

SHIPS AND SHIPBUILDING IN MESOPOTAMIA
(CA. 3000-2000 B.C.)

A Thesis

by

TOMMI TAPANI MÄKELÄ

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

May 2002

Major Subject: Anthropology

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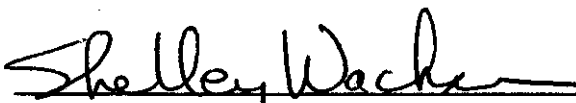
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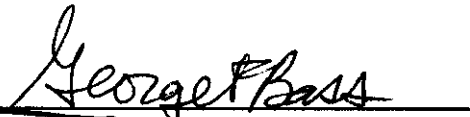
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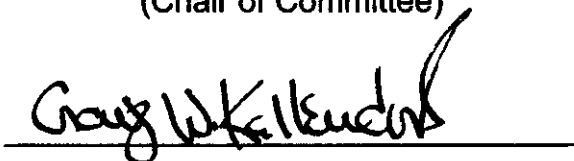
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ABSTRACT

Ships and Shipbuilding in Mesopotamia (ca. 3000-2000 B.C.).

(May 2002)

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Mesopotamian cuneiform texts speak of a complex and well-organized trade on the Euphrates and Tigris Rivers where boats of wooden construction were employed. From the evidence it appears that Meluhhan and Dilmunite traders had an important role in the Arabian Gulf trade especially during the second half of the third millennium B.C. It is possible that the boat designs and techniques used in the third millennium B.C. are no longer present in traditional boats of present-day Iraq and those of oceangoing vessels sailing in the modern day Arabian Gulf.

Based on iconographic evidence, it seems that Mesopotamian riverboats had flat bottoms and high curving ends, with a stern often ending in an elaborate design. Cultic vessels imitated the shape of a papyriform vessel. The riverine vessels in practical use described in texts, such as AO 5673, most probably had square ends. The use of bitumen might have allowed the Mesopotamian shipwrights to build hulls in which watertightness (before the application of a bitumen layer) was not the primary concern.

Mesopotamian textual evidence from the third millennium B.C. does not provide conclusive evidence as to which edge-joining methods, if any, were used. Traditional modern-day Mesopotamian riverboats, some of which seem to be clear descendants of the ancient vessels depicted in seals and boat models, do not employ edge-joining methods. Instead, they are built according to a technique where the planking is nailed to the frames.

In spite of textual references to "backbone" and "ribs," it is unclear whether Mesopotamian ships had an elaborate internal framework connected to a keel. It is probable that these vessels had a keel plank or a flat floor similar to certain traditional modern-day riverboats. Structural elements evident from the texts are beams and longitudinal strengthening timbers or stringers. It also seems clear that there were floor timbers and probably frames giving extra support to the hull.

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1 INTRODUCTION

1.1 General Background

Mesopotamia is considered the birthplace of city-states and high civilization in the Near East but direct archaeological evidence for ships and seafaring in this area is scarce. No ancient shipwrecks have been found in the Arabian Gulf, and shipwrecks from more recent periods are also few in number.¹ In comparison, in the eastern Mediterranean shipwrecks and other archaeological material have provided scholars with a considerably deeper knowledge of Bronze Age shipbuilding.

There is, however, convincing evidence to demonstrate that there was extensive maritime activity in Mesopotamia and in the Arabian Gulf during the third millennium B.C. Riverboats transported cargoes along the Euphrates and Tigris Rivers in the north and oceangoing ships sailed in the Gulf in the south.² Cuneiform texts from the Third Dynasty of Ur, or Ur III (2150-2000 B.C.), provide us with information about the size and construction of these vessels.³

This paper follows the style and format of the *American Journal of Archaeology*.

¹ There are no publications available on ancient shipwrecks discovered in the area. One of the reasons for this is the shallowness of the Arabian Gulf, whereby wooden hulls are not easily preserved. Another reason for this lack of underwater evidence is the almost complete absence to date of well-planned and organized underwater surveys for shipwrecks.

² See below, section 2, pp. 7-19.

³ See, e.g., Appendix 8.3 (pp. 144-154); Salonen 1939.

In this study I concentrate on the textual evidence from the third millennium B.C.,⁴ and I will use Salonen's work from the 1930s as a basis for the research.⁵ Salonen assumed that a wooden planked boat needed to have a keel and a pre-erected framework. This was most probably not the case in ancient shipbuilding and Salonen's assumptions have been criticized by some scholars.⁶ Although Salonen's treatment of Mesopotamian shipbuilding texts is comprehensive, later scholars have rather ignored his work. This may have been exacerbated by the fact that Salonen's writings have never been translated from German into English.

It is perhaps surprising that these informative texts have not been restudied in the light of the current knowledge of ancient shipbuilding techniques. Casson's discussion on the interpretation of three Sumerian shipbuilding terms, first translated by Salonen, is one of the few critical examinations of this material from the perspective of nautical archaeology.⁷

⁴ For a general chronology, see Appendix 8.3 (p. 116), which is based on Postgate 1992, 22.

⁵ Salonen (1938; 1939) collected an extensive corpus of Sumerian and Akkadian nautical terms, mostly from the cuneiform texts of the Third Dynasty of Ur (2150-2000 B.C.).

⁶ Casson 1967; 1971, 25-8; see also De Graeve's (1981, 97, footnote 81) comments on Casson's translation. In Salonen's defense, at the time of writing general knowledge of ancient shipbuilding techniques was at its infancy.

⁷ Other scholars, such as Alster (1983, 48-51), Klein (1990), Römer (1993), and Potts (1997, 122-37), have also briefly discussed the subject of Mesopotamian shipbuilding based on textual evidence.

In addition to Salonen's work, Parpola's unpublished translations of the most important shipbuilding texts are the main source of this study.⁸ These translations include the following texts: extract from tablet IV of the Sumerian-Akkadian dictionary HAR-ra = *hubullu*, dating to the 19th century B.C.,⁹ dealing with the ship and its parts (lines IV 252-430)¹⁰; five unpublished Ur III inventory tablets referring to boats and their parts in the collection of the Hermitage (Erm 4031, 4053, 7820, 14661 and 15259)¹¹; and an Ur III tablet, AO 5673¹² from the Museum of Louvre, listing parts for boats of different sizes. Parpola's translation is not meant to be a comprehensive and conclusive reinterpretation of the known Sumerian and Akkadian shipbuilding terms, but rather a framework for further research.¹³

In addition, a mythical text "Nanna Suen's Journey to Nippur," translated by Ferrara,¹⁴ and a royal hymn "Shulgi and Ninlil's Boat,"¹⁵ translated by Klein, will be considered. Both texts originate in lower Mesopotamia and date to the end of the third millennium B.C. Descriptions of these texts are presented below,

⁸ See Appendix 8.3, (pp. 144-154). I have left the following texts, provided by Parpola, outside of this study because they do not give relevant information as to the interpretation of the examined Sumerian terms: PDT 918 and 1312, dating to Ur III, and VAT 7035, dating to Ur III.

⁹ The date for the text is derived from Oppenheim 1964, 247.

¹⁰ Transliteration of this text is provided by Salonen (1939, 163-71) and Landsberger (1957).

¹¹ Dr. Natalya Kozlova from the Hermitage Museum has allowed Dr. Simo Parpola to translate the tablets.

¹² Transliteration of this text is provided by Salonen 1939, 172-6.

¹³ Further comparative studies are needed in order to confirm the translation of each term.

¹⁴ Ferrara 1973.

¹⁵ Klein 1990, 102-36.

in section 7.2. (pp. 68-76). Other cuneiform texts will also be referenced when attempting to translate specific shipbuilding terms in section 7.3. (pp. 76-97).

The interpretation of specialized texts, such as the shipbuilding documents from Ur III, require interdisciplinary cooperation, combining linguistic expertise with knowledge of ancient shipbuilding techniques. The purpose of this research is not to provide reinterpretations for all of the terms covered by Salonen, but to concentrate on a few crucial terms for which comparative interpretations exist. A synthesis of the different translation possibilities should provide a framework for further study of the subject.

An interesting parallel to this study can be found in Hocker and Palaima's study of a Linear B text that may deal with shipbuilding.¹⁶ Hocker and Palaima attempt to extract more reliable information from texts through cooperation between an archaeologist and a linguist.¹⁷ Although dealing with a geographical area distant from Mesopotamia, the text in question shares some similarities with the ones translated by Salonen.

1.2 Method of Research

I have compiled various translations of the Mesopotamian shipbuilding terms and have compared them to the iconographic, archaeological, and

¹⁶ Hocker and Palaima 1991, 297-317.

¹⁷ Palaima sees "the need to call upon a specialist in nautical archaeology to provide an expert commentary on technical aspects of Bronze Age ship construction and to sketch out the current archaeological context for the kind of «nautical» interpretation of these two tablets..." (Hocker and Palaima 1991, 297).

ethnographic evidence. Only terms for which several comparative translations are available, are considered. It should be noted that absolute translations for the specific terms are difficult to find. I rather attempt to define the general principles of Mesopotamian shipbuilding, such as the building material, general parts, evidence on edge-joining methods, and the potential parallels to traditional modern-day techniques. My purpose is also to suggest probable translations for some terms and to specify those for which there are no definite translations based on available evidence.

This research also concerns the historical situation in the Arabian Gulf area in the third and early second millennia B.C. I attempt to determine the major trading nations and the shifts in the balance of power between them. This is important in order to understand whether Mesopotamian shipbuilding was influenced by external traditions. A general map of the regions and places relevant to this study is shown in figure 1 A and 1 B. Since archaeological evidence for shipbuilding in Mesopotamia and in the Arabian Gulf region is almost nonexistent, I will use comparative archaeological evidence from Egypt and the eastern Mediterranean when applicable

1.3 Objectives of Research

This study attempts to create a synthesis of the ships and shipbuilding techniques of Mesopotamia. The purpose is also to study the role of seafaring in the region's cultural and trading contacts, and to establish a general framework for the further study of this subject. Here I will deal mainly with textual evidence,

supported by iconographic, ethnographic, as well as archaeological evidence.

This will aid in a better understanding of aspects of Mesopotamian shipbuilding, including construction techniques and material, size and function of the different ship types, and rigging.

One aspect is to define the parallels and influence between Mesopotamian shipbuilding and the traditions in the eastern Mediterranean. The analysis of these connections is crucial to understanding the origins of the oldest construction techniques (e.g., sewing and mortise-and-tenon joinery) and their possible survivals in the construction of modern traditional watercraft. Although most of the textual evidence relates to the riverine craft construction from the Euphrates and Tigris Rivers, I will also consider seagoing craft. This may provide answers to how, and to what extent, trade was conducted in the Arabian Gulf.

Boats of wooden construction are suited to crossing great distances at sea and to carrying heavy cargoes. One of the goals of this research is to demonstrate that timber was used extensively as a building material for seafaring vessels in the Arabian Gulf. Understanding how the Mesopotamian peoples acquired this building material is an essential element in explaining the development of this region as a leading cultural and economic center.

2 HISTORICAL AND ECONOMICAL BACKGROUND AND FOREIGN CONTACTS OF MESOPOTAMIA

2.1 Origins of Trade

Maritime activity, both on the rivers and on the sea, was an essential part of Mesopotamian culture and economics during the third millennium B.C. As described by Rice, "the two rivers themselves were the most expeditious and direct means for trade to flow from the Gulf, up through Sumer proper, onwards towards the Mediterranean into what was to become Assyria, travelling further north still, into Anatolia and to the west across the Upper Sea, possibly as far as distant Cyprus."¹⁸

Since the river courses of both the Euphrates and Tigris have changed since the third millennium B.C. and the ancient canals have silted up, it is rather difficult to trace the whole of this considerable network of waterways.¹⁹ The Euphrates was an important channel through which trade was conducted in the third millennium B.C. as well as during later periods when the Assyrian trade colonies were established.²⁰ Old Assyrian trade documents from Kültepe (ancient Kanesh) in Anatolia, dating to the 19th and 18th centuries B.C., document a sophisticated commercial network, which was used to import silver

¹⁸ Rice 1994, 266.

¹⁹ De Graeve 1981, 4-11.

²⁰ De Graeve (1981, 18) notes that "the lower Euphrates was a better natural river way than the Tigris" and its "channels and man-made canals were better developed."

and gold to Assur in the east and to export textiles and tin to Anatolia.²¹ Mari served as an important trading entrepot through which goods were transported to the ports, such as Ugarit, on the Mediterranean coast.²²

Transport of goods using canals was important to the temple economy in southern Mesopotamia during the third millennium B.C. As De Graeve points out: "The riverboats were occasionally a symbol of royalty and were sometimes used for religious purposes, but they were more often an indispensable method of transportation both for armies during campaigns and for the local population in trade and other daily activities."²³ Hausen notes that a major portion of the crews of these riverboats consisted of foreigners.²⁴ The presence of foreign boatmen raises the possibility that Mesopotamian shipbuilding might have been known in foreign lands, or that the local tradition was influenced by foreign elements.²⁵

In Mesopotamia conditions of riverine transport differed from those in Egypt in at least one concept: in Mesopotamia "both the prevailing wind and the rivers moved more or less south."²⁶ Boats were, therefore, generally sailed downstream and towed upstream. Only when the wind shifted occasionally was there a possibility to sail upstream.²⁷

²¹ Muhly 1985, 282.

²² Leemans 1960, 118-9, 138, footnote 1; Potts 1990, 228-31.

²³ De Graeve 1981, 186.

²⁴ Hausen 1979, 97-8.

²⁵ For a description of "Foreigners in lower Mesopotamia" see Leemans 1960 (139-142).

²⁶ Hausen 1979, 97; Johnstone 1988, 77. Johnstone (1988, 76) also notes that in Egypt "the River Nile flowed north, while for most of the year the prevailing winds blew south."

²⁷ Johnstone 1988, 77.

The Arabian Gulf has a stable weather system. In this Gulf, as well as in the Red Sea, northerly winds prevail most of the time.²⁸ For six months a year seasonal monsoon winds and currents prevail from the southwest along the Makran coast (South Arabian coast) and from the northeast for the other six months.²⁹ Rice describes the sailing practice in the Arabian Gulf: "The fact that the waters of the Gulf flow in a counter-clockwise motion...would have assisted the development of sailing. The merchant ships would have set out from the head of the Gulf holding to the west shore and being driven south by the counter-flow. On their return they would have lugged along the coast of what is now Iran with the Gulf's flow carrying them home."³⁰

The Arabian Gulf is a shallow and a relatively safe area. Shipwrecks, however, must have occurred as is suggested by a story of Adapa dating to the 14th century B.C.: "The sea was like a mirror. But the south wind came blowing and submerged me, causing me to go down to the home of the fish."³¹

It appears that the periods of active seafaring coincided with the rule of great monarchs who wished to expand their territories and to acquire exotic and valuable items from abroad.³² It was during these periods when seaworthy ships requiring considerable engineering skill and supplies of suitable shipbuilding wood were developed. At times of political unrest and the absence of a major

²⁸ De Graeve 1981, 13.

²⁹ Le Baron Bowen 1956, 282; Potts 1990, 23.

³⁰ Rice 1994, 273.

³¹ VAT 348, Fragment B, lines 51-3, cited from Bass 1972, 18.

³² Homell 1941, 233.

power in the region, seafaring was often constrained to "petty trading from port to port."³³ As Hornell notes, "these fluctuations in commercial relations continued in the Indian Ocean region until the time of the Ptolemies, when large-scale commerce by sea assumed a regular and semi-permanent character thanks to the enterprise of Greek rulers and Greek traders, and to the growth of demand from Europe for the varied commodities of India and the Far East."³⁴

During the fourth millennium B.C. Sumerians established "colonial" communities along the Euphrates River and further into eastern Anatolia.³⁵ At the end of the millennium this considerable trading network in the north broke down.³⁶ The collapse of this Sumerian network was followed by the creation of a new commercial infrastructure in the east, controlled by the Proto-Elamites, starting at the end of the fourth millennium B.C. Susa was situated at the junction of the two cultures, and it came under Proto-Elamite control after a long Sumerian governorship.

Trade in the Arabian Gulf seems to have increased in importance after the collapse of the northern trading network and under the increasing influence of the Proto-Elamites.³⁷ Gulf trade gained a more important role during the Early Dynastic III period (2600-2350 B.C.) when there were frequent conflicts between

³³ Hornell 1941, 233-4.

³⁴ Hornell 1941, 233-56.

³⁵ Moorey 1982, 15.

³⁶ Potts 1993, 383-4.

³⁷ Moorey 1982, 15.

Mesopotamia and the peoples of Iran.³⁸ Early third millennium B.C.

inscriptions on diorite statues discovered on Sumerian sites state that the artifacts were brought by sea from foreign lands.³⁹ It is also noteworthy that both Susa and Sumer in the second quarter of the third millennium B.C. started to import copper from Oman instead of from Iran, as they had done previously.⁴⁰ The events described above coincided with the accelerated development of seaborne trade in the Arabian Gulf, as shown below.

By the end of the third millennium B.C. a change in the economic structure in southern Mesopotamia occurred when private merchants were able to acquire more wealth.⁴¹ As opposed to the situation in Egypt, where boat building resources were controlled by the state, private seafarers of Mesopotamia dominated maritime trade.⁴² Maritime ventures were organized into partnerships where the division of the returns was governed by strict rules.⁴³ Joint ventures between private groups and royal officials were also conducted.⁴⁴ Despite the "enormous returns," Mesopotamian seafaring entrepreneurs faced considerable risks in these ventures; business documents record enemy actions preventing

³⁸ Carter and Stolper 1984.

³⁹ Potts 1990, 136-7, 139-40, 142, 184.

⁴⁰ Potts 1993, 383-4, 391.

⁴¹ For a description of the activities of the "seafaring merchants of Ur" see Oppenheim 1954.

⁴² Ward 2000, 3.

⁴³ Oppenheim 1954, 8. According to Rao (1970, 100), the merchants of Lothal in India were also organized in partnerships in the early second millennium B.C.

⁴⁴ Stieglitz 1984, 136.

the transport of goods.⁴⁵ Shipwrecks caused by suddenly changing weather conditions must have been another major risk. Although shipping was relatively expensive and the vessel required specialized personnel to be sailed properly, overseas trade was a much more lucrative form of transportation than land transport (caravan routes).⁴⁶ Whereas cheap manufactured articles were generally transported along caravan routes, certain raw materials (e.g., copper) and luxury items (e.g., ivory) were shipped from overseas to Mesopotamia.⁴⁷

2.2 Dilmun, Magan, and Meluhha

Both literary and the archaeological evidence indicate that southern Mesopotamia had wide-ranging contacts with Dilmun, Magan and Meluhha. The location of these regions has long been a matter of discussion. Most scholars agree that Dilmun is to be identified as the island of Bahrain,⁴⁸ although during the late fourth and early third millennium B.C., Dilmun did not refer to Bahrain, but rather to the eastern Province of Saudi-Arabia.⁴⁹ Magan is identified as present day Oman, but it probably also included part of southern Iran (Makran

⁴⁵ Oppenheim (1954, 9-10, footnote 11) records the following passage from UET V 81: 23-5: "repeatedly you have made them (i.e., my messengers) return empty handed through enemy territory...!"

⁴⁶ Oppenheim 1954, 9.

⁴⁷ Oppenheim 1954, 9; Leemans 1960, 117.

⁴⁸ Oppenheim 1954, 6-7; Bibby 1971, 214-29; Alster 1983; Rice 1994, 78.

⁴⁹ Potts 1990, 86; see also Howard-Carter's (1987) discussion on this subject.

coast).⁵⁰ The location of Meluhha remains somewhat tentative, but it is today widely assumed that this term refers to the Indus Valley.⁵¹

Mesopotamian rulers on occasion made known their claims over the countries and regions in the Arabian Gulf. Sargon of Akkad (2334-2279 B.C.) claimed dominion from the "Upper Sea" (the Mediterranean) to the "Lower Sea" (the Arabian Gulf).⁵² Manishtushu (2269-2255 B.C.) mentions booty of Magan in his "Standard Inscription,"⁵³ which describes his campaigns in Iran. After these Manishtushu commissioned the building of ships to sail across the "Lower Sea" to fight against a force assembled from several cities. After the victorious battle and the conquest of these cities, black stone was quarried in the mountains and loaded into ships that were sailed to Mesopotamia. Similar campaigns were conducted by Naram-Sin, grandson of Sargon of Akkad.⁵⁴

Sargon of Akkad also mentions that he moored ships of Dilmun, Magan and Dilmun at the river port of Agade (Akkad), and he boasts of capturing the cities of Mari and Ebla.⁵⁵ These sites were important trading centers situated

⁵⁰ Alster 1983, 41; Glassner 1989, 182-83; Rice 1994, 245-63.

⁵¹ Leemans 1960, 158-66; Rao 1970, 103; Gelb 1970, 1-8; Potts 1990, 165; Rice 1994, 133.

Kenoyer (1999, 25) notes that "In general the formation of large urban centers such as Mohenjodaro and Harappa, located in the core areas of the Indus Valley, can be dated from around 2600 to 1900 B.C."

⁵² Hirsch 1963, 36, Sargon b 1, rev. col. 3/4, 1. 9-10, cited from Potts 1990, 136.

⁵³ Hirsch 1963, 69, Maništušu b 1, cited from Potts 1990, 136-7.

⁵⁴ Hirsch 1963, 17, cited from Potts 1990, 136-7.

⁵⁵ Hirsch 1963, 37, Sargon b 2, rev. col. 5/6, 1. 10/12, cited from Potts 1990, 136.

along a trade route reaching from the Indus Valley to the Mediterranean. The traded articles were probably shipped further via the maritime ports at Ugarit or Arvad on the Syrian coast.⁵⁶ It is likely that Sargon's reason for the conquest was the opening of trade channels to the south as well as to the north.⁵⁷ Potts notes that "the remarkable mixture of different nationalities in the Gulf area in general, and on Bahrain in particular, which has characterized the last few centuries of our era may well have had its origins in the opening-up of trade during the late third millennium."⁵⁸

Evidence for Magan's seaborne trade may be found in the frequent use of diorite as a raw material for Mesopotamian statues and monuments, brought from Magan.⁵⁹ Additionally, copper imported from this region was essential for the economy in lower Mesopotamia.⁶⁰ Peoples living at the southern end of the Arabian Gulf "were noted as busy sea-traders" throughout antiquity.⁶¹ Hornell describes the origin of the name Magan and connects it with seafaring: "as *Ma* is the Sumerian for 'ship,' we see in these ancient folk of Magan a people similar to the Omanites of today - expert shipwrights, ocean carriers trading in their own *baghlas* and *bums* to ports in India, Iraq, Arabia and East-Africa."⁶² It is even possible that Magan formed part of the Mesopotamian empire during the Third

⁵⁶ Stieglitz 1984, 138.

⁵⁷ Potts 1990, 190-1.

⁵⁸ Potts 1990, 190.

⁵⁹ Potts 1990, 138.

⁶⁰ Leemans 1960, 121-3; Potts 1990, 138, 149.

⁶¹ Hornell 1941, 236

⁶² Hornell 1941, 239.

Dynasty of Ur.⁶³ Magan also had contacts with the east and it seems that around 2000 B.C. this region was increasingly influenced by the Indus Valley cultures.⁶⁴

The term "Magan boat" is sometimes mentioned in Mesopotamian trade-related inscriptions.⁶⁵ "Magan type of Boat" is mentioned in an administrative text from Girsu (CT 7-31) dating to Ur III.⁶⁶ Based on the surviving textual evidence it is difficult to determine whether these boats originated in Magan (Oman) or whether they were a specific type built in Mesopotamia. Rice suggests that perhaps "Magan boat" "meant something like 'China Clipper' would have done to a nineteenth-century participant in the Far eastern trade."⁶⁷

Although the Island of Bahrain is not rich in raw materials, it is well located strategically; the island, therefore, functioned as an intermediary trading station. For example, "Dilmun-copper" was probably quarried in Oman, but it was brought to southern Mesopotamia by the seafaring merchants of Dilmun.⁶⁸ Dilmun became the "principal middleman relegating Makkan and Meluhha to the background" by ca. 1950 B.C.⁶⁹ An Ur III text, UET V 292, mentions ships of Dilmun bringing luxury goods, such as ivory, timber, gold, copper, lapis lazuli, and "fish eyes" (perhaps pearls), to the cities in southern Mesopotamia.⁷⁰ For the

⁶³ See Potts 1990, 148 for discussion.

⁶⁴ Weisberger 1981, 199; Tosi 1986, 107; Potts 1990, 150.

⁶⁵ Potts 1990, 144, 147-8; Rice 1994, 250.

⁶⁶ Cleuziou and Tosi 1993, 746.

⁶⁷ Rice 1994, 250.

⁶⁸ Oppenheim 1954, 6-7, 10-11; Potts 1990, 89-90.

⁶⁹ Rao 1970, 103.

⁷⁰ Oppenheim 1954, 7; Bass 1972, 14; Alster 1983, 44.

return trip these vessels were loaded with barley, woolen garments, and leather from Mesopotamia, rich in agricultural resources.⁷¹

The Indus Valley civilization had an important role in the maritime trade of the Arabian Gulf and in the Arabian Sea. Tosi even believes the Mesopotamians only had a marginal role in the long-distance seaborne trade: "it seems increasingly likely that the Indus Civilization contributed more to oceanic sea craft than any of the other proto-urban civilizations of the Middle East.... The early efficiency of this transmaritime network greatly impressed the memory of the agricultural civilizations of Mesopotamia and Egypt that remained marginal to it."⁷²

The Indus Valley culture used stamp seals instead of the Mesopotamian/Near-eastern types of cylinder seals.⁷³ Trading relations between Mesopotamia and the Indus Valley are evidenced by the discovery of stamp seals with Indus signs carved on them in the locations of Ur, Failaka (an island in the northern tip of the Arabian Gulf), and Bahrain.⁷⁴ According to Parpola, the combinations of the signs on some of these seals, discovered in lower Mesopotamia, are not confirmed in the Indus Valley itself.⁷⁵ This suggests that these signs indicate words, perhaps personal names of non-Harappan type.

⁷¹ Oppenheim 1954, 13; Stieglitz 1984, 138; Potts 1990, 147.

⁷² Tosi 1986, 107.

⁷³ Kenoyer 1999, 88. It should be noted that these stamp seals were also used by the sea-going merchants of Dilmun (Rice 1994, 163-66).

⁷⁴ Parpola et al. 1977, 131-2, 154-5; Potts 1990, 160-7; Rice 1994, 163-66.

⁷⁵ Parpola et al. 1977, 156-7. The Indus script remains still largely undeciphered. For more information on the Indus script see A. Parpola (1994).

Several Ur III texts over a period of 45 years (2062-2028) refer to a "Meluhha-village," existing in the territory of Lagash, whose people may have been acculturated people from Meluhha.⁷⁶ It is possible that the merchants of Meluhha had a wide-ranging contact network in the Arabian Gulf and the Arabian Sea region. After settling in areas such as southern Mesopotamia and Bahrain, the Meluhhans adopted foreign names and customs. At the same time they seem to have preserved some of their own native manners, such as using a stamp seal.⁷⁷

A typical stamp seal, dated by Rao to the last third or last quarter of the third millennium B.C., was discovered at a Harappan settlement at Lothal in India, situated at the northern end of the Gulf of Cambay, in Gujarat.⁷⁸ This seal was probably associated with the maritime trade of the Arabian Gulf. Rao identifies the rectangular basin at Lothal, dating to ca. 2200 B.C., as a dock for ships.⁷⁹

Stone weights found at Bahrain and Oman represent the Indus Valley weight system and prove the Harappan influence in the organization of commerce in Dilmun.⁸⁰ These weights were made from a typical banded flint

⁷⁶ Parpola et al. 1977, 134-45, 150.

⁷⁷ Parpola et al. 1977, 152, 157. During Caspers (1984) suggests that Sumerians were also residing in trading communities in Meluhha.

⁷⁸ Rao 1965, 30-7; Rao 1973, 165; Rao 1979.

⁷⁹ Rao 1965, 32; 1973. Nigam's (1988) study of the sediments in the basin revealed traces of well-preserved marine organisms. This strongly suggests that Lothal had a dockyard connected to the sea environment with high tidal range.

⁸⁰ Potts 1990, 150, 186-9; Kenoyer 1999, 98-9.

from the Indus Valley.⁸¹ Howard-Carter describes the trading network and the standards used in the Gulf region as follows:

...by the third quarter of the third millennium Dilmun, Magan, and Meluhha were sufficiently sophisticated and organized to conduct an exchange of commodities using a standard system of measurement. By no means could these goods be classified as gifts, tribute, or in kind. This was the real world of commerce; materials from eastern areas were consigned via Mesopotamia to kingdoms in central and northern Syria. The appellation 'Dilmun shekel' was used to describe the monetary unit of this system because Dilmun, being close, was more familiar to the Sumerian merchants.⁸²

According to Chandra, Mesopotamia was already in contact with the Indus Valley and the areas of south Baluchistan about 2800 B.C.⁸³ Contact between Mesopotamia and the Indus Valley seems to have reached its peak during the Akkadian period. Gudea of Lagash (ca. 2144-2124 B.C.) states that "the Meluhhans came up (or down) from their country" to supply raw materials needed in the building of his new temple.⁸⁴ Towards the end of the Third Dynasty of Ur the number of imports from Meluhha had decreased.⁸⁵ Also, these imports were no longer transported by ships of Meluhha but by Dilmun seafaring merchants who acquired a powerful intermediary position during the early part of the Ur III period.⁸⁶

⁸¹ Weisberger 1981, 200; Potts 1990, 87-8.

⁸² Howard-Carter 1987, 88.

⁸³ Chandra 1977, 32.

⁸⁴ Parpola et al. 1977, 131, Cyl. A ix 19; xvi 22 f.; B xiv 13.

⁸⁵ Khan 1992, 41-2; Chandra 1977, 36.

⁸⁶ Parpola et al. 1977, 153-4; Rao 1970, 103-4.

During Ur III, Mesopotamian merchants participated in trade as their ships traveled to Magan and Meluhha. According to Oppenheim, this reflects the decreasing power and contact area of Magan and Meluhha. It seems that Mesopotamian merchants traveled to Magan and Meluhha "when boats of the latter ceased to come to their ports."⁸⁷

Le Baron Bowen notes that "we have no reason to doubt that Mesopotamian ships sailed to the Indus Valley during the third millennium B.C. Whether Indus boats returned the visits is problematical."⁸⁸ He bases this claim on the fact that few Sumerian and Iranian articles have been discovered in the Indus Valley, whereas numerous Indus items have been found in Mesopotamia.⁸⁹ It should be noted, however, that archaeological evidence is not conclusive proof of the direction of long-distance trading contacts. As discussed earlier, wool and textiles were exchanged for copper in Magan. Such perishable transport materials would not have left traces in the Indus Valley.

⁸⁷ Oppenheim 1954, 15.

⁸⁸ Le Baron Bowen 1956, 282.

⁸⁹ Le Baron Bowen 1956, 282. Artifacts made from the shell of the "sacred Indian chank (*Xancus pyrum*)" have been found in sites of lower Mesopotamia (Hornell 1941, 233). See also Kenoyer's (1999, 98) discussion on the Indus-Mesopotamian trade.

3 RAW MATERIALS IN MESOPOTAMIA

3.1 Wood

When studying shipbuilding in Mesopotamia one has to consider the almost total absence of suitable wood for that purpose in present day Iraq. We have to take into account, however, that the situation was probably different during the third and fourth millennia B.C. According to Willcox, "the birth of the city-states in Mesopotamia coincides with the maximum forest cover in the region and timber resources would have been more available then than at any time since."⁹⁰ Powell states that "ornamental trees" must have been a characteristic of the landscape in southern Mesopotamia, "because, otherwise, the recurrent theme [in texts] of trees being destroyed would be inexplicable."⁹¹

According to Van De Mieroop, date palms and tamarisk-trees especially were grown in orchards in southern Mesopotamia during the Old Babylonian period.⁹² Referring to Presargonic texts from Girsu, dating to the 24th century B.C., Powell states: "...the Girsu timber texts give us an illuminating glimpse into a system of aboriculture, which involved rational exploitation of woodlands as well as remarkably diversified 'garden' culture."⁹³ Potts arrives at a similar conclusion: "...the texts discussed above should dispel once and for all the

⁹⁰ Willcox 1992, 3.

⁹¹ Powell 1992, 119

⁹² Van De Mieroop 1992, 156-7.

⁹³ Powell 1992, 120.

notion that southern Mesopotamia was bereft of any useful wood, or any building material other than mudbrick, bitumen and reeds."⁹⁴

As Willcox points out, it is not easy to distinguish between imported timber and trees that are meant to be cultivated when looking at textual evidence.⁹⁵ Both of these categories were used in providing the necessary material for shipbuilders in Mesopotamia. Powell states that wood from gardens appears usually to have been used for specialized purposes, such as ship equipment.⁹⁶ The texts from Presargonic Lagash "suggest a conscious recognition that native timber could be used for many purposes but that for certain purposes appropriate timber either had to be cultivated or imported."⁹⁷

The city-states of southern Mesopotamia "had the best kinds of wood at their disposal thanks to the trade, both with the Amanus region in the west, and the Persian Gulf [Arabian Gulf] in the south."⁹⁸ Theophrastes (Hist IV, VII 7-8) mentions boat-building wood from the Gulf area.⁹⁹ Wood was imported from Dilmun, Magan and Meluhha as well as from the Amanus region situated in northern Lebanon during the time of Gudea (ca. 2144-2124 B.C.).¹⁰⁰ Inscriptions on Gudea's statue record the importation of shipbuilding wood from the Amanus region; cedar trunks of 30 and 25 meters were brought into southern

⁹⁴ Potts 1997, 113.

⁹⁵ Willcox 1992, 27; see also Moorey 1999, 349.

⁹⁶ Powell 1992.

⁹⁷ Powell 1992, 104.

⁹⁸ De Graeve 1981, 94; see also Leemans 1960, 125-7; Stieglitz 1984, 136; Willcox 1992, 10.

⁹⁹ Bretzel 1903, cited from Willcox 1992, 5.

¹⁰⁰ Falkenstein 1966, 47-9, 53; see also Salonen 1939, 139; Moorey 1999, 350-1.

Mesopotamia.¹⁰¹ Leemans also notes timber coming from the east during the third millennium B.C.: "Timber of various kinds, among other things used for boat building, was imported from Elam."¹⁰²

It should be noted that the matching of Sumerian and Akkadian terms with modern tree types is a difficult task. Moorey notes that "a single ancient word may have described many species or embraced trees of diverse types."¹⁰³ The tree designated by the Sumerian term *ù-suh₅* was a common species used in shipbuilding.¹⁰⁴ It was used for planks and for all major parts of the ship, with planks reaching a length of 2.5 to 4 m.¹⁰⁵ The term *ù-suh₅* is translated by Powell as "Aleppo Pine."¹⁰⁶ Other commonly used wood species include poplar and juniper.¹⁰⁷ As cedar was expensive it was probably used for the most important parts of watercraft.¹⁰⁸ Other shipbuilding woods used in Mesopotamia included mulberry, laurel, and even ebony.¹⁰⁹ Similar to the practice in traditional Iraqi watercraft, mulberry was probably used for underwater hull parts.¹¹⁰ In the traditional Iraqi river boat, the *gajjarije* (figs. 2, 3, 4, and 5), as described by

¹⁰¹ Gud. Stat. B Col. V. 28 ff., cited from Salonen 1939, 139; Oppenheim 1969, 269.

¹⁰² Leemans 1960, 116, 133.

¹⁰³ Moorey 1999, 347.

¹⁰⁴ Salonen 1939, 138-142; Powell 1993, 116.

¹⁰⁵ Salonen 1939, 141-2.

¹⁰⁶ Powell 1992, 116.

¹⁰⁷ De Graeve 1981, 95; Powell 1992, 109.

¹⁰⁸ Salonen 1939, 142; see also Moorey 1999, 350.

¹⁰⁹ According to Salonen (1939, 143), ebony was used in the construction of ship cabins.

¹¹⁰ Salonen 1939, 142.

Ritter, the underwater parts of the bottom planking, stem and side planking are made of mulberry.¹¹¹

3.2 Bitumen

Bitumen is frequently mentioned in Mesopotamian shipbuilding texts.¹¹²

This versatile substance, naturally available in Mesopotamia, was probably used for protecting wooden parts of boats from natural elements, such as the sun, rot and terredo worms.¹¹³ Two kinds of bitumen were used in the caulking of Mesopotamian boats. Large quantities of hard bitumen were applied for coating the exterior of hulls, whereas the softer pure asphalt was used in small quantities for covering the inside of the hull.¹¹⁴ In modern day Iraq, wet mud applied between the several layers of bitumen, gives the coating extra strength.¹¹⁵ Over time the bitumen covering cracks and it has to be changed annually as is the practice still in modern day Iraq.¹¹⁶ The old bitumen is scraped off and reused.¹¹⁷

¹¹¹ Ritter 1919, 135. For a more detailed description of the *gajjarije* see section 6.2 (pp. 61-64) in this study.

¹¹² Salonen 1939, 146-9; Potts 1997, 130-2. Potts (1997, 135) notes that "ethnohistoric sources show that, in the Gulf region and Oman, bitumen has never been used extensively as a caulking material, whereas fish, shark or whale oil mixed with lime made from ground-up shell, has been the preferred caulking medium for the past few centuries."

¹¹³ See Ochsenschlager (1992, 49-53) for the use of bitumen in modern traditional riverboats in Iraq.

¹¹⁴ Forbes 1964, 52, 95.

¹¹⁵ Ochsenschlager 1992, 52.

¹¹⁶ Ritter 1919, 135; see also Thesiger 1964, 124-5.

¹¹⁷ Ochsenschlager 1992, 52.

Reed mats, mentioned in some Mesopotamian texts, were probably used for boat interiors for protecting the bitumen cover from melting in the burning sun.¹¹⁸ In the "Shulgi and Ninlil's Boat" hymn (see section 7.2, pp. 74-75) the reed mats are described as follows: "According to your large reed-mats, you are a day-light, spread widely over the pure country-side."¹¹⁹ Without the cover the melting sticky substance would have smeared passengers and cargo items.

Bitumen might have also had a more structural function in the ship's hull. As shown above, shipbuilding texts (section 7.3, pp. 76-97) mention a variety of different types of timber used in ship construction. It is possible that Mesopotamian ships were built of numerous pieces that were not always of uniform quality and type. This might have resulted in a construction where the seams were not always tight. Bitumen would have had the function of caulking these loose seams and holes, thereby ensuring watertightness.

¹¹⁸ Appendix 8.3: Erm 7820: 1; Klein 1990, 94, 102-3.

¹¹⁹ Klein 1990, 94, 102-3. For a description of the hymn see section 7.2 (pp. 74-75) in this study.

4 ANCIENT SHIPBUILDING TECHNIQUES

Shell-first vs. Skeleton-first Construction

According to Hornell, ancient boat design evolved in the following order:¹²⁰ the first most primitive boats were bark canoes where the hull was made of a long strip of bark curled up along each side. As the form developed, sharp hull ends and several sets of internal frames were added to strengthen the construction. Dugout canoes then developed based on the earlier bark version. Plank-built canoes were created when planks were added as an extension to the dugout base. Frames were also employed with plank-built canoes. Hornell notes: "the final stage in the conversion of the dugout into a fully plank-built boat is attained when the dugout underbody is reduced to a keel-like axial beam, with sides raised upon its edges by numerous strakes of sewn on planking. This was the method of construction employed by Persian and Arab shipwrights down to the sixteenth century."¹²¹

Greenhill supports Hornell's assertion with his description of the boats of the valley of Brahmaputra, Bangladesh:

The vessels were built in purest shell tradition without formers, moulds or any aids to the eye of the builder except the swinging of a stalk of jute on each side of a line rigged from stem to sternpost. All, or almost all, of the hull shell was complete before the frames were shaped to the shell and inserted. Some boats are never framed at all except for a few floor

¹²⁰ Hornell 1946, 181-9.

¹²¹ Hornell 1946, 192.

timbers. The evidence suggests that the boats of this great floating world developed from expanded and extended logboats.¹²²

Two techniques can be distinguished in ancient wooden shipbuilding. In the shell-first or shell-based technique, the outer hull is assembled first, after which floors, frames, and other supports are inserted to provide extra strength. In this technique it is generally the hull planking that provides most of the vessel's overall strength, as well as its hull form. In the skeleton-first or skeleton-based technique, a structure, consisting of a keel, a stem, and a stern post, and a number of frames, is erected first. Next, hull planking is assembled around the pre-erected skeleton structure.¹²³ As Greenhill states: "In the shell construction method the builder can constantly check and alter his work. If he begins to go wrong he can correct his mistakes. He can take out the plank, change its shape, change the angle at which it is joined to its neighbour."¹²⁴ This is impossible in the skeleton-first technique as the frames and their angles define the shape of the hull.

When attempting to determine the presence of a keel and an internal framework in the construction of Mesopotamian ships, we need first to distinguish between two concepts. We must decide whether the framework predetermines the shape of a ship's hull, or merely provides extra strength for a hull whose shape and primary strength lies in the shell of planking. Steffy

¹²² Greenhill 1995, 110.

¹²³ For discussion on these two techniques and examples of their applications see Casson 1971, 4-39; Steffy 1994, 23-91; Greenhill 1995, 47-72; Wachsmann 1998, 215-43.

¹²⁴ Greenhill 1995, 58. For an example of a use of the shell first technique see Greenhill 1995, 42.

describes this dilemma as follows: "Some scholars believe that classical Mediterranean ships were constructed plank by plank without any form of predetermination of hull shapes, the ultimate design evolving as construction progressed. Others see complete predetermination of hull shapes, comparing construction techniques with those of latter-day sailing vessels and sometimes analyzing them as if they were modern vessels."¹²⁵ After an extensive study of archaeological evidence and knowledge derived from building replicas of ancient ships, Steffy believes the truth lies somewhere in between.

Greenhill presents another kind of classification of ancient shipbuilding methods:

...those, which are built of planks joined edge to edge and usually, but not always, to strengthening frame timbers inside the shell of planks, and those which are built of planks not joined edge to edge but only to frames...there are many ways of developing the shape, using partly the skeleton of frames and partly the growth of the skin of planks itself. But however blurred the middle ground of building methods may be, the fundamental distinction remains between the boats the planks of which are edge-joined and those the planks of which are not edge-joined.¹²⁶

Greenhill's classification provides a simple and clear starting basis for looking at boats of Mesopotamia. When examining further evidence, edge-joining will be one of the main focus areas of this research.

When building a hull in the ancient world the planks could generally be edge-joined in four ways: by clamps; by nails; by tying or sewing; and by using tenons, mortises and dovetails.¹²⁷ Based on archaeological evidence from the

¹²⁵ Steffy 1994, 77.

¹²⁶ Greenhill 1995, 53.

¹²⁷ Basch 1972, 15.

Mediterranean it seems that at least sewing and mortise-and-tenon joinery were frequently used techniques in antiquity.¹²⁸ In the former technique, a rope is usually drawn through holes on opposing planks (fig. 6 and 7C). Pegs or dowels are sometimes used together with sewing to provide extra rigidity (fig. 6 and 7A). In the latter technique, tenons are inserted into perpendicular holes drilled into opposing plank edges. Tenons are often bolted in place by using transverse pegs, hammered into holes drilled through the plank and the tenon (fig. 8).

Johnstone, in his examination of Mesopotamian boats, refers to Piggott's study of early wheeled vehicles and suggests that the wooden craft used on the Euphrates and Tigris were built with mortise-and-tenon joinery.¹²⁹ According to Piggott, "disc wheels may be a single-piece, cut from a single plank, or composite, normally *tripartite*, and made from three or more planks held together with *dowels* held in *mortices*." (fig. 9).¹³⁰ Piggott's study shows that this type of technique was known in Transcaucasia (regions to the north and north-east of the Black Sea) from the early third millennium B.C., and in the ancient Near East already from the late fourth millennium B.C.¹³¹ In the Near East some of the early wagon wheels were held together by an external rod. An example of this is a

¹²⁸ For a description and discussion on these techniques see Steffy 1994, 23-78; Greenhill 1995, 118-72; Wachsmann 1998, 215-43. Examples of the use of these techniques are discussed later in this section.

¹²⁹ Johnstone 1988, 72-5. Johnstone has, however, based much of this argument on Casson's (1967) article where the Sumerian terms of *eme-sig* and *dubbin* (discussed in section 7.3, pp. 76-97) are reinterpreted.

¹³⁰ Piggott 1983, 24.

¹³¹ Piggott 1983, 54-63, 66-76.

Mesopotamian relief, dating to ca. 3000 B.C. showing a cart with these kinds of wheels (fig. 10).¹³² Additional evidence for the use of tripartite wheels was found in the excavations in Mohenjo-Daro in the Indus Valley where chariot wheel models made of clay were found.¹³³ According to Johnstone, it is possible that the techniques described above would be similar to those required for a planked Mesopotamian ship.¹³⁴ Johnstone notes that some 19th-century A.D. vessels on the Ganges were built by an edge-joining technique similar to that employed in the construction of the tripartite wheels.¹³⁵

4.2 Internal Construction

A ship's keel serves several purposes. It can function as a junction piece for the stem and sternpost, and the bottom planking can be fastened to it. In most cases the main purpose of the keel, however, is to provide longitudinal stiffness to the hull. Hocker defines a true keel as "a centerline timber, outboard of the frames, of sufficient cross-sectional area and attachment to the rest of the hull to offer significant longitudinal strength."¹³⁶ In addition to strength, keel

¹³² Hrouda 1991, 333.

¹³³ Johnstone 1988, 180; Marshall 1996, Vol. I, 554, pl. CLIV, figs. 10, 11.

¹³⁴ Johnstone 1988, 73.

¹³⁵ Johnstone 1988, 172. For additional information on the edge-joining techniques in India and Pakistan see section 4.4 (pp. 34-38).

¹³⁶ Hocker 1998, 245.

timbers often extend beyond the bottom planking to prevent leeway (lateral motion).¹³⁷

Archaeological evidence of ancient Egyptian shipbuilding tells us that ships did not have keels or a clear internal structure of frames.¹³⁸ The ships of Queen Hatshepsut during the New Kingdom in Egypt, as seen on the relief from Deir-el-bahri (fig. 11), probably did not have projecting keels.¹³⁹ This conclusion is strengthened by boat models from the tombs of Amenhotep II and Tutankhamun that have rounded bottoms without keels and external stems and sternposts.¹⁴⁰

We also know from a well-documented history of shipbuilding in the Mediterranean that internal framework did not start playing a major role in ships' structure until the first millennium A.D.¹⁴¹ Hornell describes the use of framing in the boats of the Indian Ocean noting: "...an intermediate stage in the evolution of framing is seen in many localities on the shores and on the islands of the Indian

¹³⁷ Hocker 1998, 245.

¹³⁸ For a description of the Cheops boat and the Dashur boats see section 4.3 (pp. 32-34).

¹³⁹ Säve-Söderbergh 1946, 14, fig. 1; Hocker 1998, 245; Pulak 1999a, 223-4.

¹⁴⁰ For a description and discussion of these models see Wachsmann (1998, 22-4, 241-2).

¹⁴¹ As shown by Steffy (1994, 80-5.), the 7th-century A.D. Yassıda shipwreck, found off the southern coast of Turkey, provides us with clear evidence of abandoning the use of mortise-and-tenon joinery and a strong planking of shells in providing the major strength for the ship's hull. Wachsmann's (1995, 1996) excavations on the Mediterranean coast of Israel have, however, provided the earliest evidence from the 5th-6th centuries A.D. of abandoning the use of mortise-and-tenon joinery.

Ocean, whereby in place of pre-erected framing, a few ribs are inserted *after* the hull planking has been assembled and in place."¹⁴²

Before a true keel was developed, there seems to have been a period of experimentation.¹⁴³ A 14th-century B.C. shipwreck found at Uluburun,¹⁴⁴ off the southern coast of Turkey, had a strong keel plank, which strengthened the hull longitudinally and served as a central connecting timber for external hull planking (fig. 12). According to Pulak, the keel plank "would have served as an effective spine for the ship, provided protection to the bottom planking, and supported the vessel when beached."¹⁴⁵ The keel plank, however, added little lateral resistance to the hull as it extended only a few centimeters beyond the ship's bottom.¹⁴⁶ The hull planks of the Uluburun ship were edge-joined with pegged mortise-and-tenon joints (fig. 12). It is noteworthy that in the 1.7 meter long area of the hull that has survived, there are no traces of frames.¹⁴⁷ While the ship had probably also transverse deck beams for lateral strength, it seems that the rigidly edge-joined hull planks provided most of the hull's strength.

Mesopotamia has provided evidence of internal construction consisting of a keel plank and framework. Two fragments of clay boat models from Ischali (dating to 2200-1800 B.C.), a site located near Eshnunna in lower Mesopotamia,

¹⁴² Hornell 1946, 220.

¹⁴³ A true keel is a rigid longitudinal timber that protrudes beyond the bottom planking and prevents the ship from drifting sideways in the wind.

¹⁴⁴ Pulak 1993, 1999a, 1999b . For additional discussion see Wachsmann 1998, 303-7.

¹⁴⁵ Pulak 1999b, 18.

¹⁴⁶ Pulak 1999b, 18.

¹⁴⁷ Pulak 1999b, 17.

clearly show the inner construction with central plank and frames (fig. 14).¹⁴⁸ It is not clear whether this fragment is part of a seagoing or a riverine boat model.

Additional evidence of possible keels comes from India. The terra-cotta boat models from Lothal in India (dating from 2200 to 1800 B.C.) portray sailing ships.

According to Göttlicher¹⁴⁹ and Rao,¹⁵⁰ these models have clearly visible keels, pointed prows and high flat sterns. One of these models is shown in figure 13. Johnstone notes, however, that "the crudeness of their [Lothal models] clay construction stops much in the way of deduction from them."¹⁵¹ Qualls adds that "the Lothal model has a transom stern and a hole gouged into its interior bottom at an angle quite unlikely for a mast, unless one would argue for the presence of the forward-raking lateen mast at this early date."¹⁵²

4.3 Bronze Age Archaeological Evidence from the West of Mesopotamia

The Cheops, or Khufu, ship, dated to ca. 2650 B.C. typified one form of shell-based construction used in Egypt.¹⁵³ Its planks were joined together with a combination of pegs or tenons and lashing (fig. 15). The vessel did not have a

¹⁴⁸ De Graeve 1981, pl. VI, figs. 18, 19; see also Göttlicher 1978, 29, pl. 7, no. 94.

¹⁴⁹ Göttlicher 1978, 38-9, pl. 13, nos. 178, 180.

¹⁵⁰ Rao 1965, 35-6.

¹⁵¹ Johnstone 1988, 172.

¹⁵² Qualls's comments appear in Howard-Carter's (1987, 69) article.

¹⁵³ Haldane 1992, Ward 2000, 45-58; see also Lipke 1984; Steffy 1994.

keel but its bottom was made of three wide planks. Heavy floor timbers were inserted to provide extra transverse strength to the boat.¹⁵⁴

Another example of Egyptian Bronze Age boat construction is the group of six Dashur boats, "clear descendants of the Khufu ship,"¹⁵⁵ dating to ca. 1850 B.C. (fig. 16).¹⁵⁶ Their bottoms were rounded as compared to the flat bottom of the Cheops boat. According to Ward, all planking on the Dashur boats were held together with unpegged mortise-and-tenon joints¹⁵⁷ assisted by ligatures¹⁵⁸ across the planking seams (fig. 17). For lateral support beams, protruding from the sides of the hull, were inserted. There was no keel, but rather a central strake made of three planks at the bottom of these boats. The absence of frames or even floor timbers tells us of a rather pure form of shell-based building technique. Hornell has shown that certain native sailing craft on the East African coast are "directly comparable, in the basic features of its design, with those characteristics" of the Dashur boats.¹⁵⁹

¹⁵⁴ Lipke 1984, especially pages 21, 66, 75; Steffy 1994, 27; Ward 2000, 47-58.

¹⁵⁵ Ward 2000, 101.

¹⁵⁶ Haldane 1984; Steffy 1994, 33-6; Ward 2000, 83-102.

¹⁵⁷ According to Ward (2000, 102), "it may be that ligatures in the Dashur boats actually served to hold down battens more than anything else. I do not believe they were responsible for holding the hull together during its construction; shoring and the alignment tenons would do the job more efficiently."

¹⁵⁸ According to Ward (2000, 84, 90-4), the dovetail tenons found in the hulls are modern additions and the "mortises filled by dovetail tenons were once ligatures."

¹⁵⁹ Hornell 1946, 214-15.

Another archaeological example of Bronze Age- shipbuilding is the Ferriby boats found at Yorkshire in England.¹⁶⁰ These three vessels are each at least 13.3 meters long and they date to the middle of the 12th or the 13th centuries B.C. Like the Cheops ship and the Dashur boats, they have no keels and their bottoms are each made of three thick plans. Planking is edge-joined by lacing with flexible tree branches. Additionally, in the bottom a series of cleats with holes were made. Transverse rods were inserted into these holes across the planking edges.

4.4 Applications of Edge-joining Techniques in Arabia and the Indian Ocean

Evidence for the early use of edge-joining techniques in India is found in a few maritime representations. Rao refers to a first-century B.C. sculptural representation from Sanchi (fig. 18)¹⁶¹ and describes the technique of "fish joinery, wherein wedge-shaped pieces of wood are inserted in the joints of planks ... The advantage of fish-joinery...is that wood expands when soaked in water and the planks are held together firmly by reducing the width of the joints." Rao doesn't describe the technique further or give examples of its use in modern

¹⁶⁰ Wright 1976; see also Steffy 1994: 37.

¹⁶¹ The great *stupa* at Sanchi, located near the town of Raisen (southern part of Madhya Pradesh Province) in central India, is dated between the 3rd century B.C. and the first century A.D. (Gopal 1970, 108; Ramachandran 1970, 75). Mookerji's (1962, 23) interpretation of the same representation as "a canoe made up of rough planks rudely sewn together by hemp or string" doesn't seem probable.

traditional boats. Additional evidence of edge-joining is evident from a painting from a Buddhist cave-temple at Ajanta in India, dating to 525-650 A.D. (fig. 19).¹⁶² Rao believes that the holes shown along the edges of planking seams are evidence of the use of pegged mortise-and-tenon joinery.¹⁶³ These details may be indicative of nails used for attaching the planking either to each other obliquely, as shown below, or directly to the frames.¹⁶⁴

The earliest representation of an edge-joined boat in India, dating to the second century B.C., comes from a medallion from Bharhut (fig. 20).¹⁶⁵ The scene shows two boats, the upper with three rowers and the lower one being swallowed by a fish or seamonster. According to Ramachandran, the boats depicted "seem to have been made of planks joined with dowels."¹⁶⁶ The planking with joggled edges is perhaps joined with dove-tailed clamps (fig. 7A).

We next look at a number of different edge-joining techniques used in traditional modern boats of India, Pakistan, and East Africa. A peculiar method of edge-joining was used in building a *Monsoon* river boat in eastern Pakistan (fig. 21):

¹⁶² Mookerji 1962, 27-8; Rao 1970, 98, fig. 3. Ajanta is located in the Bihar province in the North-Eastern part of India.

¹⁶³ Rao 1970, 97.

¹⁶⁴ See footnote 141 for discussion on the earliest evidence on the abandoning of the mortise-and-tenon joinery in the Mediterranean.

¹⁶⁵ The sculptured scenes from Bharhut, located near the town of Satna (northern part of the Madhya Pradesh Province) in the Middle part of India, are in the Indian Museum in Calcutta.

¹⁶⁶ Ramachandran 1970, 75. Original source and depiction found in Cunningham (1962, pl. XXXIV, 2).

A flat staple of galvanized iron pointed at either end,..., was driven at right angles to the plank face into the end of the slot nearest the keel plank. It was then bent over and forced down into the slot, and by this action the other end was driven at a flat angle into the wood at the outer edge of the slot. When this process was complete on the inside it was repeated on the outside so that each plank was joined to the rest with a double line of metal staples.¹⁶⁷

This construction method produced a strong hull. The frames, consisting of three pieces, were later installed to strengthen the hull and hold the layer of planking in shape. Greenhill explains that "far from being joined together into a continuous frame they [the frames] would not even touch one another."

Greenhill describes the building of a Pakistani fishing boat called the *hora*.¹⁶⁸ The hulls of the *hora* are built by edge-joining the planks with "galvanized iron pegs or pins" set in precut holes "at the right angle to the plank face and edge."¹⁶⁹ Hornell, however, records that "according to the fishermen, early *horas* were fastened with wooden pins between the planks and treenails instead of spikes for all the frames and to secure the planks to the frames."

Hornell describes the construction techniques that seem to originate in ancient times used in a Sudanese craft (fig. 7B):¹⁷⁰ "As each plank is fitted in position, long iron nails are driven at an oblique angle through the seam from the upper plank into the lower. These nails or spikes are generally driven in alternately from the inner and the outer surface of the planking, the heads

¹⁶⁷ Greenhill 1976, 75-7.

¹⁶⁸ Greenhill 1976, 165.

¹⁶⁹ Greenhill 1976, 163.

¹⁷⁰ Hornell 1946, 217.

recessed." In this case the use of iron nails seems to have replaced the more ancient technique of using treenails.¹⁷¹

Greenhill provides us with an interesting example of a technique from India, using an edge-joining technique of obliquely driven treenails, similar to the one described by Hornell above. This method is a "mixture both of edge-joining and non edge-joining, of skeleton and shell construction, since the finished boat derives its ultimate shape partly from the shape of shell components and partly from the shape of part of a skeleton" (figs. 22 and 23):

On the banks of the Indus...some years ago I watched the construction of a large flat-bottomed river-boat (the *bohatja*). First her two sides were assembled. They were made of planks joined edge to edge with wooden pins driven in holes drilled diagonally across the seams from plank face outside to plank face inside... The heads are of oval shape because of the angle at which the pins emerge from the plank face... A row of floor timbers, like railway sleepers across the dry mud of the riverbank, has the planks fastened across it, outside ones first working inwards. The finished bottom is then turned over and the sides fastened to the beam ends. The ends of the bottom are forced up at either end to follow the shape of the sides. Side frames or timbers are then added and then deck beams and decks, the whole making a strong box-like boat...admirably suited to her environment and purpose, which is to be the great cargo carrier on the River Indus.¹⁷²

There are also the "Indus punts" that are "very graceful and attractive boats, seen under sail on the great river" (fig. 24).¹⁷³ These vessels are "absolutely flat amidships and the planking of the bottom is bent up at a sharp angle at either end." The hull construction of the Indus punt is similar to the *bohatja* described above; the planks are edge-joined with treenails driven

¹⁷¹ Hornell 1946, 216-7.

¹⁷² Greenhill 1995, 54.

¹⁷³ Greenhill 1995, 86-8.

diagonally across the planking edges. The larger river cargo versions of these punts were steered with "very narrow tall rudders and carved downward-pointing tillers. The rudders were hung from a massive framework built out from the bottom planking of the raised stern section."

The most common sea-boat type used on the southeast coast of Pakistan is the *sampan*. A *sampan* is built by "edge-joining its planks with nails driven at right angles to the seam from triangular-shaped notches cut into one of the planks."¹⁷⁴ These nail notches are plugged with wooden chips.

4.5 Boats of Reed Construction

Reed boats were unquestionably built and used in third-millennium B.C. Mesopotamia and the Arabian Gulf and their role and importance in relation to vessels of wooden construction is a crucial question.¹⁷⁵ Bitumen slabs bearing impressions of reed bundles and encrusted barnacles discovered inside a building of the late third-millennium settlement of Ra's al-Junayz in eastern Oman have been offered as evidence of reed vessels used in long-distance seafaring.¹⁷⁶ Despite the discovery of these slabs, their purpose remains unclear.¹⁷⁷ It is possible that this find represents rafts or small coastal vessels used by the local population.

¹⁷⁴ Greenhill 1971, 117-8.

¹⁷⁵ Potts (1997, 122) classifies the Mesopotamian ships according to their construction material into two categories: those made of reed and those made of wood.

¹⁷⁶ Cleuziou and Tosi 1993.

¹⁷⁷ Cleuziou and Tosi 1993.

Cleuziou and Tosi refer to the texts collected by Salonen and conclude that "cuneiform textual information is still too contradictory to provide us with reference information." Instead, they refer to an Ur III administrative text from Girsu, CT 7: 31a, and suggest that it is clear evidence of the construction of a Magan-type of an oceangoing boat made of reeds.¹⁷⁸ The text lists large quantities of five different kinds of trees, fibre ropes, palm fibre strings, different kinds of reeds, alfalfa, ox hides, goat's hair, fish oil, and finally "951 cubic meters of asphalt for the coating of Magan type boat." It is not clear, however, whether the text refers to the materials for the building of a ship or whether it merely lists various quantities of raw materials in stock or as trade items. It is possible that the single line referring to the quantity of bitumen coating of a Magan type boat is not related to the other items. This evidence does not seem to be strong enough to prove the use of reed boats in the trade between Mesopotamia and Magan.

Heyerdahl has shown that considerable stretches of the sea can be crossed with reed-made ships.¹⁷⁹ In 1977 and 1988 he sailed with a reconstructed reed vessel, *Tigris*, from Iraq to Pakistan and then across the Indian Ocean to the mouth of the Red Sea. It seems, improbable, however, that these types of vessels would have dominated the long-distance trade in and out of Mesopotamia. Late third-millennium B.C. texts mention heavy cargoes, such as copper from Oman, shipped directly (or via Dilmun) to southern

¹⁷⁸ Cleuziou and Tosi 1993, 746; see also Potts 1997, 126.

¹⁷⁹ Heyerdahl 1986.

Mesopotamia.¹⁸⁰ These types of cargoes could have only been carried by oceangoing ships with strong wooden hulls. We need not rely only on logical reasoning in this matter; numerous clay tablets describe the building of wooden ships in detail and certain ship depictions from the Arabian Gulf point to wooden construction.¹⁸¹

Reed boats are well suited for local use on rivers and are still used in Iraq.

Thesiger describes the building of a coracle, made of reed, called the *zaima*:

First he made half a dozen tight bundles of five or six qasab reeds rather longer than the length of the proposed boat, and fastened them securely together side by side to form the keel, eighteen inches free at both ends, which he bent upwards. He next bent five long reeds into the shape of a U, passed the middle among the loose ends of the keel, and laced them back to the keel itself. He repeated the process at either end alternatively, until he had built up the sides and the ends of the hull. This framework he stiffened by tying into it a number of ribs made from two or three willow wands. Finally he wedged three stout sticks across the boat as thwarts and secured their ends in place with lumps of bitumen.¹⁸²

Sails

Boom-footed square or rectangular sails have been widely used in the eastern Mediterranean.¹⁸³ One of the main functions of the boom is to pull the sail taut and maintain its shape.¹⁸⁴ Its weight prevents the sailcloth from luffing or

¹⁸⁰ Oppenheim 1954, 6-7, 10.; Leemans 1960, 117. According to Hourani (1951, 10), the rich Copper deposits of Oman were the main source for the copper used in Mesopotamia during the third and early second millennia B.C.

¹⁸¹ For the textual evidence see section 0 (pp. 76-97) and for the iconographic evidence see section 5 (pp. 43-53).

¹⁸² Thesiger 1964, 126-7.

¹⁸³ Le Baron Bowen 1960; Casson 1971, 18-22; Georgiou 1991; Wachsmann 1998, 248-54.

¹⁸⁴ Toby 1986, 345.

billowing excessively in the wind. By altering the distance between the yard and the boom, the shape of the sail can be controlled and its tension and curvature adjusted.¹⁸⁵ Representations of boom-footed rigs can be found in Egyptian tomb-paintings, reliefs, and boat models.¹⁸⁶ The earliest known representation of a sailing ship is on a Gerzean vase from Egypt, dating to ca. 3100 B.C. (fig. 25).¹⁸⁷ The vessel depicted has a single rectangular sail whose head was probably attached to a yard and its foot fastened to a boom. The boom-footed sail is also found in other eastern Mediterranean representations, such as the frescoes from the island of Thera,¹⁸⁸ dating to the middle of the second millennium B.C. and the depiction of Syro-Canaanite ships, dating to the 14th century B.C. (fig. 32).¹⁸⁹ According to Gopal, the ancient Indian ship representations show that the square sail was the most common type used.¹⁹⁰

Towards the end of the Late Bronze Age the boom-footed rig was replaced by the brailed rig in the Mediterranean.¹⁹¹ This new type of rig no longer has the traditional boom (i.e., the sail is loose-footed). The brailing system consists of ropes attached to the foot of the sail, running up and over the yard

¹⁸⁵ Toby 1986, 345. It was, however, not possible to take in the sail with this kind of rigging construction. The sail needed to be changed altogether (Wachsmann 1998, 248).

¹⁸⁶ Säve-Söderbergh 1946, 14; Wachsmann 1998, 17, 20-1, 24-8, 249-52.

¹⁸⁷ Black and Samuel 1991, 217-26; Wachsmann 1998, 248, fig. 11.2.

¹⁸⁸ Morgan 1988, 121-42, figs. 8-13. See also Wachsmann 1998, 86-95.

¹⁸⁹ On the Syro-Canaanite ships depicted in the 14th century B.C. painting from the tomb of Kenamun in Egypt, see figure 32.

¹⁹⁰ Gopal 1970, 110. Le Baron Bowen (1956, 281, fig. 2) notes the use of modern boom-footed square sails on the river Indus.

¹⁹¹ Casson 1971, 70; Millet 1991; Vinson 1993; Wachsmann 1998, 251.

and down to the stern where the helmsman controls them. A number of brail lines were bundled and pulled together, resulting in considerable savings in manpower, as only a few deckhands were needed to control the sail.

5 ICONOGRAPHIC EVIDENCE ON MESOPOTAMIAN SHIPS

5.1 Riverboats

Excavations in Iraq have not revealed any hulls of ancient boats and ships. Clay and metal boat models, as well as iconographic evidence from cylinder seals, provide us with some limited visual information on ancient ships and boats. When looking at pictographic representations we have to keep in mind that "Mesopotamian watercraft on cylinder seals generally suggest craft used on the rivers and canal, whereas vessels for open-water sailing must have been quite different."¹⁹²

Textual evidence¹⁹³ and boat models of the third millennium B.C. indicate that both the sail and wooden construction were in use, although the actual hull construction of these vessels is conjectural. De Graeve's study provides a comprehensive view on ancient ships and shipbuilding in Mesopotamia.¹⁹⁴ Although relying primarily on iconographic evidence, De Graeve also refers to textual evidence.¹⁹⁵ She has classified several boat models (mostly of clay) that have distinctively flat bottoms and relatively high up-curving ends. De Graeve

¹⁹² Potts 1997, 135.

¹⁹³ Alster (1983, 70-1, no. 69) refers to a passage from the Akkadian Gilgamesh Epic (X iv 10-11) where "Gilgames, crossing the waters of the dead, runs short of punting poles, and therefore uses his own body and clothes for mast and sails."

¹⁹⁴ De Graeve 1981. Qualls (1981) has studied the boats of Mesopotamia before ca. 2000 B.C., based on representations and ship models. She does not, however, connect the evidence with the textual, archaeological or ethnographic evidence, but concentrates on describing and classifying the corpus of the iconographic evidence.

¹⁹⁵ For the textual evidence references see De Graeve (1981, 95-7, 102, 105, 111).

divides the representations and models regarding wooden plank-built riverboats into three categories: flat-bottomed boats with straight upturned ends, flat-bottomed boats with incurving upturned ends, and barges.¹⁹⁶

Certain Mesopotamian representations seem to correspond with the common fishing- and hunting canoes of the marsh Arabs today. A silver model of a canoe-shaped riverboat, dating to ca. 2500 B.C., found in the Royal Cemetery at Ur has seven thwarts and six pairs of paddles (fig. 26).¹⁹⁷ Johnstone compares the Ur model to the modern reed vessels of Mesopotamia: "The availability of bitumen enabled the boat-builders of the Tigris and Euphrates to overcome the chief defects of the reed craft, the short-lived nature of its buoyancy. A reed framework covered with bitumen produced a combination of a flexible shape and a smooth featureless exterior without lashings, sewing, planks or cross-beam ends."¹⁹⁸

In Pharaonic Egypt the wooden state boats imitated papyrus craft and the papyriform craft had a cultic significance.¹⁹⁹ The high ends of the Cheops boat resemble the shape of a papyrus boat (or a papyrus vessel), a ceremonial type reflecting the origins of Egyptian hull construction.²⁰⁰ The same situation can also

¹⁹⁶ De Graeve 1981, 109-22.

¹⁹⁷ Göttlicher 1978, 29, tab. 5, fig. 90. According to Salonen (1939, 43), the Ur model represents the *ma₂-gid₂*-type of boat, as mentioned in textual evidence. Barnett (1958, 221) compares the model to the present-day *mashufs* used in Iraq. For a discussion on the *mashuf* see section 6.2 (p. 59).

¹⁹⁸ Johnstone 1988, 10.

¹⁹⁹ Ward 2000, 2.

²⁰⁰ Lipke 1984; Haldane 1991, 112; Ward 2000, 2-3.

be seen in Mesopotamia. Cylinder seals often portray cultic scenes where divinities are seated in boats with high up-curving ends. The *maqurru* (in Assyrian) is a barge used for ritual processions of the gods by water. This vessel had each end raised high above the water line and tied back. Depictions on cylinder seals suggest that it dates back at least to the end of the fourth millennium B.C.²⁰¹ In some scenes it is obvious that a reed boat is represented (fig. 27).²⁰²

Depictions of Mesopotamian cultic vessels often show standards, long poles set standing inside the hull, sometimes topped by a crescent or a spade-like object.²⁰³ The prows and sterns of some of these carry animal protomes.²⁰⁴ The animals depicted are a lion, bull, and gazelle. In some seals the complete hull of the boat is depicted as a snake.²⁰⁵ The long poles appear on a Mesopotamian stone relief from the Kassite Period, dating to the 12th century B.C. (fig. 28). This is perhaps the most detailed representation of a flat-bottomed boat with an incurving end showing. Although only a part of the boat's hull can be seen, its features point to the divine character of the vessel, perhaps a *maqurru*.²⁰⁶

²⁰¹ Barnett 1958, 221.

²⁰² For depictions see Qualls 1981 and De Graeve 1981.

²⁰³ De Graeve 1981, 25-6, pls. II-IV, figs. 6-10, 12.

²⁰⁴ De Graeve 1981, 143-4, pls. V, fig. 14, VI, fig. 20, XXXIII, figs. 68, 69.

²⁰⁵ De Graeve 1981, 144, pl. XXXVI, figs. 75, 76.

²⁰⁶ De Graeve 1981, 35, pl. VII, fig. 30.

One problem with trying to obtain information on the size, construction and details of the actual ships depicted in Mesopotamian representations is that one does not know whether they represent actual ships. Passengers, often seen standing and represented in a larger scale, may have been more important than the vessels. Seal representations are often connected with journeys, in which gods visit cities and sacred sites in Mesopotamia.²⁰⁷ As these representations don't usually show masts or sails, it seems that the artist's intention was not to depict actual vessels in use on Euphrates and Tigris in the third millennium B.C.²⁰⁸

Potts describes the *magur*-boat,²⁰⁹ a more ancient boat type than the *maqurru*:

The Magur-boat was said to resemble the moon in its crescent phase when, seen above the nights of Iraq, it lies on its convex side, resembling a boat with a high, curving prow and stern at either end... The silver boat models from the Royal cemetery at Ur may give us some idea of what Nanna-Suen's Magur-boat may have looked like, but it should be apparent even to non-sailors that the types of vessels ascribed to deities in literary texts undoubtedly differed from those used on the canals and rivers of southern Mesopotamia, while these, in turn, were probably different from those which went out into the Gulf on long-distance trading journeys.²¹⁰

A terra-cotta boat model discovered at Eridu, dating to ca. 3400 B.C., provides us with one of the best-preserved representations of a sailing vessel (fig. 29). The socket at the hull's bottom amidships is traditionally seen as a

²⁰⁷ According to Klein (1990, 91, 96, footnote 131), the *magur*-boat served as a ceremonial processions-boat for both gods and kings, in their religious, as well as, military journeys.

²⁰⁸ Göttlicher 1992, 76-96.

²⁰⁹ For discussion on the *magur*-boat see Salonen 1939, 12-9.

²¹⁰ Potts 1997, 122.

socket for a mast or an aid for hanging the model for cultic uses.²¹¹ Strasser has, however, provided an interesting, although not entirely convincing, new interpretation for the model and its socket; he sees it as a "spinning bowl used by weavers."²¹² Bourriau and Oates have countered that the Eridu model is "far too fragile for such usage...and the surviving socket is off-centre, which would have produced an unreliable wobble, as would the shape of the vessel itself."²¹³ The body of the model is molded roughly and it does not reveal any clue as to the ship's construction or its material.²¹⁴

Another boat model, similar to the one found at Eridu and dating to the fourth millennium B.C., was recently discovered at Tell Mashnaqa in Syria.²¹⁵ According to Potts, both of these models (the Eridu and the Tell Mashnaqa model) are "generally deep-keeled vessels with pointed, up-turned prow and stern...as their sides are relatively high and smooth, they would seem to represent wooden, rather than reed, boats."²¹⁶

An interesting fragment of a boat model from Warka, dating to Ur III or the Old Babylonian period, shows an internal, vertical wall (bulwark) across the hull (fig. 30).²¹⁷ According to Adams and Nissen, this model probably represents a

²¹¹ For different interpretations see Barnett 1958, 221; Casson 1971, tbl. I A; Göttlicher 1978, 23.

²¹² Strasser 1996. Strasser (1996, 922) also does not believe that the Mesopotamians would have had the technology to build sailing vessels in the fourth millennium B.C.

²¹³ Bourriau and Oates 1997, 719.

²¹⁴ Göttlicher 1978, 23, fig. 4.

²¹⁵ Thuesen et al. (forthcoming), cited from Potts 1997, 125.

²¹⁶ Potts 1997, 125.

²¹⁷ Potts 1997, 126, fig. V.3., drawn after Adams and Nissen 1972, 214.

cargo vessel, as it is markedly different from the vessels having upward curving ends.²¹⁸ These internal vertical walls across the hull can also be found in some other boat models of Mesopotamia.²¹⁹ An example of this, although from a later time period, is shown in figure 31. This is a representation of a sailing ship (mast hole shown) with an animal figurine inside. It is difficult to say whether these bulwarks had a structural function or whether they were used as dividing walls between different types of cargo items.

5.2 Cross-cultural Influences

When determining to what degree the eastern Mediterranean and Mesopotamian shipbuilding cultures influenced one another, we will briefly turn our attention to the Syro-Canaanite coast. De Graeve points out that the seagoing ships represented in Mesopotamian maritime depictions date relatively late (mostly first millennium B.C.) and are Mediterranean types representing either Phoenician or Phoenician style ships.²²⁰ Skillful Phoenician shipbuilders were commissioned to build ships for the Assyrian rulers to be used in military campaigns.²²¹

²¹⁸ Adams and Nissen 1972, 214.

²¹⁹ For depictions see, e.g., De Graeve 1981, pl. XLV, nos. 102, 104.

²²⁰ De Graeve 1981, 123. For representations and discussion on Phoenician and Syro-Canaanite ships see Barnett 1969; Casson 1971, 62-70; Wachsmann 1998, 39-60.

²²¹ Luckenbill 1968, 123, nos. 246, 154, and 350, cited from De Graeve 1981 123. For additional discussion see De Graeve 1981, 111-2.

In the Late Bronze Age the Canaanites or Syro-Canaanites, who were later called Phoenicians, had substantial wood resources at their disposal. Syro-Canaanite ships were well known in Egypt, as evidenced by vessels portrayed in an Egyptian painting in the tomb of Kenamun, an Egyptian official. This depicts a group of Syro-Canaanite ships docking at an Egyptian port (fig. 32).²²² These ships have "well-rounded but spoon-shaped hulls, prominent overhangs fore and aft, straight stemposts, deck beams brought through the sides," and a boom-footed broad square sail.²²³ Although these ships share certain similarities with Egyptian ships, there is one clear difference: the "Kenamun ships" do not employ a hogging truss often seen in Egyptian ship depictions.²²⁴ This implies that "the strength needed for sailing over open water was supplied structurally."²²⁵

Although a reasonable amount of iconographic evidence from the eastern Mediterranean exists, it is unlikely that there was a direct connection between Mesopotamian ships of the Arabian Gulf and those of the eastern Mediterranean. As will be shown below, it is more likely that Mesopotamia was rather influenced by the Arabian Gulf and Indian Ocean traditions.

²²² For a thorough discussion on these "Kenamun ships," including the textual references see Wachsmann 1998, 39-47.

²²³ Casson 1971, 35.

²²⁴ The hogging truss is "a heavy cable, which, starting with a loop about the bows, was carried the length of the deck on upright forked sticks to the poop, and ended on a loop about the stern; a lever thrust between the strands enabled the crew to twist the cable like a tourniquet, and, by twisting and twisting, reach just the tension to keep the overhanging bow and stern from sagging." (Casson 1971, 20). For an example of a hogging truss, see fig. 11.

²²⁵ Casson 1971, 35.

In the case of riverboats, the influence between Mesopotamia and the eastern Mediterranean is an open question. Assyrian reliefs from the first millennium B.C. are the main source here.²²⁶ De Graeve calls these types, depicted in Assyrian reliefs, "vessels of the periphery" and notes that "it is striking that the canoes and the larger riverboat differ from Mesopotamian types."²²⁷ Assyrian reliefs depict Mesopotamians using elongated reed rafts to flee from Assyrians.²²⁸ According to Hornell, similar boats without a mast were made of reeds, basketry and bitumen at Hit on the Euphrates up to the 20th century.²²⁹ According to Hornell, "unlike the ancient Egyptians the Assyrians, apart from the marsh-dwellers, took little account of craft constructed of reeds."²³⁰

From the Indus Civilization there are only three representations of ancient watercraft. These originate from the excavations of Harappa and Mohenjo-daro. One is a seal portraying what is probably a reed boat with two steering oars, a sharply upturned prow and stern, a cabin in the middle of the hull (fig. 33A).²³¹ The second is a graffito on a potsherd depicting a ship with a mast and two yards (fig. 33B). Wooden construction of the vessel depicted cannot be ruled out. As Le Baron Bowen points out, "the hull of this graffito does not have the great

²²⁶ For depictions on Assyrian reliefs see De Graeve 1981, pls. XII-XLII.

²²⁷ De Graeve 1981, 185.

²²⁸ De Graeve 1981, pls. XXVII-XXXI

²²⁹ Hornell 1946, 56.

²³⁰ Hornell 1946, 56.

²³¹ Johnstone 1988, 171, fig. 13.1; Kenoyer 1999, 90, fig. 5.18.

sheer at bow and stern that the papyrus boat does. The boat has a gentle sheer rise much the same as many Egyptian boats with their so-called 'spoon-shaped' hulls."²³² The mast seems to be made of two A-frames, a trait shared with Egyptian riverine vessels of the early third millennium B.C.²³³ The third depiction is on a baked clay amulet showing a riverine boat with upturned ends, a cabin amidships, and a pair of steering oars (fig. 34).²³⁴ The material of the hull of this last vessel is not certain, although Johnstone thinks it is made of reed or papyrus.²³⁵

Two seals found on the island of Failaka, situated at the northern extremity of the Arabian Gulf, present us with possible evidence on Arabian Gulf seagoing ships (figs. 35A and 35B).²³⁶ As De Graeve notes in her study, "although the Failaka seals don't strictly belong to Mesopotamian works of art, these two seals... are rare examples of early sailing boats in the Near East."²³⁷

The more detailed example of these two seals from Failaka (fig. 35B) depicts a boat, probably of wooden construction.²³⁸ The tall mast amidships is secured at its base on both sides. De Graeve describes the seal: "On top of the

²³² Le Baron Bowen 1956, 280.

²³³ Le Baron Bowen 1956, 280; see also Johnstone 1988, 172, fig. 13.3. Le Baron Bowen (1956, 280) also notes that "the Egyptians used a yard and a boom, although they did not haul both up when not in use," as shown by this Indus Valley depiction.

²³⁴ Johnstone 1988, 172, fig. 13.2.

²³⁵ Johnstone 1988, 171.

²³⁶ De Graeve 1981, 177-80.

²³⁷ De Graeve 1981, 177.

²³⁸ De Graeve 1981, 177-80. See also Johnstone's (1988, 176) comments on this.

mast a rope is fixed on which hangs the yard with a tall oblong sail. The narrow sail is divided into rectangular sections. No rigging of any kind is indicated."²³⁹

For this vessel she suggests rigging that would have included a pair of braces, a pair of forestays and a single backstay. This suggestion is based on parallels to similar sailing boats with an oblong sail in the Old Kingdom Egypt. The material of the sail is uncertain. According to De Graeve, "it could be made of reed woven like rush mats or it could be made of linen and would then represent pieces sewn together."²⁴⁰

Johnstone describes the second Failaka seal as follows: "...we have a double-ended craft with much greater freeboard, a mast amidships and a steering oar aft. The absence of lashings, the general shape and the presence of a large mast all suggest that the construction must now be of wood rather than reeds."²⁴¹ Alster compares the vessels depicted on these seals with the modern-day craft of sewn construction used in the Arabian Sea and in the Indian Ocean.²⁴² The depictions are, however, not detailed enough to reveal conclusively what type of a wooden construction method was used.

Neyland comments on the boat construction, as evidenced by the Failaka seals:

These depictions contrast with vessel representations from Mesopotamia and the Indus Valley. The centrally placed mast-horned figurehead, lack of discernible rudder, and angular hull shape reveal a distinctive class of

²³⁹ De Graeve 1981, 177-180.

²⁴⁰ De Graeve 1981, 179.

²⁴¹ Johnstone 1988, 176.

²⁴² Alster 1983, 51.

vessel. Dugouts, extended dugouts, and simple plank-built boats, rather than appearing as distinct types, seem to blend their constructions. Hence a boat that begins as a dugout may end its days as a plank-built boat. Similar transitions from dugout to extended dugout and the to plank-built boat may have occurred in Arabian Gulf vessels by the second millennium B.C.²⁴³

²⁴³ Neyland 1992, 73.

6 ETHNOGRAPHIC EVIDENCE

6.1 Sewn Boats of Arabia

When considering modern-day watercraft of Oman and other Arabian Gulf countries, we must look at the origin of their development. According to Le Baron Bowen, "man developed the first watercraft on quiet rivers, lakes, and marshes. Arabia is bounded by the Red Sea on the west, the Arabian Sea on the south, and the Arabian Gulf on the east. Not one true river flows out of this desolate waste to the sea."²⁴⁴ He plausibly suggests, therefore, that the first ships and boats of this area were adopted from regions where there were better conditions for the evolution of watercraft. According to Le Baron Bowen then, the watercraft of this region (Arabia) received its primary influence from India.²⁴⁵ He also traces the development of the different edge-joining techniques: "Thus it would seem that the method of obliquely driven treenails can be traced to ancient Egypt, while the technique of continuous stitching is probably of Indonesian or Indian origin."²⁴⁶

When studying native craft from Oman and other Arabian Sea countries, it is evident that sewn construction is the dominant method.²⁴⁷ *Sambuks* of Oman are examples of modern traditional boats, built according to a sewn

²⁴⁴ Le Baron Bowen 1952, 186.

²⁴⁵ Le Baron Bowen 1952, 186.

²⁴⁶ Le Baron Bowen 1952, 209.

²⁴⁷ Hornell 1946, 221-2, 229-41; 1942; Le Baron Bowen 1952, 202; Gopal 1970, 108-9; Chittick 1980; Severin 1985; Adams 1985; Potts 1997, 122-3; Agius 1999, 175-86.

construction.²⁴⁸ The *Periplus Maris Erythraei*, written by an unknown author in the first century A.D., mentions "boats sewed together" in connection with travel between Egypt and India.²⁴⁹ Marco Polo describes ships used in the Arabian Gulf towards the end of 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."²⁵⁰ Additionally, Marco Polo, notes that "nails of wood" were used in combination with sewing the planks together.²⁵¹

There is relatively recent evidence for the survival of sewn hulls, having a construction similar to the one described above by Marco Polo, on the Indian Ocean and on the East Coast of Africa. Hornell records the building technique of the *mtepe* on the Lamu Archipelago on the East Coast of Africa: "The hulls, built up of strakes sewn together with coir twine, are caulked with coir fibre hammered into the seams from within... When all is complete, rib frames are inserted athwart the hull and held down in place by lashings, which pass through holes in the planking. Thereafter, pegs are driven from the inner side into the stitch holes and broken off short."²⁵² According to Greenhill, the *bhum* of the Karachi on the

²⁴⁸ Hornell 1946, 237-8.

²⁴⁹ Schoff 1912, § 36; Casson 1989, 141, 181.

²⁵⁰ Yule 1871, I, 102, cited from Hornell 1946, 234-5.

²⁵¹ Schoff 1912, 155.

²⁵² Hornell 1946, 235. Adams (1985, 293) notes on the *mtepe*: "the sewn hull can no longer be regarded as "wretched affair"..., but rather as well-designed hull using flexibility as the basic principle in its design. The *mtepe* was inexpensive, quickly constructed, and versatile. Also, it was probably faster and therefore more efficient than those vessels constructed with rigid hulls."

south coast of Pakistan, having a hull of sewn construction, represents the same type as the *mtepe*.²⁵³

Adams describes the technique of sewn hull as evidenced by the *mtepe*: "The sewn hull did not have some of the components used in the western boat building tradition. These were primarily structural components. The *mtepe* had no wales, keelson or metal fasteners, and most of its components were fastened to each other with only a few simple lashings." Although planking provided the main strength for the boat, the sewn hulls were designed to be flexible. The frames and stringers, being internal strengthening components, were only lightly fastened to the hull. Adams also notes that "the foundation of the sewn hull was its keel."²⁵⁴ Adams points out that although the *mtepe* is a "relic sewn boat of the western Indian Ocean...the antiquity of its design is left to conjecture."²⁵⁵

There is a commonly acknowledged myth in the Arabian Gulf region relating to the avoidance of iron nails in ship construction. Some historical accounts state that iron nails were thought to be drawn out of vessels passing near magnetic mountains.²⁵⁶ Another reason for the preference of building sewn hulls is that they don't break as easily as nailed ships when striking a reef. Hourani notes that "on the Coromandal and Malabar Coasts of India [a] sewn

²⁵³ Greenhill 1995, 112-3.

²⁵⁴ Adams 1985, 291-2.

²⁵⁵ Adams 1985, 301.

²⁵⁶ Hourani 1951, 95. See also Johnstone 1988, 179.

boat can ride ashore on the heavy surf and stand the shock of being landed on a sandy beach from a breaker."²⁵⁷

Potts refers to texts from the Third Dynasty of Ur (e.g. CT 7: 31a)²⁵⁸ possibly relating to the use of palm-fiber and palm-leaf ropes in the construction of ships: "The tons of palm-fibre rope called for in this text suggest that some of the watercraft of the Ur III period must have been sewn or stitched vessels, a possibility to which scant attention has ever been paid in the literature on Mesopotamian watercraft."²⁵⁹ Despite Potts's comment above, references to ropes or lashings are absent in texts referring specifically to the construction of boats.²⁶⁰ It is possible that both the sewing and other edge-joining techniques were used side by side and the purpose of the vessel determined the choice. Comparative evidence for this comes from India and Pakistan where a variety of shipbuilding techniques existed side by side.²⁶¹

When considering seagoing vessels we are looking at a phenomenon quite different from native riverboats and rafts. Seagoing vessels required a considerably greater amount of resources and special skills in their building. It is also possible that in the third millennium B.C. the "ordinary people," such as local fishermen, employed a different technique than what was used to build the more

²⁵⁷ Hourani 1951, 96.

²⁵⁸ This text has been discussed earlier in section 4.5 (p. 39).

²⁵⁹ Potts 1997, 126.

²⁶⁰ According to Powell (1992, 105), the term *má lá* is mentioned in connection with building a raft in Presargonic texts.

²⁶¹ See section 4.4 (pp. 34-38) for discussion on Indian and Pakistani boats by Greenhill and Homell.

expensive craft of the state or international merchants. Le Baron Bowen notes that the sum total of evidence in the Indian Ocean shows that fisher-folk cling most tenaciously to primitive forms of watercraft. Mariners, on the other hand, usually sail in craft that have been strongly influenced by foreign elements."²⁶²

6.2 Traditional Iraqi Riverboats

In order to see whether there are traces left of the ancient techniques in modern day Iraq, we'll next consider local riverboats. The most common types of boats used in the rivers and marshes of Iraq are the *mahailah*, *mallam*, *danak*, *mashuf* (canoe), *quffah* (coracle) and *kalak* (raft).²⁶³ The largest of these is the *mahailah*, with a length varying from 30 to 80 feet. The width of the vessel is almost half of the total length. The ends of the *mahailah* are high; when fully loaded "the gunwale at bow and stern is from 10 to 12 feet above water," whereas the middle part of the ship only has a freeboard of roughly one foot. Usually three or four strong crossbeams provide extra strength for the hull. The steering mechanism of the *mahailah* consists of a tiller and rudder. The vessels have a single mast and a lateen sail. The cargo capacity of the *mahailah* is between 10 to 100 tons depending on the size.²⁶⁴

The *ballam* has a long and narrow hull shape with pointed ends and it draws very little water. The *ballam* can be rowed or sailed, although the usual

²⁶² Le Baron Bowen 1952, 186.

²⁶³ Ashkenazi 1957.

²⁶⁴ The above description is from Ashkenazi 1957, 50-1.

propulsion method is poling along the river. A certain *ballam* sub-type, the *nassari*, has a length of 40 or 50 feet and is used for carrying cargo in the sea. The *nassaris* are built in Kuwait but are based elsewhere. Another *ballam* sub-type is the *aragiyah*, a large cargo-carrying vessel, up to 60 feet long, with a cargo-carrying capacity of 50 tons. The *danaks*, yet another *ballam* sub-type, are small open boats with a length of 30 to 40 feet and pointed hull ends. The stem and stern posts of *danaks* rise 3 to 3.5 feet above the gunwale. The wooden hull of the vessel is coated with bitumen.²⁶⁵

There are differing views as to what is meant by a *mashuf*. Johnstone suggests that the vessel is made of wickerwork and reeds.²⁶⁶ Ochsenschlager describes the *mashuf* and *tarada* types thus: "The *mashuf* is a long, narrow boat of graceful line and is made in many sizes. Today all the larger ones are usually called *tarada*, a name formerly applied only to a very long example of this category with rows of interior studding if it was owned by a sheikh."²⁶⁷ Thesiger states that the *mashuf* is "the generic name for all types of canoe except a *Tarada*."²⁶⁸ An example of an Iraqi riverboat is shown in figure 36.

The records of the riverboats of Iraq seldom provide detailed descriptions on the construction techniques. Figures 37 and 38²⁶⁹ show examples of the inner

²⁶⁵ The above description is from Ashkenazi 1957, 50-2.

²⁶⁶ Johnstone 1988, 10.

²⁶⁷ Ochsenschlager 1992, 50.

²⁶⁸ Thesiger 1964, 233.

²⁶⁹ Thesiger (1964) does not specify what type of boat is shown in the picture (tbl. 52) from which figure 38 in this study is a detail.

construction of Iraqi riverboats. Young's description of the wooden war canoes of the marsh Arabs gives some details on this inner construction:

The finely-shaped canoes the Madan use almost as much today as ever before closely resemble those ancient models. All of them, particularly the *taradas* or war-canoes of the sheikhs are things of a rare, almost animal, grace. The war-canoes Falih bin Majid had built for Wilfred Thesiger in 1951 measured thirty-six feet long, though it was only three and a half feet across at its widest. Its sleek prow swept up to a point five feet above the surface of the water, smooth and black with bitumen. Five thousand years ago, the Sumerians built their boats as they do today. *Mashhufs* and *taradas* are carvel-built out of a mixture of Iraqi mulberry wood and wood imported from Malaysia and Indonesia, with the simplest of tools: a saw, an adze, a drill. When the curving Java-wood ribs have been attached to the lighter slats of the bottom that are laid out on the ground like a skeleton, a cross-beam is nailed in to buttress the sides. Detachable floorboards are slipped in, and a small part of the bows and stern are decked to provide space for two punters or paddlers fore and aft.²⁷⁰

Thesiger also notes on the *tarada* that "the top part of the ribs was planked along the inside." This construction detail is visible in figures 37 and 38.²⁷¹

Ochsenschlager describes the boats of southern Iraq as built in a skeleton-first technique using iron nails to attach outer planking to the frames.²⁷² A *tarada* has a keel or a keel plank that "will become part of the outer wood surface in the finished product." The bottom sections of the frames are attached to the keel or keel plank. It is interesting that the bottom of the hull is built upside down: "The ground on which the boat is built, upside down, will serve to hold the ribs in place until they are secured by the side planks nailed to them."²⁷³

²⁷⁰ Young 1983, 26-7.

²⁷¹ Thesiger 1976, 34.

²⁷² Ochsenschlager 1992, 50-1.

²⁷³ Ochsenschlager 1992, 51.

Ritter provides extensive information on Iraqi riverine craft in his study of native vessels of the Euphrates and Tigris.²⁷⁴ According to Ritter, the most perfect vessel on the twin rivers is the *sag* in Basra, built of teak (this type is called the *muhele* in Baghdad, and the *sefine* in Kut).²⁷⁵ This vessel is ca. 18 m long and its profile is unique in form; the keel is fairly short and it only starts from about one third of the hull's length from the bow. The stem is straight and greatly raked. The points where the stem and the stern posts meet the keel are strengthened with an angled timber. The frames of the ship are very rough, made of several parts and unevenly spaced. The planks are nailed to frames from outside the hull.

Ritter also describes an interesting ship called the *gajjarije*, having a primitive appearance that reminded Ritter of "Noah's ark."²⁷⁶ The timbers used for the *gajjarije* are mostly half-finished and the overall construction seems crude. The vessel has a thick coating of bitumen that compensates for the crude construction, resulting in larger open seams. The lifespan of a *gajjarije* is about 12 years. The ship lacks a keel, but has a flat almond-shaped floor in its place. This floor rises about two meters above the lowest level of the hull at the front and starts at 7-8 meters from the tip of the bow. At the stern, the floor starts six meters from the stern and rises about 0.75 meters above the same lowest level

²⁷⁴ Ritter 1919.

²⁷⁵ Ritter 1919, 122-8.

²⁷⁶ Ritter 1919, 134-6.

of the ship's bottom. The stem, eight meters long, is slightly curved and ends in a spiral-shaped decoration. The straight stern post is six meters long.

The construction method and hull lines of the *gajjarije* are simple. It is noteworthy that the frames strengthening the sides of the ship are straight. Straight floor timbers have a similar function at the bottom of the hull. The ends of the frames are left to stick out from behind the washboard and, according to Ritter, they are used as fastening pegs for various purposes.²⁷⁷ A bundle of roughly worked timbers lie longitudinally over the floor timbers (fig. 2). These timbers also serve as a shoe for the mast. On the sides of the hull, the *gajjarije* has numerous closely shaped longitudinal timbers. In addition, there are approximately 15 sturdy beams providing transverse strength for the hull. Figures 3 and 4 show a *gajjarije* in an early stage of its construction.

The rudder construction of this "Asphalt Schiff" is complex and sizeable (fig. 5).²⁷⁸ It is designed to be used by a steersman sitting on top of a high load of goods, such as bundles of reeds. Although attached to the stern post, the rudder construction of the *gajjarije* rudder cannot really be compared with the more modern stern rudder. Egyptian boat representations from the Middle and New Kingdom show a steering device similar to that of the *gajjarije*.²⁷⁹ The Indus punts, described earlier (section 0, p. 37) also share similarities with the rudder construction of the *gajjarije*. Unlike other more sophisticated vessels on the twin

²⁷⁷ Ritter 1919, 136. Perhaps rigging and cargo items were attached to these frame ends.

²⁷⁸ Ritter 1919, 136, fig. 18.

²⁷⁹ For representations see Wachsmann 1998 (figs. 2.27, 3.20, 11.3).

rivers, the *gajjarije* has no separate covered deck structure, only a simple deck at the bow and at the stern.

When looking at the construction method of the *gajjarije* one cannot help but wonder whether it might be of ancient origin. At first glance, however, there appears to be a conflict with the theory that skeleton-first construction was only employed in the Mediterranean during the first half of the first millennium A.D. The ship is keel-less with a flat bottom, its "side-frames" are straight, and internal strength is provided not only by the floor planks and side frames but also by a number of longitudinal timbers, situated both at the bottom and on the sides. We also have to remember that the whole hull is coated with a thick layer of bitumen that helps to even out all the rough surfaces and make any open seams watertight (in combination with caulking lying under the bitumen layer). Without the bitumen the hull probably would not be sufficiently watertight.

We now face the question of how the layer of exterior planking was attached to the other structural elements. Unfortunately Ritter's article does not reveal whether the planks of the *gajjarije* were nailed to the frames. Ritter does, however, describe in detail how the planking of the *muhele* is built (see above). In the case of the *muhele* the planks are nailed to the frames from the outside.

The construction method of the *gajjarije* seems strikingly similar to the building of flat-bottomed riverboats in the Peshawar Valley in northern Pakistan.²⁸⁰ According to Greenhill, these vessels seem to be essentially

²⁸⁰ Greenhill 1995, 54-5.

"skeleton-built on a flat bottom rockered fore and aft." The bottom is built in a manner similar to that of the *bohatja* (see section 4.4, p. 37) except that the planks that are nailed to the floor timbers rather than edge-joined. The process then continues as follows: "the stem and sternposts are fitted and the side frames, quite straight timbers with no attempt at any kind of shaping, are added, the beam shelf and deck beams, so that in its next stage of construction the boat is an angular skeleton built up on the finished bottom. Last of all she is planked up in the sides and the decks are laid."

7 TEXTUAL EVIDENCE

7.1 General

Business documents from the Third Dynasty of Ur provide ample information on different sizes and types of Mesopotamian ships. Some texts provide exact numbers of shipbuilding parts used for a specific size of a ship,²⁸¹ whereas others list general concepts, such as the "sides of a ship" or "wooden 'ground' of a boat."²⁸² Although the basic grammar and vocabulary of Sumerian and Akkadian languages are reasonably well known today, the shipbuilding texts present a real challenge. Although it is evident from the texts that the writer is describing the specific parts used for a particular type of ship in a certain time period, the names of these parts are so specialized that direct translations are not readily found. Different translations for the same terms by specialists in the Sumerian and Akkadian languages make this clear.

When attempting to make some sense out of these shipbuilding terms, one is faced with the difficulty of how to narrow down the scope of the research. It is possible to write scores of pages just for the different interpretation

²⁸¹ See Appendix 8.3: AO 5673.

²⁸² See Appendix 8.3: Hh IV: 365, 384.

possibilities of the Sumerian terms *eme-sig* and *me-re-za*.²⁸³ In the following section I examine a limited set of terms for which comparative translation suggestions exist. My purpose is not to derive conclusive new translations for these terms but to construct a general picture of Mesopotamian shipbuilding. The specific goal of this research is to focus on possible clues on edge-joining, internal construction (e.g., keel, frames) and the size of the vessels. As such, I have chosen to examine the following Sumerian terms (see section 7.3, pp. 76-97): *eme-sig*, *me-re-za*, *dubbin*, *har*, *kak*, *ger-ma₂*, *ti-ti*, *u₃*, *ad-uš*, *a-da*, *a-ra*, *tu-gul*, *nig₂-KA*, *Me-dim₂*, *ma₂-gu₂*, *hum*, *Šu-dim₂*, *Gú-sig₄*, *u₃*.

Most of the texts contain detailed lists identifying construction materials and various parts for building boats of different sizes. When considering the quantities mentioned in trying to identify different ship parts, one has to ask an important question: are the listed parts meant to be used for building one single hull or are they merely an arbitrary number of parts to be used for building ships in general? There are clues in the texts that reveal, at least in certain cases, that the quantities of parts for certain sizes of ships are listed in a consistent

²⁸³ This is evident from the discussion that Casson (1967) has raised in his article in response to Salonen's (1939) earlier work. For discussion on these terms see section 7.3 (pp. 76-97) in this study. The terms examined in this study have a prefix *giš* (e.g., ⁹¹⁸*eme-sig*), denoting that the object is made of wood. This prefix has been omitted in the following discussion for clarity's sake.

manner.²⁸⁴

In a similar study of ancient shipbuilding texts, the Pylos Linear B tablets PY Vn46 and Vn879, Hocker and Palaima propose the following alternative interpretations: "(a)...a «cookbook» or «shopping list» of the timbers necessary for the construction of a single ship;...(b) the list could be a record of timber given or assigned to a shipwright for use in the construction and repair of one or more ships;...c) the list is a more general order for timbers of certain kinds and sizes... A fourth possibility is that (d) the list represents an inventory of existing timber stocks identified by the components for which they are intended or suitable."²⁸⁵ As Hocker and Palaima state, the most attractive possibility would be the first one because "it would give some meaning to the numbers of items and suggest a rational organization of the list, based possibly on order of importance or assembly."²⁸⁶

By analogy with Hocker and Palaima's study we must ask: can the listed ship parts in the Sumerian texts in question (e.g. AO 5673, Hh IV)²⁸⁷ "be specified by: a) order of installation; b) order of acquisition; or c) order of structural importance of the elements of the ship(s)."²⁸⁸ Text Hh IV merely lists different parts and elements, and another text, AO 6573, gives specific quantities

²⁸⁴ See Salonen (1938) and the description of AO 5673 in section 7.2 (pp. 68-76) for discussion on the correspondence of quantities of parts mentioned in different texts.

²⁸⁵ Hocker and Palaima 1991, 306-7.

²⁸⁶ Hocker and Palaima 1991, 306.

²⁸⁷ Appendix 8.3 (pp. 144-154).

²⁸⁸ Hocker and Palaima 1991, 308.

for different parts for ships.²⁸⁹ The former text includes a more detailed listing than the latter.

Powell's studies on timber production in Presargonic Lagash, dating to the 24th century B.C., show that timbers listed are "classified according to their customary use in a descending order of size."²⁹⁰ These texts "typically (but not universally) begin with larger pieces of 'timber'..., among which one finds both 'trunks'..., and 'trimmed branches'...; then come things like plough parts, waggon parts, parts of furniture, etc.; and finally the whole account is often wound up by a count of the pieces of firewood..., usually categorized into 'large' and 'small'..., and the number of bundles of small branches and twigs."²⁹¹

7.2 Texts

HAR-ra=hubullu IV (Hh IV:252-430)

The text HAR-ra=*hubullu* IV (Hh IV:252-430), dating to the 19th century B.C., contains a mix of terms relating to shipbuilding and boat types.²⁹² The text is based on Sumerian prototypes and its origins probably date as far back as the 4th millennium B.C.²⁹³ HAR-ra=*hubullu* IV belongs to a group of Mesopotamian thematic lists or "encyclopedic compilations" that are "collections of logograms

²⁸⁹ See Appendix 8.3 (pp. 144-154).

²⁹⁰ Powell 1992, 100-1.

²⁹¹ Powell 1992, 100.

²⁹² Appendix 8.3: Hh IV; Oppenheim 1964, 247. Transliteration for this text is provided by Landsberger 1957.

²⁹³ Matouš 1933, 1.

grouped solely according to their meaning."²⁹⁴ Even the name HAR-ra=*hubullu* has two parts; HAR-ra in Sumerian and *hubullu* in Akkadian, denoting the nature of the text that is essentially a dictionary.

By looking at the grouping of terms, the text seems to be divided into three parts. In the first part (lines 252-61), ten terms specifying ship's parts are mentioned.²⁹⁵ The second part (lines 262-361) contains a lengthy list of different boat types appearing in a seemingly illogical order. Additionally, the boat types seem unrelated to each other. It is relevant that sailing ships and oceangoing boats ("boat from Tilmun," "boat from Makkan," "boat from Meluhha") are also mentioned (lines 281-3). It seems that the writer of Hh IV collected a sort of classification of shipbuilding terms and different kinds of vessel types.

The third part in Hh IV (lines 362-439) is the most relevant to this study. This section contains 68 lines, each of which refers to a certain part or a boat.²⁹⁶ Some of these terms are divided into groups: for example, different kinds of poles are listed on lines 388-409. Some terms or groups of ship's fittings receive more attention than others. It seems that elements concerned with the actual operation of the riverine boat (oars and their parts, mooring and punting poles) are emphasized in the text.

²⁹⁴ Sasson 1999, 2311.

²⁹⁵ Some of these terms will be discussed in section 7.3 (pp. 76-97).

²⁹⁶ Some of these terms will be discussed in section 7.3 (pp. 76-97).

Ship sizes are measured in volume and sizes of ships from 120 *gur* to 10 *gur* are mentioned in lines 354-361.²⁹⁷ In Mesopotamian texts from the third millennium B.C. two versions of the same *gur* measurement are used; a "large" and a "small" version.²⁹⁸ The large version usually had a capacity of roughly two times the small. The existence of two different measurement systems further complicates the interpretation of different *gur* capacities. In the old archaic Sumerian measurement system, one *gur* had a capacity of 240 liters. According to the 'Reallexikon der Assyriologie,' "this *gur* was the most widely used large capacity unit down into the Akkad period, when it began to be replaced by the Akkad *gur*."²⁹⁹ The "standard Akkad-Old Babylonian system," where one *gur* was roughly 300 liters, was in use during the Ur III period from which most of the texts examined in this study originate.³⁰⁰ S. Parpola, A. Parpola, and Brunswig³⁰¹ and Salonen³⁰² have all calculated that the capacity for one *gur* should be ca. 250 liters during Ur III. Based on the discussion above we can, therefore, say that the *gur* capacity used in the following examination is between 240 and 300 liters.

Using a figure of 300 liters, the cargo volume of a 120-*gur* ship would have

²⁹⁷ Salonen 1939, 158; see also Appendix 8.3: Erm 15259, AO 5673, Hh IV. Contemporary texts from Ur, such as UET III 272 also mention ships of 300 *gur*.

²⁹⁸ Personal communication with Raija Mattila from the Department of Asian and African Studies at the University of Helsinki. See also Dietz 1990, 496-8.

²⁹⁹ Dietz 1990, 493.

³⁰⁰ Dietz 1990, 497. In his translation of Hh IV: 354 (Appendix 10.3), Parpola mentions a capacity of ca. 270 liters for a *gur*. Potts (1997, 129) has used a figure of 300 liters.

³⁰¹ Parpola et al. 1977, 145.

³⁰² Salonen 1939, 158.

been ca. 36 000 liters or 30.6 cubic meters. According to Potts, however, the unit *gur* did not necessarily refer to the actual cargo-carrying capacity of a vessel. Despite the different methods used it seems very difficult to "calculate the actual carrying capacity from the very general rubrics of volumetric size used to describe the ancient Mesopotamian watercraft."³⁰³

Nanna-Suen's Journey to Nippur

The Sumerian mythical text "Nanna-Suen's journey to Nippur" originated in lower Mesopotamia and dates to the end of the third millennium B.C. It reveals parts used in the construction of a divine boat.³⁰⁴ Ferrara describes the hymn as "one of a number of Sumerian literary compositions, which have been recognized as having a thematic similarity and have been classified accordingly as 'divine journeys.' The compositions have as one of their central themes, a journey (usually by boat) taken by a deity to a cult center outside his or her own province."³⁰⁵

In the following passage, translated by Ferrara, Nanna-Suen sends men to collect materials for the construction of a *magur*-boat.³⁰⁶ Terms relevant to this study have been added in brackets as part of the text:

- ³⁸ A magur-boat he...-s, he sends for a buru mat.
³⁹ For the magur-boat's reed, to Tummal,

³⁰³ Potts 1997, 129.

³⁰⁴ Ferrara 1973, 84-5. Ferrara (1973, 2) points out that hymns of this type can have a considerably more ancient origin.

³⁰⁵ Ferrara 1973, 1.

³⁰⁶ Ferrara 1973, 84-5, lines 38-52.

- 40 Nanna-Suen sends a man.
 41 For the magur-boat's pitch, To Abzu,
 42 Ashimbabbar sends a man.
 43 For its elpetu-rush, to Duashaga,
 44 Nanna-Suen sends a man.
 45 For its strake(s) [^{gis}*mé-rí-za-bi*], to the forest,
 46 Ashimbabbar sends a man.
 47 For its ribbing [^{gis}*eme-sig-bi*], to the forest of Kununa,
 48 Nanna-Suen sends a man.
 48a. For its stern-plank [^{gis}*a-da-má-bi*], to the mountain of fragrant cedar,
 48b. Ashimbabbar sends a man.
 49 For its planking [^{gis}*ù-bi*] to the forest of Ibla,
 50 Ashimbabbar sends a man.
 51 For its fir wood [^{gis}*ù-suh₅-bi*], to the fragrant cedar forest,
 52 Nanna-Suen sends a man.

Perhaps this refers to the construction of a reed boat with wooden elements (perhaps strengthening timbers) attached to the vessel interior. Alster notes that "reed mats and bitumen are mentioned in the very first place, before the wooden material, probably used only for the vital parts of the boat."³⁰⁷ The Sumerian terms marked in the above passage will be discussed in more detail in section 7.3 (pp. 76-97).

AO 5673 (TCL V Pl. VII)

AO 5673 (TCL V Pl. VII) is a Sumerian shipbuilding text found at Umma, dating to Ur III.³⁰⁸ The text is perhaps the most informative source for this study because it lists numbers of ship parts for different ship sizes in a consistent

³⁰⁷ Alster 1983, 50.

³⁰⁸ Appendix 8.3: AO 5673. This text will be referred to by its museum catalogue number AO 5673 in this study. Parpola's translation in Appendix 8.3 has a typing error when it names the text as AO 6573. TCL V refers to the publication of the text by Genouillac 1922. Transliteration of this text is also provided by Salonen 1939, 172-6. See also Salonen 1938, 3.

manner. The crucial question raised when examining this text is whether it lists all the major parts required to build a complete riverine vessel. The following considerations suggest that the answer to this might be affirmative.

Salonen shows plausibly that the numbers of parts are consistent and the proportions of them between the different boat categories are credible.³⁰⁹ In the text (on lines I 9, II 2, II 36, III 30), a boat of 120 *gur* is listed having 46 pieces of *ù* ("planks"); eight boats of 60 *gur* have 209 pieces of *ù* (i.e., 26 "planks" for one ship); a boat of 30 *gur* has 21 "planks," and two boats of 10 *gur* have 30 planks (i.e., 15 "planks" for one ship). In case of a 10-*gur* ship, the numbers correspond also with another text, Erm 15259,³¹⁰ that is discussed below. AO 5673 also mentions the labor needed to build a boat in each case: 1800 days (line I 27) for a finished boat of 120 *gur*, 7200 days (line II 18) for eight finished boats of 60 *gur* (i.e., 900 days per boat), 450 days (line III 20) for a finished boat of 30 *gur*, and 300 days (line IV 11) for a finished boat of 10 *gur*.³¹¹

Although it cannot be proven conclusively, the parts seem to be listed in a descending order of size. As an example, in part I of the text, the listing of shipbuilding parts starts from line six; "planking" (*ù*) is mentioned on line nine, whereas "punting poles" (*gi-muš*) and "wooden nails" (*gag*) are mentioned towards the end of the list on lines 21 and 22.³¹²

³⁰⁹ Salonen 1938.

³¹⁰ Appendix 8.3: Erm 15259.

³¹¹ There is probably a mistake in the text on line IV I 12 when "two boats of 10 *gur*" are mentioned at the end, although the text starts out by mentioning "1 boat of 10 *gur*."

³¹² For translations of these terms see section 7.3 (pp. 76-97).

The "Shulgi and Ninlil's Boat" Hymn (Shulgi R)

In the Mesopotamian Royal Hymn called "Shulgi and Ninlil's Boat" (Shulgi R), dating to the time of Shulgi (2094-2047 B.C.)³¹³, a cultic processional boat is described in detail.³¹⁴ In the hymn "the various parts and equipment of the boat are praised in hyperbolic terms, rich in poetic metaphors." The challenge with these lines is to get beyond the metaphors and identify the names and meanings of the actual ship's parts. The language is, however, clear enough to allow for general interpretations of reasonable reliability. In the following translation by Klein, the terms relevant to this study have been added in brackets as part of the text.

- 8 In the huge cedar forest he caused large cedars to be felled for you.
....
- 10 According to your...*woven from*...-threads, you are a...place,
- 11 According to your large reed-mats, you are a day-light, *spread* widely over
the pure country-side,
- 12 According to your timbers [^{giš}*šu-dīm*], you are a sniffing *muš-ša-tùr*-serpent,
crouching on its paws,
- 13 According to your punting poles [*gi-muš*], you are a dragon, sleeping a
sweet sleep in its lair,
- 14 According to your oars [^{giš}*mi-rí-za*], you are a *sigsig*-snake, whose *belly is*
pressed against the waves,
- 15 According to your *floor-planks* [^{giš}*eme-sig*], you are currents of flood,
sparkling altogether in the pure Euphrates,
- 16 According to your side-planks [^{giš}*ù*], which are fastened *into their fixed*
places with wooden rings [^{giš}*har*],

³¹³ Brinkman 1964, 336.

³¹⁴ Klein 1990.

- 17 You are a staircase [*kun-sag*] leading to a mountain spring [*pú-kur-ra(-k)*], a
 ... filled with...,
 18 According to your *panels* [^{giš}*LU*], you are a persistent and firmly founded
 abundance,
 19 According to your bench [^{giš}*hum*], you are a lofty dais, erected in the midst of
 the Abyss,

 23 According to your glittering golden sun-disk [*aš-me*], *hoisted with leather-*
straps,
 24 You are a brilliant moonlight, shining brightly upon all the lands,

 36 According to your longside beams [^{giš}*ad-ús*], you are a warrior, who is set
 straight against another warrior,³¹⁵

Klein suggests that the "following groups of terms"³¹⁶ belong functionally together: Propelling devices - punting poles and oars (13-14); various planks - floor planks, side planks and panels (15-18); the cabin and its parts - the door and the bench (19-20); the religious emblems - sun disk and banner (23-26); the stabilizing devices - rudder, tow rope and mooring pole (32-35); and, finally, various parts of the vessel - longside beams, prow, stern and, perhaps, hold (36-39).³¹⁷

Erm 7820, 15259, 4053, 14661, 4031

These five texts list different shipbuilding parts.³¹⁸ They were found at Umma, and date to the Ur III period. Of the five texts, Erm 15259 is the most interesting because it lists quantities of parts for a 10-*gur* vessel, corresponding

³¹⁵ Klein 1990, 103-5.

³¹⁶ The terms appearing in the hymn will be discussed in section 7.3 (pp. 76-97).

³¹⁷ Klein 1990, 82.

³¹⁸ Appendix 8.3: Erm 7820, 15259, 4053, 14661, 4031.

with the numbers in AO 5673 (lines III 22 - IV 12). For example, in both texts the 10-*gur* boat has six pieces of *a-ra*, and 15 pieces of *ù*. It seems rather clear that Erm 15259 and AO 5673 actually list the exact number of parts required for a construction of a 10-*gur* ship.

The three other texts, Erm 4053, 4661, 4031, on the other hand, seem to list varying quantities of parts for different ship sizes; perhaps these texts refer to an inventory of stocks. Alternatively, the quantities mentioned might be for repairs. The fifth text, Erm 7820, lists quantities and labor of reed mats for the boat interior.

7.3 Interpretations of Specific Terms

Eme-sig

Eme-sig, together with *me-re-za* and *dubbin*, both dealt with below, are perhaps the most crucial terms in the shipbuilding texts discussed in this study. In AO 5673, the number of *eme-sig* listed for the largest boat class (120 *gur*) is 180 and the corresponding numbers for the smaller classes are the following: 60 *gur*, 138; 30 *gur*, 100 and 10 *gur*, 45.³¹⁹ Salonen translates the term as "die am Boden liegenden Schiffsspanten" ("lower ribs").³²⁰ All of the units seem too large to

³¹⁹ Salonen 1939, 86. See also Appendix 8.3: AO 5673, Erm 15259.

³²⁰ Salonen 1939, 86-7.

warrant identifying them as timbers for the boat's internal construction. Casson, therefore, reinterprets *eme-sig* as a "mortise-and tenon-joint."³²¹

We have to be careful when trying to calculate the cargo-volumes of Mesopotamian boats based on the capacities of *gur*. As Potts notes, "some allowance must surely be made for the crew and their belongings."³²² Casson estimates that a boat in the largest class (120 *gur*) would have had a hold measuring ca. 7 x 2 x 1 meters.³²³ It must be assumed that the length of the whole vessel, according to Casson's figures, would have been perhaps nine meters, when the tapering hull ends and the other non-cargo space are taken into consideration. He notes that a boat made of 55 planks "could easily be edge-joined with 180 mortise-and-tenons and 40 dove-tailed clamps,"³²⁴ along with a generous number of treenails.³²⁵

Casson's interpretation presents some difficulties.³²⁶ He has used Salonen's earlier article from 1938, in which one *gur* was said to contain 121 liters.³²⁷ In Salonen's later and main work, however, a different capacity, 249

³²¹ Casson (1967) also translates *dubbin* as "dove-tailed clamps," similar to those in the Dashur boats. See for the discussion on the authenticity of the dove-tailed clamps of the Dashur boats in section 4.3 (pp. 32-34).

³²² Potts 1997, 129.

³²³ Casson 1967, 288. In other words a 120 *gur* ship would have had a capacity of about 14,000 liters.

³²⁴ See discussion on the term *dubbin* below.

³²⁵ Casson 1967, 288.

³²⁶ See also De Graeve's (1981, 97, footnote 81) comments on Casson's translation of *eme-sig*.

³²⁷ Salonen 1938, 11.

liters is mentioned.³²⁸ When using a figure of 249 liters for a *gur* and applying Casson's assumptions, the size of the hold was approximately 11 x 2.7 x 1 meters.³²⁹ The overall length of the boat would, therefore, have been about 14 meters. An interesting piece of comparative information relating to the length of Mesopotamian riverine hulls, although from a later time period (9th century B.C.), is provided by a text (WVDOG IV Pl. 2 ff.) from the kingdom of Shamash-res-usur, situated in Mid-Euphrates, mentioning a riverine passenger boat with a length of 12.5 m.³³⁰ If we estimate that both sides would have at least five strakes from the bottom up to the sheerstrake, the overall length of the edge-joined area would be ca. 120 m.³³¹ If only 40 mortise-and-tenon joints were used (for a 120-*gur* ship), as suggested by Casson, the spacing between these joints would be about three meters.³³² The spacing between dovetailed clamps would be almost 0.6 meters. A spacing this wide does not seem probable, especially

³²⁸ Salonen 1939, 158. Perhaps this is due to confusion between the "large" and the "small" versions of the *gur* measurement, as discussed earlier in section 7.2 (pp. 68-76).

³²⁹ The volume of the hold would, therefore, be roughly 30,000 liters. For discussion on the different capacities of *gur* see section 7.2 (pp. 70-71).

³³⁰ Salonen 1939, 22.

³³¹ Joinery of the garboard to the bottom planking or a possible keel plank is included in the number of seams. It has also been taken into consideration in this figure that all rows of planking do not extend the whole length of the vessel. The average length of the planking seams is estimated as 12 m. Salonen (1938, 15) records the use of four-meter long strakes for the building of a 60-*gur* ship.

³³² In the Uluburun ship described earlier the spacing between mortise-and-tenon joints varies between 20-25 centimeters (Pulak 1999b, 19). Hocker and Palaima (1991, 312-3) note in relation to the Linear B tablets from Pylos that "140 tenons or pegs [as mentioned in one of the tablets] are not nearly enough even to build a small vessel in the style of the Uluburun ship."

when the side planking was made of relatively numerous strakes (ca. 27 pieces per side).

Translations provided for the term *eme-sig* by other scholars are very different indeed. According to Al-Fouadi,³³³ Powell,³³⁴ and Steinkeller³³⁵ the term should be translated as "planks," whereas Ferrara³³⁶ thinks it refers to "ribs." Parpola translates it as a "narrow plank" or a "narrow/thin tongue," depending on the context.³³⁷ Klein³³⁸ thinks the term refers to "floor planks" and Römer³³⁹ also sees it as either "Boden Planken" ("floor planks") or "am Boden liegenden Schiffspanten" ("floor timbers"). De Graeve makes an interesting point when referring to the translation of *eme-sig*: "ribbing is more likely than Casson's interpretation of tenons; but then the term 'ribbing' is used in the meaning of 'strengthening frames.'"³⁴⁰

A crucial piece of information for understanding this term comes from a "hymnic description of Enki's boat," similar to Shulgi R, stating that the *eme-sig*

³³³ Al-Fouadi 1969, 24.

³³⁴ Powell 1992, 109. Powell's translation of *eme-sig* is based on Presargonic timber production texts from Lagash, dating to the 24th century B.C.

³³⁵ Steinkeller 1987, 93.

³³⁶ Ferrara 1973, 84, 118.

³³⁷ Appendix 8.3: see, e.g., Erm 15259: 8, AO 5673: I 11.

³³⁸ Klein 1990, 103, 114.

³³⁹ Römer 1993, 382-3.

³⁴⁰ De Graeve 1981, 97, footnote 78, 81. There seems to be an error in De Graeve's citation (1981, footnote 78, 81) to Al-Fouadi's (1969) translation of *eme-sig* as "ribbing." Al-Fouadi (1969, 24) translates *eme-sig* as "planks." De Graeve's quote on footnote 78 is not from Al-Fouadi (1969), but seems to come from Ferrara (1973, 84-5).

were made of lapis-lazuli.³⁴¹ In this context it would seem reasonable to suggest that *eme-sig* was a part of the boat's visible construction. In "Nanna-Suen's Journey to Nippur" (line 47) it is mentioned that wood for *eme-sig*, was acquired from a specific forest.³⁴² In the Shulgi R the term is mentioned among the other major parts of the divine boat and therefore *eme-sig* seems to be an important part of the ship's construction.³⁴³

Shulgi R can be of further assistance when trying to translate this term. Klein translates line 15 of the hymn: "According to your floor-planks, you are currents of flood, sparkling altogether in the pure Euphrates."³⁴⁴ Römer's translation of the same passage seems to associate the *eme-sig* with waves: "Was deine Bodenplanken anbelangt, bist du Wogen, die insgesamt im reinen Euphrat bunt (auseinanderstieben?)."³⁴⁵ Based on Römer's translation of the passage, the row of frames is perhaps compared to the "alongside" waves.

By this, it seems that *eme-sig* should be associated with a major visible part of the boat's construction, in contact either directly or indirectly with water and the waves. The numbers of *eme-sig* are too large to warrant their identification as floor planks. It is difficult to see how 180 planks would have been needed to build the ship's bottom when only 55 planks were required to build the sides (120-*gur* vessel).

³⁴¹ Klein 1990, 94, line 10; for transliteration see Salonen 1939, 179-80.

³⁴² Ferrara 1973, 84, no. 47. For this passage see section 7.2 (pp. 74-75) in this study.

³⁴³ Klein 1990, 102-3; see also section 7.2 (74-75).

³⁴⁴ Klein 1990, 103. See also section 7.2 (pp. 74-75) in this study.

³⁴⁵ Römer 1993, 383.

Perhaps *eme-sig* was not really a substantial frame timber but rather a smaller and thinner plank that was inserted and attached on the inside of the hull to keep the planking edges together. In this method the *eme-sig* would be used in a way similar to that of holding together the parts of tripartite wagon wheels. In this context the *eme-sig* would be equated with the cross-bar (see figures 9 and 10) of the wheels. It is possible that these *eme-sig* were of relatively short lengths and several of them were required to complete a full run from one side of the ship to the other. This would help explain the large number of *eme-sig*. Additional edge-joining, perhaps wooden pins or dowels inserted in holes bored perpendicularly into the planking edges, may have been used. If this technique was employed, the hull planking would have provided most of the strength for the hull. Additional internal strengthening timbers (see *dubbin* below) might also have been used.

In the texts studied here the terms *eme-sig* and *me-re-za* are often mentioned together: usually *eme-sig* precedes *me-re-za*.³⁴⁶ If we take the translation of *me-re-za* as "dove-tailed clamps" inserted across the seams on the exterior planking faces (see *me-re-za* below) to be correct, it is understandable why these "fastening elements" are listed in the same context.

Yet another alternative translation for *eme-sig* might be "ceiling planking" or "deck planking." In both cases, however, the numbers seem too great to support these alternative translations. Especially in the case of deck planking,

³⁴⁶ See, e.g., Appendix 8.3: Erm 15259:9-10, AO 5673: I 11-2.

there would need to be very closely spaced cross thwarts to support deck structure made up of relatively short pieces of planking.

Me-re-za

In AO 5673 the number of *me-re-za* listed for the largest class (i.e., 120 *gur*) is 195 and the corresponding numbers for the smaller classes are the following: 60 *gur*, 150; 30 *gur*, 90; 10 *gur*, 50.³⁴⁷ The translation of *me-re-za* is problematic, and in the same way as with *eme-sig* various scholars have provided markedly different interpretations for the term. Salonen translates *me-re-za* as "Seitenspannen des Schiffes" ("upper ribs"),³⁴⁸ and Römer also equates the term with the ship's frames.³⁴⁹ Ferrara³⁵⁰ suggests a meaning of "strakes" for the term, whereas Al-Fouadi³⁵¹ thinks *me-re-za* refers to "poles of the boat." Klein translates the term as "oars" in connection with Shulgi R.³⁵² This translation seems unlikely, however, as the quantity of *me-re-za* (195 for a 120-*gur* boat, as mentioned in AO 5673: I 12) seems an unrealistically high number of oars. Additionally, since *eme-sig* is mentioned frequently in connection with *me-re-za*,

³⁴⁷ Salonen 1939, 85. See also Appendix 8.3: Erm 15259, AO 5673.

³⁴⁸ Salonen 1939, 85-6. In his study of Mesopotamian doors, Salonen (1961, 25) translates the term *ig-ma-re-za* as "Tür mit Spannen" ("door with a curved timber"). Casson (1967) does not provide any translation for *me-re-za*.

³⁴⁹ Römer 1993, 382-4.

³⁵⁰ Ferrara 1973, 84.

³⁵¹ Al-Fouadi 1969, 24.

³⁵² Klein 1990, 114.

a connection between oars with floor planks, as Klein translates *eme-sig*, seems improbable.

Klein's translation of a passage in Shulgi R, does, however, provide interesting clues as to the meaning of the term *me-re-za*: "According to your [*mi-ri-za*] you are a *sigsig*-snake, whose belly is pressed against the waves."³⁵³ In this context Parpola's suggested meaning of "clamps" for *me-re-za* is interesting.³⁵⁴ Perhaps dove-tailed clamps are meant here. The purpose of the passage "sigsig-snake, whose belly is pressed against the waves," as translated by Klein, might be to compare the snake's or reptile's scaly-covered belly with the ship's side, dotted with numerous dove-tailed clamps joining the planking edges together. As noted earlier, in some Mesopotamian seal depictions the entire hull of the boat is represented as a snake body.³⁵⁵

Dubbin (umbin)³⁵⁶

The general meaning for the term *dubbin* is a "finger" or a "claw."³⁵⁷

³⁵³ Klein 1990, 103, 114. See also section 7.2 (p. 74). The term in question appears written in both as *me-re-za* and *mi-ri-za*, depending on the text.

³⁵⁴ Appendix 8.3: see, e.g., Erm 15259: 9 and AO 5673: I 12. Parpola also translates the line 15 of Shulgi R as follows: "Your narrow planks [*mi-ri-za*] (to sail) on the waves of pure Euphrates have all been chosen by me." (Appendix 8.3: Passages).

³⁵⁵ De Graeve 1981, 143.

³⁵⁶ The term with the same meaning appears written both as *dubbin* and *umbin* in Mesopotamian texts.

³⁵⁷ Salonen 1951, 104. The problems of Casson's (1967) translation of *dubbin* as "dove-tailed joints" has been discussed above in relation to *eme-sig*.

According to Parpola, the term should be translated as "claws."³⁵⁸ Salonen translates *dubbin* as "die stärkeren Bodenspannen" or "Krallfüsse" ("floor timbers"), providing major transverse rigidity in a ship's hull.³⁵⁹ In connection with Mesopotamian carriages he translates *dubbin* as "wheel" or "wheel spoke."³⁶⁰ An example of the use of the term is "wheel/spoke of a two wheeled wagon" and a "wheel/spoke of a four-wheeled cargo-wagon." It is noteworthy that in connection with carriages and chariots, *dubbin* is consistently mentioned in pairs. In Hittite texts the term is used for a potter's wheel and a distinction is made between the right and the left side of a wagon.³⁶¹ It should be noted, however, that the early carriage wheels did not have separate spokes but were rather solid discs whose parts or panels were fastened together (figs. 9, 10).³⁶²

Salonen makes an interesting comment that gives another insight into the interpretation of *dubbin*: "Perhaps the Mesopotamians had once used a sledge-like means of transportation (*travois*) like the Old American Indians, as Dr. L. Oppenheim suggested to me, *i.e.*, two long poles with "krallenähnliche" ["nail-like"] curved ends to carry the load, drawn at the other end by draught-animals."³⁶³ Powell notes the following use of the term *umbin* in Presargonic

³⁵⁸ Appendix 8.3: Erm 15259: r. 3, AO 5673: I 18.

³⁵⁹ Salonen 1939, 87-8. Steinkeller (1987, 93) suggests that the term can be translated as "boat's ribs."

³⁶⁰ Salonen 1951, 104.

³⁶¹ Salonen 1951, 105-6.

³⁶² See for a discussion on early wheeled vehicles in section 4.1 (p. 28).

³⁶³ Salonen 1951, 104.

texts: *umbin ellag*, meaning possibly "beams" for "feet" or for "wheels."³⁶⁴

Perhaps with boats the term relates to the floor timbers.

Salonen mentions several different kinds of other parts used together with *dubbin* in the construction of carriage wheels.³⁶⁵ One of these terms is *kak-dubbin-mar-gid₂-da* that he translates as "Nagel des Scheibenrades des Lastwagens" ("wheel peg of a cargo wagon"), the batten or timber holding the parts of the wheel (usually of tripartite type) together (fig. 39).³⁶⁶ Another term is *kak-u₄-sar-mar-gid₂-da* that Salonen translates as "Pflock, Nagel des Scheibenrades" ("a kind of a peg holding the parts of a tripartite wheel together"). Salonen doesn't describe whether these pegs would have been visible on the wheel surface or inserted into holes bored on the edges of the wheel components. Piggott's study of early wheeled vehicles, already referred to in this study in section 4.1 (p. 28), shows that both fastening methods have been used in the Near East. Presargonic texts mention the term *umbin gag* that Powell translates as a kind of a "wheel peg or wheel-rod."³⁶⁷ In the early depictions from Ur these fastening timbers are visible on the outside perhaps recessed on the plank faces across the seams of the wooden wheels (fig. 10).

Yet Salonen may not be far from the truth by translating the term as "floor timbers" in relation to boats. The numbers seem realistic for the largest 120-*gur* size ship. An alternate translation would have the term referring to the planks or

³⁶⁴ Powell 1993, 112.

³⁶⁵ Salonen 1951, 108-20.

³⁶⁶ For the general meaning of *kak* see below in this section.

³⁶⁷ Powell 1992, 109.

parts of the hull bottom (in comparison with the parts forming together the wheel disc of a wagon or a chariot).

Har

The term *har* appears in connection with Shulgi R but it is not mentioned in other texts (e.g., AO 5673). Klein's translation of a passage from the hymn provides interesting information on the use of *har*: "According to your side-planks, which are fastened into their fixed places with wooden rings, You are a staircase leading to a mountain spring, a...filled with..."³⁶⁸ This translation remains unclear; perhaps the author is referring to the internal curving sides of the hull along which one can descend to the hold. It is also possible that the "stairs" mentioned in the passage refer to uneven or joggled planking edges inside the hull. The term *har* might refer to an object used in joining the planking together, perhaps a kind of a clamp. An alternative translation could be a kind of a landing structure or a staircase along which one could descend into a "mountain well" that is perhaps an allegory to a specific location. Klein suggests this mountain well could be identified with "a mythical well located at Dilmun."³⁶⁹

³⁶⁸ Klein 1990, 103; see also section 7.2 (p. 75) in this study. Römer (1993, 382) also translates the term *har* as the wooden rings used for fastening the ship's hull planking.

³⁶⁹ Klein 1990, 115.

Kak

The term *kak* means "wooden nails" or "pegs" that were often made, according to Salonen, of laurel.³⁷⁰ For a 120-*gur* size of ship, 7200 treenails were used. The corresponding numbers for the other sizes were: 60 *gur*, 3600; 30 *gur*, 1500; 10 *gur*, 600.³⁷¹ Perhaps part of the large number of treenails (7000 units) would have been used to secure possible mortise-and-tenon joints in place.³⁷² If we calculate that there would have been two nails per joint, there would have been 3500 mortise and tenon joints. This figure is clearly too high.

It is also possible that *kak* served as an additional fastener in joining the edges of planks together. In this case a hole would have been drilled diagonally or obliquely across two adjacent planks and the treenail would have been nailed into it. This kind of technique is used in craft of ancient origin in South Arabia, Pakistan and Egypt as discussed in section 4.4 (p. 36).³⁷³ This alternative interpretation is strengthened by the evidence presented next.

The term *kak-a (sikkat mē)* is translated by Salonen as "wasserabdichtende Fügelnägel" ("treenails" used in connection with making the structure watertight), although it remains unclear why the nails are

³⁷⁰ Salonen (1939, 142) translates *kak-ma₂* as "Holznagel, Pflöck des Schiffes."

³⁷¹ Salonen 1939, 99.

³⁷² This technique is called pegged mortise-and-tenon joints that ensure a very rigid and strong hold between adjacent planks. A similar kind of edge-joining technique was used in Uluburun ship (fig. 12).

³⁷³ Hornell 1930; 1946, 217; Le Baron Bowen Jr. 1956, 285; Greenhill 1995, 54.

wasserabdichtende" ("water-proofing").³⁷⁴ The term is used in the Gilgamesh epic (XI 63) in a passage (in Akkadian): "GÍŠ^{MEŠ}sikkat^{MEŠ} me₅^{MEŠ} ina qabli-ša₂ lu am-has-si," translated by Salonen: "Ich schlug in die Arche, d.h. in die Plankenfügen der Arche wasserabdichtende Fügenägel," ("I drove treenails into the planking seams of the ark").³⁷⁵ It is possible that this refers to the practice used in the Arabian Gulf where the sewing holes are plugged with treenails, discussed earlier in section 6.1 (p. 55).³⁷⁶ On the other hand, the passage above states that the treenails were driven into the planking seams. Perhaps the best interpretation is that the text refers to the use of obliquely driven treenails. This practice is referred to earlier in section 4.4 (p. 36).

Potts suggests that the large number of treenails might have been used to plug the holes caused by terredo-worms.³⁷⁷ Even if this practice was used, it seems that unlikely that the standardized number of treenails (e.g., 7200 treenails for a boat of 120 *gur*) were allotted to this purpose at the building phase.

Ger-ma₂ (girl-bi)

Another interesting term in Salonen's compendium is *ger-ma₂*. Salonen translates this term as "Schiffskrampen" ("ship's clamps") or "Fessel" ("shackle")

³⁷⁴ Salonen 1939, 100.

³⁷⁵ Salonen 1939, 100.

³⁷⁶ Hornell 1946, 235.

³⁷⁷ Potts 1997, 128.

and suggests it was used for edge-joining the planking together.³⁷⁸ The following numbers of *ger-ma₂* are listed for different sizes of ships: 10 *gur*, 35; 30 *gur*, 70; 60 *gur*, 150.³⁷⁹ The figure for a ship of 120 *gur* having only 75 pieces of *ger-ma₂* seems problematic in this context. Salonen suggests plausibly that there is an error in the listing and perhaps 300 pieces of *ger-ma₂* was meant here. Parpola translates *ger-ma₂* as "foot wood."³⁸⁰ Perhaps these items were used for the lower part of the hull.

Certain terms, listed in Hh IV (254-5, 403), translated by Parpola, might give us additional clues to the possible edge-joining methods used in Mesopotamian ships: *má*: "wooden clamps," "*gír-a-šà-ga*".³⁸¹ "wrestler's clamps," and *gír-zag-gi₄-a*: "foot fetters." Since these terms are listed in a "dictionary" without a context, their interpretation remains speculative.

Ti-ti

Ti-ti appears among the ship parts listed in Hh IV: 370. Parpola and Römer translate the term as "ribs" or "sides" of the ship.³⁸² In a text passage (CT 17, 25, 32//33) the sore ribs in a body of a suffering person are compared with those of an old ship: "demon wrecking the ribs [*tí-tí*] as if they were those of an

³⁷⁸ Salonen 1939, 101.

³⁷⁹ Appendix 8.3: AO 5673.

³⁸⁰ Appendix 8.3: AO 5673, I 23.

³⁸¹ Appendix 8.3: Hh IV: 254, 403, 404.

³⁸² Appendix 8.3: Hh IV: 370; Römer 1993, 380.

old ship."³⁸³ This symbolic description of *ti-ti* does seem to point to the fact that at least some Mesopotamian boats might have had internal frames. It is unclear, however, whether these frames were connected to a possible central timber (keel plank) or whether the different framing elements were connected to each other. Perhaps the author of the passage above saw a ship in an early building phase when the outer layer of planking had not been installed. In this respect the picture of a *gajjarije* in an early stage of construction (figs. 3 and 4) becomes interesting. All this points to a skeleton-based construction, which is certainly contradictory to what we know of the evolution of ancient shipbuilding techniques. It is also possible, although perhaps less likely, that the symbolic description above refers to the framework of "ribs" inside a finished hull, installed after the completion of the shell of planking.

U_3 (\dot{u})

Salonen translates u_3 as "Seitenplanken" ("outside hull planking").³⁸⁴ The following quantities of u_3 are mentioned for different sizes of boats: A 120-*gur* ship had 43 pieces of u_3 , whereas a 90-*gur* ship had 36, and a 60-*gur* ship 27. Salonen also notes the use of four-meter long planks for the building of a 60-*gur* ship in text ITT V 6998.³⁸⁵

³⁸³ Appendix 8.3: Passages. The term is also used in connection with wagons or chariots; Powell (1993, 114) translates *ti mar* as "ribs" for a cart or wagon in Presargonic texts.

³⁸⁴ Salonen 1939, 90.

³⁸⁵ Salonen 1938, 15.

Ad-uš

Klein's translation of a passage from Shulgi R provides a meaning for the term *ad-uš*: "According to your alongside beams, you are a warrior, who is set straight against another warrior."³⁸⁶ Römer,³⁸⁷ Klein,³⁸⁸ Parpola,³⁸⁹ and Salonen³⁹⁰ translate this as the "longside beam" of the boat. It seems that stringers or longitudinal support timbers are meant here.

A-ra and a-da

A-ra is always mentioned among the first terms in lists of shipbuilding parts (e.g. AO 5673, Erm 15259, Erm 4031). The number of *a-ra* varies between 6 and 12, depending on the ship size category.³⁹¹ Salonen translates *a-ra* as "Bugplanken" ("bow planking") or "die gegen das Wasser schlagenden Planken" ("planks striking the water").³⁹² In the texts studied here (e.g., AO 5673), *a-da* is mentioned immediately after *a-ra* and its quantity is eight for the 120, 60, and 30-*gur* categories and four for the 10-*gur* category. *A-da* is translated as "Heckstücke" ("stern planking") or "die ans Wasser angrenzenden Planken"

³⁸⁶ Klein 1990, 105; see also section 7.2 (p. 75).

³⁸⁷ Römer (1993, 384) translates the term as "Längsseite-Balken."

³⁸⁸ Klein 1990, 105.

³⁸⁹ Appendix 8.3: Hh IV: 364.

³⁹⁰ Salonen translates the term as "Langseite des Schiffes." In his study of Mesopotamian land vehicles Salonen (1951, 102) translates the term *ad-uš* as a timber used for strengthening the joining of a chariot's axle into the chariot's body.

³⁹¹ Appendix 8.3: AO 5673; Salonen 1939, 89.

³⁹² Salonen 1939, 89; 1938, 13. See also Casson's (1967, 288) comments supporting Salonen's translation of *a-ra* and *a-da*.

(planks confining the water" by Salonen.³⁹³ Casson concludes: "the nomenclature 'bow planks', 'stern planks' - and the quantities give the strong impression that these craft were made with square bow and stern. Such a shape was common in Egypt and Mesopotamia."³⁹⁴ Although it seems that certain riverboats as described in texts above had a square bow and stern, we should not take this to mean that all Mesopotamian boats were built according to this general design. The shape and construction would have been different for oceangoing vessels.

Tu-gul and nig₂-KA

It is noteworthy that the term *tu-gul* is listed as a single part following the listing of the pieces of *a-ra*.³⁹⁵ Salonen translates *tu-gul* as "Stevenverstärkung, -schutz" ("cover for the stem").³⁹⁶ Perhaps this term defines a timber that provided strength for the bow construction and protected the hull when it was hauled ashore. Salonen translates another term *nig₂-KA* as "Verstärkungsbodenspannen nahe dem Bug" ("strengthening frame" or "knee" near the bow).³⁹⁷ The largest class (120 *gur*) has five of these parts and the 60 and 30-*gur* classes has four of

³⁹³ Salonen 1939, 89; 1938, 13. Parpola (Appendix 8.3: AO 5673: II 36) translates the term as "beam."

³⁹⁴ Casson 1967, 288.

³⁹⁵ Appendix 8.3: AO 5673: I 7. It is noteworthy that *tu-gul* is only mentioned with ship sizes 120 and 60 *gur*, but not in the smaller categories.

³⁹⁶ Salonen 1939, 96.

³⁹⁷ Salonen 1939, 88.

them, as listed in AO 5673.³⁹⁸ If the Mesopotamian riverboats had a square bow and stern, these kinds of knees would have been needed to connect the end construction with the bottom that was perhaps flat. Native Iraqi boats with square sterns supporting a pier structure are shown in figure 40. Another kind of square-ended cargo vessel called "Schachtur" used on the Euphrates is shown in figure 41.

Me-dim₂ and ma₂-gu₂

The term *me-dim₂* is translated by Salonen as "Reling" ("uppermost side planks").³⁹⁹ Two pieces of *me-dim₂* are listed for a single vessel in AO 5673: I 12.⁴⁰⁰ In this case it is uncertain whether these planks extended from one end of the vessel to the other. For a full length run the planks would have needed to have a considerable length.

Me-dim₂ is followed by the term *ma₂-gu₂* in AO 5673 and their quantity is ten for the largest 120-*gur* class and eight for the other classes.⁴⁰¹ Salonen translates *ma₂-gu₂* as "Längsversteifungen des Innenschiffes" ("longitudinal strengthening timber").⁴⁰² This translation seems convincing as the term is also used in the context of preparing "long timbers" for shipbuilding in text VAT 4871:

³⁹⁸ Appendix 8.3: AO 5673: I 16, II 9, III 7.

³⁹⁹ Salonen 1939, 91-2. Two pieces of *me-dim₂* are mentioned for a single boat. "Sheerstrake," i.e., the top strake of planking, might be the most logical translation for the term here.

⁴⁰⁰ Appendix 8.3: AO 5673.

⁴⁰¹ See Appendix 8.3: AO 5673: I 13-4.

⁴⁰² Salonen 1939, 94.

10.⁴⁰³ If we take *ad-uš* to mean stringers, perhaps *ma₂-gu₂* points to additional support timbers running longitudinally at the bottom of the hull. Such timbers are shown in figure 2, showing the hull of the *gajjarije*.

Hum

According to Klein, *hum* refers to the "crossbeam (or thwart)" of the boat, and it had the same function in connection with wagons.⁴⁰⁴ It was also used as a bench; in Shulgi R a passage, translated by Klein, describes the use of the *hum*: "According to your bench, you are a lofty dais, erected in the midst of the Abyss."⁴⁰⁵ Römer translates the term as "Ruderbank" ("rudder bench").⁴⁰⁶ Salonen translates *hum* as "Versteifungsbalken, die von Bordrand zu Bordrand laufen" ("strengthening timber" running across the hull).⁴⁰⁷ He also refers to an informative Sumerian passage (ITT V 6764), where the delivery of a 4.5 meter long *hum* timbers is recorded.⁴⁰⁸

A sailing boat model from Uruk shows very clearly a bench that is in the middle of the boat's hull (fig. 31).⁴⁰⁹ Another seat is shown in a boat model

⁴⁰³ Salonen 1939, 94.

⁴⁰⁴ Klein 1990, 115.

⁴⁰⁵ Klein 1990, 115. See also section 7.2 (p. 75) in this study. Parpola (Appendix 8.3: Passages) translates the same passage: "as to your bench, you are a throne (?) set on an exalted throne-dais in the middle of the sea."

⁴⁰⁶ Römer 1993, 384-5.

⁴⁰⁷ Salonen 1939, 94-5.

⁴⁰⁸ Salonen 1939, 95.

⁴⁰⁹ De Graeve 1981, pl. XLV, fig. 103.

fragment from Babylon recorded by De Graeve.⁴¹⁰ It seems that this “high seat” in the middle of the vessel can be identified with the term *hum*. It is difficult to ascertain the function of this high seat in Mesopotamian ships. It is possible that it was only used in a cultic context but it might have also served as a lookout platform.

Šu-dim₂

No definite translation is given for the term *šu-dim₂*. It seems to point to general shipbuilding timber that did not have any specific length.⁴¹¹ *Šu-dim₂* was generally made of fir. A Sumerian text (ITT V 6998) mentions 30 hewn fir trunks each having a length of ca. 4 m.⁴¹² Although this term is not mentioned in texts listing the general boat parts (e.g., AO 5673, Hh IV), it appears in an interesting context in Shulgi R. Klein's translation of the following passage from the hymn gives us a clue as to the purpose of this term: “According to your timbers [*šu-dim₂*], you are a *sniffing* mus-sa-tur-serpent, crouching on its paws.”⁴¹³ According to Klein, the serpent should be viewed as “a monstrous and poisonous serpent, which was artistically depicted as having horns and paws.”⁴¹⁴ A possible answer

⁴¹⁰ De Graeve 1981, pl. XLIV, fig. 98.

⁴¹¹ Salonen 1939, 139-41. According to Glanville (1932, 9-10), the imported “š wood, frequently mentioned in Egyptian texts, denotes ship timbers trimmed and “ready-or-use,” instead of a particular kind of wood species.

⁴¹² Salonen 1939, 140, 142.

⁴¹³ Klein 1990, 103; see also section 7.2 (p. 74) in this study.

⁴¹⁴ Klein 1990, 113, no. 12.

as to the purpose of *šū-dim₂* can be found in modern practices of the Arabs, described by Le Baron Bowen:

The Arabs have a strange way of beaching a boat. All the dhows, that I have seen are provided with large iron rings along the gunwale; the number of rings increases with the length of the boat. On a 30-foot boat there may be only two on each side; on a 60-foot boat there may be as many as six on a side. The boat is run in as high as possible on the beach at high water; as the tide recedes the boat's keel soon comes to rest on the flat bottom. When the craft first rests firmly on the bottom the crew run around and drop poles over the side so that they are resting on the bottom and lash these to the rings along the gunwale. The poles have a little cross peg at the top to keep the rope lashing from slipping. When the tide has completely receded the vessel stands upright, looking like a many-legged bug that might have crawled out of the sea.⁴¹⁵

Based on the description above, I propose that this term might represent such poles used to support a vessel upright at low tide.

Gú-sig₄ má (e-se-en-se-ri)

Both Parpola⁴¹⁶ and Salonen⁴¹⁷ translate *gú-sig₄ má* as a "keel" of a boat. In Hh IV the term is mentioned immediately after *tí-tí*, which refers to "ribs" of a boat. The above translations for *gú-sig₄ má* should probably be taken as references to a keel plank providing structural strength to the hull and serving as a connecting surface for garboards. There doesn't seem to be a reference to keel in other texts studied here. We have to remember that Hh IV is a kind of nautical

⁴¹⁵ Le Baron Bowen 1949, 105.

⁴¹⁶ Appendix 8.3: Hh IV: 371. Parpola gives the term a general meaning of a "backbone/spine of a boat."

⁴¹⁷ Salonen (1939, 83-4) uses the term *gu₂-mur₇-ma₂* that is the same as *gú-sig₄ má*.

dictionary and it would, therefore, list parts of all kinds of boats and ships, including riverine and oceangoing ships.

8 CONCLUSIONS

Conclusive evidence on what third millennium B.C. Mesopotamian ships looked like and how they were constructed is difficult to obtain. In this study I have attempted to summarize known evidence and studies from different fields to form a general picture on the subject. Textual material from the third millennium B.C. provides an enormous area of study that, if combined with iconographic, ethnographic, and archaeological evidence, can reveal significant and detailed information on Mesopotamian ships. The texts speak of a complex and well-organized practice of trade on the Euphrates and Tigris Rivers where boats of wooden construction were employed.

It is clear that wood was used extensively in the building of Mesopotamian ships in the third millennium B.C. Although this wood was imported from the north via the Rivers Euphrates and Tigris as well as from the south via the Arabian Gulf, domestically grown wood also had an important role. The use of wood in vessels in the Arabian Gulf trade seems evident although the employment of reed watercraft, perhaps confined to coastal use, cannot be excluded.

Bitumen, available in large quantities, was an essential raw material for Mesopotamian shipbuilding and was used primarily for caulking the hull. Perhaps the availability and use of this versatile substance resulted in a shipbuilding tradition with unique characteristics. The use of bitumen might have allowed the Mesopotamian shipwrights to build hulls, in which watertightness (before the application of a bitumen layer) was not the primary concern.

Based on iconographic evidence, it seems that Mesopotamian riverboats had flat bottoms and high curving ends, with a stem often ending in an elaborate design. The cultic vessels imitated the shape of a papyriform vessel. The riverine vessels in practical use described in texts, such as AO 5673, probably had square ends. This shape was most likely well suited for the purpose of cargo carrying. Perhaps it also was simply easier to build. Unfortunately the texts studied here do not contain detailed descriptions of oceangoing vessels. Based on literary evidence and a few depictions on seals it seems that the square sail, equipped perhaps with a boom, was most probably used on oceangoing ships of the Arabian Gulf. Whether these ships were built primarily in Mesopotamia or in other regions, such as the Indus Valley remains an open question.

There were several power shifts between the areas of Mesopotamia, Dilmun, Magan and Meluhha in the maritime trade of the third millennium B.C.⁴¹⁸ From the evidence it appears that Meluhhan traders had an important role in the Arabian Gulf trade during the second half of the third millennium B.C. When Sargon of Agade opened trade channels in the Arabian Gulf, the ships of Meluhha, Magan and Dilmun were already active in the maritime trade in this region. That the ships of Meluhha are mentioned first in Sargon's statement may imply their relative importance.⁴¹⁹ It seems that the seafaring merchants of Dilmun, although perhaps owing much to Meluhhan trade networks, started

⁴¹⁸ The assumption here is that Dilmun referred primarily to Bahrain, Magan to Oman and the surrounding regions, and Meluhha primarily to the Indus Valley.

⁴¹⁹ Usually these regions are mentioned in the order of Dilmun, Magan and Meluhha referring to their geographical order viewed from Mesopotamia.

operating as increasingly important independent agents towards the end of the third millennium B.C.⁴²⁰

Although sewn construction has been dominant in the Arabian Gulf in recent antiquity (as evidenced by, e.g., classical writers), there is no conclusive proof that the situation was the same in the third millennium B.C. It seems evident that the vessels of the local people and those of the temple and the international merchants were made for different purposes using different resources and construction methods. It is likely that the boat designs and techniques used in the third millennium B.C. are no longer present in traditional boats of present-day Iraq. This might be also true of the construction of oceangoing vessels sailing in the modern day Arabian Gulf. Hornell notes that "after the passing of the city-states of the third millennium there is little evidence of a continuation of commercial intercourse with India by the sea route until somewhere about the dawn of the first millennium B.C."⁴²¹

It does not seem evident that sewing was the dominant edge-joining technique used in Mesopotamia proper. Although it is difficult to ascertain as to what degree the local shipbuilding was affected by the arrival of the Portuguese, the modern traditional boats built alongside the Rivers Euphrates and Tigris do not employ this technique. The Mesopotamian shipbuilding texts that list parts in a detailed manner, do not mention lashing except in connection with building a

⁴²⁰ Weisberger 1986, 138-9.

⁴²¹ Hornell 1941, 240.

raft. Despite the detailed listing of shipbuilding parts and their quantities, it is difficult to obtain exact information on other alternative fastening methods.

It is perhaps surprising that the traditional modern-day Mesopotamian riverboats, some of which seem to be clear descendants of the ancient vessels depicted in seals and boats models, do not employ edge-joining methods. Instead, they are built according to a technique where the planking is nailed to the frames. These "ribs" do not, however, form a strong internal framework that would clearly predetermine the hull shape. The bottom is first built independently before the sides are added.

In spite of the terms "backbone" and "ribs" mentioned in Hh IV (369-71) and the evidence presented by a boat model fragment from Ischali (fig. 14), it is unclear whether Mesopotamian ships had an internal framework consisting of a keel and closely set frames. It is probable that these vessels had a keel plank or a flat floor similar to certain traditional modern-day riverboats. Structural elements evident from the texts are beams and longitudinal strengthening timbers or stringers. It also seems clear that there were floor timbers and probably frames giving extra support to the hull. The identification of these terms among the array of Akkadian and Sumerian terms is left open for future research.

When examining traditional examples of Mesopotamian ships, the ancient-looking and bitumen-covered *gajjarije*, described by Ritter, gives us an interesting example of the potential survival of an ancient technique. The hull lines and structure of this ship are simple and it has straight "side frames" and

floor timbers, set against a flat bottom. It seems that this construction technique is a mix of the skeleton-first and shell-first techniques. The hull is built in stages whereby the bottom is built up first and the sides added. It is, therefore, difficult to say whether it is the internal structure or the hull planking that is determining the shape of the hull.

Although the sewn construction seems to have been dominant in the Arabian Gulf and common in the Indian Ocean, there are numerous examples of other edge-joining techniques in Pakistan, in the area where the ancient Indus Valley culture was located. These techniques make use of obliquely-driven treenails, clamps, and staples to join planking together. Some ancient representations from India show clearly that dove-tailed tenons were used in edge-joining.

The Mesopotamian textual evidence from the third millennium B.C. does not provide conclusive evidence as to which edge-joining methods, if any, were used. Perhaps the large numbers of treenails, listed in texts, could have been used for the following purposes: 1) treenails were driven into the sewing holes to plug them and to hold the sewing in place, 2) planks were edge-joined by treenails driven obliquely across the planking edges, or 3) treenails or pegs were inserted into holes drilled perpendicularly into adjacent planking edges. It is possible that both the sewing and other edge-joining methods, such as mortise-and-tenon joinery, obliquely-driven treenails and dove-tailed clamps were used side by side depending on the purpose of the ship, the availability of resources and materials, and even the nationality of the shipwrights. As discussed earlier

boats of several nationalities visited Mesopotamian ports and other nationalities. As shown by S. Parpola, A. Parpola, and Brunswig, residents from the Indus Valley settled in Mesopotamia and perhaps influenced the shipbuilding traditions.⁴²²

Based on the brief attempt at a reinterpretation of Mesopotamian shipbuilding terms in this study, I propose the following meanings for some of these terms: *eme-sig*, *me-re-za*, *dubbin*, *har*, *kak*, *ger-ma₂*, *ti-ti*, *u₃*, *ad-uš*, *a-da*, *a-ra*, *me-dim₂*, *ma₂-gu₂*, *hum*, *šu-dim₂*, *gú-sig₄*.⁴²³

<i>eme-sig</i>	frame ("rib") or part of it, fastened on the inside of the hull to keep the planking together
<i>me-re-za</i>	part used for edge-joining planks on the exterior surface of the hull; perhaps a dove-tailed clamp
<i>dubbin</i>	floor timber
<i>har</i>	wooden ring or clamp used for edge-joining planking together
<i>kak</i>	treenail or peg used possibly according to the technique of obliquely driven treenails
<i>ger-ma₂</i>	ship's clamp, used for edge-joining planks
<i>ti-ti</i>	general term for a "rib" or a frame
<i>u₃</i>	side plank
<i>ad-uš</i>	stringer
<i>a-da</i>	bow plank
<i>a-ra</i>	stern plank

⁴²² Parpola et. al, 1977.

⁴²³ For discussion and references regarding the translated terms, see section 7.3 (pp. 76-97). It should be noted that most of the following terms are from Hh IV, a kind of a nautical dictionary, that does not specify for what types of vessels the listed parts refer to.

<i>tu-gul</i>	cover for the stem
<i>nig₂-KA</i>	bow knee
<i>me-dim₂</i>	sheerstrake or gunwale
<i>ma₂-gu₂</i>	longitudinal strengthening timber, perhaps at the bottom of the hull
<i>hum</i>	bench; general meaning for a thwart or a beam
<i>šu-dim₂</i>	beaching pole, attached to the sides of the ship to support the vessel upright at low tide
<i>gú-sig₄</i>	keel plank

ABBREVIATIONS

AO	Antiquités Orientales, Louvre.
UET	Ur Excavations, Texts.
CT	Cuneiform Texts from Babylonian Tablets in the British Museum.
TCL	Textes Économiques D'Oumma.
WVDOG	Wissenschaftliche Veröffentlichungen der Deutschen Orientgesellschaft.
ITT	Inventaire des tablettes de Tello conservées au Musée Impérial Ottoman. I-V.
K	Kujunġik-Collection, British Museum.
VAT	Vorderasiatisches Abteilung der staatlichen Museen zu Berlin.
PDT	Die Puzriš-Dagan-Texte from der Istanbuler Archäologischen Musee.

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APPENDIX

Chronology

The following chronology, adapted from (Postgate 1992, 22), is used as a basis in this study.

Date B.C.	Period	
5000-4000	Halaf/Ubaid	<i>(Protoliterate period)</i>
4000-3200	Uruk	<i>(Protoliterate period)</i>
3000-2750	Early Dynastic I	<i>(Presargonic period)</i>
2750-2600	Early Dynastic II	<i>(Presargonic period)</i>
2600-2350	Early Dynastic III	<i>(Presargonic period)</i>
2350-2150	Dynasty of Akkad (Gutian interregnum)	
2150-2000	3rd Dynasty of Ur (Amorite interregnum)	
2000-1800	Isin-Larsa Dynasties	<i>(Old Babylonian period)</i>
1800-1600	First Dynasty of Babylon	<i>(Old Babylonian period)</i>
	Kassite Interregnum	<i>(Old Babylonian period)</i>

Figures

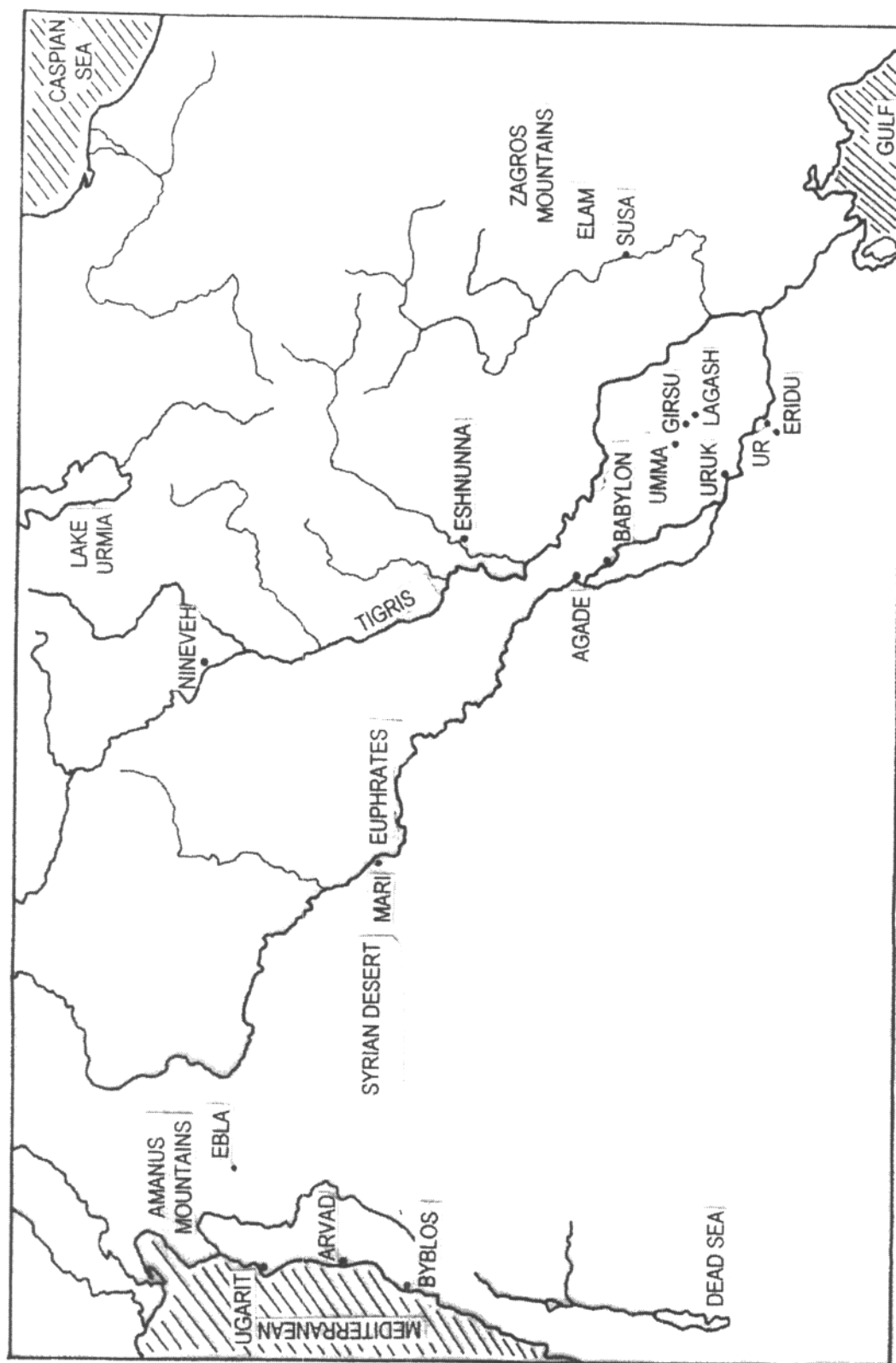


Fig. 1A. General map of the regions and places relevant to this study.

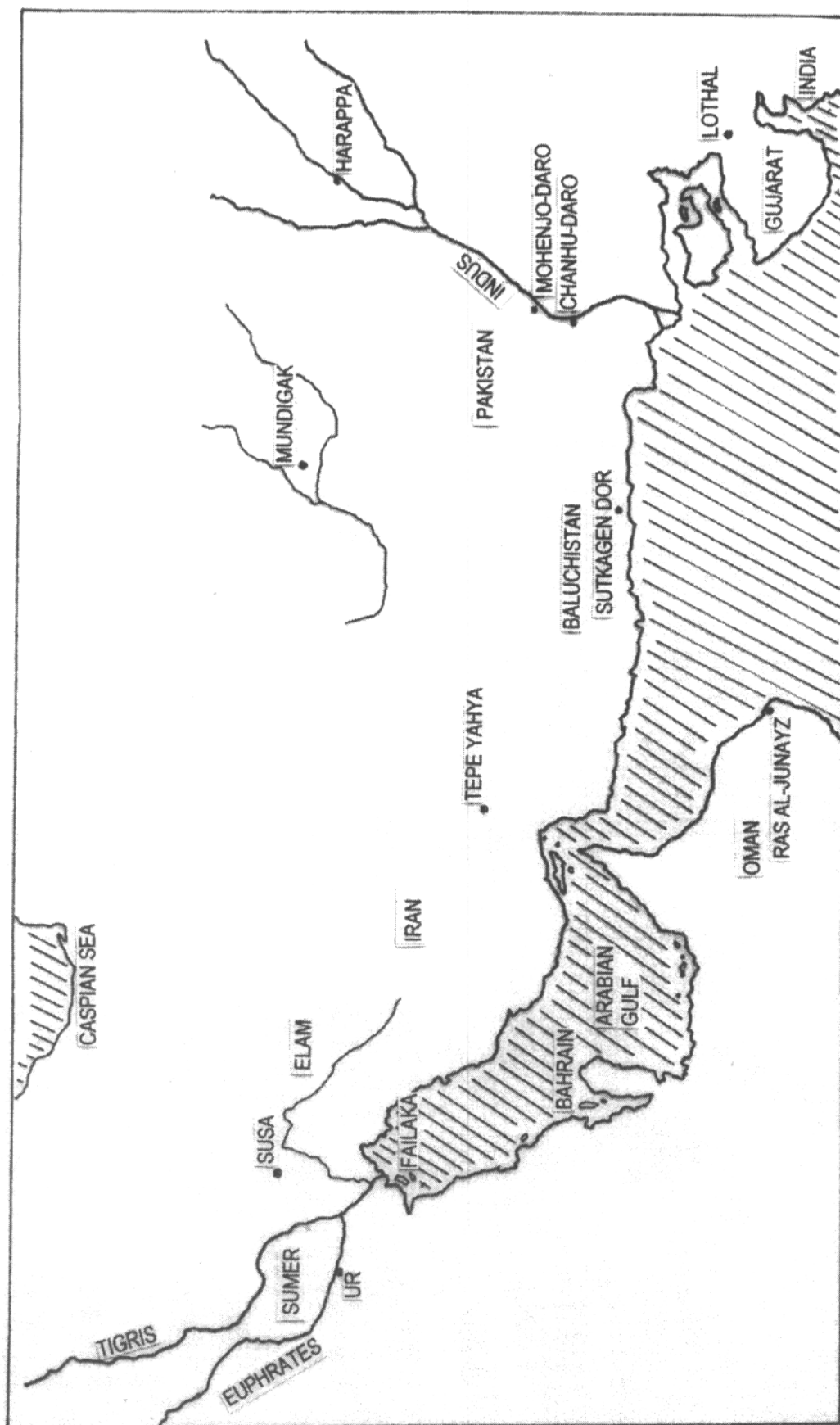


Fig. 1B. Map of the eastern regions and places relevant to this study.

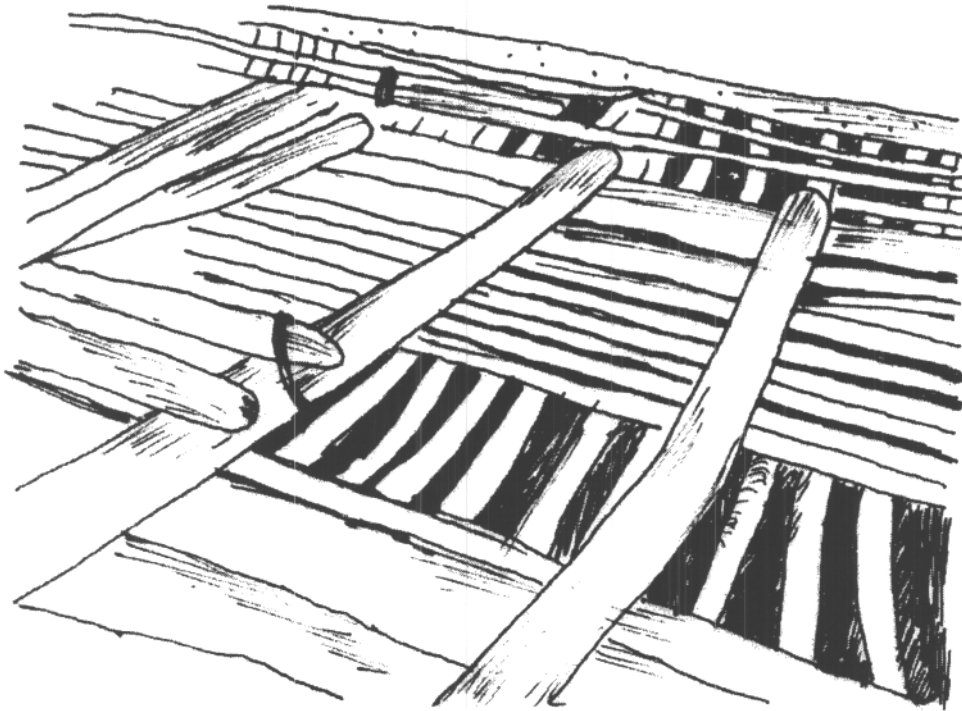


Fig. 2. Section of the inner construction of a *gajjarije*. (After Ritter 1919, Abb. 11)

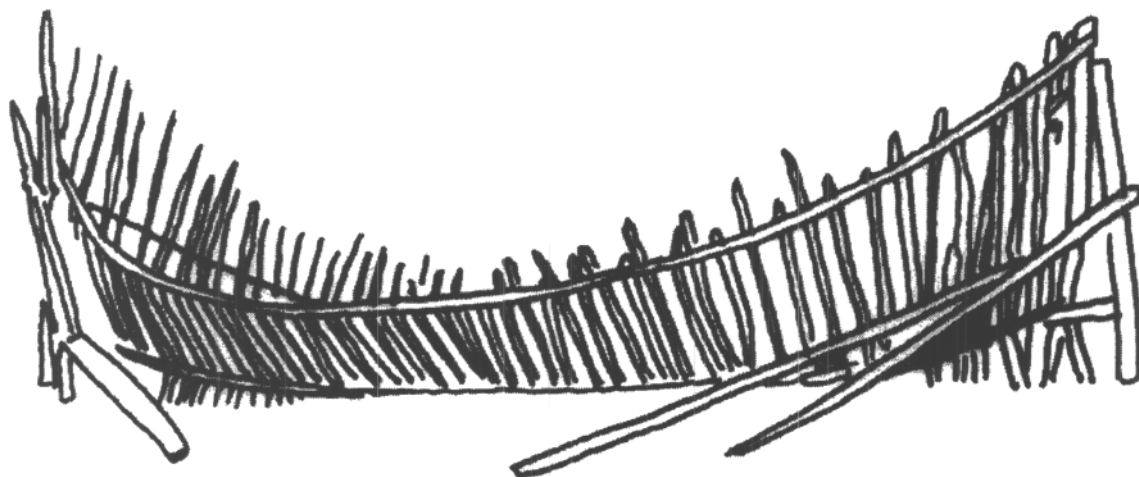


Fig. 3. *Gajjarije* at an early stage of construction. (After Ritter 1919, Abb. 16)

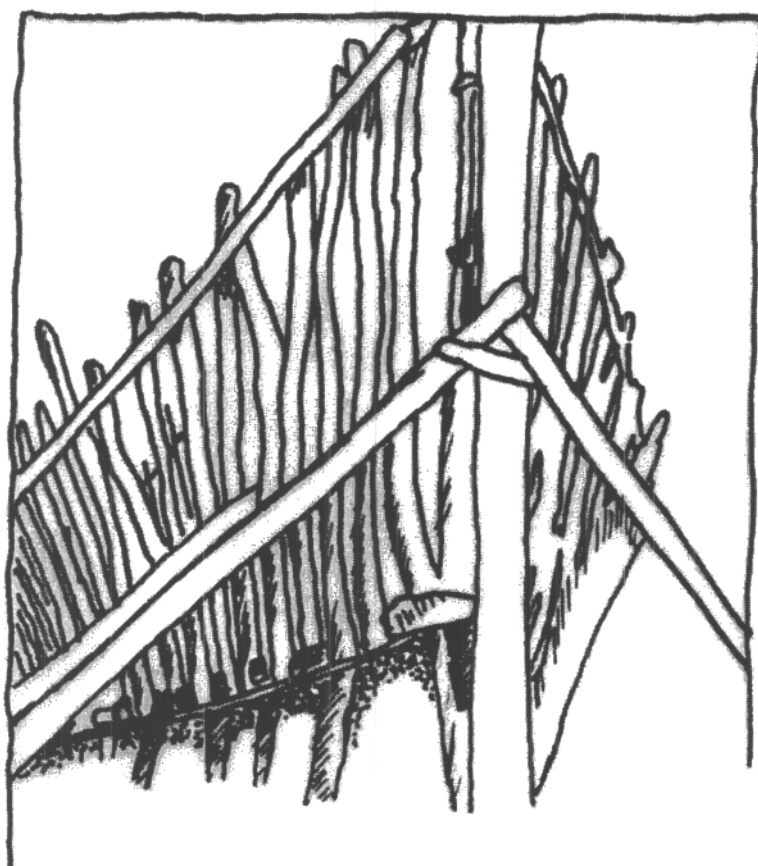


Fig. 4. *Gajjarije* at an early stage of construction - view from abaft. (After Ritter 1919, Abb. 15)

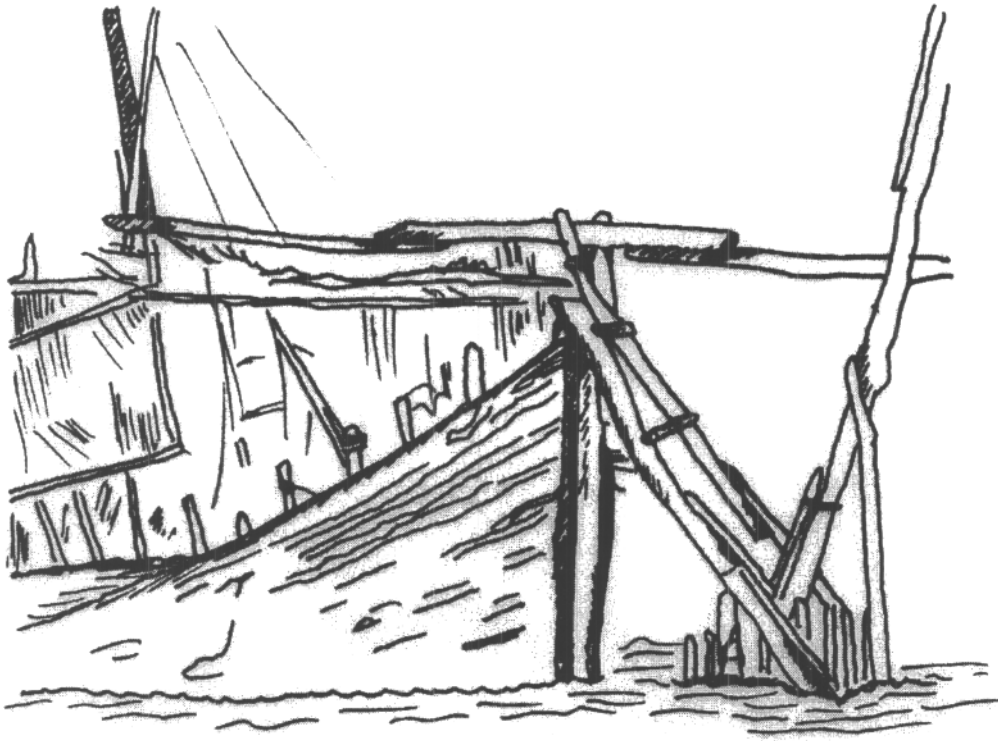


Fig. 5. Aft end of a *gajjarije* showing the complex steering mechanism. (After Ritter 1919, Abb. 18)

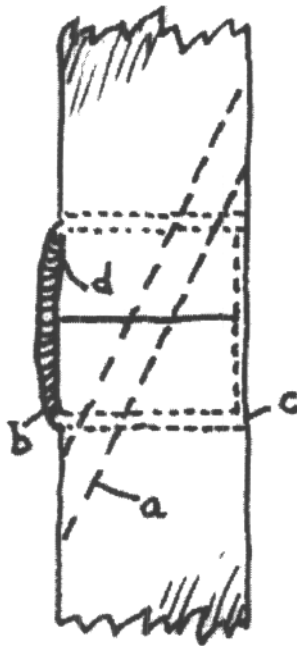


Fig. 6. Technique of obliquely driven treenails and a combination of lashing; a) treenail, b) lashing, c) channel for the lashing, and d) caulking. (After Le Baron Bowen 1956, fig. 3)

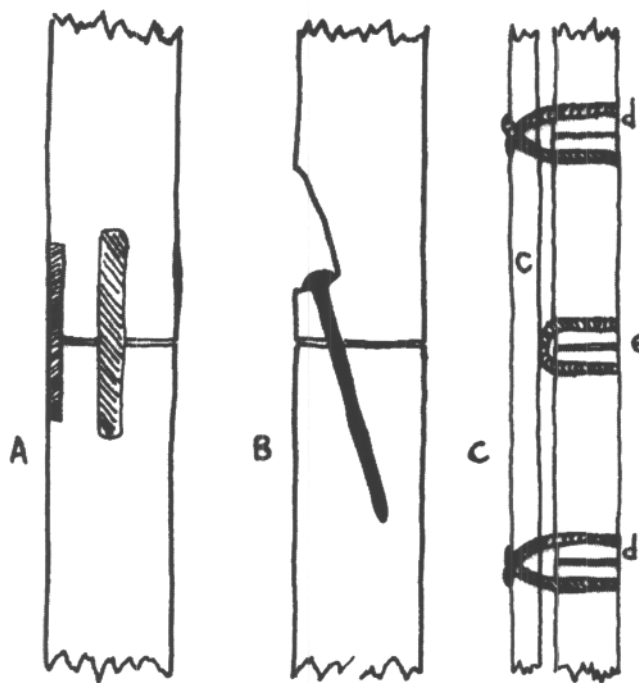


Fig. 7. Diagrams of three different edge-joining techniques: A) combination of an internal peg and a dove-tailed tenon; B) obliquely driven nail, with its head recessed used in Nubia and Sudan; C) sewing through holes in opposite sides (d, e) - the cross-frames (c) are secured in place under lashings used on the *mtepe* on the East African coast. (After Hornell 1946, fig. 29)

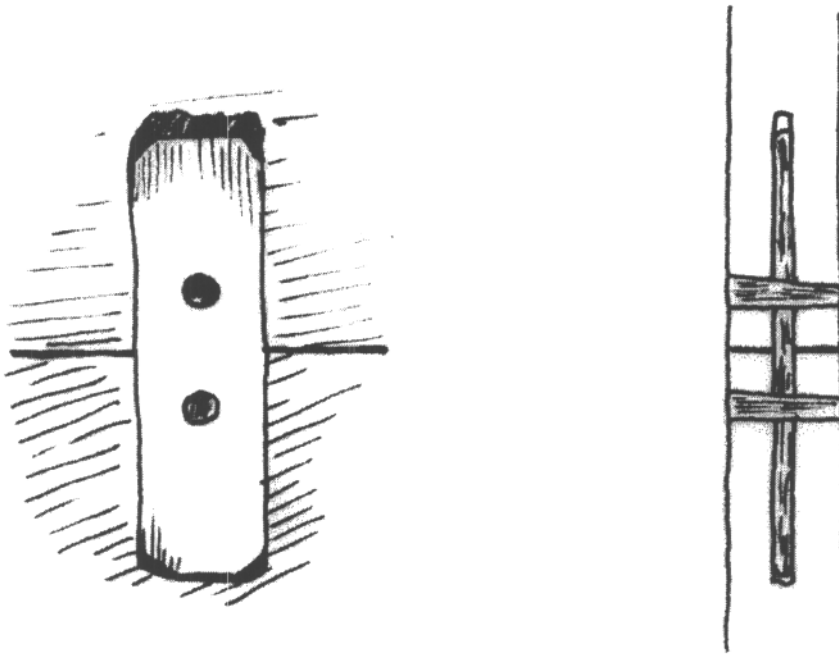


Fig. 8. Example of a mortise-and-tenon joint. (After Steffy 1994, fig. 3-26)

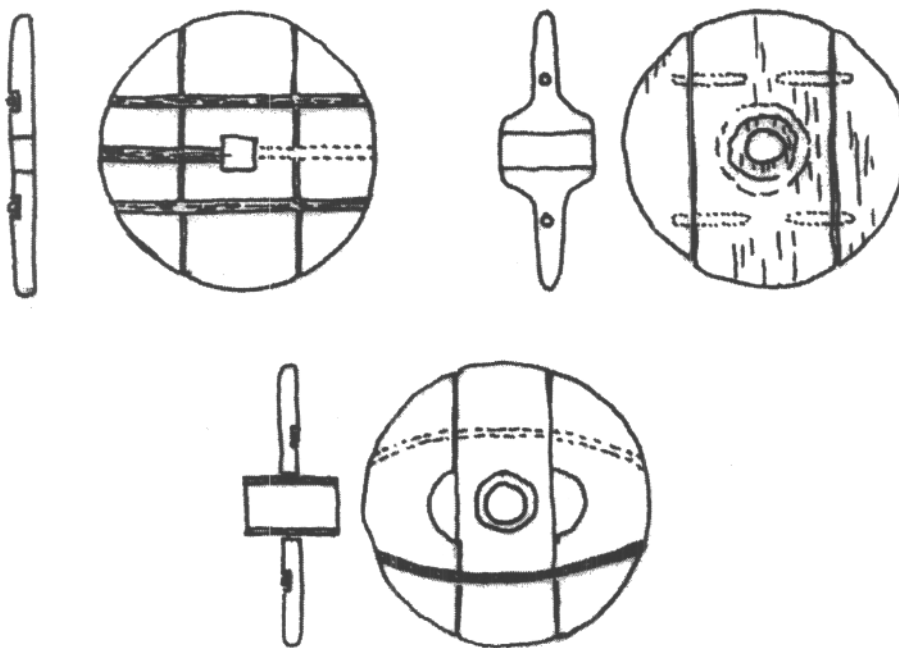


Fig. 9. Three different kinds of tripartite wheels with external securing battens and internal pegs. (After Piggott 1983, fig. 5)

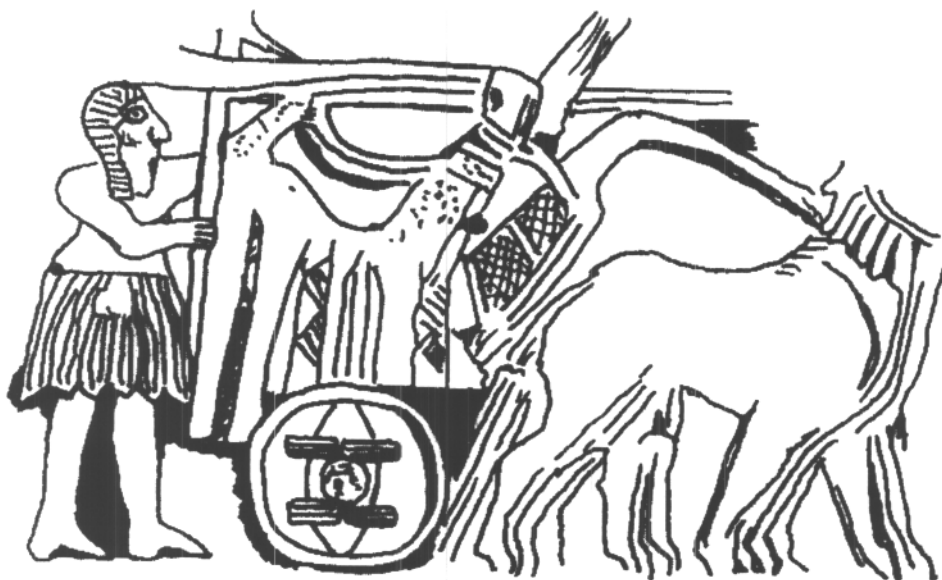


Fig. 10. Mesopotamian relief dating to ca. 3000 B.C., showing a cart with tripartite wheels. (After Hrouda 1991, 333)

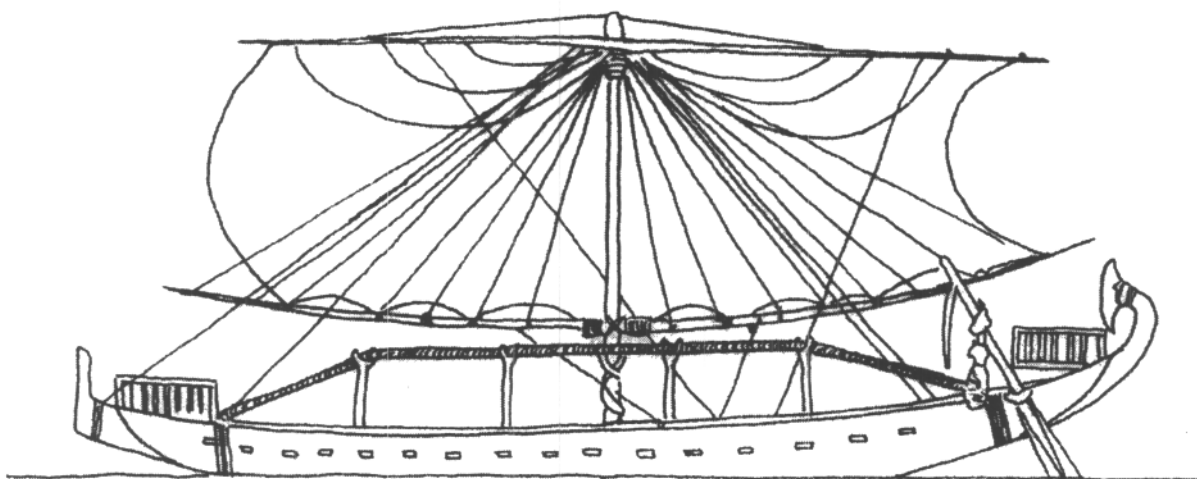


Fig. 11. Detail from one of Queen Hatshepsut's ships in the relief from Deir-el-bahri. (After Steffy 1994, fig. 3-6)

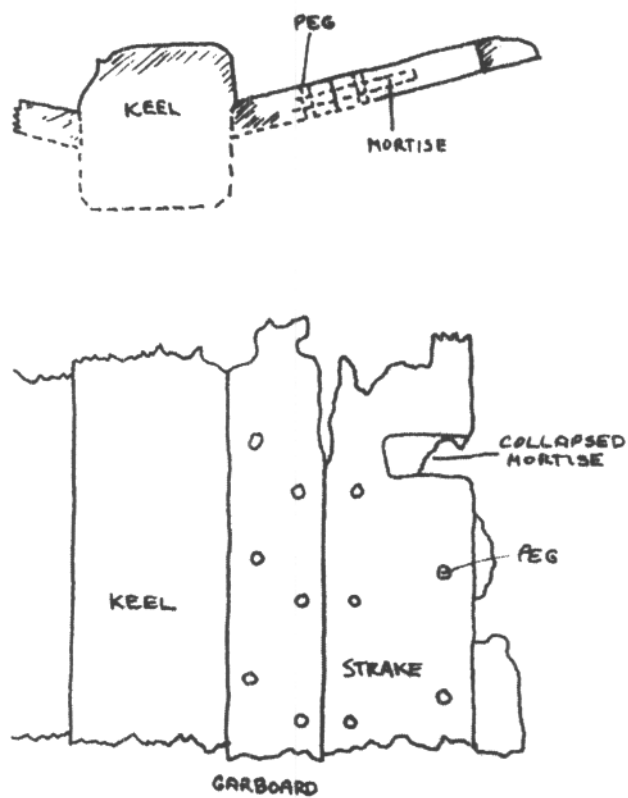


Fig. 12. Structural drawings showing features of the hull construction of the Uluburun ship. (After Pulak 1987, 130, Illus. 73)

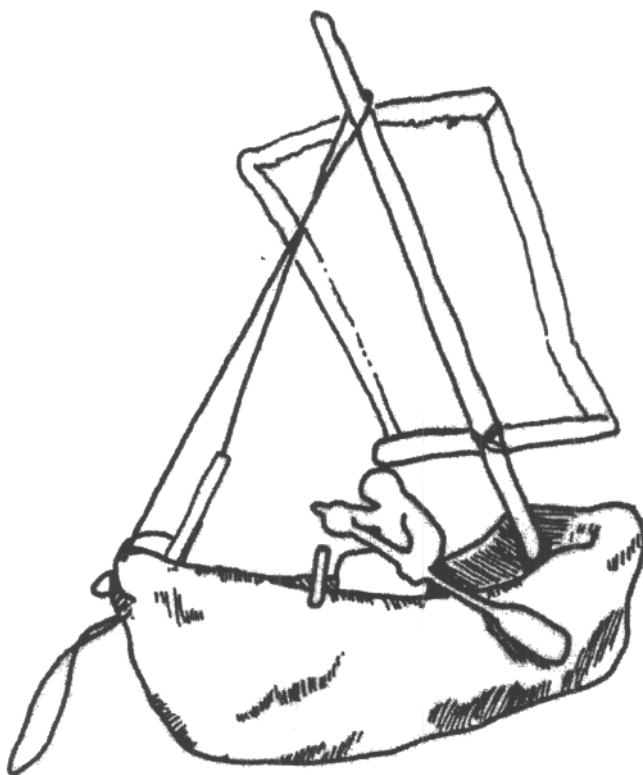


Fig. 13. Boat model of clay from Lothal. The reconstructed elements include a mast, a sail, and a human figure holding a paddle. (After Göttlicher 1978, Taf. 13, n. 178)



Fig. 14. Fragments of a boat model from Ischali, dating to 2200 B.C-1800 B.C., showing details of the internal construction. (After Göttlicher 1978, Taf. 7, n. 94)

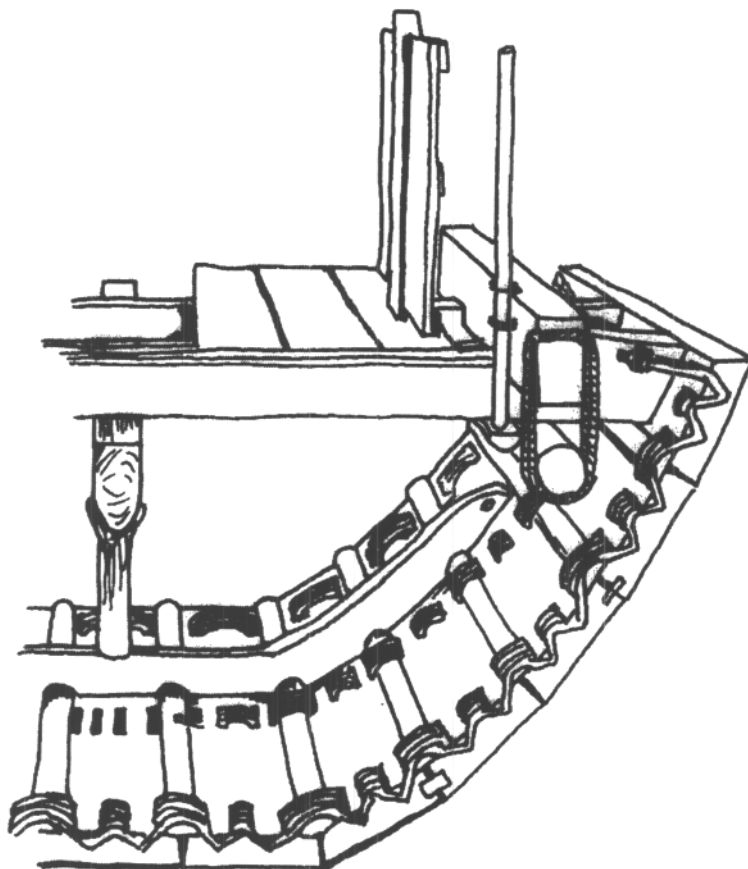


Fig. 15. Diagram (cross section) showing half of Cheops ship's hull. (After Lipke 1985, fig. 3.6)

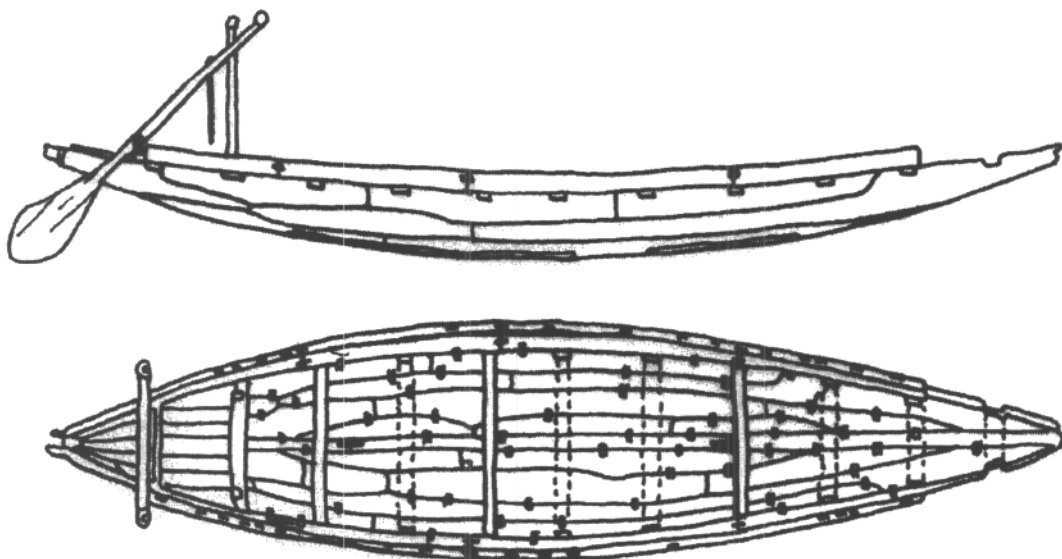


Fig. 16. Structural reconstruction of one of the Dashur boats found near the pyramid of Sesostriis III. (After Johnstone 1988, fig. 7.7)

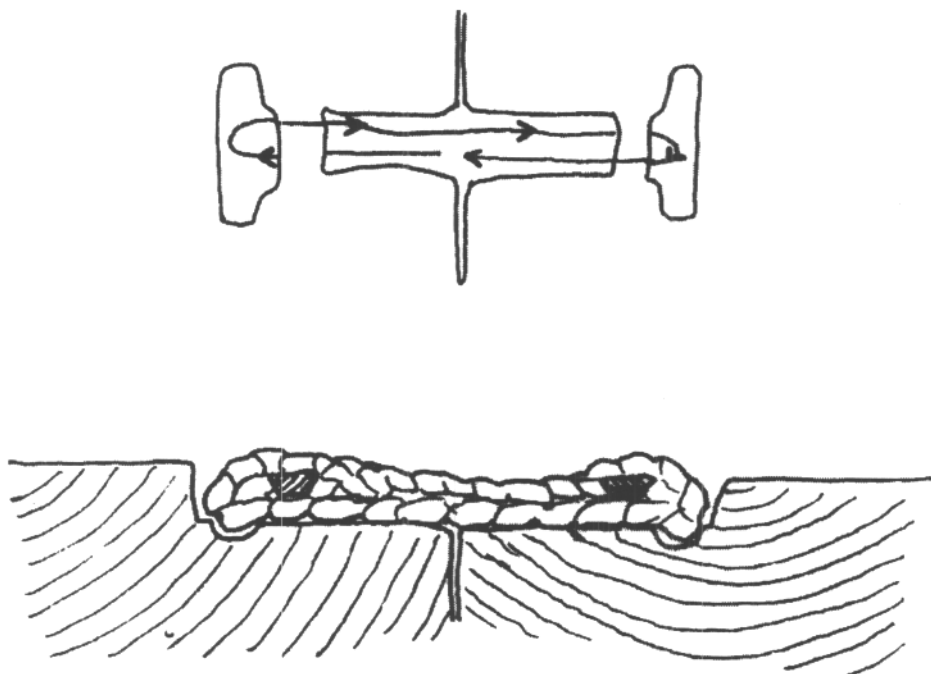


Fig. 17. Reconstruction of the ligatures used in the Dashur boats. (After Ward 2000, fig. 44)



Fig. 18. Sculptural representation of a boat carrying ascetics from Sanchi, India, dating to the first century B.C. (After Rao 1970, fig. 4)

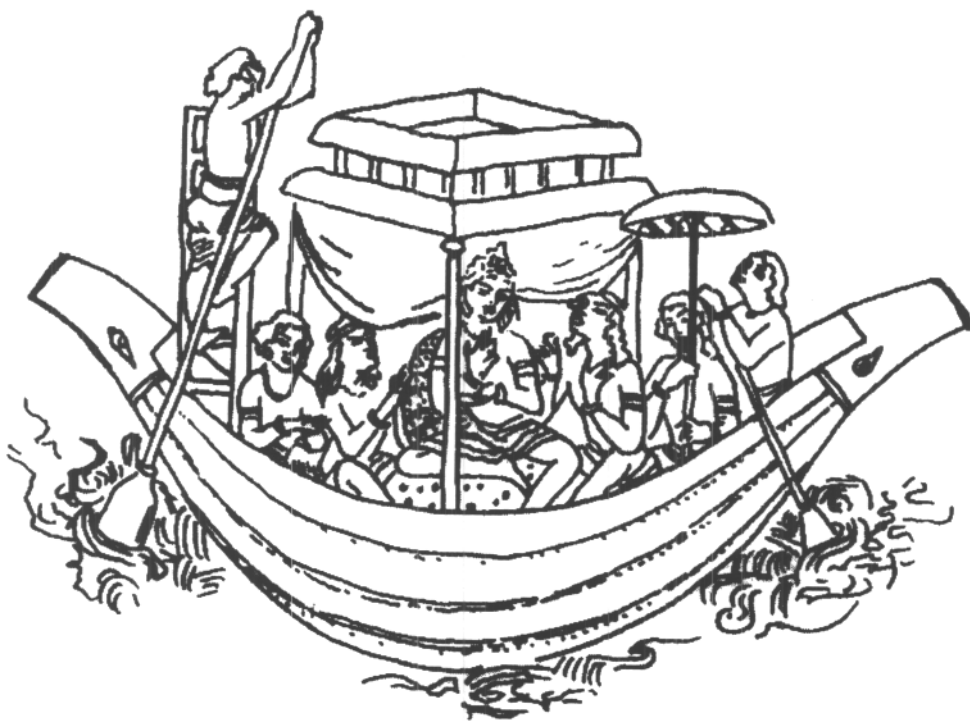


Fig. 19. Painting of a royal pleasure boat, dating to the 6th century A.D., from Ajanta, India. (After Rao 1970, fig. 3)



Fig. 20. Depiction of two boats on a medallion from Bharhut, India, dating to the second century B.C. (From Cunningham 1962, pl. XXXIV, no. 2)

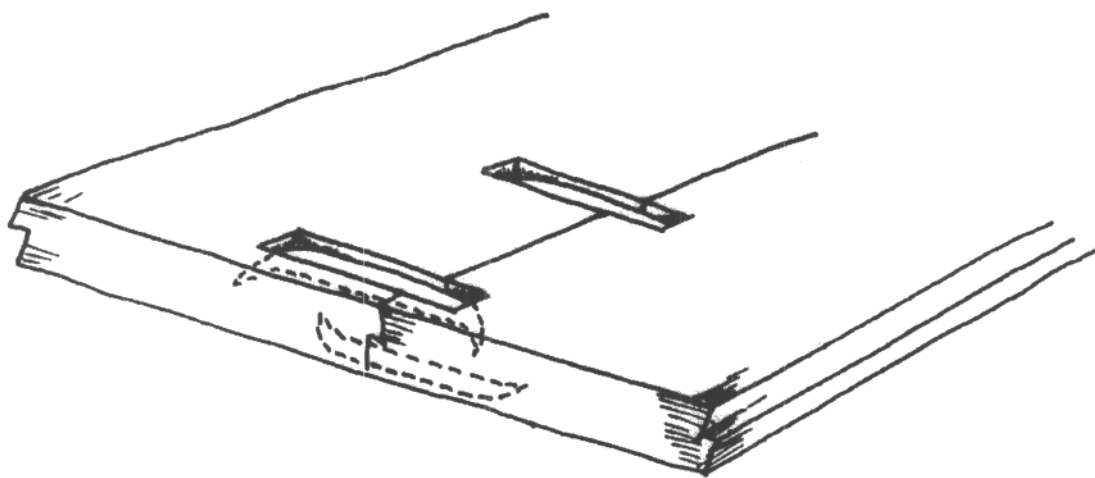


Fig. 21. Flat iron staple used in edge-joining of the planks of a riverboat in Bangladesh. (After Greenhill 1971, 76, fig. 1)

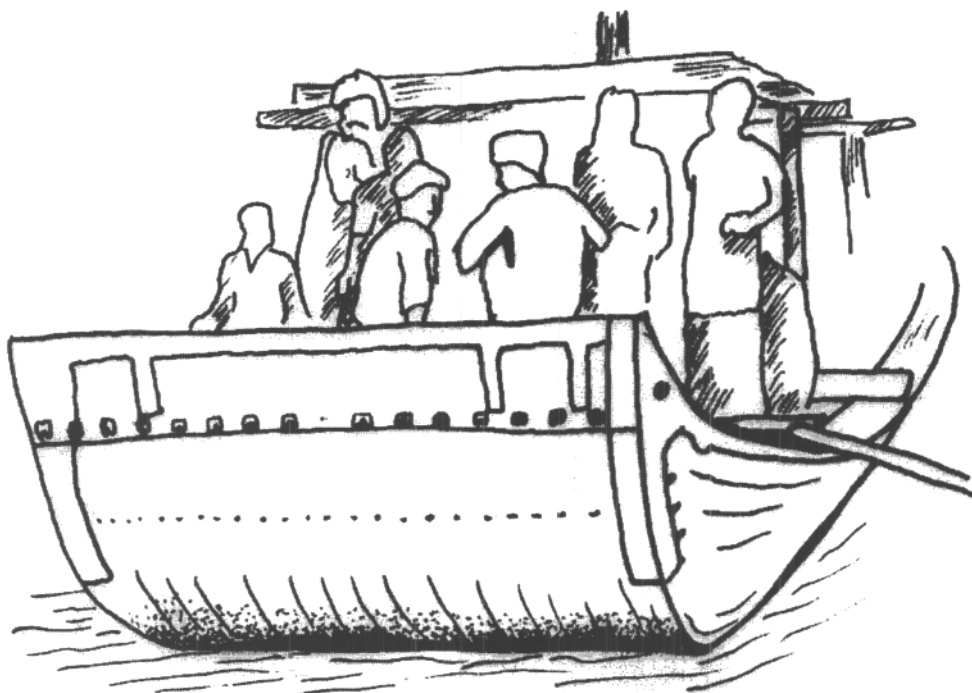


Fig. 22. Decorated front end of a *bohatja* used on the Indus River. (After Greenhill 1971, 159)

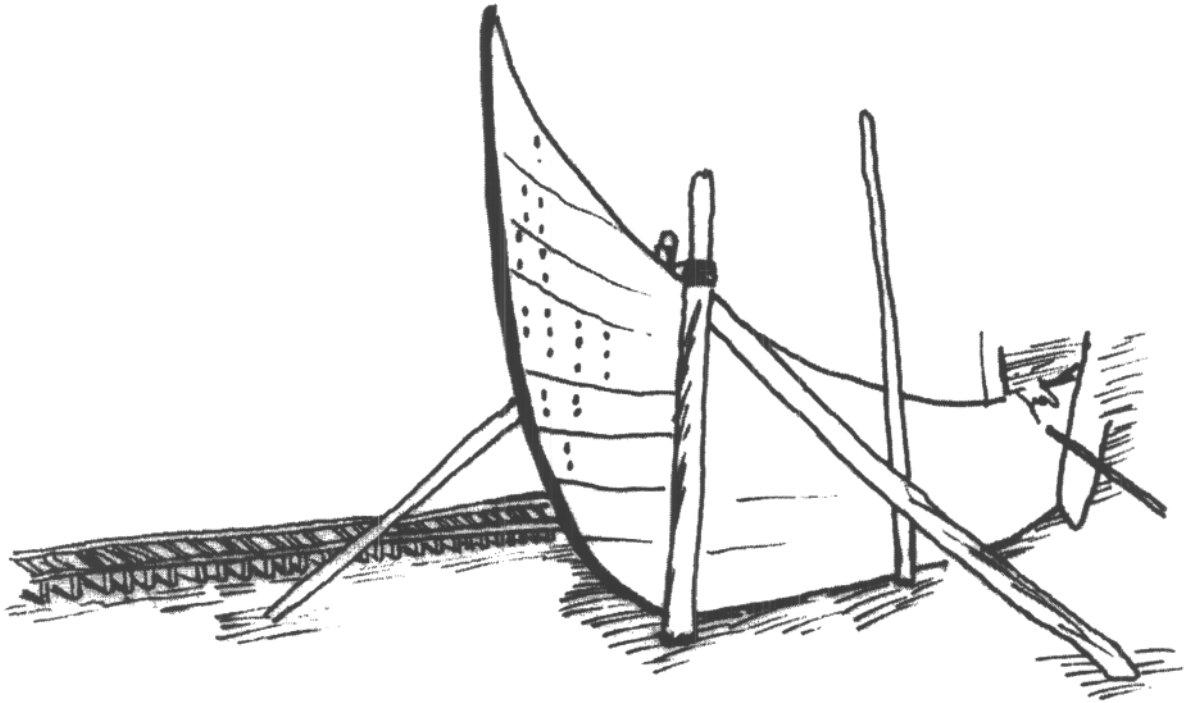


Fig. 23. *Bohatja* under construction with the completed side on the right and the bottom, consisting of floor timbers, visible on the left in the background.
(After Greenhill 1971, 159)

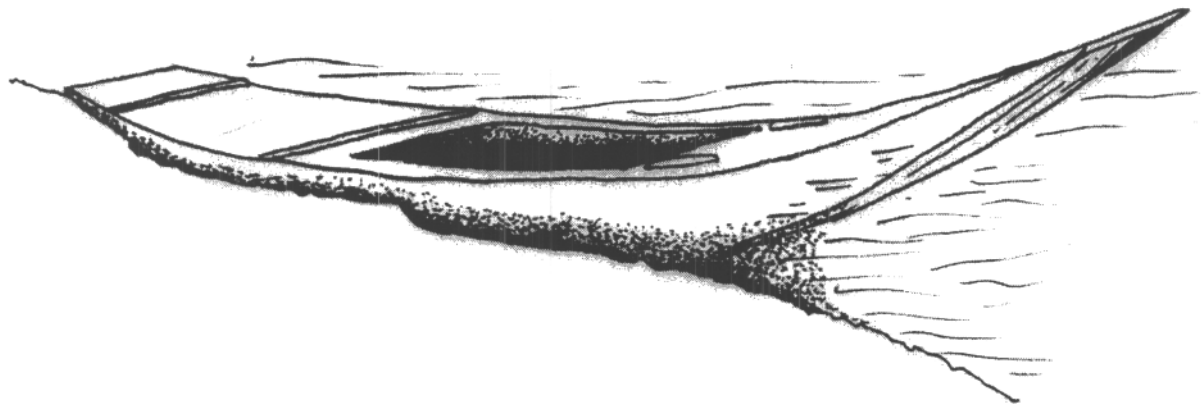


Fig. 24. Indus punt. (After Greenhill 1995, fig. 74)

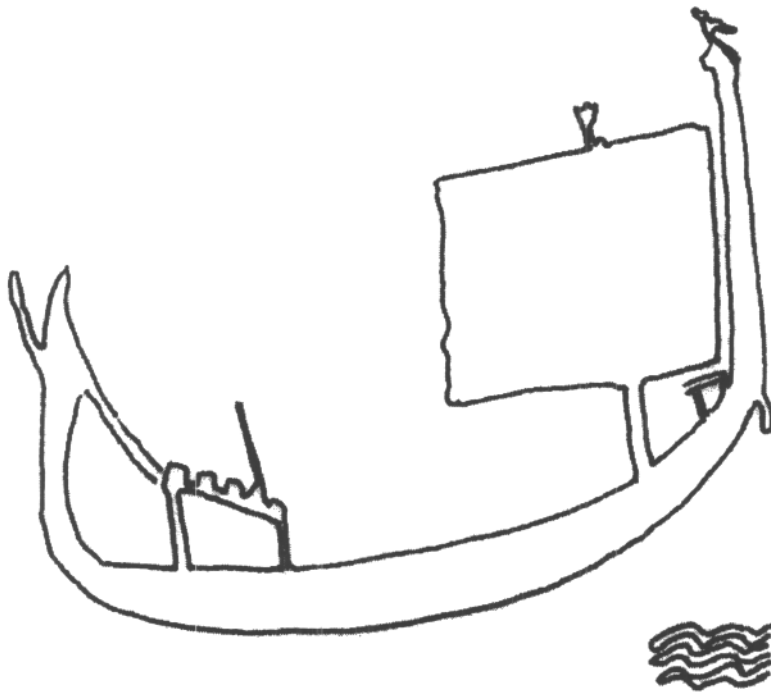


Fig. 25. Depiction of a rectangular sail on a Gerzean vase from Egypt. (After Barnett 1958, fig. 1)

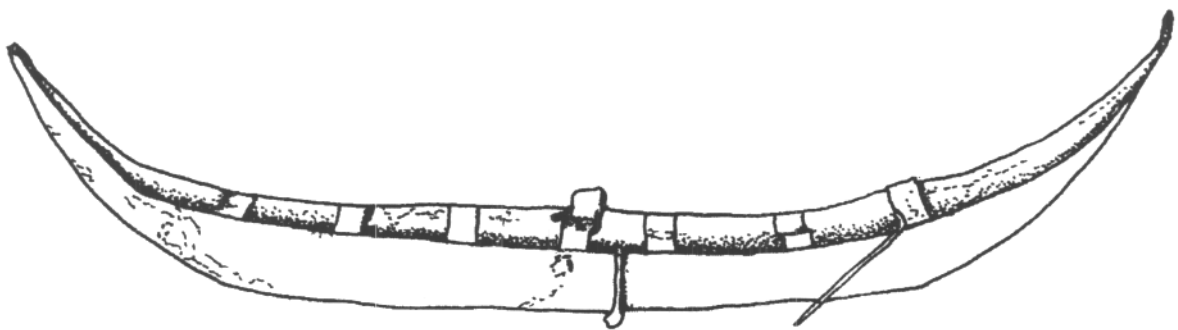


Fig. 26. Silver boat model from Ur, dating to ca. 2500 B.C. (After Göttlicher 1978, Taf. 6, n. 90)



Fig. 27. Cylinder seal depiction from Uruk, dating to ca. 3200 B.C. (After Salonen 1939, Tafel III, 2)

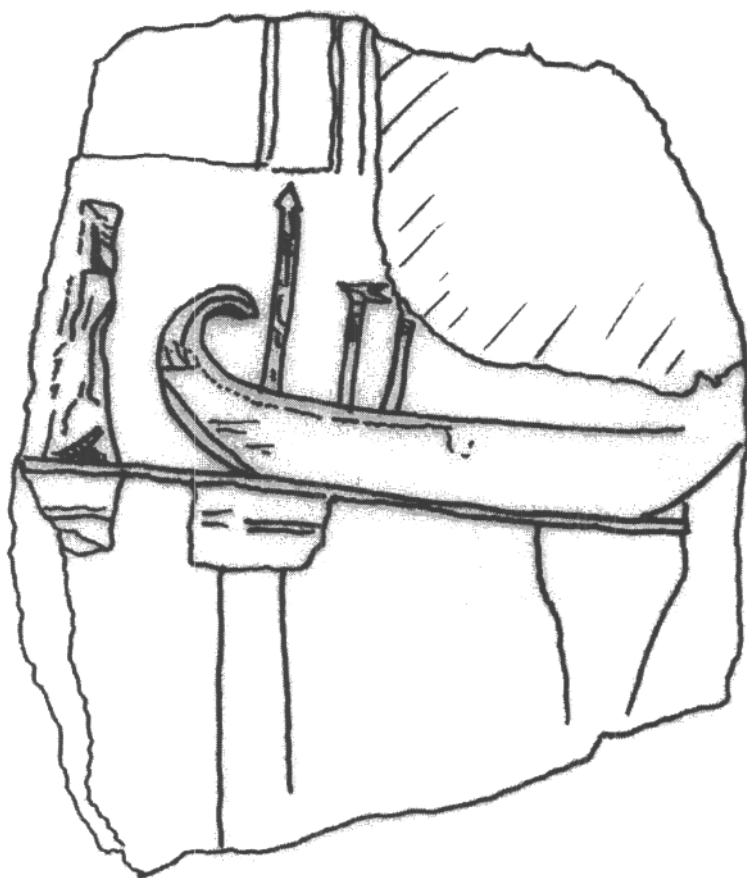


Fig. 28. Fragment of a Kassite stone block, dating to 1188-1174 B.C., showing part of a processional boat. (After De Graeve 1981, pl. VIII, no. 30)

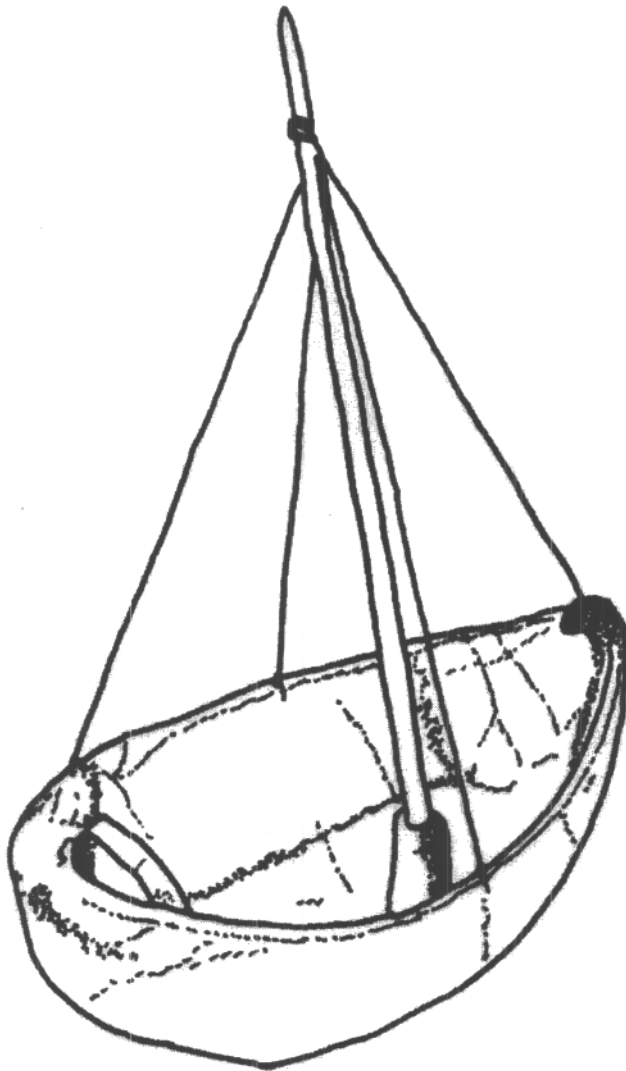


Fig. 29. Clay boat model from Eridu, dating to the fourth millennium B.C. (After
Göttlicher 1978, Taf. 1, n. 4)

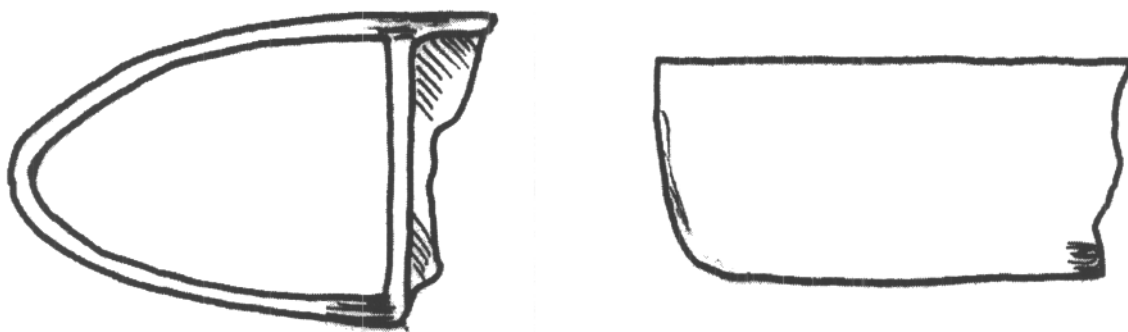


Fig. 30. Boat model fragment from Warka, dating to Ur III or the Old Babylonian period. (After Adams and Nissen 1972, 214, based on Potts 1997, 126, fig. V.3)

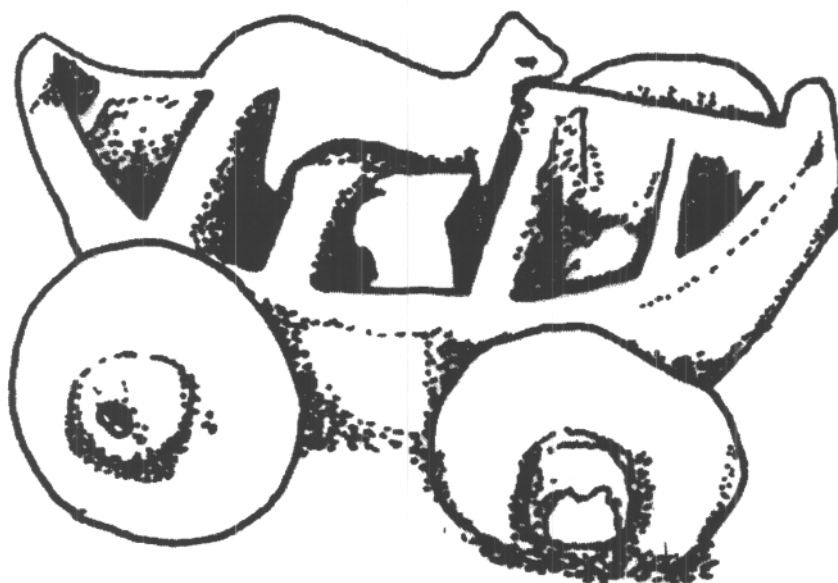


Fig. 31. Boat model from Uruk, dating to the 7th century B.C., showing a quadraped figure and a box or a seat inside the hull. (After Göttlicher 1978, Taf. 7, n. 98)

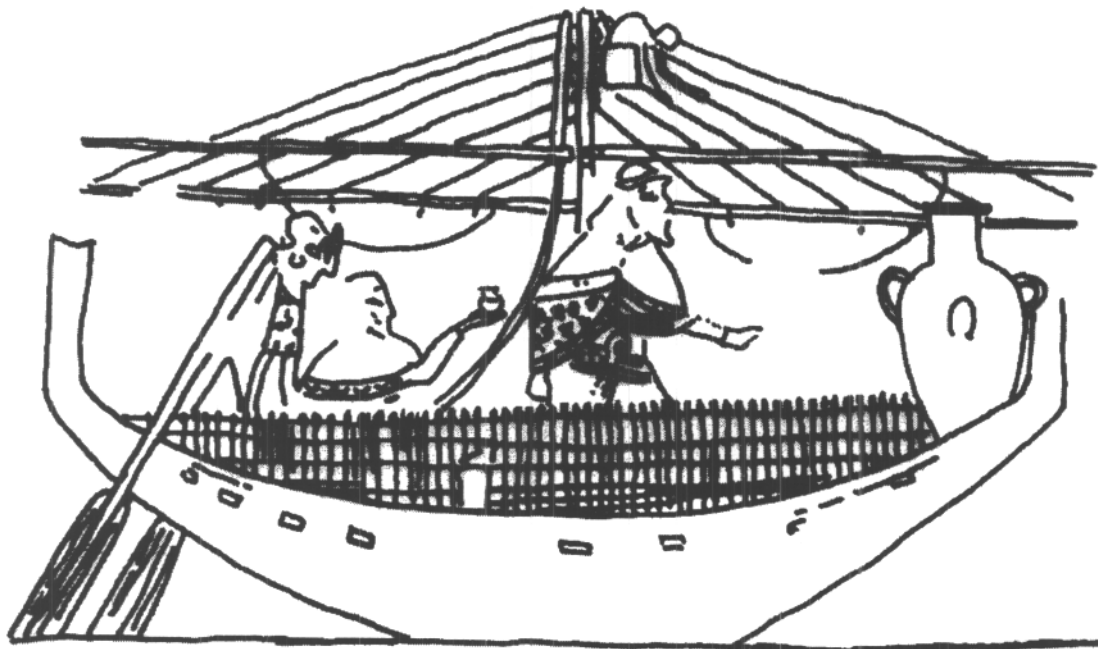
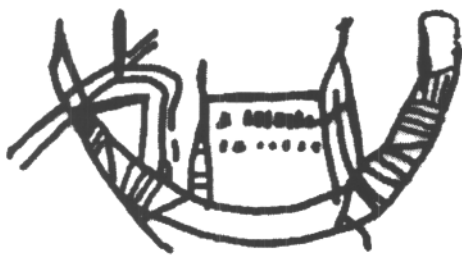


Fig. 32. Detail from the scene of Syro-Canaanite ships docking at an Egyptian port, depicted in the tomb of Kenamun at Thebes (After Wachsmann 1998, fig. 3.6)



A



B

Fig. 33. A) Depiction of a reed or papyrus boat on a seal from Mohenjo-daro; B) Graffito on a potsherd from Mohenjo-daro, depicting a ship with a mast and two yards (After Le Baron Bowen 1956, fig. 1)

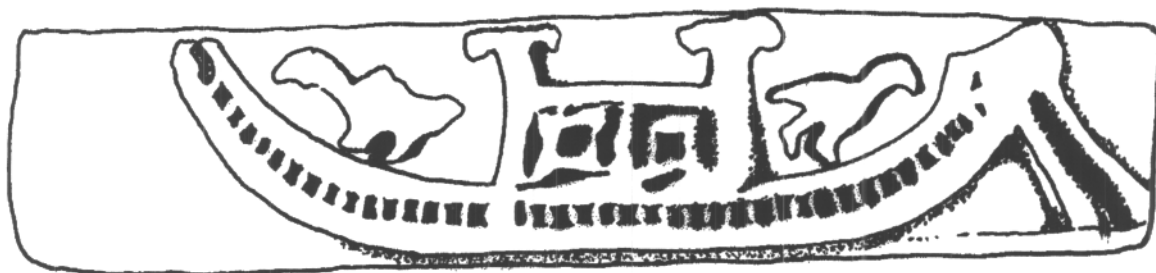


Fig. 34. Terracotta amulet from Mohenjo-daro, showing a riverboat with a structure amidships. (After Rao 1973, pl. XXXV C.)

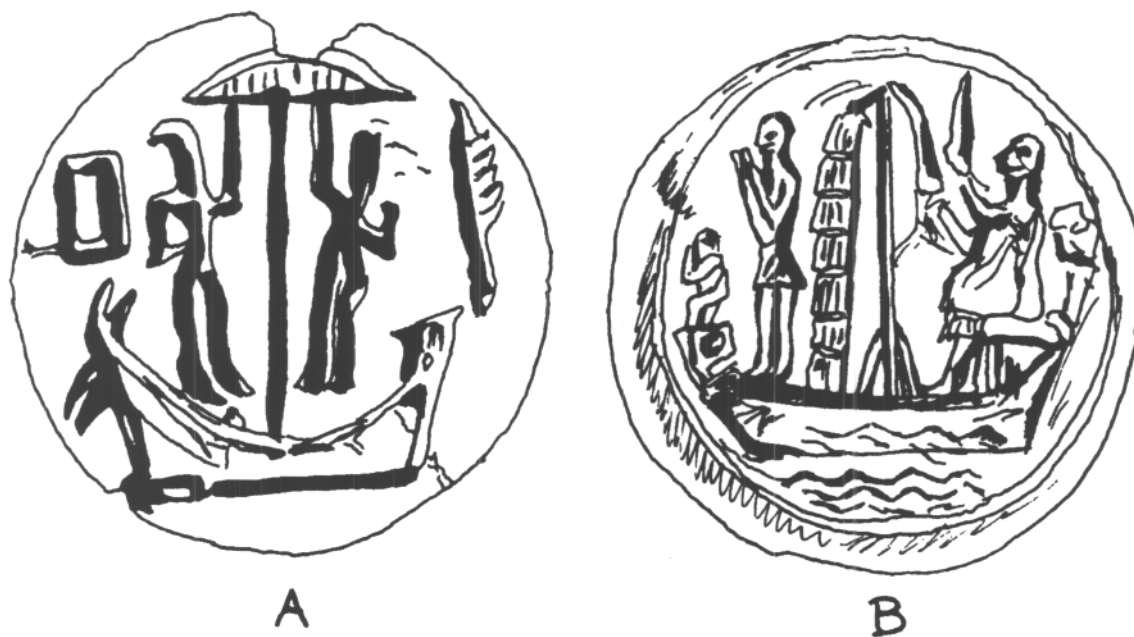


Fig. 35. Two seals (A and B) from Failaka, dating to ca. 2000 B.C., perhaps depicting seagoing ships. (After De Graeve 1981, pl. VI, nos. 20-1)



Fig. 36. Iraqi riverboat poled by two men. (After Salonen 1939, Taf. XXXVII)

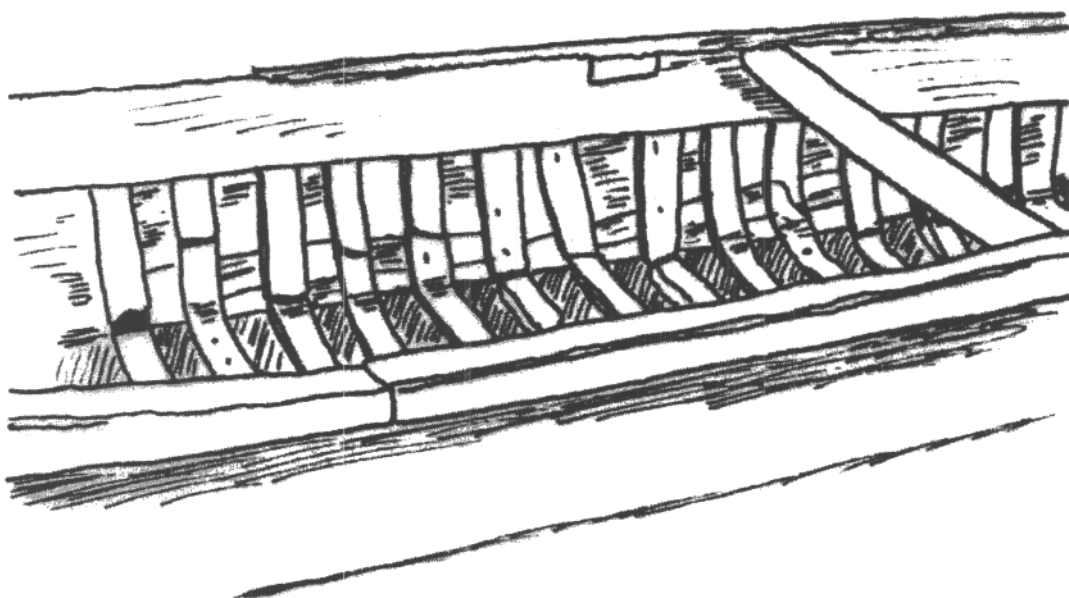


Fig. 37. Section of the internal hull construction of an Iraqi riverboat *tarada* cleaned of its bitumen. (After Ochsenschlager 1992, pl. II. 1)

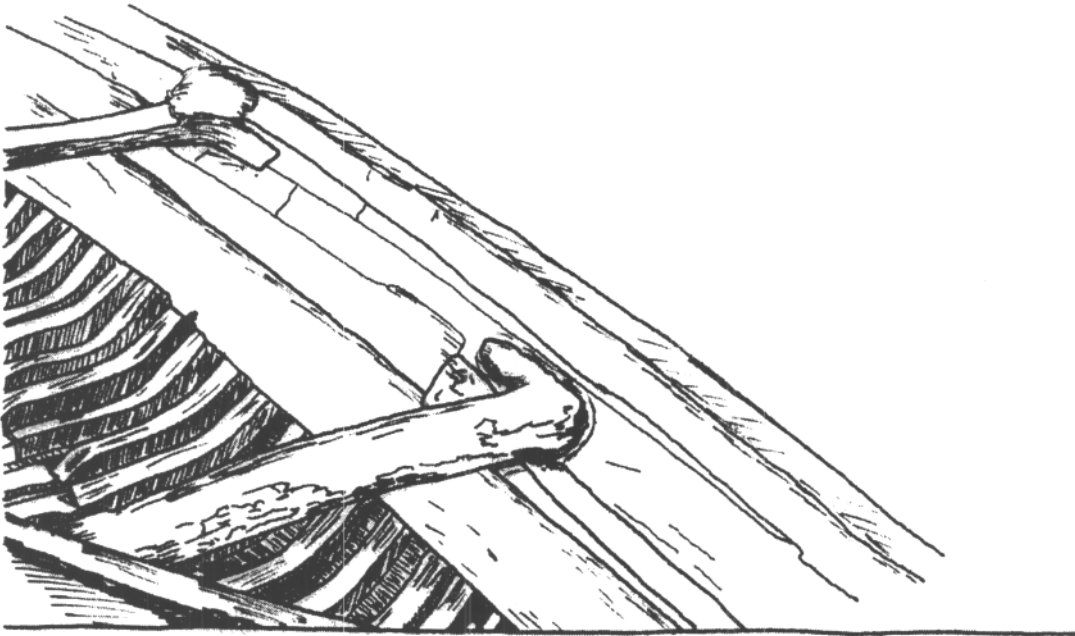


Fig. 38. Detail of an inner construction of an Iraqi riverboat (probably *balam*).
(After Thesiger 1964, fig. 51)

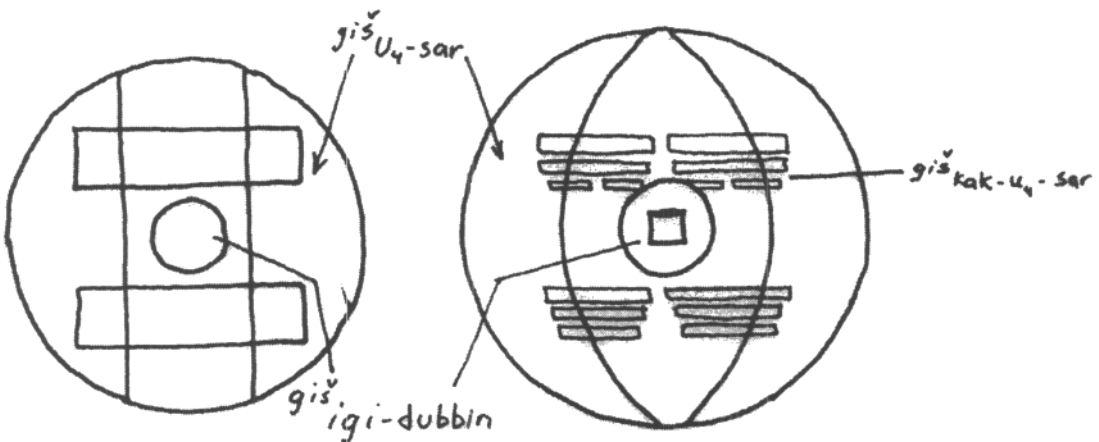


Fig. 39. Drawing of a Mesopotamian tripartite wagon wheel with the parts named in Sumerian. (After Salonen 1951, Zeichnung 8-9)

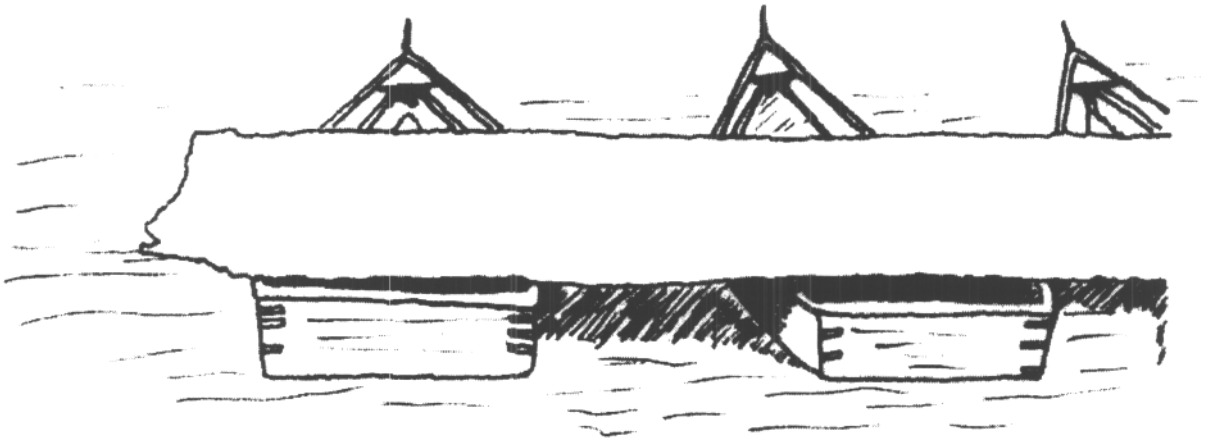


Fig. 40. Square-sterned riverboats used in the building of wharfs in Mosul. (After Ritter 1919, fig. 31)

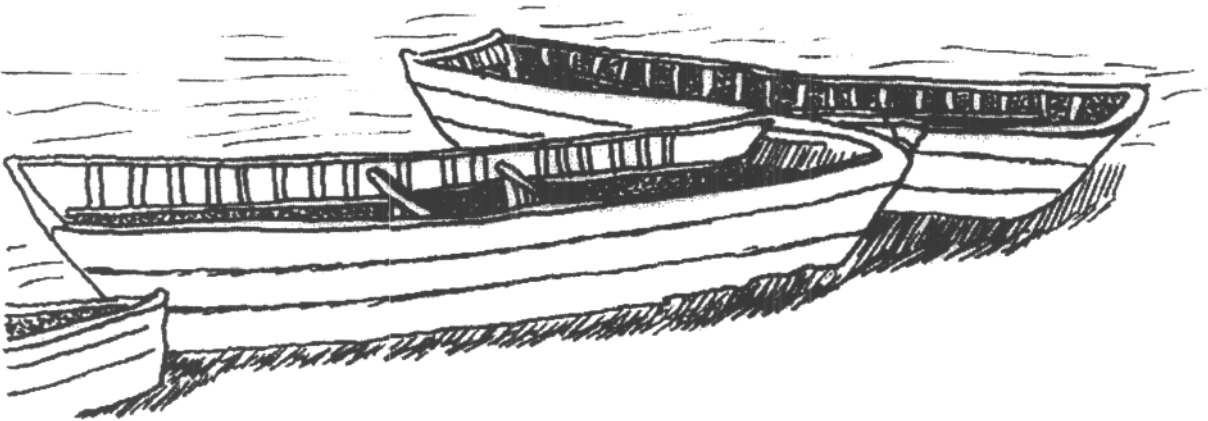


Fig. 41. Square-ended "Schachtur" cargo vessel used on the Euphrates. (After Ritter 1919, fig. 34)

Texts

Notes on the Hermitage tablets by Simo Parpola

Notes on the Hermitage tablets*

by Natalya Kozlova — St. Petersburg

See in general Th. Balke, "Eine Neusumerische Urkunde über Materialien für den Schiffsbau," *Ugarit-Forschungen* 25 (1993), 1f.

1. Erm. 7820 (Shulgi 43/ — Umma; ruled, not sealed)

Obv. 1 kid má-šà-ga: cf. UT III 1797

2. Erm. 15259 (Shulgi 45 = AS 2/ — Umma; ruled, not sealed) // TCL 5: 5673

Obv. 5 ^ša-ra: see, e.g., MVN 14:394, MVN 16:863, 1305

6 ^ša-da: see, e.g., FAOS 16:1312, OrSP 47/49:249

7 ^šù: cf. UT III 1805: ^šù sur-ra + Comm.

9 ^šmi-rí-za: see, e.g., MVN 14:529

Rev. 3 ^šumbin: see, e.g., MVN 14:86

6: cf. UT III 2240: lagab pa ku₅; Erm. 14921 Rev.1: lagab pa giš ku₅

9 si₄-SAR: cf. UT III 1663, 𒄩 ma-na šu-SAR; šu-SAR also e.g. in MVN 14:19, UET 9:394, 395

3. Erm. 4053 (Shulgi 48/V Umma; not ruled)

Obv.1 ^šù-suh₅ ^šKID.DIM: s. also Erm. 3994 Obv.3

Rev.3 a-ma-at-ka: cf. FAOS 16:918

Seal: ur-^dšul-pa-è / dub-sar / dumu lugal-kug-ga-ni

4. Erm. 14661 (AS 6/ XII; ruled, not sealed)

Obv.4 ^šù-suh₅ ZI.GAN: cf. UT III 1489, ^šKUL.ZI.GAN

5. Erm. 4031 (AS 7/ — Umma; ruled, not sealed)

* MVN = Materiali per il vocabulario neosumerico (Rome, 1974ff); FAOS = Freiburger Altorientalische Studien (Wiesbaden, 1975ff); UET = Ur Excavations, Texts (London, 1953ff); UT III = F. Yildiz and T. Gomi, *Die Umma-Texte aus den Archäologischen Museen zu Istanbul*, Band III (Bethesda, 199x)

Erm 7820, 15259, 4053

Erm 7820

- 1 102 kid má-ša-ga
- 2 ki-lá-bi 8 1/2 sar
- 3 gi-bi 306 sa
- 4 á-bi ud-51-kam
- 5 1040 guruš ud-1-še
- r.1 ki lú-igi-sa₆-sa₆-ta
- 2 lú-sa₆-l-zu
- 3 šu ba-ti
- blank line
- 4 mu en ⁴nanna máš-e l-pàd

Erm. 7820

- 1 102 reed-mats for boat interior,
- 2 their volume being 8.5 sar,
- 3 their reeds 306 bundles,
- 4 their labor 51 days:
- 5 1040 men for one day
- r.1 from Luigisasa
- 2 Lusag-izu
- 3 has received.
- 4 (Date: Shulgi 43)

Erm 15259

- 1 1 má-10-gur
- 2 esír-hád-bi 22 gú
- 3 esír-é-a-bi 0.0.5
- 4 l-ku₆-bi 5 silà
- 5 ²a-ra-bi 6
- 6 ²a-da-bi 4
- 7 ²ù-bi 15
- 8 ²eme-sig-bi 45
- 9 ²mi-rí-za-bi 50
- 10 ²me'-dím-bi 2
- r.1 ²má-gú-bi 4
- 2 ²hum-bi 1
- 3 ²umbin-bi 8
- 4 ²zi-gin₇-bi 1
- 5 ²gi-muš-bi 3
- 6 ²pa-giš-bi giš-diri-bi 3
- 7 ²gag-bi 600
- 8 ²giri-bi 35
- 9 si₄-SAR-bi 1 gú
- 10 á-bi ud 150
- 11 má dumu lugal
- 12 ki lugal-e-ba-an-sa₆-ta
- 13 lú-sa₆-l-zu l-dab₅
- s.1 mu ur-bí-lum.ki ba-hul

Erm. 15259

- 1 1 boat of 10 gur,
- 2 its dry bitumen 22 talents,
- 3 its bitumen 5 seahs,
- 4 its fish-oil 5 quart(s),
- 5 its a-ras 6,
- 6 its beams 4,
- 7 its ñs 15,
- 8 its narrow/tiny "tongues" 45,
- 9 its clamps 50,
- 10 its me-díms 2,
- r.1 its má-gús 4,
- 2 its benches 1
- 3 its wheels/"claws" 8,
- 4 its rudder 1,
- 5 its punting poles 3,
- 6 its "wood staff/twigs" and "extra wood" 3,
- 7 its wooden nails 600,
- 8 its "foot wood" 35,
- 9 its si₄-SAR 1 talent,
- 10 its labor 150 days:
- 11 a boat for the crown prince
- 12 from Lugalebansa
- 13 Lusagizu took.
- r.1 (Date: Shulgi 45 = Amar-Suena 2)

Erm 4053

- 1 140-lá-1 ²ù-suh₅ ²KID.DIM
- 2 50-lá-2 ²ù-suh₅ ²gi-muš
- 3 180 ²mi-rí-za má-120-gur
- 4 280 ²mi-rí-za má-60-gur
- 5 485 ²mi-rí-za má-30-gur ù má-15-gur
- 6 ²kiri₆ é-ša-ga-ta
- r.1 600 ²mi-rí-za má-60-gur
- 2 460 ²mi-rí-za má-30-gur ù má-15-gur
- 3 400 a-ma-at-ka
- 4 ²kiri₆ lugal-bàn-da-ta

Erm. 4053

- 1 139 fir tree(s) for ²KID.DIM,
- 2 48 fir tree(s) for rudder(s),
- 3 180 clamp(s) for a boat of 120 gur,
- 4 280 clamp(s) for a boat of 60 gur,
- 5 485 clamp(s) for a boat of 30 gur and a boat of 15 gur,
- 6 from the orchard of Eshaga.
- r.1 600 clamp(s) for a boat of 60 gur,
- 2 460 clamp(s) for a boat of 30 gur and a boat of 15 gur,
- 3 400 a-ma-at-ka
- 4 from the orchard of Lugalbanda.

Erm 4053, 14661, 4031, AO 5673

- 5 *giš hád-e de₆-a*
 6 *é-maš ku₄-ra*
 7 *ki enš-ka-ta*
 8 *ur-⁴šul-pa-è*
 9 *šu ba-ti*
 10 *iti R1 mu-ús-sa ki-maš.ki ba-hul mu-ús-sa-a-bi*

- 5 Wood brought for drying.
 6 entered into Emash.
 7 From the ruler
 8 Ur-Shulpae
 9 has received.
 10 (Date: Shulgi 48)

Erm 14661

- 1 16 *giš.ù-suh₅ am-ra*
 2 12 *giš.ù-suh₅ MA.ZA*
 3 12 *giš.ù-suh₅ a-da*
 4 120¹ *giš.ù-suh₅ zi-gan*
 5 8 *giš.ù-suh₅ zi-gan-LA ù-suh₅*
 6 8 *giš.ù-suh₅ gi-muš*
 7 32 *giš.ù-suh₅ mi-rf-za*
 8 *ša giš ba-u₅-a*
 9 140 *giš.ù-suh₅ šu¹ mi-rf-za*
 10 *ša giš gub-ba-a*
 blank line
 11 *giš giš.kiri₆ ⁴šul-¹gi¹-ra*
 r.1 68 *giš.ù-suh₅ mi-rf-za*
 2 *ša giš.kiri₆ ša-ra-bu-um*
 3 *má-60-gur 2-kam*
 4 *ki lá-⁴nin-šubur-ta*
 5 *ab-ba-sa₆-ga šu ba-an-ti*
 6 *giri a-da-lál agà-ús ab-ba-sa₆-¹ga¹*
 7 *ù giri má-gur₈-re lú.GI.ZI ugula nam-10*
 8 *iti ezen me-ki-gál*
 9 *mu⁴amar-⁴suen lugal-e ša-aš-ru.ki mu-hul*

Erm. 14661

- 1 16 *am-ra* fir trees,
 2 12 fir tree(s for) MA.ZAs.
 3 12 fir tree(s for) *beams*,
 4 120¹ fir tree(s for) rudders,
 5 8 fir tree(s for) LA-rudders of fir,
 6 8 fir tree(s for) punting poles,
 7 32 fir tree(s for) *clamp(s)*
 8 (from) among fertilized trees,
 9 140 fir tree(s for) *clamp* "hand(s)"
 10 (from) among "placed trees."
 11 Wood from the orchard of Shulgi.
 r.1 68 fir tree(s for) *clamp(s)*
 2 from the orchard of Sharabum
 3 for two boats of 60 gur
 4 from Lu-Ninshubur
 5 Abbasaga has received.
 6 In the custody of Adallal, gendarme of Abbasaga
 7 and in the custody of Magurre, GI.ZI-official, decurion.
 8 (Date: Amar-Suena 6-XII)

Erm 4031

- 1 19 *giš.a-ra má-60-gur*
 2 10-lá-1 *giš.a-da má-120-gur*
 3 3 *giš.a-da má-60-gur*
 r.1 *ki kugal-LÁL.TÚG-ta*
 2 1 *giš.a-da má-120-gur*
 3 1 *giš.a-da má-60-gur*
 4 *ki-gur₇-ta*
 5 *kišib lú-sa₆-t-zu*
 s.1 *mar-sa-a ku₄-ra mu hu-úh-nu-ri.ki ba-hul*

Erm. 4031

- 1 19 *a-ras* (for) a boat of 60 gur,
 2 9 *beams* (for) a boat of 120 gur,
 3 3 *beams* (for) a boat of 60 gur,
 r.1 from Lugal-usar.
 2 1 *beam* (for) a boat of 120 gur,
 3 1 *beam* (for) a boat of 60 gur,
 4 from Kigur.
 5 Seal of Lusagizu.
 s.1 Entered into *mar-sa*. (Date: Amar-Suena 7)

AO 6573

- I 1 1 *má-120-gur*
 2 *eslr-hád-bi 204 gú*
 3 *eslr-gul-gul-bi 12 gú*
 4 *eslr-é-a-bi 2¹ gur*
 5 *t-ku₆-bi 1*

AO 6573

- 1 1 boat of 120 gur,
 2 its dry bitumen 204 talents,
 3 its "destroyed" bitumen 12 talents,
 4 its bitumen 2 gur,
 5 its fish-oil 1 (gur),

AO 5673

6 *giš.a-ra-bi* 12¹
 7 *giš.tu-gul-bi*
 8 *giš.a-da-bi* 8
 9 *giš.ù-bi* 46
 10 *giš.hum-bi* 6
 11 *giš.eme-sig-bi* 180
 12 *giš.mì-rí-za-bi* 195
 13 *giš.me-dlm-bi* 2
 14 *giš.má-gú-bi* 8
 15 *giš.MA-má-a-bi* 8
 16 *giš.níg-KA-bi* 5
 17 *giš.eme-sig-bi*
 18 *giš.umbin-bi* 40
 19 *giš.eme-sig-bi*
 20 *giš.AD.KUL-sì-ga-bi* 2
 21 *giš.gi-muš-bi*
 22 *giš.gag-bi* 7200
 23 *giš.giri-bi* 75
 24 *túg.sar-bi* 12 gú
 25 *á-bi ud*-1800
 26 *šú-du₇-a má*-120-gur-1-kam

I 27 8 *má*-60-gur
 28 *esír-hád-bi* 1048 gú
 29 *esír-gul-gul-bi* 70 gú
 30 *esír-apin-bi*
 31 *esír-é-a-bi* 8 gur
 32 *ì-ku₆-bi* 4
 33 *giš.a-ra-bi* 64
 34 *giš.tu-gul-bi*
 II 1 *giš.a-da-bi* 64
 2 *giš.ù-bi* 208
 3 *giš.hum-bi* 32
 4 *giš.eme-sig-bi* 1100
 5 *giš.mì-rí-za-bi* 1200
 6 *giš.me-dlm-bi* 16
 7 *giš.má-gú-bi* 64
 8 *giš.MA-má-bi* 64
 9 *giš.níg-KA-bi* 24
 10 *giš.eme-sig-bi*
 11 *giš.umbin-bi* 160
 12 *giš.eme-sig-bi*
 13 *giš.AD.KUL-sì-ga-bi*
 14 *giš.gi-muš-bi*
 15 *giš.gag-bi* 28800
 16 *giš.giri-bi* 1200
 17 *túg.sar-bi* 48 gú
 18 *á-bi ud*-7200
 19 *šú-du₇-a má*-60-gur-8-a-kam
 20 ^mlugal-má-gur₈-ri
 21 ^ma-bil-a-ni
 22 ^mda-a-ga
 23 ^mšakàn-ni
 24 ^mlugal-kù-zu
 25 ^mur-^anun-gal
 26 ^mú-^asuen
 27 ^mur-^asuen
 28 *má-lah₄-e-ne tum-ma*

6 its *a-ras* 12,
 7 its *tu-gul*,
 8 its *beams* 8,
 9 its *ùs* 46,
 10 its benches 6,
 11 its narrow/tiny "tongues" 180,
 12 its *clamps* 195,
 13 its *me-dlms* 2,
 14 its *má-gús* 8,
 15 its *MA-más* 8,
 16 its *níg-KAs* 5,
 17 its narrow/tiny "tongues"
 18 its *wheels*/*"claws"* 40,
 19 its narrow/tiny "tongues"
 20 its *installed* AD.KULs 2,
 21 its punting poles
 22 its wooden nails 7200,
 23 its "foot wood" 75,
 24 its *sar*-cloth 12 talents,
 25 its labor 1800 days,
 26 finished. One boat of 120 gur.

I 27 8 boats of 60 gur,
 28 their dry bitumen 1048 talents,
 29 their "destroyed" bitumen 70 talents,
 30 their "plow" bitumen,
 31 their bitumen 8 gur,
 32 their fish-oil 4 (gur),
 33 their *a-ras* 64,
 34 their *tu-gul*,
 II 1 their *beams* 64,
 2 their *ùs* 208,
 3 their benches 32,
 4 their narrow/tiny "tongues" 1100,
 5 their *clamps* 1200,
 6 their *me-dlms* 16,
 7 their *má-gús* 64,
 8 their *MA-má* 64,
 9 their *níg-KA* 24,
 10 their narrow/tiny "tongues"
 11 their *wheels*/*"claws"* 160,
 12 their narrow/tiny "tongues"
 13 their *installed* AD.KUL
 14 their punting poles,
 15 their wooden nails 28800,
 16 their "foot wood" 1200,
 17 their *sar*-cloth 48 talents,
 18 their labor 7200 days,
 19 finished. 8 boats of 60 gur
 20 taken by Lugal-magurre,
 21 Abilani,
 22 Daaga,
 23 Sakanni,
 24 Lugal-kuzu,
 25 Ur-Nungal,
 26 Lu-Suena,
 27 Ur-Suena,
 28 boatmen.

AO 5673

29 1 *má*-30-gur
 30 *eslr-hád-bi* 90 *gú*
 31 *eslr-gul-gul-bi*
 32 *eslr-apin-bi* 4 *gú*
 33 *eslr-é-a-bi* 0.2.3
 34 *i-ku₆-bi* 0.0.1 5 *silà*
 35 *giš.a-ra-bi* 8
 36 *giš.a-da'-bi* 8
 III 1 *giš.ù-bi* 21
 2 *giš.hum-bi* 2
 3 *giš.eme-sig-bi* 100
 4 *giš.mi-rl-za-bi* 90
 5 *giš.me-dlm-bi* 2
 6 *giš.má-gú-bi* 8
 7 *giš.nlg-KA-bi* 4
 8 *giš.eme-sig-bi*
 9 *giš.umbin-bi* 15
 10 *giš.eme-sig-bi*
 11 *giš.AD.KUL-si-ga-bi* 2
 12 *giš.zi-gin₇-bi* 1
 13 *giš.gi-muš-bi* 3
 14 *giš.hu-dub-ba*
 15 *giš.ù-šub-ba*
 16 *gi.má-da-lá-bi* 30 *sa*
 17 *ù.numún éš-bi* 20 *sa*
 18 *giš.gag-bi* 1500
 19 *giš.giri-bi* 70
 20 *á-bi ud*-450
 21 *šu-du₇-a má ad-da lú-ùr-ra-ka*

22 1 *má*-10-gur
 23 *eslr-hád-bi* 31 *gú*
 24 *eslr-gul-gul-bi* 6 *gú*
 25 *eslr-apin-bi* 7 *gú*
 26 *eslr-é-a-bi* 0.1.4
 27 *i-ku₆-bi* 0.0.1
 28 *giš.a-ra-bi* 12
 29 *giš.a-da-bi* 8
 30 *giš.ù-bi* 30
 31 *giš.eme-sig-bi* 90
 32 *giš.mi-rl-za-bi* 100
 33 *giš.me-dlm-bi* 4
 IV 1 *giš.má-gú-bi* 8
 2 *giš.hum-bi* 2
 3 *giš.umbin-bi* 16
 4 *giš.eme-sig-bi*
 5 *giš.zi-gin₇-bi* 1
 6 *giš.gi-muš-bi* 6
 7 *giš.pisan-sal-bi* 10
 8 *giš.gag-bi* 1200
 9 *giš.giri-bi* 70
 10 *túg.sar-bi* 2 *gú*
 11 *á-bi ud*-300
 12 *šu-du₇-a má-10-gur-2-a-kam*

13 3.4.0 6 *silà zíd še gur*
 14 6.4.1 *kaš-du gur*
 15 0.0.2 8 *silà eša*
 16 0.0.1 5 *silà zid-kalag*

29 1 boat of 30 gur,
 30 its dry bitumen 90 talents,
 31 its "destroyed" bitumen,
 32 its "plow" bitumen 4 talents,
 33 its bitumen 2 barigas 3 seahs,
 34 its fish-oil 1 seah 5 quart(s),
 35 its *a-ras* 8,
 36 its *beams* 8,
 III 1 its *ùs* 21,
 2 its benches 2,
 3 its narrow/tiny "tongues" 100,
 4 its *clamps* 90,
 5 its *me-dlms* 2,
 6 its *má-gús* 8,
 7 its *nlg-KAs* 4,
 8 its narrow/tiny "tongues"
 9 its *wheels*/*"claws"* 15,
 10 its narrow/tiny "tongues"
 11 its installed AD.KULs 2,
 12 its rudder 1,
 13 its punting poles 3,
 14 *giš.hu-dub-ba*
 15 *giš.ù-šub-ba*
 16 its *má-da-lá*-reed 30 bundles,
 17 its *halfa*-grass (for) ropes 20 bundles,
 18 its wooden nails 1500,
 19 its "foot wood" 70,
 20 its labor 450 days,
 21 finished. A boat of the *father* of Lu-urra.

22 1 boat of 10 gur,
 23 its dry bitumen 31 talents,
 24 its "destroyed" bitumen 6 talents,
 25 its "plow" bitumen 7 talents,
 26 its bitumen 1 bariga 4 seahs,
 27 its fish-oil 1 seah,
 28 its *a-ras* 12,
 29 its *beams* 8,
 30 its *ùs* 30,
 31 its narrow/tiny "tongues" 90,
 32 its *clamps* 100,
 33 its *me-dlms* 4,
 IV 1 its *má-gús* 8,
 2 its benches 2,
 3 its *wheels*/*"claws"* 16,
 4 its narrow/tiny "tongues"
 5 its rudder 1,
 6 its punting poles 6,
 7 its *oars* 10,
 8 its wooden nails 1200,
 9 its "foot wood" 70,
 10 its *sar*-cloth 2 talents,
 11 its labor 300 days,
 12 finished. Two boats of 10 gur.

13 3 gur 4 bariga 6 quart(s) of barley four,
 14 6 gur 4 bariga 1 seah of regular beer,
 15 2 seahs 8 quart(s) of fine flour,
 16 1 seah 5 quart(s) of ... flour,

AO 5673

17 0.0.2 8 silà zú-lum
 18 1 udu 1 máš
 19 4 nigin¹-na nílg-u-nu-a udu.ùz
 20 7 silà Ì-giš
 21 gud UD.UD siskur-siskur-ra mar-sa
 22 108 gú 24 ma-na x x
 23 im má gul-la
 24 a¹-da¹ lugal-e-ba-an-sa₆ ba-gi
 V uninscribed
 VI 1 zi-ga mar-sa
 2 ki lá-sa₆-ni-zu¹-ta
 3 mu ur-bí-lum ba-hul

17 2 seahs 8 quart(s) of dates,
 18 1 sheep, 1 goat,
 19 4 she-goat,
 20 7 quart(s) of olive-oil,
 21 a clean ox, *mar-sa* offering,
 22 108 talents 24 minas of ...
 23 ... of a broken ship
 24 ... Lugalebansa has returned.
 VI 1 *mar-sa* expenditure
 2 from Lusagizu.
 3 (Date: Shulgi 45 = AS 2)

HAR-ra = hubullu IV (Hh IV)

Hh IV

- 252 [e]me-sig : me-te-nu
 253 [e]me-sig : p[ar]-¹šik¹-tum
 254 [e]má : pa-ri-is-su
 255 [e]má-ri-za zag-gi₄-a : MIN ši-iš-ši
 256 ²⁵⁵má-ri-za gu-la : MIN iš-šur-ti
 257 ²⁵⁶má-ri-za aga-a : MIN a-ge-e
 258 ²⁵⁷má-ri-za nu-gi₄-a : MIN la [t]a-ri
 259 ²⁵⁸é má-gur₈ : hi-in-nu
- 260 ²⁵⁹é má : hi-in-nu
 261 ²⁶⁰é má-dù-a : hi-in-nu
 262 ²⁶¹má : e-lep-pu
 263 ²⁶²má-gur₈ : ma-kur-ru
 264 ²⁶³má-tur : ma-tur-ru
 265 ²⁶⁴má-u₅ : ru-ku-bu
 265a ²⁶⁵má-illat : MIN tiil-la-ti
 266 ^{266a}má-lál-àm : ŠU-u
 267 ²⁶⁷má-sal-la : ŠU-u
 268 ²⁶⁸má-ti-la : mu-bal-lit-tum
 269 ²⁶⁹má-gíd-da : ma-ak-ki-tum
 270 ²⁷⁰má-gud₄-da : ma-ak-ku-[tum]
 271 ²⁷¹má-gíd-da : šad-da-[tum]
 272 ²⁷²má-gu-la : ra-bi-tum
 273 ²⁷³[²⁷³m]á]-sig : qal-la-tum
 274 ²⁷⁴[²⁷⁴má šu]-HA : e-lep ba-ri-ri
 275 ²⁷⁵[²⁷⁵má peš₆-p]eš₆ : mut-tab-ri-tum
 276 ²⁷⁶má-la-ga : al-la-ki-tum
 277 ²⁷⁷má má-ri : ma-i-ri-tum
 278 ²⁷⁸má a-šur₄-ki : aš-šu-ri-tum
 279 ²⁷⁹má urim.ki : ú-ri-tum
 280 ²⁸⁰má uri.ki : ak-ka-di-tum
 281 ²⁸¹má dilmun.ki : til-mu-ni-tum
 282 ²⁸²má má-gan-na.ki : ma-ak-ka-ni-tum
 283 ²⁸³má me-luh-ha : me-luh-hi-tum
 284 ²⁸⁴má sù-a : še-bi-tum
 285 ²⁸⁵má dim-dug₄-ga : ha-riš-tum
 286 ²⁸⁶má šà-ha : šah-hi-tum
 287 ²⁸⁷má gibil : eš-še-tum
 288 ²⁸⁸má sumun : la-bir-tum
 289 ²⁸⁹má libir-ra : MIN
 290 ²⁹⁰má šu-lál : lu-up-pu-ut-tum
 291 ²⁹¹má-gur-gur : ŠU-rum
 292 ²⁹²má dingir-ra : e-lep-pi i-li
 293 ²⁹³má-an-na : MIN ²⁹³a-nim
 294 ²⁹⁴má-gur₈ kug-ga : MIN ²⁹⁴MIN
 295 ²⁹⁵má-aš-te : MIN ²⁹⁵EN.LÍL
 296 ²⁹⁶má-úr-nu-ub-zu : MIN ²⁹⁶MIN
- 297 ²⁹⁷má-gur₈-nu-ub-zu : MIN ²⁹⁷MIN
 298 ²⁹⁸má-²⁹⁸en-líl-lá : MIN ²⁹⁸MIN
 299 ²⁹⁹má-²⁹⁹nin-líl-lá : MIN ²⁹⁹NIN.LÍL.LÁ
 300 ³⁰⁰má-tum-ma-al : MIN ³⁰⁰MIN
 301 ³⁰¹má-ki₄-zal-nun-na : MIN ³⁰¹šu-zi-an-na
- 302 ³⁰²má-šà-hul-la : MIN ³⁰²MIN
 303 ³⁰³má-íd-da nir-gál : MIN ³⁰³MIN
 304 ³⁰⁴má-darà-abzu : MIN ³⁰⁴É.A

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- 252 narrow/thin "tongue"
 253 narrow/thin tongue : (paršiktu-measure)
 254 wooden clamps : punting pole
 255 clamps of a wrestler : ditto of handcuffs
 256 big clamps : ditto for birds
 257 clamps of a crown
 258 not returning clamps
 259 procession-boat house/room : cabin of a boat
- 260 boat house/room : cabin of a boat
 261 built-up boat house : cabin of a boat
 262 boat, ship
 263 procession boat
 264 small boat
 265 vehicle, barge
 265a auxiliary boat
 266 cargo boat/raft
 267 thin/narrow boat
 268 rescue boat
 269 long boat
 270 short boat
 271 towboat
 272 large boat
 273 tiny/light boat
 274 fisherboat
 275 durable boat
 276 travelling boat
 277 boat from Mari
 278 Assyrian boat
 279 boat from Ur
 280 Akkadian boat
 281 boat from Tilmun (Bahrain)
 282 boat from Makkan (Oman)
 283 boat from Meluhha (India)
 284 sunken boat
 285 moored boat
 286 sailboat
 287 new boat
 288 old boat
 289 old boat
 290 damaged boat
 291 large boat, ark
 292 boat of god
 293 boat of Anu
 294 holy/pure procession-boat : ditto of Anu
 295 throne boat : ditto of Enlil
 296 boat which does not know (its) foundations : ditto of Enlil
- 298 boat of Enlil : ditto of Enlil
 299 boat of Ninlil : ditto of Ninlil
 300 Tummal boat : ditto of Ninlil
 301 "boat, pride of the deep" : ditto of Shuzianna
 302 "boat of joy of heart" : ditto of Shuzianna
 303 "boat trusting in the river" : ditto of Shuzianna
 304 boat of Ea

HAR-ra = *hubullu* IV (Hh IV)

305	^u má- ^d íd lú-ru-gú : MIN ^d ÍD	305	boat of the River God
306	^u má-tuš-a : MIN ^d AMAR.UTU	306	boat of Marduk
307	^u má-íd-da-hé-du ₈ : MIN ^d AG	307	boat of Nabû
308	^u má-gur ₈ -nun-ta-è : MIN ^d NIN.URTA	308	boat of Ninurta
309	^u má-abzu-nu-kuš-ù : MIN ^d NIN.GÍR.SU	309	boat of Ningirsu
310	^u má-áb-kug-ga : MIN ^d BA.Ú	310	boat of Babu
311	^u má-pa ₅ -SAL-ús-sa : MIN ^d MIN	311	boat of ditto
312	^u má-nu-ri : MIN ^d 30	312	boat of Sin
313	^u má-nu-ri-bàn-da : MIN ^d NIN.GAL	313	boat of Nikkal
314	^u má-šilam-gal : MIN ^d NIN.TIN.UG ₅ .GA	314	boat of Nintinugga (Gula)
315	^u má-íd-da-tíl-la : MIN ^d MIN	315	boat of ditto
316	^u má-sa-bad : MIN ^d MIN	316	boat of ditto
317	^u má-túl-kug-ga : MIN ^d PA.BIL.SAG	317	boat of Pabilsag
318	^u má-[x]-nir-gál : MIN ^d da-mu	318	boat of Damu
319	[^u má- ^d]a-mu : MIN ^d MIN	319	boat of ditto
319b	[^u má-x]-šár-ra : MIN ^d PA.TÚG	319b	boat of Nusku
319c	[^u má-pàd-da]-nu-nuz : MIN ^d SA.DÀR. NUN.NA	319c	boat of Sadardunna
320	^u má-[b]àn-da : MIN ^d MIN	320	boat of ditto
321	^u má-šà-ká-na-ke ₄ : MIN ^d PAB.NIGÍN.GAR. RA	321	boat of Panigingarra
322	^u má-ud-gal-gal : MIN ^d ša-la	322	boat of Shala
323	^u má-kar-mah : MIN É.KÈŠ.KI	323	boat of Bit Keshi
324	^u má-bar-mul : MIN ^d ŠUL.PA.È	324	boat of Shulpae
325	^u má-kaskal-àm : MIN ^d MIN	325	boat of ditto
326	^u má-ud-gù-dé : MIN ^d x	326	boat of DN
327	^u má-kar-nun-na : MIN ^d x	327	boat of DN
328	^u má-šà-húl-la : [MIN ^d]MIN	328	boat of ditto
329	^u má-hi-li-an-na : MIN ^d IS.TAR	329	boat of Ishtar
330	^u má-gur ₈ -na-KA-a : MIN ^d 15 KÁ.DINGIR. R[A.KI]	330	boat of Ishtar of Babylon
331	^u má-ér-ri : MIN ^d DUMU.ZI	331	boat of Tammuz
332	^u má-kalam-ma-si-sá : MIN ^d NIN.É ¹ . [GAL]	332	boat of Ninegal
333	^u má-kug-ga : MIN ^d [MIN]	333	boat of ditto
334	^u má-šilam-ma : MIN ^d [MIN]	334	boat of ditto
335	^u má-nisag : MIN <i>ni-sa-an-n[i]</i>	335	boat of first fruits
336	^u má-ki-ág-nibru.ki : MIN <i>ta-ram ni-ip-pu-ri</i>	336	boat, beloved of Nippur
337	^u má-ki-ág-urím.ki : MIN MIN <i>ú-ri</i>	337	boat, beloved of Ur
338	^u má-ki-ág-HI.GAR.ki : MIN MIN <i>k[i-si-i]k</i>	338	ditto ditto of Kissik
339	^u má-ki-ág-kèš.ki : MIN MIN <i>ke-e-ši</i>	339	ditto ditto of Keshi
340	^u má-kiš.ki : MIN ¹ <i>ki-ši</i>	340	ditto of Kish
341	^u má-giš-kalag-tuk : <i>e-lep</i> ^d GÍŠ.GÍN.MAŠ	341	boat of Gilgamesh
342	^u má-giš-tuk : MIN MIN	342	ditto ditto
343	^u má-ab-ba : MIN <i>a-bi</i>	343	ditto of <i>father</i> (or ocean)
344	^u má-gi-lum : ŠU- <i>lum</i>	344	Magilum-boat
345	^u má-gi-zum : ŠU- <i>zum</i>	345	Magizum-boat
346	^u má-gíd-da : <i>a-rik-tum</i>	346	long boat
347	^u má-sig-ga : <i>si-ig-tum</i>	347	narrow boat
348	^u má-dirig-ga : <i>né-bi-ru</i>	348	gliding boat : ferry
349	^u má-dirig-ga-ba-BAD : <i>mu-qal-pi-tum</i>	349	boat going downstream
350	^u má-gaba-rú-gu : <i>ma-hi-ir-tum</i>	350	boat going upstream
351	^u má-gaba-ri-a-ni : MIN	351	boat going upstream
352	^u má-addir : <i>e-lep ig-ri</i>	352	boat for hire
353	^u má-addir : MIN <i>né-bi-ri</i>	353	boat for hire : ferry ditto
354	^u má šuš gur : MIN <i>šu-uš-še</i>	354	boat of 60 gur (= c. 6 x 270 l)
355	^u má 50 gur : MIN <i>ha-an-ša-a</i>	355	boat of 50 gur
356	^u má 40 gur : MIN <i>er-ba-a</i>	356	boat of 40 gur
357	^u má 30 gur : MIN <i>še-la-ša-a</i>	357	boat of 30 gur

HAR-ra = hubullu IV (Hh IV)

358	^u má 20 gur : MIN eš-ra-a	358	boat of 20 gur
359	^u má 15 gur : MIN ha-meš-še-ret gur-ri	359	boat of 15 gur
360	^u má 10 gur : MIN e-še-ret MIN	360	boat of 10 gur
361	^u má 5 gur : MIN ha-mil-ti MIN	361	boat of 5 gur
362	^u u ₃ má : hi-in e-lep-pi	362	boat cabin : <i>cabin</i> of a boat
363	^u ad má : ud-di MIN	363	boat beam
364	^u ad-ús má : šid-di MIN	364	long-side plank/beam of a boat : long
364a	[^u ad-ús-ús] má : šī-da-tum GIŠ.[M]Á	side of ditto	
365	^u ki má : qaq-qar MIN	364a	[long-side planks of] a boat : long-side
366	^u úr má : iš-di MIN	(plank)s of a boat	
367	^u si má : qar-ni MIN	365	wooden "ground" (= floor) of a boat
368	^u si-si má : qar-na-a-ti MIN	366	base/foundation (= bottom) of a boat
369	^u ti má : ši-il MIN	367	"horn" (= bow) of a boat
370	^u ti-ti má : i-ga-ra-a-te MIN	368	horns of a boat (= prow and stern)
371	^u gú-sig ₄ má : e-še-en-še-ri MIN	369	boat rib (= futtocks)
372	^u peš-gú-sig ₄ má : kiš-kit-ti MIN	370	boat ribs : boat walls
373	^u anšu má : i-me-ri MIN	371	backbone/spine of a boat (= keel)
374	^u dim má : mar-kás MIN	372	"offshoot" of the backbone of a boat :
375	^u dim má : tim-mu šá MIN	workshop of ditto	
376	^u egir má : ár-kát MIN	373	"donkey" (= crutches?) of a boat
377	^u gissu má : šil-lum MIN	374	pole/pillar of a boat : rope/cable of a
378	^u gag má : sik-kat MIN	boat	
378a	^u é-gag má : hi-in-nu MIN	375	pole/pillar of a boat : pole/stake of a
379	^u gag-sag-gi ₄ -a má : mah-rat MIN	boat	
380	^u é má : bi-it MIN	376	back of a boat
381	^u igi má : pa-an MIN	377	"shade" (= awning/covering) of a boat
382	^u gur ₇ má : ka-re-e MIN	378	wooden peg/nail of a boat
383	^u te má : ti-hu MIN	378a	peg-house/container of a boat : <i>cabin</i>
384	^u da-da má : te-ha-ti MIN	of a boat	
385	^u da-lá má : til-lat MIN	379	plugging peg of a boat : front part of the
386	^u me-te-en má : me-te-nu MIN	boat	
387	^u uš-ab-dù : [x x] šad-du	380	house/room of a boat
388	^u m.MÁ.MUG : dar-kul-lu	381	face/front of a boat
389	^u nir-an-ta-MÁ.MUG : [nam-ha-šu]	382	silol/storehouse of a boat
390	^u an-nun-MÁ.MUG : [MIN]	383	approaching/colliding part of a boat
391	^u má-dù-uš : ma-du-(uš-šu)	384	sides of a boat : approaching/colliding
392	^u uš-má-dù : ma-al-da-du	parts of a boat	
393	^u gir-má-dù : gi-ir-ma-du-ú	385	side supporter of a boat : auxiliary
394	^u gir-má-dù : ŠU-u	crew of a boat	
395	^u uš-má-dù : [ŠU-u]	386	boat decoration
396	^u dim-dù : pa-su-ut-[tum]	387	dragging ... : taut [...]
397	^u dim-dù-dù : MIN	388	mooring pole
398	^u dim-dù : it-ku-u	389	upper ... of a mooring post : [impact
399	^u dim-dù-dù : MIN	post]	
400	^u dim-dù : mer-de-e-tum	390	... of a mooring post
		391	built boat dragging (device) (= stocks)
		392	wooden (device) to drag a built boat :
			dragging device
		393	feet for a built boat
		394	feet for a built boat
		395	wooden (device) to drag a built boat
		396	building pole
		397	building poles
		398	building pole
		399	building poles
		400	building pole : implement for lifting

HAR-ra = *hubullu* IV (Hh IV)

401 ^udim-dù-dù : MIN
 402 ^uzi-anšu : *ku-bu-su*
 403 ^ugir-a-ša-ga : *ú-ma-šu*
 404 ^ugir-zag-gi-a : MIN
 405 ^uguru₃-uš : *nar-da-mu*
 406 ^udim-gal : *uš-ha-mu*
 407 ^ugi-muš : *ŠU-ŠÚ*
 408 ^ugi-muš : *pa-ri-su*
 409 ^uš ibir gi-muš : *ser-ret* MIN
 410 ^ugisal : *gi-šal-lum*

411 ^ugisal-šu : MIN *qa-ti*
 412 ^ugisal-mud : MIN *up-pi*
 413 ^ugisal-anšu : *nam-ha-šu*
 414 ^ugisal-lim-ma : *giš-ru up-pi*
 415 ^ukul-gisal : *šu-mu-u šá gi-šal-li*
 416 ^udilim-gisal : *it-qur-ti* MIN
 417 ^uzi-gan : *sik-ka-nu*
 418 ^ugag-zi-gan : *sik-kât* MIN
 419 ^udilim-zi-gan : *it-qur-ti* MIN
 420 ^uumbin-zi-gan : *šu-pur* MIN
 421 ^ugag : *sik-ka-lum*
 422 ^uir : *ir-ru*
 423 ^uir-kud : *ir-ku-u*
 424 ^uir-dim : MIN
 425 ^uir-dim : *mah-ra-šú*
 426 ^uir-dim : *tim-mu*
 426a ^udim : MIN
 427 ^uir-rab : *ú-ri-nu*
 428 ^ušibir : MIN
 429 ^u(š-bir)šibir : *ši-bir-ru*
 430 ^ugag-šibir : *sik-kât* MIN

401 building poles
 402 sideboard of the "donkey"
 403 foot fetters : wrestler's clamps
 404 foot fetters
 405 mooring pole
 406 big pole
 407 punting pole
 408 punting pole
 409 "scepter" of a punting pole: "nose-
 rope/nose-ring" of ditto
 410 oar
 411 hand oar
 412 oar with a socket
 413 donkey oar : bat, racket
 414 ... oar : barricade of the (oar) socket
 415 handle of an oar
 416 "spoon" (= blade) of an oar
 417 rudder
 418 pin/peg of the rudder
 419 blade of the rudder
 420 "claw" of the rudder
 421 wooden peg/nail
 422 wooden peg, stake
 423 wooden stake
 424 pole
 425 wooden stake : post for attaching
 426 wooden stake : pole, pillar
 426a wooden stake
 427 grapnel stake : standard
 428 staff
 429 staff
 430 pin/peg/nail of the "staff"

Translations of Sumerian passages (Referred to in the text as 'Passages')

9 ^šù-suh₃ ^ša-ra má-40-gur “9 firs (for making) ... for a boat (with a capacity of) 40 gur” MVN 14 394:2, cited PSD A/1 135;

23 ^šù-suh₃ ^ša-ra má-60-gur T. Gomi SNSAT 504 r. 22

300 ^šù-suh₃ mi-rí-za má-60-gur Jean SA pl. 75 no.53 r.

^šmi-rí-za-zu-ù x-sig-sig kur-zu sag-ki tab-ba-me-èn ^šeme-sig-zu-ù a-ge₆ íd.buranun kug-ga téš-ba suh-suh-me-en “your narrow planks (to sail) on the waves of the pure Euphrates have all been chosen by me” STVC no.60:14 (Shulgi R, PSD A/1 84)

^šeme-mar *lišānu* MIN “tongue/blade of a hoe” Hh VII B 30 ^šeme-apin = *emûlišānu* “tongue of a plow, plowshare” Hh V 137f

1 ^šm[á] 3 ^šgisal 2 ^šgi-muš 2 ^šzi-gan “one boat, three oars, two punting poles, two rudders” UET 5 230:2 (parallel texts UET 4 224 and 229 omit the ^šgisal)

kupur eleppi kupur GIŠ.ZI.GAN kupur GIŠ.GISAL kupur unūt eleppi kalīša “bitumen from a boat, bitumen from a rudder, bitumen from an oar, bitumen from all kinds of appurtenances of a boat” 4R 55,1:29

45 ^šeme 4 úr ^šma-nu má-gi-lum-ma-šè UCP 9 247 60:3 (Ur III)

GIŠ.MÁ.LÁ 1 NINDA *šiddum* 0.5 2 KÙŠ *putum* 6 *melûm* “a raft, one ninda (= 6 m) is its length, one-half ninda and two cubits (= 4 m) is its width, six (cubits = 3 m) is its height” TMB 41 82:1

10 ^šme-te-núm RA 16 19f i 46, iv 14, cf. ix last line, xi 14, xii 12

ti-ti ^šmá sumun-gim in-dag-dag “the demon wrecks the ribs as if they were those of an old ship,” CT 17 25:32f

itatušu panu u arki unātušu karûšu ši-id-da-tu-šú ... ušalbiš “its sides, prow and stern, rigging, ...s, planks(?) ... I coated with gold spades and dragons” VAB 4 156 A v 22

^šhum-bi é-gal—íd-mah-ha—me-lám—gúr-ru-àm an-gim mul-a še-er-ka-an mi-ni-šb-dug₄ “its cabin (awning-covered bench) called E. he decorated with stars like the sky,” TCL 15 pl. 38:26 (Shulgi hymn)

^šhum-zu-ù gišgal⁷ ab-šà-ga-a barag-mah-a ri-a me-èn “as to your bench, you are a throne(?) set on an exalted throne-dais in the middle of the sea,” OIP 16 60:19

55 kuš udu ge₆ ... zi-ga ^šhu-um / má ^damar-^dsuen-ka, Jacobsen Copenhagen 30 r.2

^šhu-um ad-da YOS 4 292:3

hu-um LUM = *šu-ub-tum* A V/1:26

Permission Letter from Dr. Simo Parpola

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September 6, 2001

Prof. Shelley Wachsmann
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DEAR PROFESSOR WACHSMAN,

This is to certify that I have provided Mr. Tommi Mäkelä with fresh transliterations and translations of 10 cuneiform texts relating to Mesopotamian ship-building technology and given him permission to use this material in his M.A. thesis. I have nothing against its appearing as an appendix in the thesis. Providing Tommi with a reliable rendering of these texts was essential since the only published edition of them dates from 1939 and is now hopelessly out of date. Five of the texts are previously unedited tablets in the collections of the Hermitage, included courtesy of their copyist, Dr. Natalya Kozlova. I also provided Tommi with short notes on some difficult terms appearing in the texts.

Other than this and occasional discussions at an early stage of the project, I have nothing to do with Tommi's thesis, which he has written entirely independently, without any guidance from me. I append a list of the texts concerned:

- 1) Extract from Tablet IV of the Sumerian-Akkadian dictionary Harra = *hubullu* dealing with the ship and its parts (lines IV 252-430);
- 2) 5 Ur III tablets referring to boats and their parts in the collection of the Hermitage (Erm. 4031, 4053, 7820, 14661 and 15259);
- 3) 4 Ur III tablets in various other collections (AO 6573, FAOS 16 918 and 1312, and Or 47/9 249).

Sincerely,

A handwritten signature in black ink, appearing to read 'Simo Parpola', with a stylized, flowing script.

Simo Parpola

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VITA

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