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Mediterranean Wooden Shipbuilding in the nineteenth century: Production, Productivity and Ship Types in Comparative Perspective¹

Apostolos DELIS

In the nineteenth century, wooden shipbuilding was still a very important industry, as wooden sailing ships were the predominant type of sea transport at least until 1887, when the introduction of triple expansion engine in steamships put an end to the domination of sailing ships as the main sea cargo carriers.² Aside from steamships, which required almost sixty years of continuous technical improvements in the engine before becoming competitive for tramping, iron and steel sailing ships could be also considered as a threat for wooden shipbuilding business. However, the construction of iron and steel sailing ships was mainly a British phenomenon. In other European countries, as well as in the North Atlantic and Japan, even in the 1880s, the production of metal hulls was from negligible to non-existent.³ Wooden shipbuilding had a great economic and cultural impact in many coastal and insular areas in Europe, North America and in the Mediterranean basin, which lasted in certain cases until the first half of the twentieth century.

Wooden shipbuilding was for centuries the most “industrialized” activity of the secondary sector, in the service of the state (such as the Venetian Arsenal or the Royal Dockyards of Woolwich, Deptford, Chatham and Sheerness), of large merchant companies, (Dutch or English East India Companies) or of individual shipowners.⁴ Wooden shipbuilding, either in state establishments or private

1. I am grateful to Prof. Gelina Harlaftis for her valuable suggestions for this paper.
2. Gerald S. Graham, “The Ascendancy of the Sailing Ship 1850-85”, *The Economic History Review*, New Series, vol. 9, No. 1, 1956, p. 87-88.
3. Simon Ville, “The Transition to Iron and Steel Construction”, in Robert Gardiner (ed.), *Sail's Last Century. The Merchant Sailing Ship, 1830-1930. Conway's history of the ship*, London, Conway Maritime Press, 1993, Figure 3/1, p. 60.
4. Robert C. Davis, *Shipbuilders of the Venetian Arsenal. Workers and Workplace in the Pre-industrial City*, Baltimore, The Johns Hopkins University Press, 1991. Cees de Voogd, “Shipbuilding, Commercial”, in John B. Hattenford (ed.), *The Oxford Encyclopaedia of Maritime History*, Oxford/New York, Oxford University Press, 2007, vol. 3, p. 572-575. Sjoerd Hengst and Alan A. Lemmers, “Shipyards”, in John B. Hattenford (ed.), *The Oxford Encyclopaedia...*, *op. cit.*, vol. 3, p. 703-706.

yards, was in fact organized according to a strict hierarchical structure. It demanded a specialized and sometimes numerous labor force in a set of diversified sectors: lumberjacks, carpenters, ironsmiths, sail makers, rope makers, caulkers etc. Wooden shipbuilding, along with shipping to which it was inextricably interlinked, represented the most important source of wealth for many ports and maritime communities in the age of sail.

In the Mediterranean, in many of today's charming seaside tourist destinations or industrialized port-cities, shipping and wooden shipbuilding represented until the beginning of the twentieth century the major economic activities. The welfare of a large part of the population depended on it. This issue tends to be forgotten, as the eclipse of such activities and changes in the use of space, which transformed urban landscapes, erased the evidence of this past from the collective memory.

The aim of this paper is to compare and analyze the wooden shipbuilding industry in three areas located in the nineteenth century Mediterranean: the port of the Island of Syros in the Cyclades, and the adjacent regions of Provence and Liguria. Syros' development was due to the foundation of a new town after 1822, Hermoupolis, where refugees fled because of the disasters of the Greek War of Independence (massacres of Chios in 1822, of Psara in 1824). The new port town rapidly became the most important commercial and maritime center of the Aegean, at the crossroad between the Black Sea and western Mediterranean. The comparison will take into consideration the issues of production, productivity and ship types built in the shipyards. Wooden shipbuilding in the nineteenth century Mediterranean is a neglected subject. A comparative approach is hindered by the problems of access to sources, quantitative data and bibliography written in different Mediterranean languages, a factor that sometimes makes it impossible to know they exist. The choice to compare the above mentioned three areas was dictated by the availability and accessibility of such sources and data.

The data for Syros have been collected during my Ph.D. thesis;⁵ those for Provence were kindly provided by Laurent Pavlidis, a Ph.D. student and specialist of shipbuilding in the age of sail in Southern France.⁶ Finally, those for Liguria come from Luciana Gatti's book on shipbuilding activity in that region.⁷ The period examined runs between 1835 and 1859, as the available data for Provence cover the five years periods of 1835-39 and 1855-59, while those for Liguria cover the period 1838-52. Data for Syros exist for the entire period 1828-80 and more in detail for the period 1828-66.

The comparison between these three areas enables us to identify similarities and differences in shipbuilding between the eastern and the western parts of the

5. Apostolos Delis, "Hermoupolis (Island of Syros): the Shipbuilding Centre of the Sailing Merchant Marine, 1830-1880", unpublished Ph.D. thesis, Department of History, Ionian University, Corfu, 2010, (in Greek).

6. Laurent Pavlidis, "La construction navale provençale traditionnelle", Ph.D. thesis in progress, Université de Provence Aix-Marseille I. See also his articles in the present issue of the *Cahiers de la Méditerranée*.

7. Luciana Gatti, "Un raggio di convenienza". *Navi mercantili, costruttori e proprietari in Liguria nella prima metà dell'Ottocento*, Genoa, Società Ligure di Storia Patria, 2008.

Mediterranean, and thus helps us to assess the size of production in each area, the ship types and the market orientation of each industry. Furthermore, such a comparative approach on both sides of the Mediterranean shows the main tendencies of the shipbuilding industry in the wider context of evolutions in shipping, in an era of rapid economic and technological transformations such as the nineteenth century.

Spatial and geographical extensions of shipyards in these three areas differed: the shipbuilding industry in Syros was entirely concentrated on a single sand beach on the western side of the harbor, whereas Provence and Liguria comprised entire regions with many shipyards located in smaller or bigger ports along their coast.

This comparison concentrates first on the production and the productivity of each area, focusing on the number of vessels built, the tonnage, the average tonnage and the delivery times of the vessels. It also develops the types of ship built in each area, which reflects economic, technological and cultural aspects.

Production and productivity in comparison

In Liguria there were 34 shipbuilding locations during the period 1838-52. Table 1 lists the 12 most productive areas in the region, which reached more than 1% of the total production in terms of tonnage.

Table 1. Production data for the 12 more productive shipbuilding locations in Liguria (1838-52)

LOCATION	TONNAGE	%	NUMBER OF VESSELS	%	AVERAGE TONNAGE
Varazze	56 171,19	48,04	411	40,18	136,67
Voltri	10 881,85	9,31	91	8,90	119,58
Sestri Ponente	9 200,70	7,87	63	6,16	146,04
Prà	7 756,46	6,63	52	5,08	149,16
Savona	6 288,10	5,38	42	4,11	149,72
Loano	4 637,18	3,97	33	3,23	140,52
Recco	3 750,54	3,21	44	4,30	85,24
Sampierdarena	3 374,73	2,89	22	2,15	153,40
Chiavari	3 049,87	2,61	24	2,35	127,08
Foce	2 648,75	2,27	8	0,78	331,09
Lerici	2 629,05	2,25	45	4,40	58,42
Pietra	1 193,70	1,02	15	1,47	79,58
Total of 12 out of the 34 areas	115 582,12 tons out of the total 116 918,27	95,43%	850 out of the total 1023 vessels	83,09%	114,29 (average tonnage of the total vessels built)

Source: Processed data from Luciana Gatti, *“Un raggio di convenienza”, Navi mercantili, costruttori e proprietari in Liguria nella prima metà dell’ Ottocento*, Genoa, Società Ligure di Storia Patria, 2008, p. 135-175.

Varazze was by far the most productive location in the entire region. The town's shipyards produced 48% of the total Ligurian production and 40% of the total number of ships: almost one ship out of two built in Liguria was built there. The average tonnage (136,67 tons) is slightly lower than in a few other shipyards, like Sampierdarena, Savona, Prà, and Sestri Ponente, where they averaged 150 tons. The only exception was Foce, where the average tonnage was 330 tons, but only eight vessels were built there. In terms of total production Voltri was the only place beside Varazze that exceeded 10 000 tons; Sestri Ponente, Prà and Savona produced between 5 000 and 10 000 tons, but none competed with the achievements of the shipyards of Varazze.

In Provence, production was more evenly distributed among 15 areas, as presented in Table 2.

Table 2. Production data for shipbuilding in Provence (1835-39, 1855-59)

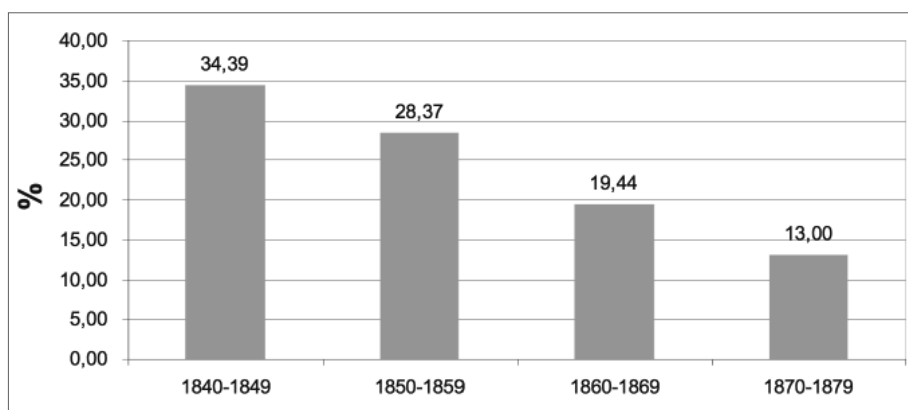
LOCATION	TONNAGE	%	NUMBER OF VESSELS	%	AVERAGE TONNAGE
Marseille	14 144	26,68	49	12,04	288,65
Saint-Tropez	13 587	25,63	81	19,90	167,74
Martigues	8 150	15,37	160	39,31	50,94
La Seyne	5 074	9,57	38	9,34	133,53
La Ciotat	2 856	5,39	14	3,44	204,00
Port-de-Bouc	2 623	4,95	7	1,72	374,71
Arles	2 386	4,50	24	5,90	99,42
Toulon	1 326	2,50	14	3,44	94,71
Antibes	1 243	2,34	12	2,95	103,58
Sanary	934	1,76	3	0,74	311,33
Cassis	273	0,51	1	0,25	273,00
Beaucaire	130	0,25	1	0,25	130,00
Bandol	126	0,24	1	0,25	126,00
Cannes	113	0,21	1	0,25	113,00
Aigues-Mortes	50	0,09	1	0,25	50,00
Total of 15 areas	53 015	100,00	407	100,00	168,04

Source: processed data from Laurent Pavlidis, "La construction navale provençale traditionnelle", Ph.D. thesis in progress, Université de Provence Aix-Marseille 1.

Marseille and Saint-Tropez were the most productive areas in terms of tonnage, both exceeded 10 000 tons in the examined period. Martigues was the next more productive area in tonnage, but dominated in terms of number of vessels with 39,31% of the total, followed by Saint-Tropez. La Seyne merely exceeded 5 000 tons, while La Ciotat, Port-de-Bouc, Arles, Toulon and Antibes produced a total comprised between 1 200 and 2 800 tons. In average tonnage, Port-de-Bouc, Sanary and Cassis held the highest positions, but the figures are based here on a negligible number of vessels built. Therefore, the shipyards of Marseille were undoubtedly the most productive, with an average of ca. 289 tons.

In Syros, the entire production was concentrated in a single location, the port of the island. In the period 1828-80, shipyards in this port built 3185 vessels with a total of 429 301 tons, and 156 tons in average.⁸

Figure 1. Percentage of Syros' shipbuilding production (in tonnage) in the total of the Greek-owned sailing merchant marine (1840-79)



Source: Apostolos Delis, "Hermoupolis...", *op. cit.*, p. 82.

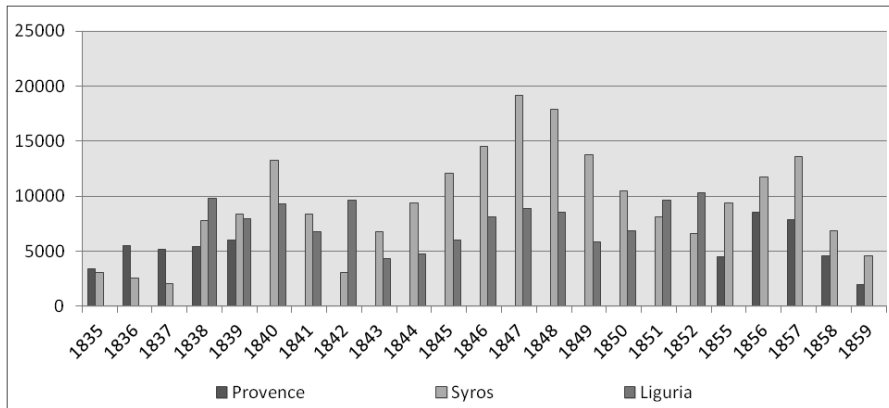
As figure 1 shows, Syros held a considerable share of the number of vessels built in the 1840s and 1850s decades regarding the total of Greek-owned sailing merchant fleet. This percentage decreased in the following decades, as a result of the rise of steam navigation, but also mainly because from the 1860s onwards, shipyards faced the competition of cheap second hand wooden sailing vessels from United Kingdom and Canada. As many British shipowners shifted to composite or metal hulls, second-hand wooden vessels turned to be a more economic as well as an efficient choice for Greek, Finnish or Norwegian shipowners.⁹

The comparison of production in tonnage (fig. 2) of the three shipbuilding areas shows that during the years 1835-59 –although it should be stressed once more that we do not have at present data for Provence and Liguria for the whole period–, none of these areas exceeded 20 000 tons of production, while only Syros exceeded 15 000 tons twice (in 1847 and 1848), Liguria surpassed the limit of 10 000 tons only in 1852, and Provence never even reached this level of production.

8. Apostolos Delis, "Hermoupolis...", *op. cit.*, p. 136.

9. Knick C. Harley, "Aspects of the Economics of Shipping, 1850-1913", in Lewis R. Fischer and Gerald E. Panning (eds.), *Change and Adaptation in Maritime History. The North Atlantic Fleets in the nineteenth century*, Newfoundland, Maritime History Group, Memorial University of Newfoundland, 1985, p. 173-174. Simon Ville, "Transport and Communications", in Derek Aldcroft and Simon Ville (eds.), *The European Economy, 1750-1914*, Athens, Alexandria Publishers, 2005, p. 231, (in Greek). Gelina Harlaftis, *A History of the Greek-Owned Merchant Marine (eighteenth to twentieth cent.)*, Athens, Nefeli Publishers, 2001, p. 232, (in Greek). Yrjö Kaukiainen, *A History of Finnish Shipping*, London-New York, Routledge, p. 104, 108, 123.

Figure 2. Yearly production in Syros, Provence and Liguria, 1835-59
(total tonnage expressed in tons)



Source: Processed data from Apostolos Delis, “Hermoupolis...”, *op. cit.*, p. 375-376; Laurent Pavlidis, “La construction navale...”, *op. cit.*; Luciana Gatti, “*Un raggio di convenienza*”..., *op. cit.*, p. 135-175. No available data for Provence from 1840 to 1854 and for Liguria before 1838 and after 1853.

In the triennium 1835-37 the production of Provence was higher than that of Syros, whereas 1838 and 1839 represented years of “take-off” for the shipbuilding industry in the island, which coincided with a rise of the freight rates and the prices of cereals from the Black Sea.¹⁰ In 1838 and 1839, the only years for which data are available for the three areas, Provence produced less than the other areas. During the years 1844-50, Syros’ production was almost double compared to Liguria, and was only surpassed by the latter in 1842, a year of crisis for Greek trade and shipping which caused also a demographic loss in the population of Syros,¹¹ and in the biennium 1851-52. The much higher levels of production in Syros in the 1840s coincide with the “golden age” of its shipbuilding industry, with an apex in the years 1846-48. This positive conjuncture was due to the drop of harvests in Western Europe in 1845-47, which provoked a peak of exports of cereals from the Black Sea to the western ports. This phenomenon raised enormously the cereals freight rates, and benefited to Greek shipowners, who held a large share in the grain trade of the Black Sea.¹² Finally, figures aside, the trend between Syros and Liguria in the 1840s and in Syros and Provence in the quinquennium 1855-59 is similar, suggesting that ship production was affected by common factors, like the Black Sea grain trade, which represented a major source of wealth for Mediterranean shipping in the nineteenth century.¹³

10. Apostolos Delis, “Hermoupolis...”, *op. cit.*, p. 93.

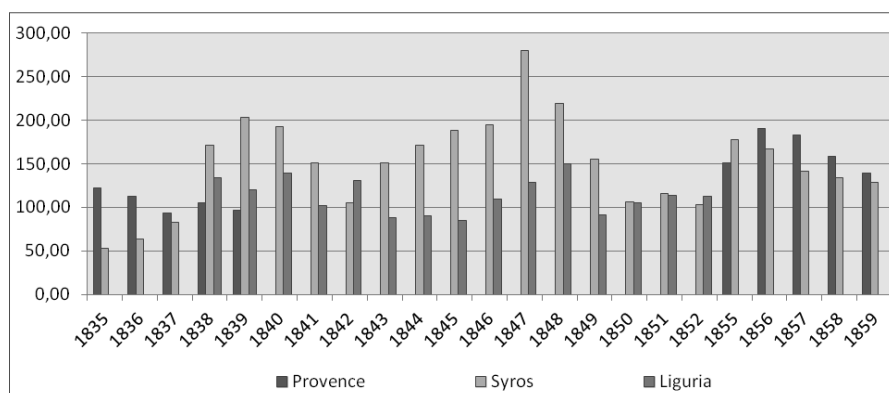
11. *Ibid.*, p. 22, 93-94.

12. *Ibid.*, p. 22, 94-95. Mose Lofley Harvey, “The Development of Russian Commerce on the Black Sea and its Significance”, Unpublished Ph.D. Thesis, University of California, 1938, Table XIXa (Appendix G), p. 392. Patricia Herlihy, *Odessa: a history, 1794-1914*, Cambridge, Massachusetts, Harvard University Press, 1986, p. 102.

13. Luciana Gatti, “*Un raggio di convenienza*”..., *op. cit.*, p. 16. Carmel Vassalo, “The Maltese

As figure 3 shows, the average tonnage of the vessels built never exceeded 300 tons in the three areas, which proves that Mediterranean sailing ships in this period were mainly built for trade within the Mediterranean. Vessels of less than 300 tons, at that time, were indeed no longer considered as fitted for oceanic trade.¹⁴

Figure 3. Average tonnage of vessels built in Syros, Provence and Liguria, 1835-59 (in tons)



Source: Processed data from Apostolos Delis, "Hermoupolis...", *op. cit.*, p. 387; Laurent Pavlidis, "La construction navale...", *op. cit.*; Luciana Gatti, "Un raggio di convenienza"..., *op. cit.*, p. 135-175. No available data for Provence from 1840 to 1854 and for Liguria before 1838 and after 1853.

Figure 3 also reveals that only Syros' vessels surpassed 200 tons in 1840, 1847 and 1848, while Provence vessels surpassed 150 tons in the triennium 1856-58 and those of Liguria just reached that latter limit in 1849. The trends in average tonnage are very similar with those of production in total tonnage. Thus the average tonnage of vessels produced in Provence is considerably higher compared with that of Syros during the years 1835-37, and the latter were almost double in size compared with Ligurian vessels in the 1840s. Also, Provençal vessels were larger than those of Syros in the years 1856-59, although Syros shipyards produced more in terms of total tonnage in that same period, as shown in figure 2.

Another possible indicator of productivity is the delivery time of a vessel. On this issue, I compared Syros and Liguria, as data of this kind are not available for Provence. However, for Syros I have calculated the average delivery times in months and days, whereas for Liguria only the earliest and the latest time span of delivery for each ship type is known.

Merchant Fleet and the Black Sea Grain Trade in the nineteenth century", *International Journal of Maritime History*, XIII, 2, 2001, p. 19-36.

14. David Mc Gregor, "The wooden sailing ship: under 300 tons", in Robert Gardiner (ed.), *Sail's Last Century. The Merchant Sailing Ship, 1830-1930, Conway's history of the ship*, London, Conway Maritime Press, 1993, p. 42-43.

Table 3. *Delivery times of vessels (in months) by Syros' shipyards (1828-66)*

Tonnage Class	1828-39	1840-49	1850-59	1860-63, 1866	Total Average
1-50 tons	2,25	1,82	2,1	1,72	1,97
51-100 tons	3,25	2,74	2,67	3,09	2,94
101-150 tons	4,7	3,31	3,7	3,47	3,80
151-200 tons	5,15	3,86	4,03	3,2	4,06
201-250 tons		4,06	4,51	4,14	4,24
251-300 tons	4	4,1	3,69	5,3	4,27
>300 tons	4,05	4,82	4,55	4,37	4,45

Source: Apostolos Delis, "Hermoupolis...", *op. cit.*, p. 133.

During the 1840s and 1850s the general trend is decreasing, which means faster times of construction, parallel to an increase in demand, except for the class of vessels over 300 tons, compared to the 1830s. As the last column shows, a coaster of the class from 1 to 50 tons was approximately built in two months, a larger coaster of the class 51 to 100 tons in three months, and larger classes of vessels, in an increasing trend, required in average roughly between four and four and a half months.

In Liguria, in the years 1838 and 1839, the launching of brigs from 150 to 260 tons, required between 77 and 317 days, thus between two months and a half and ten months and a half.¹⁵ In the 1828-39 decade brigs were built in Syros in an average length of 5,15 months. In the years 1851-52, in Liguria, the construction of brigantines from 100 to 300 tons required between 161 and 590 days, that is roughly between five and twenty months.¹⁶ The average delivery time in Syros in the decade 1850-59 for the same class of vessels was almost four months. In 1838 and 1839 Ligurian coasting vessels such as bombardes and goelettes from 35 to 147 tons, required between 95 and 260 days, that is between three and nine months. Respectively, in the same class of vessels during the 1830s, hulls with tonnage from 51 to 100 tons were built in Syros in little more than three months. Those from 101 to 150 tons asked for four months in average. In the years 1851-52 in Liguria, brig-schooners between 50 and 140 tons were built from 92 to 318 days, or from three to ten months and a half. In Syros in the 1850s, vessels from 51 to 100 tons were built in a little more than two months and a half and vessels from 101 to 150 tons in little more than three months and a half.

Finally, in smaller classes in the years 1838 and 1839, vessels between 1 and 56 tons in Liguria were launched in 16 to 276 days, which is between half a month and more than nine months,¹⁷ while in Syros vessels of the same tonnage class in the decade of 1828-39 were built in average in 2,25 months, but it has to be stressed that the sample of this class in that decade is extremely small. In 1851-52

15. Luciana Gatti, "Un raggio di convenienza"..., *op. cit.*, p. 79.

16. Luciana Gatti calculates that the average delivery time of *brigantini* built by a shipbuilder of Varazze in the years 1850-52 is 218 days, that is almost seven months, *ibid.*, p. 83.

17. *Ibid.*

in Liguria, cutters of 15 to 30 tons were built in 61 to 180 days, that is two to six months, while in Syros in the 1850s, vessels from 1 to 50 tons were launched in average in two months.

Based on the above evidence, and although data are not entirely comparable, it would seem that ships in Syros were built more rapidly than in Liguria. Moreover Syros' shipyards according to Table 4 produced more in terms of number of units and of tonnage compared to Provence and Liguria.

Table 4. General comparison in shipbuilding industry: Provence, Syros, and Liguria

1835-39, 1855-59	PROVENCE	SYROS	1838-52	LIGURIA	SYROS
Number of Vessels	407	623	Number of Vessels	1 024	1 084
Tonnage	53 020	69 807,01	Tonnage	116 641,56	159 478,53
Average Tonnage	130,27	112,05	Average Tonnage	113,9	147,12

Source: Processed data from Apostolos Delis, "Hermoupolis...", *op. cit.*; Luciana Gatti, "Un raggio di convenienza"..., *op. cit.*, p. 135-175; Laurent Pavlidis, "La construction navale...", *op. cit.*

In the years 1835-39 and 1855-59, Provence shipyards built two thirds (65,32%) of the vessels and three quarters (75,95%) of the tonnage produced in Syros. However, in average tonnage, Provence attained higher figures than Syros, as the former built far more three-masted vessels than the latter. In Liguria, in the period 1838-52, the number of vessels and tonnage built corresponded respectively to 94,46% and 73,13% of the production in Syros. Vessels built in Syros in this period, which was the "golden period" of its shipbuilding industry, were almost by thirty five tons larger in average than those built in Liguria.

The higher average tonnage of vessels in Provence is indicative of the demand by Marseille shipowners, who represented the largest clients of Provençal shipyards and who were to a large extent involved in extra-Mediterranean trade. Since the eighteenth century, the port of Marseille was the major colonial port of France and its shipowners in the nineteenth century followed well established business routes with Eastern and Western Africa as well as with the Caribbean and South America.¹⁸ As important shipbuilding places, like La Ciotat and La Seyne, shifted their production to steamship and metal construction as early as the 1830s, the main volume of wooden shipbuilding in Provence was concentrated in Marseille's and Saint-Tropez' shipyards.¹⁹ Liguria and Syros, on the other

18. Archives du ministère des Affaires étrangères, Correspondance Consulaire et Commerciale, Syra, vol. 3, 25.11.1848, p. 174v-175. Charles Carrière, *Négociants marseillais au XVIII^e siècle: contribution à l'étude des économies maritimes*, Marseille, Institut historique de Provence, 1973. Roland Caty and Eliane Richard, *Armateurs Marseillais au XIX^e siècle*, Marseille, Chambre de commerce et d'industrie de Marseille, 1986, p. 47-52. Laurent Pavlidis, "La production des bâtiments de mer en bois dans les chantiers privés provençaux au XIX^e siècle", *Provence Historique*, t. LIX, fasc. 237, Juillet-Août-Septembre 2009, p. 341. Marseille was among others the Mediterranean entrepot of Argentinean hides.

19. Roland Caty and Eliane Richard, *Armateurs Marseillais...*, *op. cit.*, p. 38. Laurent Pavlidis, "La production des bâtiments...", *op. cit.*, p. 336.

hand, seemed more confined to Mediterranean waters and especially, as already mentioned, to the booming Black Sea grain trade. Liguria's shipyards experienced an explosive increase during the 1860s and 1870s, reaching the 47 000 tons in annual average tonnage in the years 1870-76. However, the decline of the wooden shipbuilding in Syros and Liguria started in the late 1870s, while in Provence this was already manifest since the 1860s. All areas had to face not only the increasing competition of the steam navigation, but also the liberalization of ship markets, as a consequence of the globalization of sea trade and traffics. This factor affected the demand in Mediterranean shipyards, which were unable to remain competitive with North Atlantic shipyards and the influx of second-hand vessels from these countries.²⁰

Ship types in comparison

The analysis of ship types threw light on many interlinked aspects of shipping, and at first place on economic aspects, as each type corresponded to an approximate range of carrying capacity. Also, each ship type was designed for a certain kind of transport and certain routes. Its characteristics and their evolution over time were a consequence of the readjustments of demand for specific services in specific trades. A decisive factor influencing the choice of a specific ship type was namely the geography of the routes, currents, winds and depth of the waters a ship sailed through. This factor created special needs for adaptations in rigging and hull design. Therefore the use of each ship type reflects the kind and volume of trade adapted to determined geographical conditions, and the level of the economy of which it is an integral part. The brig for example, the backbone of the Greek-owned fleet in the nineteenth century, responded perfectly to the needs of grain trade. This trade demanded enough carrying capacity, moderate size (25 meters in average) for the often rudimentary infrastructures of the traffic-jammed Black Sea and Mediterranean ports, and properly rigged ships as square riggers for long distance routes like those between the Black Sea and the Western Mediterranean.

The second aspect is technological. The construction of a specific ship type requires a given level of know-how. This issue is related with the experience and knowledge of shipwrights in a specific location. The transfer of that knowledge is linked with the contacts of a port or a shipbuilding location with other ports and locations, their influence and exchange of ideas and techniques. In the age of sail, the learning of the art of shipwright was based on practical apprenticeship, and the transfer of precious knowledge in new developments or techniques was possible through the ability to learn by copying and "stealing" the art's secrets. The level of know-how attained by shipbuilders in a given location is conditioned by the needs of the shipowners, who can stimulate the construction of specific

20. Luciana Gatti, *"Un raggio di convenienza"...*, *op. cit.*, p. 19-20. Roland Caty and Eliane Richard, *Armateurs Marseillais...*, *op. cit.*, p. 38-43. Laurent Pavlidis, *"La production des bâtiments..."*, *op. cit.*, p. 336-338. See also above footnote 9.

ship types, the upgrade of existing ones or the demand for new ones. Closely connected to this issue, is the range of contacts and exchanges of each shipowning community with others, which determines the rate of transfer of knowledge and innovation. In the late eighteenth century, when Greek shipowners emerged as major carriers in Mediterranean trade, they adopted larger vessels, such as polacres and brigantines, which they initially ordered in foreign shipyards, like Fiume, Trieste or Venice. In their homeland, the methods and the design to build these types were unknown to local shipbuilders. Later, by copying these new types, Greek shipbuilders managed to build the fleet for local shipowning communities, like in Hydra and Spetses. They were also in touch with major developments in ship technology through the frequent voyages and novelties brought back home by their own communities' seafarers.

The building of a specific ship type also reflects cultural aspects. The same ship type can bear different names in different areas or countries, and conversely a ship type used under the same name in different areas could develop different characteristics. Moreover, the decision to build a specific type of ship, or to innovate, was sometimes the result of cultural biases or traditions, which cannot be easily explained by pure economic rationality. Therefore, a ship type and its special features reflected the traditions, local needs and boundaries of a specific cultural milieu. Greek shipowners from the Ionian Islands in the nineteenth century used many types of coasters originated from the neighboring Adriatic and Italian Peninsula, like *bratsera*, *trabaccolo*, *paranza*, *pielego*, *bovo* etc., whereas their counterparts from the Aegean were attached to eastern types like *bombarda*, *tserniki*, *perama*, *trehandiri* and *sacoleva*. For sure, ship types like *brigantini* used by Ionians and *briki* (brig) used by Aegeans, might have been in some instances almost identical, but clearly reasons of cultural influence and tradition led the Ionians to keep using the Italian term for it.²¹

Finally, a ship is mainly the product of an enterprise and the type of a ship reflects the image of this enterprise through its carrying capacity, its special technical features and its maintenance conditions. Therefore size, quality of technology and special characteristics reflect the economic calibre, the market orientation and the cultural context of an enterprise.

In Provence, a total of thirteen types of vessels were registered, in Syros thirty seven and in Liguria thirty one. Some of these types in Syros and Liguria are the same bearing different names, like the Ligurian *brick schooner/brick goletta* or *barck scipp/brick a palo*, which I have grouped together. In Table 5, I examine all the thirteen ship types built in Provence and the eleven and twelve more important types built respectively in Syros and Liguria. The eleven ship types of Syros represent 98,18% of the total number of vessels and 89,45% of the total tonnage, while the respective figures for the twelve Ligurian ship types account for respectively 97,98% and 77,99%.

21. Apostolos Delis, "Typology of Greek-owned vessels, 1700-1821", in Gelina Harlaftis and Katerina Papakonstantinou (eds.), *History of the Greek Merchant Marine, 1700-1821*, Athens, Kedros Publications, 2012, (forthcoming in Greek), chapter 11.

Table 5. Comparative distribution of production per ship type

PROVENCE	1835-39 & 1855-59				
SHIP TYPE	Total tonnage	%	Number of units	%	Average tonnage
trois-mâts	24 882	46,93	71	17,44	350,45
brick	16 089	30,35	113	27,76	142,38
bateau	5 878	11,09	145	35,63	40,54
allège	1 418	2,67	17	4,18	83,41
brig-goélette	1 316	2,48	14	3,44	94,00
chaland	1 050	1,98	13	3,19	80,77
goélette	1 003	1,89	11	2,70	91,18
tartane	469	0,88	10	2,46	46,90
bombarde	391	0,74	5	1,23	78,20
chasse-marée	299	0,56	4	0,98	74,75
cutter	96	0,18	2	0,49	48,00
mistic	79	0,15	1	0,25	79,00
sapine	50	0,09	1	0,25	50,00
Total	53 020	100,00	407	100,00	
SYROS	1828-66				
brig (briki)	231 892,83	81,46	1 154	53,1	200,94
goleta	20 800,66	7,31	293	13,48	73,65
bombarda	7 440,97	2,61	156	7,18	50,53
barque (gabara)	6 982,28	2,45	23	1,06	367,49
two-masted	2 634,55	0,93	16	0,74	164,65
tserniki	2 465,89	0,87	149	6,48	16,99
bratsera	2 195,29	0,77	75	3,45	25,48
cutter (kotero)	1 809,37	0,64	33	1,52	54,93
sakoleva	1 162,97	0,41	38	1,75	29,97
karavi or ploio (probably a large two-masted)	1 157,46	0,41	6	0,28	192,91
brig-schooner (goletobriko)	958,04	0,34	9	0,41	118,83
Total	279 500,31	98,18	1 952	89,45	
LIGURIA	1838-52				
brigantino	67 724,58	58,06	363	35,35	186,57
brick/brig	11 814,42	10,13	62	6,04	190,56
brick barca	7 071,98	6,06	23	2,24	307,48
brick schooner/brick goletta	7 036,87	6,03	73	7,11	96,40
goletta/schooner	6 548,18	5,61	74	7,21	88,49
barck scipp/ship/brick a palo	4 986,51	4,28	18	1,75	277,03
bombarda	2 651,29	2,27	34	3,31	77,98
nave	2 611,58	2,24	7	0,68	373,08
bovo	1 913,03	1,64	76	7,40	25,17
brig ship	841,02	0,72	3	0,29	280,34
filuca	585,2	0,50	41	3,99	14,27
cutter	495,61	0,42	27	2,63	18,36
Total	114 280,27	97,98	800	77,99	

Sources: Processed data from Apostolos Delis, “Hermoupolis...”, *op. cit.*; Luciana Gatti, “Un raggio di convenienza”..., *op. cit.*, p. 135-175; Laurent Pavlidis, “La construction navale...”, *op. cit.*

Provence shipyards produced large seagoing vessels, like *trois-mâts*, which more likely coincided with a full rigged ship, and *brick* (brigs). The rest were mainly coasting vessels, all of them averaging less than 100 tons, the largest being the *brig-goëlettes* (brig-schooner) and *goëlettes* (schooner). The term *bateau* was used generally for different types of coasters, while *allège*, *chaland*, *tartane*, *bombarde chasse-marée* were French and Mediterranean coasters. *Allège* was a type originally from Arles, *chaland* a similar flat-bottomed vessel for river navigation as the *allège*. *Tartane* and *bombarde* were also Mediterranean, the former being from the Tyrrhenian Sea and the latter of French origin. They were very widespread types of coaster in the Mediterranean in the nineteenth century.²² In terms of tonnage, three-masted and brigs held the largest share, as they reached together 77,28% of the total production, but in the number of vessels, the largest percentage was held by *bateau* (35,63%), which together with three-masted and brigs covered 80,83% of total production.

In the shipyards of Syros, we can distinguish two broad categories of ship types: the Mediterranean and the Northern ones. The former were much more numerous than the latter, but Northern ship types were built in far greater numbers and were more important in aggregate tonnage as well. Furthermore, the Mediterranean types were mainly small coasters or fishing vessels, whereas the Northern types were mostly seagoing ships or coasters, like schooner (*goleta*) and cutter (*kotero*). Among the Mediterranean types there were boats originally from the Aegean Sea, like *trehandiri* and *perama*, from the Black Sea, like *tserniki* and *sacoleva*, and from the Adriatic Sea, like *bratsera* and *trabacolo* (though only one vessel of this type was built), while the *mistico* came from North Africa and the *martingana* and *feluca* from the Tyrrhenian Sea.²³ Most of Northern types were mainly two-masted vessels (brigs, brig-schooners and schooners), and only one full-rigged ship and few barques were built in 1828-66.

The type of vessel that enjoyed the greatest demand in the entire period was the brig: 1154 brigs were built between 1828 and 1866, or an average of almost thirty brigs per year, quite an impressive figure. Brigs represented 53% of the number of vessels built and 81,46% of total tonnage produced in Syros. This tendency was strictly connected with the position of the brig as the backbone of the Greek-owned sailing merchant fleet in the nineteenth century.²⁴ Despite the overwhelming presence of brigs, the shipyards in Syros built also a great quantity of other types, like *goleta* (schooner, 293 units), *bombarda* (156), *tserniki* (149) and *bratsera* (75). This is an indication that demand was much more varied, and especially that shipbuilder's know-how could respond satisfactorily to it.

In Liguria, the production of shipyards was dominated by a single ship type too: the *brigantino*. This name was used in the Italian peninsula in the eighteenth

22. John Harland, *Ships and Seamanship. The Maritime Prints of J.J. Baugean*, Annapolis (Maryland), Naval Institute Press, 2000, p. 158-159. Carlo De Negri, *Vele italiane del XIX secolo*, Milan, Mursia, 1974, p. 36-40 and 184-189.

23. Apostolos Delis, "Mediterranean Sea: Vessels", in John. B. Hattendorf (ed.), *The Oxford Encyclopedia...*, *op. cit.*, vol. 2, p. 544-547.

24. Apostolos Delis, "Hermoupolis...", *op. cit.*, p. 245-246.

and nineteenth centuries to define a two-masted vessel, rigged with square sails in both masts, like the brig, but without her square main sail.²⁵ The British called it the “true brigantine”, as opposed to what ended up to be called brigantine in nineteenth century Britain: a two-masted vessel, square rigged on the foremast and fore and aft on the main, previously called brig-schooner or hermaphrodite brig.²⁶ The *brigantini* represented 58,06% of total tonnage and 35,35% of the total number of vessels built in Ligurian shipyards during the period 1838-52. Liguria built more three-masted vessels of northern origin, along with the two-masted brigs, brig-schooners and schooners. They were *barques* and *barquentines*, which together with three-masted ships represented 12,58% of the total production in tonnage. *Barque*, or bark, is found in the sources of the period 1838-52 under the name of *barck scipp*, *barco scipp*, *barca scipp*, *barco scip*, and *barco schipp* as well as *brick a palo*.²⁷ The Italians also called it *scippe* or *brigantino a palo*.²⁸ The *barquentine*, on the other hand, is also called *brick barca*, or *nave goletta* and *barco bestia* in the sources of the period 1838-52, the latter term being also used by the Greeks for this ship type.²⁹ Like in Syros, Ligurian shipyards built also a great variety of small coasters of local and Mediterranean tradition, like *bovo*, *bombarda*, *tartana*, *liuto*, *navicello*, *filuca* and *piatta*. *Bovo*, *filuca* and *bombarda* were the most popular ones. However, the largest share in tonnage and number of units was held by the Northern types, as this was the case in the two other areas.

Among the ship types built in the three areas, some were common, whereas other were specific. The non-common types reflect local or regional shipbuilding traditions and are usually small to medium tonnage coasters or fishing vessels.

Table 6. Specific ship types built in the three shipbuilding areas

SYROS	PROVENCE	LIGURIA
bellou	allège	bovo
bratsera	chaland	gondola
malteza	chasse-marée	lancione
perama	sapin	liuto
sakoleva		navicello
trabacolo		paranzella
trata		piatta
trehandiri		
tserniki		

According to Table 6, types of local or regional origins survived better in Syros and Liguria, which can be interpreted as an indicator of the persistence in tradi-

25. Carlo De Negri, *Vele italiane...*, *op. cit.*, p. 49, 56.

26. David Mc Gregor, *Merchant Sailing Ship, 1815-1850. The Supremacy of Sail*, London, Naval Institute Press, 1984, p. 129.

27. Luciana Gatti, “Un raggio di convenienza”..., *op. cit.*, p. 135-172.

28. *Ibid.*, p. 42. Carlo De Negri, *Vele italiane...*, *op. cit.*, p. 62.

29. Luciana Gatti, “Un raggio di convenienza”..., *op. cit.*, p. 42. Carlo De Negri, *Vele italiane...*, *op. cit.*, p. 137.

tion. The types built in Syros reflected much greater geographical origins, which in turn demonstrates the geographical extension of Greek maritime communities, from the Adriatic to the Black Sea, and the shaping of their own special cultural characteristics, which were all present in the great centre of the Greek merchant marine.

Despite the persistence of local specificities, the three areas shared a much greater number of common ship types, both from Mediterranean and Northern origins. In Table 7, common types are presented by their original denomination and the average tonnage.

Table 7. Average tonnage of common ship types built in Syros, Liguria and Provence

COMMON SHIP TYPES	SYROS	LIGURIA	PROVENCE
	1828-66	1838-52	1835-39, 1855-59
Northern types			
μπρίκι (briki)/brig /brick	208	190,56	142,38
γολετόμπρικο (goletobriko)/brick schooner; brick goletta/brig goelette	118,83	96,40	94,00
γολέτα (goleta), σκούνα (scuna)/goletta, schooner/goelette	73,65	88,49	91,18
γαβάρα (gabara)/barck scipp	367,49	277,03	
νάβα (nava)/nave/trois mats	556*	373,08	350,45
κότερο (kotero)/cutter	54,93	18,36	48,00
Mediterranean types			
βομβάρδα (vomvarda)/bombarda/bombarde	50,53	77,98	78,20
φελούκα (feluka)/filuca	8,73	14,27	
μίστικο (mistiko)/mistico/mistic	12,99	38,34	79*
tartana/tartane		32,77	46,9
πολάκα (polaka)/polacca	120*	-	

Sources: Processed data from Apostolos Delis, "Hermoupolis...", *op. cit.*; Luciana Gatti, "Un raggio di convenienza"... , *op. cit.*, p. 135-175; Laurent Pavlidis, "La construction navale..." , *op. cit.* *Only one ship of this type was built.

There are more common Northern types than Mediterranean ones. Among the latter, *filuca*, *mistico*, *tartana* and *polacca* were built in very few numbers, and they should be considered merely as a survival of the eighteenth century, when they had a very strong presence in the Mediterranean. Among the Northern types, brigs and brig-schooners were larger in Syros, but schooners and the Mediterranean *bombarda* were larger in Liguria and Provence, whereas cutters were much smaller in Liguria compared to the other two areas. In the category of three-masted vessels, ships were almost absent in Syros, while in Liguria they were slightly larger than in Provence; and barks were about 90 tons larger in Syros than in Liguria. The fact that the construction of these ship-types was widespread throughout the Mediterranean did not prevent the existence of local specificities.

Conclusion

In terms of production, Syros had the largest shipbuilding industry among the three case studies in the middle of the nineteenth century, both in number of vessels and tonnage. In terms of productivity, Provençal shipyards built in average larger vessels, followed by Greek-made ones, but the delivery of vessels was generally faster in Syros than in Liguria. Shipping and shipbuilding were very much developed in Provence and in Liguria notably because Marseille and Genoa, the main ports of these regions, were among the largest in the Mediterranean. With higher production than those two areas in the 1840s and 1850s, Syros might well be considered as the largest wooden shipbuilding industry in the Mediterranean in that period, even though we lack evidence from shipyards of the Adriatic, north-African and Ottoman ports.

A common feature in all the three shipbuilding areas is that the largest part of ship types they built, especially for seagoing trade, belonged to the northern tradition (ships, *barques*, *barquentines*, brigs, brig-schooners, schooners and cutters). They were employed in many other areas outside Mediterranean and they represented the basic ship types in the sailing fleets of the most advanced economies worldwide.

The dominance of northern maritime technology had become quite clear as early as the last quarter of the eighteenth century in the Mediterranean. In a period of great expansion of eastern Mediterranean commerce during the French Wars, the larger units of the Mediterranean fleets were ships, brigantines and brigs, whereas Mediterranean types like *polacca* and *pinco* were transformed in square riggers and assumed some characteristics derived from the northern technology in their hull design.³⁰ This adjustment to northern European types must have been an indispensable condition for the control of the main Mediterranean trade routes by local fleets, like the Ottoman-Greek or the Ragusan, which experienced a considerable growth during the French Wars thanks to their status of neutral carriers.³¹ The superiority of northern maritime technology over the more obsolete Mediterranean one is also an indication of the superiority and the penetration of North European economies in Mediterranean markets through a powerful tool such as the sailing ship.³² This is part of a longer process that started in the fourteenth century with the introduction of square sail and the sternpost rudder in the Mediterranean, and which later saw the affirmation of Northern ship types like the cog, the carrack and finally the full rigged ship as the ocean and

30. Apostolos Delis, "Typology of Greek-owned vessels...", *op. cit.*

31. Gelina Harlaftis and Sophia Laiou, "Ottoman state policy in Mediterranean trade and shipping, c. 1780- c. 1820: the rise of the Greek-owned Ottoman merchant fleet", in Mark Mazower (ed.), *Networks of power in modern Greece: Essays in honour of John Cambell*, New York, Columbia University Press, 2008, p. 1-44. Robin Harris, *Dubrovnik: a history*, London, SAQI, 2006, p. 353. Harriet Bjelovučić, *The Ragusan Republic: victim of Napoleon and its own conservatism*, Leiden, E.J. Brill, 1970, p. 41.

32. Tommaso Fanfani, "Lo scenario generale", in Tommaso Fanfani (ed.), *La penisola italiana e il mare. Costruzioni navali trasporti e commerci tra XV e XX secolo*, Naples, Edizioni Scientifiche Italiane, 1993, p. 4-6.

seagoing cargo carrier *par excellence*.³³ In the nineteenth century, the supremacy of northern maritime technology through the use of its ship types is an interesting aspect of integration in the standards of the dominant economies of the time, a sort of maritime globalization.

The size of vessels –in average less than 300 tons– implies that they were employed mainly within the Mediterranean. Only the three-masted vessels from Provence which sailed in Atlantic routes and took part to the African and South American trades, or the Ligurian ships, barks or *barquentines*, which carried emigrants to the Americas, represented an exception to the rule. The two-masted brigs in Syros and Provence and *brigantini* in Liguria were primarily destined to the grain trade routes from the Black Sea and the Sea of Azov to the Mediterranean *entrepôts* of Syros, Malta, Genoa, Livorno, Marseille or the Spanish ports.³⁴

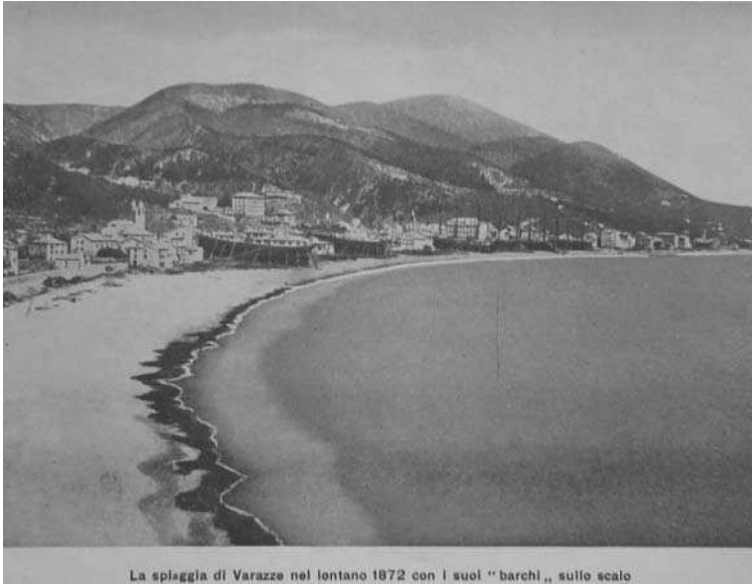
In the last decades of the nineteenth century, wooden shipbuilding persisted as an important economic activity in all of the three compared areas. However, in Syros, after 1870, wooden shipbuilding became more and more marginalized, due to the improvements related to steam, the flood of cheap second-hand northern (mainly British) sailing vessels, and local antagonisms emerging from the newly developed factories (tanneries, flour mills and textiles). Similar factors affected also the competitiveness of shipbuilding industries in Provence and Liguria. In the former, American and Canadian sailing ships and British steamers as well as French Atlantic shipyards, threatened a continuously shrinking activity in the second half of the nineteenth century.³⁵ In Liguria, after a boom in the 1860s and 1870s, shipyards experienced a considerable decline, almost at the same period as Syros. Conditions, structures and people that supported and developed this activity declined irreversibly during the transitional period of the second industrial revolution.³⁶ Indeed, the same applies for the other two areas, where wooden shipbuilding survived only in the construction of small coasters or fishing vessels, which were still capable to provide very important linkages for local Mediterranean economies up to the twentieth century.

33. Carlo M. Cipolla, *Before the industrial revolution: European society and economy, 1000-1700*, London, Routledge, 1993, p. 229-233. Richard W. Unger, *The Ship in the Medieval Economy, 600-1600*, Montreal & London, McGill-Queen's University Press, 1980, p. 163-167, 183-184. Ian Friel, "The Carrack: The Advent of the Full Rigged Ship", in Robert Gardiner (ed.), *Cogs, Caravels & Galleons. The history of sailing ship, 1000-1650. Conway's History of the Ship*, London, Conway Maritime Press, 1994, p. 77-103. Jacques Heers, *Gênes au XV^e siècle. Activité économique et problèmes sociaux*, Paris, SEVPEN, 1961, p. 271-272.

34. Among the most important grain *entrepôts* in Spain, there were the ports of Malaga, Almeria, Alicante and Cadiz: see Alexandra Papadopoulos, "Shipping enterprises, international networks and institutions in the merchant marine of Spetses, 1830-1870. Organisation, management and strategies", Unpublished Ph.D. thesis, Department of History, Ionian University, Corfu, 2010, (in Greek), p. 308-315.

35. Roland Cary and Eliane Richard, *Armateurs Marseillais...*, *op. cit.*, p. 37-43.

36. Luciana Gatti, "Un raggio di convenienza"..., *op. cit.*, p. 19-20.



Postcard. Shipyards in Varazze, 1872



Postcard. Port of Syros, 1910