THE KITTEN SHIPWRECK:

ARCHAEOLOGY AND

RECONSTRUCTION OF A

BLACK SEA

MERCHANTMAN

A Dissertation

by

KROUM NICKOLAEV BATCHVAROV

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

DOCTOR OF PHILOSOPHY

August 2009

Major Subject: Anthropology

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Approved by:

Chair of Committee,	Kevin J. Crisman
Committee Members,	Cemal Pulak
	Donny Hamilton
	William Bryant
Head of Department,	Donny Hamilton

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ABSTRACT

The Kitten Shipwreck: Archaeology and Reconstruction of a Black Sea Merchantman.

(August 2009)

Kroum Nickolaev Batchvarov, B.A., Park University;

M.A., Texas A&M University

Chair of Advisory Committee: Dr. Kevin J. Crisman

In the early 1980s Bulgarian archaeologists of the newly established Centre for Underwater Archaeology at Sozopol discovered the remains of a post-medieval ship in the southern Bay of Kitten, in the lee of Cape Urdoviza. Between 2000 and 2003, the Institute of Nautical Archaeology at Texas A&M University and a team from the Bulgarian Centre for Underwater Archaeology returned to the site to complete the first excavation of a post-medieval shipwreck in the Black Sea. The well-preserved vessel, lost in the reign of the Ottoman Sultan Selim III (1789-1807), featured constructional characteristics seen in Iberian shipbuilding tradition, such as scarfed floors and futtocks and filling pieces between the frames.

Analysis of the Kitten ship permitted the author to reconstruct the whole-molding process used by the shipwright to build the vessel. The futtock-floor hook-scarphs appear to be the identifying part of the molding process. Morphologically identical scarfs have also been observed on Mediterranean wrecks such as Culip VI (14th century),

Yassiada (16th century) and Sardineax (17th century), which suggests that the Kitten ship is a very late example of a Mediterranean-wide shipbuilding tradition that developed in the Middle Ages and from which the Atlantic vessel descended. It also points that the Black Sea maritime culture was an integral part of Mediterranean seafaring tradition.

The dissertation offers an overview of the artifact assemblage raised from the Kitten shipwreck. Fragments of an iconostas prove that at the time of sinking the vessel was operated by Christians. The smoking paraphernalia found on the wreck provides opportunity to correct the dating of some pipe bowl types proposed by previous scholars. Personal belongings open a window into the life of the crew of a Black Sea merchantman. Although the ethnicity of the crew cannot be determined at this time, a group of copper galley ware suggests that they may have been Bulgarian. An unsolved mystery is presented by the presence of a navigational instrument, probably an octant, on board.

DEDICATION

To my daughter Mariana for all the joy she has brought into my life! To my mother for being the greatest friend and in loving memory of my father!

ACKNOWLEDGEMENTS

Dr. Kevin Crisman, Chair of my Committee, was – as always – a mountain of support and encouragement throughout the different stages of this project. Without him, the excavation of the Kitten shipwreck would never have happened. I am much the richer for having met Dr. Crisman and for having studied under him! Without the educational experience of the 1998 field season in Lake Champlain, I would not have been able to undertake the Kitten shipwreck excavation. He and Dr. Fred Hocker taught me not only the techniques of hull recording and reconstruction, but, much more importantly, taught a philosophy, an approach to this field of research. My debt to them is immense and can only be acknowledged, never repaid. I was extremely lucky to have had the opportunity to study under professors of their caliber. My time at the Nautical Archaeology Program was not only among the happiest times of my life, but also the most enlightening period of it, thanks to Dr. Crisman, Dr. Hocker and last, but certainly not least, Dr. John McManamon. These gentlemen enriched me beyond what words can describe. Their friendship is very dear to me!

I would like to thank the members of my committee, Dr. Cemal Pulak, Dr. Donny Hamilton and Dr. William Bryant for their generous help and encouragement. I am particularly grateful to Dr. Pulak for all he has done for me over the years. This dissertation is the better for his corrections.

I am very grateful to my friends Dr. John McManamon, Dr. Fred Hocker, Mr. Mark Polzer and Mr. Troy Nowak for joining me in this adventure. I thank them for their trust in me, for their contributions and advise. I sincerely hope that one day we shall excavate another shipwreck together! Dr. McManamon suffered through reading an early draught of this dissertation. I cannot thank him enough for this act of heroism! He has been the greatest of friends over the years.

The late Dr. Ivan Ivanov, Director of the Varna Museum of Archaeology, was a gracious host to our reconnaissance crew in 1999. My co-director, Dr. Kalin Porozhanov, Research Secretary of the Institute of Thracology at the Bulgarian Academy of Sciences, was a gracious and deeply respected colleague. His great good humor, encouragement and authority were greatly beneficial to the expedition. Through the unrelenting efforts of Ms. Hristina Angelova, a small museum opened in Kitten, where most of the finds from the expedition are now displayed! There are not many projects that end up having their own museum!

A big Thank You is due to Dr. Georgy Mavrov for conserving the artifact assemblage from the wreck, practically donating most of his labor and time! Mr. Milen Marinov, a conservator with the Varna Museum of Archaeology, joined us in the 2003 season and undertook all our field conservation, donating his time. I am very grateful to him and only wish he had joined us earlier. Through the campaign seasons, Captain Petar Petrov was a great friend and a good colleague. Thank you, Pepi! In the 2001-2003 excavation

campaigns Mr. Rumen Zhelezarov, a NAUI instructor, served as our Diving Safety Officer and trained nearly half the Bulgarian participants in this project. Mr. Zhelezarov's diving school is now located on the helicopter landing pad, where once stood our base. Rumen was one of the most reliable and steady participants in this project.

Most of the work force for the project was provided by archaeology students from New Bulgarian University, Sofia. The contribution of Stanislav Bonev, Anita Dotzeva, Mr. Yavor Ivanov, Ivelina Petkova, Miroslav Todorov, Dimiter Vassilev is gratefully acknowledged. Here is the place to acknowledge also the participation of three Macedonian students in the project: Valentina Todorovska and Sarita Karpuzova and Goran Sanev. The bulk of the research presented below, was undertaken in the years 2005-2008. Many people generously shared their knowledge and time with me, and helped me in many other ways. Meglena Parvin found, copied and sent me enormous quantity of articles, of the existence of which, I was blissfully unaware. Debbie Cvikel arranged for the successful reading of the stamps on pipe bowls raised from the Kitten shipwreck.

I am very grateful to the Institute of Nautical Archaeology! The INA Archaeological Committee took a risk in entrusting me with this project and I thank them for the trust! The financial support of the Institute of Nautical Archaeology in the first two seasons was crucial. The late Mr. Harry Kahn generously supported the Kitten Shipwreck. He is

remembered with gratitude. RPM Nautical Foundation was an extremely generous sponsor of the Kitten Shipwreck Excavation. Thank you! The National Geographic Council for Exploration has always been a generous supporter of INA projects. The Kitten Shipwreck Excavation benefitted from the Council's generosity and vision, too, through their grant #7385-02. Thank you!

My vocabulary is too poor to properly thank Mr. John De Lapa for his exceptional generosity towards me, for his trust in me and my work. Maecenates like the Medici made the Italian Renaissance possible. If the world is ever to live through a new Renaissance era, it would be through the generosity of patrons like Mr. De Lapa. The completion of the excavation and, now, the analysis of the Kitten shipwreck made possible only through his exceptional, unparalleled bigheartedness! My obligation to Mr. De Lapa is enormous and I shall never be able to properly thank him! Only through his generosity have I been enabled to complete my doctoral studies. Here I would like also to thank Dr. Robert Walker who helped facilitated the administering of the fellowship.

Last, but far from least, I want to thank my family. My parents taught me to love the sea, archaeology and history and were the best possible friends. I want to thank Theodora for teaching me what little I know of Photoshop and photography, for helping with scanning, for the encouragement and friendship. Mariana is a treasure!

TABLE OF CONTENTS

Page

ABSTRACT iii

DEDICATION v

ACKNOWLEDGEMENTS vi

TABLE OF CONTENTS x

LIST OF FIGURES xii

LIST OF TABLES xviii

CHAPTER

I INTRODUCTION 1

Initial Investigations of the Kitten Ship Wreck in 1982-1986 3
The Bulgarian Black Sea Project, 2000-2003 8
General Conditions in the Bay 11
Organization and Methodology 15

II HISTORICAL BACKGROUND 32

III DESCRIPTION OF THE HULL REMAINS 71

The Ship's Backbone: Keel, Stem and Sternpost 74
Framing Timbers 83
Keelson, Sister Keelsons and Mast Step 91
Stringers and Ceiling Planks 95
Deck Beam 103
Planking 105
Materials 106
Conclusion 107

IV RECONSTRUCTION OF THE KITTEN SHIP 109

Longitudinal Profile 112
Hull Sections 120

CHAPTER Page

Hydrostatical Analysis 132
Measurement System 140
Designing the Kitten Ship 144
Further Research 161
Conclusion 165

V HYPOTHETICAL RECONSTRUCTION OF THE RIG 169

Literature Overview 169
Archaeological Evidence for the Rig of the Kitten Ship 170
Basis for the Reconstruction of the Rig 181
Spar Dimensions 195
Standing Rigging 198
Running Rigging 200
Handling of the Lateen Rig 205
Conclusions 220

VI ARTIFACTS FROM THE KITTEN SHIPWRECK 223

Ceramics 226
Copper Utensils 233
Wooden Spoons 249
Coins and Tokens 251
Carved Wooden Plaques 255
Personal Effects 259
Clay Pipes and Smoking Paraphernalia 264
Navigational Equipment 286
Miscellaneous 289
Conclusions 294

VII CONCLUSION 299

REFERENCES 316

VITA 326

LIST OF FIGURES

FIGURE		Page
1	Map of Bulgaria with the locations of Sozopol and Kitten	1
2	Map of the Bay of Kitten	2
3	Location of the Kitten shipwreck, the Early Bronze Age settlement and the base camp	10
4	The dark areas show the Bow square and Trench F at the end of the 2000 season	19
5	The Bow Square, 2000.	20
6	Site Plan at the end of the 2001 season	22
7	Site plan, 2002	24
8	The site plan at the end of the 2003 season	26
9	Diver recording timber scantlings	29
10	Map of the Balkan Peninsula and the Bulgarian coastline	33
11	Plan of the intact hull structure	72
12	External reinforcing timber, notched for the frame overlaps	76
13	The remains of the stem with a deep rabbet along the side.	79
14	The Sternpost	80
15	Y-shaped floor timber in the bow	84
16	Futtocks with hook notches, probably from the collapsed port side	85
17	Hook-scarfs between the floor timbers and the first futtocks on the Kitten wreck	86

FIGURE Page

18 The Midship frame consists of a large floor timber and futtocks fastened to either side of it 88

19 Notch in adjacent timber for fastener of a toptimber 90

20 The top of the keelson in the bow section 92

21 Stanchion mortise with square imprint visible 93

22 Sister keelsons and mast step 95

23 Crenelated timbers with filling pieces between the futtocks 96

24 Starboard side with stringers and filling timbers 99

25 A part of the outer footwaling strake which may have formed part of a breasthook 100

26 Transversal ceiling planks in center right of the photograph. 101

27 Deck beam. 103

28 Reconstructed lines of the Kitten Ship 117

29 Longitudinal section of the hull. 119

30 Frame 26 as recorded 120

31 Frame E as recorded 121

32 Frame at section 13, as recorded 123

33 Midship frame as recorded. 124

34 Reconstructed midship frame. 125

35 Narrowing and rising of Frame M 151

36 Narrowing and rising of Frame 13 153

37 Narrowing and rising at Frame E 154

FIGURE Page

38 Narrowing and rising at Frame 7 155

39 On the left is an experimental mezzaluna based on different numbers of frames included in the calculation 158

40 Aft mezzarola 159

41 This mezzarola fits the rising forward 160

42 One of the dried out blocks, recovered in the 1980s 171

43 The mast step, supported by the sister-keelsons 172

44 Small block recovered from the Bow square in 2000 174

45 Double block 175

46 One of the larger single blocks 176

47 Toggle in situ 179

48 Leather pieces with traces of sewing 181

49 Extreme mast rake on a lateen-rigged vessel 184

50 Fishing boats from Sozopol, c. 1912 185

51 *Sefer* boats and a *mauna* at the quay in Sozopol, c. 1912 186

52 A mahone from the early 20th century 187

53 A lateener with heavily raked mast 192

54 Detail from an engraving by Melling, showing a two-masted lateener c. 1819 193

55 Detail from a Melling engraving, c. 1819 194

56 Reconstruction of the Kitten vessel's rig 198

57 A detail from Plate 53 in *The Greek Merchant Marine* 203

FIGURE Page

58 Diagram of a lateen rig 206

59 Settee rig as carried by Alexandrian *feluccas* 209

60 Sketch of a *ghaissa* rig, sailing on a wind 210

61 A passenger *alamana*, with a stub mast and almost gunter-like lateen sail 211

62 A *mahone* with lowered yard for passing under bridges 212

63 Small lateeners on the starboard tack 216

64 KT050 227

65 Inkpots. KT079 on the left and KT080 on the right 229

66 KT112, an *oinochoe*-type jug from the stern cabin 230

67 Ceramic tiles from the stern cabin 231

68 KT082 Coffee cup 232

69 KT006 Sahan 236

70 KT067 Sahan with hatched decoration on the rim 237

71 KT065 A shallow and thin-walled plate 239

72 KT066 A *tava*. 240

73 KT007 Tas or tazza 242

74 KT063 Lid, probably of basin KT064 243

75 KT064 Basin 244

76 KT011 *Siniya* or carrying tray 245

77 KT119 Copper brazier 247

78 KT115 Two-part candlestick 248

FIGURE Page

79 KT026 Type I spoon with hexagonal handle 250

80 KT101 An accounting token struck by Ernst Lauer..... 252

81 KT102 An accounting token struck by Johan Christian Reich 254

82 KT099 An Ottoman parah coin from the reign of Selim III 255

83 KT068 Front and back sides of the gilded plaque..... 257

84 KT069 Carved plaque with cross decoration 258

85 KT070 on the left and KT072 on the right..... 259

86 KT036 A comb found in a wicker basket in the bow..... 260

87 KT035 A comb found in the stern cabin 261

88 KT061 Upper part of a man's shoe, *tzarvul* 262

89 KT060 Sole from a child' shoe 263

90 KT056 This artifact is tentatively identified as a toy sword 264

91 KT087 Disc-based pipe..... 270

92 KT092 Disc-based pipe with stamp on shank..... 271

93 KT093..... 272

94 KT094 has seen extensive use..... 273

95 KT095 has the stamp pressed in three places..... 274

96 KT096..... 276

97 KT105 An hourglass-shaped pipe 278

98 KT097 Ivory mouthpiece 280

99 KT098 Stem with amber mouthpiece from the Kitten shipwreck 282

FIGURE Page

100 KT117 Mirror from a navigational instrument 287

101 KT118 Possibly an ocular from the same navigational instrument as KT117 288

102 KT113 Marble mortar 290

103 KT012 Grain scoop 291

104 KT085 A small cask found in the stern cabin 292

105 KT058 Shepherd's bell from the neck of the goat 293

LIST OF TABLES

TABLE Page

1 Table of Proportions of Mediterranean vessels..... 114

2 Measurements in Ottoman units..... 143

CHAPTER I

INTRODUCTION

In the early 1980s Bulgarian archaeologists of the newly established Centre for Underwater Archaeology (CUA) at Sozopol (fig. 1) discovered the remains of a post-medieval ship in the southern Bay of Kitten, under Cape Urdoviza (fig. 2).



Fig. 1. Map of Bulgaria with locations of Sozopol and Kitten. Drawing: K. N. Batchvarov.

This dissertation follows the style of the *American Journal of Archaeology*.

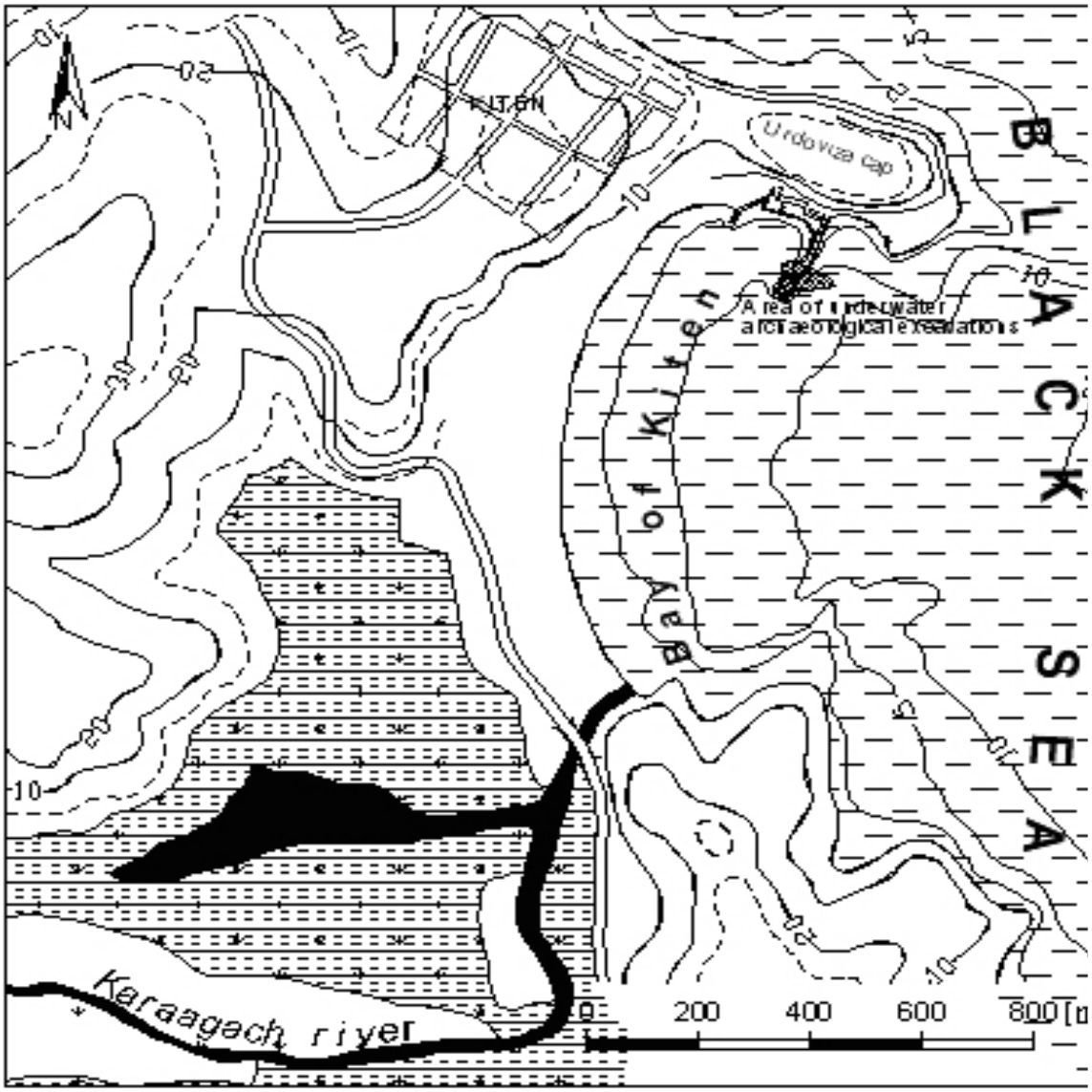


Fig. 2. Map of the Bay of Kitten.[1] Drawing: Dr. M. Georgiev.

Over three seasons Dr. Kalin Porozhanov directed a limited excavation of the site which, came to an abrupt halt when an Early Bronze Age settlement was discovered beneath the

[1] In Bulgarian the town's name is spelled with a single "T" and is transcribed into Latin alphabet *verbatim*. However, as such it tends to be pronounced in English as "kite", when it should be pronounced "kitten". To avoid confusion in pronunciation, therefore, I adopted a second "t" in this work.

ship. Since the Bronze Age settlement was threatened by the building of a marina, it required immediate archaeological attention. The construction of the marina and the absence of nautical specialists in Bulgaria led the excavators to rebury the ship and concentrate their efforts on the settlement.[2] The three seasons of excavation, in 1982, 1984, and 1986, however, yielded some noteworthy clues to the importance of the ship.

In 2000 a joint Institute of Nautical Archaeology (INA) and Centre for Underwater Archaeology (CUA) team returned to the wreck to initiate a full-scale excavation and recording.

INITIAL INVESTIGATIONS OF THE KITTEN SHIPWRECK IN 1982-1986

The vessel was lay at a depth of eight to twelve meters, with the longitudinal axis of the ship oriented NE–SW. The CUA opened seven three-meter excavation grid squares. The grid followed the length of the vessel. Squares I, II, III, V, VI, VII were in line overlaying a row of exposed frame tops; square IV was opened immediately to the east of square III. Unfortunately no site plan from that excavation survives, although Porozhanov has managed to save the field notes of the expedition from the numerous floods, closings, restructurings and other disasters that have befallen the CUA over the years. Based on these logs, Dr. Porozhanov published a brief preliminary report on the work undertaken in the 1980s. The present introduction is based on this article, the field

[2] Porozhanov 2000.

notes themselves, which he kindly allowed me to study in 2002, and personal conversations.

The CUA did not find any cargo on the wreck. A large quantity of branches and tree trunks were discovered, some of which still had bark. The reported pieces varied in length between one and three meters. It was supposed that this may have been cargo or firewood for the galley. In light of later observations, it is even more probable that the material was deposited secondarily on top of the wreck and was not part of the wreck itself. The Karaagatch River, in the southern end of the bay, to the present day tends to carry timbers.

In the northern part of the wreck the CUA discovered five dark green-glazed jugs with pinched mouths. Identical jugs from nearly the same location were also recovered in 2003. Ceramics in the area were covered with a black coating which at the time of the first excavation was assumed to be evidence of burning. During the joint expeditions of 2000-2003, however, we found no trace of fire on board the ship. The black coloring appears to be the result of the interaction between salt water, iron fastenings and oak timber. A few copper utensils, described in the article as cauldrons, were raised by the CUA from the same area of the hull and are now stored in the Sozopol Museum of Archaeology. None of them are large enough to be a true cooking cauldron and they are all better described as skillets or saucepans. All are heavily eroded and have not been conserved. Similar items were also discovered off the port bow in 2003. They were in

equally poor condition, so were not recovered. Items that were recovered in the 1980s, but are no longer to be found in the Museum, include a wooden plaque of 20 cm by 5 cm with St Andrew crosses incised on it, a broken wooden spoon (17 more were recovered between 2002 and 2003), pieces of a pigskin, fruit stones, pieces of a rush mat, rope and an iron ring. In square IV (to the east of the main line of the excavation grid), two barrels with iron hoops were discovered. On one of the barrels was incised the letter "X" (In Cyrillic this letter is read as "H"). In the same square with the barrels two bronze inkpots (*divit*s) a copper cauldron with two handles, two clay smoking pipe bowls and, what is described as two wooden "spades" were found. In 2002, we were able to identify the "spades" as filling boards from between the futtocks, placed at the level of the turn of the bilge. Since no specifically diagnostic artifacts were discovered, the wreck was broadly dated to the 16th -19th centuries.

Even in the 1980s it was recognized that the most important find of the assemblage was the hull itself. Porozhanov documents that only the eastern portion of the hull was excavated to a length of 22 meters and width of three meters, but he concluded that the width of the actual surviving coherent structure was probably at least six meters, allowing a maximum beam for the vessel of about 7-8 meters. In 2002 and 2003 we proved his inferences on both accounts to be correct. The expeditionary logs suggest that the excavation reached a depth into the site of between one and one and a half meters. This may be an overestimate, as we reached artifacts in-situ at a depth of about one meter below the surface, implying that the previous work on the site did not attain such

depth. A coherent “deck” structure was found within the excavated area. The report does not make it clear, but it appears that the archaeologists (or rather the commercial divers who worked under them) uncovered part of the bottom ceiling planking of the ship, as they are the sole surviving part that can reasonably be described as “deck” or “cabin sole”. In that same area seven small and four “large” blocks from the rigging of the ship were discovered. It is not clear whether they were stored there, or deposited there through the wrecking process. Lack of evidence for internal division of the hull in the area suggests that the blocks probably were in use at the time of sinking.

A Bulgarian ship modeler identified a disarticulated timber discovered in the southern part of the wreck, corresponding to the stern, as the sternpost. However, the identification has since been proven incorrect. In 2003 we discovered the sternpost (unmistakable with its long, curving pintle) under the starboard quarter of the ship, in a place where excavations had not been undertaken in the 1980s.

In his preliminary report, Porozhanov correctly assumed that the ship was steered with a tiller. He hypothesized an overall length for the vessel of around 24-25 meters and a beam of about 7-8 meters. The larger blocks (actually modest in dimensions) were tentatively identified as part of the shroud tackles for a lateen rig. Porozhanov expressed the opinion that the ship had a single mast with a lateen sail. Although the blocks are too small for shroud tackles, the conclusions appear to be correct, based on the discoveries of 2002 and 2003. In fact, it is worth noting that most of Porozhanov’s assumptions and

deductions were confirmed by the joint 2000-2003 expedition. This is a notable achievement, as ship reconstruction and archaeology were at the time unknown in Bulgaria; our joint effort was the first complete excavation and recording of a post-medieval Black Sea merchantman.

Artifacts suggested the wreck dated to the Ottoman Period in Bulgaria (1396-1878). Taking into account the type of pottery discovered and the smoking pipes, a 17th- or early 18th-century date was proposed. The two bronze inkpots implied that there were literate people aboard the vessel, not a common occurrence among the population in the Ottoman Empire in those days. The piece of pig's hide and the small plaque with St. Andrew crosses suggested that the ship had an Orthodox Christian crew at the time of its loss. Samples were taken from the wooden structure of the ship and sent to Associate Professor Elena Chakalova from the Biology Department of St. Kliment Ohridski University in Sofia for identification. All structural hull timbers were identified as made of oak. The decorative plaque was made of sycamore (*Platonus orientalis*). The fruit stones found on the wreck were of cornel-tree berries (*cornus sp*.). All identified species grew and still grow in the mountainous parts of the Bulgarian Black Sea coast.

In the 1980s a heavy airlift, powered by a large capacity low-pressure compressor, was used for the removal of overburden from the site. The spoil was brought to the surface and screened through a monitored sieve. The mapping of the site was based on the grid squares. For more precise drawings, the archaeologists built a movable one square meter

frame divided with thinner welded rods into 10 cm by 10 cm squares. Unfortunately the drawings produced in the 1980s were not found in the archives of the Centre in 2002 and 2003. Between seasons, the site was reburied by covering it with sandbags. Most of these bags were removed during the joint expeditions of 2000-2003.

Although the work in the 1980s was interrupted and the excavation could not be completed, archaeologists came to the conclusion that the ship could offer valuable insights into the maritime history of the Bulgarian Black Sea coast, a hitherto understudied subject.

THE BULGARIAN BLACK SEA PROJECT, 2000-2003

The Bulgarian Black Sea Project came into being in the fall of 1998 as result of a conversation over pints of Guinness among Dr. Fred Hocker, Dr. John McManamon, Mr. Troy Nowak, a student at the Nautical Archaeology Program at Texas A&M University at the time, and myself. We discussed the potential of the Bulgarian Black Sea coast for nautical archaeology, considering the length of human occupation along its shore. From these shores comes the oldest golden treasure in the world, the Varna treasure (c. 4800 BC), numerous late Neolithic and Early Bronze age inundated settlements (at last count more than 15 were known, although not excavated), the extensive and well-attested maritime traffic since the dawn of Greek colonization (7th century BC for the Bulgarian coast) to the present day. The four participants in the

conversation decided to undertake a reconnaissance trip to Bulgaria, as the Institute of Nautical Archaeology (INA) had long demonstrated interest in the region. It fell to the lot of the present writer to have the pleasure of organizing the expedition and ultimately direct both the reconnaissance and the following excavation at Kitten.

The reconnaissance trip took place in the first week of June 1999 and proved to be a great success, largely thanks to the efforts and logistical genius of the late Dr. Ivan Ivanov, director of the Varna Museum of Archaeology and principal investigator both of the famous Neolithic Varna necropolis and the 13 inundated settlements discovered in Lake Varna. His untimely death in 2001 was a significant loss to Bulgarian archaeology and to those who knew and respected him.

During the trip, the participants in the survey were introduced to Ms. Hristina Angelova, Kalin Dimitrov and Petar Petrov, colleagues from the Centre for Underwater Archaeology, based in Sozopol, who became our guides for the Southern Bulgarian Black Sea coast. Mr. Dimitrov and Captain Petrov showed the expedition the site in the southern bay of Kitten. Very little of the ship was observable, as only the tips of the framing timbers were protruding from the bottom. The little that was visible suggested that the hull remains were in good condition. The ship and other nearby wrecks lay in the middle of the inundated Early Bronze Age settlement (Fig. 3).

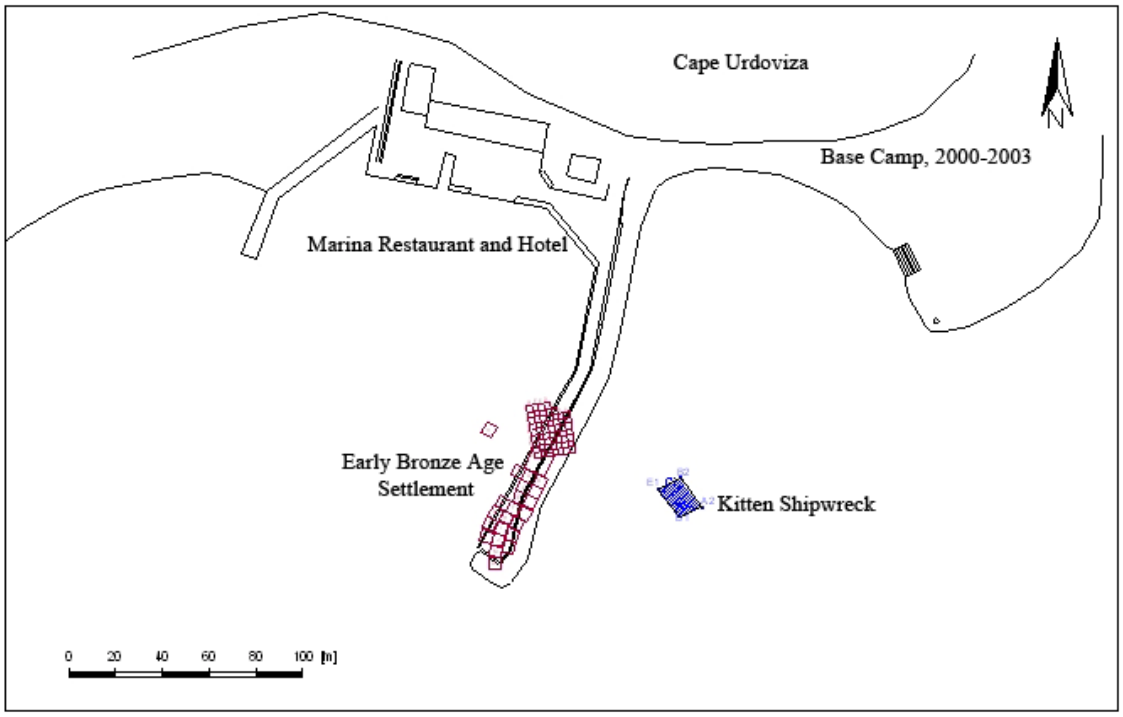


Fig. 3. Location of the Kitten shipwreck, the Early Bronze Age settlement and the base camp. Drawing: Dr. M. Georgiev.

It was believed that during previous work on the site, all notable artifacts had been raised. The assumption subsequently proved incorrect, but it had influence on the decision to resume work on the site.

After the end of the reconnaissance trip of 1999, it was decided to excavate this wreck. I thought that thanks to the previous work, the resources needed to complete the excavation would be more limited than what would be necessary if a different site was chosen. Since no other ships from this period have been excavated in the Black Sea, any data recovered from the remains of this vessel would be a significant contribution to our knowledge of shipbuilding. With the Ottoman conquest of Constantinople in 1453 the

Black Sea region became almost completely isolated from the rest of the Mediterranean world until the Treaty of Kuchuk Kainardja of 1774. The isolation caused technological stagnation, it was assumed, that the vessel would yield information relevant to much earlier periods. Furthermore, it was hoped that it might offer comparative information for the 16th-century Ottoman wreck from Yassiada, excavated by INA in the 1980s. The expeditions of 2000-2003 proved the assumption correct and yielded even more information on ship construction and seafaring in the region than I had hoped. In the late fall of 1999 was decided to return to Bulgaria in 2000 and begin the complete excavation of the wreck. In accordance with Bulgarian law it was necessary to have a Bulgarian organization to partner with in order to apply for a permit. The logical choice for a partner institution was the CUA with its base in Sozopol, 30 km from the site in the southern bay of Kitten.

GENERAL CONDITIONS IN THE BAY

The small resort town of Kitten is located at the base of the promontory which ends with Cape Urdoviza, a name believed to be of Thracian origin. The cape protects the southern bay from the northern and north-northeasterly winds fairly well, but once the wind veers further to the east, the bay becomes an open lee shore with breaking seas. The mouth of the bay is narrowed by two reefs, which present significant navigational hazards. Only the more dangerous, southern, reef has a name – *Marmalyata*. The smaller, northern reef is closer to the cape. The danger that they present in foul weather was brought to our

attention in a brutal way in 2001, when a fishing boat capsized while attempting to cut across the northern reef and one of the two fishermen on board drowned. That the anchorage could easily become unsafe is also well-attested by the presence of five or six postmedieval wrecks, most of them in very close proximity to the ship that we excavated.

During subsequent years of work on the wreck we learned more about the composition of sediments on the bay floor. Three distinct levels of overburden were observed during the excavations. The uppermost consists of shells and pebbles, mixed with sand and extends down to 50-70 cm depth. This level is disturbed as the previous work on the site certainly reached this deep. It also appears that, because of the shallowness, this level of the bottom is regularly churned by storms. For these two reasons, artifacts found in the uppermost half meter of our trenches were considered of uncertain provenience and may not have been associated with the wreck under investigation. The second level is readily differentiated from the upper one because it consists of heavy, tightly packed fine sediments – mud, which could almost be cut with a knife. The vast majority of finds were recovered from this level, which extended down for nearly two meters. The dense matrix ensured anaerobic conditions, and organic material recovered from the stratum was found to be in excellent condition. The final level consists of large-sized gravel, which slowed down the excavation considerably. The gravel was found mostly in the middle part and after parts of the wreck. Among the gravel were observed numerous pieces of flint, which does not occur naturally on the sea bottom in the bay of Kitten.

Therefore, this gravel was almost certainly part of the ship's ballast, a notion strengthened by the fact that the level was in direct contact with the ceiling planking of the hull bottom. It is notable that this gravel level was observed only from about midships to the after hold, where more of the hull structure survived and probably prevented the gravel from getting dispersed. However, the quantity of gravel appears insufficient to ensure the stability of a ship of this size, but no attempts were made to quantify this impression. In this level, virtually no artifacts were found, which also tends to argue in favour of ship's ballast, rather than overburden. Tiny shards of glass were found mixed with the gravel.

The present-day shoreline is a product of the extensive building activity of the 1980s. A helicopter landing pad (no longer used as such) built on top of concrete tetrapods, a breakwater and the Marina Hotel and Restaurant were constructed. These manmade features have undoubtedly changed the hydrodynamics of the bay significantly, even without taking into account the construction debris spread all around the bay. The wreck site lies between the landing pad and the breakwater at a depth of about 8.5 meters (Fig. 3). The incoming waves hit the quay, the withdrawing water then encounters the tetrapods of the landing pad and thus cause confused ground swells on the bottom. Because of these conditions, once waves reach Force 2 it was virtually impossible, especially for less experienced divers, to work on the seabed. Even moderate winds from the NE and E (which are dominant during the summer and early fall) can bring about powerful enough waves to make excavation impracticable, so finding the right window

of weather conditions was difficult. To our further annoyance, waves, even if small enough to permit excavation, brought seaweed to the site and quickly filled the excavation trenches. It was virtually impossible to see the wreck through the seaweeds, and nearly every day we had to begin our work by having to clear them from the site.

More significantly, the dynamic conditions on the bottom meant that shards and small artifacts could easily shift if not properly secured with sand bags. The entire bottom was covered with pottery fragments from different eras, which happily coexisted with our shipwreck material even at some depth into the bottom. Thus, the stratigraphy of the site proved to be of less use than one would expect. As an example, it is sufficient to mention the discovering of a perfectly preserved Early Bronze Age oil lamp inside a late 18th- or early 19th-century copper cauldron. The presence of other wrecks nearby added to the bottom dynamics, also made it uncertain whether finds from the upper level of the site were necessarily from the ship under excavated or represented intrusive material from one of the other wrecks. That this is a legitimate concern is demonstrated by our finding of modern cups and saucers from the Marina Hotel within the top level of the site. Slabs of dumped concrete from the construction work of the 1980s may be seen in different places in direct proximity to the wreck. During the excavation concrete was also uncovered within the wreck itself.

From the point of view of diving, operations were easier in comparison to most Mediterranean projects undertaken by INA because of the shallow water. The most

challenging part of the work was the surface swim from the base camp on the helicopter pad to the site, a distance of some 100 meters. A modest depth of 8.5 meters over the wreck meant that the duration of the dives was limited only by air consumption and water temperature. On average most of the crew, once they gained diving experience, made two dives per day, each of about 1 hour and 40 minutes duration. I averaged about 2.5-hour dives. In general, the crew was favoured with mild temperatures of around 18 degrees Celsius, except during the last season, in 2003, when water temperatures dropped unseasonably to about 6 degrees Celsius, dramatically cutting into the length of the dives. Happily, not once in four seasons of diving operations were any injuries suffered by any of the crew members.

Generally, visibility in the Black Sea compares unfavorably with that in the Mediterranean and Caribbean, but it is certainly superior to that in many lakes, rivers and temperate coastal zones. It averages between 2 and 6 meters, but on especially good days (i.e., when the water is freezing cold!) it can reach 10-12 meters. Conversely, after storms, when the sea is unsettled visibility quickly deteriorates down to a few centimeters. Coupled with the carpet of seaweeds, the situation becomes disorienting and usually we aborted diving in such conditions. No strong bottom current was discernible during the four seasons of excavation.

ORGANIZATION AND METHODOLOGY

The expedition was technically a joint venture between the Institute of Nautical

Archaeology, based at Texas A&M University in College Station, Texas, USA and the Bulgarian Centre for Underwater Archaeology (CUA) in Sozopol. In accordance with Bulgarian law, permission for international archaeological excavations was granted by decision No. 536/28.07.2000 of the Bulgarian Council of Ministers. Annual clearances were issued by the Archaeological Institute of the Bulgarian Academy of Sciences upon receipt of a satisfactory report for work in the previous season.

Administratively, the expedition was directed by a triumvirate consisting of Dr. Kalin Porozhanov, Research Secretary of the Institute of Thracology and project director, Ms. Hristina Angelova, director of the Centre for Underwater Archaeology, who served as his assistant project director on the Bulgarian side, and myself as project director on behalf of INA. Because of the lack of prior ship-recording and reconstruction experience in Bulgaria, the burden of directing the physical work under water and recording of the site was undertaken by the author. Recording and cataloging the artifacts was Ms. Angelova's responsibility.

Our excavation seasons lasted about a month each. In the first two seasons, 2000 and 2001, the INA participants consisted of Dr. John McManamon of Loyola University, Mr. Mark Polzer and Mr. Troy Nowak, students in the Nautical Archaeology graduate program at Texas A&M University, and myself. Dr. Fred Hocker visited the site and offered much appreciated guidance, advice and support. In 2001 an additional nautical archaeology student from Texas A&M University, Lauren Lancaster, participated in the

project. In 2002 and 2003 I was the sole INA representative. For this reason the main labor force was provided by Bulgarian Students from New Bulgarian University, who had taken Dr. Porozhanov's introductory course in nautical archaeology. Divemaster for the expedition in 2000 was Dr. McManamon, and from 2001 onwards Mr. Rumen Zhelezarov, a NAUI dive instructor and owner of a diving school. In general, the Bulgarian students demonstrated both enthusiasm and willingness to work. Although the weather was unpleasant, cloudy, rainy and chilly the entire month, this did not dampen the spirit of the crew at all, making the season by far the most successful and efficient of all the campaigns.

By agreement with the Bulgarian colleagues leading the expedition, the hull recording and ultimate publishing was the author's responsibility. The artifact assemblage was to be documented and studied by the Bulgarian team. Dr. Porozhanov and I had agreed to offer students the opportunity to work with the material and publish it, a rare practice in Bulgaria as I was told. At the time of writing the bulk of the work is still in progress, but the rigging elements (see Chapter V) and the smoking paraphernalia (see Chapter VI), have been completed.

We originally intended to use water dredges to excavate the site. By the end of the first season we came to the conclusion that the small 2-inch (5 cm) 5-HP Briggs and Stratton pumps could not power the large diameter waterdredges that we had. Their diameter of 10 cm (4 inches) was too large for the available pumps and we ought to have built

smaller heads. During the second season, at the insistence of Ms. Angelova, the water dredges were supplemented with the Centre's old extremely powerful air lift, a throwback to the days of Cape Gelidonya and the early seasons of the Yassiada excavation, as its design was based on descriptions and photographs in Dr. George Bass's *Archaeology under Water*, translated into Bulgarian. To describe the unwieldy beast, it is best to quote Dr. Bass' nickname for that type of airlift: the "Monster". From my experience it was a fully justified nickname. Despite the claims of the Centre's archaeologists that they could set the airlift up in such a way as to make it "controllable with a single finger," the reality was different. From a distance, working with it looked like an epic battle between Man and the Loch Ness Monster, generally ending with the victory of the latter. One thing that can be said in its favor, though, is that it had plenty of power - that is why Ms. Angelova suggested its use - as it was driven by a road air compressor, and no stone was too heavy for it to lift. On the negative side, that same just-lifted stone was almost invariably deposited promptly on top of the diver. Despite the high entertainment value provided by the "Monster", for the third and fourth seasons (2002, 2003), we reverted to INA-style airlifts made of PVC pipes. Due to the shallowness of the site, had water pumps of sufficient size been easily available, we would have been better off building and deploying new water dredges. However, taking into account that much of the seabed was covered with large shells and that hand-picking each small stone would have cost too much time, we had to accept that the powerful airlifts were the best readily available equipment for moving huge quantities of overburden covering the site.

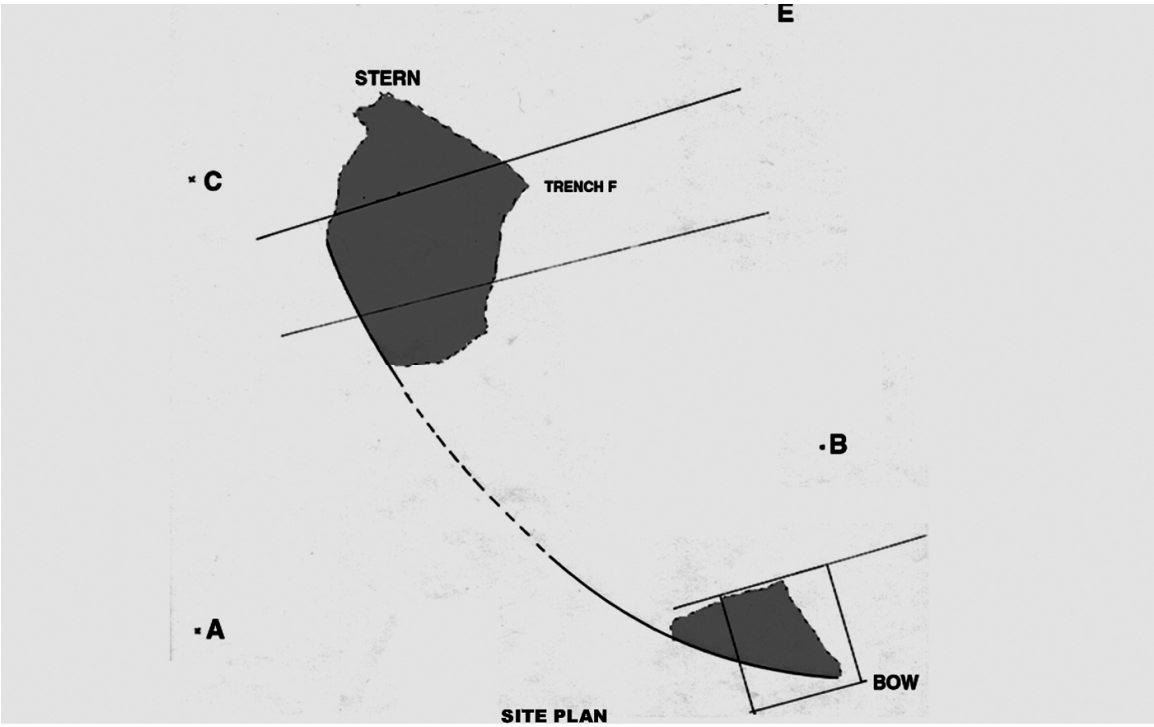


Fig. 4. The dark areas show the Bow square and Trench F at the end of the 2000 season. Drawing: K. N. Batchvarov.

For the first four-week season in 2000, the plan was to excavate a single trench across the longitudinal axis of the ship in order to get information on the extent of the wreck. This idea was based on the assumption from the 1980s work that only a small part of the bottom of the ship survived (Fig. 4). As it turned out, this was an optimistic approach. At the beginning only the tops of some frames on the starboard side were visible above the bottom sediment. We therefore chose the location of the 3-meter wide trench randomly, more or less at the middle of the line of visible frames. We were not destined to see the bottom of the ship in this location until the fourth season, by which time we had dug 3 meters into the bottom sediment. During the same season Dr. McManamon and I opened

an additional three-meter square in the bow of the ship, as the stem was discovered protruding from the bottom, amid oak posts from the Early Bronze Age settlement (Fig. 5).

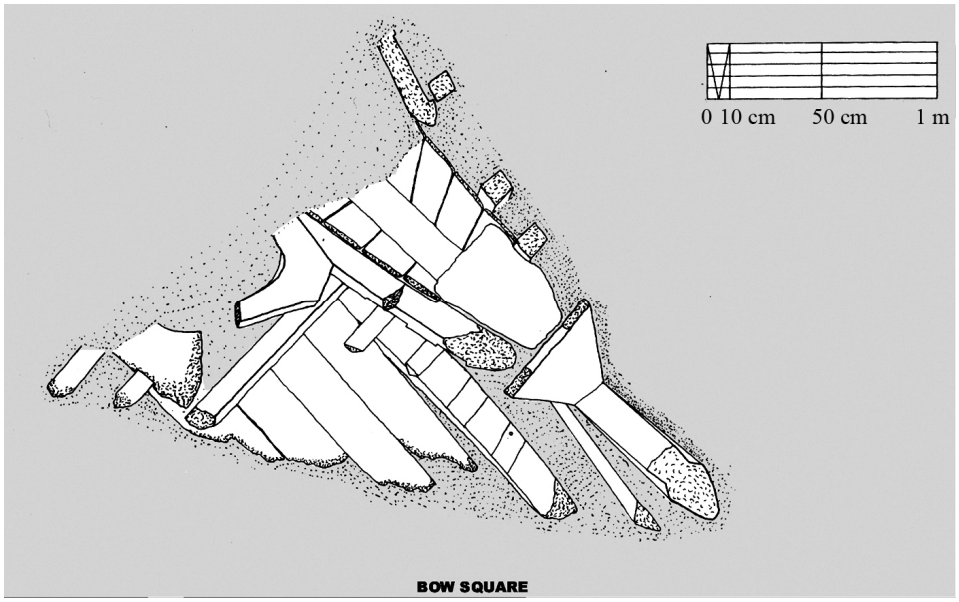


Fig. 5. The Bow Square, 2000. Drawing: K. N. Batchvarov.

During the second four-week season, in 2001, we established the length of the wreck at about 20 meters and covered it completely with a line grid. The trench from the first season was designated F, and the letter designation extended to the bow square, which became row K. The numbering of the grid squares started with 3 and extended to 6, moving from east to the west. We chose again to use the three-meter squares, thus nearly mirroring the grid from the 1980s. Our column number 3 corresponds to the location of the old grid square IV, which appears to have been more or less covered by our I3. Our grid square K4 was close to the location of the old square I. In the second season no

trace was found of the stern itself, but we were able to establish that square F4 covered the stern cabin of the ship. Grid square in column 3 proved to be to the outside of the starboard side of the wreck.

In the last week of the 2001 season, the archaeological excavation in area F started uncovering a heavy concentration of finds, beginning with a large marble mortar (fig. 6). By the end of the week, a decorated copper teapot and three plates (*sakhan*s) were raised in addition to a sounding lead and a broken, but complete, ceramic plate. A few more copper utensils were observable, but left *in situ* to await the following season. Rows G, H, and I which corresponded to the central section of the ship yielded only the fragile remains of a treble block, a couple of sheaves from medium-sized blocks and large quantities of small softwood fragments that were too heavily eroded to yield any information. A close examination of the pieces suggested that they may be remains of deck beams and planking.

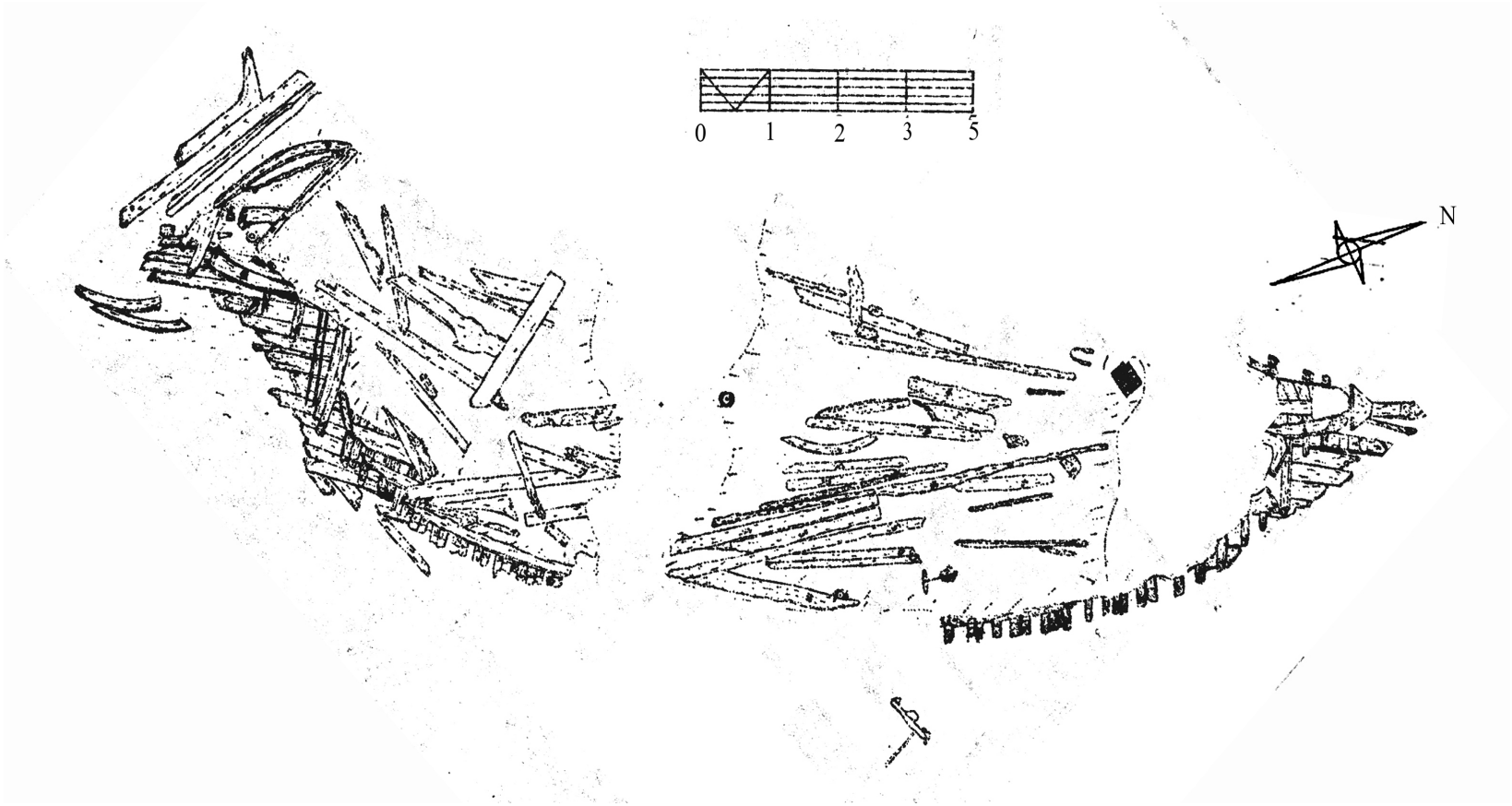


Fig. 6. Site Plan at the end of the 2001 season. Drawing: K. N. Batchvarov.

The third season, 2002, was the glory season of the Kitten expedition. The timing – September – of the excavation meant that neither Mr. Polzer nor any other INA members, except for myself, were able to return. The season began late, as the boat had not been prepared beforehand. Because of this delay, only three weeks of inclement weather, rather than four, were available to the crew to excavate. During the season the entire length of the site was under excavation, but progress was especially satisfactory in Rows F, I, J and K (the bow). Between rows H and K, the ceiling planking of the ship was reached and the mast step buttresses were discovered (fig. 7). The season ended before we reached the mast step itself.

During the fourth and final season, June 2003, the remainder of the site was excavated and numerous artifacts raised (fig. 8). At the very end of the season we also discovered the remains of the stern post, with the iron pintle still attached to it. Although the weather was mostly fine throughout the five weeks of the season, the water was unexpectedly cold; sometimes the temperature dipped to 5-6 degrees Celsius.

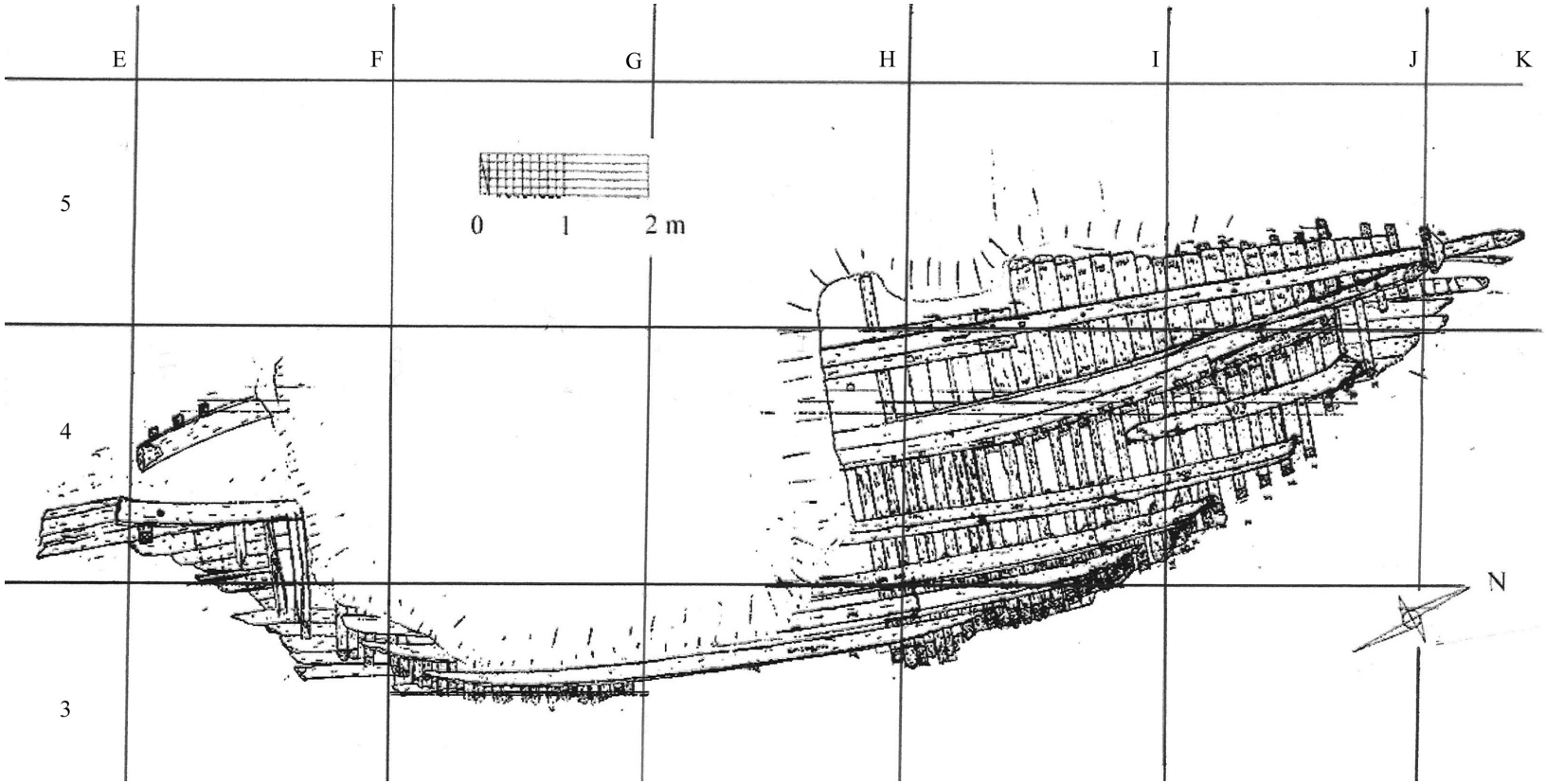


Fig. 7. Site plan, 2002. Drawing: K. N.Batchvarov.

This slowed the progress of the excavation, because it forced the crew to make shorter dives. Additionally the divers discovered that much of the wreck was filled with, or at least surrounded by concrete. The irregular distribution pattern of the concrete suggested strongly that it was intrusive. Among the more noteworthy finds were items that we believe to have been part of a navigational instrument, such as a sextant or an octant – a most uncommon instrument for the region - a few ceramic jugs, three brass accounting tokens, a silver coin from the reign of Sultan Selim III (1789-1807), rigging elements, smoking pipe bowls and even a complete pipe stem with a mouthpiece – a very rare find, indeed. The most important find, however, was an almost complete beam, which appears to have been a mast-partner component. As we were able to determine its exact position on the ship, the find permits us to establish the overall breadth of the vessel. The end of the season signaled the completion of the first excavation of a post-medieval Black Sea ship.

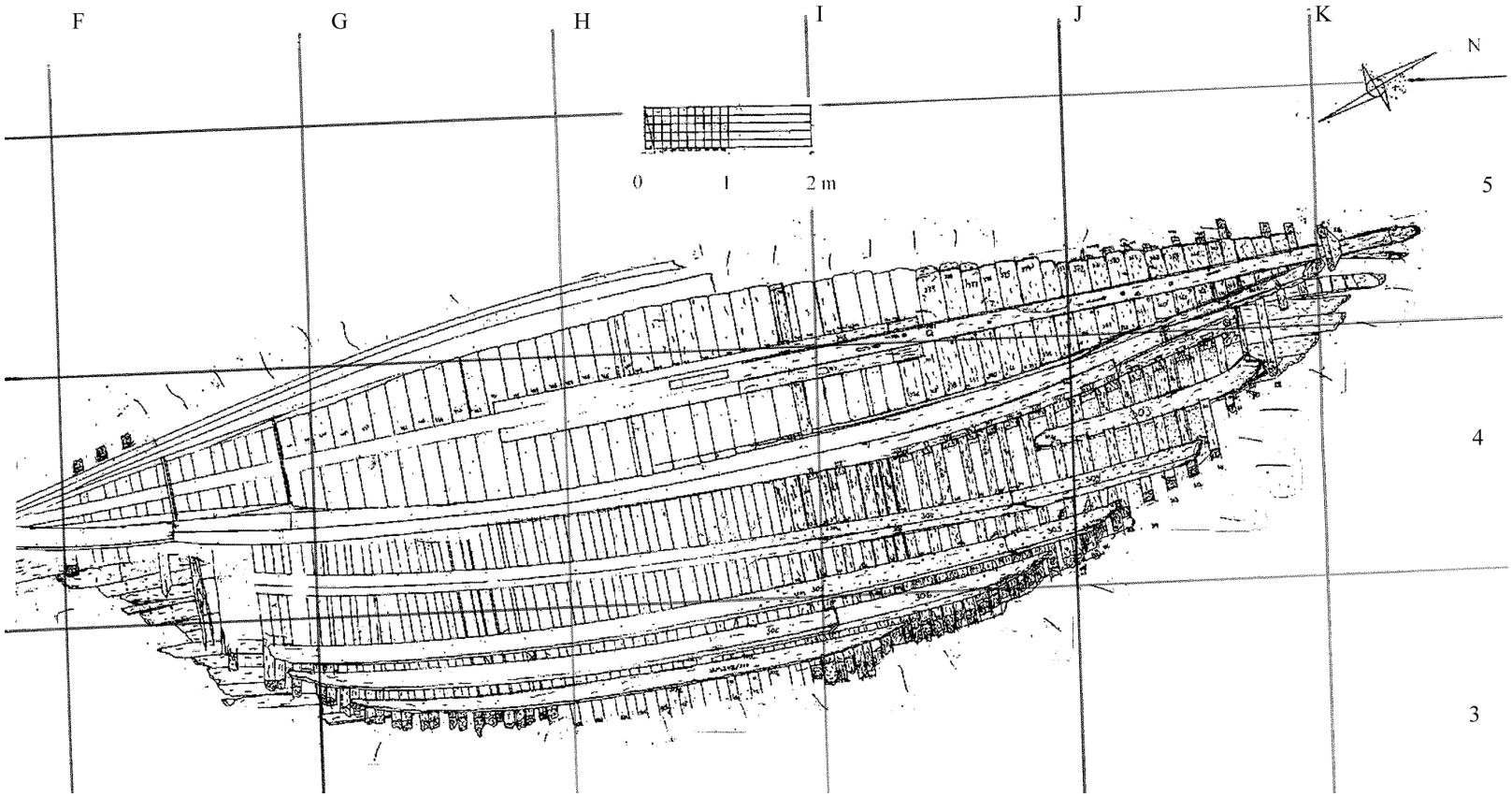


Fig. 8. The site plan at the end of the 2003 season. Drawing: K. N. Batchvarov.

Throughout the 2000-2003 excavation, the site was mapped with Direct Survey Measurement (DSM) as described by Nick Rule and used by the Institute of Nautical Archaeology at Bozburun, Turkey.[3] The gathered data was entered into WEB, a triangulation computer program developed by Rule on the Mary Rose site and licensed to INA. DSM depends on a set of control points from which distances to datum points are measured. A computer calculates positions relative to each other and provides XYZ coordinates for each point. For accuracy to be achieved, the positions of the control points must be constant. In order to attain this, we followed Mr. Troy Nowak's idea and had four "pyramids" built from iron rebar and covered with chicken wire. These pyramids were lowered to the seabed, positioned and filled with stones to secure them to the bottom. The stones and the form stability of the pyramids made it certain that the control points would not move. Although the chicken wire was completely corroded by the second season, the pyramids themselves survive to the present day and served their purpose well enough.

The DSM control pyramids were placed in what we optimistically thought were the best possible positions to provide mutually opposing measurements to each datum. In the end, we realized that one of the pyramids was too far off the site to be useful and another one was too close to the site, probably positioned on top of loose ship timbers. During the second season we added two more pyramids along the centerline of the site, outside the known location of the bow and stern. Additional control points were established

[3] Rule 1989.

along the hull itself once we started penetrating deeper into the wreck, as most of the pyramids no longer had a clear line of sight to the timbers being mapped.

Lack of properly trained personnel and shortness of time limited the extent to which DSM could be utilized. I decided to map no more than about three points on each frame timber and a sufficient number of points on the longitudinal timbers (stringers, keelson, planks, etc.) to fix their location, but not necessarily to record their shape. For recording the shapes of the frames, we used a goniometer; a tool utilizing a digital level, that has been employed to great advantage on a number of projects in the Great Lakes and elsewhere.[4] The same tool was also used for recording the keelson.

Although the DSM ought to have provided sufficient data for mapping the site, additional manual measurements between the timbers were routinely taken while recording the features and scantlings of individual timbers (fig. 9). In the process of reconstruction, this redundancy in the gathered data proved of great value, as it permitted running a check for correcting errors in the DSM measurements.

[4] Cozzi 1998.



Fig. 9. Diver recording timber scantlings. Photo: L. Klissurov.

From the second season onward, the crew built a rope grid. Its purpose was mostly to simplify one's orientation on the site and the allocation of tasks. It was also used to identify concentrations of artifacts found. Because of the way we set up the site in the first season, the lettering of the site ran from south to north, with the southernmost row being designated D. No coherent hull structure was found in D, but began to appear in

row E. The stern cabin of the ship was located in row F and the bow in row K. The numbers ran from east to west, beginning with 3 and ending with 6. The wreck was mostly situated in column numbers 4 and 5.

Napoleon Bonaparte is credited with saying that no plan survives the beginning of the battle. In some ways this statement holds true also of the Kitten shipwreck excavation. I planned the excavation on the assumption that no more than the bottom of the ship survived as a coherent structure. By the end of the 2000 season it became obvious that this was not the case and at least part of the ship's starboard side was also preserved intact. Thus, the data the wreck yielded is so much more than was originally anticipated, and the return on the modest resources invested in the project surpassed the most optimistic expectations.

Based on the artifactual assemblage, the wreck is dated to the end of the 18th century or the early years of the 19th century (see Chapter VI for the artifacts and their dating). The constructional features of the wreck indeed indicate design and construction practices typical for earlier periods: 15th-17th-century practices (see Chapter III and Chapter IV) observed in the ship's construction, which supports the original hypothesis of technological backwardness in the region. The good preservation of the hull offers the opportunity to develop a better understanding of the practical aspects of design and construction practices that hitherto were known mostly from written sources (Chapter

IV). As expected, the Kitten wreck exhibited similarities to the late 16th-century Ottoman wreck from Yassiada, Turkey.

The limited funds available for the project had a direct bearing on many of the decisions made. It would have been much more efficient to have one or two long campaigns of excavation, rather than four seasons of about a month length each. This caused a significant waste of time in setting-up at the beginning and reburying the site at the end of each season. Thus, the actual productive work time was on average between two and three weeks. Inclement weather made further inroads into the working time. The limited funding meant that few students from the Nautical Archaeology program at Texas A&M University could participate in the project, which dramatically increased my workload as I was the sole participant with any knowledge of ship structures and understanding of timber recording. Finally, the lack of funds forced early closing of the final season. Because of this, the bottom of the keel in the stern could not be reached. One more week of recording would have been beneficial, but in the circumstances was not available. Fortunately, the discovery of the lower sternpost, answered many of the remaining questions for the hull construction of that area.

Despite these frustrations and inconveniences, the project proved to be very successful. It is the first complete excavation of a post-medieval Black Sea sailing ship and provided much new information on shipbuilding and design for an area and period of which hitherto we knew very little.

CHAPTER II

HISTORICAL BACKGROUND

Despite reverses suffered since the failed siege of Vienna in 1683, the Ottoman Empire entered the 18th century with a record of military success. However, by the time Sultan Selim III ascended the throne in 1789, Ottoman imperial fortunes had reached their lowest point. In hindsight, the Siege of Vienna in 1683 was the highwater mark of the Imperial expansion. Each of the 18th-century wars that the Empire fought was a step down from the height of its power. The artifactual assemblage from the Kitten vessel provides a *terminus post quem* date for the loss of the ship in 1789. Thus, the ship appears to have conducted its trade at a time when the Empire was staggering from political weakness, military defeats and a shaken economy. A brief overview of Ottoman 18th-century history may help place the vessel in context.

On September 11, 1697, at the battle of Zenta, the greatest general of the period, Prince Eugene of Savoy, destroyed the army of Sultan Mustafa II (1695-1703) and left the Empire completely defenseless. Austria, however, was not in a position to follow up the great victory. Although the War of the League of Augsburg had just ended, it was clear that a new conflict with France was unavoidable. The Ottoman Empire, unable to continue the war, was forced to accept the fairly generous peace of Karlowitz in which both sides retained the territories they held at the time. Thus, Transylvania was freed

from Ottoman rule and was added to the Habsburg Empire, Temesvar remained in Ottoman hands (fig.10).



Fig. 10. Map of the Balkan Peninsula and the Bulgarian coastline.

The Sava and Tisza rivers became the new borders. Venice retained Morea and conquests in Dalmatia. Peter I of Russia was allowed to retain his conquests around the

Sea of Azov but agreed to destroy his forts along the border. A clause in the treaty with Austria provided for free trade of both sides' merchants within the territory of the other. This agreement had important repercussions for the growth of the Balkan merchant class. Politically, the Treaty of Karlowitz represented the Ottoman transition from the offensive to the defensive and marked the beginning of the withdrawal from Europe. The treaty also marked the beginning of the rapid decline of the Ottoman Empire, even if this was not completely obvious at the time. After the defeat, the Empire embarked upon a program of limited reforms mostly aimed at restoring the military establishment to the old state of efficiency and glory. Among the most important reforms of the last years of the 17th century was the switch from oar-powered to sail-powered vessels for the navy. Organizationally, the sailing fleet was divided into squadrons under separate commanders or *deryabey*s.[5]

The early years of the 18th century, coincided with the rule of Ahmet III (1703-1730), whose Grand Vezir, Corlulu Ali (1670-1711) continued the program of limited reforms. He eliminated much opposition by executing thousands of opponents and confiscating their properties which were then utilized to fund the reforms. For most of the period he wisely kept the empire out of European conflicts raging at the time, the War of the Spanish Succession and the Great Northern War, despite strong pressure to join one or the other side. This wise policy, however, became harder to follow after Swedish King Karl XII was defeated at Poltava (July 8, 1709) by the numerically overwhelming

[5] Shaw 1987, 223-26.

Russian army of Peter I (1682-1725). A strong war party in Istanbul, spurred on by Karl XII (1697-1718), who had escaped to the Ottoman capital, clamored to avenge the Treaty of Karlowitz. The reforms had built an exagerated confidence in the strength of Ottoman forces. Peter, aware of the feelings in the Ottoman capital, anticipated them by rebuilding his forts around the Sea of Azov in direct violation of the treaty that he himself had signed. It was neither the first, nor the last time that Russia would violate a treaty.[6]

War began late in 1710, and, in the following spring, Peter invaded. However, the Russian army soon ran out of supplies and, while trying to recross the Pruth River, was surprised and surrounded by the Ottoman army under Grand Vezir Baltaci Mehmet. The Russians suffered heavy casualties in their fortified camp, were short of supplies, and unable to break through; so Peter had no choice but accept whatever conditions were offered him. Unfortunately for the Ottoman Empire and the future of Europe, Mehmet's army was not in a much better state, and he was afraid that it might disintegrate at any moment, so he did not push for unconditional surrender. The Treaty of Pruth (July 23, 1711) stipulated that Russia would return the occupied territories and destroy its forts. Free trade agreements were reached between the two sides. Since the Moldovan and Wallachian rulers had supported the Russians in the campaign, they were supplanted by Greek rulers from the Phanariote class; thus the Greek language and cultural presence

[6]Shaw 1987, 226-28.

were strengthened in the European parts of the empire, at the expense of those of the native population.[7]

Success on the Russian front strengthened the Ottoman war party and the next action taken, was to reconquer the Morea. The feeling of satisfaction, however, was illusory, as the ensuing conflict with Austria proved. At Peterwaradin on the Danube River, Prince Eugene yet again trounced an Ottoman army that outnumbered him possibly by as much as two or three to one. The success was followed up at the Battle of Belgrade, where Eugene's 40,000 veterans crushed another Ottoman force nearly 180,000 men strong. The Austrians captured 166 guns and the entire baggage train in the process. Belgrade fell soon after, and the two sides signed the Peace of Passarowitz on July 21, 1718. The main stipulation of the treaty was that both sides agreed to keep the territories they held at the conclusion of the peace. Thus, the Ottoman Empire lost Temesvar, their last foothold in Hungary, and parts of Serbia around Belgrade.[8]

There is evidence that after the Treaty of Passarowitz (1718), the upper echelons of Ottoman society experimented with Western European models and considered some steps towards modernization. Evidently, the Grand Vezir, Damat Ibrahim Pasha, was aware that knowledge of Europe did have some importance and relevance to the well-being of the Empire. Among the more important innovations of the years immediately following the Treaty of Passarowitz was the introduction of the printing press, some of

[7] Shaw 1987, 231.
[8] Morris 1886, 92.

the earliest products of which were maps of the Sea of Marmara (1720) and the Black Sea (1724-25). To supply the press, a paper factory was opened at Yalova on the shores of the Sea of Marmara. In 1732 the water supply system of the capital was expanded and remained untouched until the reign of Abdulhamitt II at the end of the 19th century.[9]

Although parts of the ruling classes realized that the Ottoman state was falling behind their European counterparts, not enough momentum could be built for the far-reaching reforms needed to bring the empire on par with its potential opponents. Harem pressure from above and popular pressure from below usually were sufficient to strangle attempts at modernization. A strong Vizier, backed by the Sultan, could resist the pressure, but any weakness in either of the two key figures meant that the Ulema (body of Muslim scholars) would join the Agha (commander) of Janissaries and block any reform movement that might threaten the *status quo* from which they benefitted.[10] Thus, even in such vital areas as the army and navy, the reorganization never aimed at anything more than an attempt to restore the corps to their earlier state of efficiency. Therefore, when war with Austria and Russia broke out again in 1736, the Ottoman army was no better than it had been in 1717. After a slow start, the Russians invaded in their traditional way of ravaging, destroying and slaughtering all that they encountered, but – equally traditionally – their inability to create a functioning logistics system made their offensive falter after the taking of Azov. The following year, they tried their luck by invading Moldova, but the poorly supported invasion met surprisingly fierce Ottoman resistance

[9] Shaw 1987, 233-36
[10] McGowan 2005, 640

and was repulsed. Although the Austrian offensive was more concentrated and better organized than the Russian, after initial successes such as the taking of the Bulgarian border town Nish (now in Serbia), it, too, ran up against strong Ottoman opposition. In 1739 the Treaty of Belgrade was signed, in which the Empire recovered some of the earlier losses to Austria. The treaty with Russia stipulated that Russian goods exported to Ottoman territories could be shipped only in Ottoman ships on the Black Sea. Some territorial losses were also recovered. On the surface, the war had been extremely successful. Yet, there was another, less visible, side to it. The countryside was ravaged both by the armies of the Allies and by the Ottoman army. Peasants ran from their lands. The private armies of local *derebey*s grew rapidly from the abundant manpower left after demobilization, and further strengthened the local notables at the expense of the central government.[11]

The limited success in this war created a sense of security and self-satisfaction that was out of proportion to the actual achievements, notable as they were. The Ottoman Empire entered what may well be the longest period of peace that it had enjoyed since the conquest of Constantinople. The long peace and the satisfactory results from the last war destroyed any stimulus for further reforms, and gradually the little that had been achieved was reversed.[12] The following war in 1768-1774 showed just how illusory Ottoman strength was. It began over Russian involvement in Poland and started slowly, as neither side was really prepared for it. The Russian Empress, Catherine II, sent part of

[11] Shaw 1987, 244-46.
[12] Shaw 1987, 246.

her Baltic fleet to the Mediterranean, where Admiral Orlov took command. At Cheshme, July 6-7, 1770, the Russians eliminated the Ottoman navy with a surprise attack. If a Russian squadron was capable of defeating the numerically superior Ottoman fleet, the situation was indeed desperate. Less than a month later, the Ottoman Empire suffered another severe blow: at the Battle of Kartal, August 1, 1770 its army was defeated with casualties amounting to two-thirds its strength. In 1771, Orlov and his squadron stirred up a rebellion in the Morea, which ultimately they failed to reinforce and supply, thus causing it to fail. In 1772 Russia occupied the Crimea, Moldova and Wallachia. In 1774, the famous general Alexander Suvorov led an army across the Danube, cut the road to Varna and routed the Ottomans at Kozluca, establishing his reputation as the foremost Russian soldier of the century. The same year the peace treaty of Kucuk Kainardja in Nothern Bulgaria was signed, breaking Ottoman control over the Black Sea and opening it to navigation by other nations. Among the clauses of the treaty was the provision that Ottoman Orthodox Christian subjects were permitted to sail under the Russian flag.[13]

After this sobering defeat, Sultan Abdulhamit I (1774-1789) launched the traditional round of attempts to rebuild the military might of the empire. For the first time European advisors were invited without the necessity of converting to Islam or being isolated from the general population. Gazi Hasan Pasha, the sole person to come out of the Cheshme debacle with credit, was entrusted with the task of rebuilding and modernizing the navy. In terms of vessels he registered some success thanks to the employment of French

[13] Shaw 1987, 248-50.

shipwrights Le Roi and Durest. By 1784 the number of nearly serviceable vessels had increased to 22 ships-of-the-line and 15 frigates. The building of 37 large vessels in 10 years implies that materials such as timber and iron, skilled labor and shipwrights were not lacking. An attempt was also made to improve the officer corps, but in this Hasan Pasha was significantly less successful, despite the positive development of establishing a Naval Engineering school. Appointments continued to be made mostly on the basis of bribery and politics.[14]

The next war against Russia and Austria began in 1787. In 1788 Austria occupied Moldova and Bosnia. The death of Abdulhamit I brought to the throne the first true reforming Sultan, Selim III (1789-1807). This, however, did not stem Ottoman military misfortune. In October, Belgrade fell yet again to the Austrians, whose advance reached the Bulgarian town of Nish. Meanwhile, the Russian commander, Prince Potemkin captured Bucharest in Wallachia. At sea, Gazi Hasan Pasha led the Ottoman fleet to prove its increased fighting capacity. At the siege of Ochakov, a series of small craft engagements in June 1788 was one of only two actions of the war that the Russians, albeit led by Scotsman and American navy officer John Paul Jones, could reasonably claim as victories. A month later, in July 1788, the main fleets met at sea off the island of Fidonisi, Ukraine, but the fleets disengaged without a decisive result. Two years later, in July of 1790, the Russian Admiral Fyodor Ushakov engaged the Ottoman fleet near Kerch, but failed to defeat it. In September of the same year, Ushakov fought a two-day

[14] Shaw 1987, 251-52.

battle, which ended with the surrender of the Ottoman 66-gun *Melike Bahri* with little resistance and the heroic defense offered by the flagship of Vice-Admiral Said Bey. It took four Russian ships and five hours to force Said Bey at last to haul down his flag. The flagship, however, caught fire at the end of the battle and blew up. The battle of Kerch was Ushakov's greatest success in the Black Sea. The battle of cape Kaliakra, Bulgaria, fought in August 1791, was the last naval engagement of the war. Although Russian propaganda attributes legendary status to the battle and claims that at the Battle of the Nile Admiral Nelson copied Ushakov's tactics used at Kaliakra, the truth is far less heroic. Unlike Nelson, Ushakov not only did not annihilate the Ottoman fleet, but actually failed to capture, sink or even seriously damage a single enemy ship. At the end of the day, the Ottomans withdrew unmolested to Istanbul.[15]

Earlier that same month (August 4, 1791) the war with Austria on land ended with the Treaty of Svishtov, a small town on the Danube River in northern Bulgaria, advantageously for Austria. Luckily for Selim III, the Austrians were concerned about the French Revolution and were willing to terminate the war without following up their successes, despite the defenseless state of the Ottoman Empire. The Russian war also ended with a defeat for the Ottomans and peace was signed at Jassy on January 8, 1792. The Ottomans recognized the loss of the Ukraine and the expansion of Russian presence on the Black Sea littoral.[16]

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[15] Anderson 1952, 318-47. Despite its age, Anderson's account remains the best account.
[16] Shaw 1987, 259-60

Upon conclusion of peace, Selim III launched the most comprehensive program of reforms of any sultan up to this time. Although ultimately he did not succeed, his attempts paved the way for the later changes instituted by his successors. As was traditional, Selim attempted to reform the Janissary (elite infantry corps) and Spahis corps (elite cavalry, supported by fiefs), but with no success. He established a parallel army, the Nizam-i-Cedit (New Order), organized, uniformed, armed and trained on European principles. By 1806 the new corps numbered 22,685 men and 1,590 officers. In campaigns of the Napoleonic wars, such as the siege of Acre, the Ionian campaign, Egyptian campaign and the Anatolian battles against armed bands, the corps acquitted itself well. Its ultimate failure and disbandment was more a product of Selim's weakness and miscalculation than the corps' inefficiency. Simultaneously, attempts were made to bring support industries such as cannon foundries and musket manufactures up to date. With the involvement of Great Britain and France, at least partial success was achieved on this front. Under Kucuk Hussein Pasha the naval reforms were continued. The new technical schools were expanded.[17]

By far the most successful part of Selim's reforms was the rebuilding of the navy, where less resistance to change was met, possibly due to the virtual annihilation suffered at Cheshme. Until recently, the only study of these important developments in Ottoman military history was published by historian Stanford Shaw, a renowned researcher of

[17] Shaw 1987, 263.

Selim III's reign.[18]. Unfortunately, his mastery of Ottoman archives is in contrast to his understanding of matters nautical and especially naval terminology. As an example, Shaw uses the term "galleon"- probably a direct transliteration of the Turkish "kalyon," which means a three-masted, ship-rigged warship – instead of "ships-of-the-line".

Progress was made in refurbishing the materiel of the navy. In the summer of 1793, an expansion and repair of the Imperial Arsenal at Istanbul began and most shipbuilding was placed under the control of the French master shipwright, Jacques Balthasard Le Brun. Other foreigners invited to build ships for the Sultan included British and Swedish nationals. Turkish, Greek and, apparently, Bulgarian shipwrights (see below) of the Empire continued to build ships as well. Under the leadership of Hussein Pasha, the arsenals at Sinop and Sohum on the Black Sea and Silistra (Bulgaria) and Galatz (Wallachia) on the Danube were revived. Shaw mentions "new shipbuilding forms" established at Haskoey. As the expression makes no sense, it is likely that Shaw mistranslated or misunderstood a Turkish term. Most probably it refers either to building new slips (Le Brun built there the first masonry dock in this period) or lofting floors and moulds.[19]

Under the leadership of the French shipwrights the navy expanded rapidly to the extent the finances of the Empire permitted. To this period dates the beginning of copper-sheathing the ships in the Ottoman navy. In the decade between 1789 and 1798 45

[18] Shaw 1969
[19] Shaw 1969, 223-24.

warships were built, of which 3 were three-deckers. In 1806 the Ottoman Navy had 20 ships of the line and 15 frigates, mounting 2,156 cannon and crewed by 40,000 sailors and soldiers.[20]

Other parts of the reforms were less successful: the attempts to rebuild the scribal system (central state bureaucracy) mostly failed. No overall budget existed. The problem of abandoning the land and migrating to Istanbul was addressed, but not solved by closing hotels, taverns, coffeehouses and forcefully returning the peasants to their places of origin, regardless of whether or not they had anything to return to. To relieve fiscal pressures, the coinage was debased, merchant's properties were confiscated and taxes increased with little regard for the ability of the population to pay them.[21]

The first 60 years of the 18th century saw the introduction of glass, soap, sugar, gunpowder and paper industries. The Empire exported raw materials such as cotton and imported finished goods. After the 1760s, with the worsening political and military situation of the Empire, these efforts faltered and even disappeared. Trade continued to expand through the 1760s, but its value and content did not remain progressive.[22]

Throughout the century the Janissary corps gradually transformed from a full-time regular military unit into a part-time militia, intermarried within the populace, and

[20] Shaw 1969, 225-26.
[21] Shaw 1987, 264-65.
[22] McGowan 2005, 639.

involved itself in commercial activities. Janissaries kept their military status solely as a source of privileges. The corps' abilities deteriorated as a fighting force to the point that it became useless and expensive, both in political and financial terms. Ironically, it was more dangerous to the central power of the Sultan than to any of his enemies. The decline and commercialization of the Janissary corps and its mixing with the populace aided the rift between Muslim and non-Muslim subjects of the Sublime Porte (the Ottoman Government, the Sultan). The defeats that the Austrians handed the Ottomans with regularity, increased the consciousness of Serbs, Greeks and Bulgarians that they were conquered, subjugated nations. It is hardly a coincidence that the first Bulgarian history, which did so much to bring about the Bulgarian Revival, was written by Father Paisii in the 1760s just as a new war with European powers was beginning. Bruce McGowan saw three major issues as contributing to the decline of the Ottoman Empire in the 18th century: The development of what he called a "colonial" pattern of trade (exportation of raw materials and importation of finished goods), the alienation of the minority (non-Muslim) merchants and the diversion of capital and energy from industry to trade.[23]

Through careful fiscal practices and luck for a large part of the peaceful years in the middle of the 18th century, the Ottoman Empire was able to put away significant amounts of money, which were welcome at times of war. The failure to develop central

[23] McGowan 2005, 641.

banking and credit operations left the state without the financial staying power that its main war-time opponents had.[24]

In the period when European states were developing educated, competent bureaucracies, that of the Ottoman Empire lagged behind on the curve and was unable to face the new challenges. As the central cadres declined in efficiency and competence and were rotated through the provincial offices, they developed dependency on local knowledge which inevitably transferred power into the hands of the neighbouring notables – the *ayans*. The power in the hands of the *ayans* was not always used to the benefit of the central power. Ironically, in the 18th century, the extreme centralization of the state was leading the empire into an essentially feudal anarchy and decentralization. The interference from the central government, such as it was, brought mostly a stifling of free enterprise and technical progress, not stability.[25]

Crucial for the break-up of the central power and the rise of the warlords, sometimes erroneously also called *ayan*s, was the war of 1768-1774. As result of the war, Morea (Peloponnesos in Greece) was nearly lost to the Ottomans. The *ayan*s were called upon to raise troops for its retaking. Often these troops were undisciplined Albanian mountaineers. They laid the area to waste, and it took nearly a decade to rein them in. In other places the same story was repeated. The following war against Russia, 1788-1792, no less disastrous in its outcome than the previous one, proved yet again the inability of

[24] McGowan 2005, 541.
[25] McGowan 2005, 642.

the Janissaries to cope with European infantry. The war forced the rapid expansion of general levies, which, although unreliable on the battlefield, outperformed the Janissaries and swelled the retinues of the warlords and the local banditry upon demobilization.[26]

As result of the defeats, the general levies, and the crumbling central control over the vast territories of the Empire, the years 1768-1808 marked not only the nadir of Ottoman fortunes, but also the height of insecurity in the provinces. Especially hard hit were Rumelia (Southern Bulgaria) and Bulgaria (Northern Bulgaria), as the Bulgarian territories were on the forefront of each war. The unleashing of the defeated and demobilized – not to mention demoralized - peasant levies had traumatic effects on the population and strengthened the feudal struggles for supremacy with readily available recruits for private armies. Through the 1780s and 1790s the main opponents in this struggle were the ayans or more properly warlords of Seres in Aegean Macedonia and the famous Osman Pazvantooglu of Vidin in northern Bulgaria. While large-scale banditry arose in the 1770s in Macedonia, in the 1790s its centre moved much closer to Istanbul, in Eastern Thrace. The height of the lawlessness was reached from 1797 to 1807, known as the period of *Kirdjali* (as the bandits were known) raiding. It is perhaps notable that the conflicts suddenly stopped with the appointment of Mustafa Bayraktar of Silistra (a town on the Danube River in northern Bulgaria) as Grand Vizier. From this it would appear that at least part of the problem was the lack of determination on the part of the Sultan to enforce his power and protect the population from the bandits. It is

[26] McGowan 2005, 663.

perhaps ironic that the nadir of Ottoman fortunes coincided with the reign of the first Sultan who attempted to undertake real reforms, Selim III (1789-1807). Despite his good intentions, the arsenal of tools he used in dealing with the *ayan*s included various stratagems, but never determination and consistency.[27]

As early as the 16th century the position of the Bulgarian peasants had dramatically worsened, but the insecurity of the late 18th century had an even more detrimental effect on the Bulgarian people as their lands were the main field of action for the *Kirdjalii* brigandage. This drove people from the land to the cities and into the mountains, thus increasing the emphasis of the economy on herding in the less accessible parts of the country at the expense of farming. Many others left in search of security in the Habsburg and even – a sure sign of desperation - Russian territories. Many settled in Bucharest. Another response to the insecurity in the lands was the emergence of Christian armed bands, *haiduti*, generally (in many cases even correctly) hailed as protectors of the Bulgarian population. Their emergence also points to unsupportable tax burdens and inability to secure normal living conditions.[28]

The second half of the 18th century dramatically changed the ethnic map of the Eastern Balkans. Between 1770 and 1784 around 200,000 Tartars emigrated from Russian-conquered territories to Dobrudja, the northeastern part of Bulgaria. This immigration, coupled with the insecurity in the two provinces, forced more than 250,000 Bulgarians to

[27] McGowan 2005, 662-66.
[28] McGowan 2005, 646; Kortepeter 1966, 96, 100.

cross into Wallachia, en route to Banat and Russia by 1812. The *Kirdjalii* period, 1797-1812, also forced a large scale Bulgarian migration from Thrace to Istanbul and even Macedonia, thus leaving a vacuum which Muslims (Bulgarian or Turk) and, later, Greeks filled.[29] The Christian Bulgarian depopulation received a further boost in 1829, when Prince Vorontzoff, Governor General of Bessarabia, proposed to the Imperial Russian government the re-location of Bulgarian mariners to man the coastal trade in his province. The proposal was accepted by the government and was extended beyond mariners.[30] Independently of these effectively forceful deportations, unrecorded numbers of families left on their own, fearing Turkish reprisals after the Russians withdrew at the end of the 1828-29 war. Thus, the ethnic mix of the population from the 19th century is not necessarily representative of earlier times. According to Velko Tonev, the Bulgarian Christian population along the Black Sea shore in this period may have dwindled by as much as two-thirds.[31] Thus, at the time when the Kitten vessel sailed, the Bulgarian presence along the coast was much stronger than in later times.

McGowan suggested that the large scale flight of the peasants from the land is the best guide to the economic conditions in the Ottoman Empire during the latter 18th century. Rural taxation could reach 20-25%, while for share-croppers it was closer to 50%. Any surpluses of production were sold by force to the state at fixed prices, dramatically below market value. When insecurity of life was added to the economic insecurity, the

[29] McGowan 2005, 640.
[30] Tonev 1995, 39; Pavlov 1966, 60.
[31] Tonev 1995, 34-5.

response was abandonment of homesteads. Thus, Bulgarians from as far as Macedonia crossed the Danube.[32]

Throughout the period under study, most of the agricultural activities maintained their traditional, small scale character and were aimed mostly at satisfying the needs of the producers themselves and were based on small land holdings, a village common and common wood lot. Around large centers such as Sofia, Vidin and Russe, which offered ready markets, more intensive agriculture could be practiced. In such localities arose ciftliks, large farms run by enforced or hired labour. Ciftliks, always owned by Turks, were sometimes formed around a mill or some other necessary feature and grew by occasionally purchasing land from the treasury and seizing village commons. Once a village lost its common and wood lots, it lost its viability as an economic entity. The sole option for their survival was to hire themselves to the ciftliks and thus become "agha's villages" in a feudal sense. Occasions are recorded when entire villages became property of an agha as result of debt. The Ottoman courts were lax in defending villagers' rights to their commons, but were quite efficient in enforcing payment of their debts.[33]

By the middle of the 18th century in the southern part of Bulgaria, specialized agriculture began developing. Mulberry tree stands were established around Kazanluk, Haskovo, Turnovo, Vratza, Monastir and Ohrid. Kazanluk became a capital of the budding rose oil trade that began around 1750. With extensive use of irrigation, large scale rice crops

[32] McGowan 2005, 680-81, 688; Kortepeter 1966, 97.
[33] McGowan 2005, 687.

were grown around Skopje, Pristina and Plovdiv. Along the Maritza, Struma and Vardar rivers tobacco was grown: a crop whose importance remains high to the present day. Near Seres, in the geographical region of Aegean Macedonia, cotton became a major staple of the local economy and was exported by sea to France through Solun (Salonica) and by land to Germany. The growth of specialized agriculture in these regions and especially in the geographical region of Macedonia, was somewhat tempered by harsh tenancies and heavy taxes; Turkish landlords took between one and two-thirds of the produce, thus forcing peasants to run.[34]

In contrast to the bleak conditions under which the peasantry existed, the period saw wide-spread urban growth and some commercial prosperity in Bulgaria and Macedonia through the activities of native merchants who traded in tallow, livestock, hides, leather and leatherwork, wool, *aba* cloaks (woolen, waterproof cloaks resold as far away as Syria), cotton cloth and cotton yarns, rifles from Sliven and Prizren, furs from around Kostur (now Kastoria, Greece). The rising non-Muslim elite stratum of society – merchants, peddlers, money-lenders, landholders, tax collectors – led a style of life not materially different from their Muslim overlords and were sufficiently well-off to be able to build impressive, fort-like houses, some of which are still standing. The evidence suggests that this may have been particularly true of the Bulgarians who were active in animal trading, acted as middlemen for village products and traveled to sell goods at the great fairs, such as that at Uzundjova, supplying Istanbul itself. Others traded in

[34] McGowan 2005, 687.

specialized produce such as ironware from Samokov (a town in Southwestern Bulgaria) or copper utensils and *aba* cloaks from the Rhodope.[35]

The most important market for surpluses, especially those of the Eastern Balkans, remained Istanbul, the greatest center of consumption in the Mediterranean world with its population of almost 600,000. Moreover, Istanbul itself was not a production center and was entirely dependent on imported supplies for its daily needs. Providing the necessities of existence to its populace was a major concern for the Sublime Porte (the Ottoman Government, the Sultan) from the time of the Conquest onwards, and it developed policies to assure that regular deliveries were made. The policies were beneficial to the Porte and the populace of Istanbul, but were detrimental to the producers, occasionally to the merchants, and were seemingly calculated to stifle productivity, growth and enterprise in the long run. Bulgaria provided meat, honey, wax, raisins, leather, woolen clothing, tobacco, timber for construction (naval and civil) and firewood.[36] Naturally, meat and grain topped the list of state secured supplies. Bulgaria provided more than 80% of Istanbul's grain needs in the 1780s, with the other 20% coming mostly from Wallachia.[37] The supply network also included the Crimea (prior to its annexation by Russia in 1783) and the shores around the Sea of Marmara. Grain was purchased at government-determined prices, far below market value, at the expense of the producers who were forced to sell at a loss. In fact, the prices were so far below the

[35] McGowan 2005, 669, 687.
[36] McGowan 2005, 720.
[37] Panzac 1992, 195.

market value that in Istanbul grain cost less than in the provinces despite transportation costs! Yet, freight rates within the Empire around 1787 were more than twice those in Western Europe because of the poor and insecure roads. Another statistic shows that the price of wheat doubled with every 100 km of distance travelled overland. Thus, as elsewhere, water transportation was the only viable choice for bringing the necessary bulk supplies to the capital.[38] The exportation of grain was frequently forbidden, the oft-repeated decrees suggesting that none of them were completely successful in stamping out the illegal trade. Among the tools devised to fight contraband, was the issuing of permits by Istanbul *qadis* (judges) that assigned ships to specific destinations, with specified ports of lading, quantities, purchase price, the names of the ships and the captains, the dates of loading and departure.[39]

Undoubtedly the Ottoman archives contain treasure troves of documents, the careful study of which could yield extensive information on maritime activities in the Black Sea in the 18th century. Unfortunately, as Daniel Panzac lamented, domestic Ottoman trade on the Black Sea remains poorly studied.[40] Few facts are clear, among them that, until the opening of navigation to other flags besides the Ottoman (1783), most maritime traffic on the West Black Sea shore was dedicated to supplying grain to Istanbul.

[38] McGowan 2005, 681, 738.
[39] Tonev 1995, 91; McGowan 2005, 719.
[40] Panzac 1992, 189.

Some information on the ethnic background of Ottoman seafarers can be gleaned from a list of 158 captains that Panzac studied: 136 (86%) were Turks and only 22 (14%) were Greek or, surprisingly, Albanian. It would appear that at least in the period to which this document pertained, the position in domestic maritime trade held by non-Muslims was secondary, though not negligible. Their relative importance would seem to be increased by the fact that domestic trade had more than twice the value of international trade.[41] A complication in determining the ethnic background of non-Muslim seafarers is that the term "Greek" often meant the Orthodox Christian population in general, not just specifically Greek people. Presently available information makes it very hard to determine which of the two definitions was meant in this list.

Direct evidence for Bulgarian seafaring activities dates to at least the mid-13th century, the reign of Tzar John Assen II (1218-1241), who built a large galley squadron. During the 14th century, the last period of independence for medieval Bulgaria, the Dobrudjan despot Dobrotitza and his son, Ivanko, not only operated galley squadrons from Varna and Kaliakra, but successfully fought a war against Genoa. The peace treaty still exists in Genoese archives. In 1453, at the siege of Constantinople Ottoman Admiral Baltaoglu was the first-born son of a Bulgar aristocrat. The appointment of a Bulgar to this high post implies that Sultan Mehmet the Conqueror considered the Bulgars experienced mariners. Historian Vladimir Pavlov studied documents of circa 1594, which name the Bulgarians Dimiter Takadjiata, and Ivan and Kosta Takadji. In all these cases, Pavlov

[41] Panzac 1992, 195, 202-03.

connects the names with the popular Black Sea type of vessel, the *taka* (a modest double-ended vessel with a settee rig). A document bearing the date September 9, 1792, required Bulgarian *voinugan*s (part of the population holding privileged status, in exchange for service to the Porte), to be mustered for service as "*gemi yelkendji*", which essentially means seamen. This document testifies that Bulgarians had the necessary experience in seafaring to be drafted for naval service, specifically as sailors rather than as general laborers.[42] Among the names of shipwrights working at the Imperial Arsenal of Istanbul, Stanford Shaw lists a caulker by the name of Nikolay Kalfa, active in the latter 18th century. The adaptation of the name may be significant, as this is the Slavic version of a name popular among Bulgarians, Nickolas.[43] In an appendix to his study of the Ottoman Sailing Navy, Ahmed Güleryüz offers a list of line of battle ships, frigates and corvettes built between 1781 and 1868.[44] The list includes the dockyards where the ships were built and the names of the Master and Assistant shipwrights. Four ships launched between 1789 and 1792 one at Bodrum and – perhaps significantly – three at Sinop are credited to an Assistant Shipwright by the name of Nikoli. The name Nikoli is an archaic form of Nickolas. This may be the same person, the caulker, mentioned by Shaw. On the other hand, the different transliteration may indicate a different person altogether. Thus, the shipwright Nikoli Kalfa may have been a Bulgarian, although equally well he may have been Greek. A shipwright Manol (the Bulgarian version of the name Manuel) is credited with building two ships of the line and a frigate between 1830

[42] Pavlov 1966, 57-8.
[43] Shaw 1969, 223.
[44] Güleryüz 2004

and 1837. The three vessels were launched at the Gemlik (Sea of Marmara), Girit (Crete), and Fatsa (Anatolian coast of the Black Sea) dockyards. The name suggests that this shipwright almost certainly was a Bulgarian, as the name is not used by the other Christian ethnic groups in the Empire. In 1791 the 24-gun corvette *Ferah Nuema* was launched at Silistra, a Bulgarian town on the Danube River. Unfortunately, the name of the builder is not given, although the location makes it probable that Bulgarian craftsmen were involved in the building.[45]

Folk songs provide plentiful references to Bulgarian maritime enterprise, varying from legitimate commercial ventures to outright piracy. Numerous references to Bulgarian actions at sea in support of the invading Russian army and navy during the war of 1828-29 are also listed by Pavlov. The idea of Prince Vorontzoff, Russian Governor General of Bessarabia, to bring to Russia Bulgarian mariners (even though he recognized their paucity) to man its expanding merchant marine, also suggests that seafaring was not unknown among Bulgarians. Thus, there is scatered evidence for Bulgarian participation in maritime, although not always legitimate, activities within the Ottoman Empire. Yet, it is probably fair to say that in comparison to seafaring involvement among Turks and Greeks, the Bulgarians ranked of less importance. Much further research into Bulgarian maritime activities is needed, before a final conclusion can be drawn on the extent of their involvement.[46]

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[45] Güleryüz 2004, 98-9.
[46] Pavlov 1966, 52-3, 57-8, 61-2.

If little is known about seafaring in the Black Sea in this period, even less detail is known about shipbuilding along its shores in the territories of modern Bulgaria. Prior to the excavation of the Kitten shipwreck, virtually nothing was known of the ships themselves, except from casual observations of frequently ill-informed travelers and officials. In Bulgaria, maritime studies are still in their infancy. Two articles based upon partial study of a limited number of Ottoman records, and published over a span of nearly 30 years, offer some information. While Vladimir Pavlov supplied an overview of Bulgarian maritime activities, Theodora Bakirdjieva presented some notes on shipping and shipbuilding along the Bulgarian shore of the Danube river.[47] Nikolai Ovcharov published a study of ship graffiti from churches in the once major port of Messembria (now Nessebre).[48] Shtelian Shterionov wrote a general overview of economic activities along the Southern Bulgarian coast that pertained to the sea, including discussion of traditional boatbuilding.[49]

Shipbuilding, evidently, had long traditions along the Danube shore of Bulgaria. Vladimir Pavlov quotes Evliya Çelelebi as reporting that a squadron of 50 fragattas was stationed at Russe. A 15th-century document lists 21 ship guards, 26 caulkers and 6 rope-makers assigned to the fortress of Nicopolis, which was a base for the Ottoman Danubian fleet. The large number of caulkers speaks of the scale of the squadron based there. Since there was hardly any presence of Greeks in northern Bulgaria, it is likely

[47] Bakirdjieva 1992; Pavlov 1966.
[48] Ovcharov 1992.
[49] Shterionov 1999.

that most of the shipbuilders were native Bulgarians. Building time for river craft for the use of the Ottoman Army in the 16th century averaged 8-9 months, occasionally reaching a year, due to supply problems. The timber was locally cut and delivered, but the necessary ironwork was brought from Samokov in southwestern Bulgaria, removed from the construction site by some hundreds of kilometers and major mountain ranges. Life expectancy for these vessels was modest, at about 7-8 years, and, after no more than 4 years, they would be in need of major repairs. This most probably was due to the usage of unseasoned timber. Old vessels, however, still had useful roles, as they could be used for bridging pontoons, water mills and, finally, could be broken up and sold to the populace for construction material or firewood.[50]

Pavlov published a document from the 1560s in which the *ra'aya* (subject Christian population, in this case Bulgarians) were required to cut and transport timber, pitch and other materials for the construction of a galley squadron to Anhialo (Pomorie), a Black Sea port on the Bulgarian coast. In 1571 the Anhialo shipyards were employed in rebuilding the Ottoman galley fleet after the defeat suffered at Lepanto (1571). In 1753 the Frenchman Charles de Peysonel also reported shipyards around Anhialo. According to his report, the ships built there were mostly small cabotage vessels. The information is probable, as the sea around Anhialo is too shallow for vessels of significant draught. The Austrian officer Wenzel von Brognard observed in 1786 that vessels built at Varna were highly regarded as they were strongly constructed from high quality timber. Special note

[50] Bakirdjieva 1992, 136-8.

was taken of a vessel called a *marulla*, which, according to Brognard, was very similar to a Genoese *pinco*. Peysonel wrote that in Messembria between 80 and 100 small ships were built annually. He believed that larger vessels could also be built because timber was plentiful and of good quality, but sale of material of large scantlings to private individuals was forbidden, as it was reserved for the Sultan's fleet. Timber was also exported to Istanbul and even Egypt.[51]

A document from January 2, 1826, places an order for shipbuilding timber to be delivered from the Strandja mountains to Ahtopol. Evidently at Ahtopol too, state ships could be built. Another document from January 11, 1826 placed an order for the building of a corvette at the Sultan's Arsenal in Messembria.[52] The order for the corvette suggests that not only were the logistics for large-scale shipbuilding in place at Messembria, but also that it was not a unique order. Therefore, shipwrights in the vicinity must have had the experience and knowledge to build bigger ships. Nevertheless, the American Henry Dearborn, who also speaks of Messembria as a shipbuilding centre, states that mostly small vessels were built there, entirely of local oak.[53] It does not appear that Dearborn wrote based on personal observations. These documents demonstrate that as late as the second quarter of the 19th century, a time by which most maritime powers had completely exhausted their shipbuilding timber reserves, the Ottoman Empire suffered little shortages of naval timber. Other necessary shipbuilding stores were also plentiful

[51] Kortepeter 1966, 98; Pavlov 1966, 54-6; Tonev 1995, 81.
[52] Pavlov 1966, 58.
[53] Dearborn 1819, Vol. 1, 200.

and easily obtainable, for, as early as the 16th century, the 17 ironworks at Samokov provided the Ottoman Arsenals with anchors, nails and other necessary ironwork for shipbuilding.[54]

The testimony of a few contemporary witnesses speaks of mostly small ships being built along the Black Sea shore of Bulgaria. The Frenchman J. B. Lechevalier, writing in 1797 but published in 1800, considered Black Sea ships small and slow. He believed that the use of the smaller ships was due to the inefficiency of the merchants who, because of lack of warehouses, forced vessels to wait a long time for cargoes. The lack of harbour facilities was also detrimental to trade as it slowed down loading. Thus, a smaller ship could complete its lading faster.[55] William Eton (writing in 1798 and 1805), too, described the vessels as small. None of the sources, however, specify what they understood by "small". Based on a dispute over a launching permit from 1826, Tonev and Pavlov assume that "small" meant a load capacity of about 30 tons. However, most of the cargo shipped from the Bulgarian lands was bulk (such as grain, timber, firewood, etc.) and low-priced bulk cargoes require shipments in large volume to make their transportation an economically viable enterprise.

Nautical Archaeology is the discipline best equipped to provide an accurate answer to the question of Black Sea ship tonnage, but so far the only vessel excavated is the Kitten shipwreck. Although the displacement of the ship as reconstructed is an estimate, it is

[54] Faroqhi 2005, 463; Kortepeter 1966, 99, 108.
[55] Papadopoulos 1972, 315.

probably a reasonable estimate and its capacity of 160 tons displacement, is far greater than 30 tons. (See Chapter IV). A single example of a vessel is not a statistically significant sample on which to build a hypothesis about the average tonnage of Black Sea shipping and further archaeological and archival studies need to be undertaken before the question can be satisfactorily answered. However, it is perhaps significant that of the four wrecks lying on the bottom in the southern bay of Kitten, the one we excavated appeared to have the smallest scantlings, based on measurements of the protruding timbers of the other vessels. Thus, it seems that ships of more than 30-ton capacity were working on the coast. The evidence of contemporary observers such as William Eton (1805) and Henry Dearborn (1818) for the size of the average Black Sea merchantman ought to be considered through the perspective of the great maritime merchant fleets of the world at that time: British ships on the transoceanic routes were frequently above 300 tons and in the case of ships of the East Indies Company could reach 1200 tons. In comparison to those argosies, a Black Sea vessel of 100-200 tons was indeed small. It has to be admitted, however, that the question of the average size of ships on Bulgaria's coast in the latter 18th and early 19th century cannot be answered within the limits of this study and with the single archaeological example of the Kitten shipwreck.

Our knowledge of the characteristics and construction of vessels from the area is also woefully deficient. In his *Survey of the Turkish Empire*, published in 1798, William Eton wrote: "…They navigate vessels of the worst construction possible, which can never

sail, but before the wind; when the wind changes they run into port; this is the reason so many mercantile vessels are lost in the Black Sea, and not from the dangerous navigation of that sea…" [56] In 1805 Eton published an even more negative judgment on Black Sea merchant vessels, which was later copied verbatim by Dearborn from Eton's *A Concise Account of the Commerce and Navigation of the Black Sea.*[57] Due to its curious statements the description is worth quoting in full:

> This Sea has been by the Turks called the *Black* and has been by them esteemed most dangerous. Nor is it matter of wonder to those who have seen their mercantile vessels that navigate it. Their heads and sterns are of an enormous height. From the latter hang a great number of festoons to the waters surface. They have one or two masts, with immensely large sails, which hang over the vessels sides a great way to leeward, by which, when the wind is strong, the lateral pressure of the yards is so strong against the masts, that they often cannot be lowered. The remedy, in this case, is to dart logs of wood with a sharp end, or a kind of javelin, at the sail, by which they make holes to let out the wind.
>
> They cannot lie-to, as their bows spread out so much above water that a sea to windward striking them turns them to leeward. Therefore they never attempt it, but run for the first port, which if they cannot make, they go on shore.

[56] Eton 1798, 84.
[57] Eton 1805,4-5; Dearborn 1819, Vol. 2, 212.

In fairness to the Black Sea seafarers so disparagingly described by Eton, it should be noted that the western shore is a permanent lee shore as the dominant winds vary between N and SE and this may have had more to do with the alleged heavy ship losses than the lack of seamanship. Although the suggested approach to sail-handling in rising winds is perhaps less than probable, the higher ends of the vessels, as compared to those in use in Western Europe, is supported by iconographic evidence such as contemporary illustrations from westerners and ship graffiti in Bulgarian Churches from Nessebre.[58] Eton stated that a sharp vessel was desirable for the navigation of the Black Sea, but did not say whether the merchantmen plowing its waters were sharp or not in practice.[59] As discussed elsewhere in this work, the evidence of the Kitten vessel suggests that shipwrights in the region did build vessels with a sharp entry.

Eton's views on the qualities of Black Sea Ottoman merchant shipping were extremely critical. Surprisingly, this was not so on the subject of naval vessels. In his earlier detailed study of the state of the Ottoman Empire, he described Ottoman vessels as roomy and larger than British equivalents of the same nominal power. He acknowledged that they were built of good quality oak, but the timbers were placed too "far asunder" which weakened the ships. According to Eton the slightness of the scantlings and great distance between the timbers caused Turkish ships to hog quickly. The Turkish shipwrights' solution was to build the decks with great sheer, so that once the vessels settled, the decks would be straight. This technique, however, produced leaky ships with

[58] Ovcharov 1992; Müller-Wiener 1994.
[59] Eton 1805, 7.

short life-spans. In support, Eton offers a case from 1776, when supposedly the finest ship of the fleet foundered in the Black Sea because its caulking worked out due to its weakness of construction. If this weakness of the bottoms was indeed present and not on par with the above quoted sail-handling solutions, the Turks may have used an older, not doubled, style of frames.[60]

In contrast to Turkish naval construction, Eton gives high marks to the shape or design of their vessels. He reported a conversation with a French shipwright, a Mr. (possibly Lieutenant) Le Roy (Shaw gives the name as Le Roi), who built ships for the Ottoman navy and told him that his models were based on "Turkish bottoms". Historian Stanford Shaw, however, stated that the Ottoman vessels were built on French models.[61] According to Eton, both English and French sailors agreed that the Turkish vessels were well-shaped and went on: "…It is certain that they [the Turkish men-of-war] are very fast sailors, but their upper works are very inferior to the ships of other nations…" It was for the improvement of the upper works that foreign, mostly French, shipwrights were employed.[62] Contrast this contemporary statement with Stanford Shaw's study of the Selim III naval reforms, where he considered Ottoman ships to be poorly designed too, and not just poorly constructed.[63]

[60] Eton 1798, 81-3; Batchvarov 2002.
[61] Shaw 1969, 225.
[62] Eton 1798, 83.
[63] Shaw 1969, 213.

If Eton was critical of the qualities of Ottoman ships, he is even more critical of the seamanship of Ottoman sailors. The Empire had no "nursery" for sailors, as he put it, and most of the navigation was done either by Greeks or Maltese slaves. The Turks themselves served the guns and helped in weighing. However, they were considered masters of handling narrow, sharp boats. Even among the Greeks, seamanship was weak: only the Navy used compasses (none were found on the Kitten shipwreck) and even these were poorly made, with the variation built into them, thus making them really usable only in a specific area. Yet, the same compasses were used for all waters of the Empire. Even in the navy, there were few officers who could take a meridian observation (yet, on the Kitten merchant vessel the remains of an octant or sextant were found), the exception being the Algerines, who did possess some knowledge of navigation. Merchant vessels, Eton asserted, never sailed out of sight of land, which also contributed to the high losses.[64]

Although Eton's statements seem in some respects exagerated, the generally poor level of seamanship among the Greeks, the alleged master mariners of the Ottoman Empire, is attested by other sources. J. B. Lechevalier wrote in 1797 about the Black Sea trade that Ottoman sailors lacked competence.[65] Although he probably wrote about Turkish sailors, the Greeks were probably not much better. F. C. H. L. Pouqueville, writing circa 1813 (but published in 1827), pointed out that discipline was entirely unknown amongst them. He described them as unruly and lazy, preferring to roll in filth rather than sweep their

[64] Eton 1798, 84, 215.
[65] Papadopoulos 1972, 315.

decks. No watches were kept on their ships and helmsmen frequently slept while underway by tying the tillers down. On their navigational skills Poqueville had the following to say: "…The honesty of the Galaxiodite ship-owners affords no more protection in trade than does their knowledge in the art of navigation…"[66]

William Gell wrote that Greek sailors from the island of Ithaca tended to overcrowd their ships and in 1807 spoke of at least two ships recently lost in the Black Sea.[67] A. L. Castellan, unusually well disposed towards the local sailors – ethnic Greeks in this case - wrote that that the manner of handling a ship differed dramatically from the one used in the west: "…Everything is set in motion at once, without order or obedience to rules: there is neither discipline nor cooperation. The Captain's speaking trumpet and the quarter-master's whistle resound unceasingly and often give contradictory commands…"[68] Claude Savary, less favourably disposed than Castellan, considered the incompetence of Greek sailors equaled only by their superstition.[69] Edward Daniel Clarke's description is worth quoting in full:

> As soon as fog or darkness begin to obscure the land, the Greek pilots remain in total ignorance of their situation: generally, losing their presence of mind, they either run their ships ashore, or abandon the helm altogether and have recourse to the picture of some Saint, supplicating his miraculous interference for their

[66] Pouqueville 1827, 479-83; Papadopoulos 1972, 337.
[67] Papadopoulos 1972, 388; Gell 1807, 30-2.
[68] Castellan 1820; Papadopoulos 1972, 390.
[69] Papadopoulos 1972, 391; Savary 1792.

> safety, It more than once happened to us, to have the responsibility of guiding the vessel without mariner's compass, chart, or the slightest knowledge of naval affairs...[70]

As late as the 1830s, the standard of seamanship had not improved much. C. B. Elliot wrote:

> It is surprising that more accidents do not occur among the country vessels navigating the Archipelago, for Greek sailors use no astronomical instruments and therefore can take no observations; they seldom steer by compass, and have only a general notion of its variation, which is here more than a point to the east; they keep no dead reckoning and no log; in the day there is no regular watch, and the helm is readily consigned to any passenger who offers to take it; while in the night, the steersman, who generally *sits* [Elliot's emphasis] on the deck, and therefore cannot see ahead even with the aid of the moon, may or may not be accompanied by a watch on the forecastle; and this watch may or may not fall asleep: this is as it happens. Under all these circumstances, it is easy to perceive that if the Greek sailors were not as timid as they are inefficient, many vessels would be lost…[71]

Although all of these testimonies refer specifically to Greek sailors, it is likely that their standard of seamanship – rather, the lack thereof – was widespread among subjects of

[70] Clarke 1810, 108-9.
[71] Elliot 1838, 160-1.

the Ottoman Empire, Bulgarians included, in this period. Taken on their own, each of these statements might be considered a gross exaggeration. However, taken together, they begin to sound more persuasive. It would appear that the problem of Black Sea navigation did not lie with the vessels, but with the incompetence of the sailors. Both William Eton and Edward Clarke speak of running ships ashore as a frequent occurrence. Others of the quoted travelers suggest that only Providence prevented more ships from being lost. Embellished as these opinions may sound, the archaeological situation in the Bay of Kitten seems to confirm them: at least four, possibly five shipwrecks were observed within 20 meters of each other and Petar Petrov of the CUA noted that at least one more wreck lies in the southern part of the small bay. They all appeared to date to the roughly same period of the latter 18th and early 19th centuries. However, the possibility that they all fell victim to one or two severe storms and sank together can not be completely excluded.

The Ottoman Empire entered the 18th century still holding a position of power and respect and held extensive territories in Central and Eastern Europe, conquered at the height of its power. By the end of the century it looked like its days of holding any part of Europe were nearly over. The decline was steady, but the process accelerated rapidly in the second half of the century to reach its nadir in the last decade of the 18th and first decade of the 19th century. The vessel in the Bay of Kitten very likely sank in the reign of the Ottoman Sultan Selim III (1789-1807), at a time when the Ottoman Empire had lost its internal cohesion and strength, its institutions had decayed and were no longer

able to meet the needs of the state. By the end of the 18th century the central government had almost completely lost control over the provinces of the Empire, which had fallen under the power of warlords too strong for the Sultan to tackle directly. At the same time, the military power of the empire had declined so much that victory against a European opponent or even Russia was no longer possible, either at sea or on land. The political and military decay had important repercussions on the economic and social conditions in the Empire and had an especially negative impact upon the *ra'aya*, the non-Muslim population.

Although trade stagnated in the second half of the 18th century, it did not disappear. After the peace of 1774 the Black Sea, virtually a Turkish lake from the 15th century onwards, was opened to international navigation again. The main task of Black Sea maritime trade and shipping was the supplying of the capital Istanbul with provisions, fuel and timber. The Bulgarian lands had a major role to play in this, as the surplus production of the Eastern Balkans was exported through Bulgarian ports. The Eastern Balkans provided 80% of the grain needs of Istanbul. The main exports to Istanbul, agricultural products, were bulk low-cost items, which had to be shipped in quantity and by sea to make the transportation costs economically bearable. These requirements determined the vital importance of shipping for the region. The Kitten ship was part of this trade network. At the time of sinking the ship was operated by Christians, as evidenced by finds from the wreck. The ethnic background of the crew, however, is harder to establish. The majority of the artifactual assemblage suggests connection with

the Bulgarian population, but traditionally historians associate maritime affairs in the Empire with the Greeks. Even so, evidence for Bulgarian participation in seafaring and shipbuilding and even piracy is not lacking.

CHAPTER III

DESCRIPTION OF THE HULL REMAINS

Prior to our resumption of excavation on the Kitten shipwreck in 2000, and based on information from the doyen of Bulgarian underwater archaeology, the late professor Michael Lazarov, we believed that no more than the bottom of the hull was still extant. The excavation soon proved this assumption wrong.[72]

The extant remains of the ship have a length of 19 m, a width of approximately 5 m and a depth in hold of nearly 3 m. The vessel lists nearly 30 degrees to starboard on the bottom, but the remains were twisted severely in the wrecking process; thus the degree of heeling is only an approximation. The port side of the ship is almost completely missing: only the bottom of the hull survives, approximately up to the wrongheads. The starboard side is much better preserved, nearly to the height of breadth amidships. The vessel is settled down by the stern. The bow is eroded, but not broken up, while the stern is practically torn to pieces, especially on the port side. Frames are either completely missing or heavily twisted and split (fig. 11).

[72] Most of the material discussed in this chapter was published in the Proceedings of the 10th International Symposium for Boat and Ship Archaeology. Here the information is presented with slight modifications, mostly in correcting some small errors that I have permitted to slip into the publication. (Batchvarov 2003).

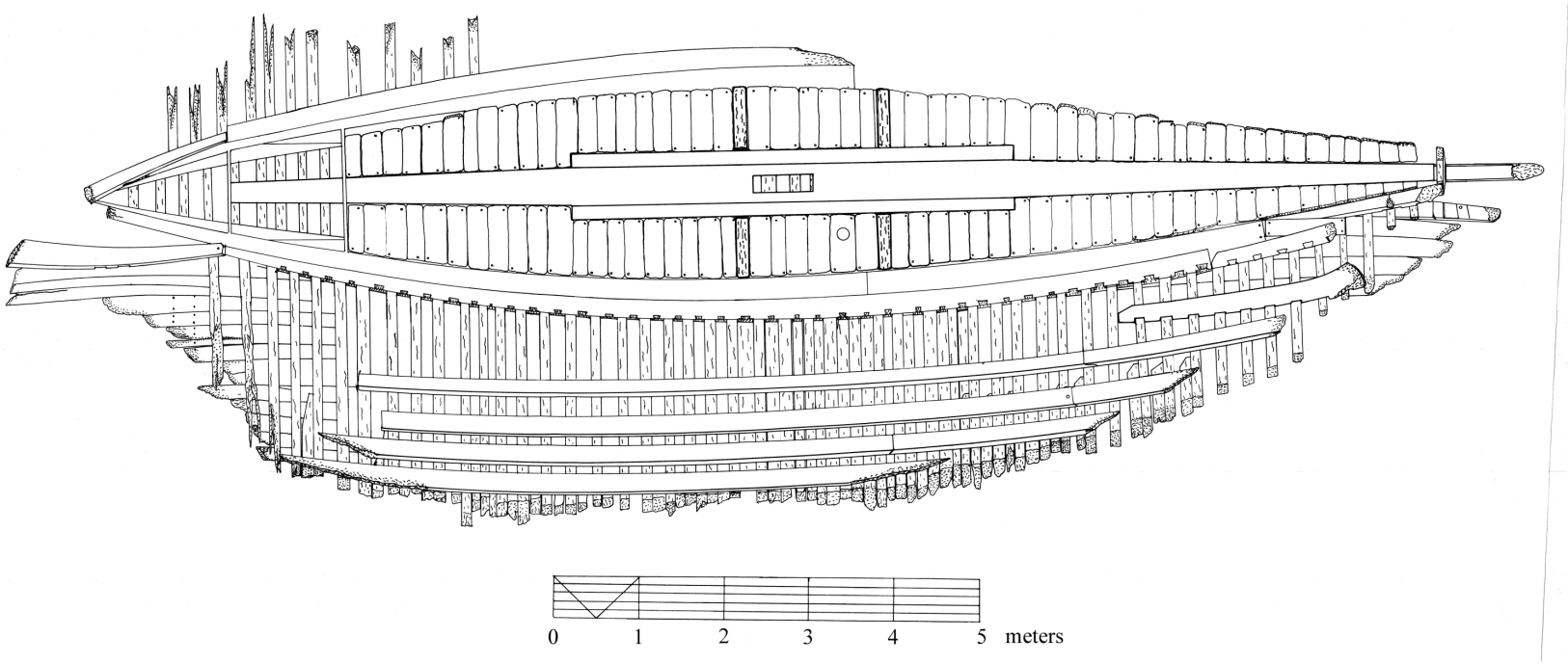


Fig. 11. Plan of the intact hull structure. Drawn: K. N. Batchvarov.

The Kitten ship was found to be constructionally of greater interest than anticipated. As it is the first and only example of a postmedieval ship from the Black Sea to have ever been excavated and recorded to date, no parallels have been published, thus severely complicating the task of the researcher. However, a few Mediterranean wrecks feature similar construction to that observed on the Kitten ship. A similarly constructed ship, the Culip VI wreck from Catalonia, Spain, is dated to the early 14th century from the associated pottery.[73] This ship's bottom survives to 11 meters length and three meters breadth and includes keel, keelson, floor timbers, exterior planking, two mast steps and the lower part of the stem. The 14th-century Contarina I wreck from Italy was discovered and excavated in 1898.[74] It is estimated to have been 20 meters long with a beam of over 5 meters and had two masts. The hull was extensively preserved and the keel, keelson, lower stem and sternpost, floor timbers, first futtocks and toptimbers, bilge- and side stringers survived. In 1979 at Villefranche-sur-Mer, France the wreck of an early 16th-century vessel was located that is believed to have been the Genoese carrack *Lomellina.*[75] The wreck covers an area of 35 meters by 9 meters and includes the port side of the vessel with the orlop and the lower decks. The Ottoman wreck from Yassiada, Turkey, is dated to the end of the 16th century or very early 17th century.[76] Surviving hull structure includes floor timbers, the heels of the first futtocks, the keel and parts of the stem and sternpost. Another poorly preserved wreck is that of a tartana lost off Sardineaux, at the entrance of Saint Tropez (France) and dated to the latter 17th

[73] (Rieth 1998a; Rieth 1998b.
[74] Bonino 1978.
[75] Guerot 1995; Guerot 1989.
[76] Personal communications with Dr Cemal Pulak.

century.[77] Similarly to the Kitten ship, better preserved is the starboard side of the small coaster. The remains extend to 7.65 meters length and include the damaged keel, floor timbers and first futtocks. According to a description supplied by Taras Pevny, Ukrainian archaeologists have raised a well-preserved wreck of a galliot from the Dnepr River.[78] The hull construction has not been recorded and little is known about it. With the alleged exception of the Dnepr wreck, none of them was as extensively preserved as the Kitten ship, but have sufficient hull preservation to offer useful comparative material.

THE SHIP'S BACKBONE: KEEL, STEM AND STERNPOST

Regrettably, the consistency of the bottom sediment, lack of time and, ironically, the extensive hull preservation conspired to prevent excavators from reaching and recording the keel in detail. It was partially recorded only in the bow, but even there the garboard hid important details, including the stem scarf. The width of the keelson and patches of concrete that have found their way between the floor timbers prevented direct observation of the inner face of the keel and made it impossible to say with certainty whether the keel tapered or not, either in moulded or sided dimensions. The surviving part of the stem close to the keel was measured to be 17 cm sided and 27 cm moulded. The sided dimension can be assumed to be close to that of the front end of the keel itself. We were unable to observe the after end of the keel, but as the sternpost (see below) has

[77] Joncheray 1988.
[78] Personal communication with Taras Pevny.

a sided dimension of 15.5-17 cm, it seems reasonable to assume that the keel had virtually no taper in width. The moulded dimension of the keel at the stern probably matched the 15.7 cm measurement of the sternpost. From indirect measurements this appears to be close to the moulded dimension of the forward end of the keel as well, so it is likely that it did not taper in this direction, either. At the bow end a rabbet was clearly visible and from examining the lower side of the sternpost, there was a rabbet aft, as well. No direct observation was possible amidships because of the wide (46 cm) keelson and the closely spaced floor timbers. The wrecks from Culip VI, Sardineaux and Yassiada did not have a rabbet except in the bows and sterns. It is possible that the keel of the Kitten vessel, had a rabbet only in the bow and stern, but not amidships.[79]

The Sardineaux ship had a keel length of 7.65 meters, about half the extrapolated length of the Kitten ship's keel, but in practice the surviving keel length of the Sardineaux vessel was significantly shorter, as only two small pieces survived in the extremities of the wreck, and they showed no hint of tapering. Its keel had a rectangular section and no rabbet. The reported scantlings were 9.8 cm moulded by 7.0 cm sided. The American naval architect and maritime historian Howard I. Chappell studied traditional Turkish fishing boats in the years 1956-57, at a time when some vessels still demonstrated older building techniques and sail had not completely disappeared from workboats. He reported that keels of Turkish fishing boats from the Black Sea were shallow and tapered

[79] Rieth 1998b, 120, fig 51; Joncheray 1988, 44, fig 20.

in sided dimensions towards both the bow and the stern.[80] Kostas Damianidis in his study of Greek vernacular boatbuilding does not speak of tapering keels. It should be noted, however, that most of the material that he gathered is from the first half of the 20th century and it is not certain that the shipbuilding practices at that later date mirror those of the earlier period. The keel of the 17th-century wreck off Yassiada has no taper. Thus the suggestion that the Kitten ship's keel did not taper is supported by the closest excavated parallels.



Fig. 12. External reinforcing timber, notched for the frame overlaps. Photo: K. N. Batchvarov.

On the starboard exterior side of the hull, the third plank from the keel was found to be a longitudinal timber, laid parallel to the keel, with a thickness of 9.6 cm and width of 14.5

[80] Chapelle 1957, 44.

cm (fig. 12). The timber is notched to fit over the frames to which it was fastened with spikes and possibly treenails (one empty treenail hole or bolt hole was recorded in the extreme forward edge of the timber). The length of the notches averages 21 cm, which agrees well with the space taken by the frame overlap. Remains of an identical timber were also found to port of the keel. That timber, however, was so badly eroded that no measurements were possible. These timbers may have supported the lower end of the stem. It was not possible to trace them further aft, because of the solid wall of timber that the framing formed. Drawings published by the French Admiral Edmond Paris illustrate a late 19th-century Turkish coaster from the Black Sea, with similar timbers extending throughout the length of the vessel and serving as sister keels. On the Kitten shipwreck, these thick exterior timbers were paralleled on the interior of the hull – at least in its visible parts – by the bilge stringers, which are also notched over the frames. Thus, the heavier outer timbers probably continued throughout the length of the vessel, reinforcing the turn of the bilge and possibly helping alleviate lateral drift when sailing under heel to windward. These timbers would also have supported the ship when lying aground and protected its bottom. The Contarina I wreck had similar timbers, running parallel to the bilge stringer.[81] Joncheray reports two broadly similar timbers from the Sardineaux wreck, though their morphology is not identical to the Kitten timbers. The timbers on the Sardineaux wreck change in section from triangular to trapezoidal. The triangular section has scantlings of 11.2 cm by 6.2 cm by 14.2 cm. The rectangular section has

[81] Bonino 1978, 14, fig. 4.

scantlings of 9.6 cm by 5.6 cm.[82] Taras Pevny informed me that his Ukrainian colleagues have discovered and raised a rowing vessel from the Dnepr River, which was built for the 1730s campaigns of the Russian army against the Ottoman Empire. That vessel, possibly a galliot, was built by a French- and Venetian-trained shipwright. Although I have not seen any documentation from that wreck, Pevny reports that two similar timbers, strengthening the turn of the bilge, were also observed on the Dnepr wreck. Scantlings are not available.[83] The Culip VI wreck does not appear to posses similar timbers at the turn of the bilge.[84] No such timbers were recorded on the 16th-century Yassiada wreck, either. It is notable that all vessels with similar timbers at the turn of the bilge were with shallow keels and, with the possible exception of the large Kitten ship, may have been expected to take the ground frequently for loading. When laying aground, the timbers would have helped keep the vessels on even keel and protected the bottom planking.

[82] Joncheray 1988, 45-7. fig. 21.
[83] Pevny, September 29, 2008 pers. comm.
[84] Rieth 1998b, 40, fig. 64.



Fig.13. The remains of the stem with a deep rabbet along the side. Photo: K. N. Batchvarov.

The stem is eroded almost down to the level of the keelson, but the remaining part is sufficient to suggest that it had a steep forward rake and was 17 cm sided by 27 cm moulded (fig. 13). The rabbet of the stem is 10.5 cm wide by 2.5 cm deep. Interestingly, the stem appears to be simply butted into the keel without a scarf. No evidence was found that a knee or an apron was ever installed. Any strengthening of the joint must have come from breasthooks and the above-mentioned timbers on the external side of the hull. Numerous wales probably added support higher up the side.

Although some remains of the stem were discovered on Culip VI, it is not clear how the keel and stem were attached, but it appears that a flat scarf was used. On the Sardineaux wreck, the connection between the stem and keel is a flat scarf, fastened with spikes. The forward part of the 16th-century Yassiada keel is broken, so it is not clear how the missing stem was attached to the keel, but there are some traces remaining on the upper face that may be remains of a flat scarf. The stem was supported by an apron, a small piece of which survives. Pevny informed me that the stem on the Dnepr wreck was also butted directly into the keel without a scarf. The late 16th- or early 17th-century wreck from Rondinara, France, likewise had its stem butted into the keel, rather than scarfed.[85]

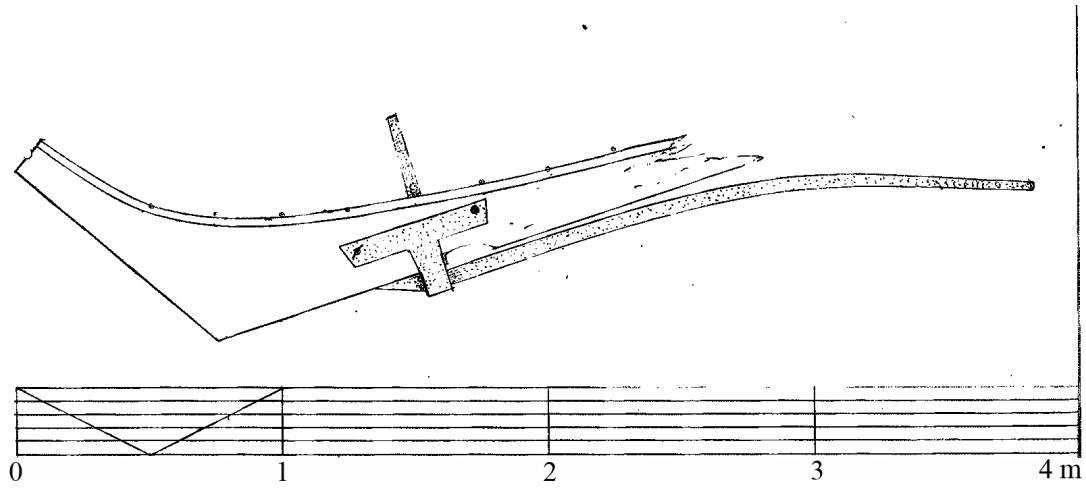


Fig.14. The Sternpost. Drawing: K. N. Batchvarov.

The sternpost, a naturally grown knee, survives in better condition than the stem (fig. 14). It has a preserved length of over 2 m and includes the lower part of the post with the

[85] Villie 1988, 142-3, Plates VI and VIII.

pintle still attached. It was found torn off the hull and buried under the starboard quarter. The upper part of the sternpost demonstrates damage similar to that suffered by the frames in the stern, but the lower part is in remarkably good condition, allowing for a detailed recording. It is certain that the sternpost was not scarfed but simply butted to the keel. The surface of the butt is original, preserved completely undamaged, and clearly shows the half-round notch left by drilling for a stopwater. The thickness of the timber is almost uniform, varying between 16 and 16.7 cm. The depth of throat is 48 cm. The rabbet is cut to 3 cm width and 2 cm depth. The pintle is now bent out of shape as result of the ripping away of the rudder in the wrecking process, but extends to its original length of 2.27 meters and tapers in diameter throughout its length from 5.5 cm to 3.2 cm. In addition, the pintle is bent off-center to port. Initially I assumed that this also was result of the wrecking, but Dr. Pulak informed me that Ottoman Imperial caiques in the Naval Museum in Istanbul invariably have their pintles bent to port.[86] According to Pulak this aided the hanging of the rudder, as otherwise the high sternpost would have been in the way. The Kitten vessel was larger than the caiques and so the rudder is unlikely to have been frequently unshipped, but it is possible that the pintle was intentionally bent to port during construction of the vessel. Two iron cheeks support the pintle on the sides of the sternpost and are held in place by forelock bolts driven from opposite directions. The plates are 3 cm thick by 9 cm wide and are 59 cm long. The two plates are connected with integral strap of the same material and thickness, which supported the heel of the pintle. They appear to have been forged together and wrapped

[86] Pulak 2009 personal communication.

around the post. The pintle passes through a long iron eyebolt that penetrates the sternpost and extends over 30 cm from the inner edge. Although the end is now broken, it is likely that it was a forelock bolt. The extra length of the bolt must have been used in securing the sternpost to the hull either through a stern hook or a knee. The long pintle proves something that we long suspected from the general shape of the wreck: the ship had a round sharp stern, similar to the 16th-century Ottoman wreck from Yassiada. This type of stern was generally popular among traditional lateen-rigged craft in the Mediterranean world until the 19th century, if not later. Usually sternposts with long pintles are curved, but there are some exceptions as evidenced by Jouve's and Baugean's drawings.[87] The aft face of the Kitten wreck's lower sternpost is almost straight, with slight indication of curving towards the broken end.

According to Pevny, the Dnepr wreck's sternpost also butted into the keel with no scarf, in a manner identical to that observed on the Kitten ship.[88] Just as on the Kitten vessel, the Dnepr wreck's sternpost had a stopwater at the butt. Although a large portion of the sternpost is extant on the 16th-century Yassiada ship, its heel does not survive. Nonetheless, it is probable that a flat scarf strengthened by an inner post attached it to the keel. Remains of the inner post were observed, but were heavily eroded. A concretion found on the Yassiada wreck was identified as containing the pintle and was cast and analyzed. Although the shape of the support plates is not identical to those on the Kitten ship pintle, overall the pintles are similar. A concreted pintle was also

[87] Joncheray 1988, figs. 30, 31, 32, 39; Harland 2000.
[88] Pevny 2009 personal communication.

discovered on the wreck from Sardineaux. Only 17.8 cm of the length of the pintle survive and had a diameter of 1.8 cm. It was supported and secured to the now missing sternpost with a 0.7 by 3.5 cm strap, bent into a U-shape. The distance between the sides of the U was 6.2 cm, with a length of 27 cm. Three holes in each side match holes on the opposite side. Joncheray believed that the sides were bolted through the hull and headed over washers.[89]

FRAMING TIMBERS

On the Kitten Shipwreck a bend of timbers or a frame consists of a floor, two futtocks and two toptimbers. Remains of 57 frames survive, but it is probable that a few more were originally attached to the now missing part of the stem. Likewise two or three more frames must have existed in the stern. Of the existing frames, 29 are located aft of the midships frame and 26 forward of it. The room and space between the bends of timber averages about 30-32 cm. Frame scantlings vary, but most average 12 cm sided by 11.5-13 cm moulded at the turn of the bilge and taper slightly up the side. Extremes of the range of scantlings extend from 8 cm to 16 cm for sided, and from 10 cm to 13 cm for moulded dimensions. The floor timber amidships has a length of around 2.4 meters. There is no deadwood (or rising wood) in the bow or in the stern. Instead, the floor timbers are deep grown Y-shaped tree trunk crooks (fig. 15). There is evidence that the Y-shaped floors continued on to the stem and their lower faces were cut at an angle and

[89] Joncheray 1988, 62-4, figs. 37-8.

toe-nailed to the stem, so that the futtocks would have been vertical to the waterline and were directly nailed to the wrongheads. For this reason, no cant frames were used by the master shipwright. The few floor timbers that could be observed in detail, mostly in the extremities of the hull, do not show any limber holes, although no doubt these existed on floor timbers fitted atop the flat keel.



Fig. 15. Y-shaped floor timber in the bow. Photo: K. N. Batchvarov.

All timbers within a bend are longitudinally fastened. In the bow, the futtocks simply overlap the floors and are secured to them with a single nail. The overlap averages 40 cm in length. In the central part of the hull, 27 frames extending over nearly half the length

of keel have their floors and the futtocks hook-scarfed (fig. 16). The hooks are very shallow, varying between 1.5 cm and 2 cm, thus they could not have added materially to the strength of the scarf, as the port side broke off along at the scarfs.

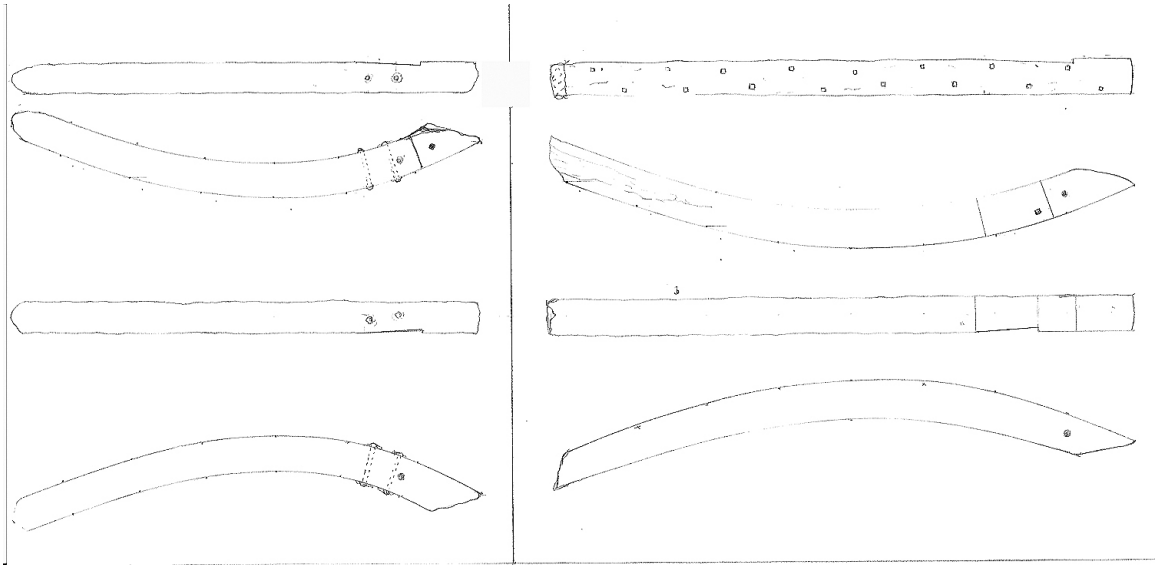


Fig. 16. Futtocks with hook notches, probably from the collapsed port side. Drawing: K. N. Batchvarov.

The purpose of the hook scarfs was probably to assist in aligning the timbers during the fastening process. The floor timbers and futtocks are fastened with a nail and a treenail, with no observable pattern to their distribution (fig. 17). It was not possible to ascertain whether the fastenings were driven from the same direction or from the opposing sides of the timbers.

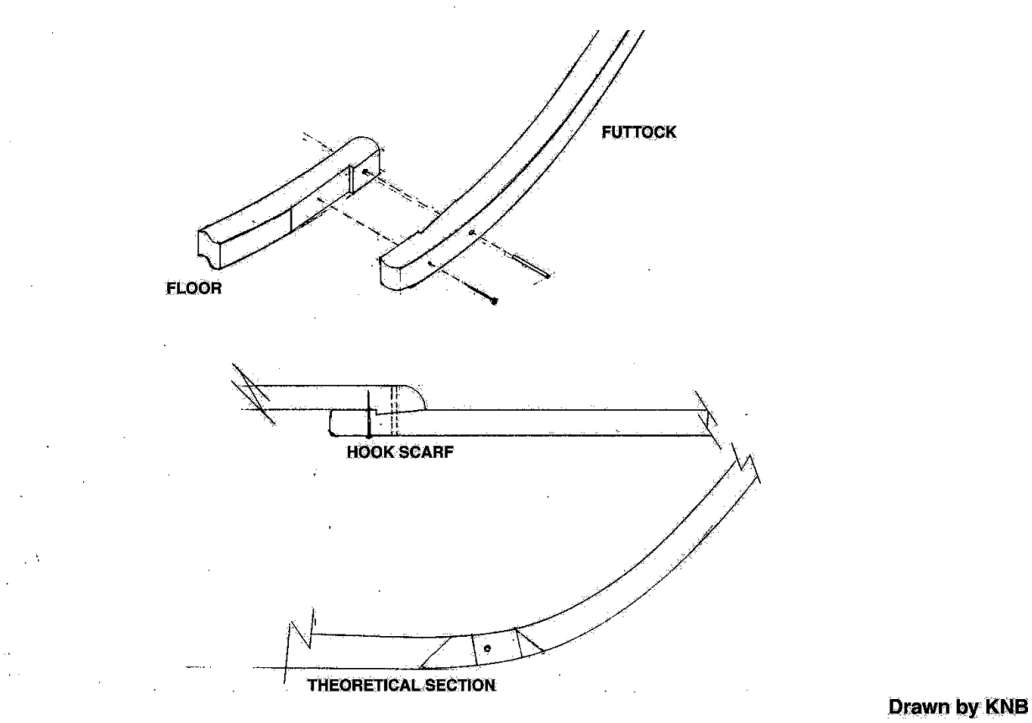


Fig. 17. Hook-scarfs between the floor timbers and the first futtocks on the Kitten wreck. Drawing: K. N. Batchvarov.

Towards the stern the scarfing of futtocks and floors changes again, with some of the futtocks slightly half-lapped, but not hooked; most are simple overlaps that appear to be nailed together. The closest parallels for the morphology of the scarfs are those found on the 16th-century vessel from Yassiada.[90] At around 70 cm, the overlap is nearly twice as long as that on the slightly longer Kitten ship. It is possible that the longer overlap may be related to the longer floor timbers. The small coaster from Sardineaux had nearly identical scarfs, but with significantly longer overlaps, proportionally, than those on the Kitten or even the Yassiada shipwrecks.[91] Pevny reports that on the Dnepr wreck the floor timbers were likewise attached to the futtocks with hook-scarfs. Unfortunately no

[90] Pulak, personal communication; Steffy 1994, 137.
[91] Joncheray 1988, 51-4, figs. 26-8.

information is available on their length, the nature of the fastening (possibly clenched nails) and the number or direction of the fastenings. The Culip VI wreck also exhibits hook scarfs, but they are cut much deeper into the timbers than those on the later wrecks.[92] Guerot and Rieth report that the upper timbers of Lomellina's frame employed both dovetail and hook scarfs, but the floor timbers to first futtocks scarfing was accomplished with dovetail joints in what is believed to be Atlantic tradition.[93]

It was possible to determine that the bow floors were toe-nailed to the keel with a single nail in the middle. A special triangular recess for the nail was cut into the forward face of the floor timbers, probably with two strokes of a small single-hand held adze, known as Turkish adze. The fastening system could not have contributed much to the integrity of the hull in the bow. The strength must have come from the attachment of the frame to the planking, stringers and wales. As it was impossible to disassemble the keelson, we were unable to determine how, if at all, the rest of the floor timbers were fastened to the keel, though nailing seems to be the most probable method.

The midship frame was easily discerned upon removal of the bottom ceiling planks and was found to consist of a floor timber and a pair of futtocks hook-scarfed to each face of the floor timber (fig. 18). The floor timber, about 22 cm sided, is almost twice the sided dimension of the other floor timbers. The 13-cm moulded dimension of the floor is consistent with that of the neighboring timbers in the middle part of the hull. The

[92] Rieth 1998b, 206, fig. 2.
[93] Guerot 1995,43, 49, note 4.

midship frame's futtocks are of average dimensions: 10.5 cm sided by 12.5 moulded cm, and 9 cm sided by 12 cm moulded.



Fig. 18. The Midship frame consists of a large floor timber and futtocks fastened to either side of it. Photo: K. N. Batchvarov.

Identical arrangement of a floor timber with two futtocks on each side was also recorded on the first Contarina ship, dated to the 14th century.[94] The early 16th-century wreck of the Genoese carrack *Lomellina* also has a midship frame with futtocks attached to either face of the floor timber.[95] In contrast, the early 14th-century Culip VI wreck had two midship floor timbers, one floor had the hook scarfs cut on opposite sides of the

[94] (Bonino 1978), 14, fig. 4
[95] (Guerot 1995), 43, 49, Note 3.

wrongheads.[96] The 16th-century Yassiada ship had two floor timbers with single futtocks attached to each wronghead. The forward bend had the futtocks fastened to the foreward side of the floor timber and the aft bend had them facing the stern of the vessel. The same arrangement is also observable on the Sardineaux wreck.[97] I do not possess any information on the Dnepr wreck regarding the construction of its midships frame.

On the Kitten shipwreck, forward of midships the toptimbers and floors are in line, with the futtocks fayed to the forward face of the respective floor timbers; aft of midships, the sequence changes, with the futtocks placed on the aft face of the floor timbers. The toptimbers overlap the futtocks and are nailed to them. In a number of places the futtocks of the adjacent bends had to be notched deeply to provide clear path for driving the nails (fig. 19). This suggests that the toptimbers were installed after the preassembled floor timbers and futtocks were raised on the keel.

[96] Rieth 1998b, 206, fig 2: see futtocks M113-M114.
[97] Joncheray 1988, 52 and fig. 26.



Fig. 19. Notch in adjacent timber for fastener of a toptimber. Photo: K. N. Batchvarov.

A particularly interesting feature of the framing is that the central section of the hull, which roughly matches the length of the sister keelsons, had filling timbers driven between the futtocks, thus forming a solid timber wall. After disassembling the bottom ceiling planks, we observed that the doubling extended only down to the turn of the bilge. The filling timbers are of different scantlings, hewn to conform to the spaces between the futtocks. Their lower ends ended with a taper towards the external planking, but sometimes they came down square. The upper ends were invariably cut diagonally to conform to the heels of the toptimbers. The filling pieces do not appear to have been fastened to the frames, but only to the stringers and, presumably, the external planking.

Probably they were added before the attachment of the stringers, or else it would have been very difficult, if not outright impossible to install them. They may have been inserted after the attachment of the toptimbers, as otherwise the diagonally-cut heels of the toptimbers could not have been nailed to their respective futtocks. Max Guerot and Eric Rieth speak of "packing pieces" between the frames of *Lomellina*, a feature that may be similar to what we observed on the Kitten ship.[98]

KEELSON, SISTER KEELSONS AND MAST STEP

The keelson is a single timber of about 14.3 m in length and tapering in section from 46 cm sided by 19 cm moulded amidships, to 19 cm by 15 cm in the bow (fig. 20). The keelson is notched over every floor to a depth of about 3 cm. No fastening pattern is clearly identifiable; however, two or three concretions in the forward third of the keelson may be remains of iron bolts or spikes. Abaft that point no traces of fastenings are visible. It is conceivable that the keelson was also fastened with treenails, as treenails are difficult to identify in poor visibility and limited light conditions. In addition to iron forelock bolts, treenails were used on the 16th-century Yassiada ship to fasten the keelson.[99] In comparison with Western shipbuilding traditions, the keelson appears lightly fastened, but this does not seem to have caused any weakness in this part of the hull, as the keelson was not displaced in the wrecking process and we could not remove it (fig. 20).

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[98] Guerot 1995, 43.
[99] Dr. Cemal Pulak, pers.comm., October 6, 2008.



Fig. 20. The top of the keelson in the bow section. No trace of fasteners are observable. Photo: K. N. Batchvarov.

Amidships, two longitudinal timbers, sister keelsons, run parallel and adjacent to the keelson to which they are spiked. The timbers are 5.17 m long (a little less than one-third the length of the keelson), 34 cm moulded and 17 cm sided. As the keelson itself, they are notched over the floors to the depth of 3 cm. The sister keelsons protrude 15 cm above the upper edge of the keelson. The timbers are supported transversally by two sets of buttresses, which lie on top of floors. Their length is 65 cm, their thickness is 12 to 13 cm, and their width conforms to the shape of the floors. The buttresses taper from the

sister keelsons towards the bilge stringers into which they butt. No notches are cut into the bilge stringers to receive the ends of the buttresses.

Immediately forward of the sister keelsons a shallow square (c. 10 cm per side and 10 cm deep) mortise is cut into the upper face of the keelson. The mortise is surrounded by a square imprint, probably caused by the lower end of a stanchion (fig. 21). Neither the stanchion itself, nor any trace of it was found. This represents the only stanchion mortise found.



Fig. 21. Stanchion mortise with square imprint visible. Photo: K. N. Batchvarov.

The only surviving mast step is located between the sister keelsons. Taking into account its position, the length of the sister keelsons and the vessel remains, it is probable that the ship had a single mast. The step is cut through the keelson, spans three floor timbers, and at its aft end terminates on the floor timber immediately forward of the midship frame (fig. 22). The mast step has a length of 70 cm and width of 20 cm. No traces of wear associated with the loads that the mast must have carried were found on the keelson around the opening. The excessive length of the maststep mortise suggests there must have been a wedging system (of which no trace survives) to hold the mast heel in position. This would explain the lack of wear on the keelson. A very close parallel for this maststep is the one found on the 14th-century galley from the island of San Marco di Boccalama in the Venetian Lagoon, which was sunk to crib the shore in AD 1328.[100] On the Genoese carrack *Lomellina*, the main mast step is also bound on both sides by 5 m-long sister keelsons (which Guerot and Rieth call side keelsons), which are supported with buttresses (called chocks by the two authors), butted into the thickstuff. Two dovetail jointed crosspieces fore and aft of the mast support the sister keelsons.[101] Similar, though not identical to the Kitten ship mast step appear to have been used on the mid-18th-century wreck from Sharm-el-Sheikh from the Red Sea and the 19th-century DW2 wrecks from Israel, neither of which are published in much detail in English. The mast steps of both vessels, however, appear closely related to the mast step on *Lomellina*.[102] Eric Rieth also proposes the same arrangement for the Culip VI wreck.[103]

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[100] Mauro Bondioli, personal communication, September 2003.
[101] Guerot 1995, 44.
[102] Raban 1971, 151; Cheryl Ward, pers. comm. 2003; Yak Kahanov, pers. comm. 2003.
[103] Rieth 1998b, 129, fig 59.

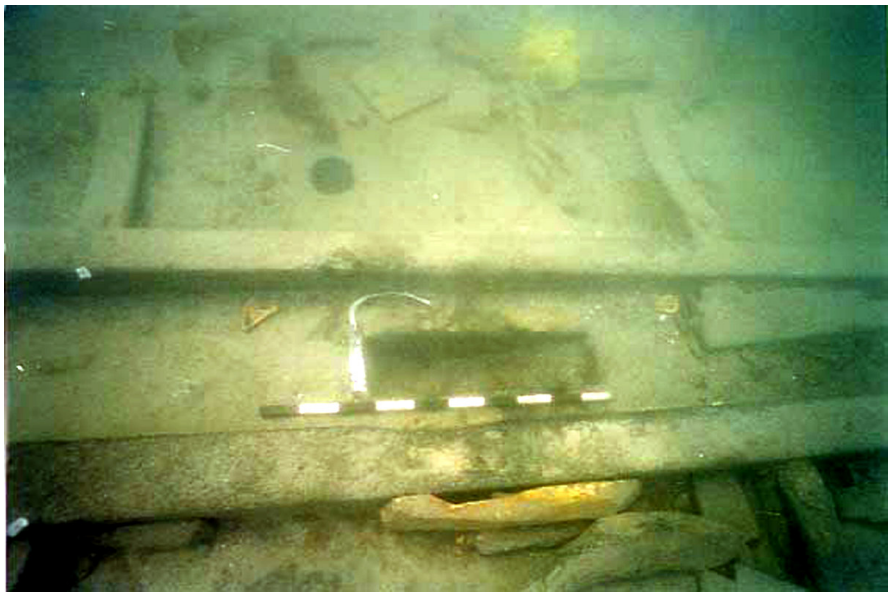


Fig. 22. Sister keelsons and mast step. Photo: K. N. Batchvarov.

STRINGERS AND CEILING PLANKS

The starboard bilge stringer consisted of three pieces, with the two shorter pieces forming the bow and the stern risings. The third and longest piece extends along the central part of the hull. The three pieces are fitted to each other with long diagonal scarfs, but we found no evidence of fastenings. The timbers are heavy, 10 cm thick, and are deeply (more than 5 cm) notched over the frame bends, to which they are spiked. At more than 15 cm, the stringer is wide enough to cover most of the frame scarfs and it was so heavily fastened that it defied our efforts to disassemble it. The width and depth of the stringer's notching also covered the area of the frame scarfs where any sirmark would have been located.

The bilge stringer is partially covered by two thinner, but still massive strakes (c. 5-10 cm thick and c. 20 cm wide each) of footwaling extending from about the middle of the stringer outboard. Forward, the outer strake butts into a timber with nearly square section, which forms the continuation of the strake towards the bow of the vessel. Originally, it probably reached the stem or a breasthook. The timber was fastened to each frame, although most frames have now fallen off and the timber itself is in very poor condition. Nevertheless, dovetail mortises were clearly observable on its upper and outer surfaces, and some still contained the dovetails of filling pieces that covered the room between the futtocks. Aft, the outer of the two footwaling strakes is crenelated and notched around the futtocks, with dovetail-jointed filling pieces between the frames (fig. 23).



Fig. 23. Crenelated timbers with filling pieces between the futtocks. Photo: L. Klissurov.

This arrangement is very similar to the one recorded on a well-preserved mid-16th century wreck from Cattewater, at Plymouth, England, which is believed to have been

Iberian built.[104] The same arrangement is reported for the Emanuel Point Wreck, a large mid-16th century Spanish ship found in Pensacola Bay, Florida, believed to have formed part of Tristan da Luna's fleet.[105] A crenelated timber and filling pieces have also been reported on a medieval wreck from Tantura Lagoon, Israel, however it is popularly associated with the Iberian Atlantic tradition of shipbuilding.[106] Evidently, this association needs to be extended to include Mediterranean and Black Sea shipbuilding as well, although Joncheray does not mention filling pieces between the futtocks of the wreck from Sardineaux. This arrangement was also absent on the Culip VI and Yassiada wrecks. These three vessels were less well preserved than the Kitten wreck, which may explain the absence of filling pieces.

The surviving part of the Kitten ship's starboard side has four stringers fastened to it. They differ in scantlings and form, being either narrow and thick, or wide and thin. The scantlings of the first group average 15 -25 cm wide by 8 cm thick and those of the second 25 cm by 4 cm thick (fig. 24). The thicker pieces are occasionally notched over the frames to which they are attached, especially in the curving extremities of the hull. Even the thinner stringers are notched where differing moulded dimensions of the frames prevent a smooth run. The stringers are fastened to every frame timber with two nails driven at an angle to each other, making their removal during excavation difficult. Evidently the iron fasteners are still in good state of preservation. Most of the stringers

[104] Steffy 1994, 133.
[105] Smith 1998, 299.
[106] Kahanov 2004, 118, fig. 8.9; Oertling 2004,133, fig 9.5.

were built of at least two planks scarfed together with simple diagonal scarfs. The lowermost thick stringer had a nearly S-shaped scarf, but whether this was the intention of the shipwright or the result of poor workmanship, it is difficult to ascertain. It is notable that contrary to generally accepted convention, the scarfing of adjacent stringers was not staggered out along the length of the vessel, but was concentrated in one area. This ought to have caused a weakening of the construction in this area of the hull, but there was no evidence to support this view.

The uppermost surviving stringer is thin and, as its location coincides with the overlap between the toptimbers and the futtocks, it is likely that another stringer existed higher up on the side. This now-missing uppermost stringer may have formed the clamp. There is indirect indication that a missing stringer formed the clamp shelf, as there is no evidence for attachment of beams on the surviving stringers.



Fig. 24. Starboard side with stringers and filling timbers. Photo: K. N. Batchvarov.

In the bow, there is a timber, similar in scantlings to the heavier stringers, which butts into the outer strake of the footwaling and curves towards the stem, which it probably reached. It is likely to have been part of a breasthook (fig. 25). The timber is in very poor condition.

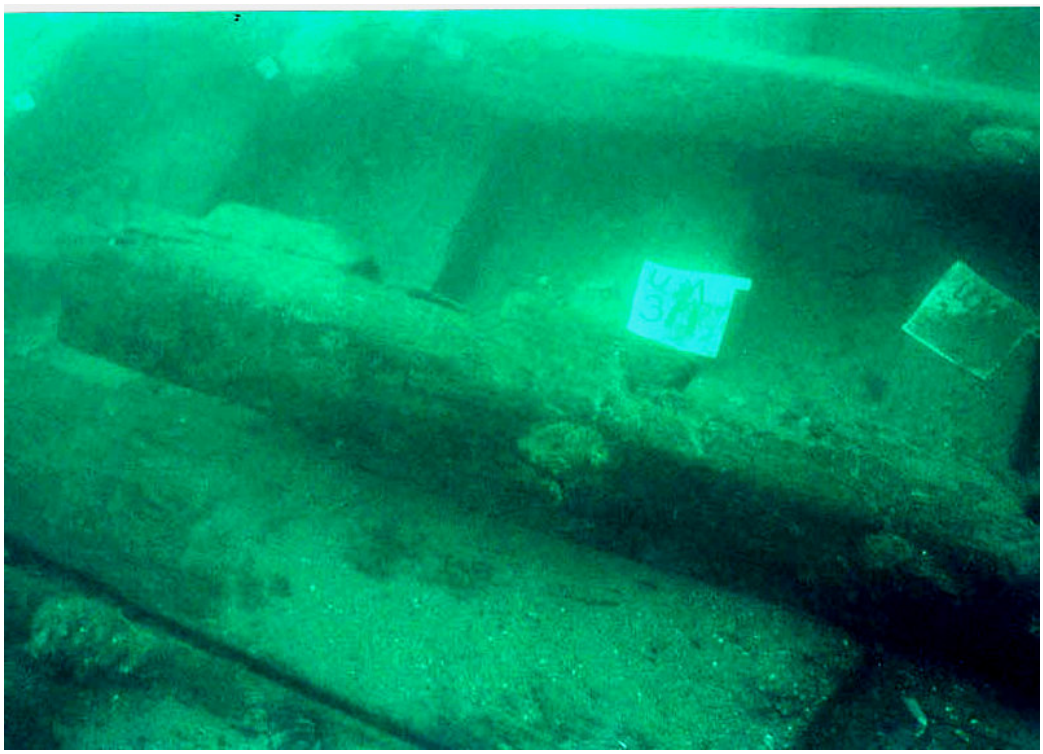


Fig. 25. A part of the outer footwaling strake which may have formed the arm of a breasthook. Photo. L. Klissurov.

Another longitudinal timber of 3.5 m length is located in the forward end of the wreck halfway between the footwaling and the first stringer. The timber is notched around and fastened to every frame that it crosses (O to V). Although the forward part is heavily eroded, some remaining traces of curvature may indicate that the timber did not reach

the stem. If so, it may have been a long lodging knee, supporting a beam into or against which the standards of the bitts rested. This interpretation was proposed by Dr. Fred Hocker, who discovered the timber in 2000. In the stern, two rider timbers, which angled sharply upwards, were notched and fastened to the frames with spikes and one treenail. Their upper ends are eroded, but they likely formed or butted into sternhooks. Their lower ends butt into the bilge stringers, but are distinctly separate from them. Most probably, these timbers provided some strength to the otherwise weak attachment of the sternpost to the hull and likely counteracted the hogging stresses of the high stern.



Fig. 26. Transversal ceiling planks in center right of the photograph. Photo: K. N. Batchvarov.

Transversal ceiling planking, well preserved for the entire length of the ship, extends from the bottom up to the turn of the bilge (fig. 26). However, the sides above the turn of the bilge are covered only by the four sets of stringers and otherwise remain open. The transversal oak ceiling planks are the same thickness as the oak exterior planks (3.5 cm). Their widths vary, but average about 19 to 21 cm, as do the exterior planking. Notably, they are nailed in place, and have their top surfaces level with the *upper* edge of the keelson. The inner edges are fastened with iron nails to ledges nailed to the sides of the keelson. The ledges are 7.5 cm wide and 14 cm thick, resting on top of the floors without being notched for them. The outer edges of the planks are nailed to the bilge stringer and butt into the inner footwaling edge. Thus the bilge stringer is completely covered by the ceiling and the footwaling planks. The ceiling planks are nailed to the stringer, too.

One of the starboard planks, located between the transversal buttresses, has a round opening 20 cm in diameter that most likely accommodated the lower end of a bilge pump tube. At the time of excavation the pump opening was covered with a square softwood plank, and from the marking of the plank it seems probable that the cover was in place at the time of sinking. The nailing of the ceiling planks made it impossible for the ship's crew to reach the bilges and clean limber holes routing the water to the pump. Between the futtocks at the turn of the bilge are driven the filling pieces (see above), which cover the wrongheads and are dovetailed into the outermost strake of the footwaling, thus completely sealing off the bottom of the vessel from the hold.

DECK BEAM

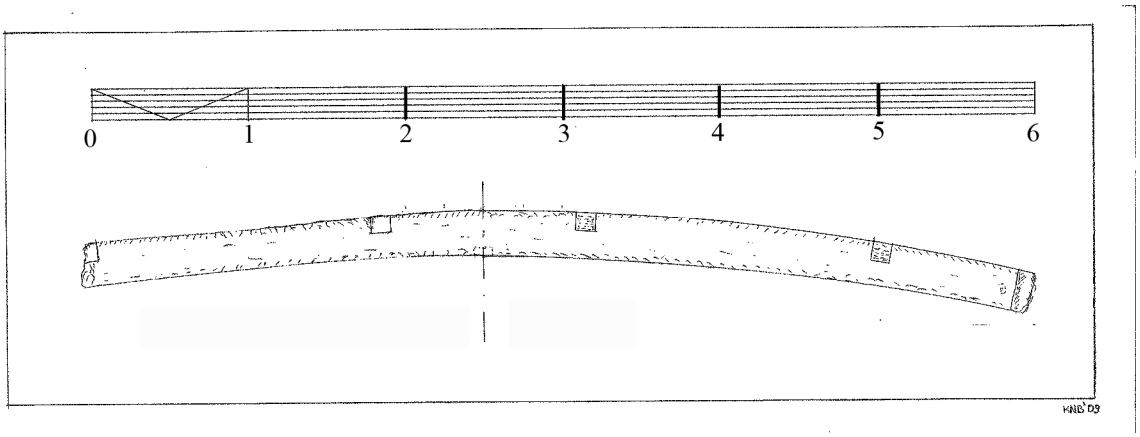


Fig. 27. Deck beam. Drawing: K. N. Batchvarov.

Only one nearly complete deck beam was found (fig. 27). That sole example proved to be most informative for reconstruction and interpretation of the hull and its sailing rig. The extant length is 6.04 m, but it was evidently about a meter longer originally. One face of the beam is very heavily eroded and no original surface is preserved, but the other face is in much better condition. The better-preserved face at the peak of the camber has a shallow indentation approximately 50 cm wide and less than 2 cm deep. The indentation is more visible at the upper part of the beam than at the lower, which suggests that the pressure causing the indentation was applied at an angle. On either side of the indentation deeply cut notches are preserved (about 12 cm sided by 10 cm moulded and separated by about 1.2 m) that probably supported carlings. The notches were observed only on the side with the indentation, but this may be due to the extremely poor preservation of the opposite face of the beam, where no original surface remains. Another notch is cut into the lower face of the beam, in the middle of the

indentation. It appears to have been the mortise for the tenon of a stanchion, although it differs morphologically from the only stanchion mortise found on the keelson. It is too heavily eroded for measuring, but appears to be similar in size to those for the carlings.

One end of the beam is preserved completely, although with damage from erosion. The end itself shows remains of a dovetail cut into it. It appears that the beam was secured to a clamp through dovetail joints, which supports the view that the surviving stringers do not include the clamp. On the same arm, 1.1 m from the dovetail another notch cut into the upper face of the beam is preserved. Likely, it was the bed for another carling, also fastened by a dovetail joint. The other arm is broken precisely at the notch. Based on the symmetry of the beam, it can be estimated that the original length was around 7 m. The location of the beam and its purpose can also be reconstructed from the position of the stanchion mortise on the keelson. As only one such mortise was found on the keelson, it is likely that the corresponding notch on the beam was directly above it. The indentation on the beam is most likely to have been caused by pressure from the mast, and the two carlings around it would have formed the mast partners.

Thanks to this find, it is possible to accurately estimate the maximum beam (including the exterior planking, but without the wales) of the vessel at 7.46 cm. The recorded hull section at the notch in the keelson and the length of the beam permit us to estimate the depth of the hull at about 3.56 m at this location. The positions of the maststep and the

reconstructed depth in hold at this location will, in Chapter V, allow us to reconstruct the rake of the mast and help identify the Kitten wreck's rig.

PLANKING

Given the time and funding constraints under which the archaeological team operated, it was impossible to uncover the preserved exterior of the wreck. Yet, it was possible to obtain some information about the external planking in the bow and the stern. Planks vary in width, without discernible pattern, between 19 and 21.5 cm, with most being 21 cm wide. Plank thickness is almost uniform at 3.5 cm. It was possible to identify at least three sets of wales. The wale sets consist of two thicker strakes separated by a single thinner strake, the thickness of a standard plank. Their dimensions from the lower to upper strakes are as follows: 6 cm thick by 13 cm wide, followed by a standard plank and a 7 cm by 15 cm wale, then a 5.5 cm by 11.5 cm wale followed by an almost standard plank, but narrower than average (16 cm), and then a 5.5 cm by 12 cm wale. The third set consists of two 6.5 cm by 13 cm wales, separated by a narrow plank of normal thickness. It would appear that most of the preserved wales were under water amidships when the vessel was afloat, even when not fully loaded.

All planks are fastened with two nails per frame. No treenails were observed. Planks within a strake butt into each other and the butts, where observed, were placed on frames. These observations were made at the extreme bow and stern ends of the vessel,

where futtocks were missing, but the external planks were still in place. Unfortunately, no measurement for the length of planks within a strake was possible. No evidence for caulking was discovered anywhere on the ship, but remains of a pitch coating were detectable. Both drop strakes and stealers were employed by the shipwright. Within the limits of the preservation, one drop strake in the bow was identified, and, on the port side of the stern, a stealer was discovered with iron nails still protruding from it. Under the starboard quarter and below the waterline of the ship, we found a repair to one of the planks: a piece was cut out and replaced with a dutchman. However, it is not known whether the repair was made in the process of building to correct a plank defect or was done later in the life of the vessel. The former seems more probable.

MATERIALS

The ship is built almost completely out of oak. Some remains of softwoods were also uncovered in the first two seasons, but they were so poorly preserved that it was impossible to obtain samples suitable for identification. It is probable that they were remains of a deck. Among the well-preserved oak parts of the hull it is evident that timbers were carefully worked. None show any bark or even much sapwood. This confirms that they were cut from large baulks. The large grown Y-shaped floors in the bow and stern, the massive timbers in the bow that may be breasthooks and the overall quality of the timber are evidence that the master shipwright did not suffer from any shortage of quality material. As the vessel is almost entirely iron-fastened, it is natural to

conclude that iron was plentiful and cheap. In the Ottoman period, these conditions – availability of timber and iron - existed in the territories of present-day Bulgaria. The Bulgarian town of Samokov, located in the southwestern part of the country, was the principle supplier of iron within the Ottoman Empire. The Strandja Mountain chain, which reaches the southern coast of Bulgaria in the vicinity of the present day town of Kitten, was known for its export of timber and charcoal. It appears likely that the ship was built somewhere along the Bulgarian shore.

CONCLUSION

The vessel represented by the Kitten wreck is large for this region, and likely displaced between 100 and 200 tons. The quality of the craftsmanship evident in the well-worked timbers and tight joinery imply the ship was built in a professional shipyard that followed longstanding traditions. The regular framing, nearly uniform scantlings and clear fastening pattern of most timbers suggest the work of a master shipwright who had experience building similar vessels. That the pre-assembly of floors and futtocks is limited to the central part of the hull, offers evidence for a system of controlling the shape of the hull through some, probably the traditional, Mediterranean system of whole-moulding, rather than building by eye or from a lofting.

During the four seasons of work in the southern bay of Kitten, it was possible to confirm the reports of Bulgarian colleagues that at least three more ships lie around the excavated

wreck. A fourth vessel, in the southern end of the bay, is reported but was not observed by our excavation team. Usually the ships are almost completely covered by bottom sediment, but in 2001 a storm uncovered, a double-ended vessel of apparently identical construction to the one under study. This vessel was significantly better preserved with some decking and part of the single mast still in place. Its extant overall length was found to be almost exactly 27 m at deck level. The other wrecks have suffered more damage, but the scantlings of the visible timbers are generally heavier than those of the ship under study. This implies that despite popular belief to the contrary, large ships were likely built and certainly operated along the coast, nor were they rare if one is to judge by the carefully planned construction of the ship and the quality workmanship. The sheer number of large shipwrecks found in the small bay of Kitten alone supports this conclusion.

The main export of the Bulgarian territories were destined for the capital of the Ottoman Empire, Istanbul, and primarily consisted of low-value bulk commodities such as grain, hides, honey, timber, bulk iron and charcoal. This type of low-cost, but high-volume cargo requires large ships for the voyage to be profitable. The obvious implication is that economic conditions on the western Black Sea coast necessitated the use of relatively large cargo carriers. If the capital for building such vessels was made available, the importance of seafaring for the local population must have been significant, pointing to the existence of a more vigorous maritime economy than was heretofore believed.

CHAPTER IV

RECONSTRUCTION OF THE KITTEN SHIP

As stated earlier, it is probable that the Kitten ship was lost sometime in the reign of the Ottoman Sultan Selim III (1789-1807) or shortly thereafter (1807-1825). Since the excavation of the Kitten shipwreck is the first complete archaeological excavation of a post-medieval vessel from the Black Sea littoral, there are presently no close parallels for the construction of this hull. Thus, a thorough study of the Kitten shipwreck provides an opportunity to add to our knowledge of shipbuilding practices for an area of the world which hitherto has been *Terra Incognita*, but this breaking of new ground means there is a dearth of sources and comparative material. In general the eastern Mediterranean (including the Black Sea) has been poorly served by nautical archaeology for the postmedieval period. Few wrecks have been excavated and published, and even fewer have undergone reconstruction. As the previous chapter demonstrated, the Kitten ship was extensively preserved, despite having sunk in the surge zone. Amidships, the remains extend nearly to the height of the deck. The bow is poorly preserved and the stern is mostly missing. The fortunate discovery of the sternpost provided us with useful data from which to reconstruct the stern. Only about a meter of the bow survives and the timbers in this part of the hull have fallen apart.

Although no exact parallels for the Kitten ship have been published, some Mediterranean vessels offer similarities that suggest a common culture of shipbuilding in the Black Sea, Levant and Mediterranean. The similar 14th-century Culip VI, the 16th-century Yassiada and the 17th-century Sardineaux wrecks are significantly less well-preserved than the ship from Kitten, which also may have been the largest in the group. Thus, these archaeological examples were of limited use in the reconstruction, but still important for placing the Kitten wreck in the shipbuilding traditions of the Mediterranean world.

By the end of the 18th century plentiful literature on shipbuilding and design existed in the West, some of which offered detailed lists of scantlings for different types of vessels. So far nothing similar has been uncovered for the shipping of the Ottoman Empire. Kostas Damianidis extensively researched Greek vernacular boatbuilding for his doctoral dissertation and although this study has some relevance – the Greek islands and mainland were part of the Ottoman Empire until the Great Powers established an independent Greek kingdom – his research was based on interviews with traditional boatbuilders and the information is only pertinent to the first half of the 20th century.[107] Still, some data can, with caution, be used for the earlier period, too. In the mid-1950s American maritime historian and ship specialist Howard Chapelle studied traditional Turkish boatbuilding and found strong traces of 18th-century traditions still practiced.[108] Again, Chapelle's material cannot be used directly, as most of the boats he described had already been modified from their sailing ancestors for the use of engines.

[107] Damianidis 1989.
[108] Chapelle 1957.

A final source of comparative information is iconography, including both contemporary graffiti and conventional art. Generally speaking iconography is overrated as a source of constructional knowledge. Research aimed at identifying archaeological remains based on contemporary paintings is often futile, given that the bottom of a hull is usually the sole part that survives to be excavated and recorded, and art is concerned mostly with the upper part of the hull above the waterline. Thus no direct correlation between the two can be made. This factor, however, has not dampened attempts to reconstruct ships from depictions. The sole convincing attempt in this direction, of which I am aware, is the reconstruction of the *Duyfken*, a Dutch yacht of the early 17th century. There, however, data obtained from statistical analysis of works of Dutch masters from the 17th-century Golden Age, renowned for their technical proficiency and reliability, was combined with more prosaic, but also more informative and conclusive written shipbuilding instructions as offered by Nicolaesz Witsen (1671). A similar approach is impossible with the Kitten ship, as the vital second component – reliable written rules – is not available. Thus, illustrations from contemporary European visitors to the Empire are used with some caution for the reconstruction of the rig's type and the general outline of the upperworks of the hull. Extensive cataloguing of graffiti from Bulgarian churches has also demonstrated the same trends, but their crudeness renders them of even more limited utility. Finally, the French Admiral Edmond Paris published in his *Souvenirs de Marine* (originally published in 6 volumes, 1882-1908) two draughts of Ottoman vessels from the Black Sea. Both recorded vessels are dated to the second half of the 19th century and

were clearly constructed differently than the Kitten vessel.[109] This limits their usefulness as comparative material.

LONGITUDINAL PROFILE

Starting from at least the earliest Renaissance shipbuilding treatises of the early 15th-century, and probably from much earlier, the keel length has been the most important dimension. It is the first dimension to be determined in building a ship, and the measurement from which all others are derived. On the Kitten shipwreck the keel timber could not be measured directly, but some reasonable estimates can be made, based on indirect measurements. The location of the forward butt joint between stem and keel was recorded. In the stern, the filling chocks that supported the garboards' entrance into the sternpost were directly observable too, which helped to determine the position of the sternpost. Since the lower part of the sternpost itself was also discovered and recorded, the length of keel was deduced on the basis of these findings. For the calculation of proportions in order to compare them with available sources, the length of keel is taken to be the length of the imprint the keel would make on the ground, known in 17th-century English sources as "thread length". Thus, the gripe of the stem and the hook of the sternpost are included. The length of the Kitten ship's keel is estimated to be 16.86 m.

[109] Paris 1999.

Table 1 supplies typical hull proportions based on surviving Venetian shipbuilding treatises for Mediterranean craft and the limited number of archaeological finds for which the necessary data exists. It will be seen that the ratio of Keel Length and Beam varies between a low of 2.3 to a high of 3.2. By great good fortune the dimensions of the one recovered deck beam supplied the moulded breadth of the Kitten ship to within a few centimeters. It should be pointed out that all early Renaissance treatises provide stevedore measurements for their proportions and the ratios have been calculated on this basis, including the ratios for the Kitten ship, which, at 2.5, falls in the mid range of values.

Kostas Damianidis offers a large body of tabulated data on vernacular Greek boats from the early 20th century. Although his data covers a later historical period, it is geographically close to the Kitten shipwreck.

Table 1. Table of proportions of Mediterranean vessels. All measurements are in meters.

Source	LOA	LKL	Beam	Depth	Floor Length	LOA/B	LKL/B	B/D	B/Floor
Culip VI (reconstructed)	16.35	c.11	4.11	1.94	n/a	4	2.7	2.1	n/a
Contarina I (1300)	20.98	16.5	5.2	n/a	2.63	4.03	3.2	n/a	2
Nave Latina, c.1410	27.5	20.7	8.28?	n/a	3.1	3.32	2.5	n/a	2.7
Nave Quadra, c. 1410	33.06	22.62	9.22	4.52	3.93	3.58	2.5	2	2.4
Contarina II (1550)	20.5	14.55	6.3	n/a	1.67	3.25	2.3	n/a	3.8
Timbotta's 250-botte nave	n/a	20.88	7.13	2.96	2.96	n/a	2.9	2.4	2.4
Pre Teodoro Nave (1550)	24.9	17.4	8	4	2.44	3.1	2.8	2	3.3
Pre Teodoro Galleon (1550)	47.15	34.8	13.05	5.92	3.83	3.6	2.7	2.2	3.4
Kitten Shipwreck c. 1800	23?	16.86	7.46	3.56	2.4	3.1	2.3	2.1	3.1
Tartane, c. 1800[110]	13.5	10?	4.21	1.99	n/a	3.2	2.4	2.1	n/a

As his sources were traditional boatbuilders, the proportions they offered were inherited from their forefathers and, thus, were not too distant from the period when the Kitten ship sailed. However, it should be recognized that the changing means of propulsion have had a significant impact on both construction and design, thus forcing

[110] Delacroix 1997, 22. Identified as built by a H. Penevert at Rochefort in the „first years of the 19th century."

modifications and adaptations on traditional boat shapes. For this reason, the data from Damianidis was used cautiously for comparison.

According to Damianidis' Table 5, in which he offers the range of proportions for *trechadiria*, (singular: *trechadiri*), the beam was to be less than half of the length of keel.[111] Rake of stern and stem posts were calculated as a fraction of the keel: one-third for the forward rake and one-sixth for the aft rake. For the generally larger *peramata* (pl.; singular: *perama*), Daminidis offers forward rake of a quarter the length of keel, stern rake one-eight the length of keel and a beam of between half and a third the length of keel.[112] *Peramata* were generally considered better sailers than *trechadiria* and perhaps ought to be more relevant to the reconstruction of the Kitten ship.

Calculating the bow and stern rakes of the Kitten ship is particularly fraught with danger, as little survives to guide us in the process. This is especially true of the bow, where less than a meter of length survives. Fortunately, two floor timbers found in the area provided some assistance. A V-shaped floor timber, with eroded wrongheads was found *in situ*, backed into the forward end of the keelson. The general shape of the timber is trapezoidal, with straight-line sides, showing no hollow. The bevels of the two sides of the timber assisted in determining the run of the planking in this area and were used to establish the entry of the first, lowermost, waterline. A second floor timber, in even worse condition than the first, was found in the bow square, but it was no longer *in situ*

[111] Damianidis 1989, 48, Table 5.
[112] Damianidis 1989, 49.

and the sides were too eroded to provide conclusive direction for the waterlines. Luckily, the bevel of its lower face, which lay on the stem, was reasonably well preserved, and it was possible to measure it with some claim to accuracy. Between these two points and the recorded remaining length of the stem, it was possible to reconstruct a plausible fair curve, with the lower part being almost certainly correct. The part of the curve above waterline 5, however, is less certain. Traditionally, the shape of the stem in a Mediterranean (or any other European) vessel was drawn as one or two tangential arcs, usually with radius length based on a proportion of the beam. The scarce surviving archaeological evidence for the shape of the stem made attempts to reconstruct the radii of the arcs inconclusive. It is, however, probable that two tangential arcs were used. As drawn, the shape is influenced by iconographic evidence,[113] personal observations of the general shape of stems on traditional Black Sea boats and, even more so, the proportions derived from the two Turkish coasters published by Edmond Paris.[114] It can surely be said for the upper stem that it does not contradict any available evidence. However, it must be recognized as no more than a reasonable hypothesis.

[113] Tzamtzis 1972, 53-174; Müller-Wiener 1994, Ovcharov 1992.
[114] Paris 1999.

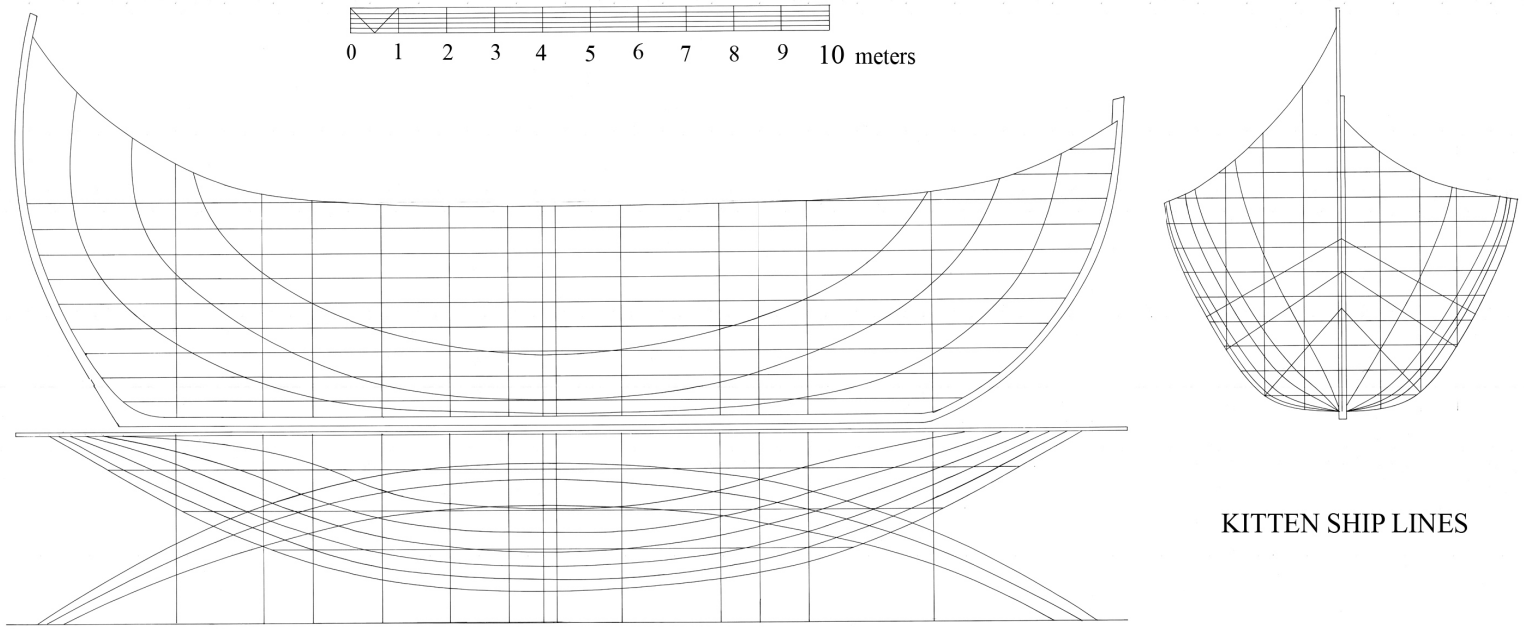


Fig. 28. Reconstructed lines of the Kitten Ship. Drawing: K. N. Batchvarov.

The stern rake as drawn on the lines plan is less than that of the bow, a practice confirmed by all quoted sources of information. The usual ratio between fore and aft rakes is about two to one in favour of the bow rake. On the Kitten ship this ratio is preserved. More of the sternpost survived than of the stem, so a higher confidence can be placed in its reconstruction. The proportions calculated from Admiral Paris' drawings were used together with those provided by Damianidis and available iconographic evidence for the general shape and height of the stern. By Western European standards the height of stern and bow may seem exaggerated for a vessel of the last decade of the 18th or first decade of the 19th century, but there are contemporary descriptions that confirm this practice.[115] The hood ends of some planks survived in the stern and correspond to the surviving sternpost, making them useful in determining the post's position. They, unfortunately, do not help determine the shape of the missing upper post. The surviving part of the sternpost extends to waterline 5 (fig. 28), thus up to this point the shape of the vessel is based entirely on archaeological evidence and can be reconstructed with confidence. The remaining part is conjectural but does not contradict any available evidence. Although it is possible that a shallow and short transom may have been utilized in the upper part of the stern as is done on traditional Black Sea *taka*s, a vessel type still in use, especially in Turkey, the general shape of the hull makes it more probable that it was a true double-ender.

[115] Eton 1805, 4-5.

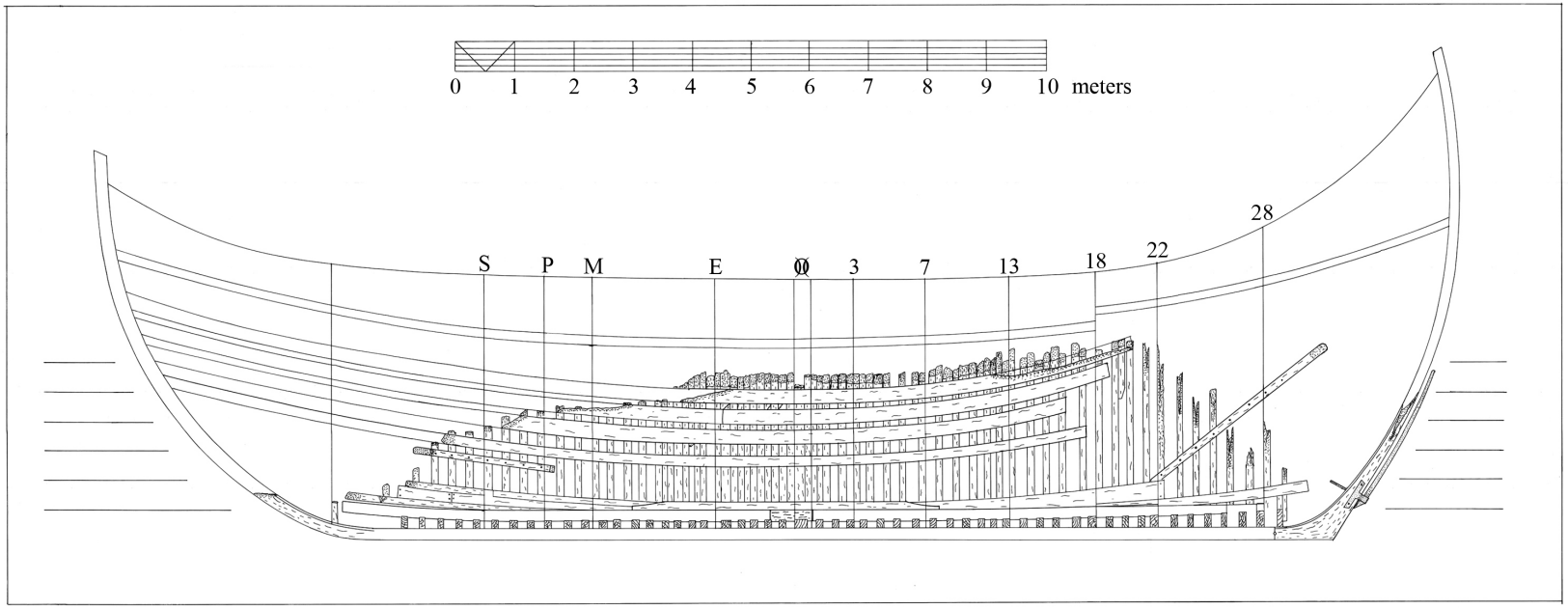


Fig. 29. Longitudinal section of the hull. The drawing shows the extent of hull preservation. Drawing: K. Batchvarov.

HULL SECTIONS

We used a goniometer for recording transversal sections from which to reconstruct the lines of the ship (figs. 28, 29, 30). In the 2002 season, virtually every frame between the bow and the forward buttress was recorded to the inside of the ceiling planks.

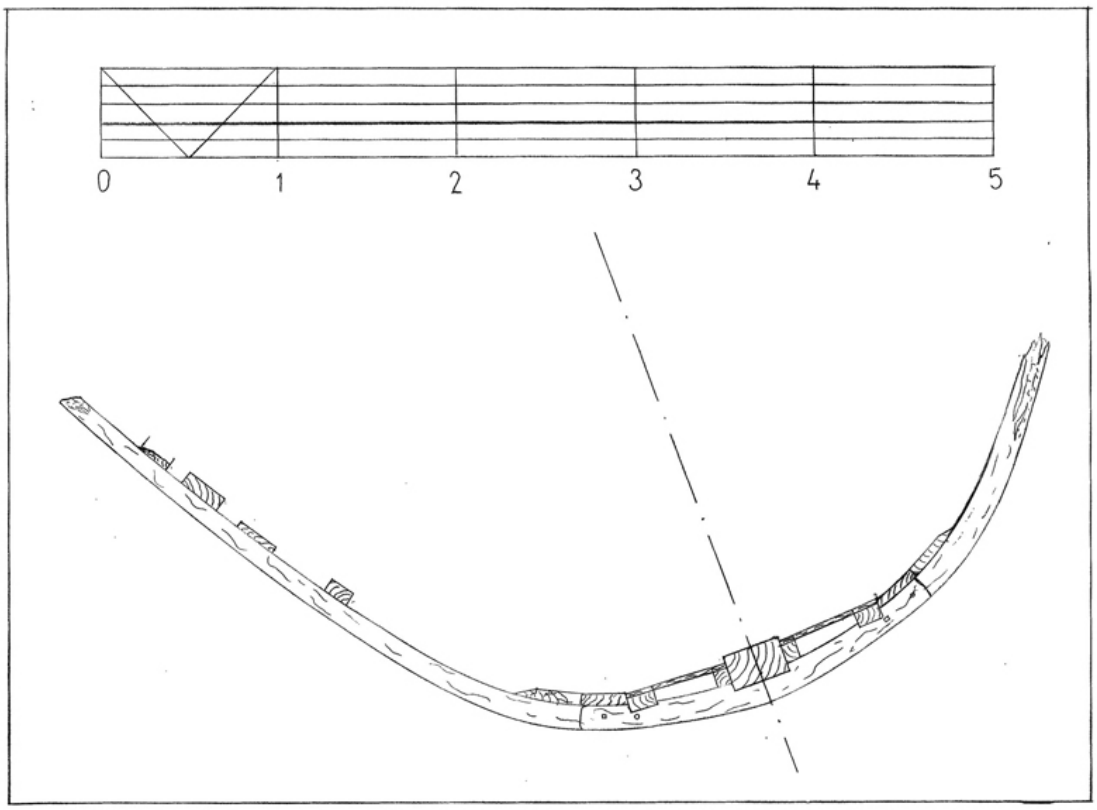


Fig. 30. Frame 26 as recorded. Drawing: K. N. Batchvarov.

In the 2003 season, the ceiling planking was removed, but lack of time prevented the goniometric recording of every frame. A total of 11 sections were taken, with higher

concentration in the bow and stern areas where the shape of the hull changed more rapidly. The recorded sections include from the bow toward the stern S, P, M, E (fig. 31), the midship frame, 3, 7, 13, 18, 22 and 28 (fig. 28, 32).

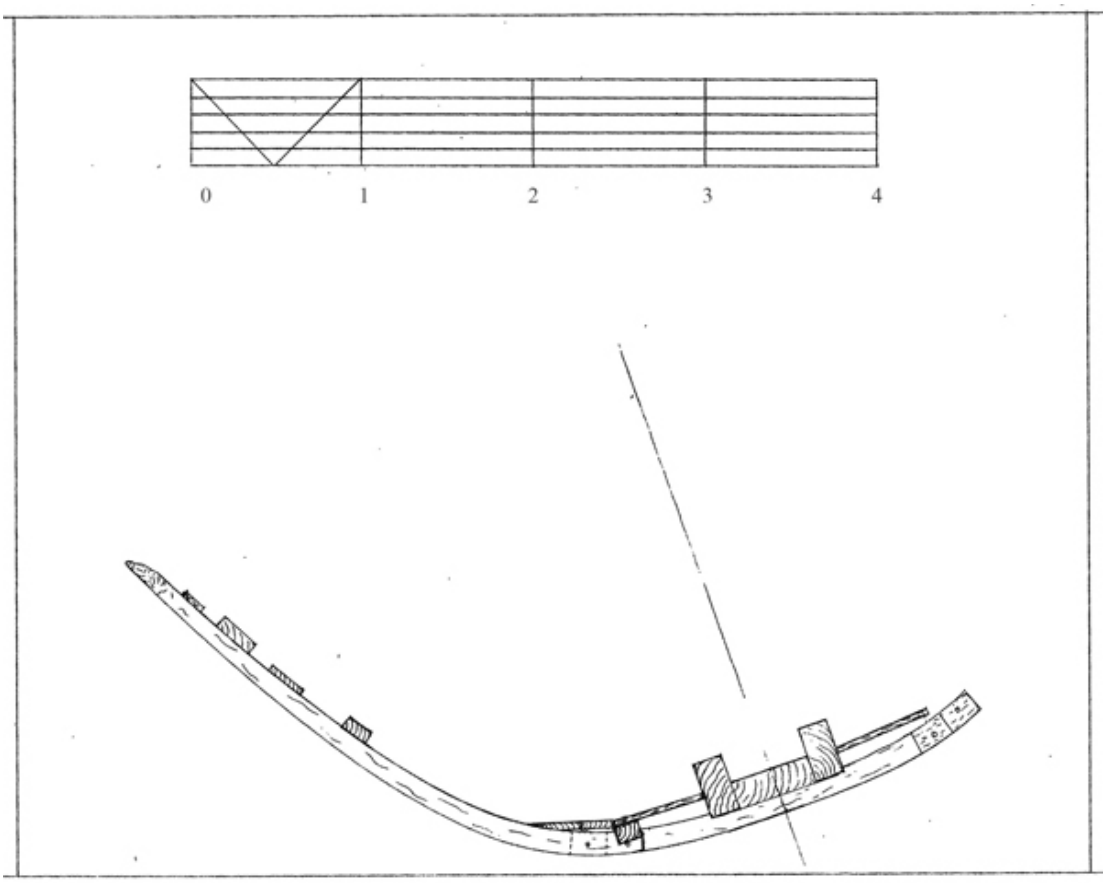


Fig. 31. Frame E as recorded. Drawing: K. N. Batchvarov.

The large sizes and close spacing of the longitudinal strengthening elements (i.e., the bilge stringer, four side stringers, the large knee/breast hook, the stringers in the stern) as well as the filling timbers amidships, made it impossible to follow the outer faces of the frames. The goniometer was led along the inner face of the frames, taking the moulded

dimensions at each length of its base. When drawn, the results of all frame recordings were consistent enough in relation to each other. While analyzing the angle measurements, it was found that they are very close for each of the frames. I cut a pattern of one of the frames (the futtock of the midships frame) and was able to match it with every one of the other frames. This was clear evidence that the hull was designed using a single pattern, adjusted along the length of the vessel for the narrowing of the hull. This system of design is known as whole-moulding and different versions of it were used from the Mediterranean up along the Atlantic coast to Northern Europe, including the British Isles.[116]

The two most fortunate discoveries of the expedition were the sternpost, and a huge balk of timber, found lying on the surface, which was originally considered intrusive material or possibly part of a timber cargo. It was only in the last season that recovery of this timber allowed us on the basis of its symmetrical curvature and the dovetail mortises to identify it as a beam. Since the poorly preserved lower face still held traces of a mortise for a stanchion and only one corresponding mortise was found on the keelson, forward of the sister keelsons, it was easy enough to determine the original position of this timber. Due to the symmetry on either side of the crown, it was possible to reconstruct

[116] Sarsfield 1984; Bellabarba 1993.

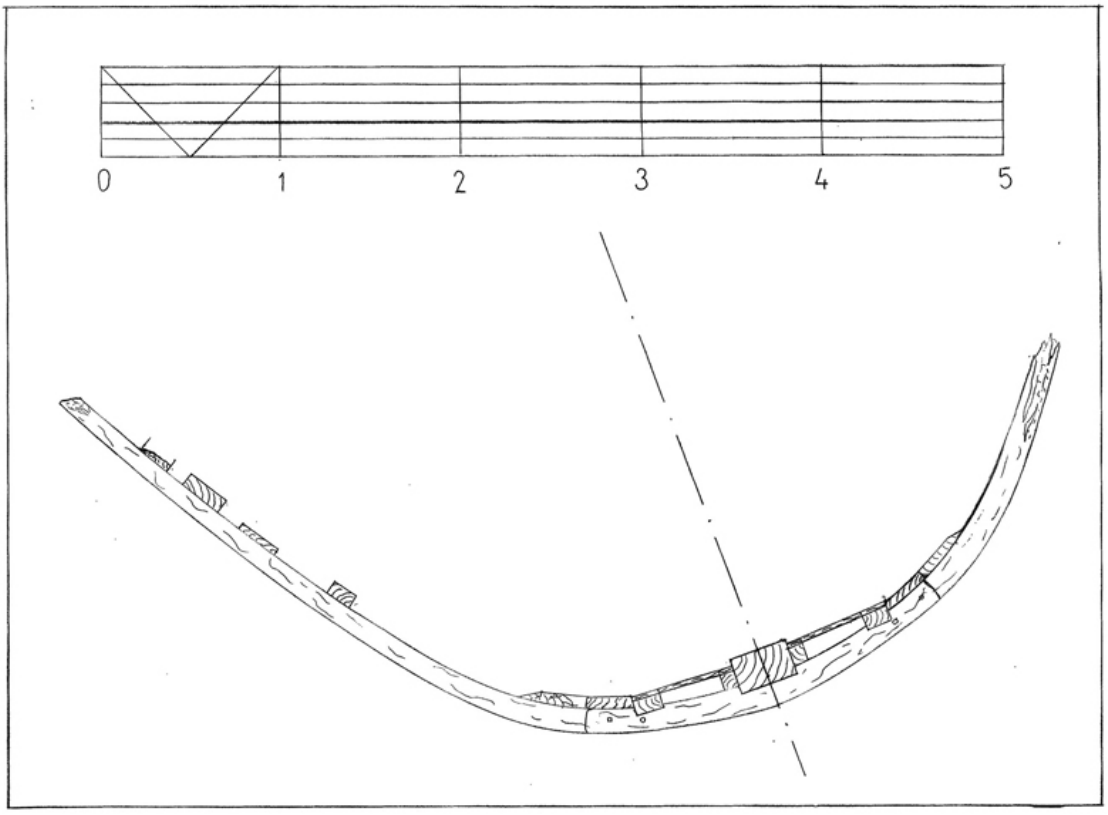


Fig. 32. Frame at section 13, as recorded. Drawing: K. N. Batchvarov.

the original length and therefore, the maximum beam. As the length-of-keel-to-beam ratio was found to fall within the limits of traditional values (Table 1), it was expected that the beam-to-depth-of-hold ratio, too, is likely to be within the traditional ratio of half the beam equals the depth, as proved to be the case.

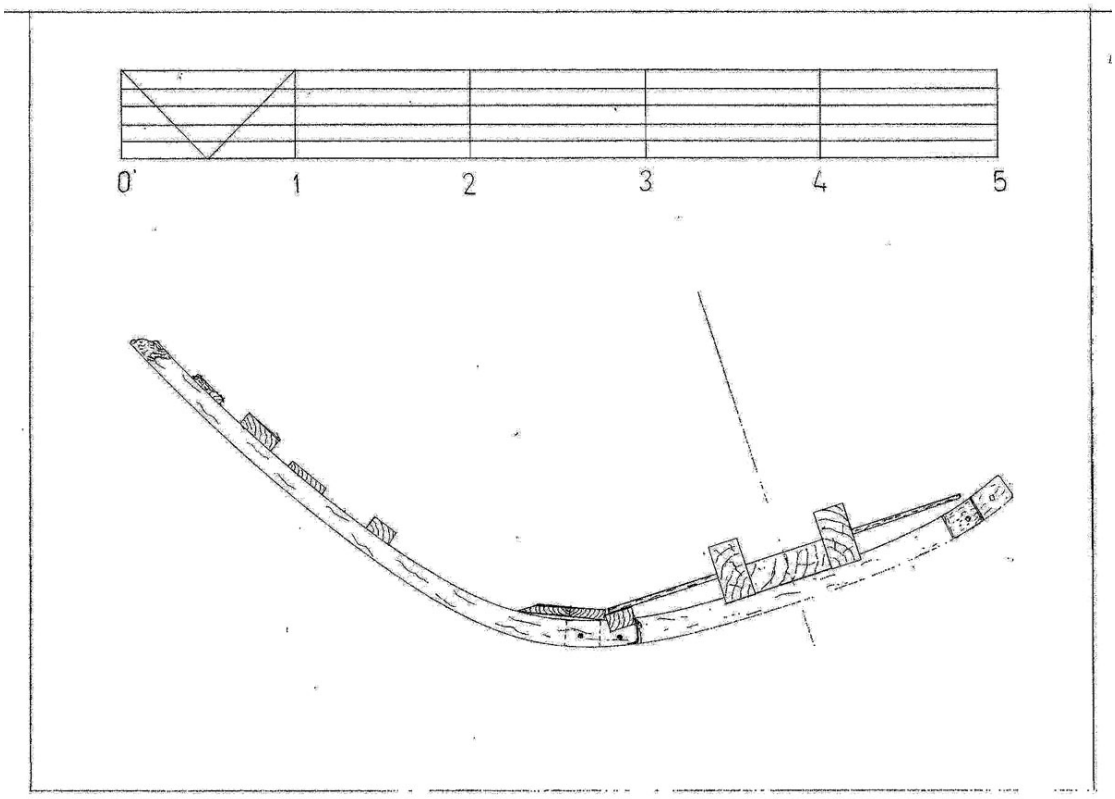


Fig. 33. Midship frame as recorded. Scale in meters. Drawing: K. N. Batchvarov.

With the help of the beam and the recorded surviving part of the midship frame (fig. 33), it was possible to reconstruct the master frame of the vessel. The recorded shape of the frame was plotted, the centerline was struck and a cutout of the beam was moved up along the centerline until it was possible to achieve a fair section by extending the extant futtock to an intersection with the half-beam. Throughout the reconstruction process of the Kitten shipwreck, I followed a minimalist approach: the minimum size and angle or simplest form that matched the available evidence was employed (fig. 34). Thus, the minimum depth in hold required to produce a fair curve for the section was found to be 3.56 m. With a stevedore (to the inside of the frame) beam of 7 m, the traditional

proportions as recorded in the treatises fit almost perfectly with the data for the Kitten ship. However, the possibility that amidships the hull was deeper in hold than 3.5 m cannot be excluded, especially if the preserved beam indeed formed the forward part of the mast partners. At 3.5 meters depth in hold amidships, the forward rake of the mast would be extreme indeed, although not without parallels.

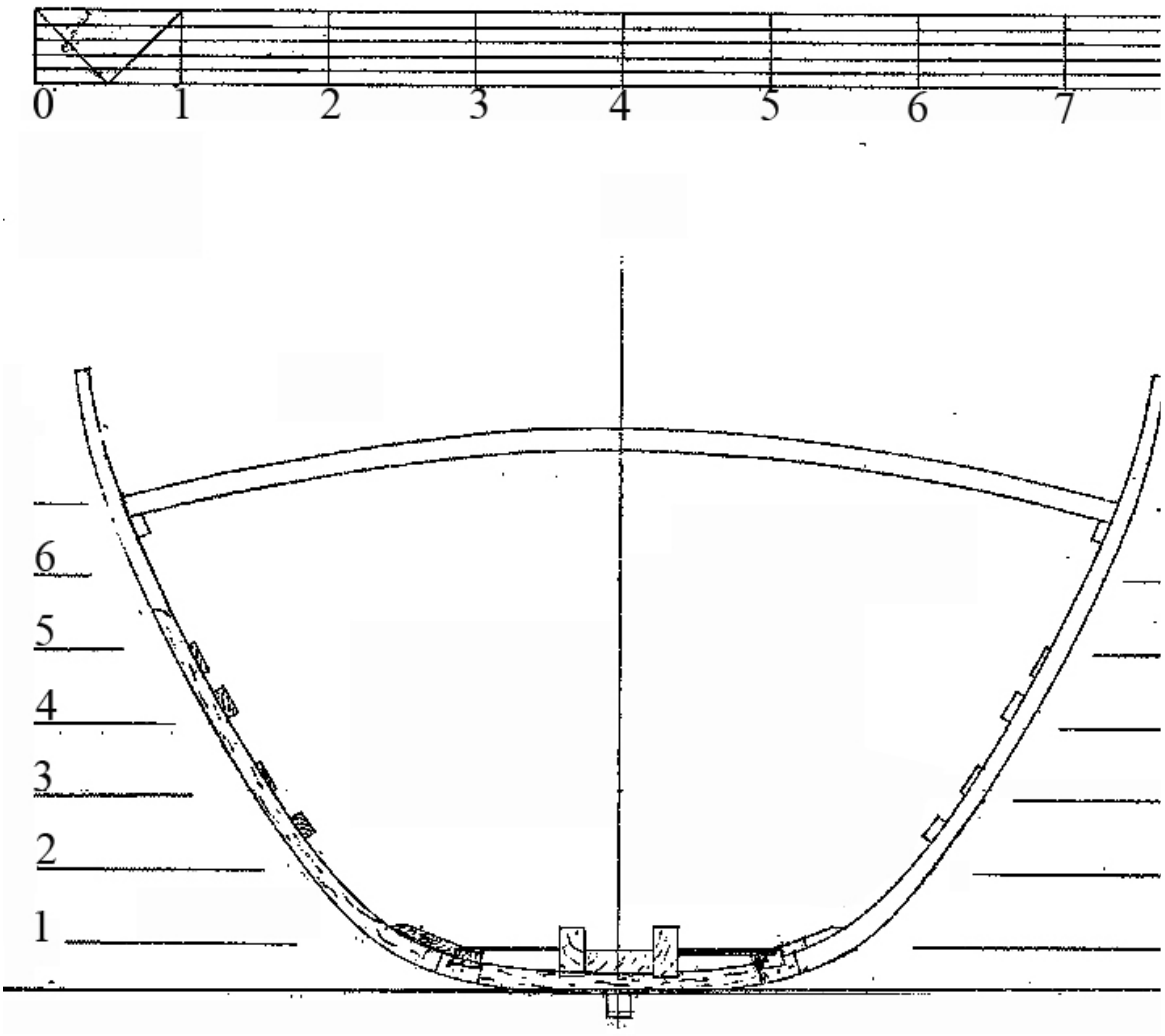


Fig. 34. Reconstructed midship frame. Drawing: K. N. Batchvarov.

Particularly problematic is the reconstruction of the deck. Both of the Turkish (Ottoman) Black Sea coasters illustrated by Edmond Paris have platforms in the bow and stern and an open central area with no complete deck. Such an arrangement was considered for the Kitten ship, as well. The poor preservation of the surfaces of the beam do not offer much detail on how the deck was built, but the upper face preserves rust discoloration and traces of nails that are consistent with the fastening of deck planks. The large size of the vessel also argues in favor of a continuous deck, rather than a hull with an open central hold. The 27-meter long wreck found in 2001 about 20-30 meters away from the ship we excavated, had an almost completely preserved continuous deck, which, oddly, was nailed in the bow section at an angle to the centerline, rather than parallel to it, as is usual. In 2006 I dived on that wreck again, but by then most of the deck was no longer extant and the remains of the mast were no longer observable, either. Finally, contemporary illustrations of vessels that are smaller, but evidently similar to the Kitten ship also feature decks.[117] It seems likely that the Kitten ship also had a complete deck along its entire length.

Thanks to the discovery of the beam, the position of the deck amidships can be determined with some certainty. The bow and stern, however, are a different matter altogether and the reconstructed curve of the deck line is no more than a conjecture. Based on contemporary descriptions it is likely that the sheer of the deck was

[117] Papadopoulos 1972, Plate 53; Müller-Wiener 1994, Plate 20; Paris 1999, Plates 103, 109.

significantly greater than for contemporary western vessels.[118] Unfortunately, just how much spring it had cannot be established. Nor is it clear if it was a flush deck fore and aft, or it had breaks. For the bow there is no preserved evidence for the presence of a forecastle. However, both Turkish vessels that Paris published (from Inebolu in the Black Sea and the Istanbul coaster), have raised decks in their bows, though not full forecastles in the Western sense.[119] In the Inebolu ship a small platform was placed above the hawse holes of the vessel and was only large enough to provide a step for handling the sails on the bowsprit. The platform in the bows of the Istanbul coaster is also small and its sole purpose appears to have been to assist in sail handling, too. The height of the bow of the Kitten ship would have made sail-handling extremely difficult without the presence of a raised platform, and one therefore probably existed.

In the stern, it is even more likely that the deck was stepped up. As described in Chapter III, the stern part of the vessel yielded the remains of a bulkhead and a cabin platform that rose slightly, about 15 cm, above the rest of the hold. To starboard there was an interruption of the bulkhead, which may have contained a door to the stern cabin, though no trace of hinges was found. The slightly raised floor of the stern cabin may indicate a corresponding rise in the deck above. Another argument in favour of a raised deck aft is the likely height of the sternpost. Iconographic evidence establishes that traditional Ottoman vessels were steered with heavily curving tillers, which swooped down from the rudder heads, above the sternposts. If there was no raised poop in the stern, the tiller

[118] Eton 1798; Eton 1805.
[119] Paris 1999, Plates 104-107.

would have had to be brought down more than 3.5 meters to reach a likely height above deck. Contemporary witness accounts state that helmsmen sat on deck while steering, rather than standing up as they did in the West (see Chapter II). A contemporary painting published in Papadopoulos shows the helmsman actually lounging on deck while steering.[120] Although these descriptions are specifically for Greek mariners in the Aegean and Eastern Mediterranean, the general similarity of vessels within the Ottoman Empire makes it possible that the same practice was followed in the Black Sea. If this was indeed a general practice for the region, then ergonomics would dictate that the handle of the tiller came down to between half and one meter above deck. For the Kitten ship this would suggest that the poop aft was at least 1.5 meters higher than the deck amidships. Edmond Paris' depictions in plates 104 and 105 of coastal vessel from Istanbul, illustrate a two-level rise of the deck in the stern, the second being very small and clearly intended for the helmsman. When we consider the typically high bows of the vessels, it is clear that a higher station for the helmsman was of absolute necessity if he was to see anything ahead of the vessel.

Paris also published three sheets of drawings of two Greek *Sakolevas*.[121] Both vessels had raised poops, despite their small overall dimensions. Plate109 of Paris's collection presents a bratsera-rigged (two masts with standing lug sails) *perama*, recorded in 1878 in Istanbul. The vessel, not even 15 meters long, also had a raised platform for the

[120] Papadopoulos 1972, Plate 14.
[121] Paris 1999, plates 101, 102 and 103.

helmsman. Thus, contemporary sources, seamanship logic and comparative material from Paris favor raised platforms for the stern of the Kitten ship.

The height of the bulwarks above deck level is particularly problematic. Paris shows bulwarks so low that a barrier of cloth was found necessary to keep spray out of the vessel. Similar information can be gleaned from an article on Istanbul lighters and from iconographic evidence.[122] The bulwarks on the Kitten ship were therefore reconstructed as 80 cm above deck amidships.

Next to be considered are the means of access to the interior of the vessel. If it was completely decked, the ship must have had at least one cargo hatch. More probably it had a small hatch or scuttle forward of the mast and the main hatch aft of the mast. This seems to have been the typical arrangement on most Mediterranean lateen-rigged vessels. Gerard Delacroix reconstructed the mid-18th-century *tartana La Diligente* with a small hatch abaft the mast.[123] The dimensions of the hatch seem insufficient, but since this was a naval tartana and not a cargo carrier, a larger hatch was evidently not needed. The Turkish vessels published by Paris cannot be used as comparison for they do not have complete decks. Yet, on the Istanbul coaster (Plate 105), the large open hold is aft of the mast. The *perama* (Plate 109) has a large cargo hatch between the two masts.

[122] Borgschultze 2005; Paris 1999, Plate 105.
[123] Delacroix 1997.

Delacroix published illustrations of *tartanas* from *Album de Jean Jouve*.[124] None of the illustrations is conclusive on this subject, but it does appear that their main hatches were all located abaft the mast. In contrast, Gilberto Penzo published the draught of an 18th-century lateen-rigged merchantman, probably a *tartana*, on which the main hatch is before the vertical mast, which in turn appears to be stepped in the middle of the keel. A small scuttle is drawn immediately abaft the bitts.[125]

It is probable that the main hatch on the Kitten ship was located aft of the mast. This position is suggested by the comparative material and by available room on deck. Evidently the mast heavily raked forward. The lower end of the lateen yard (for the rig reconstruction see Chapter V) and its associated rigging would have been in the way of cargo loading and discharging operations. Undoubtedly, there were also riding bitts in this area and possibly the heel of the bowsprit to add to the clutter. Aft of the mast the deck was open of clutter as far as the hypothesized stepped-up stern. Therefore, it seems probable that the hatch was aft of the mast. Even less certain is are the dimensions of the hatch. The available length between the mast and the bulkhead of the stern cabin is about 4.5 meters. The hatch probably had a length of between 3 and 4 meters. The outer carlings on the recovered beam are separated by 5 meters. This distance suggests that the likely maximum width of the hatch. However this seems to be excessive and normally deck openings tend to be larger fore and aft, than athwartships. Penzo's published

[124] Delacroix 1997, 9-13.
[125] Penzo 2000, 21, fig. 6.

draught illustrates a hatch of about one-third the maximum beam of the vessel.[126] Paris' Greek *sakoleva* (Plate 103) of 13 m length on deck and 3.5 m breadth on deck has a main hatch of about 2 meters long by 2 meters wide. The 14-meter long *perama* from Istanbul published by Paris (Plate 109) has a main hatch of more than 3 meters length and less than 2 meters width. The maximum breadth of the vessel is listed as 3.8 meters. When we take into consideration that the most likely cargoes for the Kitten wreck were bulk commodities, it is probable that a large hatch would have been needed. Taking the proportions from the vessels illustrated by Paris, a main hatch of about 3 to 4 meters length by about 3.5 meters width for the Kitten wreck seems a reasonable estimate.

In 2003 we found the remains of the cabin bulkhead in the stern of the vessel. The length of the cabin sole was surprisingly short – less than 2 meters, but artifacts found between the frames further aft suggest that the cabin was open into the stern. The extant part of the bulkhead consisted of two planks, placed transversally, with about 0.75-meter opening cut in them on the starboard side of the vessel. No trace was found of bulkhead framing or hinges for a possible cabin door. No fastenings of the planks to the hull were observed. Presumably a support frame for the bulkhead existed once, but has not survived. It is possible that the cabin had no solid door and the entrance was covered by canvas or some similar material, if at all covered. No trace was found of any other bulkheads anywhere on the wreck, which implies that the stern cabin opened directly into the hold. The tight space between the position of the hypothetical main hatch and

[126] Penzo 2000, 21, fig. 6.

the bulkhead precludes the presence of a deck scuttle for entry into the cabin. Therefore the main hatch must have offered the main entrance into the insides of the vessel whether for cargo or the crew. The small semi-round chock attached to the keelson immediately forward of the bulkhead may have served to support a cask with drinking water in convenient proximity to the cabin.

In summary, the lines of the Kitten vessel were drawn based on the 11 recorded sections and the reconstructed profile of the vessel. As the survival of the framing timbers amidships extends to waterline 6, the lines up to that waterline can be considered accurate representations of the original shape of the vessel. The sides of the ship above waterline 6 are somewhat conjectural, but based on the logical continuation of the extant frames, typical proportions and iconography.

HYDROSTATICAL ANALYSIS

It is rare that the hydrostatics of a wreck can be calculated with relative accuracy, but the extensive preservation of the Kitten hull allowed the calculation of the displacement of the vessel, the shape coefficients and even an estimate of the wetted surface and weight of the hull. The calculations were based on the assumption that the normal load waterline of the vessel was between waterline 5 and waterline 6. The estimate was reached by determining that the end of the rudder pintle probably reached about waterline 6. Typically the lower pintle of double-ended vessels protruded above the water.

Displacement and all other calculations were carried out for both possible load waterlines 5 and 6.

For most calculations, the trapezoidal rule was used.[127] The rule requires equal spacing between the stations; the lines, however, were drawn based on the recorded sections. For this reason three temporary sections were added to obtain the necessary equal spacing. The common interval used is 2.6 meters.

The volumetric displacement for load waterline (Lwl) 5 was calculated to be:

Volume Displacement (VD5) = 114. 426 cubic meters.

Since salt water has an average weight of 1025 kilograms per cubic meter, the weight displacement would be:

Weight Displacement 5 (WD5) = VD5 x 1.025 = 117.3 metric tons

The respective values for load waterline 6 are VD6 = 158.327 cubic meters and WD6 = 162.3 metric tons.

[127] Steffy 1994, 251-2.

These displacement values are, of course, only approximations. The volumes of the keel, the stem, sternpost and the rudder were ignored as not enough information is available to calculate them. Therefore, the offered values are a little low, but the difference is probably insignificant. Thus, it can be estimated that the Kitten ship displaced at light load about 117 tons and at full load about 160 tons.

The block coefficient is the ratio of the actual underwater volume of the hull to that of a block with dimensions equal to the waterline length, maximum beam and depth of hull. For small craft the ratio varies between 0.25 and 0.50, with sailing yachts usually having a block coefficient of 0.35 to 0.45. The higher a block coefficient is, the higher the resistance of the hull and consequently the slower the vessel is. As with the displacement, the block coefficient of the Kitten ship was calculated for both waterlines 5 and 6, but it was found that the two barely differed.

$Cb = VD / Lwl \times Bwl \times D$

$Cb(5) = 114.43 / 21.4 \times 5.86 \times 2.32 = 0.39$

$Cb(6) = 158.33 / 21.9 \times 6.34 \times 2.82 = 0.40$

The Kitten ship has a relatively low block coefficient, which means that the hull had low resistance. In practical terms a low resistance hull requires less “power” to be driven through the water up to hull speed and thus a modest rig would have been sufficient for its operation.

The prismatic coefficient compares the vessel's underwater volume to a prism with length equal to the length of the waterline and cross section equal to the largest hull cross section. The coefficient describes the distribution of hull volume; whether the ends are fine or full. Higher values indicate fuller ends. In modern yacht design values of 0.50 to 0.56 are considered acceptable. The prismatic coefficient is calculated following the formula:

Cp = VD/Am x Lwl,

where Am is the section with maximum area and Lwl is the load waterline. In the case of the Kitten ship, the section of maximum area is the midship frame. Therefore:

Cp(5) = 114.43 / 9.6 x 21.4 = 0.56

Cp(6) = 158.33 / 12.78 x 21.9 = 0.57

In both cases, the value falls in the higher end of acceptable range of values, indicating that the ends of the vessel were full, at least in comparison to a modern yacht. Higher values are advantageous in vessels intended to sail in stronger wind conditions, though, in the case of the Kitten ship, this is probably due more to maximizing carrying capacity than anticipated weather conditions.

The coefficient of the waterline plane is a ratio between the area of the load waterline and a rectangle of the same length and width equal to the waterline beam. It illustrates

the fullness of the hull and as the waterline plane contributes to hull stability, the coefficient gives some indication of it, as well. In modern small craft the values range between 0.65 and 0.80 or even higher. The lower end of the range represents fine-ended sailboats.

Cwp = Aw / Lwl x Bwl,

Where Aw is the Waterline plane Area, Lwl is the length of waterline and Bwl is the beam at the waterline.

Cwp(5) = 77.688 / 21.4 x 5.86 = 0.62

Cwp(6) = 85.956 / 21.9 x 6.34 = 0.61

A waterline plane coefficient of 0.61-0.62 is on the low end of the usual design range and may be explained by the double-ended shape of the hull, for which fine ends are characteristic. The somewhat low value of the coefficient possibly indicates that under sail the ship may have been tender and prone to heeling. Likely, the ship was lateen or settee-rigged and this tendency would have been compensated by the rig's ability to spill wind, rather than endanger the vessel (see Chapter V for further discussion of the rig).

For the sake of fullness of the hydrostatics calculations, the midship section coefficient is also offered, which compares the actual area of the midship section to a rectangle with

sides equal to the waterline beam amidships and the depth. The coefficient indicates the fullness of the section and varies between 0.40 and 0.80 or higher.

Cm = Am / Bwl x D

Cm(5) = 9.6 / 5.86 x 2.32 = 0.71

Cm(6) = 12.785 / 6.34 x 2.82 = 0.71

The coefficient for the Kitten ship demonstrates that the vessel had full sections, which is consistent with its cargo-carrying purpose.

To this point, all calculations were based on reasonably certain data because they involved mostly archaeologically-derived data. The calculation of the wetted surface is also a close approximation as sufficient hull remains make the reconstruction of the underwater hull highly probable. Again the calculations were performed for the two most likely load waterlines used in the previous calculations. If the vessel floated at or near waterline 5, the wetted surface would have been about 111.85 square meters. For waterline 6, wetted surface would have risen to 128.9 square meters. Both values are only general approximations as neither the area of the rudder, nor that of the keel is included. At the low speeds at which the Kitten ship was sailed, most of the hull's resistance would have been frictional which is directly related to its wetted surface. Perhaps the ratio between the sail and the wetted surface areas is more informative for

the speed potential of the vessel, but this calculation unfortunately cannot be made as the rig's reconstruction is based more on comparative than actual data.

Finally, a potentially informative calculation is an estimate of the hull weight of the Kitten ship. This reckoning is even more fraught with guesswork, as some significant assumptions have to be made. First, the extremities of the hull are not preserved but rather were reconstructed, and this creates a level of uncertainty. Second, the available data do not cover the deck and superstructure, and therefore no reliable estimate is possible of their weight. Third, the calculation excludes the weight of the rig for the same reasons: nothing has survived to give us an indication of its weight. Fourth, the weight estimate does not include the ship's equipment, the crew and their personal possession or their provisions. Taking into account the likely shortness of the voyages between ports, the last two items were probably negligible in weight. Despite the uncertainties of the accuracy of the final estimate, even a vague approximation of the weight is of use as it would offer us a fair guess of the probable payload tonnage.

One more assumption has been made in the calculation: that the solid timbering of the hull extended throughout the whole length of the vessel. In reality, it covers only the middle part of the hull. This oversimplification may go some way towards compensating for the ignored deck and the extreme height of the stern and bow of the ship, which are not otherwise accounted for in the formula. The formula itself is simple and involves

calculation of the hull area multiplied by the thickness of the "shell" – in this case thickness of planks plus frames – and by the weight density of the material (oak).

The average frame thickness is taken as 12 cm. To this value is added the 3 cm thickness of the planking for a total shell thickness of 15 cm. More problematic is the weight of the oak, since, depending on the actual species, it varies from 590 to 1009 kg a cubic meter. Usual industry standard values are 753 kg for seasoned oak and 1009 kg for unseasoned timber.

Weight = Hull area x thickness x weight density

Weight = 186.16 x 0.15 x .753 = 21 tons

Weight = 186.16 x 0.15 x 1.009 = about 28 tons

It seems probable that with the deck and the rig, the ship weighed between 25 and 35 tons, thus leaving 120-130 tons for the payload. The displacement and weight estimates for the Kitten ship demonstrate the fallacy of some historians' claims that vessels on the Bulgarian coast of the Black Sea during the Ottoman period did not exceed 30 tons in displacement (see Chapter II).

MEASUREMENT SYSTEM

Attempts to establish the linear measurement system that the shipwright used in building the Kitten Ship have been partially successful. Depending on the degree of rounding up or down of the results, the recorded measures can be made to suit either of two known values of the Ottoman architectural arsin (cubit) and for overall dimensions even the Venetian feet and paces produce a convincing fit.

The first experiments with measurement units used the Venetian system, as the overall proportions and even dimension of the vessel fit reasonably well with data in Venetian shipbuilding treatises. In the calculations, the values for Venetian units offered by Bellabarba in his article on the square-rigged ship described in the treatise *Fabrica di Gallere* were followed: Venetian pace of five Venetian feet equal to 1. 74 meters and Venetian foot equal to 34.8 cm.[128] Converting the metric values for the Kitten ship to Venetian units, one obtains a keel length of 48.45 Venetian feet (16.86 m / 0.348 m = 48.45) or 9.69 Venetian paces, a beam of 20.5 Venetian feet (stevedore beam measurement of 7.14 m / 0.348 m = 20.51 feet) and a depth in hold of 10 Venetian feet (3.56 m / 0.348 m = 10.23 Venetian Feet). Even the reconstructed overall length of the vessel, of 23 meters, when converted into Venetian feet, comes very close to a round figure of 66.09 Venetian feet.

[128] Bellabarba 1988.

The comparison, if it is to have significance, must correspond to the timber scantlings as well. The Venetian foot was subdivided into 16 *deda* of 2.1733 cm each. Thus, taking as an example FR478, the aft-most (partially) preserved frame, one obtains 5.784 *deda* for the sided dimension (12 cm). Metric measurement works out to a nearly even or natural subdivision of Venetian measures. FR479, with a sided dimension of 11 cm, is an even better match: 5.07 *deda*. Therefore, the Venetian mensuration system, although not a perfect match, is fairly close and may have been used.

Comparison of the Kitten shipwreck scantlings with Ottoman measurements are more difficult to make. Throughout its history the standard length of the cubit or arşin changed. Even in the same period, there does not appear to have been a standard pattern for the arşin. Baron Tott, appointed chief architect by Sultan Mustafa III (1757-1774), observed that each Ottoman master mason who served under him had his own arşin that differed from the one used by another master.[129] Presumably the same was true for shipwrights, too. Selim III was the first Sultan to establish a publicly accessible standard length for the arşin in 1794-1795. As this period coincided with the Kirdjali disorders in the Balkan lands of the Empire (see Chapter II), it is not clear how soon the new standard became dominant along the Bulgarian Black Sea coast, where the Kitten ship was most likely built. Thus, as the actual date of launching is not known, it is logical to try to compare the scantlings to both arşins known to have been in use in the later 18th century, those of Mustafa III and Selim III. The length of the arşin that Sultan Mustafa

[129] Özdural 1998, 104.

III gave to Baron Tott equaled 76.4 cm and was divided into 24 digits, *parmak*s, of 3.18 cm.[130] The arşin of Selim III was in use until Turkey switched to the metric system in the 1930s and so its length is certain: 75.8 cm. The standard which was kept at the Engineering School was divided into two scales: one of 24 digits per arşin and the other 20 digits per arşin. Attempts with the division of 20 proved that this was not used by the shipwright who built the Kitten ship. Arşins of 24 *parmaks* (each equal to 3.16 cm), however, give believable results. "Believable" results are natural, even divisions such as wholes, halves and quarters. In all the calculations, preference was given to dimensions of completely preserved parts of the hull rather than dimensions of reconstructed parts. Thus, more weight is attached to the length on keel than to the overall length of the hull. Similar calculations were done for the scantlings of the frame timbers, the stringers, the sister-keelsons, the heavy timber on the exterior of the hull and the planking.

The problems with consistency of arşin length that Baron Tott encountered were mentioned above. There is no reason to suspect that things had dramatically changed by the end of the century. To the uncertainty of the "standardization" of the arşin can be added the uncertainty over which of the two arşins was used – that from the period of Sultan Mustafa III (and recorded by Tott) or the standard established by Selim III. The problem is complicated by the fact that the difference in length between the two was less than a centimeter (76.4 cm vs. 75.8 cm). The difference between the *parmaks* consequently was even less. Thus, there is rarely a clear-cut difference between the two

[130] Özdural 1998, 105-6.

Ottoman units when scantlings are converted from metric units. Considering the isolation of the region, and the Kirdjali disorders of the last years of the 18th century and early years of the 19th century, it is not likely that the new standard was enforced in the provinces quickly enough to have been utilized in the building of the Kitten ship. The table demonstrates that Mustafa III's arsin fits the vessel's length on keel, but not as closely when it comes to the beam. Selim III's standard provides a reasonable, but less logical value for the keel length (why make it 22 and one-quarter arşin's, when a rounded 22 is an easier and more natural unit?). However, for the beam it offers a better fit than Mustafa III's standard (9.76 arşins vs. 9.68 arşins). For the scantlings of the ship's timbers, both arşins come reasonably close.

Table 2. Measurements in Ottoman units.

	in meters	in *arşin*s	
	Kitten Ship	**Mustafa III**	**Selim III**
Keel	16.86	22.07	22.24
Beam	7.3	9.55	9.63
Depth	3.56	4.66	4.69
Floor	2.46	3.22	3.24
	in centimeters	in *parmak*s	
Keelson sided	46	14.46	14.55
Keelson moulded	19	5.97	6.01
Sister Keelson moulded	34	10.69	10.75

Based on the recorded dimensions and scantlings, it is fairly certain that the master shipwright employed an Ottoman builder's arşin, but it is less certain which of the two used in the closing years of the 18th century was employed for the construction of the Kitten shipwreck (Table 2).

DESIGNING THE KITTEN SHIP

A few features of the Kitten wreck immediately suggested that the shape of the hull was developed through some kind of whole-moulding technique. By the third season of excavation it became clear that the overlaps of the floor timbers and the futtocks were regular and formed a fair curve. The difference in the morphology of the overlap supplied a second clue: the forward end of the ship had simple, straight overlaps between the futtocks and the floor timbers, which were simply nailed to each other. Further aft, however, the timbers were connected by a hook scarf and were fastened with a spike and treenail. In the aft quarter of the vessel the pattern reversed to simple overlaps and nailing. Eric Rieth suggested that the hook scarph is characteristic of the Mediterranean shipbuilding tradition, a position accepted by Hocker and McManamon.[131] The earliest evidence so far reported for this type of scarf comes from the 14th-century Culip VI wreck from Catalonia, and Rieth proved that it was a diagnostic feature for the use of whole-moulding to shape the vessel. Naturally, discovering the same characteristic in the framing of the Kitten wreck, immediately suggested that this vessel, too, was built with predetermined frames' shapes. Additional support for such a hypothesis is offered by the data from the recording of the futtocks, which demonstrated that all surviving futtocks were identical in shape. Evidently the same mould or pattern, with appropriate modifications, was used for all frames of the hull.

[131] Rieth 1998, 206; Hocker and McManamon 2006, 7.

Whole-moulding is a method of shipbuilding based on incremental modifications of the midship frame. In the Venetian shipbuilding treatises that have survived, the guides for these modifications are known as *partisoni.*[132] The physical process of shaping the hull through moulds and partisoni was very clearly explained and illustrated by Joseph Furtenbach in his *Architectura Navalis*, of 1629.[133] Although it is among the clearer and easier to follow of the early texts, *Architectura Navalis* is rarely studied or mentioned by scholars nowadays, yet its relevance and usefulness cannot be doubted.

The starting point for all variations of whole-moulding is the shape of the midship or "master" frame, which was transferred to patterns or moulds used to shape the rest of the frames. In the classical Venetian system, four aids to controlling shape, *partisoni*, were used: the narrowing of the floor, the rising of the floor, the narrowing of the breadth and the rising of the breadth (also called hauling down of the futtock).[134] The method spread throughout the Mediterranean in different forms.[135] The variations usually consist in the number of predetermined frames, the number of partisoni used, and the exact technique (geometrical mechanical aids or arithmetic) of producing the increments of the partisoni. The partisoni determined the positions of the points (sirmarks) at which the different pieces of the mould overlapped, thus forming narrower and sharper mutations of the

[132] Hocker 2006, 1.
[133] Furtenbach 1629.
[134] Hocker and McManamon 2006, 6.
[135] Marzari, 187.

midship frame. As Mario Marzari explained, the partisoni were a function of the number of frames that had to be designed prior to erection on the keel.[136]

Kostas Damianidis interpreted whole-moulding differently, preferring to classify the varieties of moulding on the basis of the number of pieces that constituted the moulds. He divides the Greek variants into five-aid and three-aid systems.[137] To me this shifts the emphasis from the conceptualization of the hull shape to the purely mechanical manufacturing process. The actual number of pieces constituting the mould is irrelevant for the control of the shape of the hull, as that is based on the partisoni.

In whole-moulding's most basic form, a vessel could be built with a single pre-designed frame – the midship bend or master frame – and ribbands bent around it and terminating at the stem and sternpost. The rest of the framing timbers could than be spiled to the ribbands. Although a fair shape can be achieved this way, the available volume of the vessel would be limited. The addition of "tail" frames alleviated this problem by pushing the useful volume of the hull into the ends of the ship. Their position could be varied; their shape, however, was a derivative of the master frame. It is usually accepted that the method predicted the shapes of the frames between the tail frames and the midship frame, but the ends of the vessel still had to be framed by spiling the timbers to ribbands.[138] If this was indeed done so in practice, the reason was not due to any

[136] Marzari, 187.
[137] Damianidis 1998, 222.
[138] Hocker and McManamon 2006, 2.

technical limitations imposed by the whole-moulding process. Joseph Furtenbach describes whole-moulding all the way into the extremities of the hull, not only the central part of the hull, and from the text it is clear that he considered this the usual procedure for building galleys.[139] Experiments that I have carried out with whole moulding the vessel from Edmund Bushnell's treatise *The Complete Shipwright* and following the English shipwright Sir Anthony Deane's famous *Doctrine of Naval Architecture,* confirm that the methods permit moulding the extremities of a hull, as long as all frames are square and no cant frames are used.[140]

It would appear that, in practice, vessels built along the Atlantic border of Europe contained fewer scarfed and predetermined frames than Mediterranean vessels.[141] For example, on the Red Bay *nao*, believed to be the Basque whaler *San Juan* and dated to the mid-16th century, only 14 frames were moulded.[142] In contrast, almost all frames of the 14th-century Culip VI wreck were moulded, as evidenced by the carpenter's marks and all of them had hook scarfs.[143] Only three frames 139-141, placed on top of the stem, do not bear carpenter's marks and therefore were likely spiled to ribbands. These three frames are also the only ones that did not have hook scarfs. This implies that predetermined frames were always scarfed in this shipbuilding tradition, probably because the scarfs aided the aligning of the timbers within the bend. Loewen quotes Joao Baptista Lavanha's treatise from Portugal and the Spaniard M. de Aroztegui's

[139] Furtenbach 1629, 38.
[140] Lavery 1981; Bushnell 1669.
[141] Loewen 1998, 216, Tables 1 and 2.
[142] Loewen 2007, 65.
[143] Rieth 2003, 9.

shipbuilding Ordinances of 1618 as identifying mortised frames with moulded frames.[144] Thus, on the 16th-century Ottoman wreck from Yassiada it is likely that all frames were moulded too, as all surviving timbers bear hook scarfs. The same seems to be the case with the 17th-century wreck from Sardineaux, although the incomplete preservation and the not-particularly-clear illustrations do leave some room for uncertainty. In the Kitten ship, the chronologically latest example in the group, half of the frames bear hook scarfs and thus can be considered predesigned. Sergio Bellabarba explains that in the Venetian treatises only the central part of the hull between the tail-frames was geometrically defined with the help of the partisoni.[145] Although Kostas Damianidis illustrates between one-third and one-half of the frames in the central part of traditional Greek vessels as predetermined through moulding techniques, all his sources date to the first half of the 20th century and have limited relevance to the earlier period discussed here.[146] Nevertheless, the bulk of the comparative material and archaeological evidence from the wreck itself strongly argue that on the Kitten ship only the central half of the hull was predetermined, too.

Loewen noted that tail frames are known only from Italian and Iberian treatises and argued that at least in Atlantic vessels, they were not necessarily the last scarfed frames.[147] Acknowledging the challenge of determining just which bend of timbers can be associated with the tailframes on the Red Bay *nao*, Loewen favours the frame from

[144] Loewen 1998, 214.
[145] Bellabarba 1993, 280.
[146] Damianidis 1998, 219.
[147] Loewen 1998, 218, note 15.

which more marked rising began. For the Mediterranean, the best comparable archaeological evidence comes from the Culip VI hull. There the last moulded frame coincided with the frame placed on top of the scarf between the keel and the stem. Joseph Furtenbach does not specifically mention tailframes, but indicates points along the length of his galley where changes in the shaping of the timbers occured. Thus, it appears that the tail frames would have coincided with the last frame of the flatter part of the vessel.[148] The problem of determining the tail frames on the Kitten ship exists but is perhaps easier to resolve. From the recording of the hull sections, it is evident that in both extremities of the hull the rising beyond the last scarfed frame was more marked, as was the narrowing. Thus, the last scarfed frames were assumed to be the tail frames, especially as they also delineated the central portion of the vessel and this interpretation agrees with the Mediterranean practice.

Having determined that all futtocks are of the same shape, that it is likely the frames in the central portion of the vessel had predetermined shapes, and that some form of whole moulding was used in constructing the ship, an attempt was made to determine the method of controlling the incremental modifications to the master frame used to derive the rest of the frames. A pattern was cut to the shape of the master frame. Fitting it to the other recorded frames and particularly to those with hook scarfs, it was easy to determine both the rising and the narrowing of the floor timbers. Thus, the range of two partisoni could be established and it remained to determine the geometrical aid used to

[148] Furtenbach 1629, 36-7.

design the increments of change. The results of this part of the experiment are reasonably dependable, because they are based on surviving archaeological evidence. Unfortunately the same could not be done for the partisoni of the breadth, as the only futtocks that almost reach the height of breadth were those few immediately before and abaft the master frame.

Knowing the maximum narrowing and rising of the floor at the last scarfed frames fore and aft, an attempt was made to find the geometrical aid – for example a mezzaluna, mezzarola or incremental triangle - that would produce divisions corresponding to the recorded values. Although working solutions were found for both rising and narrowing of the floor timbers, the lack of identified carpenter's marks, or sirmarks, does not permit one to positively state that one of these methods was indeed utilized in developing the sections of the hull, but only that such a method was *probably* used.

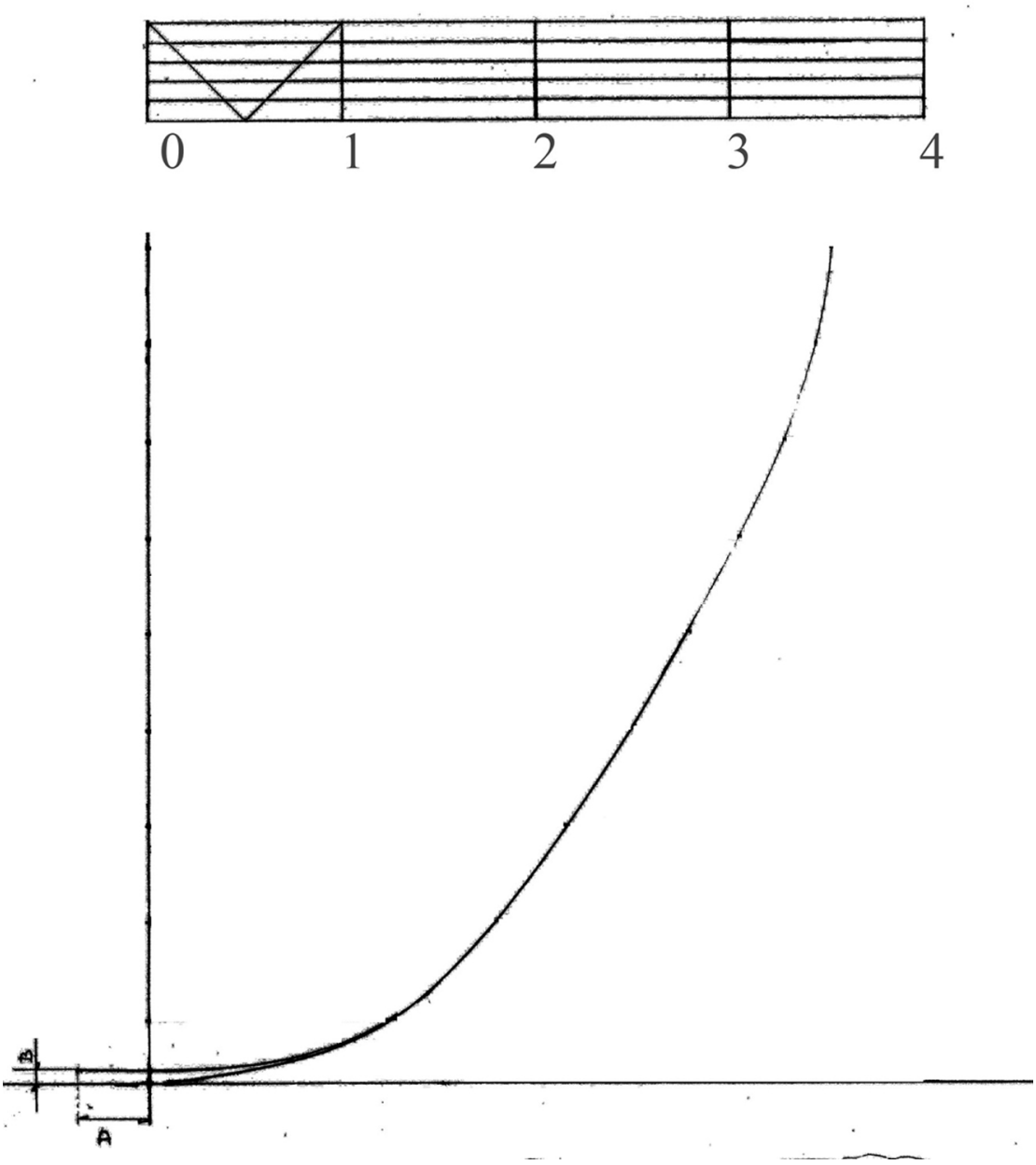


Fig. 35. Narrowing and rising of Frame M. Drawing: K. N. Batchvarov.

Determining the narrowing and the rising of the recorded frames was a fairly straight-forward process. The presumed tail frames, M forward and 13 aft (figs. 35 and 36) of midships, were redrawn on separate mylar sheets and the common pattern (which would have been the mould), cut to the shape of the midship frame, was slid into place until it faired with the recorded shape of the respective section. Along the drawn centerline the rising of the mould/pattern above the base of the master frame was measured. The narrowing was measured along the protruding part of the floor mould from the centerline. Although the narrowing was noticeable, the rising was significantly less so. Bellabarba commented that following the traditional Venetian methods, the rising should not begin with the master frames, which is exactly what we recorded on the Kitten ship. The rising is supposed to be less than the narrowing (also as observed on the Kitten ship) and be greater aft than forward.[149] The last requirement is easily explained with the necessity to achieve a clean and narrow run of the ship for good steering.

[149] Bellabarba 1993, 280.

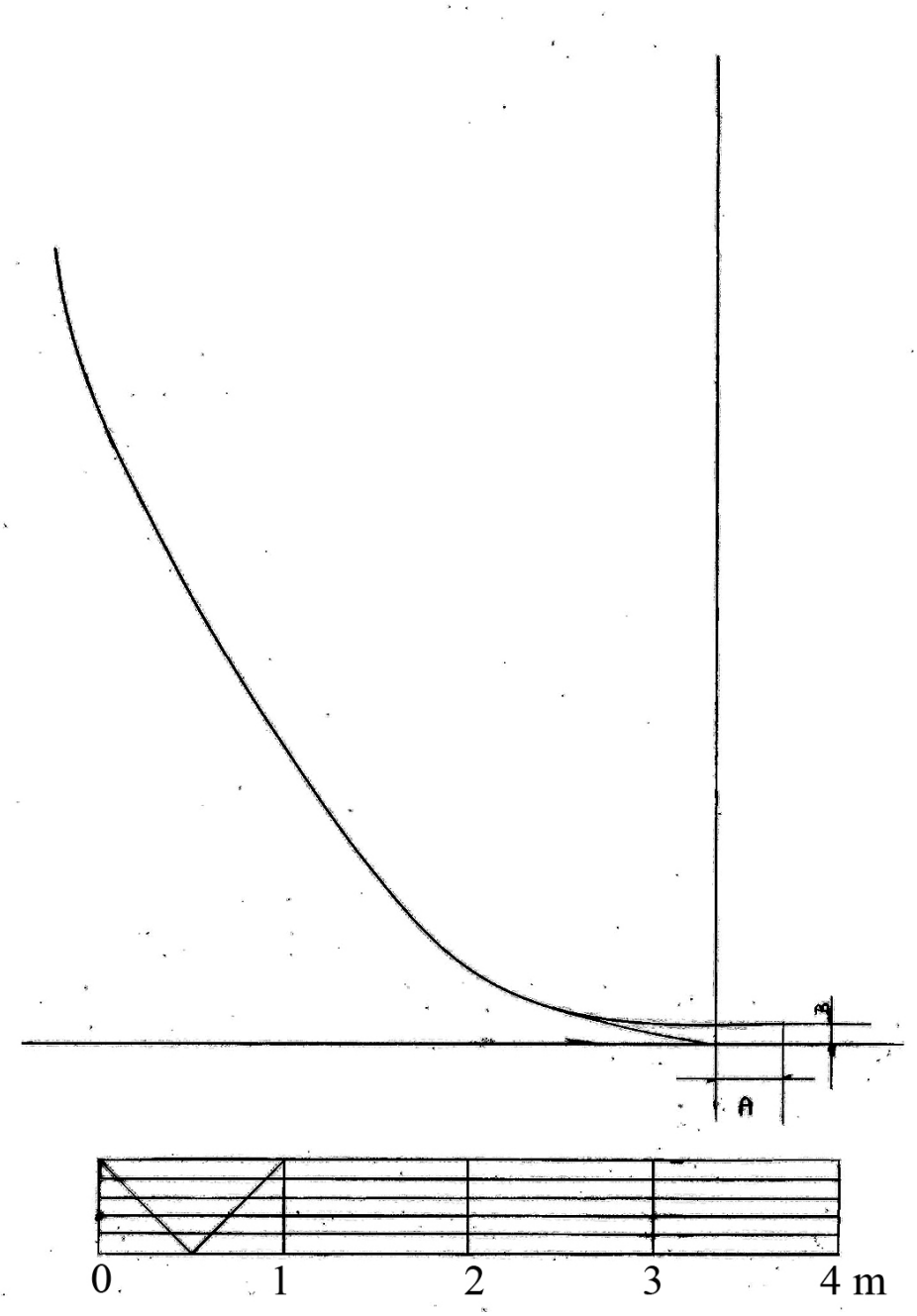


Fig. 36. Narrowing and rising of Frame 13. Drawing: K. N. Batchvarov.

Both before and abaft the master frame, we recorded one or more additional sections, without which it would have been impossible to attempt the reconstruction of the geometrical aids used to produce the partisoni.

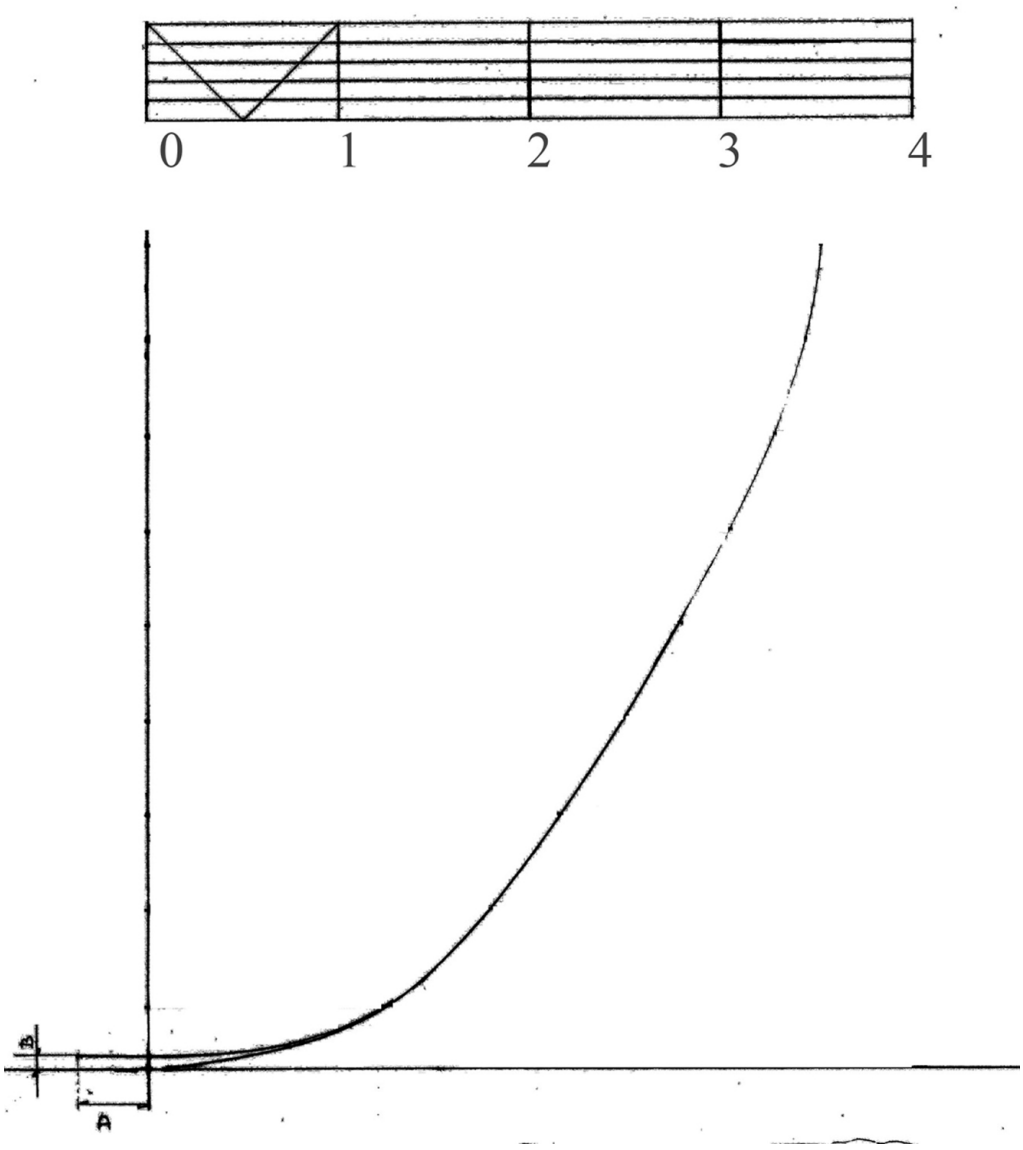


Fig. 37. Narrowing and rising at Frame E. Drawing: K. N. Batchvarov.

Forward, this was frame E (fig. 37). Aft, frames 3 and 7 were recorded, but 3 was so close in shape to the midship frame that the distinction would hardly be noticeable at the scale at which I worked and for this reason frame 7 (fig. 38) alone was used. Knowing the maximum narrowing or rising at the tailframes, I had to attempt to find a geometrical aid - mezzaluna, mezzarola or triangle - which would produce increments into which frames E and 7 would fit.

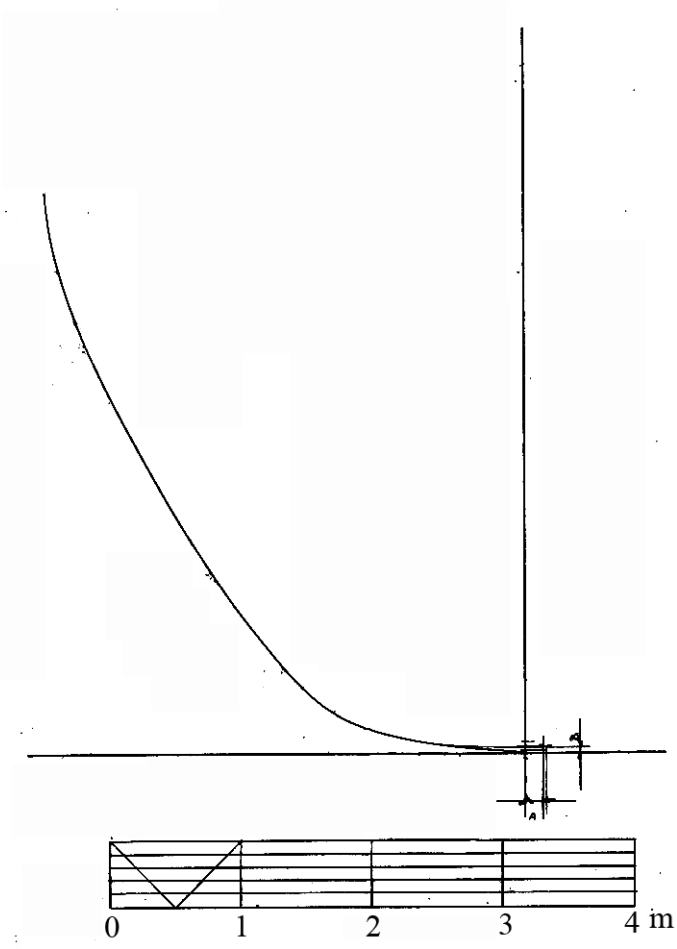


Fig. 38. Narrowing and rising at Frame 7. Drawing: K. N. Batchvarov.

As this was a trial and error process, mezzalunas and mezzarolas were constructed to cover all of the most probable scenarios. The mezzaluna is a well-known geometrical aid and instructions on its use are frequent in contemporary literature on ship design. A drawing of a mezzaluna is to be found in the mid-15th-century Zorzi da Modon, (Trombetta) manuscript.[150] Furtenbach describes it in 1629, too, and offers instructions on its construction.[151]

The mezzaluna is a half circle, with a diameter equal to the total narrowing or rising. The two quarter circles are each divided into as many equal parts as the number of frames over which the narrowing/rising has to be achieved. The divisions on the quarters are connected with lines parallel to the diameter, which divide the 90 degree radius into segments. These segments are the incremental narrowings and risings of the respective frames. The mezzarola is another similarly constructed geometrical aid, which so far does not appear to have been reported outside the Aegean.[152] A mezzarola is constructed by drawing a line equal in length to the maximum narrowing or rising. From each end an arc is struck, with the two arcs crossing above the line. Each of them is divided into as many equal parts as the number of frames over which the modifications need to be applied. Straight lines, parallel to the base, connect the respective points on each arc. These lines are the incremental modifications to be applied for the respective frames.

[150] Anderson 1925, 154.
[151] Furtenbach 1629, 33.
[152] Damianidis 1998, 222.

Damianidis suggest that the mezzarola produces slightly fuller, but otherwise similar lines to a mezzaluna.[153]

A variation on the mezzarola is the triangle. A base is drawn equal to the narrowing or rising. With a compass two small arcs are drawn with as large as possible radius, which arcs cross above the line, creating a point that marks the apex of the triangle. Each of the sides is divided into as many equal parts, as the number of frames. The respective points are connected with lines parallel to the baseline and these lines are equal to the narrowing or rising of the respective frame.[154] Furtenbach also employs the triangle, and a direct derivative – a trapezoid, for determining the rising in the bow of his galley and for the deck line both fore and aft.[155]

The experiment with the Kitten ship began with constructing mezzalunas for the narrowing and rising of the floors before and abaft the midship frame (fig. 39). This required a minimum of four mezzalunas. There are 13 scarfed frames forward of the master frame and the same number aft for a total, with the midship bend of timbers, of 27 scarfed and presumably pre-designed frames. The fore and aft narrowings differed very little from each other (less than 1 cm), and it is most probable that the shipwright originally used the same increments for both, thereby using the same gage. The mezzaluna was constructed on the basis of 13 frames. The intermediate sections fit

[153] Damianidis 1998), 230.
[154] Sarsfield 1984, 87.
[155] Furtenbach 1629, 45-9.

surprisingly well and the other increments also produced results that do not contradict the reconstructed lines. Thus, it is very probable that the incremental narrowing of the floor timbers was controlled with a mezzaluna, using all 13 frames from the master.

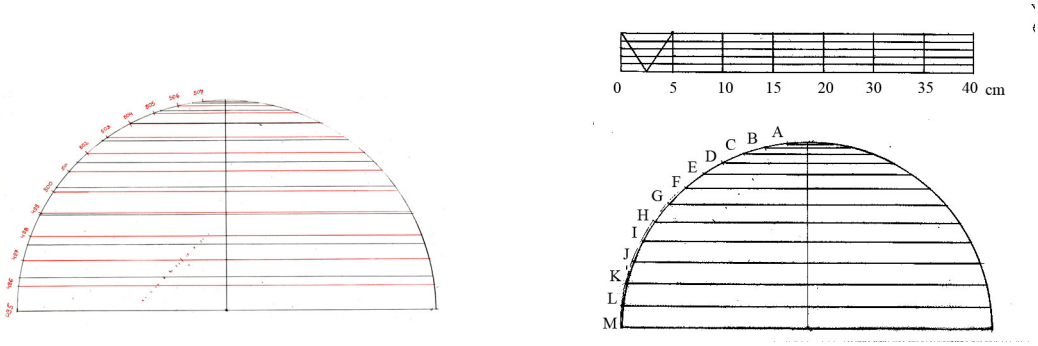


Fig. 39. On the left is an experimental mezzaluna based on different numbers of frames included in the calculation. On the right is the final mezzaluna that matches the narrowings fore and aft. Drawing: K. N. Batchvarov.

Attempts to make the rising, rather inconsequential in the middle part of the hull, fit dimensions produced by a mezzaluna were unsuccessful. Mezzalunas were constructed with 13-frame, 10-frame- and even 7-frame divisions, taking into account the probability that at least some of the frames immediately adjacent to the midship section would not have had any rising. Section 1, for example, demonstrated no rising in comparison to the master frame. None of these attempts produced increments fitting the recorded values for frames E and 7.

A set of mezzarolas was produced with the same divisions, 13, 10 and 7 frames. A mezzarola constructed for 10 frames was the only one to fit the rising of 7 (figs. 40 and 41).

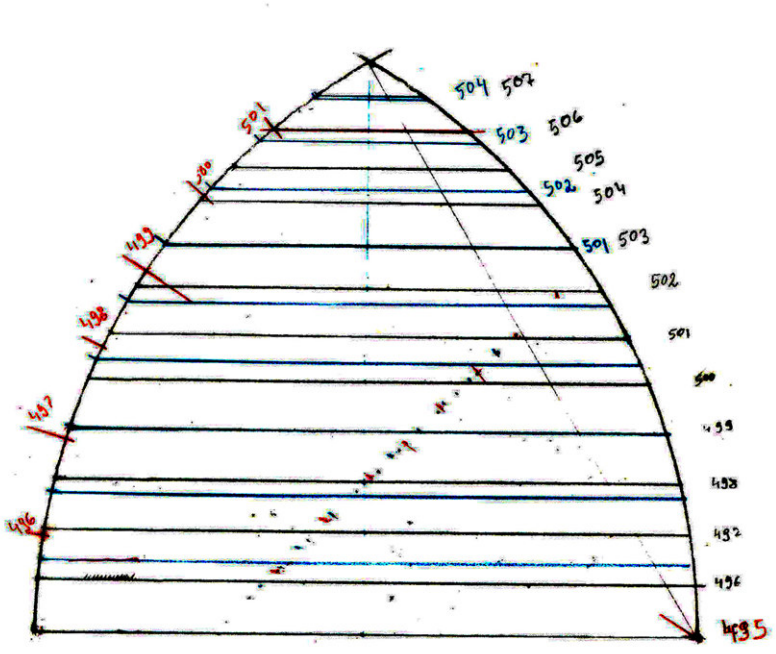


Fig. 40. Aft mezzarola. For comparison the different trial divisions were superimposed on the same drawing. Drawing: K. N. Batchvarov.

The same was discovered to be the case forward. Thus, it appears that the shipwright was well-acquainted with more than one geometrical aid for producing partisoni. Before far-reaching conclusions are reached, it should be noted that the same result for the rising could have just as easily been achieved with the use of a batten or by the hanging of a string as a guide. Until the emergence of further evidence, the most that can be said is that a mezzaluna for the narrowing, divided into 13 parts corresponding to the number of scarfed frames on either side of the master frame, and a mezzarola with 10 divisions,

leaving the 3 frames fore and aft of the master with no rising, produce results that best match the recorded evidence.

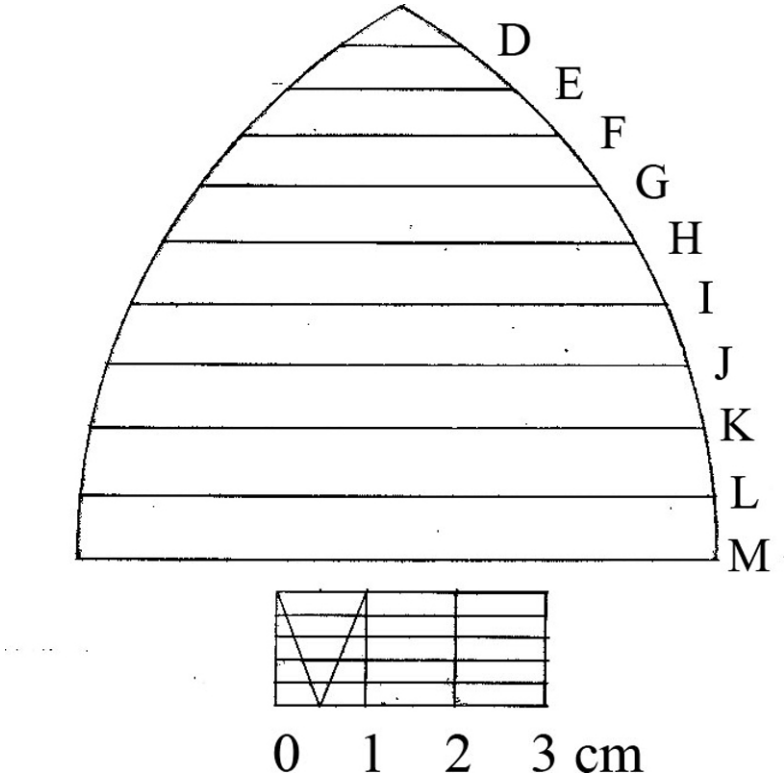


Fig. 41. This mezzarola fits the rising forward. Drawing: K. N. Batchvarov.

Although we have assumed that the whole moulding of the hull was limited to the scarfed frames only, there is no technical reason why the rest of the hull could not have been moulded too. In fact, it is possible that this was at least partially the case, as the recorded shape of the futtocks forward of tail-frame M are identical to those within the middle section of the hull. However, the much more haphazardous method of assembling the frames outside the tail-frames makes it likely that a less structured

approach to their shaping was followed. It can be suggested that ribbands or *fourmes* as they are called by a fifth-generation Bulgarian wooden boatbuilder, Dimiter Hrusov from Sozopol,[156] may have guided the narrowing and rising of the frames, but their actual shape was cut according to the same mould that was used for the central part of the hull.

FURTHER RESEARCH

A number of interesting questions arise from the research into the moulding methods used on the Kitten ship and their relationship to the methods of the greater Mediterranean world, questions which require further investigation before they can be answered. The first question to ask is when the whole-moulding method was born. In his doctoral dissertation, Mathew Harpster argued that the 9th-century AD vessel from Bozburun, Turkey, excavated by Fred Hocker, was built to a conceptual famework based on standard measurements and proportions.[157] McManamon and Hocker persuasively argue that the conceptual framework noticeable on the Bozburun vessel was an early form of whole-moulding.[158] If further wreck excavations confirm this early date the logical conclusion would be that whole-moulding was a product of the Eastern Roman Empire. The next question to investigate would be the direction and timing of its distribution. The earliest evidence for whole-moulding's existence west of the Balkan

[156] Personal communication with Dimiter Hrusov from Sozopol, September 2002 and August, 2006. Although he still uses *fourmes* and inherited patterns, he lofts his boats and is not acquainted with whole-moulding and the geometrical methods of producing the divisions of the *partisoni*.
[157] Harpster 2005, 471-85.
[158] Hocker and McManamon 2006, 1.

Peninsula so far reported is that employed on the early 14th-century Culip VI wreck, and possibly the early 14th-century Contarina I wreck from Italy, but the earliest written documents describing the method come from Venice, about a century later. Can it be a coincidence that so far no evidence in the West has been reported prior to the 13th century?

If this date can be demonstrated to stand and if further evidence is gathered that the birth place of whole moulding was Byzantium then the logical conclusion would be that the spread of the method to the West coincided with the capture of Constantinople by the knights of the Fourth Crusade in 1204. This would be the most probable historical moment when this shipbuilding secret could have been conveyed to the West and fits chronologically with the appearance of the earliest archaeological and literary evidence for the method outside the Byzantine Empire. Venice bears a large portion of the responsibility for Crusaders ending up in Constantinople instead of the Holy Land, and the Venetian Dodge, Enrico Dandolo (1107-1205), was a major presence at the fall of the great city and its aftermath. He even participated in the disastrous campaign against Bulgaria that ended in a debilitating defeat at the hands of Tzar Kaloyan at the Battle of Adrianople in 1205. Is it than a mere coincidence that the earliest surviving written evidence for whole moulding comes from Venice?

Although that evidence dates to the 15th century, scholars have established that the surviving versions were copied from originals that no longer exist or have not yet been

found. Byzantine shipwrights remained highly valued in Venice until the Ottoman Turks conquered most of the Aegean and Levantine Islands and cut off the supply. Plentiful evidence suggests that as late as the early 15th century the products of such master shipwrights as Byzantine Teodoro Baxon were considered to be superior.[159] A possible explanation may be that the original method continued to develop and change in the intervening 200 years in the Byzantine territories. Supporting evidence for such a supposition may be the possible use of a mezzarola, as illustrated by the rising of the floor timbers of the Kitten vessel, as this geometrical aid does not appear to have been reported from anywhere outside the Byzantine world. Shortly after the easy access to expertise from the Eastern Roman Empire was interrupted, the first written treatises began to appear. Was this an attempt to preserve knowledge that traditionally was passed on orally through apprenticeships, but the source of this knowledge was no longer available, thus the need to preserve it on paper?

These are questions that at present cannot be answered. Only further excavation and detailed recording of shipwrecks from the Eastern Mediterranean and Black Sea from the relevant period can answer them in conjunction with archival research. It is likely that only archaeology will be able to answer questions about the speed and direction of the dissemination of this shipbuilding knowledge.

[159] Lane 1934.

At present, the origin and distribution of whole moulding in the Mediterranean and Black Seas are perhaps no more than a hypothesis, a direction for further research. What is clear, however, is that since the 14th century a common tradition of whole moulding existed in south and south-east of Europe, which survived in more isolated parts of the continent until the beginning of the 19th century, as demonstrated by the Kitten ship. There are some details that still need further study to determine the relationship between wrecks showing whole-moulding techniques and the surviving treatises. Further experimentation through constructing research models is needed to determine the practicality of the different geometrical methods of producing the incremental changes to the master frame.

The relationship between Mediterranean and Atlantic whole-moulding traditions remains less clear. A comparative study of treatises and wrecks assigned to the two traditions may help determine the viability of a theory of Atlantic vs. Mediterranean shipbuilding traditions as posited by Thomas Oertling.[160] This may be one case in which the popular theoretical archaeological approach of looking at the bigger picture, ignoring the details, may be playing us a bad trick, as with each level of remove, the picture resolution decreases and conclusions based on this picture are bound to be misleading. To illustrate this point it is enough to look at Oertling's list of characteristics that, he argues, define the Atlantic vessel. He states that not every characteristic needs to be present in order to recognize a vessel as built in the Atlantic tradition. Following this argument, the Kitten

[160] Oertling 2004.

ship could be identified as an Atlantic vessel, as it possesses almost all listed characteristics. The possibility of reaching such an erroneous conclusion implies that the determining factors are to be found in the details. Rieth has proposed that the morphology of the scarfs is one of the differences between Atlantic and Mediterranean vessels. I propose that Oertling is right in putting a heavy emphasis on the characteristic Atlantic maststep in determining to what tradition a wreck belongs. This, however, may prove to be less a question of Atlantic vs. Mediterranean tradition than a question of square vs. lateen rig. This still would imply a vessel built for the Atlantic, but only because the square rig was better adapted to operation on long-haul voyages in stormy seas, and not a matter of conceptual difference in design.

CONCLUSION

The extensive preservation of the Kitten shipwreck allowed a highly plausible reconstruction of the vessel. The central portion of the hull is preserved within a few decimeters of the clamp and so the lines in this part of the vessel are trustworthy. The discovery of the sternpost under the quarter of the ship enabled us to determine the shape of the stern section and the run of the ship. The proposed shape of the bow merits the least confidence, as it is based on very limited archaeological evidence. As drawn, the stem is conjectural, yet it does not contradict any available evidence. Features of the upper hull, the sweep of the deck, its companionways and hatches, raised sections at the

ends, and the heights of the bulwarks are based on literary and pictorial evidence, rather than archaeological evidence.

The reconstructed lines of the ship allow more extensive hydrostatical calculations than is usually the case with shipwrecks. The vessel had a displacement of between 120 and 160 tons, depending on the loading. As this is the smallest vessel of the four that we have observed in the Bay of Kitten, one can surmise that its size was not unusual along the western Black Sea shore. In turn, this conclusion brings into doubt the assumption of some Bulgarian historians that ships in the region never exceeded 30 tons. The reports of contemporary Western travelers visiting the Ottoman Empire, that Black Sea ships were small, do not contradict this conclusion. To their eyes a 160-ton vessel would indeed be small when compared to West Indiamen and colliers, let alone the huge East Indiamen. The calculated hull coefficients imply that the Kitten ship would have been well-adapted for its routes, capable of decent turn of speed, weatherly for its draught and flat floor with shallow keel. The ship may have been tender-sided, but as it probably carried a lateen-rig capable of spilling wind rather than being overpowered, this would not have put it at excessive risk. The high bow and stern would have been detrimental for progress to windward. On the other hand, they would have offered an added margin of safety in the short, steep waves encountered in the Black Sea.

Of great interest was the mensuration system utilized in the construction of the ship. Evidently, the Ottoman arşin of the latter 18^{th} century was used. The arşin, however,

changed its values across the centuries, and it is not certain that there ever was a generally recognized standard length for it, as Baron Tott observed in the 1770s. It is hard to determine whether the arşin in use was that used during the reign of Sultan Mustafa III or that fixed during the reign of Sultan Selim III in 1794-95, as the difference between the two was only 6 mm. Both provide a good fit with the measurements of the Kitten ship.

Experiments with determining the method of controlling the shape of the vessel suggested that the Kitten shipwreck is indeed a late example of an old tradition of whole moulding; some of its elements may have been in place in the region as early as the building of the Bozburun ship in about 874 AD (possibly on the Black Sea shores), which may very well have been built not far from the launching place of the Kitten ship itself.[161]

The reconstructed method of design or control of the shape of the Kitten vessel fits well with the tradition recorded in documents of the Italian Renaissance. It is evident that the master shipwright was conversant with whole moulding techniques, similar to those described in the extant treatises and observed on the Culip VI wreck. It appears likely that he was aware of the slightly different characteristics of the curve produced by the mezzaluna and the mezzarola and may have utilized them accordingly to produce the rising and narrowing of the frames.

[161] Hocker and McManamon 2006, 1.

The use of different geometrical aids demonstrates the flexibility of whole moulding. The broad similarities observed between such wrecks as the 14th-century Culip VI, the 16th-century Yassiada, the 17th-century Sardineaux and the late 18th– early 19th-century Kitten are evidence that a common Mediterranean tradition of whole moulding and ship construction probably existed. One of the easily observable and diagnostic characteristics of this tradition was the hook scarfs between floor timbers and futtocks. It would appear that the fall of Constantinople to the Ottoman Turks in 1453 and the subsequent transformation of the Black Sea into an internal lake for the Empire came about at a time when this shipbuilding tradition had already established itself along the western shore and thereafter helped preserve the tradition from transformation. The Kitten vessel so far is the latest reported example of this shipbuilding tradition. The explanation likely lies in the relative isolation of the region assisting the preservation of older methods into the 19th century.

CHAPTER V

HYPOTHETICAL RECONSTRUCTION OF THE RIG

LITERATURE OVERVIEW

Literature on seafaring in the Eastern Mediterranean in the centuries after the fall of Constantinople in 1453 is rather sparse and for the Black Sea is virtually non-existent. In Bulgaria only three publications have a direct connection with the sea and vessels, none of which can be considered a dedicated study of seafaring and shipbuilding. Nickolay Ovcharov's book on ship graffiti from the churches in Nessebre is poorly translated into English, but even the Bulgarian original is disappointing. The most important contribution of the book is the catalog of graffiti published as an appendix.[162] The late Professor Velko Tonev's study of the Bulgarian Black Sea coast during the National Revival movement of the 18th and 19th centuries only marginally touches on maritime affairs and virtually not at all on ships.[163]

Shteliyan Shterionov published a study of the Southern Bulgarian coast in the 18th – 19th centuries, which has a chapter dedicated to ship building and ship types.[164] Of the Bulgarian publications, it has the most relevance for the present study. The illustrations,

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[162] Ovcharov 1992.
[163] Tonev 1995.
[164] Shterionov 1999.

which are uncredited, are most probably taken directly from the German edition of Marquardt's *Eighteenth Century Rigs and Rigging*, as the scales are still marked in German. Because of their origin, they are suspect as evidence for seafaring on the western shore of the Black Sea.[165] Details of ship construction are not provided in his monograph, nor is there anything regarding the rigging of the vessels. In fact, all the technical information appears to have been taken verbatim from Marquardt.

If so little is written about post-medieval ships in the Eastern Mediterranean and Black Seas, even less attention has been paid to the rigging of local craft. A general consensus seems to exist that little is known, but that the vessels were rigged archaically and versions of the lateen rig dominated at least until the beginning of the 19th century.[166]

ARCHAEOLOGICAL EVIDENCE FOR THE RIG OF THE KITTEN SHIP

During the initial excavation of the Kitten ship by the Bulgarian Center for Underwater Archaeology in the 1980s, archaeologists recovered 11 complete and partial rigging blocks. Practically nothing of the documentation of the CUA has survived the numerous reorganizations over the years and what little survives did not provide provenience for the finds or description and measurements. All of these blocks were permitted to dry out before conservation and are now useless as sources of information, except one of the sheaves, which is likely to have been made of *lignum vitae* – a Caribbean basin tropical

[165] Marquardt 1992.
[166] Prins 1992, 77-87.

hardwood that is an unexpected material for this region. Because of the lack of provenience and the unlikely material, it is questionable whether it actually came from our ship. All other blocks and sheaves appear to be made of oak with wooden pins (fig. 42). Although they are now deformed, cracked and in pieces, the one certain information that can be derived is that they generally fell into two size groups, smaller and larger blocks, and were all single-sheaved, with one possible exception. Based on the block assembly, Porozhanov suggested that the vessel was likely to have been lateen-rigged and associated the larger blocks with shroud tackles.[167] Although the reasoning behind the rig identification is based on very limited evidence, the conclusion appears to be correct.



Fig. 42. One of the dried out blocks, recovered in the 1980s. Photo: K. N. Batchvarov.

[167] Porozhanov 2000, 3.

To briefly review, the only mast step located on the wreck is located between a pair of sister-keelsons. Taking into account its position and the length of the vessel remains (19.7 m), and the provenience of the recovered rigging elements, it is most probable that the ship had only one mast. The mast step is cut through the keelson, spans three floors and has a length of 70 cm and width of 20 cm. The excessive length of the opening suggests there must have been a wedging system to hold the mast in position that has not survived (fig. 43). The mast step on the Kitten ship ends one room and space forward of the midship frame. At a distance of 2.54 meters forward of the front end of the step is a notch in the keelson that must have supported a stanchion.



Fig. 43. The mast step, supported by the sister-keelsons. Photo: K. N. Batchvarov.

The single nearly complete deck beam found on the wreck, proved to be informative and most useful. The extant length is 6.04 m, but it was evidently a meter longer. One face of the beam is very heavily eroded and no original detail is preserved, but the other side is in much better condition. The beam is about 30 cm molded and survives to 17 cm sided. The better-preserved face has a shallow indentation, approximately 50 cm wide and less than 2 cm deep, at the peak of the camber. The indentation of the beam is likely the result of pressure from the mast leaning against it. Notches for carlings on either side of the indentation indicate the locations of the mast partners. Considering the distance between the notch in the keelson and the forward end of the mast step, the mast must have had extreme forward rake (the precise angle would have depended upon the depth in hold). Although no direct evidence for the depth in hold has survived, the necessary minimum to achieve a fair section at this point of the hull with the known beam is 3.56 meters (see Chapter IV). Kostas Damianidis lists in his dissertation typical proportions for vessels built in Greece and its surrounding islands.[168] Proportions of the Kitten ship fit best the *trechadiri,* known in Turkish as *chektirme,* or *perama* type of hull. The Turkish term is used along the Southern Bulgarian coast to the present day. For the present study the more conservative proportion is taken. Based on this depth, the rake of the mast comes to more than 25 degrees.

[168] Damianidis 1989, 48.



Fig. 44. Small block recovered from the Bow square in 2000. Photo: K. N. Batchvarov.

During the second, INA-CUA campaign of excavation (2000-2003), blocks and pieces of broken blocks started emerging as early as the first season, but the most informative of them were found in 2001 and 2003 (fig. 44). In 2001 one large treble block was discovered in what proved to be the midship area of the ship. Unfortunately it was in very poor condition, eroded to its centerline and was destroyed during recovery. Fortunately general measurements had already been made.

In 2003 an equally large double block was discovered on the starboard side of the ship, again about level with the mast step (fig. 45).



Fig. 45. Double block. Repairs to the shell are visible. Photo: K. N. Batchvarov.

Fortunately this artifact, well protected by the mud, was in excellent condition and was successfully recovered. Dr. Georgi Mavrov carried out the conservation and presently the sheaves are rotating again. For some reason this well-preserved rigging element is not on display at the museum in Kitten, and its present location is unknown to the author. Remains of a line that passed through the block are also conserved as well as remains of the stropping. The size, location and types of the double and treble blocks make it almost certain that they formed the halyard tackle for a large yard. These two blocks, as well as all others recovered from the Kitten shipwreck, have wooden pins and no coaks. The double block was crudely repaired at one time, with two extension pieces nailed to the cheeks. The repair demonstrates that the block had likely been in service for

some time prior to the sinking of the ship. The rest of the shell is in excellent condition, strong and without checks. The double block is 39 cm long by 21 wide. The sheaves have diameters of 17 cm and are 5 cm thick. The clearance between the sheaves and the shell is also 5 cm, which is probably close to the diameter of the line that once passed through it. The grooves for the stropping are almost circular at the top and have a diameter of 6 cm. The shell of the block is carved from a single piece of wood. The openings for the sheaves were chiseled through after pre-drilling the ends of the slots to avoid splitting the wood. This same technique of manufacture was used also in shaping the smaller blocks.



Fig. 46. One of the larger single blocks. Photo: K. N. Batchvarov.

A few smaller blocks and parts thereof have been recovered. Although hand made, all are nearly uniform in shape and size. Most were recovered in the same general area from which the halyard-tackle blocks came, with one found farther forward and one aft of them. Most of the blocks have sheaves of about 10 cm in diameter and a thickness of 3 cm, with grooves of 2.4 cm (fig. 46). The stropping groove on these blocks is about 3 cm wide. The shells range from 17 cm up to 20 cm long and all are 12 cm wide. One of the two smallest blocks is about 15 cm long by 7 cm wide, with a sheave diameter of 5.5 cm. The other block is even smaller, with a length of 9 cm, thickness and width of 4.5 cm, and sheave diameter of 3.8 cm. The rope groove of the sheave is only 1 cm. This tiny block was likely used for a flag halyard, as it is too small to have been used for anything else. Regardless of their size, all blocks have virtually the same construction: a single-piece shell carved out of oak, a wooden sheave, and a wooden pin without coaks. On all observed blocks, the opening for the sheave was chiseled out after the four corners were drilled with an auger to prevent splitting the shell. Similar blocks with wooden pins and no coaks have been recovered from the Akko 1 shipwreck in Israel.[169] This vessel is believed to be nearly contemporaneous with the Kitten shipwreck, dating to the end of the 18th or early 19th century. Although the remains appear to have come from at least seven different blocks (exclusive of the halyard blocks), the number, even when added to the 11 blocks found in the 1980s, does not seem to be adequate for the rigging of a ship with estimated size of 23 meters by 7.5 meters. Undoubtedly, many more were in use on the vessel during its sailing career.

[169] Kahanov 2008, 17, fig. 3.

No special types of blocks, such as fiddle or sister blocks, were found. Moreover, neither deadeyes and chainplates, nor traces of them, were located. Taking into consideration the extensive survival of the hull, it therefore seems likely that none were used on the ship. On another wreck about 30 meters away from the studied ship, at least one deadeye was still present in 2001, so the conditions in the bay are conductive for preservation of such items.

Seven toggles, rigging elements that may indicate the type of rig, were also discovered. Four of them were in good and recognizable condition, and the other three were severely degraded.[170] The toggle assembly is T-shaped, with the body consisting of three long iron bar links, the upper one ending with an eye, through which a wooden cross piece is passed (fig. 47). The lowest link ends with a hook. Marquardt illustrates an example, similar to the one found at Kitten, but made of chain.[171] He describes it as a large toggle for the strop of the lower block in the shroud tackles of lateen-rigged galleasses. The same source states that this type of toggle was also used as a quick-release on the running backstays of naval cutters and sloops.

[170] As a serious error of the project director should be reported that none of them were recovered, but were instead reburied on the site.
[171] Marquardt 1992, 155.



Fig. 47. Toggle in situ. Photo: K. N. Batchvarov.

A large quantity of line was discovered, most of which fell apart at the slightest disturbance from the excavators. Nevertheless, samples were recovered and analyzed by Dr. Chakalova. Most of the samples ranged between 2.5 and 3.5 cm in diameter, which corresponds well with the size of the sheaves recovered from the wreck. The ropes were made from two twisted strands, rather than three or four as is usual. Even stranger is the material – reedmace (*Thypha* sp.) – which resembles basten. Alan Villiers, who sailed on traditional Arabian dhows in the late 1930s, reported that the halyards were made of "plaited straw."[172] Numerous sticks with rounded heads on one end were uncovered during the excavation and although generally they were identified as broom handles

[172] Villiers 1961, 249.

(more than a dozen brooms were recorded), it is possible that at least some of them were used for rope twisting. Similar sticks were used for basten rope making in Viking times.[173] Ms. Hristina Angelova, Director of the CUA, conducted interviews with old fishermen from Sozopol, who confirmed that as late as the 1930s, reedmace was still used for rope making in the region. Sozopol is about 30 km north of Kitten and the whole district was surrounded by marshes, some of which have now dried up or have been reclaimed, so reedmace was at one time plentiful.

No data were recovered on the construction of the sail. As was to be expected, no part of the sails survived and no spare sails were found inside the hull, although traces of textiles were found. However, two pieces of leather were recovered and conserved, which have holes from sewing around their perimeters. Originally they were identified as clothing, but after conservation, Dr. Mavrov brought them to my attention and pointed to their irregular shape. It appears that these pieces were leather strengthening, conceivably from the sail, although their odd shape makes it impossible to be certain (fig. 48).

[173] I was shown hand-laying of basten rope with a similar stick in the Viking Museum in Roskilde, during the 10th International Symposium for Boat and Ship Archaeology (September, 2003).



Fig. 48. Leather piece with traces of sewing. Photo K. N. Batchvarov.

BASIS FOR THE RECONSTRUCTION OF THE RIG

Considering the limited extent of the wreck and the lack of preserved spars, it is unlikely that a definite statement on how the ship was rigged will ever be possible. However, enough clues have been discovered to offer at least one hypothesis.

Masts with pronounced forward rake, as appears to have been the case with the Kitten ship, are usually associated with the lateen rig or, in Greek waters, the *sakoleva*, which is a version of the sprit rig.[174] *Sakoleva* drawings from 1878 were published by Admiral

[174] Dimmock 1946, 34-41.

Paris, but the depicted vessel is no more than half the surviving part of the Kitten ship in size.[175] A Beaugean engraving from the first decade of the 19th century, though, depicts a large *sakoleva*.[176] In both cases the mast is heavily raked forward and the shrouds are set up with deadeyes. Even where the deadeyes are not clearly illustrated, the shrouds have ratlines which strongly argue in favour of standing, non-movable rigging. No depiction of a *sakoleva* shows toggles in the standing rigging. Toggles are invariably associated with lateen rigs, as a study of Beaugean's engravings and Paris' drawings testify.

Damianidis speaks of lateen rigs and quotes Greek wooden shipbuilders as stating that in "earlier times" large lateeners of up to 250 tons were common, but by the mid-19th century their numbers dwindled and they completely disappeared less than a century later. A few photographs are included in his work and seem to date to the early part of the 20th century. On the bigger vessels, the yards were never lowered, but the sails were furled by sailors who shinnied up the yards.[177] Damianidis quotes a Greek authority from c. 1860 as describing the lateeners as one- or two-masted *trechadiri*.[178]

Sir Alan Moore describes lateen- and settee-rigged boats that he observed during World War I in Greek and Ottoman waters.[179] D. Verwey published sketches of Turkish lateen rigged vessels from the Sea of Marmora that he observed in the early part of the 20th

[175] Paris 1999, Plates 101-103.
[176] Harland 2000, 119, Plate 104.
[177] Damianidis 1989, 76-8; Moore 1925, 117.
[178] Damianidis 1989, 77.
[179] Moore 1925.

century.[180] H. M. Denham provided a photograph from about 1916 with vessels captured in the Sea of Marmara. Of the four, two were lateen rigged and those he identified as "Turkish Lateen" and "*tchirme*".[181] "Tchirme" is undoubtedly misunderstanding of "*tchektirme*", which is the Turkish equivalent of *trechadiri*.[182] "*Tchirme*" refers to a small rowing galley in the Western Mediterranean.[183]

Wolfgang Müller-Wiener's monograph on the harbors of Istanbul dedicated part of a chapter to Ottoman vessels and included extensive collection of prints and photographs of lateen-rigged vessels.[184] Some of the ships are substantial in size with extreme forward rakes evident in their masts (fig. 49).

[180] Verwey 1932.
[181] Denham 1986, 281.
[182] Güleryüz 2004, 95.
[183]Müller-Wiener 1994, 90.
[184] Müller-Wiener 1994.

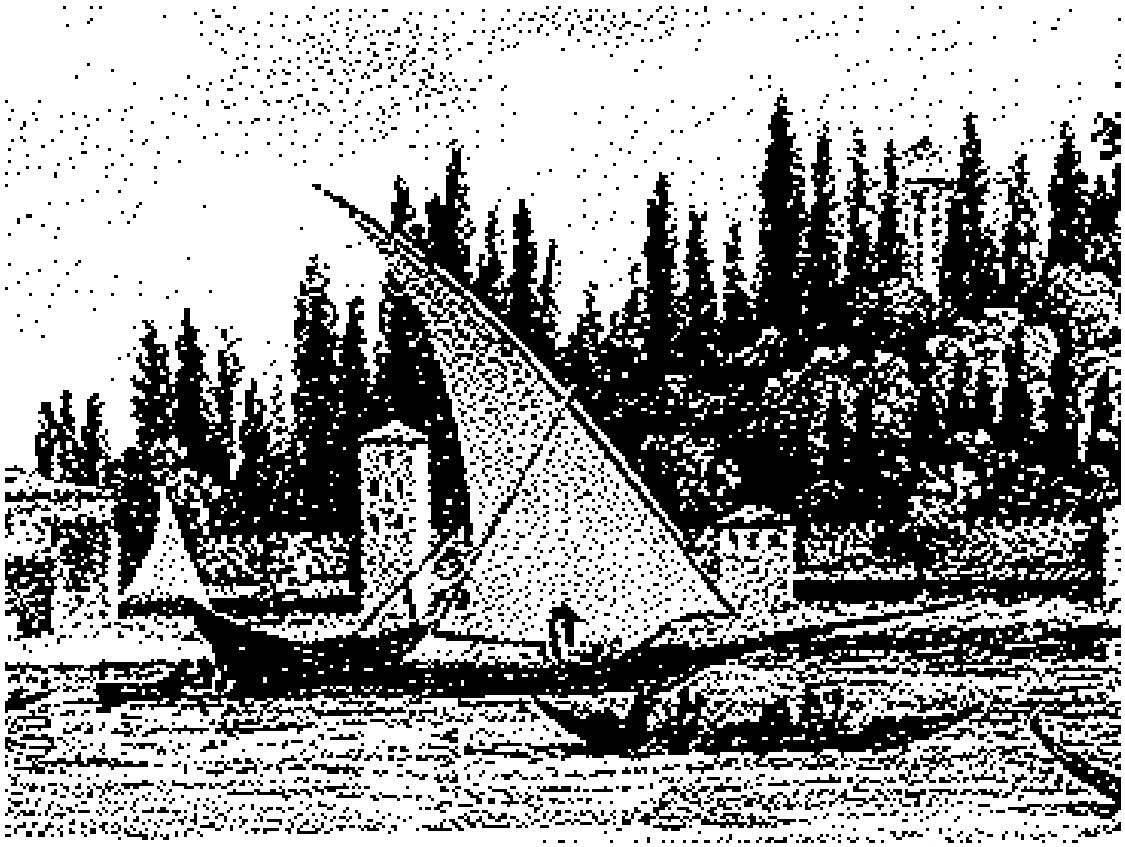


Fig. 49. Extreme mast rake on a lateen-rigged vessel. Detail. Also reprinted in Müller-Wiener as Plate 6.

In almost all cases the sterns are significantly higher than the bows and some have a tiny lateen mizzen that seems to be placed almost on top of the sternpost.[185] Settee rigs (a lateen sail with a short luff) are also visible on two photographs from Sozopol harbor (See Figures 50 and 51).

[185] Müller-Wiener 1994, 61-65 and plates 5.2, 6.1, excellent depictions of forward raking mast of lateeners are 19.1, 20.1 and especially, 36.1, 43.2, 44.1, 52.2, 55.1, 56.1.

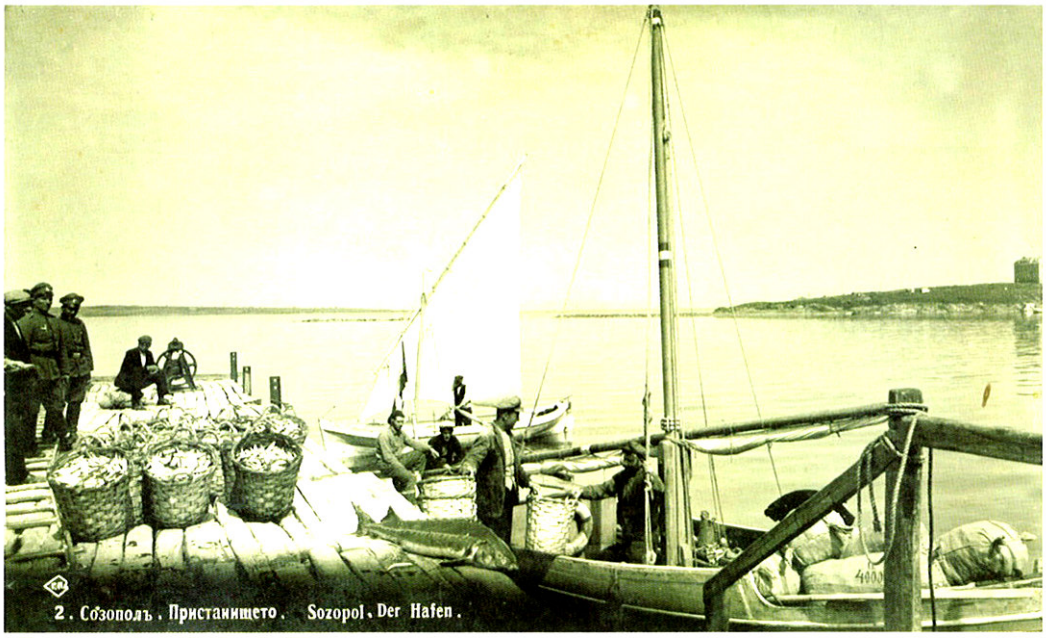


Fig. 50. Fishing boats from Sozopol, c. 1912. The closer boat appears to be a *mauna*. From a postcard. Photographer unknown.

The boats are small and the photos are not dated, but based on the uniform of the Bulgarian soldiers, the likely date is c. 1908-1912. Small fishing boats from the Bulgarian coast, called *sefer,* of 5-9 meters length (visible in the photographs from Sozopol) carried settee sails as late as the 1970s and as a child I had the good fortune to sail on a few, mostly as a passenger.

By the 1980s sails had virtually disappeared, only to be revived here and there in the late 1990s and early 2000s as rising fuel prices and the general economic collapse made the free wind an attractive motive power again.



Fig. 51. *Sefer* boats and a *mauna* at the quay in Sozopol, c. 1912. From a postcard. Photographer unknown.

Graffiti from the Nessebre churches (about 100 km north from Kitten, but less by sea) also depict lateen-rigged craft.[186] They have not been precisely dated, but most probably were scratched into the wall plaster during the 18th and 19th centuries. Many illustrate vessels at anchor with furled sails and raised yards. Shrouds are depicted with ratlines only on the few square-riggers, which may indicate that the shrouds on the other vessels were meant to be running and therefore set with "quick-releases". Typical for these double-ended vessels, the sterns are invariably much higher and rise more steeply than the bows, although it is hard to quantify this statement, because of the tenuous nature of iconographic evidence. The high, sharply rising stern feature is visible on photographs

[186] Ovcharov 1992, catalog numbers 117-20, 145-47, 149, 159, 161-62, 173, 175, 176.

published in a recent article on *mahones* lighters, a double-ender with low freeboard, of various dimensions, which were also lateen-rigged (fig. 52).[187]

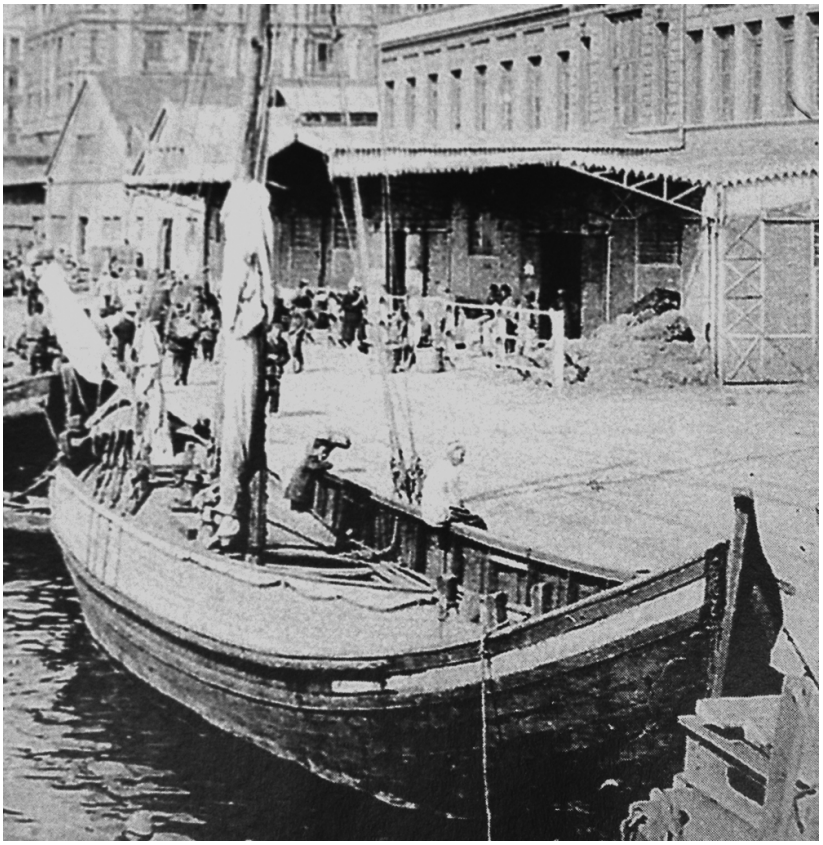


Fig.52. A *mahone* from the early 20th century. Detail after Borgschultze.

The source for most of these photographs (referenced in the article) is Müller-Wiener's monograph on the Istanbul harbors. Larger, sea-going versions of the *mahone* were also built and they differed little in rigging or construction. Other spellings and pronunciations of the name are *mahownah* as transcribed by Moore or *mauna*, as it sounds in Bulgarian. *Mauni* (plural form of *mauna* in Bulgarian) survived until at least

[187] Borgschultze 2005, 164.

the mid-20th century and smaller ones are still operated as fishing boats, but with engines.

Some indirect information on the rigging of Black Sea ships can also be deduced from Eaton's early 19th-century book *On the Commerce and Navigation of the Black Sea*. He notes that Ottoman ships from the region "…have one or two masts, with immensely large sails, which hang over the vessels sides a great way to leeward, by which, when the wind is strong, the lateral pressure of the yards is so strong against the masts, that they often cannot be lowered…."[188] The passage does not preclude outright the sakoleva/sprit rig, yet it is more likely that Eton was speaking of the lateen rig, because he suggests that it was impossible to shorten sail underway in a squal by lowering the yards. In a sakoleva or sprit rig, the sprit usually is not lowered, but the sail is brailed.[189] In the region, the mainsails on sakolevas traveled along a rope horse stretched between the mast and the sprit. Thus, lowering the sprit to strike sail is not necessary – it was a question of using an inhaul to bring the sail to the mast. Even if for some reason the lowering of the sprit was found to be necessary, it is physically impossible for it to be prevented from coming down because of wind pressure, as it was held to the mast only by a snotter. As most of the spar was aft of the mast and at an angle, gravity would soon (perhaps quicker than desirable) bring it crashing to the deck. In a lateener, on the other hand, it is more probable that the crews lowered the yards in a sudden storm. Unlike the sprit, the lateen yard has a larger proportion of its length forward of the mast and is

[188] Eton 1805, 4.
[189] Tzamtzis 1972, 53-174. See Plates 97, 98 and 99.

much more likely to have enough friction in its parrels to prevent it from easily sliding down the mast in strong winds. The quotation also sheds light on the probable handling of the rig, to which we shall return later. More iconographic evidence for the popularity of the lateen rig in the Ottoman Empire, including the Greek Archipelago, is published in *The Greek Merchant Marine*. [190] Tzamtzis also speaks of the lateen rig's popularity and sees it as well-adapted to the fickle conditions of the Mediterranean: the long yard permits the sail to catch the slightest breath of air, yet it also allows the sail to spill the wind in sudden gusts.[191] In this respect the sail would be well-adapted for use in the Black Sea also, where conditions can be very similar to the Mediterranean in the sailing season.

These examples demonstrate that lateen rigs were popular and well-known in the Ottoman Empire and specifically along the western Black Sea shore. Thus, it is likely that the Kitten ship carried this type of rig, possibly in a settee version. Review of the archaeological finds also supports the hypothesis that the vessel may have been lateen rigged. The heavy forward rake of the mast and the presence of at least seven large toggle assemblies are the strongest evidence to support such a reconstruction. Additional indirect evidence is that no traces of deadeyes or chainplates have been found. Yet, deadeyes survived on a nearby wreck, that was in poorer state of preservation. The

[190] Papadopoulos 1972. See Plates 37, 43 (It is titled *Raising sail on a Sakoleva*, but the sail appears to be a lateen, not sprit), 58, 95, 99.
[191] Tzamtzis 1972, 53.

apparent absence of deadeyes on the Kitten wreck does not rule out their prior existence, but it is more likely that none was used in the first place.

The forward rake of the mast on the Kitten ship is a matter of conjecture and is based on the tentative reconstruction of the depth in hold. The minimum depth as reconstructed suggests that the mast rake was about 25 degrees or more. This extreme value is not impossible as plates in Mueller-Wiener's work demonstrate.[192]

The previously mentioned Beaugean engravings from the first decade of the 19th century provide plenty of examples of rakes in this range, too. Lionel Dimmock wrote that rakes of 10-20 degrees on Arab lateeners were normal.[193] The very heavy rake of the mast on Arab vessels was also noted by Richard Le Baron Bowen Jr.[194]

The same observation, this time for European Mediterranean craft, is made by Sir Alan Moore, with the additional information that the mast was nearly amidships.[195] The same location is observed on the Kitten shipwreck and is depicted on plates 6 and 20 in Mueller-Wiener (fig. 53). Plate 89 in the 1999 abridged edition of Edmond Paris's *Souvenirs de Marine* depicts a fishing *bilancella* from the Ligurian coast, the mast of which rakes forward 23 degrees.

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[192] Müller-Wiener 1994, especially Plates 6.1 and 20.1.
[193] Dimmock 1946, 37.
[194] Bowen Jr. 1948, 101.
[195] Moore 1925, 89.

Use of toggles is depicted in engravings by the French marine artist Beaugean, published by John Harland.[196] Toggles are illustrated in Joseph Furtenbach's 1629 *Architectura Navalis*.[197] Delacroix provides the French 18th-century tartana *La Diligente* with toggles, too.[198] An Italian fishing tartana from the Adriatic Sea is also illustrated with toggles for her shrouds. Admittedly the vessel was *bratsera*-rigged (Adriatic Lug), rather than lateen.[199] However, research into the usage of toggles has not yielded any positive evidence for associating this quick-release device with other types of rig, such as square or fore-and-aft, except for lug and, conceivably, for the backstays of naval cutters.[200] All lateen-rigged vessels in the plates from Mueller-Wiener have tackles for the shrouds and not one has deadeyes. Regrettably the reproductions are too small for the toggles to be visible if they were used (figs. 54 and 55).

[196] Harland 2000, 100, 155, 144.
[197] Furtenbach 1629, Plate 18.
[198] Delacroix 1997, Plate 15.
[199] Marzari 1985, 287-303.
[200] Marquardt 1992, 155. It should be pointed, however, that he does not provide any source for this statement and no illustration.



Fig. 53. A lateener with heavily raked mast. This vessel is probably very similar to the Kitten ship. Shrouds are set up with tackles. Detail from Melling, reprinted by Müller-Wiener in Plate 20.

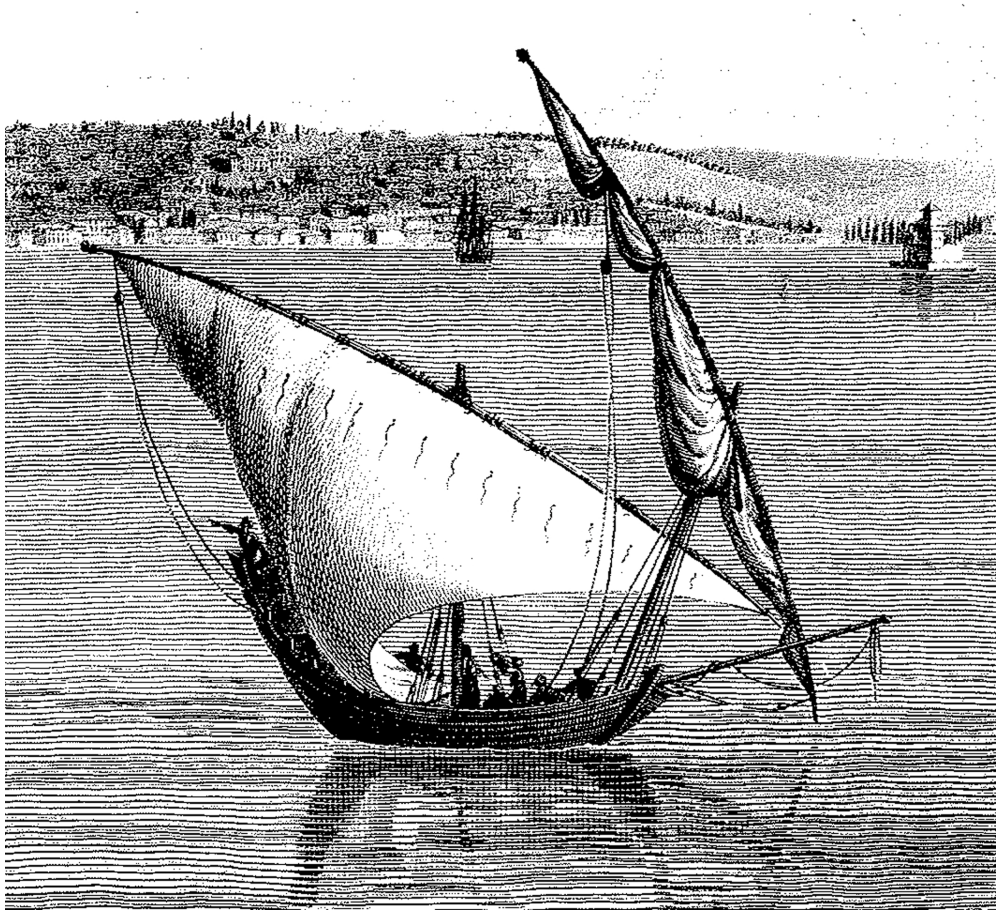


Fig. 54. Detail from an engraving by Melling, showing a two-masted lateener c. 1819. Republished by Müller-Wiener as Plate 36. Shrouds are set up with tackles, though the toggles are not visible.

As mentioned earlier, a treble and a double block were found on the Kitten wreck. The presence of only one such pair, baring freak survival, implies that only one yard was large and heavy enough to require such powerful purchase for handling it. This cannot be taken as direct evidence for a lateen rig, but it is known that lateeners require very massive yards, frequently longer than the hull of the ship itself. For a vessel of around 23 meters length, the yard would have been massive indeed. Moore reports an Egyptian

vessel on which this spar was 80 feet (24 m) long.[201] Even on conservatively rigged vessels, the yard could be at least equal in length to that of the ship itself.[202]

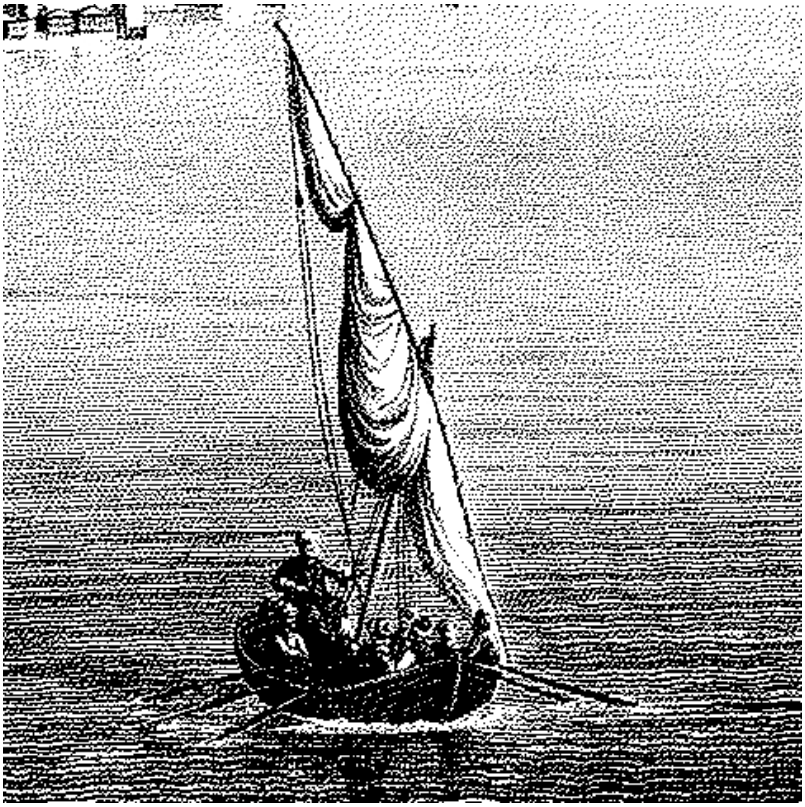


Fig. 55. Detail from a Melling engraving, c. 1819. Republished by Müller-Wiener as Plate 44. The small lateen-rigged boat is similar to the sefer boats. The shrouds appear to be set up with tackles.

The archaeological evidence, although not definite, all points towards one specific type of rig, the lateen sail, which was clearly present in the Black Sea when the Kitten ship was in service. The presence of toggles and lack of deadeyes, the probable heavy

[201] Moore 1925, 116.
[202] Moore 1925, 88, 93.

forward rake of what was probably a single mast located nearly amidships, and the powerful purchase of the halyard tackle argue that the Kitten ship was lateen-rigged.

SPAR DIMENSIONS

No list of proportions for lateen-rigged cargo ships from the Levant, Eastern Mediterranean or Black Seas has come to light during research. Some proportions can be deduced from the ship draughts published by Paris and Furtenbach. Additionally, attention was paid to such iconographic evidence that looked dependable, technically detailed and bereft of major distortion in perspective because a rig was shown from the profile. Based on these sources, proportions for the rig and mast were calculated and applied to the Kitten ship. The spars were proportioned based on what was most easily measured or what dimensions were listed in the source material; for this reason they are not consistently calculated based on the same dimension (i.e., the overall length of the hull or length of mast).

For the tartana illustrated in Paris' Plate 89, the proportions of the rig were calculated as follows: mast length equal to three times the beam or 1.15 times the overall length of the ship. The yard equals 4.2 times the beam or 1.25 times the length of the vessel. For the tartana on Plate 54 the mast is 1.15 times the length of the ship, and the yard is 1.5 times the length of the mast.[203] On *La Diligente* the mast equals 1.15 times the length of the

[203] Paris 1999, plates. 54, 89.

tartana, the yard equals 1.3 times the length of the mast.[204] It should be noted that *La Diligente* was a two-masted vessel and the draughts are a secondary source. Bowen records yards on Arab dhows in excess of 130 per cent of the hull length.[205] Joseph Furtenbach's Plates 16 and 18, illustrating a barca and a polaca, are of special interest. A tartana is discussed, but not illustrated. Furtenbach gives more detail on the barca so here only the proportions for this vessel are used: mast to length of vessel ratio equaled 1.15, yard to mast equaled 1.5 for the foremast and 1.7 for the mainmast. Sir Alan Moore, speaking of the *mauna* (*mahownah* in his transcription) states that yards were frequently as long as the boat itself and in many cases significantly longer.[206] He uses "boat" somewhat inconsistently – sometimes it means indeed a boat and some times it is used as synonymous with ship. Furtenbach describes all three vessels (*Barca*, *polaca* and *tartana*) as extremely fast and capable of 8 to 10 knots, an impressive speed for the early 17th century indeed. Supporting evidence that lateeners could achieve such speeds comes from Bowen, who reports speeds of between 10.5 and 12 knots in favorable conditions.[207] If one looks at the huge spread of sail of these ships, it is hardly surprising that they were fast sailers.

All examples of vessels discussed had an overall length-to-beam ratio of about 3.5:1, while the Kitten ship is hypothesized to have had a ratio of about 3.2:1. Logically it would be expected that this vessel could have carried an even more-extreme rig, thanks

[204] Delacroix 1997, plans 14 and 15.
[205] Bowen Jr. 1948, 111.
[206] Moore 1925, 88.
[207] Bowen Jr. 1948, 102.

to the added stability of the proportionally larger beam. However, considering the rough sailing conditions of the Black Sea where sudden and violent storms arise even in the summer months, and ships frequently encounter short steep waves and open roadsteads, a more conservative stance was taken. The proposed reconstruction has limited proportions to the lowest ratios calculated. The length of the single mast is equal to the length of the ship of 23 meters. The yard, following most proportions, ought to be 33.75 meters long, but the figure was decreased to 28 meters. The decrease was "eye-balled" to what seemed appropriate, rather than calculated.

A bowsprit was added to facilitate the spread of a foresail or "polaca" sail as Harland calls it. Furtenbach confirms the name of the large jib found on the bows of tartanas. The protruding part of the bowsprit is based on the tartana and the two Ottoman vessels' rig dimensions in Paris. The foresail would have been a necessity for the Kitten vessel if it was to avoid a heavy weather helm.

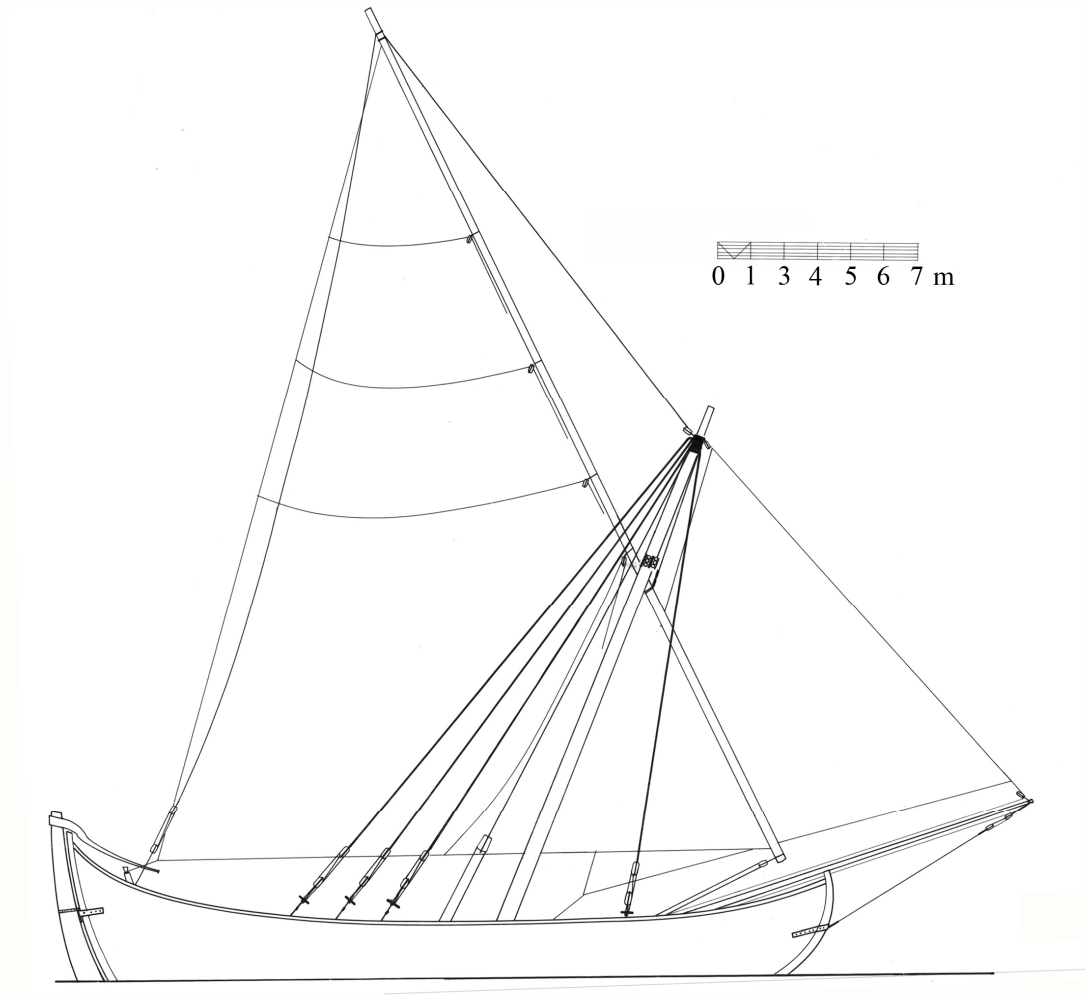


Fig. 56. Reconstruction of the Kitten vessel's rig. Drawing: K. N. Batchvarov.

Since no evidence for the Kitten ship's spars exists, it is inevitable that the spar dimensions are at best an educated guess.

STANDING RIGGING

Strictly speaking, the classic lateen rig, proposed for the Kitten ship, does not have standing rigging, since all shrouds and stays are shifted each time a tack is changed. For

convenience the term shall be used, however, to describe all lines that are intended to support the spars rather than control the sail.

In this hypothetical reconstruction, the shrouds are set with toggles, three of them abaft the mast and one forward. Bowen describes at least one shroud forward of the mast on large Arab lateeners; Dimmock demonstrates a similar arrangement, too and some of the iconographic evidence published by Harland supports such a position.[208] It may be significant that three of the toggles at Kitten were found far aft on the site, but a fourth one was found in the forward third of the hull, on the starboard side of the wreck. Marquardt and the *La Diligente* monograph show the shrouds lashed to the masthead.[209] The iconographic evidence from Nessebre, published by Ovcharov is useless in this case and, regrettably, so are the illustrations in Müller-Wiener, for, in all of them either the vessel is too distant for such details to be visible, or, the details are hidden by the sail itself. The photographs of boats in Sozopol harbor (figs. 50, 51) depict the shrouds looped around the mastheads. The hypothetical reconstruction of the Kitten vessel uses the same technique of securing the shrouds. Although there is evidence for such an arrangement, it should be recognized that it is for simple open boats, not for ships. The decision is open to question. Significantly easier to deduce is the arrangement for the lower ends of the shrouds. All sources are unanimous that this was done through a tackle which allowed speedy easing and setting of the shrouds when tacking. On Adriatic and western Mediterranean vessels the tackle consisted of a single and a long-tackle (fiddle)

[208] Dimmock 1946, 36.
[209] Delacroix 1997, 71, Plate 15; Marquardt 1992, 155, fig. 112.

block. The surviving pieces of blocks from the 1980s expedition are mostly of single blocks with one exception that may have been a double block. Because of the lack of double blocks, the setup of the shrouds is reconstructed with a gun-tackle arrangement.

The arrangement for the bowsprit support is lifted in its entirety from the small Turkish coaster (a sprit, *not* lateen-rigged vessel) published by Edmund Paris.[210] The bowsprit is butted into bitts, passes through a collar at the stem and is supported by a bobstay. However, extensive and apparently dependable iconographic evidence suggests that bowsprits on lateeners within the Ottoman Empire were not necessarily supported by standing rigging. This is particularly well illustrated in an 1817 engraving by Ch. Pertusier of a single-masted lateener (fig. 53) and an 1819 engraving by A. J. Melling of a two-masted vessel (fig. 54).[211] Both illustrations point to the lack of a standing forestay on this type of rig. The presence of such stay would have made it virtually impossible to shift the yard in tacking maneuvers, as this was usually done by shifting it forward of the mast. Therefore, the large foresail or *polaca* was set flying.

RUNNING RIGGING

The blocks of the main halyard were already described. Here it should only be reiterated that none of them looked like typical lateener ram-blocks. The treble was never properly

[210] Paris 1999, Plate. 106.
[211] Müller-Wiener 1994, plates 20.1 and 36.1 taken from A. J. Melling, *Voyage pittoresque de Constantinople et des Rives du Bosphore* (Paris, 1819; re-issued Istanbul, 1970) and Ch. Petrusier, *Promenades pittoresques dans Constantinople et sur les rives du Bosphore*, (Paris, 1817).

studied, but the double block was documented. The grooves for the strop are angled towards each other in the upper part of the block. Two possible ways of stropping it come to mind. First, that the block could simply be stropped with a becket to which the halyard was bent. Second, the halyard tye was spliced around the block or it formed a bight in which the block was secured and the two ends reached a pair of masthead sheaves or blocks. Either one of the methods would work, but the evidence does not permit us to determine which one was used. On smaller vessels, the halyard tyes passed through a single sheave at the masthead from aft forward and the line was bent to the yard. In bigger vessels the tyes formed a bight around the upper block and then passed through two sheaves in the cheeks of the masthead. If the size of the Kitten ship is taken into account, the double tye seems the more probable arrangement. A parrel would have held the yard close to the mast and under control. Dimmock, Moore and Bowen describe simple arrangements for parrels. None of them include ribs, only trucks, but in all cases they describe Egyptian and Arab dhows. The parrels on the Kitten ship are derived from the photograph of one of the boats in the photograph from Sozopol harbor (figure 51).

The huge lateen yard is also controlled with the help of tacks, rigged as simple whips and belayed to either side in the bow of the vessel. A lift is rigged from the upper end of the yard to a block at the masthead and belayed to the deck or one side of the vessel, as a photograph of the Sozopol boats demonstrates (fig. 50). The lift would have been necessary to support the lengthy and heavy upper part of the large yard. Additional control is provided by the means of two vangs led to the quarters of the vessel. Both are set with guntackles. However, Moore recorded that high-peaked lateeners did not have vangs for safety: vangs would prevent the yard from sagging to leeward and spilling wind in gusts (on vangs see fig. 58).[212] The vangs may have been in the way while tacking, but in all illustrations in Müller-Wiener vangs are shown. They are also clearly visible in plate 53 of *The Greek Merchant Marine*, where the vangs are rigged through two – apparently single - blocks at the top of the yard, thus forming a whip (fig. 57).

[212] Moore 1925, 93.



Fig 57. A detail from Plate 53 in *The Greek Merchant Marine.* The vangs are visible, rigged with simple whips.

If the vessel was to be tacked by shifting the yard on each tack, than likely it had a single mainsheet, with a simple whip belayed to a protruding timber head. Possible archaeological evidence for such a timber was discovered at Kitten. The timber, a rider, butts into the bilge stringer and extends from there upward at a sharp angle. Besides supporting the sharply rising high stern, these timbers could have served as belaying points for a sheet or mooring line, depending where they actually ended.

Considering the huge size of the sail, it probably needed a way to spill the wind quickly. The reconstruction proposes the use of three leach lines and a brail to the foot. Three leech lines seem to be a sufficient number, based on iconographic evidence.

The rake of the mast makes it almost a certainty that in tacking, the yard was carried across on the forward side of the mast. Thus, any foresail would have had to be set flying. In the hypothetical reconstruction of the Kitten ship rig, the foresail is set with a halyard passing through a block at the masthead and led to the base of the mast, although it is possible that it was led to one of the sides. The tack is rigged with an outhaul lead through a single block at the end of the bowsprit. The foresail sheet was either a single line or a whip. In either case with the fairly large crew, possibly of around 17 or 18 men and boys, there would have been sufficient manpower available to strike the sail or set it.

HANDLING OF THE LATEEN RIG

The lateen sail is among the less well-understood rigs (fig. 58).[213] It has generally, and less than convincingly, been argued that the sail was developed and distributed by the Arabs; that the lateen rig made the great geographical discoveries possible (yet almost all great explorers wasted no time in converting their lateen-rigged caravels to square rig); that the lateen sail was the immediate predecessor of the fore and aft rigs.[214] I. C. Campbell in his study of the lateen rig, argued persuasively that whatever the actual origin of the sail, the Arabs likely had very little to do either with its invention or its diffusion.[215] Furthermore, he concluded that the most probable region in which the rig originated is the northern Aegean and that its use predates the Muslim invasions of the 7th century AD. He proposed that "…the gift of the lateen sail to Atlantic maritime history could well be Italian….", thus charting a course for dissemination of nautical technology from the Eastern Mediterranean to the Iberian Peninsula. [216]

[213]Harland 2000, 11.
[214] Campbell 1995, 1.
[215] Campbell 1995, 4-7.
[216] Campbell 1995, 10.

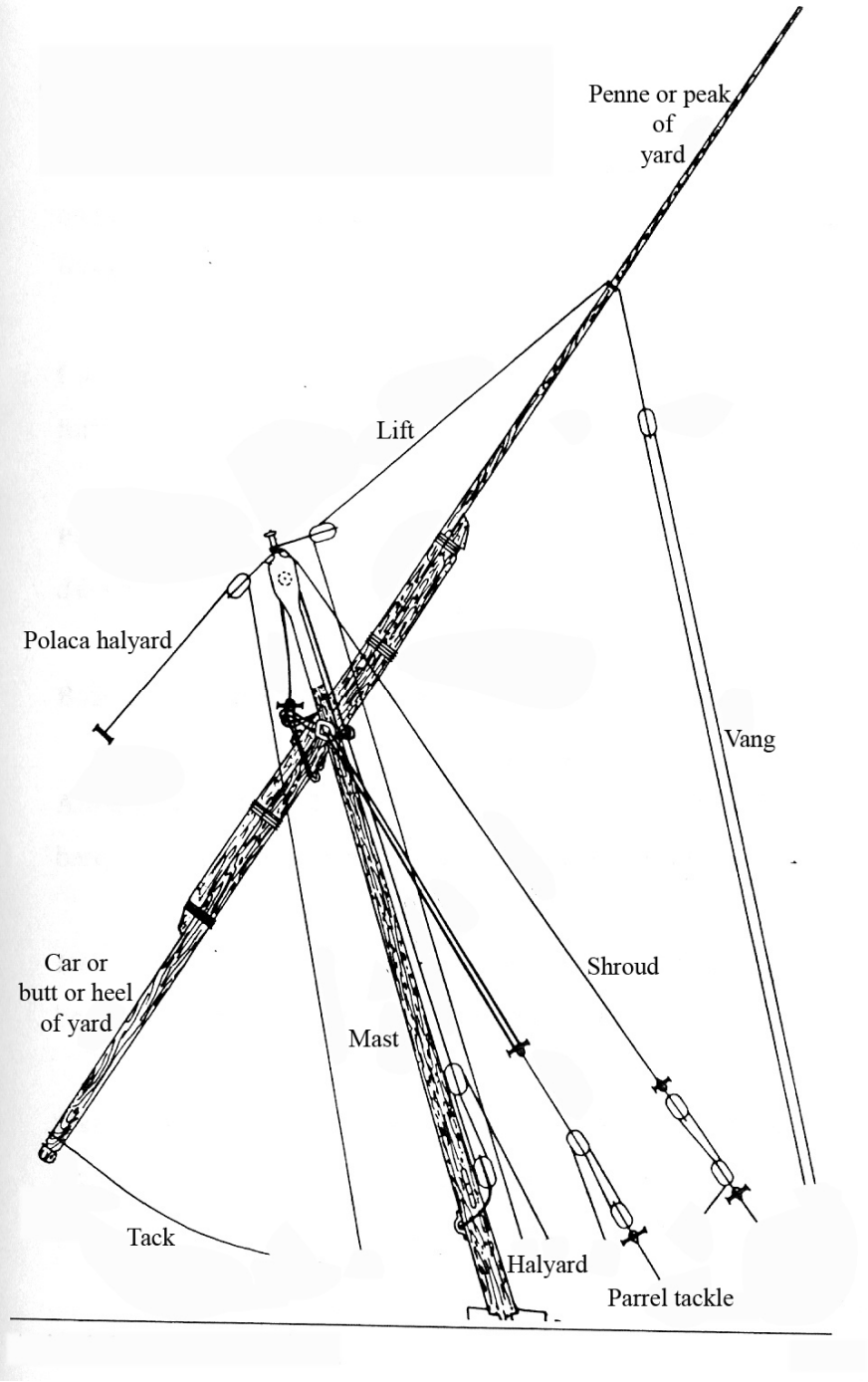


Fig. 58. Diagram of a lateen rig. Computer modified from the *Amics de la Mar Menorca* site.

The handling of the lateen rig has entertained the wits of researchers for some time and the literature on the subject is not small (fig. 58). The best short description of the seamanship of the lateen rig is to be found in John Harland's *Ships and Seamanship*. The descriptions are perfectly complemented with the exceptionally accurate engravings of the French marine artist, J. J. Baugean. Virtually all maneuvers are illustrated by this prolific and accurate artist.[217] The general consensus has it that the yard had to be shifted on each tack to the leeward side of the mast; otherwise the sail would loose some of its efficiency.[218] Plentiful evidence exists to support this view, at least for Western lateen-rigged vessels. Two methods of doing this have been proposed: by the fore side of the mast or by the rear, as it was done on large square-riggers with lateen mizzens. On fully lateen-rigged ships, it appears that the first method was employed. A mast with a heavy forward raking would have facilitated this maneuver. Hans-Jockel Nickel quoted passages from Oliveira, Juan Escalante de Mendoza and Pantero Pantera (Commander of the Papal galleys) on the lateen rig of caravels in the 16th century.[219] All three authorities agreed that the lateen rig was weatherly, but hard to manage and labour-intensive in shifting the yards. The same sources describe shifting the yard by bringing its heel to the foot of the mast with the tacks and then rolling it across the masthead. Meanwhile, the sheets and vangs are reset on the new tack and, presumably, so are the shroud tackles. The description implies that the sail was brailed during the procedure, for if the canvas is simply left to feather out of control severe damage to the rig and injuries to the crew

[217] Harland 2000, 6 and 11-13.
[218] Nickel 2002, 192-96; Nickel 2006, 166- 71; Ostermann 2003, 192-7; Göhren 2004), 24-28.
[219] Nickel 2002, 194.

would be inevitable. All three quoted authorities make a point of the dangerous nature of the maneuver.

Alternatively, Hermann Ostermann hypothesized that on multi-masted lateen-rigged vessels the yards were placed on opposite sides of the masts and were set depending on the course steered, the sail to windward of the mast being furled.[220] Although the proposed solution to the problem of shifting yards at sea is ingenious, it is not applicable to single-masted vessels and ignores that a two-master would not be properly balanced with one of the sails furled.

Norton explained that going about in lateen-rigged craft depended on the cut of the sail and the method of yard suspension.[221] On Alexandrian (Egypt) *feluccas*, the sails were cut with a vertical leech and short luffs, referred to as a settee sail (fig. 59). These craft came about frequently and on short tacks kept the yards on the same side of the mast. On longer tacks, however, the clew of the sail was passed forward of the mast and the yard rolled over the masthead.

[220] Ostermann 2003, 193.
[221] Norman 1957, 327.

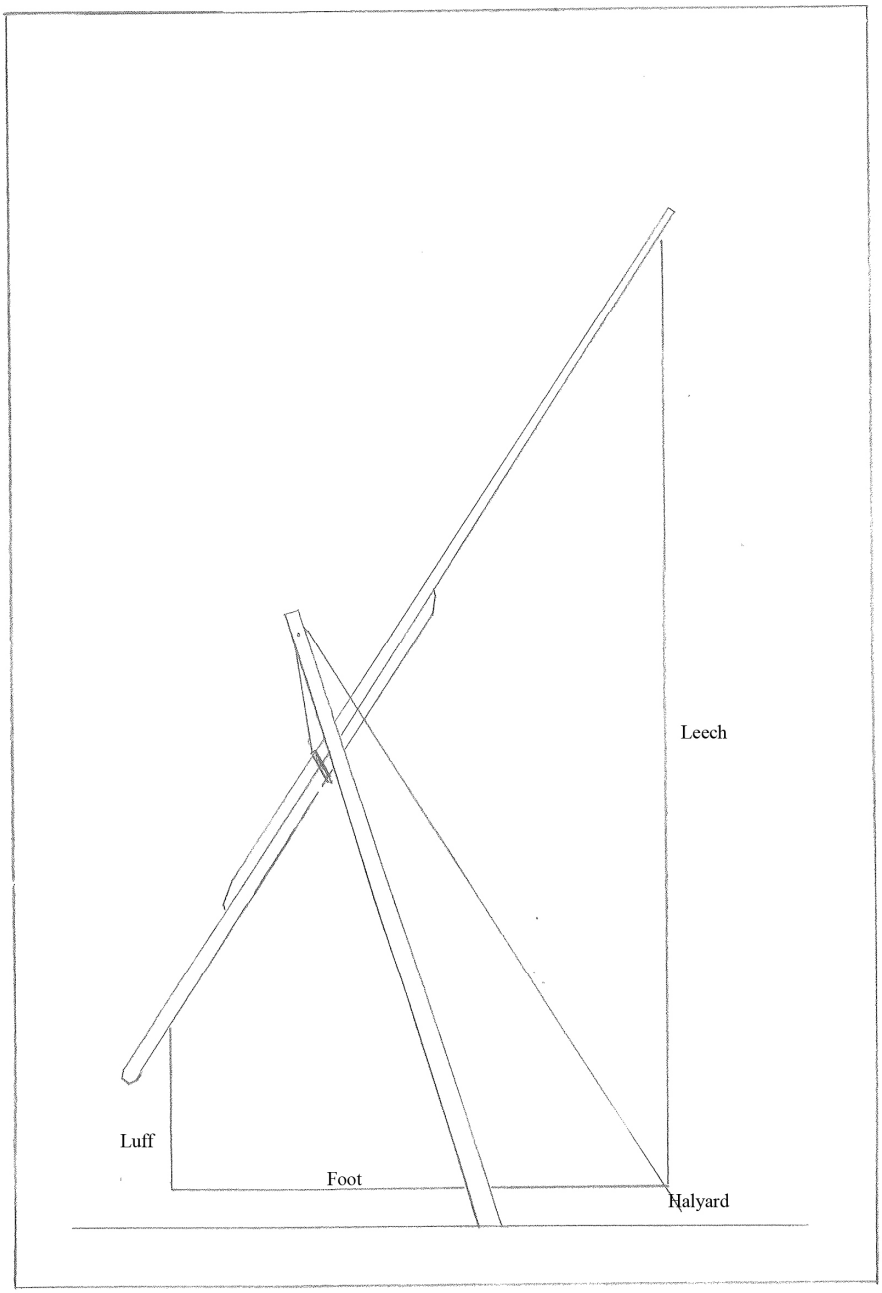


Fig. 59. Settee rig as carried by Alexandrian *feluccas*. The halyard leads aft and the yard swings forward of the mast in tacking. Drawing: K. N. Batchvarov.

A slightly different rig and procedure were used on Nile *ghaissas* (fig. 60). These boats were single-masted and their sails were cut with a vertical leech, low foot with no roach

and no luff. The yard was slung abaft the mast (meaning that the halyard was led forward, rather than aft) and on a wind the heel of the yard was boused in to the mast to the point where the rig resembled a gunter sail.

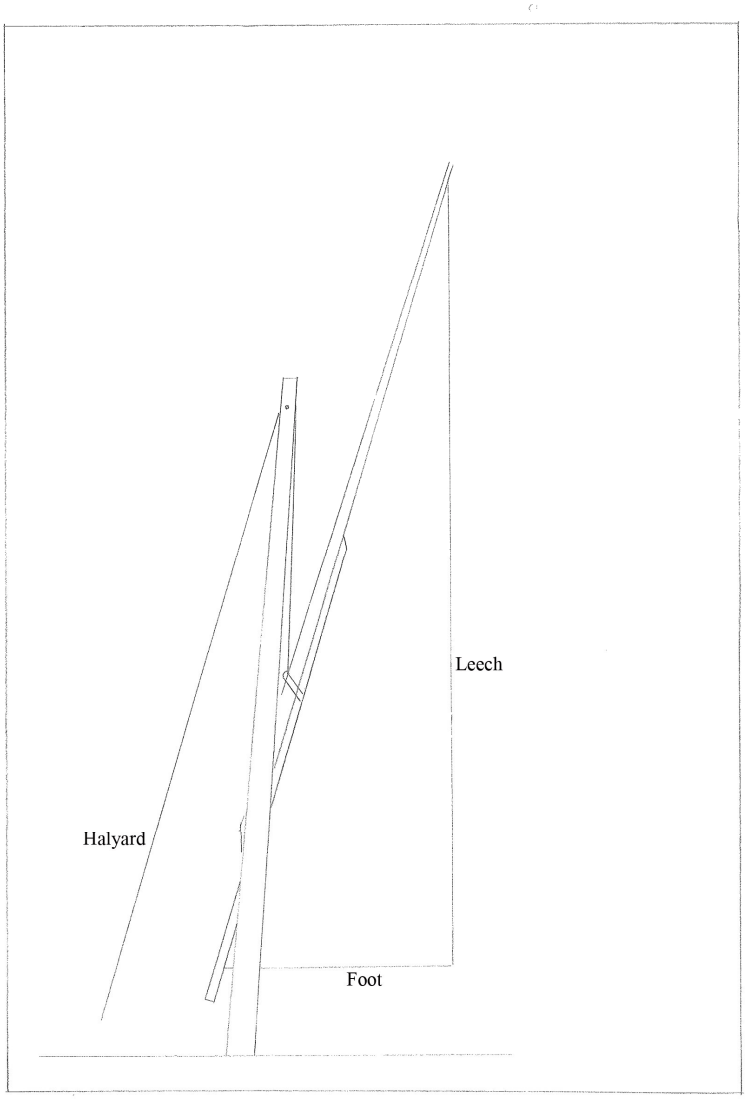


Fig. 60. Sketch of a *ghaissa* rig, sailing on a wind. The halyard is led forward. Drawing: K. N. Batchvarov.

Thus, the sail set well on either tack, and shifting the yard was not necessary. The mast raked slightly aft and was placed in a tabernacle to permit easy negotiation of the bridges at Cairo. A nearly identical arrangement was used on the Istanbul lighters, the *mahones*. A short stubby mast supported a tall, nearly vertical lateen sail, which, when set, also resembled a gunter (fig. 61).



Fig. 61. A passenger *alamana*, with a stub mast and almost gunter-like lateen sail. Borgschultze incorrectly identifies the vessel as a *mahone*.[222] Note the difference in profile from fig. 62, which indeed is a *mahone*.

[222] Pulak, personal communication.

The yard had a counterweight on its heel to ease lowering and raising when the vessel passed under the Istanbul bridges (fig. 62). In 2001 a vessel, discovered about 20 meters from the wreck we excavated in the southern Bay of Kitten, still had the remains of the stubby mast and tabernacle. In 2006 I dived on this wreck again, but no trace of the mast remained.

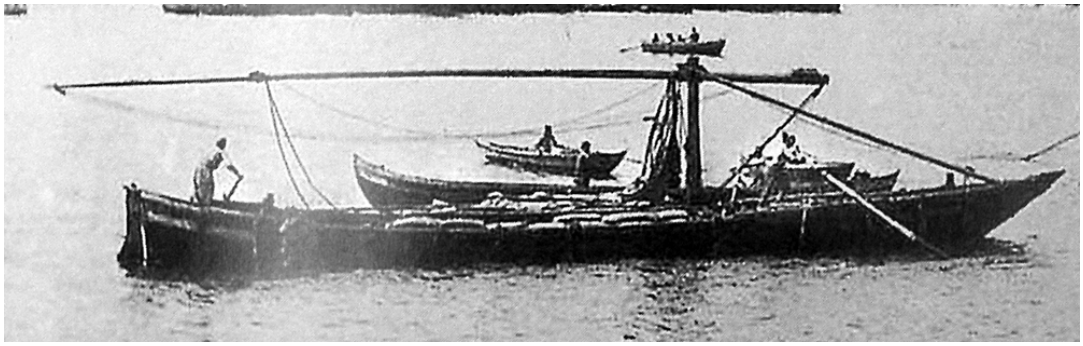


Fig. 62. A *mahone* with lowered yard for passing under bridges. Detail after a photo in Borgschultze.

Norman also speaks of two-masted *ghaissas*, the sails of which had roach and short luffs. On the two-masted vessels the sails were set in the more conventional manner of a true settee with yard at an angle to the masts, rather than nearly vertical, but the sails were left to windward only for short tacks.

N. Lishman likewise described handling Arabian lateen-rigged vessels.[223] According to his experience, lateeners only wore and did not tack. The maneuver was the same regardless of the size of the vessel, and only the gear needed to support the yard and

[223] Lishman 1961, 57.

mast differed. The craft turned downwind, the tack and sheets were cast loose, the parrel was loosed, too, and the tack brought in to the mast. The sheet and the yard were passed in front of the mast and clewed down, then the tack was made fast. According to Lishman, a peak halyard was also attached to the yard to help in its shifting. Although most of the sail handling could be done from deck, to furl the sail the mariners had to go up the yard. The spar itself was rarely brought down on deck except when anchored in an open roadstead and there was necessity of lowering the centre of gravity. Lishman also spoke of the set-up of the shrouds: a long pendant from the masthead with two single blocks. The lower block was equipped with a toggle which was slipped through rope grommets or salvagees. Alan Villiers gives virtually the same description, but he adds that the two single blocks were arranged in a gun tackle.[224] They in turn were fitted to convenient points round the vessel in accordance with the course being steered. This arrangement is very close to the one proposed for the Kitten ship, with the notable exception that the lower block must have had the salvagee attached to a becket and the toggles were directly attached to the hull, either through an iron eyebolt or a grommet.

Lishman speaks of double sheaves in the masthead for the jeers (Harland calls them tyes). A large block with up to four sheaves was set in the bight of the jeers. The lower block on most Arabian vessels was secured to the hull in the form of a vertical stanchion, fastened to beams and stepped on the keelson. In the Kitten ship, as described above, the jeers or tyes were set up with a double and a treble block. It is difficult to be certain

[224] Villiers 1961, 249.

which of the two blocks was secured to the jeers and which to the hull, but based on provenience, it is possible that the treble block was secured to the hull and the double to the jeers, because the first was found inside the wreck, to port, while the double block was discovered outside the hull, to starboard.

Unfortunately, direct observations and descriptions of handling of lateen-rigged craft in the waters of the Black Sea are virtually unknown. Some deductions can be made on the basis of analogy with other regions in which the lateen rig was used and on a limited body of iconographic evidence. The sole written source describing ship handling in the Black Sea is of questionable value and comes from the already quoted William Eaton:

> The remedy, in this case [*NB: that is*, *the necessity to shorten sail in a strengthening breeze*], is to dart logs of wood with a sharp end, or a kind of javelin, at the sail, by which they make holes to let out the wind.
>
> They cannot lie-to, as their bows spread out so much above water that a sea to windward striking them turns them to leeward. Therefore they never attempt it, but run for the first port, which if they cannot make, they go on shore.[225]

The hurling of darts at the sail to spill the wind was surely not a general practice, nor does it appear likely that Black Sea sailors intentionally ran larger craft aground on what is a rocky lee shore in all dominant winds. Thus, we are reduced to reconstructing

[225] Eton 1805, 4-5.

Ottoman seamanship in the Black Sea through parallels, educated guesses and iconography. The first question to answer is whether vessels in these waters regularly shifted the yards when tacking. Considering the usual routes along the Bulgarian coast and the dominant winds in the sailing season, it is not likely that ships were forced frequently to beat tack upon tack to reach their destinations. Long boards on the same tack are more probable. Some limited maneuvering would have taken place when entering or leaving anchorages. All comparative material presented above demonstrates that, in cases of short boards, the yards were usually left on the same side of the mast. In my limited experience of lateen- (settee-, actually) rigged fishing boats in the 1970s, the sails were never shifted, rather it was accepted that on one tack the boat will sail less efficiently than on the other. Because these flat-bottomed boats had shallow keels and very limited weather-going abilities to begin with, it made surprisingly little difference to their performance. Yet, a small fishing boat is not a sail-propelled merchantman of some 160 tons.

An 18th - century engraving of the Ottoman port of Seraya in the Gennadeios Library in Athens (Greece) depicts two lateen-rigged small vessels sailing on the starboard tack (fig. 63).[226] The size of the image is small and details are not easily discernable, but it is clear that both are open boats, that the shrouds are set up with pendants and tackles and that the boat on the left is larger and it flies a foresail (a *polacca* or *polacre* sail) in addition to the lateen mainsail.

[226] Papadopoulos 1972, fig. 99.

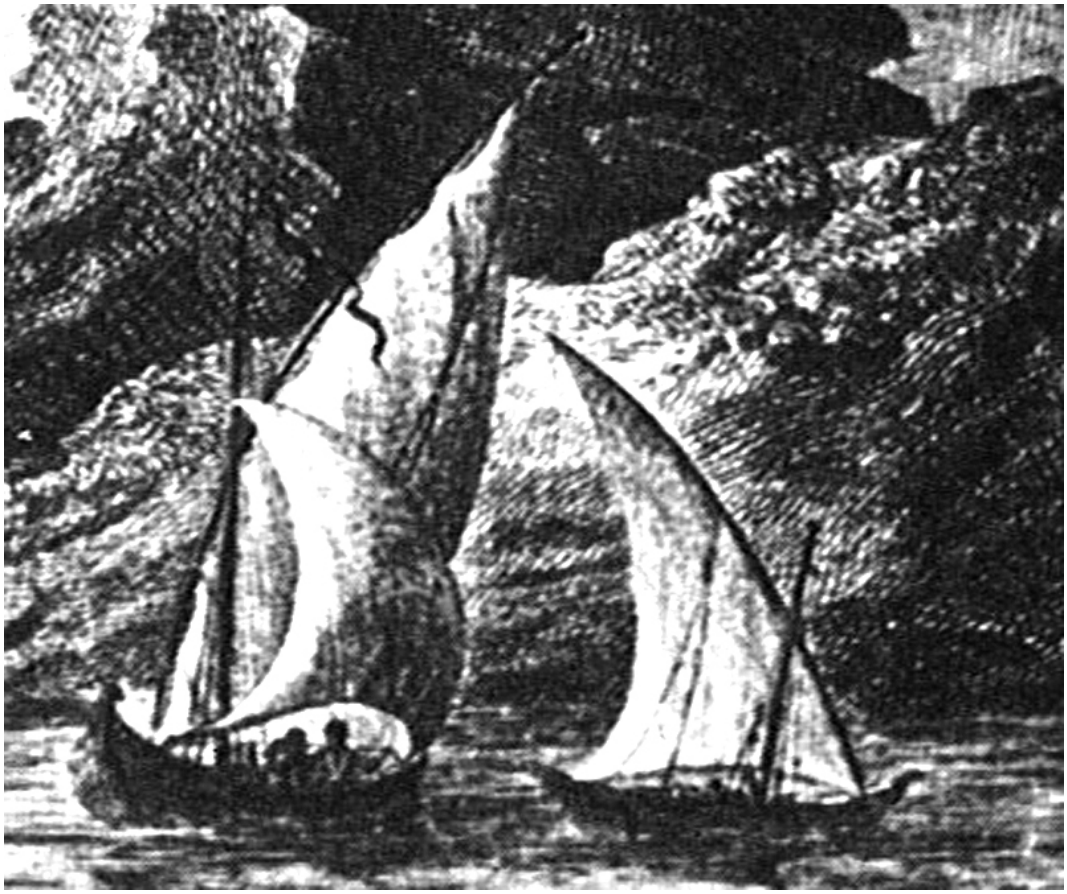


Fig. 63. Small lateeners on the starboard tack. Modified detail from an engraving of Seraya. After *The Greek Merchant Marine*.

This boat also has the yard on the windward side of the sail. The smaller lateener has its yard on the lee side of the mast. This engraving illustrates the vessels at the mouth of a harbor so it may be depicting the boats while making short boards, beating tack upon tack. From the presented evidence, we know that in such circumstances other lateeners could sail without shifting the yards. In other words, in this instance iconography simply confirms what we have already established.

The archaeological evidence suggests that the Kitten ship had a heavy forward rake to its single mast. Harland pointed out that this feature eased the shifting of the yard forward of the mast; therefore, we can hypothesize that this is how the crew of our vessel would have handled it.[227] Some additional support to the hypothesis comes from the provenience of the tye blocks, which seems to indicate that the halyard was passed from forward aft, as would be the case if the yard was to be shifted on the forward side of its mast. Yet further support is added by the presence of toggles. Had the yard been shifted aft, the way it was done on lateen-rigged mizzens on Northern European vessels, the need to shift the shrouds and therefore use toggles would not have been present.

When sailing on the wind, it is likely that the sail was on the inside of the lee rigging, as this seems to be attested to by most of the iconographic evidence. Close-hauled, the lee rigging would have interfered very little with the sail. Once the wind started moving to the beam and abaft it, two things would have occurred. First, the sail would begin to chafe on the rigging, especially in the case of baggy sails as used in this region according to Eaton. Second, the sail would have to be eased farther out from the centerline of the ship. The lateen sail is inherently unbalanced, as its largest part is aft of the mast. The farther aft of the beam the wind comes from, the less balanced the sail becomes, as its center of effort moves away from the hull's center. This dramatically alters the steering of the vessel, creating heavy weather helm. Once the sail is launched completely out, it will have the tendency of broaching the ship to. Two possible remedies existed, as

[227] Harland 2000, 12.

discussed by Harland.[228] First, it was possible to ease the tack (Harland refers to it as "bowlines") and cant the yard, with the front end of it (the "car" in Mediterranean lateen terminology) to rise and the upper end, the *penna*, to be lowered. When the vessels sailed directly before the wind, the yard could be brought perpendicular to the centerline of the ship and nearly horizontal. The spar could be set either before or abaft the mast, although in the later position the mast would have interfered with the sail and caused chafe.[229] Alternatively, it was possible to launch the polacre sail (or foresail) to weather, its foot spread on a boom, much like a modern spinnaker. Interestingly, the usual practice appears to have been to raise the polacre stopped with thin lashings, preparatory to setting. This way it was kept ready for setting even at anchor. Harland reproduces three Baugean engravings that illustrate the practice.[230] The use of a polacre set off the centerline of the vessel and suggesting that the "bowsprits" on such vessels were indeed more in the nature of a boom is also illustrated by the vessel in the engraving of the port of Seraya (fig. 63).

At this stage of the research, it is not possible to identify positively the ethnic affiliation of the crew of the Kitten vessel, although it is likely that they hailed from the present day Bulgarian Black Sea coast. This adds to the problem of insufficient source material to determine the probable crew organization. Villiers, in describing arrangements on the dhow on which he sailed in the 1930s, stated that there was no division in watches, the

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[228] Harland 2000, 13.
[229] Harland 2000, plates 57, 90, 98 depict lateen-rigged craft running before the wind with the yard aft of the mast. Plate 110 depicts a Turkish *djerme* with the yards forward of masts.
[230] Harland 2000, plates 52, 54, 87.

helm was relieved whenever somebody thought of relieving it, and all maneuvers required the entire crew.[231] He ascribed no great seamanship to the Arabs of the Red Sea, but noted that their abilities were adequate for the prevailing conditions in which they sailed. The low opinion that William Eaton had of Ottoman (evidently Turkish) sailors in the Black Sea (quoted above), although seemingly exaggerated and improbable in some details, makes it clear that in a Westerner's eyes those sailors were unskilled. Unfortunately, Eaton does not speak of the crew organization. Among the subject population of the Ottoman Porte, Greeks usually are considered the best seamen, which is not the same as being good sailors. Papadopoulos reproduced excerpts from travelers' accounts that do shed some limited light on crew employment. According to a quotation from A. L. Castellan: "… I have already mentioned their way of handling a ship; it contrasts still more with our own since they perform it according to their fancy. Everything is set in motion at once, without order or obedience to rules: there is neither discipline nor co-operation. The Captain's speaking-trumpet and the quarter-master's whistle resound unceasingly and often give contradictory commands. Silence, so scrupulously observed in our own vessels, is unknown to them; they urge each other on with shouts and maniacal gestures and accompany their efforts at hauling the shortest rope with a kind of song whose refrain is repeated by the ship-boys from the top of the masts. …"[232]

[231] Villiers 1961, 246.
[232] Papadopoulos 1972, 390.

C. B. Elliot wrote of Greek (Ottoman) ships that "… in the day there is no regular watch, and the helm is readily consigned to any passenger who offers to take it; while in the night, the steersman, who generally sits on the deck, and therefore cannot see ahead even with the aid of the moon, may or may not be accompanied by a watch on the forecastle; and this watch may or may not fall asleep: this is as it happens."[233]

Although the quoted passages vacillate between the hilarious and farcical, they are probably reasonably accurate, as close acquaintance with the Balkan character would suggest. They also suggest the likelihood that on the Kitten vessel, no regular watch was kept either and that for any maneuver such as tacking or wearing, the entire crew of 16 to 18 people had to be gathered.

CONCLUSIONS

It is unlikely that we will ever be entirely certain how the ship from Kitten was rigged. The limited nature of the archaeological material permits us no more than an educated guess. The surviving toggles and lack of deadeyes strongly suggest that the ship carried a lateen rig, which is known to have been popular in the region. Only one mast step was found during the excavation, located amidships, and this probably indicates that the ship had a single mast. Iconographic evidence supports the hypothesis. The double and treble sheaved blocks suggest that a single, very large yard carried most of the sail area. The

[233] Elliot 1838, Vol. II, 160-61.

bowsprit and foresail (staysail or polacre) added on the reconstruction drawing are not based on archaeological data, but seem to be a reasonable proposition, as otherwise the centre of the sail area would be too far aft and the ship would have carried too much weather helm. There is plentiful iconographic evidence for the use of such foresails. The proportions of the rig are even more open to question than the type. The proposed values are based on averaging proportions from different sources and the best that can be said is that they are reasonable values.

Undoubtedly of great interest is the unusual material and construction of the lines which may be typical for the Bulgarian Black Sea coast in the 18th -19th century and as late as the first half of the 20th century. From this one can infer that, in essence, the shipbuilding industry along the shoreline of present-day Bulgaria was self-sufficient when manufacturing lines. It is likely that the lines were weaker than equivalent thickness of manila or hemp and probably needed more frequent replacement. The fairly flexible sail plan, with the ability of the sail to spill gusting wind, would have helped save the lines and keep the rig standing.

In conclusion, for the region in which operated the Kitten ship was a large cargo carrier that may have been involved either in the grain or timber/charcoal trades on the western Black Sea shore. Most likely the ship had one mast with a large lateen sail and may have also carried a bowsprit and foresail. The crew was probably large in comparison to equivalent tonnage Western vessels and archaeological finds, such as the number of

wooden spoons hint that it numbered about 17 or 18 men and boys. Such large numbers would have been sufficient to control the unwieldy lateen sail. The conjectural nature of the rig reconstruction makes it hard to estimate the vessel's speed, but historical sources suggest that speeds of 8 to 10 knots were within the reach of similar lateen-rigged vessels.

CHAPTER VI

ARTIFACTS FROM THE KITTEN SHIPWRECK

According to the agreement among the directors of the Kitten ship excavation, the task of analyzing and publishing the artifacts recovered during the project rests with the Bulgarian Center for Underwater Archaeology. The two exceptions are the smoking pipes and paraphernalia, and the rigging artifacts, both of which were studied by the author. For this reason the present chapter is no more than an extended catalog of the finds. Any discussion is limited to insights into the dating of the wreck, the likely trade routes served by the ship, and the ethnic background of the crew.

The overwhelming majority of objects were found in two areas of the wreck: most, not surprisingly, were in the area that comprised the small stern cabin, while the rest were found in the extreme bow of the ship. Stray artifacts were recovered from the central part of the hull, but they were few. From this area came one or two broken pipes, fragments of rigging blocks and large quantities of line. The double block and the remains of one barrel with iron hoops were found amidships, but outside the hull. The second barrel that Porozhanov reported in the 1980s was not relocated.

The richest assemblage of finds came from the stern cabin. Virtually all higher quality copper utensils were recovered from that part of the ship. Most of the personal items also

came from there, as did the complete skeleton of a goat kid with a brass bell around its neck. The presence of a live baby goat in the cabin at the time of the ship's loss is evidence that the sinking was due to a sudden catastrophe, with no time for evacuation. The smoking paraphernalia was also discovered in the stern cabin. From the distribution of the finds, it is clear that in Black Sea ships the higher status members of the crew (and possibly passengers) were quartered in the stern quarters, tiny as they were on this vessel.

A few interesting items were discovered in the bow. To starboard, between the frames, were found two small green-glazed jugs with pinched rims. Seven such jugs were also recovered in the 1980s and are still to be seen in the storage area of the Sozopol Museum of Archaeology; recently one of them was conserved and is now on display in the museum. Of more interest are the items that were recovered from the port bow, immediately outside the wrongheads. Besides the remains of a served line eye, that may have been part of a stay, we found heavily corroded remains of yet more copper utensils (these were not recovered, as they were in small pieces), the remains of what we believe to have been a toiletries box, and a mirror and two lenses with wooden rings treaded for screwing into a tube – possibly the ocular for an octant or sextant.

No recognizable cargo was found on board, which suggests that the ship may have been lost at Cape Urdoviza while waiting to load or was carrying a buoyant cargo that floated away after the hull broke up. The town of Kitten has existed only since the 1930s, but

until the 1940s three loading stages operated in the southern and northern bays of the cape. Two of them were located in the southern bay, where the wreck was discovered. One of the two was close to the mouth of the Karaagach River and the other one in the immediate vicinity of the cape. From these quays charcoal and timber for Istanbul were loaded. It is not certain which of the two cargoes, if in fact either of them, the Kitten ship was destined to transport. The large (for the region) displacement of 160 tons implies bulk cargo of some sort. No trace of charcoal was found on board ship, nor was there any evidence found that timber was the intended cargo. Structural characteristics of the hull may offer clues in this respect. The vessel has a completely sealed bottom with tightly laid thick ceiling planks nailed in place. The sole pump opening was discovered without the pump tube and covered completely with a flat softwood board. A similar characteristic on the Clydesdale Plantation Sloop was interpreted as indicating an adaptation for rice carrying.[234] It is possible that the sealed bottom of the Kitten ship may have been an adaptation for carrying grain. This hypothesis is supported by the fact that grain was a major export from the Bulgarian lands to Istanbul. A large wooden ladle with grains of wheat stuck to it was discovered amidships, too. However, it is equally possible that this ladle was for the use of the crew, who likely crushed their own grain for meals as suggested by the discovery of a large marble mortar and a crude wooden pestle in the stern cabin.

[234] Fred Hocker, personal communication.

It is known that charcoal was exported from the bay. It is also known that brooms are used in charcoal burning for beating out the flames and thus, the nine brooms found in the stern cabin, may be pointing towards charcoal as the intended cargo. This, however, is not a clean commodity and it ought to have left traces of its presence on board had it been shipped before, and yet, none was discovered. Timber was also loaded in the bay, but no logs, cut timber, timber-handling tools or related artifacts were found to provide evidence for this type of freight. In conclusion, the ship's intended cargo cannot be determined with certainty, but charcoal or grain seem most probable.

CERAMICS

Surprisingly, ceramic vessels were relatively few in number. Earthenware predominates, mostly green glazed jugs or carafes with pinched rims. A number of such jugs were recovered in the 1980s, of which six are still preserved in storage and one is on display at the Sozopol Museum of Archaeology. Nearly identical jugs were discovered during the excavations of Sveti Ioan Predtecha (St. John Podromos) Monastery on the island of Sveti Ioan (St. John), in front of Sozopol Harbour. The monastery was destroyed by the Turks in 1628 and never rebuilt. Based on the finds from the closely datable context of the monastery ruins, the Kitten ship jugs were assumed to be typical for the 16th - 17th centuries, and it was partially on this basis that in the 1980s the wreck was dated to the same period. To the best of my knowledge this type of ceramics has not been extensively studied or published. In addition to the examples found in the 1980s excavation, more of

these jugs were found in 2003 in the starboard bow (square I3) between the frames and were almost certainly used for water storage. Not surprisingly, they were filled with mud and sand when raised. The examples found in the 1980s came from the same location.

The stern yielded a meager number of ceramics. The most interesting and diagnostic was an earthenware plate (KT050) from the workshops of Chanakkale on the Asia Minor side of the Sea of Marmara. The pottery manufactures at Chanakkale were active from the 1740s to the 1920s. The deep plate is red earthenware with a shallow base ring (fig.64).



Fig. 64. KT050. Late 18th-century slipware plate from the workshops of Chanakkale. Photo: K. N. Batchvarov.

It was dipped in white slip on which is incised a stylized floral ornament in a lozenge arrangement. The decoration is of a brownish color, while the dish is finished with light yellow glaze. The narrow rim has four segments of latticed patterns between two concentric circles. It has the following dimensions: diameter: 24 cm; height: 4.5 cm; base diameter: 15.3 cm; rim width: 2.4 cm; Wall thickness: 0.55 cm. Numerous broadly similar plates have survived in different collections and museums in Turkey, Bulgaria and even in France. An identical plate, but broken and with missing pieces, is in the collections of the Varna Museum of Archaeology.[235] Valentin Pletnyov dates it to the end of the 18th or early years of the 19th century. Fragments of two broadly similar plates were found in the excavations at Saraçane.[236] Hayes considers this type to be late and tentatively dates it to the late 19th century. Hülya Yilmaz disagrees and dates this type of Chanakkale plate to the second half of the 18th century, reasonably close to the date Pletnyov assigns to this example.[237] Henri Amouric *et al.* date this type of plate to the late 18th century as well.[238] In the context of the artifact assemblage from Kitten, a late 18th-century date seems consistent with other evidence.

Two earthenware inkpots were discovered, one came from the stern (KT079; dimensions: height: 4.1 cm; maximum diameter: 5 cm; opening diameter: 2 cm), and the other from the port bow of the ship (fig. 65). The one in the stern (KT080; dimensions: height: 4.4 cm; maximum diameter: 5.8 cm; opening diameter: 2.6 cm) had a small

[235] Pletnyov 2002, 22.
[236] Hayes 1992, plate 44.3 and 44.4.
[237] Hulya Yilmaz, *The Suna and Inan Kirac Collection of Çanakkale Ware*, http://seramik.kaleicimuzesi.com/english/koleksiyon.html, Accessed on April 18, 2008.
[238] Amouric et al. 1999, 157-58, fig. 288.

conical lead weight inside it, which probably served to keep the ink mixed and as ballast for the inkpot. Traces of ink are still visible. Neither had lids when found. In the 1980s two bronze inkpots, were raised but they cannot be located. The large number of inkpots is notable. It is only to be expected that someone on board a merchantman would be literate, but the distribution in two separate places on the ship, and the relatively large number and different materials used in their manufacture suggest more than one literate person on board, which could be indicative of large scale trade.



Fig. 65. Inkpots. KT079 on the left and KT080 on the right. Photo K. N. Batchvarov.

In the stern cabin a large unglazed earthenware jug (KT112; Dimensions: height: 39 cm; bottom diameter: 12.5 cm; maximum diameter: 14 cm) of coarse clay was also discovered (fig. 66). It is much larger than the green-glazed jugs, but, like them, has a pinched mouth and for this reason Hristina Angelova described it as an *oinochoe*. Likely, it contained water and was the product of some small workshop in one of the ports

visited by the vessel. In the starboard bow the lower part of a similar jug was also discovered.



Fig. 66. KT112, an *oinochoe*-type jug from the stern cabin. Photo K. N. Batchvarov.

Manufacturing decorative tiles has a long history in the Ottoman Empire. Two whole (KT047, KT048) and one broken tile (KT049) were discovered in the starboard side of the stern cabin. Their dimensions are identical: side length 15 cm and 2.3 cm thick. When found, they were believed to be from the galley, but subsequently it became clear

that they were independent finds. The pale ochre clay has a fine texture and the glaze is well-preserved, but the floral decoration is unimpressive (fig. 67). The colors are suggestive of late 18th-century production, but the dating and identification of the manufacturing center remains for the detailed study of the artifact collection. Aboard ship, the tiles were probably used as coasters for hot pots.



Fig. 67. Ceramic tiles from the stern cabin. From left to right: KT047, KT048 and KT049. Photo K. N. Batchvarov.

Fragments of at least three, and possibly more ceramic, green-glazed candlesticks were recovered. Two of the fragments were located forward of the stern bulkhead, but originally they likely were placed on a shelf inside of it. Fragments of one or two more candlesticks were found close to the bow of the ship. All candlestick fragments are made of the same pale ochre earthenware. At least two similar fragments were also recovered in the 1980s and are still in the storeroom of the Sozopol Museum of Archaeology.

Fine ceramics were largely absent from the wreck. Immediately forward of the stern cabin bulkhead and, therefore, probably spilt from there, excavators found a small green glazed cup (KT082; height: 4 cm; diameter: 6 cm) without a handle. The vessel is typical of Ottoman coffee cups (fig. 68).



Fig. 68. KT082 Coffee cup. Photo: K. N. Batchvarov.

Although the clay is fine textured, the quality of the glaze is fairly low and it has crazed extensively. Its place of manufacture is not known at the moment, but the cup does not appear likely to be a product of the Kutahya workshops, which specialized in finer ware and by the late 18th century were in decline. Accessible published material on Chanakkale products do not show convincing parallels for this cup either. It may have

been a product of Lule Burgaz (Arcadiopolis) in Eastern Thrace, as it is known that this town had an extensive pottery industry.[239] In the lower levels of the wreck, especially among the ballast, a few fragments from higher quality faience and porcelain vessels were discovered. Most are not diagnostic, but it is likely that they are from coffee cups. One or two of the fragments include part of the bottoms of cups and one of the porcelain pieces has the crossed swords of the German Meissen porcelain manufactures. Hayes reports that imitation Meissen stamps were common, so the presence of the swords on this bottom does not necessarily mean that the cup was a Meissen import. However, it confirms that the vessel must have made its fatal voyage after the mid-1760s.

COPPER UTENSILS

Among the most notable part of the artifact assemblage were the 17 copper vessels that were discovered in nearly perfect condition. The poorly preserved remains of at least another three cauldrons were also observed in the bow area of the wreck, to port, but they were not raised due to their fragmentary condition. In the 1980s another group of three, possibly four, poorly preserved cauldrons were found in the starboard bow. They were not conserved, but the pieces are still in storage at the Museum in Sozopol.

Sixteen of the seventeen discovered vessels were found in the stern cabin of the ship; one small, but heavy copper cooking cauldron was found amidships, to port. It may have

[239] Walsh 1828, 80.

served for the preparation of the crew's food which was typically a soup or stew. The copper vessels in the stern demonstrated some level of social stratification among members of the crew. The higher status personages ate their meals on good quality, expensive vessels in the relative privacy of the small stern cabin.

From modest usage in the 17th century, demand for copper vessels increased dramatically through the 18th and 19th centuries and did not begin to decrease until the second half of the 20th century. The rapid increase in the demand for copper household products in the 18th century is associated with the re-urbanization of the Bulgarian population and its improving economical status, despite the foreign overlordship of the Ottoman Turks. Most purchasers of such copper products were Bulgarian elites, and many of the products were commissioned for specific persons. By and large the copper industry was in the hands of Bulgarian craftsmen, although Turkish and Pomak (Bulgarian Muslims) craftsmen worked in the Rhodope Mountains also.[240]

The general practice of melting and reusing copper has assured that few items have been found in dateable archaeological context, but some surviving examples bear inscriptions, frequently with dates. Although some move towards standardization is discernible and makes it difficult to identify specific workshops in the absence of stamps or inscriptions, general patterns in decoration can usually be broadly assigned to specific ethnic groups within the Ottoman population. Thus, Bulgarian craftsmen appear to have preferred

[240] Bakirdjiev 1957, 21.

clean, open surfaces with simple single line decorations.[241] Later in the 18th century heavier decoration began to appear, but the general shape of the vessels remained the same.[242]

The large and varied collection from the Kitten Shipwreck may give some indication of the dominant regional cultural influence among the officers and crew, once it is studied in detail. Here only a brief description and analysis are offered. Of the 17 copper vessels recovered from the wreck, only 13 were available for study. The first four raised in 2001 were still in the conservation laboratory of Professor Vessela Inkova, a renowned Bulgarian specialist in metal conservation. These four vessels consisted of a decorated *ibrik* (pitcher), two deep plates – *sahan* – and a single flat, thin-walled *sahan*. When last seen in 2001 the vessels were in fair condition, although the deeper sahan's bottom was heavily eroded. The present condition or exact location of the items is not known. The vessels described here were conserved by Dr. Georgi Mavrov of the Museum of Sofia.

Discovered in 2001, although not raised until 2002, a copper jug with a hinged lid (KT005; Dimensions: height 15 cm [without lid]; diameter of mouth: 9 cm; bottom: 13.2 cm) was found immediately aft of the cabin bulkhead, wedged between the futtocks of the starboard side. A similar item is illustrated by Bakirdjiev in his Appendix.[243] Bakirdjiev's example, like KT005, is not dated and has virtually no decoration.

[241] Bakirdjiev 1957, 21-2.
[242] Bakirdjiev 1957, 23.
[243] Bakirdjiev 1957, plate 52.

According to Bakirdjiev it is a vessel used for warming *rakia*, a popular home-brewed brandy. Assuming the identification is correct, the presence of this vessel would strengthen the argument for Christian ownership of the ship, as Islamic practice forbids consumption of strong spirits.

KT006 is another deep *sahan*, similar to those in Prof. Inkova's hands. The inner diameter (without the broad rim) is 16 cm and the depth of the sahan is 2.4 cm (fig. 69).



Fig. 69. KT006 Sahan. Photo: K. N. Batchvarov.

The 20.8 cm-diameter vessel (including the rim) has a relatively thick wall of 0.14 cm and has preserves traces of tinning, a technique commonly utilized for copper vessels intended for food preparation or consumption. The sole decorative element on the bottom of the plate is an incised circle. The perfect accuracy of the circle and the general smoothness of the surfaces imply that the vessel spun to shape on a lathe from sheet copper. KT067 is nearly identical, although thicker (c. 3 mm) and with some decorative hatching along the rim (fig. 70).



Fig. 70. KT067 Sahan with hatched decoration on the rim. Photo: K. N. Batchvarov.

Its dimensions are diameter 22.8 cm, bottom diameter 16 cm, depth: 3.4 cm and rim width 2 cm. This type of deep *sahan* is not rare. The National Museum of History in Sofia has at least one on display, inscribed with a date of 1739. Bakirdjiev offers parallels also, generally ascribed to the mid-18th century.[244] Dr. Vera Kovacheva of the National Ethnographic Museum in Sofia, a renowned specialist in copper vessels in Bulgaria, advised me that, generally speaking, the thicker the wall, the earlier the date of a copper vessel. The sahan type of plate was popular and likely had a long use span.

A flat, thin-walled plate, KT065, is also in excellent state of preservation (fig. 71). The plate has dimensions of 27.3 cm maximum diameter, inner bottom diameter of 17 cm, 5 cm wide rim and wall thickness of 0.01 cm.

[244] Bakirdjiev 1957.



Fig.71. KT065 A shallow and thin-walled plate. Photo: K. N. Batchvarov.

Two similar plates are in Professor Inkova's laboratory. Neither of the plates bear any inscription to help with dating, but an identical plate in the National Museum of History in Sofia has an inscribed date of 1757. Thus, this type of *sahan* can also be dated to the second half of the 18th century. The slightly later date in comparison with KT006 and KT067 is supported also by the thinner wall – c. 0.1 cm. Bakirdjiev published a photograph of an identical *sahan*, with an inscribed date of 1773.[245]

[245] Bakirdjiev 1957, 25, fig. 9.

A broad and shallow copper cooking dish, KT066 (diameter 24.1 cm; diameter of bottom: 21.7 cm; depth: 6 cm; rim width: 1 cm) with two hinged handles, a *tava*, was raised in 2001 from the stern cabin (fig. 72).



Fig. 72. KT066 A *tava*. A similar vessel Bakirdjiev calls a *caravana*. Photo: K. N. Batchvarov.

Similar dishes are even today widely used in Bulgarian villages and small towns for cooking. Bakurdjiev did not publish exact parallels. KT066 cannot be unique and no doubt research will yield parallels in ethnographic collections. The thinner wall would suggest a date of the latter 18th century or even later. Bakirdjiev published a somewhat

similar vessel, from Karlovo, which he calls a *karavana.*[246] The handles, however, are not hinged, but firmly riveted to the sides, as far as can be judged from the photograph.

A very poorly preserved tall beaker (KT009; height: 16.3 cm; diameter: 7.4 cm; wall thickness: 0.05 cm) was found in direct proximity to KT005. The side has a large piece missing and the bottom has also deteriorated beyond recovery. No parallels are illustrated by Bakirdjiev, but the general type appeared in the late 18th century and was widely distributed by the early 19th century.[247]

KT008 is a small copper cauldron of conical shape (height: 23.1 cm; diameter (upper): 22 cm; bottom diameter: 25 cm; wall thickness: 0.3 cm). The sides meet the bottom at a very sharp angle. The vessel is well preserved, with thick, heavy walls and bottom. No attachment point for handles was observed, although typically this class of cauldrons has one, for hanging above an open fire. It was found amidships and does not appear to have been in the stern cabin at the time of sinking. It is possible that the food for the crew was prepared and served in this cauldron.

KT007 (diameter: 15.5 cm; height: 11.1 cm; depth: 9.8 cm) is a small copper bowl, known as *tas* or *tazza* (fig. 73). The vessel looks like a bakers bowl, but was used for mixing wine and water.

[246] Bakirdjiev 1957, plate 48.
[247] Bakirdjiev 1957, 23.



Fig. 73. KT007 Tas or tazza. Photo: K. N. Batchvarov.

Bakirdjiev illustrates two broadly similar vessels and ascribes it to Karlovo, a wealthy small town in the *Podbalkan* (Sub-Balkan, the valley between the Balkan Mountains and the Sredna Gora - Middle Range - Mountains, in central Bulgaria). He assigns an 18th century date to them.[248] It seems at least possible that KT007 was also a product of the Karlovo workshops, as were KT064 and KT063. Both these items are of great interest. KT064, a large poorly preserved basin, was raised in 2002 from the stern cabin. It has dimensions of 35 cm maximum diameter, depth of 10.6 cm and rim width of 7 cm. The rounded shape of the bowl and the large, incompletely preserved rim quickly made us nickname the find "Don Quixote's Helmet", because of its resemblance to a barber's basin. An identical item with complete rim is illustrated by Bakirdjiev and described

[248] Bakirdjiev 1957, 22, fig 7, plate 23.

simply as a basin.[249] KT 063 is a filigree lid (max. diameter: 21.1 cm; diameter of boss or handle: 7.5 cm; total height: 3.7 cm), which originally was identified incorrectly as part of a lantern (fig. 74).



Fig. 74. KT063 Lid, probably of basin KT064. Photo: K. N. Batchvarov.

It is here re-classified as the lid of basin KT064 (fig. 75), based on two identical items published by Bakirdjiev (figure 28). They are identified in the captions of the illustration

[249] Bakirdjiev 1957, fig. 28.

as products of the Karlovo workshops and dated to the latter 18th century.[250] No dated examples of filigree-decorated vessels were known from a period later than the first third of the 19th century at the time Bakurdjiev published his study.[251] It appears likely that KT063 and KT064 form a basin with a lid, on the boss of which stood the *ibrik*. They were used for washing hands prior to a meal in the Ottoman Empire.[252]



Fig. 75. KT064 Basin. KT063 was probably the lid of this basin. Photo: K. N. Batchvarov.

KT011 is a copper serving tray or *siniya* (fig. 76). The tray has a diameter of 49 cm. Such trays frequently substituted for low tables, *sofri* (singular – *sofra*). The siniya, when used as sofra, was popular throughout the 18th century, especially among the

[250] Bakirdjiev 1957, 56, fig. 28.
[251] Bakirdjiev 1957, 30.
[252] Pulak, personal communication.

Turks, but was also used by Bulgarians. It was especially widely used in the region of the Rhodope Mountains.



Fig. 76. KT011 *Siniya* or carrying tray. Photo: K. N. Batchvarov.

Most surviving examples were manufactured in Istanbul, Solun (Thessaloniki, now in Greece) or Odrin (Adrianople, Edirne, now in Turkey). There appears to be some evidence for Bulgarian manufacture, too, especially from Ustovo in the Rhodope Mountains, from around 1765.[253] As with almost all other copper utensils from Kitten, the only decoration on the siniya consists of three sets of concentric circles cut into the surface of the metal. This tray, too, was evidently worked on a lathe. The lack of

[253] Bakirdjiev 1957, 24.

decoration and the wide clear surfaces argue in favor of Bulgarian craftsmanship, rather than Turkish.

A very interesting artifact recovered from the stern cabin is the copper brazier, KT119 (fig. 77). It is manufactured of two parts, the upper section where the charcoal burned and lower which serves as a stand. The two parts are riveted together with three copper rivets with large flat heads. Two oversized handles are riveted opposite each other. Their large size may have helped to move the heated brazier, without burning one's hands. This type of brazier is used for heating, suggesting that the captain and possibly his family lived on board the ship in the colder seasons, too. Bakirdjiev illustrates a vaguely similar, though evidently taller brazier from Karlovo (Plate 34). The dimensions of the brazier are: total height: 20 cm; Diameter (with rim): c. 43 cm; diameter of bowl: 27 cm; rim width: c. 8 cm; depth of bowl: 8.44 cm; diameter of the bottom with the flange: 28 cm; lower half height: 9.3 cm; flange width: 1.1 cm; wall thickness: 0.1 mm. Another similar example is on display in the Ethnographic Centre in Kazanluk, another town in the Sub-Balkan.



Fig. 77. KT119 Copper brazier. Photo: K. N. Batchvarov.

Neither Bakirdjiev nor Anastas Primovsky include similar examples for the two-part copper candleholder (KT115) found in the stern cabin, between the starboard frames.[254] The candlestick is manufactured in two sections, the base and the standing body which held the candle. It measures 16 cm high with diameter of the base of 14.35 cm (fig. 78). The diameter of the candle holder is 2.4 cm. The two parts screw into each other and can be disassembled. The artifact was probably hammered (or cast) and then finished on a lathe, as were the other copper finds. It is in an excellent state of preservation and is almost completely devoid of decoration beyond its general shape and incised circles. Stylistically and in the high quality of its production, the candleholder fits well with the assembly of copper utensil aboard the ship.

[254] Primovsky 1955.



Fig. 78. KT115 Two-part candlestick. Photo: K. N. Batchvarov.

Although these are only preliminary notes on the copper assembly and a detailed study remains to be undertaken, some general conclusions may be offered. It would appear that most items come from either Karlovo or the general Sub-Balkan region. If so, the likely manufacturers were Bulgarians. The smooth surfaces, with little or no decoration also point in the same direction for their manufacture. The siniya, although more popular among the Turks and the population of the Rhodope Mountains, does not preclude Bulgarian manufacture either, and may have found its way on board the ship as

adaptation to the limited room available. The presence of a large collection of copper utensils in the stern cabin suggests that its inhabitants, most probably the captain and possibly his family, were not struggling economically. The concentration of the finds in the stern also points to social divisions within the crew. Although it appears likely that the copper vessels were manufactured by Bulgarians, this does not necessarily mean that the crewmembers of the vessel were ethnic Bulgarians too, for copper utensils were a valued commodity and widely traded.

WOODEN SPOONS

The justification of putting the spoons in a separate category lies in the sheer quantity recovered -17 (one was also found in the 1980s, for a total of 18) - and the identification of three different types among the recovered examples. Most of the spoons appear to be carved from willow, which is the preferred species for this type of carving to the present day.

By far the largest group, for convenience here called Type I, consists of spoons with straight, parallel-sided bowls, ending in more or less sharp points forward (KT018, KT019, KT020, KT024, KT029, KT030, KT033, KT051). The back side of the bowl terminates in well-defined “shoulders”, a straight line perpendicular to the handle. The shape of the handles varies. Most have half-round handles with flat upper surfaces and chamfered edges. The width of the chamfering varies and so does the general quality of

the carving. Rectangular (KT031), octagonal (KT023) and hexagonal handle sections (KT026) are preserved (fig. 79).



Fig. 79. KT026 Type I spoon with hexagonal handle. Photo: K. N. Batchvarov.

The second group, Type II, consisting of spoons KT025, KT027 and KT032 is characterized by a pear-shaped bowl, with the narrower end of the bowl attached to the handle. At the transitional point between handle and bowl, the handle is squared and has a floral decorative element carved on its upper surface. KT025 and KT032 have handles that are elliptical in section, while the handle of KT027 has a flat upper surface.

Type III is represented by spoons KT021 and KT022. The type is close to Type I, but the bowl is oval in shape and ends in a sharp point. The handles are similar to those of Type I spoons.

The spoon collection may provide our closest estimate of the Kitten ship's crew size. If we subtract two for the woman and the child, the remaining 16 may be the number of

sailors on board. However, there is no certainty that the recovered spoons are all the spoons originally used on board. Neither is it certain that each individual on board had his or her own spoon because no personal identifying marks were found on any of these artifacts. Conversely, a crew size of 15-16 men is probably appropriate for a 160-ton lateen-rigged vessel, as lateeners require large manpower to handle them.

COINS AND TOKENS

During the last season of the expedition, three brass tokens or jetons and two Ottoman silver coins were found at the stern bulkhead. One of the jetons has eroded so badly that it is illegible. The other two, although damaged, proved to be readable. The silver coins have not escaped deterioration either, and are thus difficult to identify. These are the only two coins discovered on the wreck.

Token KT101 has an irregular shape and was struck slightly off center of the brass blank (fig. 80). On the reverse of the token is depicted a ship, viewed from the port quarter. The depiction is highly stylized and appears to illustrate a two-decked warship. It is surrounded by the motto *Plus Ultra* (Further Beyond) of the Holy Roman Emperor Charles V. Subsequently, this also became the motto of Habsburg Spain. According to mythology, the Pillars of Hercules (Straits of Gibraltar) bore the warning *Nec Plus Ultra* or “nothing further beyond” to prevent sailors from falling off the earth. The adoption of the modified motto by Charles V was meant to state a commitment to going further than

any before him. The association with the Pillars of Hercules is probably the connection between the motto and the ship depicted on the token. The obverse contains a sun face, moon and stars. Around the periphery is inscribed “E. L. S. Lauer RECHEN PF.” The first stands for Ernst Ludwig Siegmund Lauer, the manufacturer of the jeton. Lauer evidently was born in 1762, started work in or about 1783 and retired in 1833. It appears that he died as late as 1845. The second part of the inscription is to be read as *rechen Pfennig*, or “accounting token” in German. It appears that Lauer struck large quantities of this type as they frequently appear on internet auction sites. A Lauer jeton was also found at Corinth in Greece, but as the article did not include an illustration of it, I cannot be certain that it is identical to KT 101.[255]



Fig. 80. KT101 An accounting token struck by Ernst Lauer. Photo: K. N. Batchvarov.

[255] Williams II 1989, 48.

Bulgarian archaeologist Boni Petrunova reports what appears to be a similar jeton from Simeonovgrad in Southern Bulgaria, near the Maritza River.[256] She has not published an illustration, but from the description in her catalog, it is evident that the KT101 and her jeton are very similar, if not identical. Petrunova notes that this type of jeton has not been the subject of studies, and their function is not certain. She implies that they are usually associated with maritime activities, as the most frequent finds in Bulgaria are from German and Austrian manufacturers and, according to her, made their way into Bulgaria through Danubian trade. Finding this jeton close to the Maritza River, she argues, implies that the river may have been navigable until recently. Petrunova assigns a 17th-18th century date to the jeton and reads the inscription on the obverse as follows: LVD LAVER.KECH PFEN. The reverse has PLUS ULTRA inscribed. Evidently the Simeonovgrad find is another Lauer product. LVD LAVER should be read as Ludwig Lauer. KECH has no meaning and there can be little doubt that it actually says RECH for *rechen* as on the KT101. A 17th-century date is improbable as Lauer was born in 1762.

KT 102 is a similar accounting token (fig. 81). On the obverse is a setting sun with rays and stars above it. Along the periphery is inscribed Iohann Christian Reich RE. P.F. On the reverse is depicted a double-ended 3-masted ship, surrounded by the motto MIT GLUCK (German for With Luck). RE. P.F. most probably must be read as *Rechen Pfennig Fecit*. According to L. Forrer in the *Biographical Dictionary of Medalists*

[256] Petrunova 2006, 315, 324, Inv. N 5.

Johann Christian Reich was a Bavarian, born in Eisenberg (Saxe-Altenburg) about 1740. In 1758 he settled at Furth and died in 1814. He appears to have started a counter and medal manufacturing business about 1762. His business interests were extensive and included the ownership of a factory for organs, clocks, mathematical instruments, and musical boxes. A Reich manufactured token, dated to the latter 18th century, was found at the Ottoman Citadel of Alanya and from the description appears to be identical to KT102.[257]



Fig. 81. KT102 An accounting token struck by Johan Christian Reich. Photo: K. N. Batchvarov.

Two Ottoman silver *para* coins were recovered from the same area as the tokens. KT100 was struck off centre and about half of the tughra is missing. However, it may be the

[257] Bilici 2005. Accessed May 13, 2008.

same as KT099, which appears to be an 18th-century coin.[258] Dr. Cemal Pulak tentatively identified KT099 as bearing the tughra of Sultan Selim III (1789-1807). According to Pulak the coin was minted in Misr (Egypt) (fig. 82). This find provides a *terminus post quem* date for the sinking of the Kitten ship of 1789.



Fig. 82. KT099 An Ottoman parah coin from the reign of Selim III. Minted in Misr (Egypt). Photo: K. N. Batchvarov.

CARVED WOODEN PLAQUES

In the 1980s a small wooden plaque with St. Andrew's cross incised on it was recovered. Based on this find and a piece of pig's hide, Dr. Kalin Porozhanov suggested that the vessel was owned by Christians.[259] Although the ownership cannot be determined with

[258] Igor Lazarenko, Assistant Director of the Varna Museum of Archaeology, personal communication.
[259] Porozhanov 2000.

certainty, it appears likely that it was at least crewed by Christians. Some finds from the 2000-2003 joint expeditions seem to confirm this view. Fragments of at least six different wooden plaques have been recovered. Only the first to be discovered, KT068 (raised in 2001) does not have crosses inscribed in one form or another. However, it is the most spectacular of the lot, as it is the only one to show skillful, accomplished floral carving and still bears remains of gilding (fig. 83). The plaque was carved on both sides. One of the edges seems to bear a trace of hinge carved out of the wood and may have formed part of a diptych or triptych. On one face is carved a round indentation which probably contained an appliqué, possibly the depiction of the guardian saint of the crew. The preserved dimensions of the plaque are length 20.5 cm; width: 10.5 cm, and 0.85 cm thick. Tentatively, it is proposed that KT068 was part of an iconostas, a screen that acts as support for icons, although it may also have been part of a box.



Fig. 83. KT068 Front and back sides of the gilded plaque. Discoloration from a fastener is visible. Photo: K. N. Batchvarov.

The other plaques are even more fragmentary than KT068. KT071 is a fragment, apparently a quarter, of a plaque identical to KT069 (fig. 84). KT070 (fig. 85), KT072 (fig. 86) and KT073 are not carved, but a nearly identical decoration is cut with a v-shaped gouge: a cross within a square lozenge, both of which are circumcised by a circle.



Fig. 84. KT069 Carved plaque with cross decoration. Photo: K. N. Batchvarov.

Between the corners of the square and the circle, diagonals are cut with a v-gouge. All plaque fragments were decorated on both sides and therefore were meant to be seen from both sides, thus eliminating the possibility that they were part of a paneling. At the moment, the only hypothesis that can be offered is that they, too, were part of the iconostas, though what that iconostas might have looked like and how the pieces were assembled and related to each other is unclear. Once the Bulgarian Center for Underwater Archaeology completes a detailed analysis of the finds from Kitten, these questions may be answered convincingly.



Fig. 85. KT070 on the left and KT072 on the right. Photo: K. N. Batchvarov.

The contemporary English sailor, journalist and traveler James Silk Buckingham relates that a small "altar" was attached to the cabin bulkhead of the small vessel on which he travelled from Egypt to Syria in December of 1815. The vessel was crewed by Arab Eastern Orthodox Christians and they regularly burned incense and kept a small lamp lit in front of an iconostas.[260]

PERSONAL EFFECTS

Very few items were found on board that could be described as personal effects. At least three possible explanations come to mind for this paucity: there was enough time during the sinking to evacuate with valued personal items, there were very few personal items on board, or most personal effects have dispersed during the wrecking process. The

[260] Buckingham 1821, 9.

presence of the goat skeleton in the cabin argues against the first explanation. Most probably, there were few personal objects on board. The few items that have been found, however, give us interesting clues for life on board.

A small wicker box, KT034, was found in the port bow, with its bottom and top made out of single pieces of thin softwood plank. On top of the cover was roughly incised a graffito of a single-masted, square-sterned vessel with high bow and stern, possibly a *saique*. The possibility that the incision was supposed to represent the Kitten ship cannot be excluded completely, although it is improbable because of the difference in the sterns. Regrettably, as result of conservation with PEG, the image is invisible now. Even after recovery it was hard to see it, and photography did not catch the graffito. The diver who discovered the box reported that during the recovery attempt the wicker work disintegrated, but the contents of the box, its top and bottom were saved.

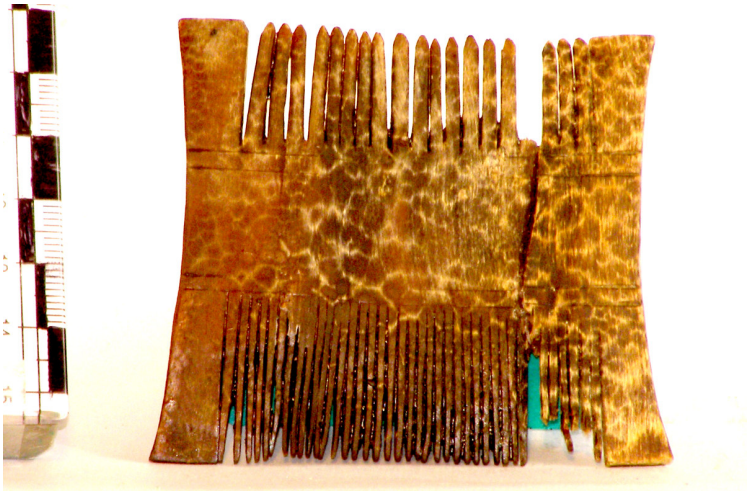


Fig. 86. KT036 A comb found in a wicker basket in the bow. Photo: K. N. Batchvarov.

Inside wicker box KT034 were found the ceramic inkpot KT079 and a small wooden comb, KT036 (Length: 6.8 cm; Width: 6.3 cm, fig. 86). A second comb, KT035 (Length: 8.5 cm; Width: 6.2 cm), was found in the stern cabin (fig. 87). The combs are stylistically similar, H-shaped and with fine and coarse teeth. KT036 is smaller and some of its teeth are broken. Similar combs are known from other wrecks, such as the one found on the Basque whaler lost in Red Bay, Labrador, in the 1560s. Similar combs were commonly used to comb lice out of the hair.

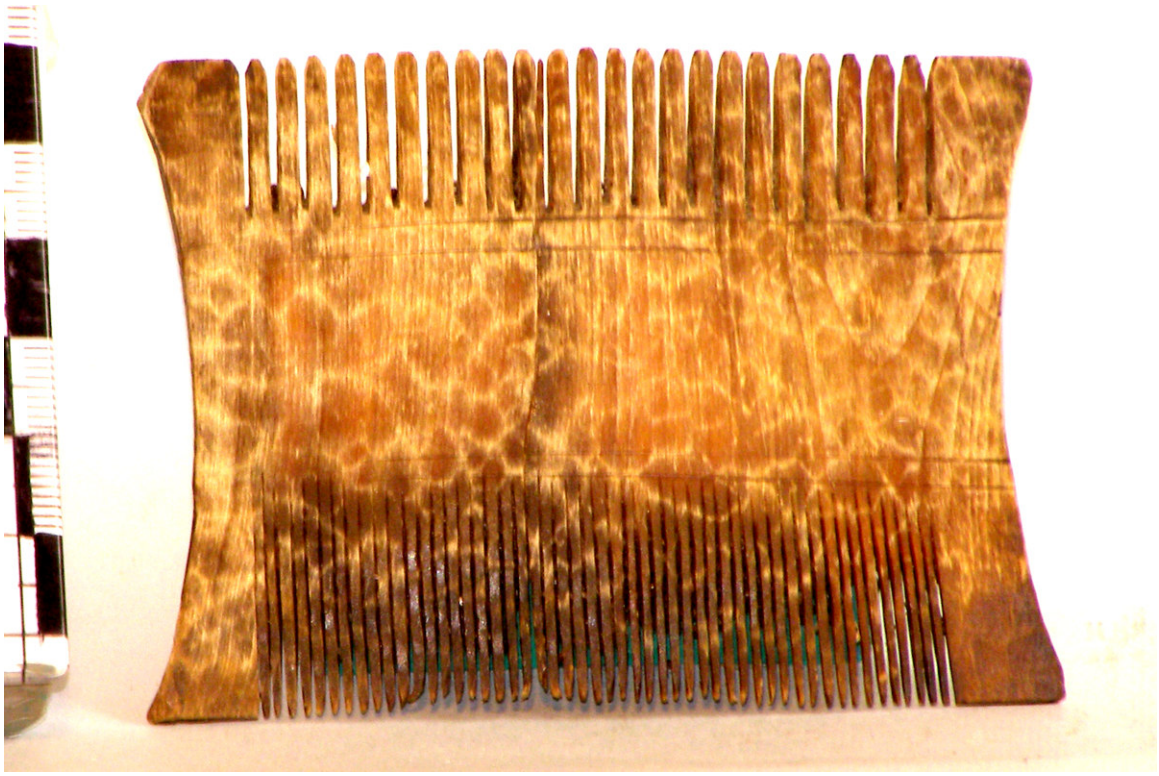


Fig. 87. KT035 A comb found in the stern cabin. Photo: K. N. Batchvarov.

In the stern cabin was found the lower part of a small sheet brass button, KT076, which may have come off a woman's dress. In the same area (F5) excavators found heavily

eroded brass earring (KT075) and a thin silver leaf-shaped piece, which may either have been part of another earring or some other form of embelishment. A small mother-of-pearl four-leafed clover, KT109, must have formed part of a jewelry item, too. This set of personal adornments implies the presence of a woman on board.

In the stern cabin were found the remains of four leather shoes. One of the soles is in Prof. Inkova's laboratory and was not available for photography and description. Of the remaining three, two are the upper parts of moccasin-type shoes, or *tzarvuli* (pl.). KT059 is only the front upper part of a shoe, whereas KT061 is better preserved and consists of the entire upper half (fig. 88).



Fig. 88. KT061 Upper part of a man's shoe, *tzarvul*. Photo: K. N. Batchvarov.

Of great interest is shoe sole KT060, (fig. 89).



Fig. 89. KT060 sole from a child' shoe. Photo: K. N. Batchvarov.

Only 14 cm long, the small size of the sole implies that it was a shoe belonging to a child. This strengthens the proposed identification of another find, KT056. When discovered, this strangely shaped piece of wood defied attempts to identify its purpose. Hristina Angelova proposed that it was a toy sword because of the sharp edge, diamond-shaped cross-section and pointed end. The rear part of the "blade," where the guard would have been, has eroded. At the time the suggestion was met with general jocularity among the crew, but in the light of the identification of KT060 as a child's shoe, the proposed identity of KT056 as the toy sword becomes less a subject of mirth and may prove to be correct (fig. 90). Alternative identification was offered by Pulak: that it is the

"sword" from a sword-fish. Similar artifacts were found at Yenikapa.[261] This identification, however, does not exclude its possible use as a toy sword. Thus, the earring, the silver leaf, the mother-of-pearl clover, the small shoe and the toy sword argue for the presence of a woman and child on board the ship. Their presence in the stern cabin may identify these individuals as the captain's wife and son, although it is also possible that they shipped as passengers on the fatal voyage.



Fig. 90. KT056 This artifact is tentatively identified as a toy sword. Photo: K. N. Batchvarov.

CLAY PIPES AND SMOKING PARAPHERNALIA

By far the largest group of artifacts acknowledged as personal possessions is the smoking paraphernalia. The smoking-related artifacts consist of more than a score of clay smoking pipes and pieces thereof, a wooden pipe stem, one amber and one ivory mouthpieces. Although clay pipe bowls from the Ottoman Empire are not rare, the stem and mouthpieces recovered at Kitten are among the few originals in existence. Rebecca Robinson, possibly the best authority on Ottoman pipes, specifically mentions the

[261] Pulak 2009, personal communication.

scarcity of original stem pieces and considers the ones in the Benaki Museum in Athens as the only surviving historical stems. Only three are illustrated in her seminal article.[262]

That pipe (*chibouk*, *tchibouque*) smoking was popular within the Balkan territories of the Empire is well-attested by travelers, especially in the early 19th century. Captain Edmund Spencer, who traveled through Bulgaria in the 1840s described the Turks' daily routine and national character as follows: "…still, his character is composed of contrarieties; that quiet sedate-looking man, we see sitting cross-legged on his little carpet, *smoking tchibouque from sunrise to sunset* [my italics] is susceptible of the strongest passions that can agitate the breast of man…".[263] Descriptions of the bowls have also survived, but are not detailed enough to offer good clues to styles and dating. A case in point is the report of the Reverend Robert Walsh who published an account of his travel in 1827 from Constantinople through Bulgaria on his way to Great Britain: "A fine clay is found in the neighborhood [of Lule Burghaz] which is formed into pipe-bowls, [coffee?] cups and other utensils. These [pipes] are unglazed, but highly polished and ornamented with gilding."[264]

The Ottoman smoking pipe consists of a bowl (*lule*), stem and mouthpiece. Generally, the bowl is made of clay in a two-piece mold and is subsequently carved and decorated. This was the cheapest part of the smoking paraphernalia and is widely found on

[262] Robinson 1985.
[263] Spencer 1851, Vol. 2, 365.
[264] Walsh 1828, 80.

archaeological sites. The stem was made of cherry or jasmine sticks, specially grown for the purpose. Stems could be richly decorated and of a length that could reach 4 meters. Although on military campaigns shorter stems of about 1 meter were used, the length and decoration appear to have been status symbols. The stem ended in a mouthpiece, which could be made of different materials. Most expensive and popular were mouthpieces made of amber, but coral was also valued.[265] St John Simpson describes mouthpieces as the most expensive part of the chibouk with amber being particularly valued.[266] The English traveler James Silk Buckingham, in 1825, confirms the high value placed on amber mouthpieces: "…we were served with long pipes made of the stem of the jasmine steeped in rose water, and mounted with the richest amber…"[267] Elsewhere Buckingham wrote that the amber mouthpieces were considered so valuable in the Ottoman Empire that they were used as bribes.[268] The manufacturing of Ottoman chibouks involved three types of craftsmen: the clay pipe-makers, manufacturers of stems and mouthpiece-makers, as Buckingham relates in his description of Diarbekir in Asia Minor: "… and a hundred and fifty makers of ornamented pipe-stems only, besides those who make the clay balls [bowls], amber mouthpieces, & c. [sic!]…"[269]

Both Vulka Iltcheva and Magdalina Stancheva made attempts to classify pipes, based on general shape and assumed date, but each went her own way in the actual grouping.[270]

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[265] Robinson 1985.
[266] Simpson 1998, 7.
[267] Buckingham 1825, 341.
[268] Buckingham 1827, 265.
[269] Buckingham 1827, 380.
[270] Iltcheva 1975; Stancheva 1972.

Thus, Iltcheva's Group V corresponds to Stancheva's Group I from Varna. In John W. Hayes' classification these pipes are described as Saraçane Type X.[271]

Rebecca Robinson worked with the collections of pipes from the excavations of Kerameikos, Corinth and the Athenian Agora.[272] Her terminology and classification have become the standard used in describing Ottoman pipes and is followed in this study. Generally, her dating fits the finds from the Kitten ship better than that of Hayes. Robinson separates the pipes into three major types based on shape: lily-shaped (the Bulgarian archaeologists describe this category as bell-shaped), disc-based and rounded-bowl type. The one point on which all researchers agree is that the lily-shaped type is chronologically the latest, appearing around the middle of the 19th century. No pipes of this type were found on the Kitten wreck, thus implying an earlier date for the sinking of the vessel. The other two types, Robinson believes to have co-existed since the 17th century.[273]

John W. Hayes studied the large collection of pipes from Saraçane in Istanbul. As early as 1980, he proposed a preliminary typology of pipes.[274] The date that he suggests for Type X appears to be too late in comparison with the likely date of the Kitten Shipwreck. Hayes himself points out that the pipes do not come from secure layers;

[271] Hayes 1980. Hayes does not appear to have read their articles, just the summaries.
[272] Robinson 1983, 1985.
[273] Robinson 1985, 163.
[274] Hayes 1980.

therefore, the dates are only his best guesses.[275] His belief that the marks and stamps on Bulgarian pipes such as his Type X are illiterate imitations of Arabic is shared by Stancheva but now appears to be incorrect.[276] He also ignores the fairly large number of stamps that *have* been successfully read. Iltcheva reports that in the Veliko Turnovo collection that she studied, 33 out of 40 pipes with stamps, could be read. Five were personal names, presumably of the manufacturers. Of the names, four were Turkish and only one Bulgarian – Ivan.[277] Other inscriptions were poetic references to tobacco and smoking.

Despite the growing number of publications on Ottoman pipes, a definite chronology or even a standard taxonomy have yet to be established. The lack of dating is largely due to the context in which most of the pipes have been recovered. Until recently material from 17th - 19th century levels was considered "modern" and was either disposed of or not recorded.[278] In many cases the collections consist of surface finds or come from heavily disturbed levels, which are useless for dating. A few disc-based pipes from Varna were discovered in the graves of Turkish soldiers from the Russo-Turkish war of 1828-1829, together with four bell-shaped pipes.[279] Another pipe, apparently a Varna I type, is reported to bear a date on its bowl of 1700.[280] These are the exceptions. In this respect

[275] Hayes 1992, 237.
[276] Stancheva 1968, 97.
[277] Iltcheva 1975, 184.
[278] Robinson 1985, 158.
[279] Stancheva 1972, 90.
[280] Iltcheva 1975, 185.

the value of the Kitten finds is significant, for they come from a closed, reasonably well-dated context.

Although the dating of chibouks may lack the precision of Western pipes, some general principles have been established. Robinson measured the diameters of the shank openings and concluded that they vary between less than 10 mm to around 17 mm in the late 19th century.[281] From the 18th century onwards, the dominant color of the bowls becomes brick-red or brown. It appears that, at the end of the 18th century and in the early years of the 19th century, yellow-ochre bowls gained popularity. This color may be specific to Varna products, because clay of this description is readily available in the area.[282] It should be noted that no historical documents have so far come to light that offer evidence for the existence of a Pipemaker's Guild in that city on the Black Sea. From the Balkans, only two pipe-making centers are attested in documents: Sofia and Lule Burghaz (Arkadiopolis), a small town in Eastern Thrace, not far from Adrianople in present day Turkey. The latter was so well-known for its pipe manufacturing that it even contains "pipe" ("lule" in Turkish) in its name. Stancheva based her hypothesis that pipe-making shops existed in Varna entirely on the large quantities of identical, usually unused, pipes found there. Virtually all pipes recovered from the Kitten ship have direct parallels with those from the Varna collection.

[281] Robinson 1983, 268-69.
[282] Stancheva 1972, 87.

The chibouks from the wreck that preserve some diagnostic characteristics fall into two categories: round-bowled (one of hourglass shape) and disc-based. No lily-shaped pipes were found either in the 1980s or the 2000s.

Five pipes belong to the disc-based category, KT086, KT087, KT089, KT091 and KT092. Most of them can be described as severely compressed round bowls with rims, but at least two have nearly flat discs as bases and the rim forms the entire bowl. Not one of the five has survived complete. At least one, KT087, came from the upper levels of the wreck, as the growth of a barnacle attests (fig. 91). For this reason its association with the ship is uncertain.



Fig. 91. KT087 Disc-based pipe. Photo: K. N. Batchvarov.

All examples in the category were made from red to brick-red fired clay and have small shank diameters of about 12 mm. They are poorly eroded to have preserved much trace of decoration; however, it is probable that whatever decoration they once had was not

part of the mold, but was stamped on, after the shaping of the pipe. One of the pipes (KT092) has a flower-shaped mark stamped on the side of the shank (fig. 92).



Fig. 92. KT092 Disc-based pipe with stamp on shank. Photo: K. N. Batchvarov.

All examples retain at least some trace of rouletting, mostly around the keel and the rim-bowl transition. Numerous parallels are known for these chibouks. The general shape appears throughout the Ottoman Empire and is often depicted in contemporary illustrations from the early 18th century through the first half of the 19th century. Robinson also points to the relative longevity of the shape. Following her estimates, the shank diameters fall within the later 18th century.[283] The closest parallels for these pipes can be found at Kerameikos, Corinth and the Athenian Agora. Similar pipes appear to have been recovered at Saraçane, too, but the poor illustrative material in the final publication of these excavations makes it hard to confirm this. A pipe with a mark

[283] Robinson 1983, 268-69.

identical to KT092 has been reported from as far away as Gozo (Malta) and is assumed to have been manufactured in Varna, too.[284]

The largest group of chibouks (six, of which only three were available for study) from Kitten is of the round-bowl Varna I category. The clay for most examples is of a fine uniform texture. Colors vary between brick-red and yellow-ochre. The decoration is rich and employs the full range of possibilities available to the maker: integral with the mold (see especially KT093, fig. 93) and stamped.



Fig. 93. KT093. Until recently this type of stamp was considered an imitation of Arabic. Photo: K. N. Batchvarov.

Three pipes that are not illustrated, but were essentially identical to KT094 are still at the laboratory of Prof. Vessela Inkova so were not available for this study. Microscopic examination of these three pipes suggested that they came from the same mold.[285] At

[284] Wood 1999, 238.
[285] Vessela Inkova, 2001, personal communication.

least one of the three had been used. KT094 also has heavily carbonized remains of tobacco inside the bowl (fig. 94).



Fig. 94. KT094 has seen extensive use. Photo: K. N. Batchvarov.

None of the yellow-ochre colored bowls (KT093, KT095 and KT096) show any sign of usage. The type (which includes the brick-red colored KT094) is characterized by a straight, faceted rim, the panels of which are usually separated by two vertical incised lines; the bowl can be paneled, spirally fluted, or vertically fluted (fig. 95). The shank is faceted, with a heavy gadrooned termination. Numerous parallels for this type of pipe exist.[286] All bowls have identical stamps. They are applied to the lower side of the pipes, either on the keel itself, or on the bowl, or on both. The identical stamps and the similar style of the chibouks suggest that they came from the same work shop.

[286] Robinson 1985, Plate 55, C90, Plate 56, C93, C94, C96, C98 – identical to KT095, C99, Plate 62, A21. Hayes (1980, 8) states that more than 74 pipes of this type were found at Saraçane.

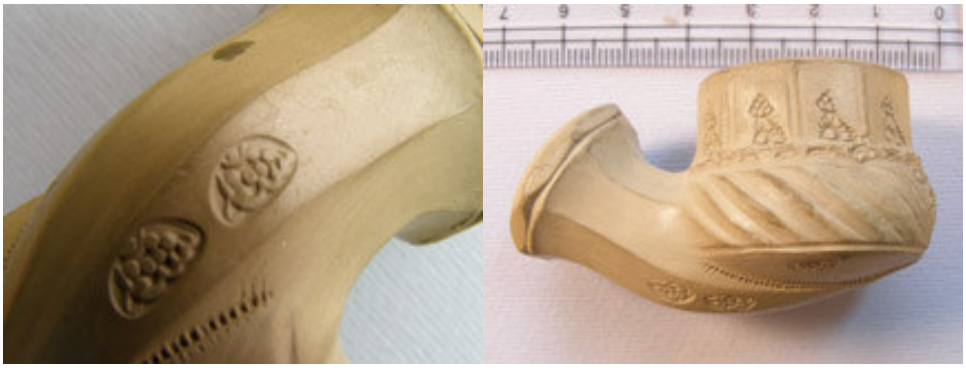


Fig. 95. KT095 has the stamp pressed in three places. Photo: K. N. Batchvarov.

The entire group of yellow-ochre pipes is well preserved with no trace of erosion from sand scouring.

The pipes, found deep in the wreck, undoubtedly belonged to the ship's crew or passengers. Many parallels are preserved at the Varna Museum of Archaeology, many were found at Saraçane, quite a few are reported from Greece and at least one each has been reported from Gozo and Israel.[287] Virtually identical to the Kitten finds are C93 through C100 from Corinth and A19 to A21 from the Athenian Agora.[288] All pipes from Corinth have the same stamp as the Kitten pipes, but from the Agora only A20 has it. Robinson describes the type as a 19th-century product, Hayes as late 19th-century. In contrast, Stancheva believes it to be an early type and dates it to the beginning of the 18th century based on a reported Romanian find from Mihai Voda (from a level dated to the mid-18th century), the report of two Russian researchers on a similar pipe in Moscow

[287] The pipe was found on the Akko 1 wreck, tentatively dated to the Napoleonic siege of Acre in 1799. Personal communication, Ms. Deborah Cvikel.
[288] Robinson 1983, Plates 52 and 53; Robinson 1985.

and dated to the first half of the 18th century and for other, unspecified, reasons.[289] Based on a stamped date on one pipe from Veliko Turnovo, Iltcheva assigns an early 18th-century date.[290] It appears that the longevity of this category of pipes was quite remarkable and extended from the early 18th to the mid-19th century if Stancheva's and Iltcheva's dating is correct. All things considered, a late 18th to very early 19th century date for this type of pipes seems to be the most reasonable estimate, with the recognition that the type was popular (as the large quantities found at different sites attest) and had a long life span. It appears that Stancheva's view of a Varna origin for the type is correct, and neither Robinson nor Hayes challenges it. It may not be a coincidence that all reported finds come from areas that have direct access to the sea: Varna, Kitten, Istanbul, Corinth, Athens, Gozo and Akko (Israel). This distribution certainly suggests trade routes followed by seafarers from the Ottoman territories.

Pipe bowl KT095 has the same mark stamped in three different places on the lower side of the pipe (fig. 95). This particular stamp is frequently found on pipes from the Varna collection and until now was assumed to be an illiterate imitation of Arabic. However, it has been recently established that the marks are mirror images of Arabic script.[291]

[289] Stancheva 1972, 86-7.
[290] Iltcheva 1975, 185.
[291] Through the kind offices of Ms. Deborah Cvikel, a Ph.D. candidate at the Leon Recanati Institute for Maritime Studies at Haifa University, photos of the stamp were submitted to the Arabic scholar Mr. Azam Halabi who successfully read the stamps.

Evidently the die was cut directly and so, when applied to the pipe, produced a mirror image of the word. Halabi read the stamp as "Allah" (God).[292]



Fig. 96. KT096. The stamp reads as the Muslim male name Ali. Photo: K. N. Batchvarov.

Pipe bowl KT096 is different from the other round-bowl chibouks (fig. 96). Although it is of the same colour and texture of clay, it differs in shape, decoration and stamp. The highly-burnished pipe has a round bowl with short, straight rim. The shank is decorated with a scalloped end wreath. The lower part of the bowl is petalled by small palmettoes stamped in each petal. The rim is separated from the bowl with a wreath or decorated shoulder. A stamp on the shank is sharply imprinted, but differs significantly from the half-moon found on the Varna I type pipes from the Kitten ship. At Ms. Cvikel's request, Mr. Halabi kindly read this stamp too. The stamp appears to bear a mirror image

[292] Deborah Cvikel, personal communication of 22 December, 2007 and 26 January, 2008. I would like to express my particular gratitude both to Ms. Cvikel and to Mr. Halabi for taking the trouble to look at the stamps and reading them. He appears to be the first scholar who has noticed that the stamps are mirror images! His contribution to the understanding of the Kitten smoking pipes is here gratefully acknowledged.

of the Muslim male name "Ali". This probably was the name of the pipemaker and is consistent with the historical data that pipemaking was mostly in the hands of the Turks. Chibouk KT096 is unused. Robinson published close parallels for this pipe from all three sites that she studied.[293] She proposes an early 19th-century date for petalled pipes of this type, which agrees fairly well with the dating of the Kitten shipwreck.

Three broken, heavily eroded pipes (KT086, KT087, KT090) were recovered from layers of the wreck that make the association with the ship less certain than for those already discussed. All three are undoubtedly round-bowl chibouks made of red clay. Two of the three are no more than large fragments, but retain some diagnostic features. The third one is better preserved. The best preserved pipe, KT086, has a complete bowl and shank, with partially preserved rim. The bowl is gadrooned and has some rouletting around the keel, shank and shank termination that is still visible. The shank end is round. A line separates the rim from the bowl and another was incised under the rim edge. No stamps appear to have been applied to the pipe. The other two are too fragmentary to determine their exact shape or dimensions as not even the bowls are complete. Likely, they were similar to the already described pipe but without the gadrooned bowls. As noted these may be intrusive artifacts not related to the wreck.

A single pipe (KT105) of a type described by J. W. Humphrey as "*chay*-glass shaped", by Robinson and Simpson as "sack-shaped" and by Stancheva as "hourglass-shaped"

[293] Robinson 1983, No. 24 (Plate 53) from the Kerameikos; Robinson 1985, Corinth C55-C64.

was recovered from insufficiently deep layers of the site to make it probable that the pipe was in situ.[294] It is brick-red in color, with complete bowl, broken rim and completely missing shank (fig. 97). The keel of the pipe is mostly discernible through the faint rouletting that delineates it. The rouletting follows the outline of the keel and meets halfway up the front end of the pipe, where it ends in three lozange shapes, symbolizing a plant. The clay is fairly coarse, similar in consistency and colour to that of the disc-based and fragmentary round-bowl pipes; faint traces of red slip are still visible on parts of the bowl. Most probably it is a late 18th-century type. Parallels for this pipe bowl have been reported from the Agora, Saraçane and Corinth.[295] A similar pipe is found in the assemblage from the 1980s expedition to the shipwreck.



Fig. 97. KT105 An hourglass-shaped pipe. Photo: K. N. Batchvarov.

In addition the commonly found clay pipe bowls, the finds from the Kitten shipwreck included KT098, a wooden stem with an amber mouthpiece, and KT097, an ivory

[294] Humphrey 1990, 4.
[295] Robinson 1983, 1985; Hayes 1992.

mouthpiece. Such artifacts are rarely found in archaeological contexts. Simpson lists ivory as one of the possible materials for mouthpieces, but does not mention any found in archaeological context.[296] He listed only three mouthpieces in existence: one of greenstone (possibly from a musical instrument rather than from a pipe) and two ceramic ones.[297] Presumably, he spoke of those found within Palestine only, as Robinson illustrates three amber mouthpieces and stems from the Benaki Museum.[298] Petrana Bojilova and Ilina Sirakova report three stems with mouthpieces held in the Museum of History, Shumen, Bulgaria.[299] Two of them are broken and only two have mouthpieces: one of ivory, one of amber. Clearly, the mouthpieces in existence are very few and the Kitten examples represent a significant contribution.

The ivory mouthpiece KT097 (fig. 98) does not appear to have any parallels from any other archaeological site that has yielded Ottoman smoking paraphernalia. The example from Kitten may be the only one found in an archaeological context. It is shaped like an hourglass and is of modest dimensions (Length: 3 cm; Diameter max: 1.5 cm), but the diameter of the central perforation is proportionately large (0.7 cm). It is not highly polished.

[296] Simpson 1998, 15.
[297] Simpson 1998, 7.
[298] Robinson 1985.
[299] Bojilova, Sirakova 1991, 171-72.

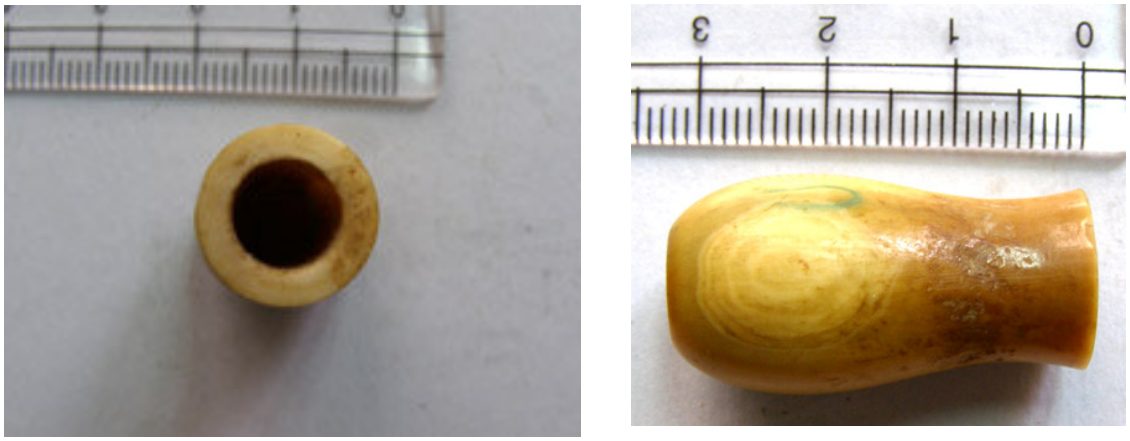


Fig. 98. KT097 Ivory mouthpiece. Photo: K. N. Batchvarov.

Of great interest is the cherry wood stem (KT098) recovered from the shipwreck. It is about 70 cm long, thus on the short side as these stems go. Although varying lengths are mentioned in the literature, they are believed to have measured between a meter and four meters in length. The shorter values are for what Robinson describes as "campaign" stems, the longer ones being too awkward to use under field conditions. This awkwardness would be even more noticeable aboard a ship, especially one with such a small stern cabin as the Kitten ship, so the short length may well be a seagoing adaptation. Their decoration could reach extravagant proportions in expensive examples and stems were looked upon as status symbols, too.[300] In the case of the Kitten shipwreck example the decoration is very modest. The stem appears to be from a cherry branch with the bark left on. Simpson relates that cherry roughed out sticks for stems were imported from Persia and Central Asia (presumably to Istanbul, although he does not specify), but it is unlikely that this was necessary for manufacturers in Bulgaria,

[300] Robinson 1983, 266.

where cherry orchards are frequent.[301] The sole decorative element is a narrow (40 mm) band of silver-plated copper with stamped floral decoration at the mouthpiece end. The examples reported from Shumen are not close parallels to the Kitten find. The only complete example that Bojilova and Sirakova reported has a length of 44 cm and forms part of a complete chibouk, which was intended for use with cigarettes, mounted in the clay bowl. They assigned it to the second half of the 19th century. It was made of cherry.[302]

All researchers and contemporary sources agree that most high status mouthpieces were of imported Baltic amber.[303] They were also the most expensive. The stem from the Kitten shipwreck, KT098, has a large pear-shaped amber mouthpiece (30 mm long, 21 mm maximum diameter, 8 mm inner diameter). The narrower (diameter 10mm) end of the pear was attached to the stem (fig. 99). Compared to the ivory mouthpiece, the amber one has a much smaller-diameter opening. Found deep within the hull, the artifact undoubtedly belongs to the ship. None of the chibouk heads (the bowls) were found in direct association with the stem. It is possible that one stem was used for more than one pipe head. Travelers' accounts, for example, speak of individuals possessing more than one pipe head.[304] This may have been the case with mouthpieces, too, as two were found on the wreck, but only one stem. On the other hand the end of the stem was turned down to fit into the small diameter opening of the amber mouthpiece and the ivory one would

[301] Simpson 1998, 15.
[302] Bojilova 1991, 171.
[303] Simpson 1998, 15; Robinson 1985, 156; Buckingham 1825, 341.
[304] Walsh 1828.

have been too large to fit securely, so it is more probable that the other stem did not survive.



Fig. 99. KT098 Stem with amber mouthpiece from the Kitten shipwreck. Photo: K. N. Batchvarov.

As with most artifacts from the wreck, the smoking paraphernalia and most of the bowls were found in the stern part of the ship where the cabin bulkhead was located. This is hardly surprising since this is where the captain (and possibly part-owner of the ship) slept. At least three of the bowls had been used and any one of them (or all) could have been associated with the one stem that was found. This raises the question of whether the pipes were personal or trade items. The evidence is ambiguous. It would have been of the greatest value to know more about the pipes recovered in the 1980s, including the types, quantities, and whether or not they were used. Regrettably, this information is now unavailable. Based on the finds from the joint expedition, however, it seems

unlikely that the pipes were intended for trade as the numbers involved are too low. Since pipe bowls were fragile, they could get broken frequently and therefore appear to have been bought in quantity. The Reverend Robert Walsh himself bought four pipes on passing through Lule Burghaz.[305] Thus, it would appear that the pipes from the wreck were personal property; and for the stem and the two mouthpieces, that this is so practically certain. If we consider only the best preserved pipes, which unquestionably belonged to the ship, we discover two different types: Varna I and the heavily decorated round-bowl chibouks. The different stamps suggest that the two types came from different workshops. It is interesting to speculate whether all of them belonged to the same person, who most probably have been, the captain, or different persons bought them from their own preferred suppliers – hence the difference in style and stamps. It appears that the Varna I type of faceted rims and round bowls was quite popular as more pipes of this type have been discovered than any of the others. The multiple examples stamped with "Allah" may indicate sole ownership, with the other pipe belonging to someone else, or, alternatively the sole pipe may indicate that the smoker had decided to expand his collection with an experimental new type.

Beyond the utility of these finds in adding some precision to the dating of certain classes of pipes, the smoking paraphernalia from the wreck tells us something about life aboard, social status and perhaps even the direction the ship was heading when lost.

[305] Walsh 1828, 80.

The discovery of most smoking paraphernalia in the stern of the ship may also indicate that, if anyone had any leisure time on board, it must have been the person inhabiting the stern cabin, most probably the ship's captain. Alternatively, there may have been limited places aboard ship where smoking was permitted. In Western ships, this was always the galley area. In Eastern ships, Ward has suggested that this was also true, although for the Sadana island ship this appears to have been in the bow and the stern, with the higher value materials, including smoking paraphernalia, found aft.[306] On the Kitten ship no discernible galley was discovered. A number of copper cooking utensils were discovered in the 1980s, which came from the bow. At least one cauldron was found amidships, but no trace of cooking stove or fireplace was found in either place. Neither was any charcoal or firewood observed to indicate where cooking took place. The stern cabin possessed a copper brazier, the only potential cooking equipment that was found. Therefore, the possibility that smoking was permitted only in the stern cannot be ignored.

The pipes may also hint at the last port of call before the loss of the ship. If, as most researchers seem to agree, the Varna I pipes were indeed a product of Varna workshops, then the presence of so many unused pipes suggests that the ship may have sailed from Varna and was sailing south along the coast of Bulgaria, likely *en route* to Istanbul. Urdoviza Bay could not have been the final destination of the ship, as at the time there was no settlement there.

[306] Ward and Baram 2006, 12-3.

In conclusion, the finds from the Kitten shipwreck contribute to our knowledge of the chibouk and the smoking paraphernalia by adding items rarely found in an archaeological context. The smoking material also assists in the general interpretation of the wreck. In the first instance, the finding of different types of smoking pipes in the same closed archaeological context supports Robinson's view that different types of pipes coexisted and that chibouk styles had a fairly long life span. Her hypothesis that shanks may be more diagnostic and useful in dating than the shape of the bowl needs more testing because KT096 has a completely different shank from the other finds, but it is of the same date. It is possible that pipes of the Varna I type continued in manufacture into the late 19th century. However, defining them purely as a late 19th-century product as Hayes does (under the designation Type X) is evidently incorrect. The style probably appeared some time in the 18th century, perhaps as early as mid-18th century. The "Allah" stamps found on many examples of this type of pipe suggest that pipe-making was mostly in the hands of Muslim crafstmen. This hypothesis is also supported by the name Ali, stamped on KT096.

Smoking paraphernalia from the ship adds to our understanding of the status of seafarers in the Black Sea waters of the Ottoman Empire. The history and archaeology of Ottoman-era seafaring has received so far such cursive treatment as to be of little value, largely because of the lack of sources. The Kitten shipwreck offers insights that future research and complete archaeological excavations of other wrecks from the region may expand. No doubt, the Ottoman archives also contain information that awaits

enterprising researchers with strong knowledge of Ottoman Turkish. The smoking assembly from the Kitten wreck confirms what the copper utensils and the rest of the finds suggested: the stern area of the vessel was the living area of the ship's captain. In Western European tradition of seafaring, the stern cabin is always the prerogative of the captain. In comparison with quoted descriptions of pipe stems, the find from Kitten is quite modest in dimensions and decoration. Its short length may have been an adaptation for the space constraints aboard ship. The minimal decoration of the wooden stem, which still has its bark, identifies it as a unpretentious example. However, the mouthpiece is of a most expensive and valued material – amber. It would appear that the owner of the pipe stem was a man of some means and of a certain social status.

The contribution of the smoking paraphernalia to our understanding and interpretation of the entire wreck is of significant value and demonstrates the opportunities offered even by mundane artifacts found in small numbers.

NAVIGATIONAL EQUIPMENT

In 2001 a sounding lead was discovered in the stern cabin. With a length of about 22 cm and maximum diameter of 9.7 cm at the base, it is short and stubby. Its bottom is heavily worn and misshapen, and the edges are curled upwards. In the middle of the base a slight indentation is still observable, which probably contained tallow for "arming" the lead to collect samples of seafloor deposits. Considering the predominance of coastal navigation

along the Kitten ship's probable trade routes, the presence of a sounding lead is hardly surprising.

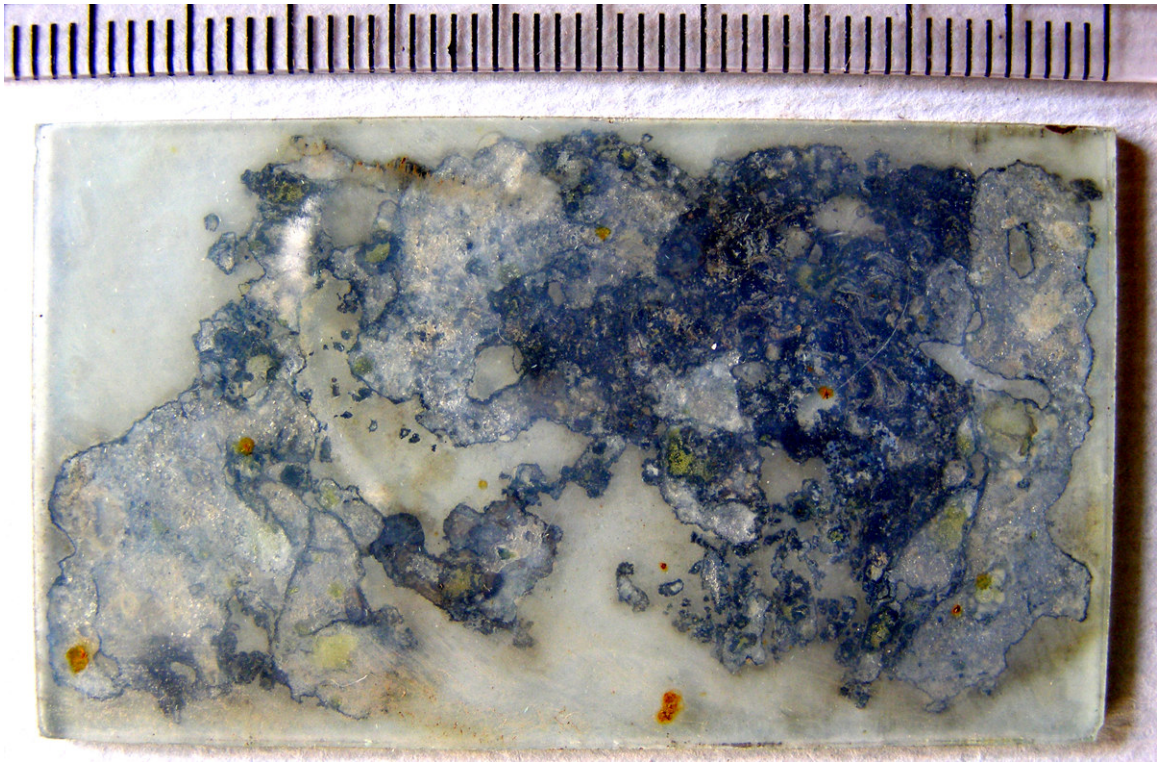


Fig. 100. KT117 Mirror from a navigational instrument. Photo: K. N. Batchvarov.

Of greater interest is the presence of what may be a complete navigational instrument, possibly an octant or a sextant. In the port bow of the ship, next to the small toiletries box were found two glass lenses each with its associated threaded wooden rims, and a small mirror (KT117) with exfoliating silvering (fig. 100). The dimensions of the mirror (5.2 cm x 3 cm) correspond precisely with the reflecting mirror of a sextant or an octant. The dimensions, converted to Imperial measurements, yield exact divisions of the inch: 2 1/16 inches by 1 3/16 inches. This seems to point to a British manufacturer of the

instrument. The diver who discovered the items related that the lenses and rims were found among a mushy substance, which belatedly he identified as disintegrating paper, possibly from a *papier-mâché* tube. It appears that they comprised part of a small telescope or ocular tube for the instrument (fig. 101). Such ocular tubes appear to be more frequently found on sextants than on octants. No remains were discovered of the instrument's frame, which probably was made of wood. This, in turn, makes it more probable that the instrument was an octant, as wood was the usual material for their frames. Sextants from early on were more often made of metal.

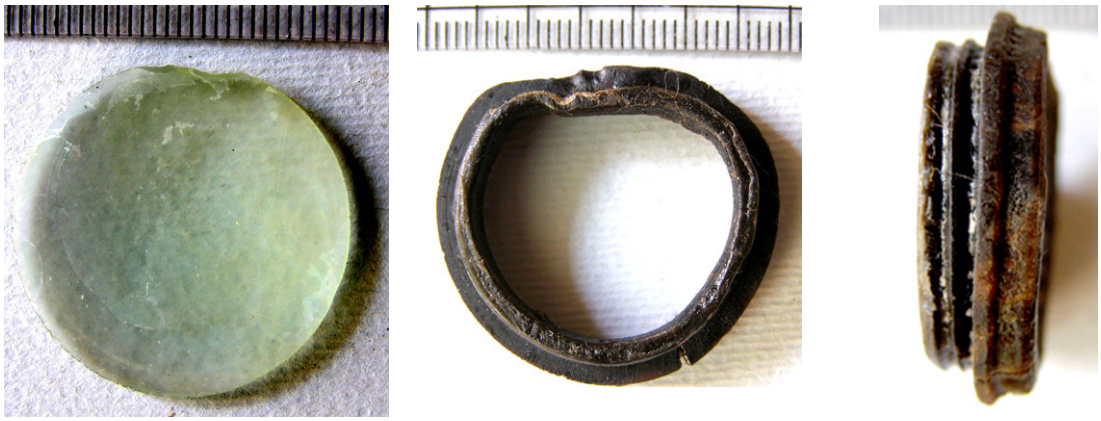


Fig.101. KT118 Possibly an ocular from the same navigational instrument as KT117. Photo: K. N. Batchvarov.

Regardless of whether the instrument was an octant or a sextant, its presence on board the Kitten ship is rather surprising. The use of celestial navigation along the likely trade routes served by this ship – namely the Bulgarian coast from the northern Bulgarian ports (*i.e.* Varna) to Istanbul – is not necessary. Even more to the point, plentiful evidence exists from contemporary observers, both travelers and Western military advisors, that even the pilots for the Ottoman Navy did not know how to use sextants

and octants. Merchant skippers depended entirely on previous experience on the routes and generally sailed only on the same routes. Thus, how such an instrument found its way on board the Kitten ship is a mystery. Had it belonged to the captain, one would have expected it to be found in the stern cabin, not in the bow. Possible explanations for its provenience are that the captain lost the instrument while abandoning ship over the bow, since the stern was smashed to pieces on the shallow bottom, or the instrument belonged to someone else, a passenger perhaps, who was quartered in the bow of the ship.

MISCELLANEOUS

The first artifact raised from the stern cabin came to light in the 2001 season. It is a large marble mortar (KT113) of 22 cm height and diameter at the mouth of 21 cm. It was most likely used for crushing grain and other foodstuffs for feeding the crew (fig. 102). A crudely carved wooden pestle, KT039, was discovered in 2003 in the immediate vicinity of the cabin front bulkhead. Originally, it may have been stored on a shelf attached to the bulkhead.



Fig. 102. KT113 Marble mortar. Photo: K. N. Batchvarov.

KT012, a large elongated wooden scoop for grain, was discovered just forward of the bulkhead (fig. 103). A similar, though smaller scoop is known from the wreck of *La Belle* of the French explorer Sieur de La Salle, lost in Matagorda Bay, Texas, in 1686. Whether the scoop from the Kitten shipwreck served only the purposes of the crew or was related to a possible cargo is not clear.



Fig. 103. KT012 Grain scoop. Photo: K. N. Batchvarov.

The stern cabin also yielded at least nine complete brooms and fragments of an unknown number of others. All of them were located on the port side of the cabin. It is not certain what their purpose was. While a maniacal dedication to cleanliness among the crew cannot be completely excluded, it is more probable that the brooms were associated with the cargo. Brooms are used in charcoal manufacturing to put down flames breaking through the earth clods that cover the burning pile. The Bay of Urdoviza (today Kitten) is known to have exported charcoal. Such brooms could also have been in use if grain was the intended cargo.

In the stern cabin a brass wick holder, KT074, from an oil-lamp was found. Only two T-shaped iron fasteners (KT010 and KT045) were recovered out of the half-dozen that were found in the wreckage of the cabin. Similar fasteners are known also from 24M site in Red Bay, believed to be the wreck of the Basque whaler *San Juan*, dated to the middle of the 16th century. Unfortunately, not one of the fastenings was found in situ and it is not possible to determine what timbers they held together. Yet, the fact that none was

found attached to structure, is evidence that they must have been associated with the missing upperworks of the ship.



Fig. 104. KT085 A small cask found in the stern cabin. Photo: K. N. Batchvarov.

A perfectly preserved small cask, KT085, discovered in the middle of the stern cabin (fig. 104). The cask has two bung holes – one in a stave and one in the end lid. Neither was fitted with a bung, and the cask itself was filled with sand.

Finally, the inventory of the stern cabin would not be complete without mentioning the four-legged passenger, who may have been the sole casualty of the shipwreck. In 2002,

diver Miroslav Todorov discovered a complete goat's skeleton and a small brass bell between the skull and the body, KT058 (fig. 105). This type of shepherd's bell has had a very long lifespan and are used extensively by the region's shepherds to the present day. The presence of the little goat in the stern cabin suggests that it may have been a pet, rather than a source of fresh meat for the owners.



Fig. 105. KT058 Shepherd's bell from the neck of the goat. Photo: K. N. Batchvarov.

Two solitary cask bungs, KT037 and KT038, with perforations in them, were discovered in the hold area of the ship, between excavation units G3 and G4. Neither was associated with a barrel, although the remains of one barrel were discovered outside the hull, to starboard (unit I3). Porozhanov reported a second barrel from the 1980s, left in situ; the barrel may have perished in the intervening 20 years, since it could not be relocated. In fact, apart from the small cask in the stern and the half barrel in unit I3, no barrels were found on board or in the vicinity of the ship.

Conspicuously absent from the wreck are carpenter's tools for shipboard repairs. The only exception is a small hand auger discovered just forward of midships in 2002. No other tool of any description was found. It is unlikely that a ship of this size sailed without a carpenter's chest, so the question arises whether some items were salvaged from the wreck. Certainly, access to the stern cabin was impossible, as the ship sank stern first and the aft end of the vessel is completely destroyed, but it is possible that the bow remained close to the surface of the sea until it fell apart, and items stored there may have been accessible for some time after the sinking. If the carpenter's tool chest was stored in the bow, then it may have been saved at the time of sinking.

CONCLUSIONS

As this chapter is no more than a preliminary overview of the finds from the Kitten Shipwreck, its conclusions must be tentative. Nevertheless, the artifact assemblage does yield valuable information even at this stage of the research.

It is likely that the vessel was either owned or at least operated by a Christian crew as attested by the several plaques with cross decorations found during the two series of excavation campaigns in the 1980s and 2000s. The pig skin reported from the previous expedition on the site strengthens the argument further. Based on the assemblage as a whole, and especially the Selim III issue coin, it would appear that the ship was lost after 1789 and probably not much later than the early years of the 19th century, because there

are very few artifacts of Western origin. In the immediate aftermath of the Napoleonic Wars, trade expanded greatly and the Ottoman market was flooded with European wares. Thus, although we have a fairly secure *post quem* date and less certain *ante quem* date, in all likelihood, the ship was lost between 1789 and the end of the Napoleonic Wars in 1815.

It is not possible to determine with any certainty the ethnic background of the crew. The assemblage of copper utensils, however, appears to be the product of Bulgarian master craftsmen and likely originated in the Sub-Balkan region, where Bulgarians remained dominant. The copper vessels suggest a Bulgarian crew, but it should be noted that copper products were widely available and extensively traded. The different ethnic groups in the Balkans seem to have had slightly divergent tastes in decoration and, thus, it is probable that Bulgarians were the principal customers of Bulgarian craftsmen, but this can not provide conclusive evidence for the nationality of the crew.

Smoking pipes, most probably manufactured in Varna, copper vessels from central Bulgaria, and pottery from Chanakkale suggest that the ship served the trade routes between Istanbul and the Western Black Sea ports. We do not know what the cargo for this ship was, but grain, timber and charcoal appear to be the most probable. It is unlikely that the ship ever sailed further than the Sea of Marmara.

The artifacts help to develop some ideas about the social status and domestic economy of the commanding officer, possible members of his family, and the crew. From the concentration of relatively valuable artifacts in the stern cabin, it is clear that the individuals occupying it were of modest privileged status. The copper assemblage especially points to people of certain economic standing. The collection of smoking pipes and, more specifically, the amber mouthpiece appear to confirm this view. In the cabin food was served with some elegance, as evidenced by the use of graceful copper vessels and the limited pottery, rather than in the simple wooden equivalents. The presence of the sounding lead in the cabin suggests that the privileged person was most probably the captain himself. The displayed wealth may be evidence that he was also at least part-owner of the vessel.

The child's shoe, the toy sword – either wooden or, as has been proposed by Cemal Pulak, a swordfish beak – and the simple jewelry point to the likelihood that a woman and a boy were on board as well. It appears that they shared the cabin with the captain, from which one may conclude that they were his family. The goat probably belonged to the family and may have been more in the nature of a pet than an immediate source of food. However, it should be pointed out that at this time smaller animals frequently lived in the houses with the families, so the goat's presence in the living quarters may simply be an adaptation of land practices to life on board a ship.

In contrast to the relative luxury of the cabin, the crew appears to have eaten from common cooking pots. The large number of spoons found on the wreck, however, may suggest that each crewmember or passenger had a separate spoon. The quantity of spoons (eighteen including the one found by the previous expedition) may reflect the number of people on board the ship. This would suggest a crew of about 15 to 16 men. Considering the likely lateen rig and large size of the ship, this seems a reasonable number.

The only connections to the Western European world are a sextant or octant of possibly British manufacture and the tokens manufactured by the Germans Lauer and Reich. The two tokens are common and have been found on other historical period Ottoman sites. The presence of the navigational instrument is harder to explain, as most authorities agree that virtually no one, even in the Ottoman Navy, knew how to use one, let alone the crew of a small merchantman, which traded along traditional, well-known routes that virtually never took the vessel out of site of land. Besides not needing to use such an instrument, the skill to do so was likely also absent. Charts of the Black Sea were still few and mostly inaccurate. Almanacs and other navigational reference works do not appear to have been available at the time either. Thus, the presence of such an instrument is clearly unusual, and archaeology is ill equipped to explain this anomaly. Perhaps an answer to this question may be found one day in the war archives of Great Britain and France, as both countries are known to have sent officers to the Ottoman Black Sea

coasts to gather intelligence related to building ships or obtaining timber and other supplies.

CHAPTER VII

CONCLUSION

In the 1980s a shipwreck was discovered lying in about 10 meters of water, close under Cape Urdoviza, in the southern Bay of Kitten. Bulgarian archaeologists, directed by Dr. Kalin Porozhanov, undertook preliminary work on the vessel, but were forced to abandon their excavation for lack of ship specialists and the discovery of an inundated Early Bronze Age settlement threatened by the construction of a marina. In 2000 the Institute of Nautical Archaeology (INA)- Centre for Underwater Archaeology (CUA) team began the complete excavation of the site. The project was co-directed by Dr. Porozhanov on the Bulgarian side, assisted by Ms. Hristina Angelova, Director of the Centre for Underwater Archaeolgy (CUA), our host institution, and the author on the INA side. Although in the first two seasons students from Texas A&M University participated in the project, scheduling conflicts prevented those that were invited back from returning to the site for the final two seasons in 2002 and 2003. Most of the labor force therefore was provided by Dr. Porozhanov's archaeology students from New Bulgarian University, Sofia. In the first two seasons, we had additional help from three students from Macedonia.

Although the vessel sank in the surge zone, it quickly became clear that the state of preservation was significantly better than originally believed, and the wreck likely held a considerable number of artifacts. Over four seasons of excavation the wreck was

completely uncovered and recorded, the artifacts raised and conserved. The 2000-2003 excavation agreement stipulated that Bulgarian archaeologists under the directorship of Ms. Angelova were responsible for cataloging and studying the artifacts, while the INA contingent would record and study the vessel. The analysis of the finds from inside the wreck is still ongoing and so the study of the Kitten shipwreck presented here offers only a preliminary analysis of the select few artifacts that have assisted in dating the ship. Thanks to efforts on the part of Ms. Angelova, a small museum has opened in Kitten that now houses the artifacts from the shipwreck.

The Kitten ship project had its challenges, but overall the excavation and analysis have been completed successfully. It is the first complete post-medieval shipwreck excavation to have been undertaken in the Black Sea. Prior to this excavation little archaeological information was available for the vessels that plied the waters of the Ottoman Empire, especially those of the Black Sea. The excavation was undertaken with very limited resources, yet achieved important results and provided information on subjects that were little known until now, such as shipbuilding traditions of the Black Sea and their relationship to the greater Mediterranean world. The project demonstrated the potential of nautical archaeology in the region to answer questions that cannot be answered fully from other sources. Finally, the project advanced from completion of the excavation, to conservation, research and analysis, and finally to museum display for the education of the public in a short time span of only five years.

Although attempts to date the wreck through dendrochronology were not conclusive, the finds from the ship suggest that it most probably sank in the reign of Sultan Selim III (1789-1807). Two silver coins found on the wreck bore the tughra of this ruler. The two legible tokens were manufactured in Germany in the late 18th century. The closest parallels for the large assemblage of copper utensils found on board also date from the second half of the 18th century. The smoking pipes from the wreck suggest a late 18th-century date as well. As the diagnostic artifacts seem to collectively date to the second half of the 18th century, it is most probable that the catastrophe took place either in the last years of the outgoing century or the early years of the 19th century.

The 18th century in Ottoman history is a period of gradual decline and territorial loss that accelerated in the last decade to reach its lowpoint in the period of the Napoleonic wars (1804-1815), when entire parts of the Empire were beyond the effective control of the central government. The repercussions of this political decline were wide and far reaching, and affected virtually every aspect of life for the population, Muslim and Christian alike. Trade, only tolerated rather than encouraged, stagnated in the second half of the 18th century, but it did not disappear. The treaty of Kuchuk Kainardja in 1774, between Russia and the Ottoman Empire reopened for the first time since the fall of Constantinople in 1453 the Black Sea for navigation by non-Ottoman subjects and thus opened the door for further expansion of foreign activity.

The main impetus for Black Sea maritime trade and shipping remained the same as before, supplying the Ottoman capital of Istanbul with provisions, grain, fuel and timber. The Bulgarian lands played a major role in that supply effort. Bulgarian ports exported the surplus production of the entire eastern Balkans, and they provided 80% of the grain needs of Istanbul. The main exports to the huge city, which consisted of agricultural products, were low-cost bulk items that had to be shipped in quantity and by sea to make their transportation economically viable, a fact that has often escaped the attention of Bulgarian historians, who have argued that vessels on the Black Sea did not exceed 30 tons burden. The necessity to feed the capital determined the size and tonnage of the region's merchant fleet, and the Kitten vessel operated within that trade network.

At the time of its loss, the vessel was manned by a Christian crew, as evidenced by finds from the wreck. The ethnic background of the crew, however, is more difficult to establish. Traditionally, it has been assumed that all maritime activities were handled by the Greeks and that they were the great seafarers of the Empire, even though contemporary Western observers spoke scornfully of Greek qualities as seafarers. While Greeks were likely the largest group of non-Muslims in the Ottoman Empire involved with maritime activities, documentary and other evidence indicate that Bulgarians participated in seafaring, shipbuilding and piracy even if in modest numbers. Taking into account that the Kitten ship plied the waters of the Black Sea and the crew consisted of Christians, they must have been Greeks or Bulgarians. The large group of copper utensils stylistically suggests that they were manufactured in the Sub-Balkan region,

Central Bulgaria, where there was no Greek minority. The smoking pipes probably were manufactured in Varna, on the north coast of Bulgaria, by Muslim craftsmen, as the two stamps that have been identified read “Allah” and “Ali”. The only complete earthenware plate found was manufactured in Chanakkale on the Asian side of the Sea of Marmara at the end of the 18th century. It is unlikely that we shall ever know with certainty the ethnic background of the crew, but it appears that they were Bulgarians.

The 18 wooden spoons found on the wreck may indicate the number of persons on board during this fatal voyage. The presence of a child’s shoe and a possible toy sword suggest that among the passengers was a little boy; the jewelry may have belonged to a woman, possibly the boy’s mother. As the clues to their presence were discovered in the stern cabin, they likely were members of the captain’s family. The sole confirmed victim of the shipwreck appears to have been the family’s goat-kid. Its skeleton was found in the stern cabin. Calculating a total of 18 wooden spoons found on the wreck, and allowing one spoon each for the child and woman, the result indicates that the crew perhaps numbered about 15-16 men, including the captain. One major question regarding the people on board at the time of the wrecking concerns the presence of the navigational instrument in the port bow of the ship. Such an instrument was a rarity in the Ottoman Navy of the time, and it is all the more surprising to find it on board a small merchantman that sailed between Istanbul and the Bulgarian ports, a route on which the navigator would rarely lose sight of land for long. The presence of a sextant or an octant also presumes ability on the part of somebody to work with one, knowledge of

navigational astronomy, charts, almanacs, and of spherical trigonometry – skills that were rare even in the Sultan's Navy. The only other navigational tool found on board was a sounding lead, discovered in the stern cabin. Its provenance strongly suggests that it belonged to the captain, the most probable "navigator" on board. No other navigational instruments, such as a compass or dividers, were found on the ship, although the absence of evidence is not evidence for their absence. Still, the presence of a sextant or octant when no evidence for a compass was found on board is strikingly odd. The captain would have been the most logical owner of the sextant, but its location in the bow of the ship suggests otherwise, unless it was lost while attempting to abandon ship from the bow. This possibility, however, is not supported by the association of artifacts (toiletries box, inkwells, cauldron remains, rope) with which the sextant mirrors and lenses were found. If the instrument did not belong to the captain, it must have been the possession of a passenger. The owner of this device will remain a mystery until further data, perhaps archival evidence, emerges.

The finds from the ship help us to learn about the social status and internal economy of the captain, his family and the crew. The concentration of artifacts of higher value in the stern cabin leads to the conclusion that privileged individuals occupied that space. The many copper vessels found there imply a person of a certain economic status. The amber mouthpiece on the otherwise simple chibouk stem suggests likewise. Some elegance was associated with serving food in the cabin, as evidenced by the finely crafted copper vessels and some earthenware pottery. The poorly preserved remains of copper

cauldrons and large pots from the bow area, suggest that the crew messed from a common dish, separately from the captain and his family.

The archaeological evidence permits us to build a hypothesis on the final voyage of the ship. It appears that at the time of sinking there was no cargo aboard, so the vessel may have entered the bay for the purpose of loading. It is known that there were three loading stages around Cape Urdoviza, one on the northern side and two on the southern side. One was located more or less where the Marina Restaurant now stands, the other was in the mouth of the Karaagach River in the southern part of the bay and the third in the *Atliman* to the north of the cape. The location of the wreck indicates where the ship intended to load. From Cape Urdoviza (the hamlet, now town, of Kitten did not exist until the 1930s) was exported timber and charcoal. It is not known if grain was also exported from there. Combining the knowledge of those exports and the numerous twig-brooms found, charcoal appears the likely intended cargo. Yet, no trace of this dirty cargo was found on board, so questions still exist on this count. If we consider the tightly sealed lower part of the hold, it would appear that grains such as wheat and rice comprise logical intended cargoes as well. Since there was virtually no hinterland around Urdoviza that could be a market for imported goods, the odds are that the ship arrived in ballast. The destination of whatever cargo was to be loaded would logically have been the largest consumer centre of the Mediterranean world, Istanbul. The port of origin is less certain. Nevertheless, a likely hypothesis is that it was Varna. Varna was a major transshipment centre for produce from Dobrudja and the interior of the Balkan

Peninsula, brought down the Danube River. Varna was also the main entrepot for imported goods brought from and via Istanbul. A Varna origin of the voyage may be implied by the smoking pipes found on board. Since, their quantity was not sufficient for them to be a cargo item, they are likely to have been the personal property of people on board. Typologically these pipes are widely accepted in the literature as products of Varna workshops. Some of the pipes were used, but a few were pristine, suggesting that they were recent purchases. Therefore it seems probable that the ship began its last voyage from Varna, possibly in ballast, and anchored under Cape Urdoviza to load cargo for Istanbul. An alternative hypothesis that is also possible is that the ship was returning in ballast from Istanbul and tried to shelter in Urdoviza Bay, only to be overwhelmed by a storm.

From the general orientation of the wreck and the structural damage suffered, we are able to reasonably reconstruct the final moments of the ship. It appears that the ship was at anchor, in the lee of Cape Urdoviza, possibly waiting to load cargo. The small quantity of ballast found and the lack of identifiable cargo in the hold suggest that much. The general orientation of the wreck points to a storm coming from the NE, which is the dominant direction of the winds for most of the year. It is possible that the captain misjudged the depth in which he anchored. It is, however, more probable that either the anchor dragged, as the grapnel anchors typical for the region are only too prone to do, or the cable broke and the ship found itself in the surf, still with its bow into the wind. Once in the shallow surf zone, the stern hit the bottom first, likely tearing off the sternpost.

The vessel appears to have beaten its stern into the bottom for some time, as the aftmost frames, especially on the port side, are completely twisted and broken. Since the vessel did not turn on its beam ends in the surf, it would appear that the bow was held into the eye of the wind and therefore the anchored dragged, but the cable did not break. The force of the waves must have been significant, as the ship was driven stern down and lies deep into the bottom to the present day at a distinct angle from the horizontal.

The sinking must have happened quickly, as the goat was left in the cabin. Yet there may have been some time to grab easily accessible items, as there is a dearth of valuable personal effects or coins. No traces of human remains were identified during the excavation, so either all people on board safely abandoned ship or the bodies drifted away. Either in the wrecking itself, or shortly thereafter the port side tore off and probably floated away, as very little evidence of it was found. The remaining starboard side was filled with mud and sand. The bow probably sat up from the bottom for some time, until shipworms and erosion took their toll on it. Eventually, the parts of the hull protruding from the sea floor disappeared. Interesting and informative as all the finds are, the largest, most important and informative artifact proved to be the vessel itself.

The coherent structure encompasses most of the starboard side of the ship, but unfortunately very little of the bow has survived. The stern is heavily damaged too, but the discovery of the lower part of the sternpost was indispensable in the reconstruction. The central portion had suffered significant distortion over the 200 years since it sank, but the individual frames have mostly preserved their shape. On the port side most of the

floor timbers have survived almost to their original length and most of the transversal ceiling was still in place, but no futtocks were present, except a few in the port quarter of the ship and they were all split and broken up, completely distorted.

During the recording of the ship structure it was observed that the words "timber shortage" must have been completely unknown to the master shipwright who built the excavated vessel. All parts of the ship were converted from large baulks of timber. None of the timbers were observed to have sapwood, let alone bark, while I have personally observed that many of the timbers on the Swedish Royal Ship *Vasa*, lost in 1628, were barely worked and still had bark on them. On the Kitten ship all compass timbers were naturally grown. Thus, the floor timbers of the rising both fore and aft were cut from V-shaped and Y-shaped forked trees. The keelson, and evidently the keel too, were of single trees. The filling pieces between the futtocks in the central part of the hull also appear wasteful, but they were probably required for stiffening the hull in an area of high stress from the rig. Alternative explanations are that the hull needed the reinforcement for specific intended cargo (although it is difficult to envision what that cargo could have been) or that the reinforcement was found necessary as the ship was supposed to take the bottom regularly during loading and unloading operations. Port facilities were virtually non-existent and some vessels were beached for loading. Considering the large size and the likely draught of this ship, beaching is unlikely to have been a regular occurrence, especially since it would not have eased loading in any way. Thus, the two most likely

explanations for the filling timbers must remain the reinforcement for the support of the rig, or protection of the external planking from the cargo.

Of great interest was the discovery of hook scarfs in the frames. A broken futtock found, that was no longer in situ, had a clearly observable hook in its end and remains of fasteners. This brought to mind the 16th-century wreck from Yassiada, Turkey, and was the first hint that the Kitten ship may prove to be a wreck of significant importance for understanding of shipbuilding in the Black Sea and the Eastern Mediterranean. Subsequently, it was determined that the middle half of the hull, consisting of 27 frames, including the midship frame, were hook-scarfed. The morphology of this type of scarf is associated with Mediterranean whole-moulding techniques, although until now the only vessel that has been thoroughly analyzed is the 14th-century Culip VI wreck from Catalonia, Spain. At least two other vessels are known to have the same scarfing, the Ottoman wreck from Yassiada and the wreck from Sardineaux, France.

The good preservation of the Kitten ship permitted a reconstruction of the hull lines with only the shape of the bow and particularly the stem being hypothetical. Fortunately for any further analysis, the middle part of the vessel formed a coherent structure and any distortion could easily be corrected. Of particular value for the reconstruction process was the recovery of a midship beam that extended almost to its original length and the missing part could be estimated on the basis of symmetry. The beam and the midship frames could produce fair lines of the section at a minimum of 3.56 m depth in hold,

which matches reasonably well with the traditional proportion that the depth in hold is about half the beam of the vessel. Comparison with treatises and other data demonstrated that the shipwright followed traditional proportions and methods in building the vessel.

The second fortunate discovery was the disarticulated sternpost of the ship under the starboard quarter. Only about 2 meters of it survived, but these included the pintle and the lower end, which butted into the keel. Thus, the actual thread length of keel and the rake of the lower sternpost could be determined and then the approximate draught of water for the ship could be estimated. The height of stem and stern were based on iconography, comparative proportions calculated from Paris' drawings and proportions tables from Damianidis' doctoral dissertation on vernacular Greek boatbuilding. Though probable, the heights of stem and sternpost cannot be considered certain.

Once the reconstruction of the vessel was complete, it was possible to estimate the displacement and calculate the hull coefficients. The obtained results demonstrated that the Kitten ship was likely to have been a fairly good sailer, with lines that were well-suited for rough conditions. The lines and the rig would have permitted good windward performance, which, however, was probably influenced negatively by the high bow and stern. It has been argued that the ship was single-masted with a lateen sail providing most of the motive power. It is very likely that the ship had a polacca or foresail, too. That the rigging lines were made of reed (*papur*) bast – indicates the fitting out of the ship was done locally; ropes of this material were being hand-twisted along the coast as

recently as the 1930s and 40s. Although it is hard to say what the properties of reed rope are without comparative studies and experiments, it is likely a weaker material than hemp. Therefore one would expect the ship to have been sailed conservatively. This conclusion seems to be supported by the writings of contemporary Western European travelers, although most of them expressed this in somewhat stronger and harsher terms, in particular Eton who was openly dismissive of the sailing characteristics of vessels on the Black Sea. Be that as it may, vessels similar to the one at Kitten served their purpose and met the needs of the maritime community in a technologically and politically backward area of the world. With a displacement of about 160 tons, the ship was large enough to make the transportation of bulk cargoes economically practicable and small enough to have a fairly fast turn around in port.

Two aspects of the design of the ship were explored. An attempt was made to determine the mensuration system used by the shipwrights. The most logical was to expect the ship to have been built to Ottoman units, and this was the original working hypothesis. However, since Venice had a strong influence in the region, including upon Ottoman shipbuilding in the early period of the Empire, and when it became clear that the Kitten ship was built through whole-moulding similar to the system described in the Italian treatises, the units used by the *Serenissima* were also tested. Conversion of the recorded metric measurements into Venetian *piedi*, paces and *deda* demonstrated that these units are unlikely to have been used, despite the even divisions obtained for keel length, stevedore beam and even overall length. The timber scantlings when converted did not

produce logical divisions, proving that different units were used. This brought us back to the original hypothesis. However, the value of the Ottoman architectural *arşin* changed over the centuries. We know these values for the 1770s, (though there is strong indication that these values may not have been universally used) and we know its last incarnation, established by Sultan Selim III in 1794-95. Experimentation proved that Ottoman measuring units were used, but it is harder to determine which of the two standards was employed. The difference between the two is only 6 mm and thus results for calculations based on either of the two *arşin*s offered good results. At present no final conclusion can be offered. It is also not impossible that *both* standards were used simultaneously. Improbable as this may sound to a 21st-century Westerner, Baron Tott remembered that when he compared the builders' arşins of the twenty or so masons under his direction to the arşin he was sent by Sultan Mustafa III, not one matched the length of the one sent by the sultan. As if this was not enough, no two of the mason's arşins matched each other! In the light of Baron Tott's experience, it is not impossible that the situation among shipwrights was not much different. Thus, the overall dimensions match better an arşin length of Mustafa III's reign, but many of the timber scantlings are closer to the newer arşin of Sultan Selim III. The main point, however, to be made on the basis of the measuring units, is that there was no *direct* Venetian or Italian influence in the building of the ship.

The next stage of the analysis of the vessel was to attempt to recover the method used for controlling the hull shape. The scarfs gave a strong indication that a form of whole

moulding was used. Unfortunately, the preservation of the upper hull is insufficient to permit analysis of the narrowing and rising of the breadth. However, this could be determined for the floor timbers. Whole moulding has been defined as a method in which the hull is formed through incremental changes of a master frame, the midship bend of timbers. These incremental changes were based on the partisoni – a geometrical progression (for the Mediterranean) that determined the increments. Four partisoni were usually used: the narrowing and rising of the floors, and the narrowing and rising of the breadth. From the treatises it is known that the frames immediately before and abaft the master frame usually had no rising and frequently no narrowing either. Experiments carried out on the Kitten ship led us to determine that the narrowing was controlled with a mezzaluna and all 13 frames before or abaft the master were projected. For the rising no mezzaluna seems to fit the recorded information. Either the rising was determined by eye with a batten, hanging string or some other mechanical device, or a different geometrical tool was employed for graduating the partison. Kostas Damianidis describes traditional methods of moulding that were used in small shipyards in Greece until at least the middle of the 20th century. The information that he offers may shed light on this aspect of the Kitten ship. It should be noted, however, that the Greek methods, as described by Damianidis, are modified from their original form. The switch to engines not only modified the proportions and general shape (especially the stern) of boats, but also the control points from the turn of the bilge and height of breadth to the waterline and sheer. The geometrical methods of producing the increments, however, appear to be relevant. Damianidis describes the mezzarola, a derivative of the mezzaluna, which he

believes to be typical of the Aegean and unknown in other areas. Three different mezzarolas were constructed before finding that one based on 10 frames before and abaft the master frame fits the recorded measurements on the Kitten ship. Thus, it is at least possible that a mezzarola was used for determining the increments of rising on the Kitten ship.

There is, then, sufficient evidence to conclude that the Kitten ship was built by an experienced master shipwright, who had constructed similar vessels before. To shape the hull, he used whole moulding. It can be postulated that the excavated vessel is a late example of an ancient method of shipbuilding, the origins of which Hocker and McManamon suggest go back to the Middle Ages.[307] Traces of the method are evident in a shipwreck from Bozburun, Turkey, dated to circa A.D. 880 (timber for its construction possibly felled in present day southern Bulgaria) and the wreck at Serce Limani, Turkey, dated to circa A.D. 1025. The method can be traced through the centuries in the Culip VI wreck (c. A.D. 1300), the Contarina I ship (c. A.D. 1300), the Venetian treatises of the 15th and 16th centuries, the Ottoman wreck from Yassiada (end of the 16th century), the treatises of the 17th century (*e.g.*, Joseph Furtenbach), and the shipwreck from Sardineaux (17th century). The Dnepr wreck, dated to the 1730s, may also prove to be an example of this whole-moulding tradition.[308] It is to be hoped that the wreck will eventually be studied from the point of view of the history of technology. The latest known example of a whole-moulded ship so far excavated is the Kitten wreck, which

[307] Hocker and McManamon 2006.
[308] Taras Pevny 2009, personal communication.

sank at the end of the 18th or the beginning of the 19th century. From the dates of recorded instances of its usage, it would appear that by the beginning of the 18th century, the traditional whole-moulding process was in decline. Other methods of designing ships were coming into general use. The old ways appear to have been preserved only in areas that were technologically falling behind, such as the Ottoman Empire, or Russia. The Dnepr wreck, although discovered in Ukraine and built for service on the Ukrainian rivers, evidently was built for the Russian army.

The existence of a whole moulding tradition common in its broad outline to the entire Mediterranean and the Black Sea as well seems clear now. In the archaeological record, the use of this system in constructing the vessel is attested by the presence of hook scarfs between the floor timbers and the futtocks. Earlier wrecks were built with scarfs along their entire lengths, but in the Kitten ship, they were limited to the middle part of the hull. From the work of Damianidis it is clear that Greek boatbuilders also projected the shape of one-third to one-half of the frames in the central section of the hull. Interestingly, the Iberian treatises seem also to suggest that only a small portion of the frames were to be moulded and scarfed. The archaeological and historical evidence seem to suggest that by the time Constantinople fell to the conquering Ottoman Turks in 1453, this style of whole moulding was well-established and widely used. The isolation of the Black Sea littoral from the technological development in the West may have aided the preservation of the old tradition until the 19th century.

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