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MAPPING SARDINIA IN THE 19TH CENTURY

The "*Piano della rada e darsena di Cagliari*".

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Abstract. The essay is part of a wider research that analyzes the cartographic heritage of Sardinia between the end of the eighteenth century and the first half of the nineteenth century.

This period -characterized by a significant development of the survey methodologies and by an improvement of the topographical instruments- determines an excellent quality of maps in terms of the precision of the territorial data and graphic representation.

Sardinia's territory in this era is interested by an intense knowledge activity - especially of the coastal landscape- carried out by French and English Navy's experts and by the Piedmontese officers.

Coastal defense -entrusted to the strongholds of Cagliari, Alghero and Castelsardo and to a system of watchtowers- and access to ports, are the main reasons that guide the reconnaissance.

The extensive documentation kept in the Archives clearly shows the methodologies employed based on the use of cornerstone (as towers, bell towers, or others elements visible even at a great distance) necessary for the construction of an accurate survey grid, that allow -if compared with aerial photogrammetric surveys- an historical reinterpretation of landscape transformations.

Among these documents the "*Piano della rada e darsena di Cagliari*", realized by the French Navy in 1841 and analyzed in the present contribution, arouses considerable interest.

Keywords: Survey; Graphic representation; Coastal landscape; Eighteenth century; Sardinia.

1 Modern cartography and graphic representation of Sardinia landscape

The first cartographic representations of Sardinia date back to the second half of the fifteenth century and offer an image of the island far from the shape that nowadays can be deduced with great precision by means of modern surveying techniques.

The sixteenth century will soon bring an important revolution in the field of the representation of the territory and the Europe, starting from the second half of the

century, is ready to welcome and affirm the primacy of the image over the text and to modify the entire system of representation "starting from the refusal of the literary language of the geographical text and its replacement with the geo iconographic language" [1].

Sardinia remains on the margins of this process until when Rocco Capellino, a military engineer, produce in 1577 a document that marks the passage from the written text to the drawn text and will represent -together with the work printed in 1589 by the Dutch cartographer Gerard Mercatore- a reference model that will represent the "public" image of the island until the eighteenth century.

In Europe an important passage takes place in the middle of the eighteenth century with "the passage from the perspective map to the planimetric or zenithal one, a method of representation that around the 1750 appears to be widely diffused" [2] and in the last two decades of the century there is an important development and improvement of the survey operations and representation of architecture and territory.

The affirmation of military topographers and descriptive geometry that contributes to the resolution of the graphic description of the orography is confirmed, the level curves in the topographic survey (1782) and the metric-decimal system (1791 -96) are introduced.

At this time, the systematic survey of the territory by geodesic triangulation is also applied; the "*Carte géométrique de la France*" -the "Cassini map" made between 1740 and 1793 by César-François Cassini and his son Jean-Dominique- divided into 182 sheets in a scale of 1: 86.400 can, for its use at large scale, can be defined the first modern map.

The methods of descriptive geometry proposed in the *École royale du génie* in Mézières are applied in the orography representation system and trigger a scientific and cultural debate which will lead in France in 1802 to the establishment of a commission, whose members express their opinion "concerning the purposes and uses of the maps, discuss their contents, provide indications on the construction procedures ... and on the training of the men called to perform the topographical operations" [3] and whose guidelines- soon accepted by the whole of Europe- are indicated in the "*Mémorial Topographique*" (1803).

This intense activity determines a cartographic production of Sardinian territory entrusted to modern methods without resorting to sixteenth-century models variously revised and updated -but substantially unchanged- over the centuries.

The purpose of this study becomes the verification -through the graphic analysis of the selected documents- of the application of modern procedures employed in Europe in the nineteenth century and the deepening of the knowledge of the transformations of the Sardinian coastal landscape.

2 Survey and representation of coastal landscape of Sardinia in the Eighteenth century

In Sardinia at the beginning of the nineteenth century, territorial surveys are intensified, aimed in particular at the cartographic representation of the coastline.

A significant contribution to these reconnaissance is due to the captain of the British Navy W.H. Smith, author in 1823 of the "Sardinia Cagliari bay" and in 1828 of the work "Sketch of the Present State of the Island of Sardinia".

In the area of interest, around the 1940s, the French Navy produced the "*Carte particulière de la Côte méridionale de Sardaigne depuis la tour de Pula jusq'au cap saint-elie*; partie occidentale du golfe de Cagliari. Levée in 1842".

These are graphic representations of the coastal landscape that apply methods of acquiring measures and codes in full compliance with the dictates of the "*Mémorial*" and also adopted by the Piedmontese officers particularly active during the great urban and territorial transformations that characterize this period in Sardinia.

Among these documents, the "*Piano della rada e darsena di Cagliari*" offers the opportunity to recognize and analyze the procedures adopted [4] and the historical landscape of the island's capital.

3 The "*Piano della rada e darsena di Cagliari*"

The hydrographic map dated 1841 and aimed at the description of the bay and dock of Cagliari (fig. 1), represents with remarkable precision the characteristics of the coast between the promontory of Sant'Elia -in the east of the city- and the strip of land which separates the sea from the Santa Gilla pond in the west.

The aim of the map is to indicate a safe access to the port of Cagliari; the information acquired during surveys operation are therefore mainly referred to the coast line and at the seabed near the city but nevertheless the landscape context appears described with a great attention.

The drawings show the bastioned perimeter of the Marina district, the hilly systems of Monte Urpino and Calamosca and the salt works in their essential lines, precisely identified thanks to the use of all the operating methods required for a precise survey and representation of the territory.

Strong points and visual lines -which employ the construction procedures of nautical charts [5]- are present in large numbers in order to ensure a correct insertion of the identified elements on the map.

The legend that accompanies the document, oriented and with a metric scale (unit of measure called "*tese*"), identifies some architectures of which we can verify the correct positioning thanks to the compatibility of the map with the current aerial photogrammetric surveys.

Some of the axes represented are of particular interest as they belong to the cartographic tradition of the city [6].

Among these, the Bonaria-Monte Urpino axis (shown in figure 1), which originates from the "L" position, taken by Alberto Ferrero Della Marmora [7] during the operations aimed at defining the "*base*" of Cagliari and the construction of the geodesic network (1834-1839) of the "*Carta dell'isola e regno di Sardegna*" on a scale of 1: 250.000 (fig. 2).

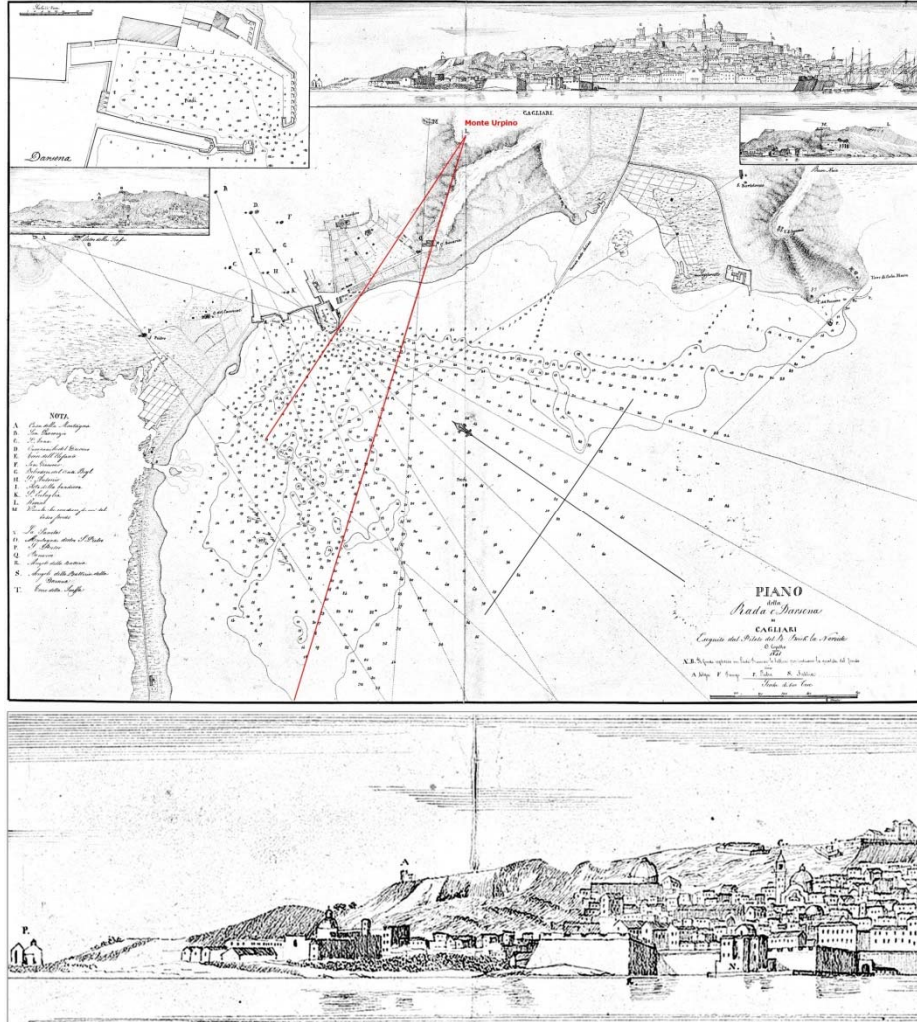


Fig. 1. “Piano della rada e darsena di Cagliari” (“Sardinian collection Luigi Piloni”, University of Cagliari) with detail of the view -present at the top left in the table- that shows the only existing bell tower “C” of the church of Sant’Anna (the second was built in the 1930s, damaged by the allied bombing of 1943 and rebuilt after the second world war), the farm “A” on the hill and the sail bell tower of the church of San Pietro “P”.

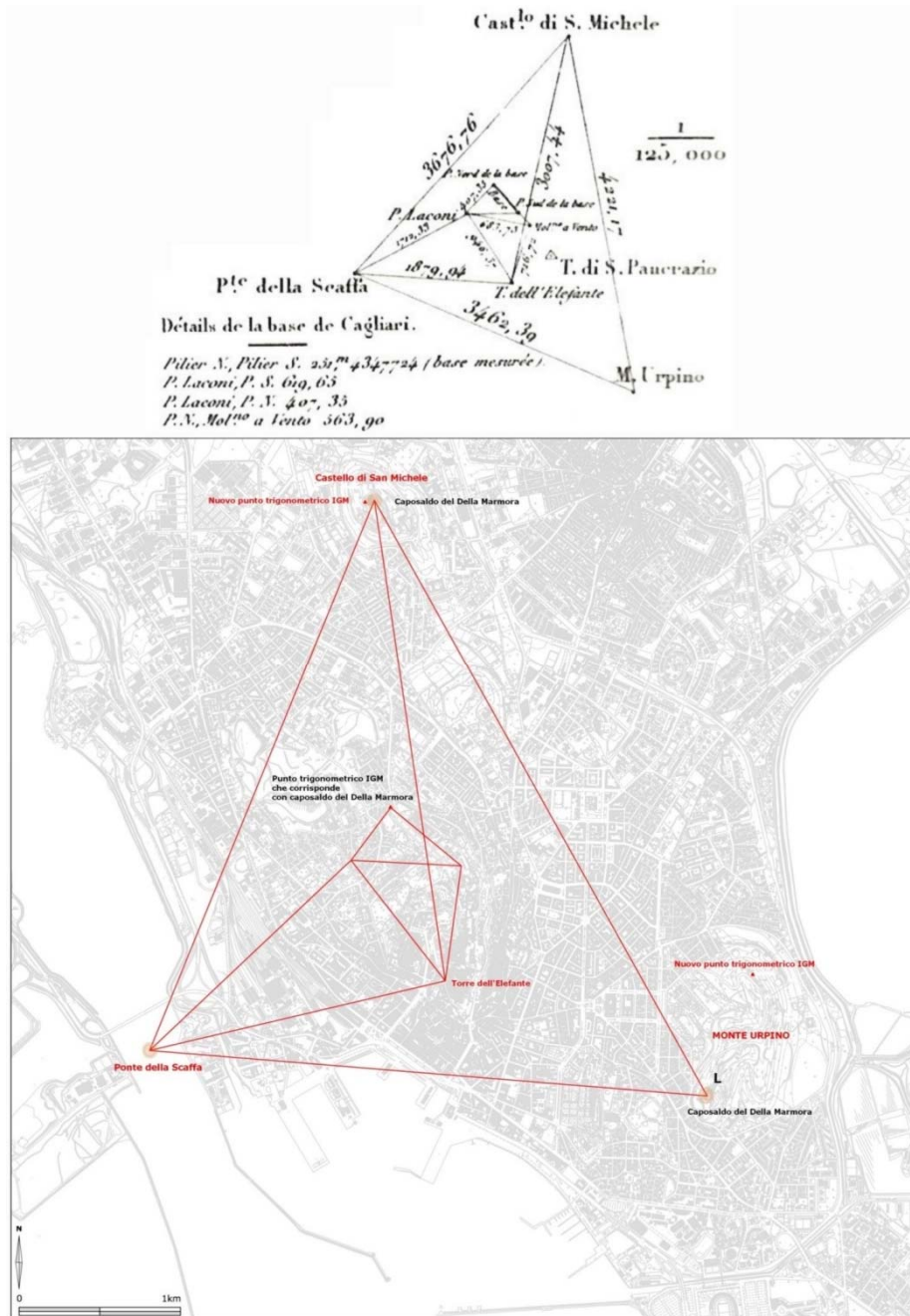


Fig. 2. Detail of the "Base of Cagliari " present in the "Carte démonstrative de la triangulation de 1.er ordre, exécutée en Sardaigne de 1835 à 1838 et deux bases mesurées en cette ile" (State Archive of Torino) and its overlapping on the Regional Technical Map dated 1998.

The "L" point (ruins) corresponds to the site originally occupied by the "*ridotta di Monte Urpino*" (a little fort), identified in the "*Carta dimostrativa de' contorni di Cagliari*" of the late eighteenth century [8], as well as in figure 3 "*DIMOSTRAZIONE DELLI FATTI D'ARME DEI GIORNI 24,27,28 GENNAIO, E 13,14,15 E 16 FEBBRAIO 1793. SEGUITI TRA L'ARMATA SARDA E QUELLA DELLA NAZIONE FRANCESE. Prospetto delle Parti assediate e nuove Fortificazioni di Cagliari. Prospetto delle Parti del Disimbarco ed accampamenti di Quarto*" by the officer G. Maina and in "*Cagliari e i suoi dintorni*" of 1850 with the toponym "*fortino*" and the trigonometric point symbol (fig.4a). The cornerstone, in addition to "crossing" the Bonaria bell tower, is connected to the pier of the dock (the "*Darsena Mole Head*" also describe in Smith's "*Sardinia Cagliari bay*"), a point where further axes that depart from A=casa sulla montagna and C = S.Anna converge.

The dock and its description assume great importance, as evidenced by the detailed drawing placed in the top left corner of the map and the alignments that intersect it; among these, the D-G axis "*Campanile Duomo - Belvedere Conte Boyl*" and the H-K axis "*Sant'Antonio - S.Eulalia*" which reproduces a view used by the French Navy in the 1842 map (fig.4b).



Fig. 3. Part of the 1793 map in which are identified with the number 76 the three forts built on the ridge of the Monte Urpino hill ("Sardinian collection Luigi Piloni", University of Cagliari).



Fig. 4. Part of "Cagliari e i suoi dintorni" (Historical Archive of the Municipality of Cagliari) with the indication "Fortino" employed as a cornerstone on the hill of *M. Urpino* and "Carte particulière de la Côte méri-dionale de Sardaigne depuis la tour de Pula jusq'au cap saint-elie; western part of the golfe de Cagliari. Levée in 1842" (Cagliari, Library of the Regional Council of Sardinia; published in Piloni 1974) with the axis that intersects "L'Eglise de San Antonio par l'extrémité di Môle" and the axis "Le convent ruiné de Bonaria par the extrémité Nord du Plateau du *M. Urpino*" passing the Bonaria bell tower, as shown in figure 5.

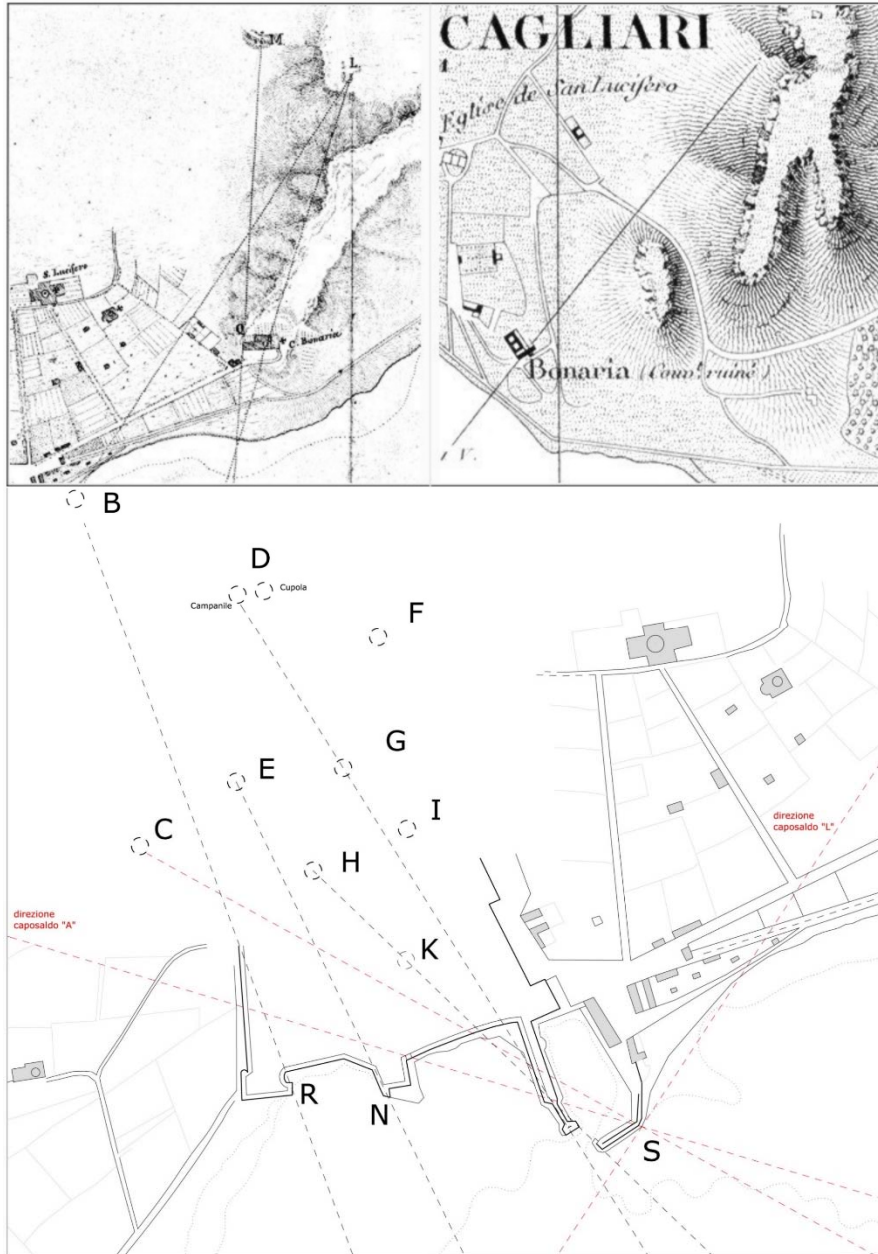


Fig. 5. Visual axes and cornerstones (hill of Monte Urpino and bell tower of the church of Bonaria) represented in the documents of 1841 and 1842-46 and elaboration of the "Piano della rada e darsena di Cagliari" aimed at highlighting the concurrence in the point "S" of numerous alignments as SA (cornerstone on the Tuvixeddu hill), SL (cornerstone on the Monte Urpino hill) and SC (cornerstone on the bell tower of Sant'Anna).

The analysis of the map highlights the presence of further axes that connect towers, bell towers and bastions of the Marina district (B-R “*San Pancrazio*” - “*Angolo della Bateria*”, E-N “*Torre dell’Elefante* - “*La Sanità*”). To the east, far from the city port, the alignments between the church of San Bartolomeo and the end of the “*canale della palafitta*” are identified and also -to the west- the AP alignment “*Casa della Montagna*” - “*S.Pietro*” and OP “*Montagna dietro S.Pietro*” - “*S.Pietro*” and the M.Q. axis “*Visuale che conduce fuori dal basso fondo*”, necessary for navigation and a safe approach to the city.

The axes guide the entrance to the bay and the dock supported by a dense recognition of the seabed of which depth is expressed in feet and quality by letters, as indicated on the map itself.

Both alignments M.Q. and O-P are shown in the view and specified in two drawings (fig. 6) placed on the edge of the map.

The careful observation of the document also allows an understanding of the urban growth of the island's capital and the architectural quality of some of its important monuments.

The first view, located at the top right of the map, is centered on the M-Q alignment that frames the church of Bonaria. The representation of the coastal profile of Cagliari -which at the time had the complex of the Mercedari friars as its western limit- is completed by the church of San Bardilio (demolished in 1909) adjacent to the monumental cemetery built in the west side of the hill of Bonaria and not yet expanded according to the project of the architect Gaetano Cima.

The second view, subtitled “*San Pietro della Scaffa*”, specifies the O-P alignment and the position taken by the cornerstone “A” where since the early twentieth century stands the Villa Muscas redesigned in Liberty style on a pre-existing building.

The landscape portrayed in the view is completed by the urban fabric grown along the Royal Road (*Strada Reale*) that connect south and north Sardinia since the 1920s.

The wide view (fig. 7), made with great care, allows to recognize many civil and religious architectures and to distinguish the shapes and consistency of the bastioned line of *Castello* and *Marina* district. The walled line of *Marina* -designed to protect the port and the neighborhood- still preserves the *Porta del Molo* and the seventeenth-century church of San Francesco da Paola with the facade characterized by the “carabiniere lamp” terminal and the portal framed by couples of Corinthian columns (of which a trace can be recognized in the drawing), demolished in 1932 to be replaced with a new neoclassicist facade.

At the center of the view we can also distinguish the cornerstone H positioned on the dome of the church of Sant'Antonio, the cornerstone K on the bell tower of the Aragonese church of Sant'Eulalia, the towers of the Elephant and San Pancrazio (E and B) built from the Pisans at the beginning of the fourteenth century, the bell tower of the Cathedral and the “Belvedere Conte Boyd”.

The image of the walled city portrayed by the sea is completed with the description of the sixteenth-century shape of the bastion of Sant'Agostino, adjacent to the building “*La sanità*” indicated with the letter “N”, with the representation of the main facade of the church of Sant'Anna, from the dome of the Jesuit complex of San Michele in *Stampace* district and the *bastione del Molo* with its gate.

The information on the area of the new *Lazzaretto* and Calamosca is certainly of interest for approaching the coast line; in figures 8 and 9 in fact it is possible to recognize the *Lazzaretto* salt works and the new *Lazzaretto* equipped with a pier, the canal that connects the new salt works designed by Delitala in 1832, the eighteenth-century fort of S. Ignazio, the Tower of *Cala Mosca* and the *Torre del Prezzemolo*.

The mouth of the *canale delle Saline* crosses a visual axis that continues up to the cornerstone positioned at the seventeenth-century church of San Bartolomeo; this is a useful reference for approaching a good landing place although characterized by a low backdrop ("Partly dry at times") -as reported by the Smith map [9]- and by the presence of *Bancs d'algues a fleur d'eau*, as specifies the French map of 1842.

In the map of 1841 there is a further alignment tangent to the islet and the coastline near the *Cala Mosca* Tower (fig. 9).

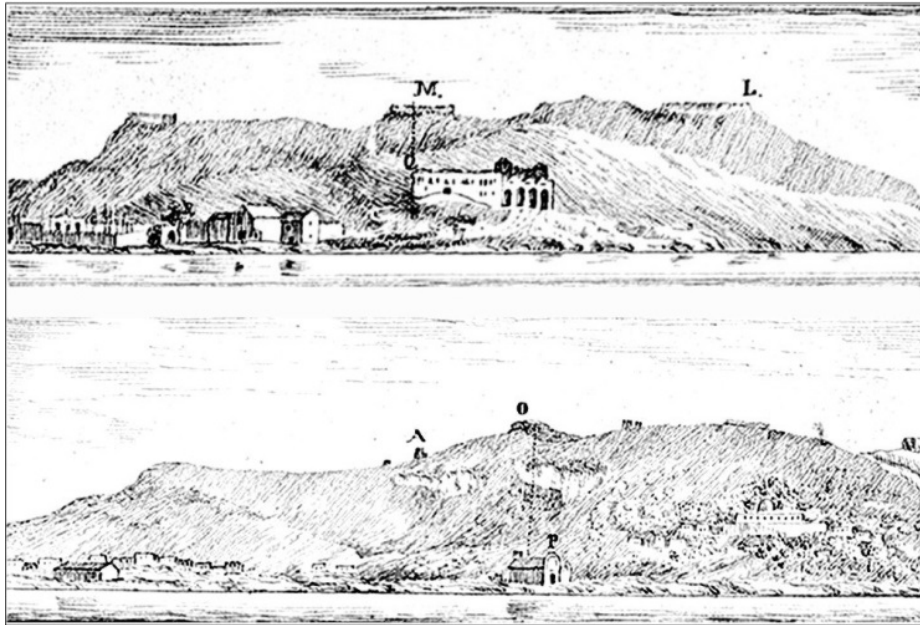


Fig. 6. Views of the city that identify the "L" point on the ridge of M. Urpino and the MQ axis between a cornerstone positioned on the hill and an edge of the church of Bonaria and the OP axis between the strong point positioned on the hill and the church of S. Pietro located along the west bank of the S. Gilla pond.

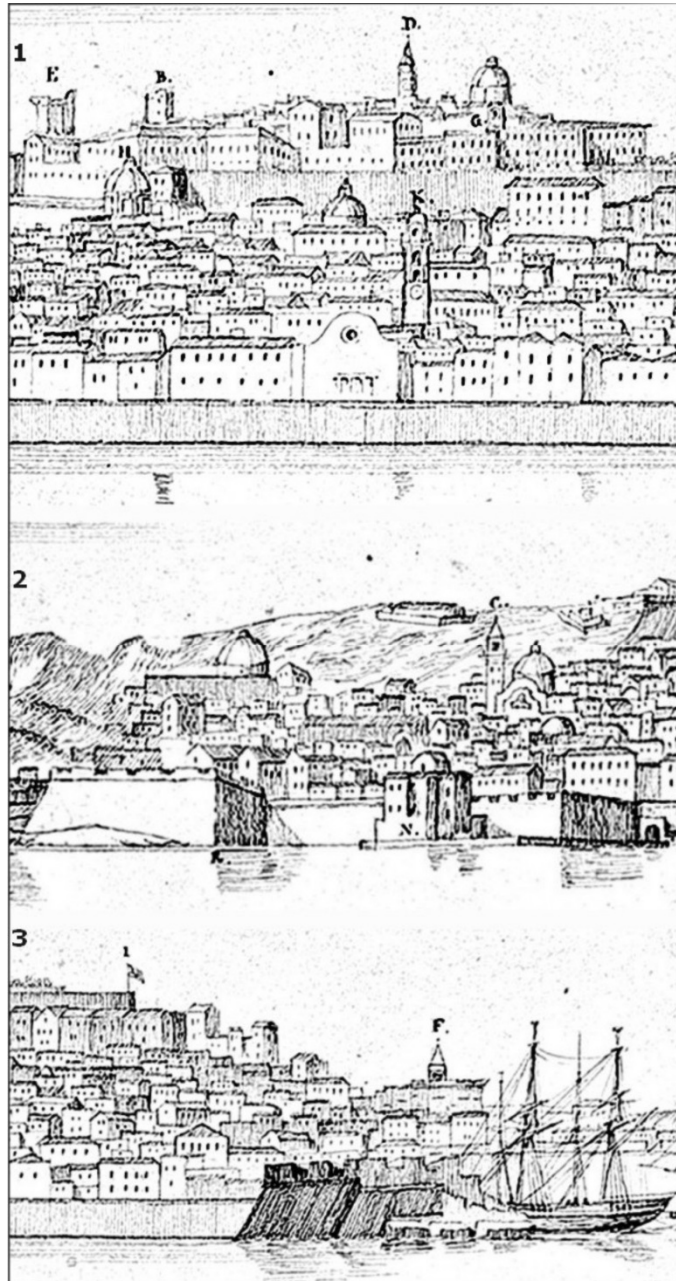


Fig. 7. Detail of the wide view of the city. 1- At the center of the image is the church of San Francesco da Paola. 2- In the foreground the bastion of Sant'Agostino with the building called "Sanita" and the *Molo* gate. 3- The dock protected by the S. Vincenzo bastion [10].

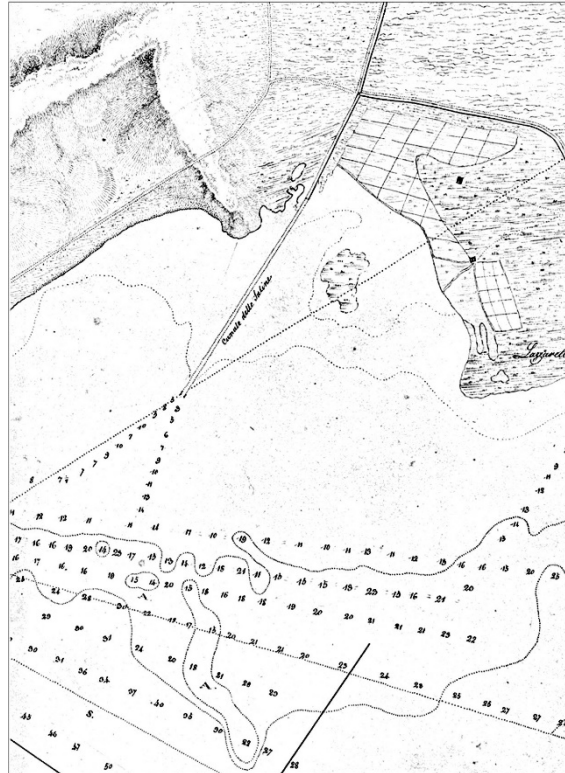


Fig. 8. Details of the "Piano": "Lazzaretto" salt works and main characteristics of the landing.

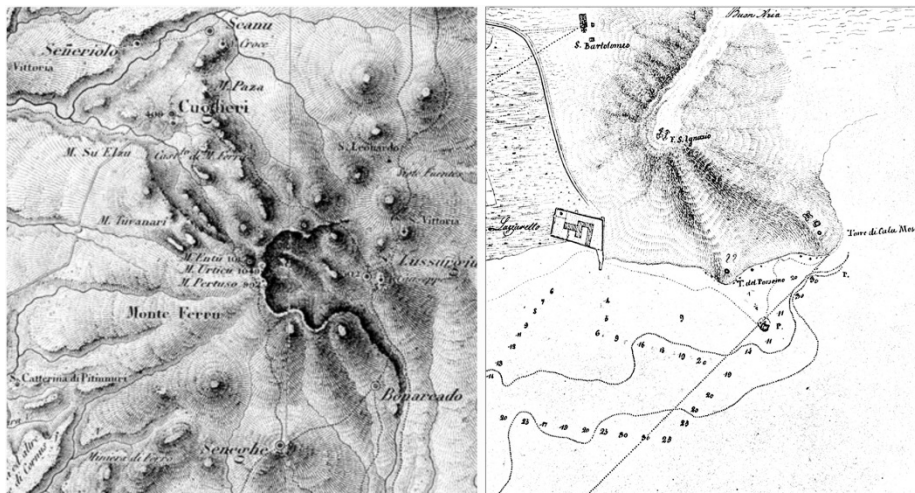


Fig. 9. Representation of the orography in the "Carta dell'Isola e Regno di Sardegna" realized by Della Marmora (<http://www.sardegnaigitallibrary.it>) and detail of the Calamosca area in the 1841 map.

4 Comparative analysis between the "*Piano della rada e darsena di Cagliari*" and the most recent cartographic representations

The ascertained of modern procedures applied for the construction of the studied map suggests an in-depth analysis of the compatibility between the nineteenth-century drawing and a recent survey.

With this aim a graphic overlay was carried out between the signs (cornerstones and alignments) that characterize the "*Piano della rada e darsena di Cagliari*" and a recent aerial photogrammetric survey of the city.

The result of the comparison showed a good correspondence between the two representations, in particular between the position of some of the cornerstones -indicated in the document of 1841 and recorded in the recent digital survey- and a good overlap between all of the alignments (fig. 10).

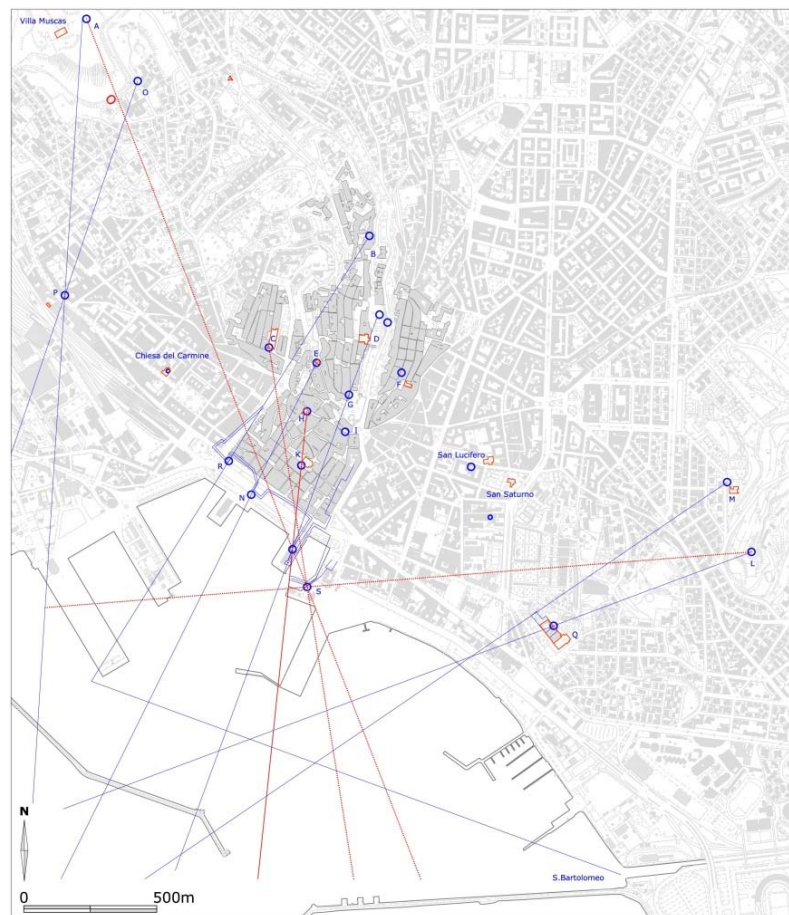


Fig. 10. Graphic overlay between the network of cornerstones (blue circles) and a recent aerial photogrammetric survey.

However, the greatest accuracy was found between the cornerstones H and K which correspond respectively to the dome of the church of Sant'Antonio and to the bell tower of the church of Sant'Eulalia in the Marina district.

Of these cornerstones, employed in the cartographic representations of 1841 and 1998, we appreciate not only the precise alignment -as it happens for the CS visual line in support of the bell tower of the church of Sant'Anna and the EN line in support of the Elephant tower- but also the correct measurement of the distance between them (fig. 11). The cornerstones that complete the network of the survey system and its position is however of certain interest because allows to observe the changes in the urban form that took place following the decree of cancellation of Cagliari (dated 31 December 1866) from the role of "military stronghold". Minor rotations "move away" the historical defensive perimeter of the *Marina* from the position actually occupied by the bastion line which left "space" to the new urban axes as "*Viale Regina Margherita*", "*Largo Carlo Felice*" and "*Via Roma*" on the harbor front.

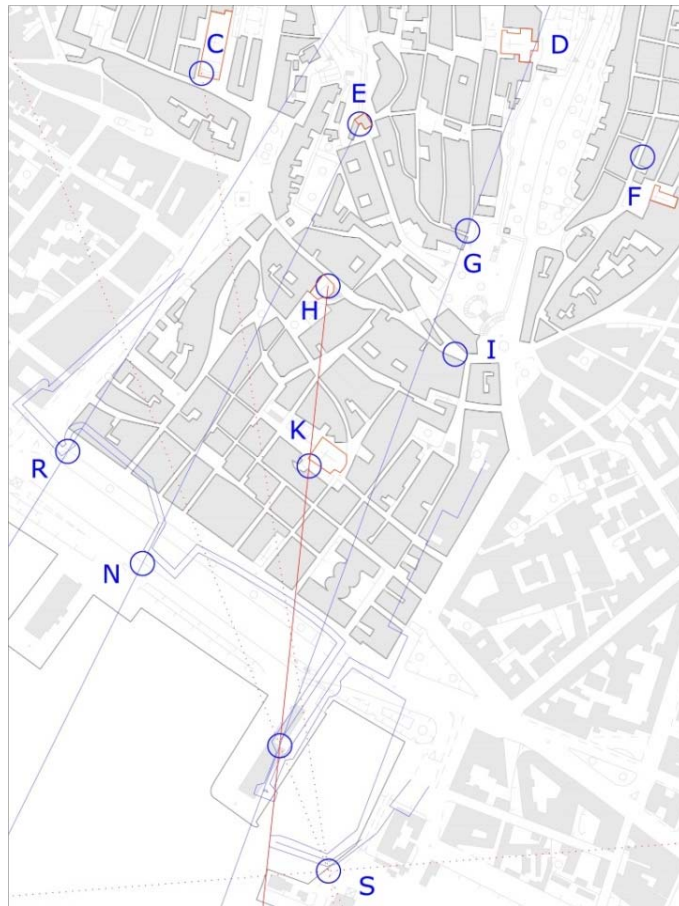


Fig. 11. Detail of figure 10 that highlights correct alignment and positioning of H-K axes in both representations (historical and actual).

The proposed study highlighted the application of rigorous procedures for the survey and representation of the hydrographic map called "*Piano della rada e darsena di Cagliari*".

The use of alignments functional for the realization of the views and necessary for a safe access to the port of Cagliari, the choice of cornerstones -required for the survey of the dock and bay of Cagliari- and the correct registration of the selected elements, delivers a document rich of information useful to "read" the transformations of the historical landscape of the island's capital.

Modification of the coastline and urban growth, identification of lost architectures or interested by the modifications implemented between the end of the nineteenth and the first half of the twentieth century -such as the sea front of the fortifications of *Marina* district- and scientific rigor that characterizes the survey operations and representation of the territory, are some of the first results of a research that involves the entire nineteenth-century cartographic production of Sardinia.

In fact, the graphical analysis conducted on the document offers the possibility of observing the conformation of the coastal profile of Cagliari not yet modified by the important fillings that will characterize the early twentieth century [11].

The landscape and architectural context of the city still retains the drawing of the "*Lazzaretto* salt works" and the "salt works of S.Pietro" both shortly abandoned, the bastions of the *Marina* which will soon to be demolished- and the original facade of some monuments which between the end of the of the nineteenth century and the beginning of the twentieth century will be the subject of a stylistic reinterpretation such as the church of San Francesco da Paola and Sant'Anna.

The methodologies of drawing the territory and landscape are applied according to the operating practice of the time [12].

Graphic codes are employed for the "graphic transcription" of architectures and land use and in the description of the orography, with the aim of producing a drawing which -although characterized by scientific rigor- is easy to understand and that "imitates the nature"; this choice is confirmed in a preference -which in the first half of the nineteenth century unites the various Topographic Offices of the Italian peninsula- of the use of the "most effective and least expensive oblique hatch", as an alternative to the contour lines, a method adopted by Piedmontese officers -engaged in the mid-nineteenth century in Sardinia- and proposed in the treatises [13].

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