

# Contents

<b>List of Figures.....</b>	xiii
<b>List of Tables.....</b>	xix
<b>Lists of Abbreviations .....</b>	xxi
<b>Introduction.....</b>	1
The Mortella wrecks: a valuable source of information .....	1
The issues addressed and the objectives of the study .....	1
The limits of the archaeological study .....	2
Construction techniques .....	3
The architecture of the ship.....	4
Archaeological sources .....	4
Documentary sources .....	4
The sources of the historical perspective .....	5
<b>1. Shipbuilding in the Mediterranean in the 16<sup>th</sup> century: State of the art and issues .....</b>	7
1.1. The concepts of ‘maritime space’ and ‘technical culture’ at the heart of current issues.....	7
1.2. Construction techniques: in search of ‘technical fingerprints’ .....	8
1.3. The components of the architectural project: in search of an architectural model .....	8
1.3.1. Proportions: the relationship between dimensions.....	8
1.3.2. The form: the shape of the master-frame .....	13
1.3.3. The design method: the moulding process .....	18
<b>2. Portraits of the Mortella wrecks: The discovery of the sites, their characteristics, their chronology &amp; excavation methods.....</b>	23
2.1. The Mortella II and III: discovery of two sites of the same origin. Characteristics and background.....	23
2.1.1. The discovery of the sites .....	23
2.1.2. General description of the Mortella sites at the time of their discovery .....	23
2.1.2.1. Site characteristics .....	23
2.1.2.2. Nature of the sites .....	25
2.1.2.3. The link between the two sites .....	25
2.1.3. Background and history of interventions .....	25
2.2. Archaeological material and wood of the hull: the artefacts and the material helping the chronology .....	26
2.2.1. The contribution of the artefacts to the understanding of the wreck and to its dating .....	27
2.2.1.1. Artillery.....	27
2.2.1.2. Ceramics .....	27
2.2.2. The wood: its characteristics and contribution to dating using dendrochronology.....	28
2.2.2.1. The wood and its origin.....	28
2.2.2.2. Its use in shipbuilding.....	29
2.2.2.3. Woodworking and tool marks.....	31
2.2.2.4. Dendrochronological study .....	31
2.3. General layout of the Mortella III site and context of the shipwreck .....	32
2.3.1. General layout of the remains of the hull (fig.26) .....	32
2.3.2. The context surrounding the sinking .....	32
2.4. Defining the research programme: research axis, methodology and excavation strategy .....	36
2.4.1. Methodology and excavation strategy.....	36
2.4.1.1. Objectives and excavation strategy .....	36
2.4.1.2. Means and excavation methodology .....	36
2.4.2. Conservation and protection of the site .....	41
2.4.2.1. Preventive conservation of the artefacts .....	41
2.4.2.2. Conservation of the remains on the site .....	42

<b>3. The hull of the Mortella III wreck and its construction method .....</b>	<b>43</b>
3.1. The transversal framework: organization, dimensions, morphology and scarfs methods .....	43
3.1.1. General layout of the transverse framing .....	43
3.1.1.1. Definition of the frames groups.....	43
3.1.1.2. Sequencing of the frame components, room and space .....	45
3.1.1.3. The frames of the aft part of the hull .....	47
3.1.1.4. Frames located between the tailframes.....	49
3.1.1.5. Frames of the fore part of the hull .....	52
3.1.2. Components of the frames (see Table 10 for a summary of dimensions) .....	57
3.1.2.1. The floor-timbers .....	57
3.1.2.2. Scarfs of the floor-timbers to the first-futtocks.....	60
3.1.2.3. The first-futtocks .....	63
3.1.2.4. Scarfs from first to second-futtocks .....	64
3.1.2.5. The second-futtocks.....	66
3.1.2.6. Summary tables of the frames measurements .....	66
3.1.3. Scarfs typology of the frame components .....	66
3.1.3.1. A technical choice .....	66
3.1.3.2. A possible architectural design function.....	69
3.2. The longitudinal framework: layout, dimensions, morphology and scarfs methods .....	71
3.2.1. The keel, the heel of the keel and the keelson .....	71
3.2.1.1. Search for keel length.....	71
3.2.1.2. Morphology of the keel and types of scarfs .....	73
3.2.1.3. The heel of the keel, its scarf to the keel and the stern.....	75
3.2.1.4. The keelson.....	79
3.2.2. Clamps, sill and ceiling .....	80
3.2.2.1. Clamps .....	80
3.2.2.2. The ceiling and the sill .....	84
3.2.3. The planking and its fastening method to the frames.....	84
3.2.3.1. The wood .....	84
3.2.3.2. Morphology and dimensions .....	85
3.2.3.3. Fastening method of the planking to the frames .....	86
3.2.3.4. The forward end of the planking .....	88
3.2.3.5. Caulking and sealing products.....	90
3.3. Fastening system for the timbers.....	92
3.3.1. Iron nails and absence of treenails .....	92
3.3.2. Circular section of the nails.....	93
3.3.3. Folded down nails tips .....	94
<b>4. The attributes of the hull: The mainmast step, the pump, and the rudder .....</b>	<b>95</b>
4.1. The main mast-step .....	95
4.1.1. The longitudinal timbers of the mast-step arrangement (or sister-keelsons). ....	95
4.1.2. The buttresses .....	95
4.1.3. The keys .....	96
4.1.4. A major Mediterranean technical ‘fingerprint’ .....	96
4.2. The pump .....	100
4.2.1. The foot-valve .....	102
4.2.2. The pump-tube .....	102
4.3. The rudder .....	107
4.3.1. The rudder device: definitions and vocabulary .....	108
4.3.2. Morphology of the rudder blade.....	108
4.3.3. The nailing .....	109
4.3.4. The bolts .....	109
4.3.5. The iron-works .....	111
4.4. Analysis and interpretation of the remains uncovered .....	114
<b>5. The architectural profile of the Mortella III wreck: Shapes and proportions .....</b>	<b>117</b>
5.1. Attempt to restore the shape of the master-frame M27.....	117
5.1.1. Position of the master-frame on the keel.....	117
5.1.2. Characteristics and shape of the frame.....	118
5.1.2.1. The rising and narrowing of the master floor-timber .....	118

5.1.2.2. The shape of the master-frame M27 .....	121
5.1.2.3. The design of the master-frame .....	122
5.1.2. Restoration of the master-frame shape .....	125
5.2. The deck and depth of hold .....	129
5.2.1. The number of decks .....	129
5.2.2. Decks height .....	129
5.2.3. The depth of hold .....	132
5.3. Rake of the sternpost and shape of the stem .....	133
5.3.1. The rake of the sternpost and the overhang .....	133
5.3.2. The stern and its overhang .....	135
5.4. Proportions of the ship, the attempt to restore her shape and longitudinal dimensions .....	137
5.4.1. The main proportion ratios .....	137
5.4.1.1. The keel width/length ratio .....	138
5.4.1.2. Summary of proportions .....	139
5.4.2. Attempt to restore the longitudinal shape and the dimensions of the ship .....	139
5.5. The gauging .....	139
5.5.1. An essential unit of volume in 16 <sup>th</sup> century shipbuilding .....	139
5.5.2. Calculation of tonnage in the 16 <sup>th</sup> century .....	141
5.5.2.1. The Venetian method .....	141
5.5.2.2. The Spanish method .....	141
<b>6. Historical study: Issues, references, and identification attempt of the Mortella wrecks .....</b>	<b>143</b>
6.1. Hypothesis and historical issues .....	143
6.2. The naval combat and shipwrecks of 1555 .....	143
6.2.1. The historical context of the period .....	143
6.2.2. Related Texts .....	143
6.2.3. Analysis of the hypothesis of the shipwrecks of 1555 .....	145
6.3. The shipwrecks of 1526 .....	146
6.3.1. The historical context of the period .....	146
6.3.2. Related texts .....	146
6.3.3. Analysis of the texts on shipwrecks of 1526 .....	147
6.4. The shipwrecks of 1527 .....	148
6.4.1. The historical context of the period .....	148
6.4.2. Related texts .....	148
6.4.3. Analysis of the texts on shipwrecks of 1527 .....	149
6.5. Provisional lessons drawn from historical research .....	150
6.5.1. The architectural portrait of a Genoese nave .....	150
6.5.2. Historical landmarks on the development of the Genoese nave .....	151
<b>Conclusion .....</b>	<b>153</b>
The architectural portrait of the Mortella III ship .....	153
The historical portrait of the Mortella III ship .....	153
The contribution of the wreck to a Mediterranean technical model .....	154
The contribution of the wreck to the definition of a Mediterranean architectural model .....	155
The exploration of the Venetian treatises in relation to the Mortella III wreck .....	156
Future prospects for knowledge of Mediterranean shipbuilding .....	157
<b>Sources and Bibliography .....</b>	<b>159</b>
<b>Glossary .....</b>	<b>169</b>
<b>Annex 1. General layout and planimetry of the Mortella III wreck .....</b>	<b>173</b>
<b>Annex 2. Photomosaic of the Mortella III wreck .....</b>	<b>175</b>
<b>Annex 3. Dendrochronological study .....</b>	<b>177</b>
<b>Annex 4. Study of the transverse compression of the Mortella III timbers .....</b>	<b>191</b>
<b>Annex 5. Chemical analysis of caulking and sealing materials .....</b>	<b>197</b>

<b>Annex 6. Main original texts resulting from literature research.....</b>	<b>203</b>
<b>Annex 7. Selection of texts mentioning or inducing the <i>As-Dos-Tres</i> rule .....</b>	<b>209</b>
<b>Annex 8. Study of the West Anchor of the Mortella III wreck .....</b>	<b>211</b>
<b>Annex 9. Divers team list.....</b>	<b>213</b>
<b>Annex 10. Photos of the excavation .....</b>	<b>215</b>
<b>Annexes 1 and 2 are also available as an accompanying download</b>	