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Precursors of scientific mapping of Peloponnese: two early 18th century rare Venetian maps

Keywords: Venetian maps; 18th century cartography; Peloponnese; Regno di Morea; Cartographic Heritage; Military cartography; “semi-topographical” mapping

Summary: The importance of the Peloponnese, due to its geographic position, is well known in History. The key-position in the Mediterranean was reflected into the great number of cartographic representations in the course of mapping history. Almost a century before the “semi-topographical” military maps,1 of French, British and Austrian origin representing Greece and the surrounding areas in the early 19th century, with Peloponnese dominant in these representations, the Venetians had performed surveying and mapping works in Peloponnese. Actually from the late 17th to the early 18th century the Venetian surveyors, civil and military, were active in fieldwork all over their possessions in the Morea for the construction of general medium-scale regional maps and of a number of local cadastral plans. The Venetian mapping of the Peloponnese was so less-known in the current cartographic historiography, compared to the very well known a century later relevant maps by the French, Austrian and British military, that the majority of those dealing with the “semi-topographical” mapping of the Peloponnese considered the early 19th century as its major reference date.

It was the rather recent unveiling and revisiting of the military Venetian maps of the Morea, kept at the War Archive of the Austrian State Archives in Vienna that helped to learn about the work of engineers of the Serenissima who, a century before the French, mapped very well the territory possessed in 1685 and kept for the next thirty years.

In this paper two Venetian maps of Peloponnese are examined, both dated 1707, from a pure cartographic point of view concerning the geometric content with emphasis on the comparative best fitting techniques with reference to the coastline patterns. The analysis showed that the two maps are, geometrically speaking, almost the same, apparently referred to the same original. The impressive fitting of the coastline with the modern counterpart, with the exception of the south and east parts of Peloponnese, demonstrates the high quality of the work carried out by the Venetian surveyors. These Venetian maps should be compared only with maps of affine origin and not at all with maps of scholar or academic origins, examples of which are abundant in depicting Peloponnese since the 18th century and after, especially those inserted in Atlases or used for navigation purposes, which are usually in much smaller scale than the scale of the 1707 Venetian maps treated here.

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1 Barbié du Bocage introduced the term in the late 18th/early 19th century.
Introduction

Peloponnese, this *platanus orientalis* leaf-shaped land, the core of the Modern Greek state, was a Venetian possession from 1685 to 1715 known as the *Regno di Morea*. It is a particularly privileged geographic unity in the cartographic history of the East Mediterranean and the Aegean Sea. Not only because of the exceptionally mnemonic power of its shape, but also for its very specific geopolitical importance in the course of history, as far as this is documented since the existence of geographic descriptions and cartographic representations of that area. Numerous representations of Peloponnese are associated with almost all the well-known mapmakers of the major schools of cartography in various map-typologies from the Late Middle Ages and after.

The geostrategic positional importance of Peloponnese (Fig. 1a) and particularly of its three southern peninsular extensions into the Mediterranean Sea, which form its emblematic shape, unique in the entire East Mediterranean geographical setting, is unquestioned because together with the extreme west-tip of Crete and the Cythera - Antikythera islands, are controlling the naval traffic to/from the Aegean Sea, the Black Sea and the East Mediterranean. This geostrategic significance is evident and well understood already since the early existing representations of the Mediterranean (from 12th century onwards) as are the Arab and the Greek transfers of Ptolemy’s *Geographia* in map-forms and/or the Latin nautical portolan maps (Fig. 1b).

The major naval powers are militarily and commercially active in this geographic area and especially the Venetians (mainly from 14th century and after, but also during their short but strongly involved domination of the Morea, 1685-1715), the French (from the period of *Capitulations*, since the start of 16th century to the Napoleonic period and to the mid 19th century) the British and the Dutch (since their own capitulations from the end of 16th century and after) but also the Russians (from the second half of 18th century) and the Austrians (mainly from the early 19th century). All naval powers based their geopolitical interest also on mapping and cartography for the establishing of their own supremacy in the spatial monitoring of the area and the associated sea-passages. This very geopolitical interest was obviously behind an intense cartographic activity inheriting a rich reservoir of maps the legacy of which characterises today the strong international flavour of the European cartographic heritage.

*Coastline cartographic typologies*

Peloponnese was represented on maps produced by the cartographic schools of those naval powers having political and commercial interests in the region from the 15th century and after. The very particular shape of its “closed” coastline (of island-type) facilitates its drawing on maps and establish specific shape-patterns in its representation. From the Ptolemy-type representations of Peloponnese coastline (Fig. 2a) to those of the *meta-Ptolemy* typologies, as are e.g. the Ortelius maps (Fig. 2b), the nautical portolan maps in much smaller scales as, e.g. those by Georgios Sideris (Fig. 2c) and Coronelli (Fig. 2d), it is evident that the shape of Peloponnese is formed mainly from the three southern peninsulas of Messenia and Laconia and from the two deep in-between gulfs, together with the Argos peninsula and its deep gulf at the east coastline. On the

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2 Called also *Moreas or Morias; Morea* in Venetian, *Morée* in French.

3 For the important issue of the *Capitulations* see e.g. E. Eldem 2006, “Capitulations and Western Trade”, in *The Cambridge History of Turkey*, 3, “The Later Ottoman Empire, 1603-1839”, Faroqhi Surnya (ed), Cambridge: University Press, 283-289.

4 In the cartographic heritage referred to the East Mediterranean the representations of Peloponnese, Crete, Cyprus and of the Aegean Sea is dominant in maps of the great European cartographic schools of that time.
other hand, the north and west coasts have a general shape-uncertainty in all representations with a certain exception at the coastal-tip of Patrai at the Northwest and at the straights of Corinth. From 18th century and after, the characteristic coastline-patterns of Peloponness, as shaped by the French schools, e.g. the De Fer’s hydrographic representations in the early 18th century (Fig. 3a) and the Barbier du Bocage’s (Fig. 3b), of the so-called “semi-topographical” type, are listed as representative of the ending period of this cartographically rich century, before the advent and prevalence of the scientific (i.e. geodetic/triangulation) era of the 19th century cartography. In the meantime, some examples of advanced “semi-topographical” cases of early 19th century, e.g. the Leake’s (Fig. 3c) and Lapie’s (Fig. 3d) coastline depictions of Peloponness are very representative as well. These coastline patterns present an obvious shape-convergence to the scientific cartographic standards established later, lasted to the mid 19th century, thanks to the geodetically-based cartographic work by the French *Expédition Scientifique de Morée*, 1828-1832.

Figure 1a: The centrality of Peloponness (Morea) in the Ancient World and in the Mediterranean. Google Earth representation of the geostrategic centrality of Peloponness (red circle) in the Mediterranean Sea. Peloponness was for centuries close to the centre of the Ancient World.

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5 *Cartes semi-topographiques*, called by the French (e.g. Barbier du Bocage) the maps produced by land-surveys but without rigorous scientific (i.e. geodetic) framing, e.g. without the establishment of trigonometric networks for consistent positioning. In any case, the land-surveys for the semi-topographically derived maps have an association with astronomically supported point-wise georeference, used for the ground and ground control of the partial land-surveys. In this context, the semi-topographic maps stand between the scholar/academic cartography and the scientific/geodetic cartography of the type implement in Peloponness by the *Expédition Scientifique de Morée*, 1828-1832.


7 For the cartographic work of the *Expédition* and generally for the spatial representations of Greece from the late 18th to (mainly) the entire 19th century, see E. Livieratos 2009, *Cartographic Adventures of Greece, 1821-1919*, Athens: MIET-ELIA (in Greek).
Figure 1b: The centrality of Peloponnese (Morea) in the Ancient World and in the Mediterranean. Peloponnese (Morea) at the centre of the marine cross-roads of the Mediterranean. The 16th century Venetian portolan map by Georgios Sideris (Museo Correr)

Figure 2 (a to d): A sequence of coastline-pattern depictions from the late 15th to the second half of 17th century.

Figure 3 (a to d): Coastline patterns depictions sequence in 18th to early 19th century.

The Venetian maps of the Regno di Morea

Until the late 20th century, the idea that prevailed was that the cartographic advancement in the coastline representation of Peloponnese, compared with the modern counterpart, was due to the
“semi-topographical” representations of the early 19th century, as it is shown in the examples of coastline depictions in Fig. 2 and Fig. 3. This idea overturned in 1990 when Olga Katsiardi-Hering first reported the existence, at the Vienna War Archive/Kriegsarchiv, of three hitherto unknown Venetian maps of the Morea, one from the end of 17th century and the other two dated 1707, giving also the interesting way in which these maps were transferred by the Austrian military from Venice to Vienna.  

The case concerns the maps:  

1. DISEGNO DEL REGNO DI MOREA, 1690-1692, by the known, in the Venetian carto-bibliography, engineer Francesco Vandeyk (or Vandejik), when Tadio Gradenigo was the Provveditore generale of Morea.  

2. DEL REGNO DI MOREA, 1707 (Fig. 4a), by the also known, in the Venetian carto-bibliography, inspector-engineer for the cadastre (Cf. the map-legend: Soprintdte Ingegnere Cat”), Bortolo Carmoy[ý] and the Venetian public administration experts (Cf. the map-legend: Publici Periti), Tomaso Castelli and Antonio Borini when Provveditore (Superintendent) was Angiolo Emo. In the following this map is called the Carmoy-Castelli-Borini or the Ca-Ca-Bo map.  

3. PIANTA GEOGRAFICA DEL REGNO DI MOREA, 1707 (Fig. 4b), with Gaetano Ramena the map-designer, a cadet-trainee of the Fortification engineering Academy (Cf. the map-legend: Cadetto studente nel Accademia della Fortifica), under the orders of another well-known in the Venetian carto-bibliography, the military engineer captain Bortolo Riviera (Cf. the map-legend: Cap. Ing.) also during Angiolo Emo’s provveditorato (superintendency). In the following this map is called the Ramena-Riviera or the Ra-Ri map.

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10 Cat. No. [B III a 114], see Katsiardi-Hering, 1993, 302-303.  
11 Francesco Vandeyk was commissioned by the general Grimani to develop the cadastral surveys of Peloponnese and the surveying and mapping of the castles in the area, e.g. of Patrai, Rion, Argos, Chlemoutsi/Tornese. He is also the author of a nice description of Argolis, see Mondry Beaudouin 1880, “Fragments d’une description de l’Argolide faite en 1700 par un ingénieur italien”, Bulletin de correspondance hellénique, Vol 4, 4, 206-210.  
12 Cat. No. [B III a 116], see Katsiardi-Hering, 303-304.  
13 Cat. No. [B III a 115], see Katsiardi-Hering, 303.
a. The four-sheet map by Carmony-Castelli-Borini, rotated 60 degrees clockwise, so that the North is upwards.

b. The four-sheet map by Ramena-Riviera, rotated 60 degrees clockwise, so that the North is upwards.

Figure 4 (a and b): The two 1707 Venetian maps (Kriegsarchiv, Vienna).

From these three maps brought to our attention by Olga Katsiardi-Hering, the second (Fig. 4b) and the third map (Fig. 4b) are analysed here, deserving special attention. Whilst the first, the Vandeyk map, is of the very well known Coronelli’s coastline typology the two other maps are of particular interest due to their unusual large scale of representation for that period. The scale could be compared, at least concerning the coastline, with the one-century-later maps of the “semi-topographical” typology.

The coastline typology time-sequence

The importance of the two 1707 Venetian maps of Peloponnese is that they are the first very close (with some interpretable exceptions) to the geodetically derived coastline pattern of the relevant and in comparative scale, a century younger Expédition map. The map constructed by the Venetian engineers in much larger scale than those by Leake and Lapie, a century before the ap-

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14 The maps were available in digital form after the scanning of high-resolution photo slide-images, without any image rectification. Here, it is necessary to note that the use of digital images derived from photography hides inherent geometric deficiencies due to the properties of the central-projection, which drives all photography products.


Also, V. Tsioukas, M. Daniil, E. Livieratos 2006, “Possibilities and problems in close range non-contact 1:1 digitization of antique maps”, e-Perimetron, Vol 1, No 3, 230-238.

15 These maps have previously been discussed by M. Wagstaff and S. Chrysochoou-Stavridou according to their own point of view in “Two unpublished maps of the Morea from the second Venetian period”, Proceedings, 5th International Conference of Peloponnesian Studies, Athens: Society of Peloponnesian Studies, 1996-1997, 289-316.

16 The 1707 Venetian maps are represented in much larger scale (of the order of 1:250,000) than those by Leake and Lapie, close to the scale of the 1832 Expédition map (1:200,000).
pearance of the “semi-topographical” maps by the Scotsman and the Frenchman, revise the so far established time-sequence of maps series depicting Peloponnese coastline pattern, as it is shown in Fig. 3. The two 1707 Venetian maps are now inserted in the relevant time-sequence, between the map-typologies by Coronelli (Fig. 2d) and De Fer (Fig. 3a), much before the appearance of the Leake and Lapie maps at the beginning of 19th century, as it is shown in Fig. 5.

![Figure 5: The time-sequence of the known series of coastline patterns from late 15th to early 19th century with the insert of the 1707 Venetian maps (shaded).](image)

The 1707 maps of the Venetian topographic engineers are, with no doubt, a very early example of “semi-topographical” mapping, intercalary so-to-say, in the time-sequence of the depiction of the Peloponnese coastline-pattern series, comparable to the much later Leake and Lapie patterns in the early 19th century. The technology of topographic land surveying of the period the Venetian maps are constructed, the first years of 18th century, was based on measuring instruments available at that time as it was e.g.: a. The encased portable precision compass with attached sighting device for the determination of the orientation, the *alidade*, as it is known in relevant bibliography, b. The plane-table/ *tabula pretoriana*, for the in situ topographic drawing, with attached compass and a sighting device, c. The *semi-circular disc* equipped with *angle quadrant*, for the angle measurements and d. The *odometer* for the distance measurements on the ground, especially useful for measuring the non-straight lines.

For the precise geographic latitude and longitude positioning, the Venetian surveyors followed the known astronomical methods and techniques of their times, implementing the widespread observational and measuring settings of the past, with the addition now of the *telescope* and the precise recording of the time, especially for the determination of the geographic longitude. The period of construction of the two Venetian maps (1707) is just in the middle of the scientific mapping and cartography modernization era, cultivated in France in the context of the French *Académie*, starting in 1666 and extended almost to the mid 18th century, with the associated advances in the field-measuring instruments.

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17 Before the Venetian maps the Leake and Lapie coastline patterns were considered as the first closer to the *Ex-pédition* counterpart.
18 E. Livieratos 2009, “Key coastline depictions…”.
The external recognition comparison of the two maps

From a first comparison of the two maps under investigation here, with the focus on the geometric and not on the thematic content, especially concerning the external recognition cartographic characteristics,20 the following remarks can be made:

Origins, orientation, scale, graticule

The two key-words Rilevato and Copia, written in the legend of the Carmoy-Castelli-Borini map, suggest that it is derived from land-surveying (rilevato) and it is a copy (copia) of an original map, obviously compiled after the proper computations and the treatment of field measurements and the associated “croquis”, i.e. the field hand-drawings. In the legend of the Ramena-Riviera map, two different key words are used, Levata and Disegnata, which indicate that, this map was derived (levata), obviously from some other map, thanks to the drawing skills (disegnata) of a certain cadet-trainee in fortification engineering.

Both maps are drawn in four sheets, which when put properly together the representation of Peloponnese is rotated 60 degrees anti-clockwise with respect to the upwards North direction. This means that for the depiction with the North upwards, the representation should be rotated 60 degrees clockwise (Fig. 4).

The maps are scaled graphically. The length of the graphic-scale in the Ca-Ca-Bo map corresponds to 50 Italian miles on the ground,21 whilst in the Ra-Ri map the graphic-scale correspondence is of 24 Italian miles. The drawing of the graphic-scale looks more skilful in the Ca-Ca-Bo map than in the Ra-Ri counterpart, where the scale drawing looks as added at the last time, thus placed at a very narrow place in the map-legend.

In both maps, a reliable correspondence of the graphic-scale to the numerical-scale counterpart requires the certainty of the accurate determination of the physical dimensions of the original maps, which unfortunately is missing in our case. But it can be approximated thanks to an a-posteriori handwritten addendum of a numerical-scale (cf. 1:250.000) marked on the Ca-Ca-Bo map.22 Since the assembled dimensions of the maps are referenced in bibliography,23 to be 98X72 cm concerning the Ca-Ca-Bo map and 125X90 cm concerning the Ra-Ri map, it means that the first map is physically 20% smaller than the second one, which means that its numerical-scale can be estimated to be of the order of 1:200,000,24 or even less than that, the value of 1:225,000 sounding more reasonable. The scales of the Venetian maps are impressively large for that time, compared to the scales of the scholar maps, of the same order of scale used for the representation

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20 In the context of the Bertin’s definitions of the external and internal map-recognition, see J. Bertin 1967, Sémiologie Graphique. Les diagrammes, les réseaux, les cartes, Paris: Gauthier-Villars.
21 1 Italian mile = 1837 metres.
22 It is noted in the map-legend below the graphical scale in Italian miles. In the same way it is written in catalogue no. [B III a 116] after Katsiardi-Hering.
23 Katsiardi-Hering. Due to missing reference about the exact dimensions it is here assumed that they refer to the frame of the two maps. In addition, it should be noted that there are not available the precise data of the photography-parameters of the original maps in order to obtain photo-transparencies from which it could be derived the digital images used in this analysis.
24 The uncertainty in the estimation of scales, as it is made here, requires attention in the derivation of geometric parameters, which one could possibly extract by implementing cartometric methods known in modern cartography.
of Peloponnese in the French Expédition map (1:200,000) constructed almost a century later (1832).25

Both maps have no reference to a graticule of meridians and parallels, neither to numerical longitude and latitude values on the map-frame. It is worth thinking that due to their state/military origin the geographic reference is not drawn for secrecy reasons.

**Design and map content**

In the Carmoy-Castelli-Borini map, the coastline is more rigorously drawn than in the Ramena-Riviera map, where the coastline is of lacy-type. This lacy-type coastline representation recalls older patterns, a common practice in cartographic education, when the lacy line drawing gave an artistic hint in the shape of the coastline.

The very important military information about the moorings, associated with the coastline, is depicted with proper symbolism in the Ca-Ca-Bo map, missing instead in the Ra-Ri map.

The toponyms and their point wise spatial reference are more numerous on the Ca-Ca-Bo map than on the Ra-Ri map, whilst the graphic design of toponymy looks more artistic in the Ra-Ri map.

The ground relief (especially the mountainous areas) is represented similarly in both maps using the old symbolic depiction technique of the *molehill* or *moll mound*. In both Venetian maps the molehills are drawn normal-wise (i.e. not in perspective) graphically emphasised with empirical dashed-shading.

A main characteristic of the Ca-Ca-Bo map is the spatial placement of settlements, the villages and towns, with their toponyms, as well as of nameless castles and country churches, obviously depicted as military reconnaissance cartographic markings. All of them are signed with proper thematic point-symbols, which are missing in the Ra-Ri map.

In addition, in the Ca-Ca-Bo map, some auxiliary straight lines / baselines, are drawn in the north part of Peloponnese (Fig. 6), forming a shape of convergent baselines with vertices at bigger or smaller castles, like those of Patrai, Corinth, Argos, Lepanto/Naupactus and the ones of Cellene/Glarentza and Catakolos at the seaside. An auxiliary point marked at the middle of the baseline Catakolos – Argos completes this auxiliary baselines shape. Despite the fact that these baselines are forming triangular combinations, there is no relation, whatsoever, with the rigorous geodetic method of triangulation which will be implemented a century later by the French cartographers of the Expédition (1828-1832). The manner the baselines are drawn on the map suggests that they are rather related to the map-use than to its construction, although the geometric consistency of the north part of the map could probably support a proper scenario related to the construction of the map. It is worth noticing the absence of the topographically important Tornese/Chlemoutsi castle from the scheme of the baseline connections of castles at the upper part of the map.

In the representation of the administrative boundaries on the Carmoy-Castelli-Borini map the emphasis is given to the Provinces (*Provinzie*) and not to their subdivisions, the Territories (*Territorii*), as it is the case in the Ramena-Riviera map.

The Ra-Ri map is clearly more generalised, in the cartographic meaning of the term,26 compared to the degree of generalisation of the Ca-Ca-Bo map.

25 Yet belonging to the scientific/geodetic era of cartography.

Figure 6: The auxiliary lines added on the Carmoy-Castelli-Borini map.
The lengthiest line connecting the castle of CapoTornese/Glarentza with Corinto/Corinth is of the order of 150 km.

Cartometric analysis, comparative best fittings and results

The approach to the two Venetian maps, from the point of view of cartometry,\textsuperscript{27} requires the geometric analysis of digital copies.\textsuperscript{28} In the traditional thinking of the historians of cartography, coming from humanities, the concern about the geometric (cartometric) analysis and interpretation of maps, i.e.

- the study of the coastal patterns of shapes,
- the impact of scale in cartographic representation,
- the point wise compatibility with respect to the geographic reference systems,
- the issues related to the projective properties of maps,

is traditionally an almost abstract or even meaningless exercise. However today, with the advancement and the spread of modern digital computational methods and techniques of representation allowing even visualised interactive processes in the analysis of old maps,\textsuperscript{29} the geometric approach of old cartographic patterns is not only a fascinating and attractive new approach to historic cartography but also allows the disclosure of so far unknown interesting properties of old maps, sometimes larger and sometimes smaller, sometimes important and sometimes less important, but surely always useful and meaningful, for new understandings and interpretations of old maps and their history.

Such type of studies about the emblematic cartographic representations of Peloponnese, as far as the coastline patterns are concerned, have recently presented\textsuperscript{30} using rigorous and fully defined

\textsuperscript{28} The cartometric approach of the two maps was done through digitized photo-transparencies of the originals, in central-projection and not using 1:1 scale digital copies, in ortho-projection.
Also C. Boutoura, E. Livieratos 2006, “Some fundamentals for the study of the geometry of early maps by comparative methods”, \textit{e-Perimetron}, Vol 1, No 1, 60-79.
methods of digital cartographic transformations and best fittings.\textsuperscript{31} Especially for the two Venetian maps under investigation here, has already attempted a relevant approach, from which the extraction of some cartometric conclusions has been proposed.\textsuperscript{32}

\textit{Comparative analysis}

In this study, following new digital techniques,\textsuperscript{33} the coastline patterns of the 1707 maps are analyzed comparing, on one hand, the two maps between them and, on the other, their affinity to the present shape standard of Peloponnese. A similarity (conformal) best fitting,\textsuperscript{34} of the images of the Ramena-Riviera four map-sheets to the corresponding sheets of the Carmoy-Castelli-Borini map, was applied and the comparison result is shown in the digital transparency,\textsuperscript{35} (in Fig. 7) or in Fig. 8, displaying the coastlines best fitting. From the comparison it is proved the good concurrence of the coastlines depicted in the two maps, with the exception of the representation of Hydra Isle, which is placed largely shifted in the two maps (see at the top-right of Fig. 7 and Fig. 8). The good general fitting of the maps confirms their overall close typological affinity.

Fig. 9 shows the result of the best fitting under similarity transformation (i.e. without alteration of shape) of the Ca-Ca-Bo map coastline pattern to a modern map, as it is, e.g., the Google Earth map of Peloponnese. With the exception of the deviations at the south part of the coastline, which obviously is the result of missing positioning control at the area,\textsuperscript{36} the fitting in the rest longer part of the coastline is impressively good, considering the age of the Venetian map construction. This is a real step ahead with respect to the so far known coastline patterns, as are the later comers, the Coronelli patterns or those of the French hydrographers (e.g. the De Fer maps) or even those of Barbié du Bocage (Fig. 5).

A sharper qualitative uptake of the deviations of the coastline pattern of the Ra-Ri map (and, by extension, of the Ca-Ca-Bo map) is given in Fig. 10, which derives from the introduction of an auxiliary equidistant orthogonal model-grid,\textsuperscript{37} which covers the map and from its best-fitting to the modern coastline pattern (i.e. the black line as it looks in the conformal fitting of the Ca-Ca-Bo coastline to the Google Earth map of Peloponnese,\textsuperscript{38} Fig. 9). This qualitative uptake supports the formulation of some first approximation conclusions concerning the technical component of the 1707 Venetian maps.

\textsuperscript{31} C. Boutoura, E. Livieratos 2006.
\textsuperscript{32} M. Wagstaff, S. Chrysochoou-Stavridou 1996-97.
\textsuperscript{34} According to this type of best-fitting the shape of the two coastlines remains unaltered (i.e. the conservation of the property of similarity/conformality) with only change of a unique scale and rotation of the shape.
\textsuperscript{35} See for more: Boutoura, Livieratos, 2006.
\textsuperscript{36} See e.g. M. Daniil 2006, “Comparing by digital transparency the differences between two almost identical 17th century maps of North Aegean”, e-Perimetron, Vol 1, No 4, 287-296.
\textsuperscript{37} Either because of missing interest or due to the strong terrain relief and the natural difficulties in approaching the area, as it is the case of the Mani peninsula, despite the existence there of two castles, even of minor importance, those of Passavas and Kieles, see e.g. G. Amoretti 2006, La Serenissima Repubblica in Grecia, XVII-XVII secolo, Torino: Omega Edizioni, 64-73.
\textsuperscript{38} The grid is auxiliary (with no relation to any cartographic projection) used only to assist visually the non-expert, in mathematic cartography, to perceive the quality of the Venetian representation, compared with the present-day coastline standards.

\textsuperscript{38} The cartographic projection of the images available by the Google Earth web provided is the so-called General Perspective Projection/GPP, a pseudo-azimuthal, aphylactic, projection intersecting the terrestrial sphere, as defined in http://en.wikipedia.org/wiki/General_Perspective_Projection.

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Figure 7: Digital transparencies of the conformal best fittings of the Ramena-Riviera four map-sheets (the white of the image negative on the transparency layer) to the corresponding Carmoy-Castelli-Borini map-sheets (the black of the image positive on the transparency layer).

The “exact fitting” which is implemented here,$^{39}$ leads to the result of the image in Fig. 10, where now the black coastline is that of the Venetian maps associated to the black equidistant orthogonal grid and the white coastline is the same coastline fitted exactly to the modern coastline pattern. The fitted white coastline is associated with the white deformed grid, the qualitative comparison of which, with the original black,$^{40}$ drives to the visualisation of some useful conclusions that follow, concerning the cartographic quality of the 1707 Venetian maps.

$^{39}$ Of the, e.g., finite-element type, see Boutoura, Livieratos 2006.

$^{40}$ It is used the term qualitative to contrast the terms quantitative and numerical the latter demanding more advanced mathematical-cartographic elaboration, which is out not of the frame of this paper, but also from the methodological limitations imposed by the specific digital copies (the digitized slides) of the Venetian maps, which are available.
Figure 8: Best fitting, under conformality, of the Ramena-Riviera coastline (blue line) to the Carmoy-Castelli-Borini counterpart (red line).

Figure 9: Best fitting, under similarity, of the Carmoy-Castelli-Borini coastline (black) to a modern cartographic counterpart (Google Earth). The differences here are due to the diverse map projections.
Consistency from cartometric evidence

The cartometric results of the analysis, shown in Fig. 6, Fig. 7, Fig. 8 and Fig. 10, lead to some basic conclusions, summarised to the following:

- The Ramena-Riviera and the Carmoy-Castelli-Borini maps are geometrically almost the same; this holds also for the coastlines. It means that both are most probably constructed from the same original, to which the Ca-Ca-Bo could be an exact copy, as it is stated in the map-legend (Copia) and the Ra-Ri is a derived copy of the original or of another copy, with small differences which are due to the copying followed by the student-cadet Ramena. The coastline differences of the Ra-Ri map, in combination with its large scale and with the degree of generalisation applied on the representation, should lead to the idea that the drawing of this derived map was done with analogical mechanical tools, e.g. a pantograph, well known and widely diffused at that time.

![Figure 10: Relation of the Venetian map coastline (black) and the auxiliary equidistant orthogonal grid attached (black) with the deformed coastline (white), after the exact fitting to a modern coastline counterpart, under a finite-element transformation (see footnote 44). The area of Peloponnese within the black dotted curve presents a better fitting with the modern patterns (North, West, up to the centre) without much deformation of the auxiliary grid, whilst the area within the white dotted curve (South) presents the most of deviation and the Central-East area the less deviation.](image)

41 Probably as a student-work in cartography at the Venetian military Fortification Academy.
42 See previous footnote.
• From the study of the coastlines it comes out that the original early 18th century land mapping of the Venetian surveying engineers in Peloponnese, is a high quality operation at the North and West parts to almost the centre of the territory, whilst the surveying at the Central and East parts is gradually deviating from what was expected to be becoming worse towards the South parts where the deviations are large.

• From the cartographic analysis of the coastlines and their impressive fitting to the modern coastline pattern of Peloponnese (with the exception of the South and East parts), it comes out that the surveying was based on careful topographic field work, evidently the first systematic work of this type in the Peloponnese. The use of the known measurement techniques of the time is apparently obvious, with the astronomic latitude and longitude positioning placed first (the meridian and parallel graticule can be easily derived from this geo-positioning), as well as the topographic measurements of angles and lengths with the use of the most common instrument of topographic surveying at the time, namely the plane-table/\textit{tabula pretoriana} combined with the \textit{trigonometric parallelogramme}. In any case, it is evident that the Venetians made astronomical positioning observation at the castles, at the ends of their interconnecting base lines (Fig 6), shown in the \textit{Carmoy-Castelli-Borini} map, given the very good fit of the Venetian mapping to the modern counterparts at that area.

• The good coastline fitting of the Venetian maps with the modern counterparts confirms the rigorous work carried out at the Northwest part of Peloponnese, where the fitting is impressive. In the rest areas the large deviations, mainly at the South, are not referenced to the coastline shape but to its spatial placement, with respect to the modern pattern. This means not necessarily a scarcity in the land surveying of the coastline but a weakness in its spatial relation with the geographic system of reference i.e. the geographic latitude and longitude defining the geospatial positioning in a unique reference frame. In this case the reference is not such good as in the Central - West and North areas.

• The westwards spatial deviation of the Mani Peninsula is very evident, as it is also the latitude deviations of the northern coasts of the Gulf of Messenia and especially that of Laconia, which reflect the very weak astronomical positioning control of the surveying at that area. This shortcoming is perhaps due to the stiff relief of the Mani Peninsula, making the approach difficult for field observations or due to the Venetian lack of interest for that area, taking also under consideration the traditional hostile behaviour of the local population of Mani. All these reasons could be the causes of a cartographically poor representation of the Southern areas in the Venetian maps.

\textit{On the map projection}

Given the limited geographical space of the representation (almost 2X2 degrees in longitude and latitude), the issue of the determination of the exact map-projection is not so demanding for a detailed investigation, maybe of no practical meaning.

\footnote{This graticule is not visible on the map, most probably for obvious reasons related to military secrecy.}

\footnote{See e.g. F. Camerota 2008, \textit{“Catalogo delle opere in collezione, Bolletino dei Musei Civici Veneziani, III serie: Gli strumenti scientifici delle collezioni dei Musei Civici Veneziani, Venezia: Marsilio Editori, 52-53.}}

\footnote{Almost 200X200 km on the terrestrial surface.}

\footnote{This is confirmed by the almost identical graphical results of the best-fitting (due to conformality/similarity) of the Venetian maps onto modern counterparts represented in various map-projections, as it looks in Fig 9 and Fig 11. See, e.g. J. P. Snyder 2007, \textit{“Map projections in the Renaissance”}, in D. Woodward (ed.), \textit{Cartography in the European Renaissance, The History of Cartography, Vol 3, 1, Chicago/London: The University of Chicago Press, p 378.}
It is of major interest, instead, the investigation of the deformation induced in the map shape compared to modern patterns (Fig. 11). In addition, the period of the map construction (early 18th century), the scale of representation and the state/military provenance, do not allow drawing safe conclusions like those requested for maps of Ptolemy- and post-Ptolemy-legacy, as it is e.g. the Mercator and post-Mercator typologies obeying specific projective properties. Neither it is allowed to draw affinities with projective systems used much later in 18th century or associated with geodetic triangulations.

Nonetheless, and taking under account the relatively small geographic area represented on the maps, it is reasonable to argue that the two Venetian maps, analyzed here, most probably obey an easy to construct azimuthal (horizontal plane) equidistant projection, as it was practically usual in the military cartographic works of the time, with the projection’s contact-point at the centre of the area of the land surveying (i.e. the northwest Peloponnese).

In Fig. 12 (1) a relevant example is given concerning the best conformal fitting of the Carmoy-Castelli-Borini map to a modern representation of Peloponnese in the azimuthal (horizontal plane) projection with the contact-point at the middle of the Catacolo – Argos baseline, traced at the North part of the map.

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48 The reference is made to the map-projection systems used in later date in military cartography of medium and large map-scale.
50 This view is confirmed by experts in Italian military mapping of the time, e.g. Prof. Carlo Monti of the Polytechnic University of Milan (private communication, May 2010).
51 Base-line length of ca. 130 km. The middle of this distance is the point (?) in a configuration of traced lines at the north part of the Venetian map.
It is interesting to notice here that almost identical results are obtained after the fitting on two more projections, which are much more difficult to construct mathematically, compared to the azimuthal projection, as are e.g. the pseudo-conic equal-area/equivalent map-projection, Fig. 12 (2), referring to the legacy of Ptolemy’s second projection, as they are the known projection of Bonne, Albers etc and the equidistant conic projection (refers to the azimuthal equidistant in the cases examined here), Fig. 12 (3), or some more, listed in the cartographic literature and used at the time of the construction of the two Venetian maps.

The same results with the practically simpler azimuthal projection are given by the sinusoidal projection (known as the Sanson projection), which is known that was used at the time. More composite and complicated projections, with respect to the simpler azimuthal equidistant, are used mainly by the scholar/academic cartographers (or the “office cartographers”) of the 17th and 18th centuries, mostly for the construction of maps to be inserted in Atlases.

On the other hand, the experiments of the fitting to a normal Mercator projection, Fig. 12, (4), leads again to the same results, even for the southeast tip of the Argos peninsula coastline.

Figure 12: Best fittings of Northwest coastline of Peloponnese in Carmoy-Castelli-Borini map onto modern projective counterparts obeying conformal transformation. The results show no evident differences due to the projection selection. The azimuthal equidistant stands as the most reasonable projection used by the Venetian state / military surveying engineers.

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52 See Bugayevskiy, Snyder 1995.
54 The normal Mercator projection is a cylindrical conformal projection.
Concluding remarks

This brief study is an introductory approach to the geometric properties of the two very interesting Venetian maps of 1707, which are the preamble of the one-century later “semi-topographical” maps of Peloponnese/Morea of French, British and Austrian origin. It is obvious that the field is open for more research on the issue, concerning e.g. the method of construction, the fieldwork, the projection implied, the drawing techniques followed as well as the purpose of the maps and their use.

The investigation followed the map-recognition methodology, which is generally based on the identification and analysis of the external and the internal recognition of characteristic elements of the maps.\(^{55}\) The recognition of these elements is mainly focused on selected geometric characteristics of the two maps and less on the thematic elements of the map-content.\(^{56}\) The subject could not be exhausted, also because of the alterations imposed on the geometric characteristics of the maps, due to the effects caused by the central projection properties intrinsic in the photographic image capturing of the map originals, recalling that the available images here are digitised photo-transparencies/slides.

In addition to the points referred to sections 3 and 4, some more concluding topics are listed aiming at the proper placement of the two Venetian maps in the time-sequence of the 15\(^{th}\) to 19\(^{th}\) century maps of Peloponnese.

- The two 1707 Venetian maps are much affine to each other, with respect to geometry and the coastline pattern. They represent a territory the Venetians are dominating fully and safely, as it was the case of the Morea during their rule there. As products of land surveying fieldwork (directly the Carmoy-Castelli-Borini map and indirectly the Ramena-Riviera map) both maps are implementing the available topographic know-how of the time, considered as the first “semi-topographic” representations of Peloponnese, according to the later relevant French terminology. The maps are neither based on nor derived from any previous map of Venetian or other provenance (which was anyway unnecessary because of the way these maps were constructed) and of course have not at all any relation with the Vandeyk map of the 1690-1692,\(^{57}\) or with any other earlier map.

- The two Venetian maps of state public-service and military origin should be only compared with affine maps of the same typology and not at all, of course, with maps of scholar or academic origin, examples of which are abundant in depicting Peloponnese since the 18\(^{th}\) century and after, especially those inserted in Atlases or used for navigation purposes, which are usually represented in much smaller scales. The 1707 Venetian maps allow and merit comparisons only with maps of the same nature (i.e. military) but almost a century younger, as are those of the French, British, Russian and Austrian military cartographic legacy from the last decades of 18\(^{th}\) and the first of 19\(^{th}\) century. This actually shows the geometric quality of the Venetian maps.

- From the so far available data and from the level of the analytical cartographic research implemented on this problem, it is not yet possible to confirm with scientific certainty if the more complete map by Carmoy-Castelli-Borini is related, in terms of geometric properties (the thematic counterpart is not the main issue here) with the slightly earlier large scale topographic plans (from ca. 1:25.000 to ca. 1:40.000), constructed from 1689 to 1700, depicting areas of Pelopon-

\(^{55}\) According to Bertin.

\(^{56}\) For the thematic map-content see the classics, e.g. E. Arnberger 1988, Handbuch der Thematischen Kartographie, Wien: F. Denticke.

\(^{57}\) DISEGNO DEL REGNO DI MOREA, cat. No. [B III a 114], see. Katsiardi-Hering, 302-303.
nese under the general title DISEGNO DEL TERRITORIO DI …, known as the “cadastral plans” mainly compiled by the well known engineer Francesco Vandeyk. At first sight, recalling also the history of land surveying and of the relevant fieldwork as practiced that period, in various scales, the 1707 maps seem to be part of a different mapping philosophy and methodology than the cadastral plans.

- The reference to the “semi-topographical” 1707 maps could not be, whatsoever, part of the generalised discussions concerning the overall Venetian cartography, as it is sometimes attempted with unfortunate reference to the cadastral plans of the Morea, because the latter belong to a completely different typological, methodological, metrical, representational and cartographic-utility type of different order and scale than the 1707 “semi-topographical” maps. It is, in any case, obvious that in both 1707 maps a particular geometric care is focused on the northwestern part of Peloponnese, namely the province of Achaia (Accaia).

- The deviations in the geographic longitude and latitude at the southern part of the Peloponnese coastline as depicted in the 1707 Venetian maps, have been corrected in the later “semi-topographical” maps, e.g. those by von Weiss (1818-1823, 1829) and by Lapie (1822, 1826), with no more changes in the other parts of the Morea. With the exception, of course, of the differences due to the shape generalisation of the coastlines, as represented later on, when the map scale has reduced to almost the half of the scale in the Venetian maps.

Despite the cartographic local “weaknesses” of the Venetian maps, which after all are not based on a unique and uniform triangulation network, as it is the case of the one-century-later map of Peloponnese derived by the French cartographic works in the frame of the Expédition, these maps are of remarkable quality. It is their overall quality, which puts them on top in the set of the so-called “semi-topographical” maps of the Morea following much later, before the end of the second decade of 19th century (i.e. the maps by Leake, Lapie and Weiss, before the Expédition map).

Even if the overall quality of the representation of Peloponnese in the 1707 maps it is not contested, rests however an open question about the rough mapping of the southern part, of this strategic territory, which controls the sea-passing from the West and Central Mediterranean, including the Adriatic and Ionian Seas, to the Aegean Sea, the Black Sea and East Mediterranean. It seems that the plains and the fertile territories of the Northwest was of much greater interest for the Serenissima, in its late life, than the geostrategic enforcement of the South. Besides, the Northwest territories of the Regno di Morea looked much profitable in the context of the cadastre, which was the major concern of the Venetians for their land policy and taxation and of course the

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58 The maps, e.g., with cat. No. [B III a 121], [B III a 121-1], [B III a 122], [B III a 122-1], [B III a 123], [B III a 124], [B III a 126], [B III a 127], see Katsiadi-Hering, 301-302.
59 He is the maker of the map of Peloponnese DISEGNO DEL REGNO DI MOREA of 1690-1692 period, of Coronelli-typology, which can be seen as the «key-map» of the topographic maps of the administrative divisions represented in the DISEGNO DEL TERRITORIO DI …
63 Despite the existence of castles in that southern part of Peloopnese, i.e. the castles of Coroni, Methoni, Passava, Kielafa, Monenvasia/Malvasia (see e.g. G. Amoretti) in which it was possible to implement the necessary astronomic observations for proper geospatial positioning, if there was a real mapping interest at that area.
“nightmare” of the local Greek populations which traditionally contested strongly the idea of establishing a proper West-European-type cadastre.

Acknowledgements

This paper is a re-elaborated version, in English, of a paper prepared in 2010 for inclusion in a collective volume, in Greek, relevant to the Venetian maps of the Peloponnese/Morea, in preparation for publishing by MIET, the National Bank of Greece Cultural Foundation, edited by Olga Katsiardi-Hering. Thanks are due to Prof. Katsiardi-Hering who kindly made available the digital images of the Venetian maps treated here and to MIET for the cooperation and understanding.

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