewn boat methodology dominated the region's boatbuilding for millennia, and remnants of the sewn technology are found today in some working boats of India, the sewn *sambūq* (*kambārī*) of southern Oman and the partial sewing of vessels like the fishing *badan* and fishing *battīl*. It is commonly believed that the Portuguese introduced the use of nails. There is, however, archaeological evidence for the use of nails in a wreck in India dated between the tenth and thirteenth centuries, long before the Portuguese penetration into the region (Tomalin et al. 2004; Pedersen 2004). Roman ships, also nailed, are known to have traded with India and possibly southern Arabia, and nailed Chinese vessels were present in the Indian Ocean during the fifteenth century. No matter from whence the influence, nailed construction gradually became nearly universal in the region during the latter half of the second millennium CE.

5 Historical and Traditional Vessels

A variety of vessel designs evolved over the centuries. Throughout nearly all the history of western Indian Ocean and Arabian Gulf seafaring, the design of vessels followed the 'double-ended' paradigm. This likely was due to the methodology of construction, that is, the legacy of the lashed reed bundles of the Neolithic and Bronze Age. When assembling a boat using rope fastenings, whether from reed bundles or wooden planks, the natural solution is to gather the ends of the bundles or planks together. Ubiquitous use of cordage for fastening the structures of a vessel was therefore one of the primary influences on design.

It is not until the middle of the second millennium CE that we see transom-stern indigenous ships appearing. An examination of western Indian Ocean maritime graffiti and iconography dating just prior to the Portuguese arrival does not reveal

one unequivocal example of a transom stern (Garlake and Garlake 1964; Gorakshkar and Desai 1989; Nicholle 1989; Deloche 1996; Sidebotham 1996). The emergence of a transom could have come from various influences. One was the arrival in the Indian Ocean of transom-stern vessels from China and Europe in the fifteenth century. Another was the increasing use of nails rather than cordage for fastening. Nails offered possibilities for joinery (such as the intersection of the hull planking with a transom) that were awkward using the sewn technique. The recognition of the greater cargo capacity of a transom-stern vessel over a similar length double-ender may also have been a factor. By the last quarter of the second millennium, several types of 'dhow' with transom sterns were established, such as the *baghla*, *ghanja*, *sambūk, shū'ī*, *abūbūz* and *jalbūt*. There were also transom-stern vessels such as *jahāzī* in East Africa and the small *māshuwa*, used both for fishing and as a ship's boat.

Commander Alexander Rowand, who served in the Royal Indian Marine and the Royal Navy, published information on traditional vessels of the region in J.G. Lorimer's *Gazetteer of the Persian Gulf* (Lorimer 1915: 2319–2326). Rowand maintained that there were 14 types of vessels in the Arabian Gulf and Sea of Oman, naming them as *Baghlah*, *Ghunchah* (*ghanja*), *Batīl* (*battīl*), *Baqārah* (*baqqārah*, *baggārah*), *Sambūk* (*sambūq*, *sanbūq*), *Būm*, *Dangi*, *Kūtiya*, *Shū'ai* (*shū'i*), *Zārūqah, Māshuwah, Badan, Jālī or Jālībōt and Shāshah. Rowand briefly describes each*, *and* these descriptions correspond rather well to extant imagery and descriptions from other authors. Hawkins (1977: 138–141) listed 30 different 'dhows', including 11 from Rowand's list. Many of these were Indian, Pakistani or Red Sea types, but a significant number were Arabian Gulf and Arabian Sea types.

Rowand's focus is mainly on the trading vessels of the region, but some he mentions were employed nearly exclusively in fishing or pearling, while others served for both trading and fishing or pearling. The *baghla*, *ghanja* and *battīl* could be fitted with cannon and used in warfare or as armed merchantmen, but there were rarely any indigenous vessels designed specifically as warships. With its shallow draft and fine lines, the *battīl* boasted a reputation for being fast and weatherly and was used in smuggling or slave trading as well as trading and pearling.

During the early nineteenth century, Admiral François-Edmond Pâris and John Edye documented a large number of Indian Ocean and Arabian Gulf vessels (Pâris 1843; Hornell 1926).

There are distinct Arab vessels, such as the *beden seyād* and *beden safar*, the *battīl bahwy, battīl qarib, shāhūf* and *zarūka* that were not included in Rowand's list but which have been recorded by others (Agius 1998, 2002, 2007; Donaldson 1979; Hawkins 1977; Howarth 1977; Jewell 1976; Pâris 1843; Rieth 2012; Vosmer 1997; Weismann et al. 2014).

It should be noted that nomenclature of only some of these are set. Agius (2002: 7, 32–8) Donaldson (1979: 136) and Vosmer (2007: 387) alluded to this difficulty, observing that names of boats are sometimes loosely applied and that the fluidity of terminology both regionally and chronologically, the huge number of types that evolved through history and the disappearance of some types for which no descriptions are extant make it impossible to catalogue all the types.

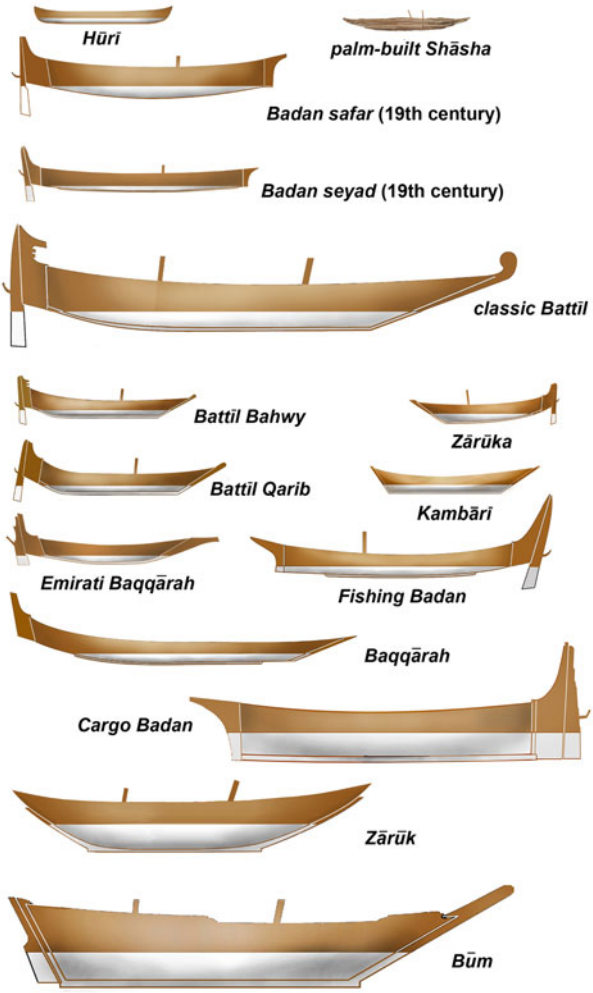

Fig. 12 Double-ended traditional vessels of the Arabian Gulf and Arabian Sea (Image courtesy of Tom Vosmer)

Apart from a few motorized wooden 'dhows' that still trade between Iran, Pakistan, the United Arab Emirates, Yemen and Oman, virtually all of the 'traditional' cargo vessels have disappeared. Some few fishing vessels remain. Descriptions of the vessels follow. Figures 12 and 13 show profiles of many of the types of vessel.

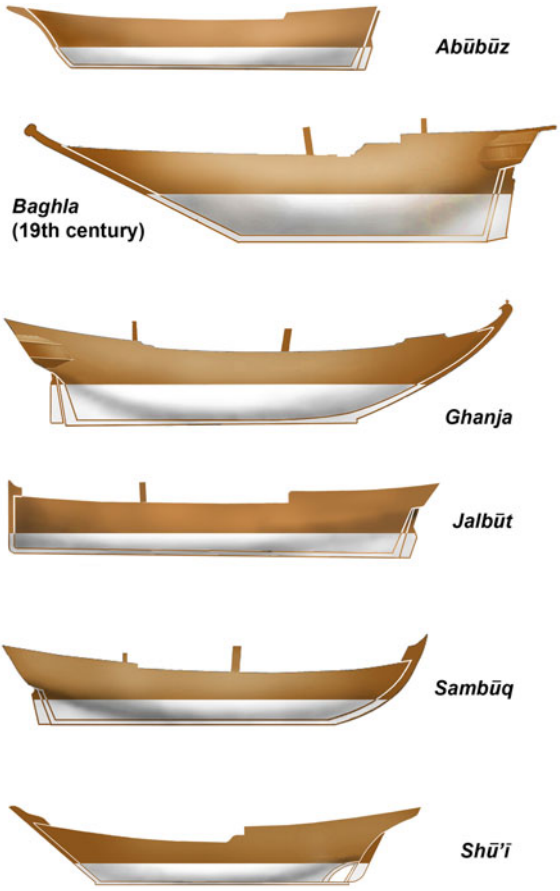

Fig. 13 Transom-stern traditional vessels (Image courtesy of Tom Vosmer)

5.1 Shāsha *(pl* shāshāt *or* shūsh*)*

These vessels, about 3–4 m long, are actually 'raft-boats', gaining buoyancy not by keeping water out but by the lightness of their materials. They comprise hull and deck built from the rachis of date palm leaves (*zur* or *jarīd*) with a buoyant material—formerly the butts of date palm stalks (*karab*), but now blocks of expanded polystyrene foam—sandwiched between deck and hull. The craft is lashed together using fibre that grows on the trunk of the date palm (*līf*) or with coir. The vessels are inexpensive and can be built by two men in a few days.

Because they absorb water gradually, the *shāsha* are never left in the water, but hauled up the beach when not in use. They can be rowed, or sailed with a primitive rig. Since the introduction of outboard motors, some have even been modified to accommodate an engine, mounted through a square hole cut through the hull.

The *shāsha* is common on the Batinah coast of Oman, the east coasts of the UAE, Fujairah, Qatar and Kuwait. In Bahrain, a similar palm-rib vessel is known as *firteh*

and in Kuwait as *wāriyya* (pl *wāriyyāt* or *wariyyāt*). Although unknown on the Indian Ocean coast, similar craft were reported by Mr. and Mrs. Bent in 1897 on the island of Socotra off the Horn of Africa (Doe 1992). On the Batinah coast of Oman the *shāsha* retains a presence, largely due to its low cost and its ease of use by only one or two persons.

5.2 Hūrī *(pl* hawārī*)*

Not mentioned in Rowand's list, but reported by several chroniclers is the *hūrī*, or dugout canoe. In Oman, they are found primarily from Muscat south to the Yemen border. Made from mango wood (*Mangifera indica*), *hawārī* are imported from the Malabar coast of India, and often modified after arriving in Arabia, with planking added to form a built-up dugout. They are used for lightering, ferrying people and long-line fishing. They generally range in size from 5 to 9 m in length. They have been known to land sharks as long as the dugout itself.

There is also a planked boat referred to as a *hūrī* by some fishermen (Donaldson 1979) which was usually motorized with an inboard diesel engine.

5.3 Kambārī *(pl* kambāriyyāt*)*

Also known as a 'sewn *sambūq*', the *kambārī* was some 6–10 m long. *Kambārī* were used for sardine fishing and for lightering cargoes to and from ships anchored off shore. It is said their sewn construction made them flexible, able to withstand the battering of the surf when landing on the beach.

Of all Omani boats, the *kambārī* probably exhibited the purest ancient lineage, unaffected by outside influences. Double-enders, with straight keel and raking stem and sternposts, *kambārīs* were of completely sewn construction.

The *kambārī* owes its name to the fact that the boat is sewn with *qanbar*, *qinbar* or *kambar*, Dhofari names for the fibre of the coconut. Writing in the late twelfth century, Ibn-Jubayr writes of the boats built at Aydhab, a medieval port on the Red Sea coast just north of the present Egyptian-Sudanese border: 'They are sewn with cord made from *qinbar*, which is the fibre of the coconut and which the makers thrash into a cord until it takes the form of thread, which then they twist into a cord with which they sew the ships' (tr. Broadhurst 1952: 65).

5.4 Badan *(pl* badana *or* bdāna*)*

The word '*badan'* is related to 'body', or 'belly', and may be related to the concept of the hull of a boat. The word *beden* is also used for a type of boat in Somalia which

Fig. 14 The *beden seyād* (replica based on drawings by Admiral Pâris 1843) (Image courtesy of Alessandro Ghidoni)

is different from the Arab *badan* (Chittick 1980), and hence *badan* seems to be a generic term as well. Pâris, in his seminal work on traditional seacraft of the Indian Ocean, illustrates two types of *badan*: one he calls a '*beden safar'* and the other a '*beden seyād'* (Pâris 1843). The sewn-plank *beden seyād* was unusual in that it was frameless and built of only five wide planks, one bottom plank and two on each side (Fig. 14). The sail has a long luff relative to conventional settee sails, the yard is slung just forward of its midpoint, and the mast is near vertical, which is basically in keeping with the mast configuration on most *badana*. The steering is controlled by two ropes fastened to an aft-pointing tiller fixed to the rudder, as was common in many double-enders. The rudder has a rope strop rove through a hole near its upper end, and this strop is slung from a notch in the top of the *fashīn*. According to illustrations by Donaldson (1979), this rope-controlled steering system seems to have persisted for some time after the adaption of motorized power and the disappearance of the *fashīn*, when it would not have been required.

The *badan*, like other plank-built Arab craft of the region, was originally of sewn-plank construction, using coconut fibre (Miles 1919: 413). The few fishing *badan* that survive have only their hood ends sewn, the planking being fastened to frames by long hand-forged double-clenched nails.

An unusual feature of the fishing *badan* is that rather than having a traditional keel, it has a horizontal keel plank, with skegs attached along its edges. Like most traditional coastal fishing boats, *badana* are drawn up on the beach when not in use,

and the skegs permit the *badan* to stand upright on the beach without the props or supports one sees with other vessels.

Two types of *badan* exist today: the fishing *badan* and the much more capacious cargo *badan*. The *fashīn* of the fishing *badan* is tall and pointed, and a rudder which extends below the keel is suspended from the tip. Steering is by the rope system described above. Although the fishing *badan*, if used at all today, is rowed, they still retain mast steps and mast partners, alluding to their sailing days.

The cargo *badan*, also called the *'uwaisiyyah* (Ministry of Heritage and Culture 1979: 135) of which only one is extant (*Al-Khammam* on Masirah Island), was of nailed construction. Their hood ends, rather than being sewn or nailed to the stem and sternpost, were let into V-shaped rebates in the stem and sternposts. The cargo *badan* does not have the twin skegs as does the fishing *badan*, but a straight traditional keel. It had one or two masts. The *fashīn* of the cargo *badan* in the early twentieth century was tall and pointed, but later in the century, the cargo *badana* developed a truncated *fashīn* with a curved forward edge. In the fishing *badan*, the rudder was merely suspended from the top of the *fashīn* and held in place against the aft edge of the *fashīn* by the steering lines, while in the large cargo *badan*, the rudder is fixed in place with standard gudgeons and pintles rather than the rope fastening system of the past. The use of rope steering fitted to an aft-pointing tiller, however, was retained.

The *badan* is recognized as a purely Omani type, though there are records of *badana* appearing in the Gulf and they were often seen in Yemeni and East African ports but apparently were mainly, if not exclusively, built in Oman. Lieutenant James Emery, governor of Mombasa from 1824 to 1826, recorded 55 *badana* arriving there in the first 4 months of 1824 (Prins 1982: 187). In his publication, *Dhows at Mombasa*, Jewell shows several photos of *badana* entering or leaving that harbour (Jewell 1976: 58–61). These are of course all cargo *badana*.

5.5 Baghla *(pl* bghāla*)*

The *baghla* has been referred to as the 'aristocrat' of Indian Ocean dhows (Hawkins 1977: 85). It was a transom-stern vessel, the largest and most elaborately decorated of all the traditional ships, its transom ornately carved, with a bulbous finial crowning the end of the stem at the bow. The transoms of the *baghla* and the *ghanja* bore a notable resemblance to the sterns of eighteenth- and nineteenth-century European ships, even to the presence of quarter galleries. But in most respects, the similarity was superficial. Unlike the quarter galleries of European vessels whose windows provided light to the great cabin and the accommodation aft, the quarter galleries of the *baghla* and *ghanja* were windowless and mere decoration, serving no functional purpose. Rowand rated the *baghla* as capable of carrying up to 300 tons of cargo, but mentioned one alleged to have 500 ton capacity (Lorimer 1915: 2321).

5.6 Ghanja (*pl* ghanjāt)

Though generally slightly smaller, the *ghanja* was very similar to the *baghla*, to the point where the casual observer might have difficulty telling them apart, and even some scholars have confused the two. The *ghanja* was less decorated than the *baghla*, and the stem finial resembled a bird's head looking back towards the ship. They could haul up to 80 tons of cargo (Lorimer 1915: 2322).

Numbers of both the *ghanja* and the *baghla* gradually declined, probably due to motorization, and the introduction of alternate modes of shipping but also owing to the intricate carving on them being expensive. They were superseded by plain work horse vessels such as the *abūbūz* and *būm*.

5.7 *Abūbūz*

The Suri vessel called the *abūbūz* was not mentioned on Rowand's list, but was an important trading vessel. It had a short 'schooner' bow and a flat raking transom stern. The upper planking sometimes extends past the transom in a winglike design, similar to the *shū'ī*. According to William Facey, none had been built since the early 1960s (Ministry of Information and Culture 1979: 134) and none survive. They were slightly smaller than an ocean-going *sambūk*. A photo shows an *abūbuz* at Sur, Oman, that appears to be about 50 ft (15 m) long (Ministry of Information and Culture 1979: 134).

5.8 Būm (*pl* abwām)

In its form, the *būm* seems to trace its lineage from centuries ago, although it is not mentioned in the literature until the twentieth century. It is a double-ender with a straight keel and straight-angled stem and sternpost, bearing a striking resemblance in hull form to the thirteenth-century vessels illustrated in the *Maqamat* of al-Hariri from Iraq and recalling the early second millennium BC seals from Falaika (Kjærum 1983: cat 351 & 254). The *būm* is known all over the Gulf (motorized versions still trade) and, with the disappearance of the *baghla* and *ghanja*, is the largest of the traditional Arab trading vessels, carrying up to 400 tons. It is thought to be mainly Kuwaiti.

Although the bum lacks a *fashīn*, the steering system is similar to the rope steering seen on vessels like the *badan*. Instead of the aft-pointing tiller, a wooden yoke is fixed transversely to the rudder. Chains lead forward from each end of the yoke to a drum to which the ship's wheel is attached. This keeps the aft deck clear, unencumbered by a tiller.

5.9 Sambūk, sambūq, sanbūq *(pl* sanābīq*)*

Characterized by its scimitar-shaped stem and transom stern, the *sambūk* was once a common site in the Gulf and western Indian Ocean. Up to 80 ft (25 m) long, the *sambūk* could carry from 15 to 60 tons of cargo (Lorimer 1915: 2323). An abandoned 15 m *sambūk* (named *al-Dhib, 'The Wolf'*) was documented on the beach at Sadh in southern Oman in 1993, and a replica which is on display at Khor Rori was built by the Maritime Oman team in the early twenty-first century. The original was the last *sambūk* in Oman. Owned by the al-Shekeili family, it had been employed in trading to Yemen and East Africa. It was partially decked, fore and aft and had two masts. The *al-Dhib*, while beached at Sadh, was unfortunately destroyed by a violent storm, but the afterbody, with the transom, carved in relief with an invocation, was saved and is on display at the Museum of the Frankincense Land in Salalah. The translation of the invocation is:

> O you who preserve life (sailing) on a ship,
> O you who rescue ships from the depths of the sea.
> Save and guard our sanbuq;
> O Allah, provider and saviour! (Agius 2002: 31).

The inscription is dated in the Hijri calendar 1371, which converts to 1951/1952 in the Gregorian calendar.

5.10 Shū'ī

The *shū'ī* is characterized by a straight raking stem and a transom stern. The upper planking strakes extend past the transom, finishing in a winglike profile of a shallow 'S' form, which is echoed in the form of the end of the stem. Prior to motorization, the vessel had a single mast and settee sail.

According to Donaldson (1979: 134), the *shū'ī* was a recent arrival (post 1970) in Oman after the introduction of inboard diesel engines. Donaldson says the design of the *shū'ī* (also called 'lanch' after the English term 'launch') was influenced by vessels from the Arabian Gulf. This may well be true but there are illustrations from 1813 of Muscat harbour, *Muscat from the Harbour* and *A View of Mutra from the East* published by W. Haines, 10 Molton St, London, which illustrate vessels looking nearly identical to the *shū'ī*.

Demonstrating the fluidity of terminology, the vessel known as a *shū'ī* in Oman is called *sambūk* in the Gulf, while the Omani *sambūk* is called *shū'ī* in the Gulf.

5.11 Baqqāra *(pl* baqāqīr*)*

The *baqqāra*, or *baggāra*, comes in two forms. One is a small double-ended fishing vessel from the Emirates having a distinctive stem (Weismann 2005). Apart from the stem, the Emirati *baqqāra* is very similar to the *zarūka*. The other type of *baqqāra* is a double-ended fishing boat that was until recently seen on the northern Batinah coast of Oman. A long, elegant boat with a high stern, it was usually rowed but retains a mast step and partner beam which indicated a sailing past. Like the *badan*, it was primarily used for seine net fishing.

5.12 Battīl *(pl* batātil*)*

Renowned as the fastest of Arab ships, the classic *battīl* was characterized by very fine lines, shallow draft, a *fashīn* in the shape of a stylized dog's head and a club-like profile in the bow, a straight keel, rising gently from just aft of midships towards the stern and an approximately vertical sternpost and *fashīn*. Classic *batātil* were used for pearling, smuggling and trading and at times, as warships.

The classic *battīl* survived at least into the mid-twentieth century, and echoes of them are still to be found. Most of these survivors are traditional fishing vessels. In Musandam, northern Oman, one can still find two types of *battīl*, the *battīl bahwy* and the *battīl qarib*. They are much smaller than the classic *battīl*, rarely exceeding 11 m. The *bahwy*, which is normally slightly smaller than the *qarib*, retains the 'dog's head' *fashīn* motif. The *qarib fashīn* is larger, extending the length of the vessel, and shaped more like the *fashīn* of a *zarūka*. The *fashīn* of the *bahwy* rakes slightly aft, while that of the *qarib* rakes forward.

5.13 Zarūka *(pl* zarāwīk*)*

The *zarūka* is a small double-ended fishing boat of the Musandam region, used for seine net fishing. It is not to be confused with the Red Sea *zarūk*, a completely different traditional vessel. The forward portions of the zarūka hull are usually deeper than the aft portion. They are used for seine fishing in Musandam. Rowed by two to four men, they often retain echoes of their sailing past, including mast partners and rudders.

6 Conclusion

The history of the evolution and development of traditional indigenous maritime technology and vessel design in the region, stretching over millennia, is complex. Thousands of types of vessel have developed, and most have since disappeared.

Those few which we see today, or which were recorded in recent times, are all that remain of this glorious past. Soon they will be seen only in museums, and a distinctive phase of Arab seafaring will have come to an end.

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