Shipbuilding in the medieval Adriatic

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Abstract. *In Venice, naval construction was carried out by the squeri, small private shipyards and as of the 14th century by the Arsenal under the control of the Commune, for galleys and round ships. The first treatise on naval construction is attributed to Michael of Rhodes in 1434. He describes three types of galleys and two types of round hulls. The master-builders or proti were specialized in one type of vessel. Venice, and the Adriatic ports from Ancona to Bari and Split to Ragusa, drew their prosperity from the sea.*

Résumé. *À Venise, la construction navale est effectuée par des 'squeri', petits chantiers naval, et, à partir du XIVe siècle, l'Arsenal, sous contrôle de la Commune, construit les galères publiques et les navires ronds. Le premier traité de construction navale est dû à Michel de Rhodes en 1434 : il distingue trois types de galères et deux types de navires à coques rondes. Les maîtres constructeurs ou 'proti' se spécialisent dans la production d'un type de navire. Venise, comme les ports adriatiques, d'Ancône à Bari et de Split à Raguse, tirent leur prospérité de la mer.*

The history of shipbuilding in the medieval Adriatic is, as is much else in that area, the story of Venetian efforts to extend the city's control. Early on, ships were small and small shipyards could be sited on just about any level area with access to wood, water and skilled labor. As trade grew, Venice prospered and worked to funnel more regional and international trade through its own markets. At the same time the need for larger ships for commerce and navies to protect them grew apace.

The sailing route up and down the Adriatic follows the northeast coast because storms coming out of the north and northeast create the danger of a lee shore along the Italian side of the sea. This explains the strenuous efforts of Venice from the 10th century on to control the Dalmatian coast. Unlike the relatively smooth coastline of the Italian side of the Adriatic, the many islands and inlets of the Dalmatian coast provide shelter and anchorages. A seafaring tradition, including a strong element of piracy, was of long standing along that route. The great forests stretching inland to the Danube region provided ample raw materials for shipbuilding. The Roman *liburna*, the backbone of the Imperial

fleet, was adapted from an Illyrian pirate vessel and was the predecessor to the late-Roman and Byzantine warship types that came to be known as *dromōnes*.[1]

Squeri, arsenals and the Arsenal

Before the early 13th century shipbuilding everywhere in the Adriatic zone was a private, decentralized affair. Early on, even the fighting ships that projected the power of maritime cities were built, equipped, and manned privately in the service of the state. Naturally, governments were first interested in assuming control over and, finally, organizing the building of warships. The most famous shipbuilding facility in western history is the Venetian Arsenal. It has impressed visitors from Dante to present-day tourists. From earliest times the inhabitants of the Venetian lagoons have, of necessity, had an intimate relationship with the sea. Their livelihood depended upon the boats and ships they could build.

As the city grew, the need for various kinds of watercraft, and larger numbers of them, increased. To obtain sufficient supplies of wood to build everything from small lagoon craft to large sea-going ships Venetians could, early on, rely on the forests of the nearby mainland. At the same time, one must remember that most of the structures of the city are raised on pilings of tens of thousands of tree trunks driven deeply into the mud of the lagoon bottom. Between building the city and building its ships, Venice's appetite for trees was insatiable. Trees cut down along the Piave, the Brenta, and other rivers that empty into the Adriatic near Venice were rafted there to be turned into ships. Eventually, it would be necessary to go farther afield, to the forests of Dalmatia while also developing a program of systematic forestry. Lumberjacks were a very important part of the process of shipbuilding.

Shipyards (*squeri* in Veneto) in Venice were located on the Bacino di San Marco, along the Grand Canal, and in the *sestiere* of Castello at the far eastern end of the city. The Zattere in the *sestiere* of Dorsoduro along the Giudecca Canal is so called for the rafts of timber (*zattere*) that were landed there because that canal was broad enough to allow the large, clumsy aggregations of tree trunks to be maneuvered in its waters.

There were yards that specialized in building small craft intended for use only in the city canals and in the waters of the lagoons. These *squeri di sotil* do not require much room and a half-dozen or so still exist in Venice. The oldest of these, and most familiar to tourists in the city, is the Squero di San Trovaso which claims to date from the early 17th century and still produces about one gondola per year. *Squeri da grosso* built galleys and ships, larger sea-going craft and, of course, occupied more area.[2] Whether large or small, a *squero* was a relatively simple affair. All that was needed was a place to store materials, an area large

[1] Pryor J. and Jeffreys E.M., *The Age of the ΔΡΟΜΩΝ: The Byzantine Navy ca. 500–1204*, Leiden and Boston: Brill (2011), p. 125.

[2] Zanelli G., *L'Arsenale di Venezia*, Venezia: Centro Internazionale della Grafica (1991), p. 12.

enough for the completed hull with space around it to work and, for the *squeri da grosso* a basin large enough to float completed hulls. The work of raising masts, rigging, and outfitting the ship for sea took place in the basin.

Private shipyards sufficed for the needs of the Venetian Republic even as maritime activities, mercantile as well as naval, were increasingly closely regulated by the state. In the present Arsenal there is a marble plaque dating from the early 19th century which proclaims that the Arsenal was founded in 1104 in connection with the First Crusade. There is virtually no evidence to support this claim though it is likely that from sometime around the beginning of the 12th century state-owned storage and repair facilities were beginning to develop in that area. Although an *arsena* already existed in the area of San Pietro di Castello towards the end of the 12th century, private shipyards still supplied most of the naval vessels of the Republic.[3] The most important arsenal in Venice as late as the beginning of the 14th century was located on the Bacino di San Marco, just south of the Piazza San Marco. Its outline is preserved by a small park, the Giardinettii Reali. This *Arsenale di Terranova* could build up to fifteen galleys at once.[4] The Arsenal in Castello, which came to be called The Old Arsenal, primarily a repair and storage facility, could work on about a dozen galleys. In the first quarter of the 14th century the New Arsenal was built, adding to the Old Arsenal and increasing the area of the state-owned shipyard fourfold.[5] These facilities were enclosed within walls and, with subsequent additions, remained an active naval facility into the 20th century.

In the course of the 14th century, the state-owned shipbuilding complex at the eastern end of Venice grew in complexity and capability. Alongside the Arsenal, the Tana – the ropewalk and storage facility for hemp and canvas so necessary for sailing ships – emerged. Throughout the 13th century hempworkers had become increasingly regulated, especially under the pressures of wars with Venice's rival, Genoa. By the 1330s the Arsenale Nuovo and the Tana emerged as independent but interdependent elements of the Venetian Republic's shipbuilding efforts. The Tana was a central workshop where hemp was hackled, i.e., turned into fibers suitable for spinning into yarn to be twisted into rope or woven into canvas. Merchant employers or shipbuilders purchased the fibers to be put out to workers who spun them into finished products. To produce critical cordage for ships, there were spinners who worked in the Tana where close quality control could be maintained.[6] The Arsenal of the 14th century concentrated on the building of both merchant galleys and light galleys. The great sailing ships were built elsewhere in the lagoon in private shipyards. The line between state and private shipbuilding activities was not always as sharp as the modern mind might expect. Light galleys for the navy could be built by private individuals in privately-owned *squeri* or by the state in either private shipyards

[3] Concina E., *L'Arsenale della Repubblica di Venezia*, Milano: Electa Editrice (1984), p. 9.
[4] Zanelli, *L'Arsenale di Venezia*, *op. cit*., p. 15–16.
[5] Lane F.C., *Venice: A Maritime Republic*, Baltimore, MD: The Johns Hopkins University Press (1973), p. 163.
[6] Lane, *Venice: A Maritime Republic*, *op. cit*., pp. 162–163.

or state owned facilities. Merchant sailing ships were built in private facilities but their construction was closely supervised by the state. As, in the course of the 14th century, the building of galleys for the state was centralized in the Arsenal in Castello, the methods of construction in themselves were not substantially transformed. The master shipwright with his expert 'eye' still controlled the outcome along with the other skilled craftsmen who worked under his direction. Each vessel was still slightly different from every other one.

The craft of shipbuilding

The experienced eye of a master shipwright guided the process of construction. It was his knowledge of the principles of construction and his ability to conceive and guide the shaping of the hull through acquired experience and innate talent that determined the outcome of the shipbuilding endeavor. But, it took the hands of many men to see that vision realized. Sawyers turned tree trunks into planks and curved and forked trees into ribs and knees. Carpenters assembled and finished the rough wood from the sawyers into the frame of the desired vessel. Finally, caulkers completed the work on the hull. There were two classes of caulkers. The 'calafadi da fizer' who fastened the planks of the hull to the frame were paid at a higher rate than the "'calafadi da maggio' who, with mallet and iron, drove tow into the seams between the planks and covered the hull with pitch to make it watertight.[7] Other craftsmen, such as ropemakers, sailmakers, and oar makers were needed before a ship could put to sea. By the 13th century, these workers were being organized into craft guilds.

Ancient and medieval ships are customarily divided into two broad categories: round ships and long ships. Round ships are thought of as purely sailing vessels used primarily in merchant endeavors, though a large sailing ship was eminently defensible and could even undertake certain kinds of offensive operations. Long ships were designed to be propelled by oars though they, in practice, used sails as much as possible. Galleys were primarily, though not exclusively – especially from the 14th century on – war ships. Within each of these broad categories there were many sub-types. There was also considerable change over time. In the years around 1300 there were major changes in both long ships and round ships. About 1295 a new type of trireme galley appeared, probably first in the western Mediterranean. The type was quickly adopted by Venice and within a few years became the standard warship of Mediterranean navies, replacing the earlier bireme galley. At almost the same time, round ships from the Atlantic began to influence strongly the way such ships were built in the Mediterranean. The cog, with a single square sail, a clinker-built hull, and a stern-post mounted rudder developed along the coasts of the Baltic and Northern Europe. The carvel-built Mediterranean hull was adapted to take the single large square sail and stern rudder of the northern design.

[7] Lane F.C., *Navires et Constructeurs á Venise pendant la Renaissance*, Paris: SEVPEN (1965), p. 89.

What we know of the way ships were built is general to the Mediterranean area as a whole but certainly applies to the Adriatic region. Ships of the classical period were built planking first. That is, after the keel was laid, the hull was built up, plank by plank, each one securely fastened edge-to-edge with the next using closely spaced mortise and tenon joints. Once the bottom was completed, floor timbers were inserted. Then, the process continued up the sides of the vessel with more framing inserted when the side planking was completed. Most of the strength of the hull was in its tightly jointed planking, the frames contributing only some additional strength.[8] This process allowed the shipwright to observe and control the curves of the hull as it rose. The Mediterranean tradition of carvel building certainly descends from this method of construction.

Gradually, the framing of the hull took on more of the role of giving strength to the hull. Mortise and tenon joints came to be more loosely fitted and farther apart. Eventually, it seems that they were used only to establish the curvature of the lower part of the hull while the upper strakes of the planking were nailed to the frames that were raised on the hull floor. Finally, by the 11th century, ships were being built frames first, with the planking attached to the frames, in the manner that we think of as 'normal'.[9] In some respects, frame-first construction is cruder and requires less labor and a less refined technique than planking-first shipbuilding. On the other hand, frame-first construction requires the shipwright to project in advance the desired lines of the vessel in terms of its cross sections, represented by the frames. In either case, of course, there were no plans or written instructions for building of ships. Everything was in the mind and hands of the shipwright, his helpers, and apprentices. The skills required to build a ship were acquired over long apprenticeship and years of practice and repetition. It was not until the 15th century that written and illustrated works on shipbuilding began to appear. These works were not plans or instructions that would enable the uninitiated to build a vessel but were part of a wider trend to demystify, rationalize and record in writing what had theretofore been closely held craft skills.[10] Venetian seamen led the way in this development. The earliest surviving manuscript treatise on shipbuilding was written in 1434 by Michael of Rhodes, who had risen through the ranks of the Serenissima's navy from simple oarsman to the highest ranks open to a non-noble. Information on shipbuilding is the second largest portion of Michael's work after mathematics.[11]

[8] Steffy J.R., *Wooden Ship Building and the Interpretation of Shipwrecks*, College Station, TX and London: Texas A&M University Press and Chatham Publishing (1994), pp. 42–52.

[9] *Ibid*., p. 83–85.

[10] Dotson J.E., 'Treatises on shipbuilding before 1650', in *Cogs, Caravels and Galleons: The Sailing Ship 1000–1650*, ed. R.W. Unger, Conway's History of the Ship, London: Conway Maritime Press (1994), p. 164; McGee D., 'The shipbuilding text of Michael of Rhodes', in *The Book of Michael of Rhodes, A Fifteenth-Century Maritime Manuscript*, Vol. 3: *Studies*, ed. P.O. Long, Cambridge, MA and London: The MIT Press (2009), p. 239.

[11] Stahl A., 'Michael of Rhodes: Mariner in service to Venice', pp. 35–98, *passim*, and McGee D., 'The shipbuilding text of Michael of Rhodes', pp. 211–212, in *The Book of Michael of Rhodes*, ed. Long, *op. cit*.

These treatises of the 15th century echo earlier, no longer extant, works. The portion of Michael's book devoted to shipbuilding was copied from an earlier work or works and not always copied very well or accurately.[12] A similar work by Giorgio 'Trombetta' da Modone, a Venetian resident in the town of Modone in the Peloponnesus, was compiled a few years after Michael's. It is important to note that neither Michael of Rhodes nor Giorgio da Modone were shipbuilders. Michael was a seaman, well familiar with ships but not experienced in their construction. Giorgio was a musician, a trumpeter for a time on the Republic's galleys. The self-evident sloppiness of the transcriptions in Michael's work has created considerable difficulties of interpretation for modern scholars. Not only is one dealing with a text written by an amateur that addresses itself to a reading audience that was familiar with now-lost principles and practices, but the realization that the transcription was often faulty creates further problems.[13] These notebooks seem to reflect earlier practice but how that practice evolved is unwitnessed.

The major difficulty in building a ship with frame-first construction is to control the interrelationships of the various key proportions of the hull: the length on the keel, length overall, the depth of the hull, and the midship beam. Solutions to determine the lines of a vessel from its basic measurements were determined by geometry and proportion. The books of Michael of Rhodes and Giorgio da Modone both contain drawings of various key parts of the structures of different kinds of ships with illustrations of how lines were determined by measurement and proportion. The results of these rules were not always exact in the sense that a modern builder would expect design measurement to be exact but they would come very close. The skill of the shipwright was in making the final small adjustments in the course of building. Thus, every ship – even ships of the same type, made in the same shipyard by teams led by the same shipwright – were individuals not duplicates.[14]

The Book of Michael of Rhodes provides the earliest and, even though flawed, the best look at medieval shipbuilding concepts. The word 'concepts' applies here because Michael's work does not, and does not purport to, give instructions for building ships, yet it does afford some understanding of the design principles behind the building process. Michael discussed five different types of ships in some detail: three galleys and two round ships. The three types of galleys were the Flanders galley, the Romania galley and the light galley. The first two were primarily merchant galleys intended to transport valuable cargoes. Hold space in any galley was very restricted making them inefficient cargo carriers. Their only advantage was that, since they were basically warships, they were defensible against hostile action. This alone made them the vessel of choice for the transportation of goods of great value in small packages. They carried gold, silver, jewels, silks, valuable spices and similar goods. The Flanders galleys, as its name implies,

[12] Bondioli M., 'Early shipbuilding records and the Book of Michael of Rhodes', in *The Book of Michael of Rhodes*, ed. Long, *op. cit.*, pp. 244–246.
[13] *Ibid.*
[14] *Ibid.*, p. 254.

plied the route from Venice to Flanders and England. It was the largest and heaviest galley type, since it had to be able to cope with Atlantic swells and the storms of the Bay of Biscay. The Romania galley was designed for routes from Venice to ports in the eastern Mediterranean, especially to the ports of the Byzantine Empire (Romania, to the Venetians: 'the Land of the Romans,' i.e., a recognition of the Byzantine claim to be the surviving part of the Roman Empire) and to the Black Sea. The primary threat along that route was hostile action, especially during most of the 13th and 14th centuries from Venice's main rival, Genoa. Thus, the Romania galleys were lighter, more maneuverable, more like warships than the Flanders galleys. Finally, the light galley, the *galia sotil* was the primary warship of the Mediterranean powers. The two round ships were the *nave latina* and the *nave quadra*. The *nave latina* was the descendent of the standard round ship of the Mediterranean down to the 14th century and so called because it was propelled by triangular lateen sails. The *nave latina* of Michael's time would, a hundred years earlier, simply have been called a *nave* since all Mediterranean ships before about 1300 wore lateen sails, as galleys continued to do. The *nave quadra* was propelled by square sails, a descendent of the early fourteenth-century cog.

The differences in measurements of the three types of galleys do not seem to be of great significance to a modern student who has never experienced the capabilities of a galley directly. The Venetian Flanders galley was, in modern measurements, 41.21 meters overall length, 6.09 meters in the beam (6.77:1 length to beam ratio) with a deck 2.74 meters above the keel. The Romania galley was 41.04 meters overall, 5.74 meters in the beam (a length to beam ratio of 7.15:1), and 2.55 meters in height.[15] It may be possible to use these measurements to get at least a glimpse of regional variation in galley types. We know that Michael of Rhodes copied earlier works to produce his book around 1434 but we do not know how much earlier his sources were. The Genoese *Liber Gazarie* gives maximum permissible measurements for Genoese versions of galleys for Flanders and Romania. The Genoese measurements may be reliably dated to 1333 for their Romania galley and 1340 for their Flanders galley. There was a tendency for merchant galleys to increase in size over time in response to demands for increased cargo space to the detriment of their combat capability. That was the reason for the Genoese laws restricting the maximum size of these galleys.[16] Given the uncertainty of the time difference between the examples, comparing these galley dimensions with those given by Michael of Rhodes is, at best, a very rough comparison. The Genoese Flanders galleys were 40.11 meters in length overall and 5.94 meters in the beam for a length to beam ratio of 6.75:1. Their Romania galleys were also 40.11 meters in overall length and 5.03 meters in the beam, giving a length to beam ratio of 7.97:1. This suggests that the Genoese built their merchant galleys just slightly smaller and with finer lines than did

[15] McGee, 'The shipbuilding text of Michael of Rhodes', *op. cit.*, p. 222.

[16] Dotson J.E., 'Merchant and naval influences on galley design at Venice and Genoa in the fourteenth century', in *New Aspects of Naval History*, ed. C.L. Symonds, Annapolis, MD: The Naval Institute Press (1981), pp. 26–27.

the Venetians. Both, within their own frameworks, made their Flanders galleys beamier than their Romania galleys.

In building a galley, after laying the keel it was necessary to determine the proportions and curve of the stem and stern posts. Michael provides diagrams that show where measurements may be taken to determine these key dimensions. He also provides diagrams for *morelli*, or measuring rods, used to establish a number of key measurements. In practice, every vessel that a shipwright built was based on a previous one he had worked on. Molds were laid out on the shipyard floor using various *morelli* to determine the shapes. All the large, curved timbers of a ship were made up of smaller pieces of wood fished together. When possible, these pieces were taken from curved limbs or trunks of trees so that the grain of the wood would run, as nearly as possible, along the curve of the finished piece providing maximum strength. Once the stem and stern posts were completed and fastened to the keel, the next step would be to lay out the curve of the midship frame, i.e., the frame that determined the widest part of the hull. Michael described the curve of this frame by giving half-beam measurements at determined heights above the keel, as did numerous writers after him. When the midship frame was completed, it remained to determine the curves of the hull by narrowing and heightening successive frames forward and aft to produce smooth curves. Later works refer to geometrical methods of determining the width and curves of key frames using what was known as the *partison*, a base measurement which determined the others by simple proportions. Michael of Rhodes, does not, however, mention this method.[17] The tail frames were the last frames fore and aft of the midship frame that were full floor frames. Beyond those, the frames became V or Y shaped as they rose to end points of the hull. Other key frames were placed 18 feet in either direction from the midship frame. When those key frames were in place, three ribbands – thin strips of wood – were nailed at determined heights on the standing frames running from stem to stern. It is possible that these ribbands could have been used to determine width of subsequent frames but they did not accurately determine the curves of bow and stern beyond the tail frames. Only the eye of a practiced master shipwright could do that.[18] When the carpenters had completed the work of shaping the various frames and had attached them to the keel, stem, and stern posts, the *calafadi da fizer* began planking the vessel while carpenters continued to work on the deadwork of the hull: the decks, bulkheads, hatches, cabins and so forth. House carpenters could do this work. Planking the hull, on the other hand, was skilled work. Not only did the planks have to follow the established curves smoothly, especially the very complex curves at bow and stern, but they had to be precisely placed with space between the planks to allow for expansion and contraction of the wood as it became wet and dried out. Those spaces had to be wide enough to allow the caulking that waterproofed the seams to remain in place when the wood had expanded to the maximum but close enough to hold the caulking firmly in place when the wood dried and contracted.

[17] McGee, 'The shipbuilding text of Michael of Rhodes', *op. cit*., p. 213.
[18] *Ibid.*, p. 214 and Lane, *Navires et Constructeurs á Venise pendant la Renaissance*, *op. cit*., pp. 84–86.

The *calafadi da maggio* would drive tow or oakum into the seams using mallets and tools shaped like broad, dull chisels. Then, they would then paint the hull below the waterline with pitch for the final seal. The same procedures were used to build galleys, sailing ships, even small lagoon craft with, of course, appropriate adjustments in the measurements and proportions. Once the hull was complete, caulked, and sealed with pitch it was launched into the shipyard's basin. There, the process of arming the ship began, i.e., fitting it out with all the equipment necessary for it to go to sea. These final steps of preparing the vessel for its voyage were carried out under the supervision of the ship's officers who would be responsible for its operation.

Master shipwrights

As noted several times above, the key figure in the construction of a ship was the master shipwright. At Venice these were known as *proti*, i.e., foremen. The essence of their craft was their ability to guide a crew of carpenters through the process just outlined to produce galleys and ships with lines that gave them desirable performance qualities at sea. Naturally, some were better than others and the ships and galleys they produced were regarded as especially good. These men were particularly sought after when new vessels were to be built. There were *proti* for each type of vessel to be built, merchant galleys, war galleys, etc. Additionally, there was in the Arsenal a foreman to supervise all of these crews, the *proto dei marangoni*, the Foreman of the Carpenters. This position required primarily administrative and personnel management skills and did not necessarily go to the builder of the best galleys. Conflicts could sometimes arise when the *proto dei marangoni* found himself supervising a shipwright whose galleys enjoyed a better reputation than his own.[19]

Because the builders of galleys in the Arsenal were, perforce, engaged in the business of the Republic some few records relating to them have survived. The builders of sailing ships for the mercantile fleet engaged in private transactions for the production of their vessels and left no such records. Very little information has survived other than names of the *proti* who appear in the record. However, that information is enough to deduce that certain families seem to have passed the position down from generation to generation.[20] The best known of these is the family of Tedoro Baxon. Baxon, a Greek, was a master shipwright with a reputation for building excellent light galleys. He was appointed *proto dei galee sotil* (foreman for light galleys) in 1403. It seems that he was brought in to the Arsenal not only to supervise the building of galleys for the navy but to pass on his knowledge and techniques to a new generation of ship carpenters, since he was granted a lifetime income to teach his art to others.[21] Galleys that

[19] Lane, *Navires et Constructeurs á Venise pendant la Renaissance*, *op. cit*., pp. 52–53.
[20] *Ibid*., pp. 51–52.
[21] Bondioli, 'Early Shipbuilding Records and the Book of Michael of Rhodes', *op. cit*., p. 273.

Baxon built were kept as exemplars for others to follow. When he died, in 1407, the government of Venice began negotiations with his nephew, Nicolò Palopano of Rhodes to succeed him. It was not until 1430 that Palopano finally assumed his uncle's place as *proto dei galee sotil*. Palopano, as the admired outside expert, inevitably became embroiled in a rivalry with Bernardo di Bernardo who had been chosen *proto dei marangoni* in 1424, the same year that serious negotiations to bring Palopano to Venice had begun. Bernardo was known for his merchant galleys while Palopano specialized in light galleys for the fleet. By 1437 the rivalry came to a head. In that year the Senate voted that all galleys, merchant or light, should be built according to the lines laid out by Nicolò Palopano. A few months later, the Lords of the Arsenal expelled Bernardo. Nicolò did not live long to enjoy his triumph, dying only two months after Bernardo's expulsion. Nicolò's son, Giorgio, known as 'The Greek,' was immediately hired into the Arsenal but, unlike his father, specialized in the building of merchant galleys.[22]

Adriatic regional ship types?

The origins of the *liburna* hints at questions of regional ship types, or regional variations of more widespread general types. Certainly there were such across all time periods. Differing meteorological and geographic conditions, strategic and tactical considerations (for warships), cargoes and routes (for merchant ships), available resources, and even different aesthetic traditions would virtually guarantee the existence of some regional variations. References to the origins of the *liburna* from a Dalmatian ship type are evidence of the existence of at least one such Adriatic type in the ancient period. Regional differences among sixteenth-century war galleys have been well-documented. Venetian galleys of that period were considered to be the fastest under oars and the poorest sailors when compared to Spanish and Ottoman galleys.[23] As noted above, Venetian and Genoese merchant galleys differed in their proportions. However, very little is known about the nature of such variations in the Middle Ages. Iconographic evidence before the 15th century is too scanty and too open to questions of artist's intent and to the limitations of modern interpretation to provide anything more than a vague idea of general Mediterranean types. Archeological evidence is increasingly available but surviving hulls are incomplete and have not, so far, furnished sufficient information to allow anything as subtle as the identification of regional variations in types. While there were myriads of ship and boat types known to sailors in the waters of the Medieval Mediterranean, many of these types are now nothing more than words with little specific meaning attached to them. When Doge Pietro III Candiano led a fleet of 33 *gumbariae* against the

[22] Lane, *Navires et Constructeurs á Venise pendant la Renaissance*, *op. cit*., pp. 57–58 and Bondioli, 'Early shipbuilding records and the Book of Michael of Rhodes', pp. 273–275.

[23] Guilmartin J.F., *Gunpowder and Galleys: Changing Technologies and Mediterranean Warfare at Sea in the 16th Century*, London: Conway Maritime Press (2003), pp. 220–231.

pirates of the Dalmatian coast in 948[24] he and his contemporaries would have grasped exactly the type of vessels he used, their capabilities and limitations. None of that is at all clear to scholars of the 21st century.

Lesser and regional ports

A number of ports of regional importance along both coasts of the Adriatic maintained a capacity to build and maintain ships for their merchant fleets and even, in some cases, some naval fleets. Venice was largely successful even if only intermittently in dominating maritime activities over the whole region.

Along the Italian Adriatic coast, Ravenna's port, Classe, was established by Augustus as a major naval base. It had extensive facilities and personnel devoted to the building and maintenance of ships for the fleet. Though it was primarily a naval base, it also supported an extensive maritime commerce. Even after the collapse of the empire in the West, it remained important in both naval and commercial activities, keeping open the sea lanes between Ravenna and Constantinople. Finally, in the 8th century, Classe was destroyed during the Lombard Wars. Its harbor silted up and it never really recovered its former importance.

Further south, Ancona possessed the best natural harbor on the Italian Adriatic coast protected by the elbow-shaped promontory that gave the city its name from the Greek *ankon* (elbow). Founded by Greeks in the 4th century BC it quickly became, and remained, an important trading and naval port. The rich agricultural produce of the Marche was the foundation of a trade that was maintained by the Anconitans with ports all over the Mediterranean. Although Venice kept up a virtually constant pressure on Ancona in its drive to redirect all major commerce in the Adriatic through its Rialto markets, Ancona was able to maintain an independent maritime commerce at least until the 16th century. The Anconitan shipbuilding tradition was revived in the late 20th century by the immense Italian firm of Fincantieri, whose yards in Ancona turn out luxury yachts for the world market.

Bari and Brindisi in Apulia were also important ancient seaports that fell on hard times as Roman power collapsed in the West. The Apulian ports were well situated to maintain trade between southern Italy (while it remained under Byzantine control) and Constantinople. Through the 11th century the Venetians continued to extend their power and protection over the Adriatic. The Normans, under Robert Guiscard, after taking Bari in 1071, made it their main naval base in the Adriatic. The city's capabilities to build and maintain fleets must be assumed, since Guiscard was able to mount and sustain an attack on the Byzantines in Greece ten years later from his base there. Again, Venice intervened to aid the Byzantines. In the struggles that followed, Bari and the other Apulian ports suffered repeated blockades and sieges. With the revival of

[24] Pryor and Jeffreys, *The Age of the ΔΡΟΜΩΝ*, *op. cit*., p. 67.

Western Mediterranean trade from the 11th century, and political stabilization provided by the Norman Kingdom, both towns became Norman naval bases and important crusading ports. Under Norman rule, Bari and Brindisi once again became significant maritime commercial centers. By the 14th century these cities and their ports suffered in the wars of the Angevin dynasty that ruled Southern Italy. Aragonese rule replaced the Angevins in the 15th century. Their attempts to fortify the harbor of Brindisi to protect it against Turkish raids caused silting problems. Both Bari and Brindisi suffered continued decline as a result of the belligerent and short-sighted policies of foreign rulers.

On the Dalmatian side of the Adriatic, similar dramas played out as cities that had been important ports in ancient times found themselves often endangered by the vagaries of mainland politics and by raiders from the sea. Most of the Dalmatian coast was occupied by Venice after the 11th century. Spalato (Split) sought Venetian protection early in that century. Zara (Zadar) was intermittently under Venetian control from 998 and, famously, was brought firmly into the Venetian orbit when crusaders of the Fourth Crusade laid siege to the town and captured it for Venice. The largest and southernmost port of Dalmatia was Ragusa (Dubrovnik). Internal instability and threatening politics in its hinterland brought Ragusa under Venetian control from 1205 to 1358. Both Zara and Ragusa were important ports for trade between Venice and their hinterlands but they also had their own significant merchant fleets. Ragusa was expected to provide ships to support any Venetian war fleet operating within the Adriatic itself. The Ragusans were expected to supply approximately one galley for every thirty in the Venetian fleet. This can be taken as a very rough guide to the balance of naval strength between the two cities. Trade between Zara, Ragusa and areas outside the Adriatic was unhindered, but any trade within the Adriatic had to be channeled through Venice. Regulations promulgated in 1232 spoke of the Ragusans sending four ships per year with a capacity of 70 *miliaria* (1 *miliaria* = 1000 Venetian pounds or about 477 kg.) to Venice. This is interesting in light of the fact that the maritime laws of doges Jacopo Tiepolo (1229) and Raniero Zeno (1253) only regulate ships of 200 *miliara* capacity and above. This is not to suggest that the Ragusans did not have larger merchant ships in their service, but it gives some idea of the size of ships that were considered suitable for use.[25]

Conclusion

Venice and the other Adriatic ports – but Venice above all – relied upon ships, the maritime commerce they carried, and the protection they provided when organized into navies, for their prosperity and their very survival. Venice without its ships would, simply put, not have existed. Ancona could not have

[25] Harris R., *Dubrovnik, A History*, London: SAQI (2003), pp. 46–47; Lane, *Venice, A Maritime Republic*, *op. cit.*, p. 63.

maintained its independence and prosperity as long as it did. Brindisi and Bari struggled against raids from the sea and conflicts on the mainland, but when they experienced periods of revival it was due to their maritime activities and when they declined, it was because their maritime commerce was interrupted. On the Dalmatian side of the Adriatic, Spalato (Split) became a Venetian-dominated center for trade with the Hungarian and, later, Ottoman hinterland. Likewise, Zara (Zadar) was largely dominated by Venice in the Middle Ages. Ragusa (Dubrovnik), after the Fourth Crusade, became a major Venetian naval port and remained so until the middle of the 14th century, when it became a republic with its own maritime trade under first Hungarian, then Ottoman influence. All of these cities, and countless lesser towns and villages along the coasts, existed and prospered – or not – depending upon their relationship with the sea and the resources they could draw from it and the commercial contacts they could make across it. Like all seas, the Adriatic was a thoroughfare that drew those living along its shores closer together.