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Organizing the Cartographic Series – New Technical and Conceptual Contexts

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which represents an advance in the world of map libraries. Finally, the conclusion points out future issues to be faced by map libraries in the context of an evolving world.

Organizing the Cartographic Series New Technical and Conceptual Contexts

Introduction

Literature on the treatment of cartographic materials in libraries is rare. The main reason for this situation is that maps are treated as books, or rather that librarians tend to treat them as books, with only limited success. The standard used currently for classifying cartographic documents is in fact an adaptation of the standard used for books. As a result, it is difficult to produce consistent descriptions of maps and yet, at the same time, many readers are disappointed in their search for cartographic documents in library catalogs.

The reason is very simple. When searching for a map, the reader will look first for the representation of a physical place, usually by its name. The second step is to include other research criteria, whether generic (*author, title, publisher, date, etc.*) or specific (*scale, subject, projection method, etc.*). However, while the tools available offer high performance searches on generic criteria, the results are usually inadequate when searching for geographic data. At best, each document will be described by a few geographic names - five or six - which correspond to the most important places on the map, regardless of the hundreds or thousands of other locations it contains. Thus, catalogs are most often unable to respond to requests from readers.

However, it is important to identify two major categories of maps because they are displayed in substantially different ways in digital catalogs: monographs, and series (or sets) of maps. A monograph is a map on a single sheet, regardless of its scale. Many maps covering a town, a region or a country fall into this category. A map series is a map which, because of the scale of reduction, size of area represented and / or restrictions relating to paper size, must be represented on several sheets. Series can use a variety of scales: from a cadastral map with a scale of 1:500 to a world map at 10 millionths. It can also be produced on anything from 2 and more than 2,000 sheets. Unlike periodicals, there is no specific method for cataloguing maps series. Monographs usually bear titles which refer to their geographic content, e.g. *Carte de France, Map of London*. On the other hand, sheets in a map series are not always given a proper title and are sometimes only identified by a number. Even if there is a title, it is often unrepresentative or misleading. For example, the map of *Constantinople* in the *Balkans 1:100.000e* series represents the city of Istanbul with a very simplified image measuring less than a centimeter (Figures 1 and 2). For this reason, traditional catalogs are more effective for monographs than for series.

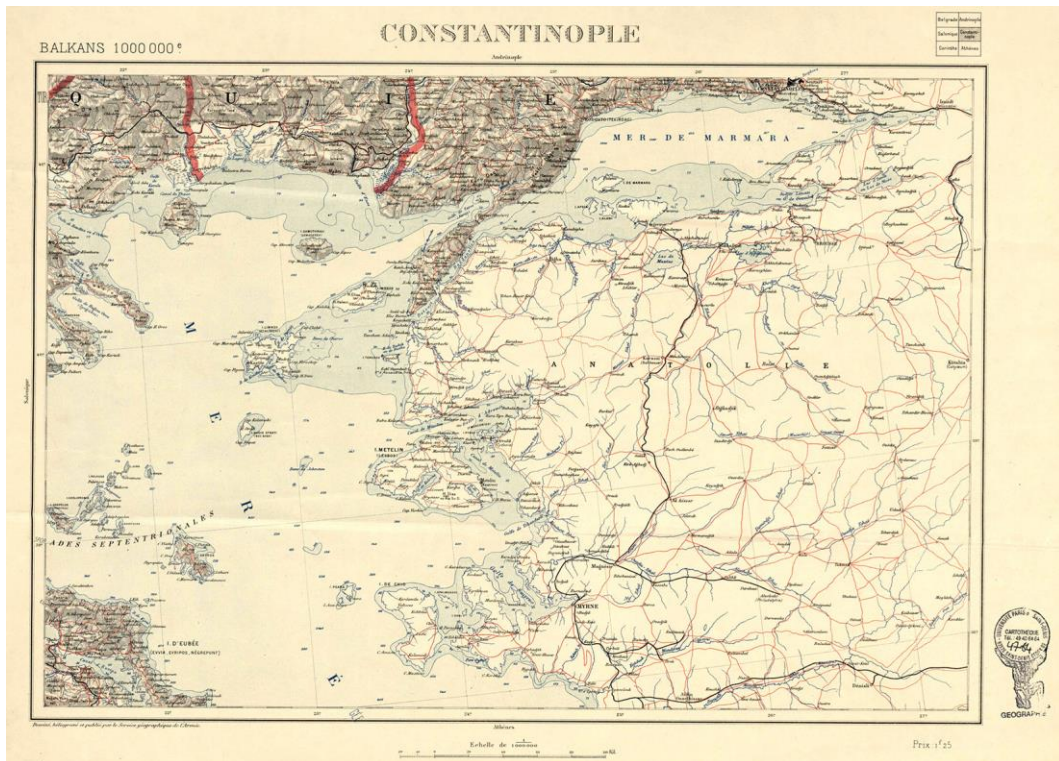


Figure 1. The sheet Constantinople represents an area of several thousands of square kilometres
Source: Series: *Balkans 1:1 000 000*, sheet *Constantinople* (ca. 1900). Paris: Service géographique de l'Armée, by courtesy of the Paris 8 University's Map Library.

Digital catalogs are so poorly adapted to the peculiarities of map series that most map librarians continue to use old card catalogs, rather than take advantage of leading computerization programs. Similar observations have been made in many major map libraries around the world. In France, for example, the National Library's Maps Department - one of the 15 largest map libraries in the world - still uses a card catalog for map series¹ and its earliest records date back to the late nineteenth century. This card catalog covers approximately 350,000 documents, about a third of its total holdings (Figure 3).

This situation is changing for two reasons. First, multi-purpose databases developed during the last decades of the twentieth century have their limitations. Currently, data managers prefer to create more specific data structures to fit the peculiarities of documents to be catalogued. In the recent years, this was made easier by the development of search engines which are able to operate with multiple resources. Second, over the last decade, online geographic information systems (GISs) have facilitated the development of enhanced user interfaces for cartographic research. Although these interfaces have not been adapted to handle search requests such as "I am looking for a map of Istanbul"², the user has the possibility of selecting any region of the

¹. In other institutions, such as the Library of Congress, each series is cataloged through a single entry which does not indicate the number of the sheets, between 2 and 2000!

². Toponyms are very variable by the languages, periods and alphabets. There are also very large ranges of homonyms. For these reasons they cannot be used as geographic references.

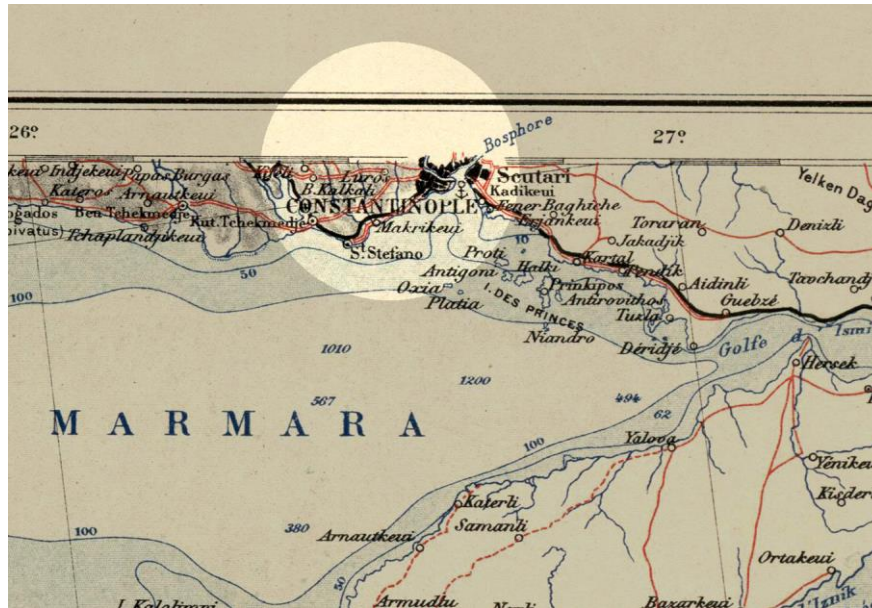


Figure 2. Excerpt from the previous figure. The representation of Constantinople does not exceed one square centimetre.

Source: Series *Balkans 1:1 000 000*, sheet *Constantinople* (ca. 1900). Paris: Service Géographique de l'Armée, by courtesy of the Paris 8 University's Map Library.

world, regardless of size, via an interactive planisphere. Moreover, these technologies help with navigation through large sets of maps. Clearly, geographic information will become a central element in map library management systems in the coming years. In this context, the future of map libraries will involve the integration of new expertise in the processing chain. In addition to using a standard methodology for bibliographic descriptions, it will be necessary to ensure that each record contains geographic data formatted for access using online GIS.

Currently, there are no specific training courses for map librarians. Map curators are versatile librarians who may become involved in a map library at some point in their career. However, despite their undoubted skills in describing printed books and saving textual data, they have not been trained in dealing with geographic data. Thus, the possibilities offered by new technologies remain largely untapped in libraries because their implementation requires important changes that are not currently on the agenda. Preparing information for geographic databases and understanding specific concepts such as projections, coordinates, scales, and grids are essential skills. In addition, librarians must master the GIS tools that will produce this information.

It is not possible to train all librarians in these concepts and software. However, two complementary changes are on the horizon. First, the development of specific tools will assist map librarians and simplify the production of geographic data. Meeting this first objective should not be too difficult, since the data is not used to draw high-speed railway lines or to fire shells, and therefore it is possible to make approximations. There are few examples of this kind of tool, but among them is the program *CartoMundi Online promotion of the cartographic heritage* (<http://cartomundi.eu>) developed by Aix-Marseille University in France. Second, the development of specific courses in training

Prusse et Rhurings. - Carte Géologique au 1/25.000 [Ge CC 15
Notices [Ge FT 33]

Gradabteilung 63.		Lieferung	Date.			Lieferung	Date.
1				16	Geisa	1876	(1876)
2	Ludwigsdorf.		1889	17	Langfeld.	1886	(1886)
3	Rotenburg.		1889	18	Altenbreitungen.	s.d.	(1889)
4	Hornbach.		s.d.	19			
5	Gerstungen.		1894	20			
6			s.d.	21	Hünfeld.	184	1912
7				22	Spahl.	171	1910
8				23	Tann.	184	1912
9	Hersfeld.		1886	24	Oberkatz.	s.d.	(1889)
10	Friedenwald.		1886	25			
11	Vacha.		1886	26			
12			1886	27	Fulda.	184	1912
13				28	Kleinsassen.	171	1910
14				29	Hilders.	171	1910
15	Eitenfeld.		1886	30	Helmershausen.	s.d.	(1889)

Figure 3. Example of cart catalog still in use at the French National Library's Map Department. Each line corresponds to a box of the sheet index, each date to a different edition of the corresponding sheet.

Source: by courtesy of the French National Library.

schools for librarians could lead to the emergence of a body of specialized map librarians. Thus, just when databases are becoming more specialized, it is likely that the work of librarians will also evolve in this direction.

The situation is paradoxical because map series represent a large proportion of cartographic production since the mid-nineteenth century. Thus, work on these series is undoubtedly the main challenge for the coming years in terms of cartographic documentation. In this chapter, we will now concentrate on these documents. Rather than offer a new definition by taking a general approach, we will reflect on specific problems encountered during long experience in classifying and cataloguing cartographic series. On this basis, we will focus on the notion of map series and, using several examples, present the main difficulties that map curators are likely to face in organizing their collections.

After this introduction, the chapter is divided into five sections. The first section presents the general features, history and peculiarities of cartographic series. The second is mostly dedicated to a particular category of documents: sheet indexes. It will show why they are an essential tool for understanding and depicting the geographic organization for each series. This section will also present different categories of sheet indexes and the difficulties that map librarians may encounter with this type of document. The third section deals with statements printed on the sheets and shows that they may be very useful and yet sometimes misleading. The fourth section focuses on a presentation of the *CartoMundi* system developed at Aix-Marseille University. Finally, a conclusion will identify issues that map libraries may have to face in a changing context.

Background

Since the mid-nineteenth century, most cartographic documentation has been organized in series. This massive production was achieved thanks to technical advances in printing and a growing demand for precision from civil and military administrations. While they form the largest part of map collections, descriptions of their contents are often unsatisfactory. Until a few years ago, this was due to the lack of appropriate tools for map librarians. However, this context is now changing, as recent technological progress allows more specific descriptions of series in response to demand.

The main difference between monographs and map series is their physical form. Monographs consist of one document, while each map series is composed of several documents. There is no equivalent category in library holdings, the closest comparison could be in the field of book collections. However, organizing a map series is much more complex. A collection of books includes documents dealing with a similar subject, published over a period of time. In general, this has developed along a single dimension, time, and this makes it easier to use a simple list to describe its contents.

Map series, on the other hand, are organized in two dimensions: space (sheets tile the area covered), and time based on two determinants. The first determinant refers to the time required to achieve tasks such as survey, mapping, and editing on all sheets in a series: for example, publication of the topographic map of France, at scale 1:80,000, on 274 sheets, spanned more than half a century. The second determinant is linked to changes occurring in the represented area: creation of new roads, expansion of cities, changes in land use, etc. Such transformations lead to revisions on each sheet and to new editions which are dictated by user demand and the number of changes involved. Thus, while the whole French territory was not fully covered by the series mentioned above, the sheet *Paris* has been produced in six different versions³.

According to the standard definition, a map series is a "map document containing a specified number of sheets and whose publication is considered as a whole". This definition is simple and general enough to cover documents in several different categories and can be used to describe a political world map published in two sheets of the same date, a detailed topographic map of a country on hundreds of sheets published over a long period of time, or a town's cadastral map. Despite the diversity of objects that may constitute a 'map series', the standard definition is not sufficient for representing the reality of map production, on the one hand, and organizing collections, on the other. Thus, map curators encounter many difficulties in defining the geographic, temporal and legal perimeters for the series they hold.

The situation is made even more difficult because IT systems used by libraries to store data are designed for monographs and therefore do not easily allow for grouping individual units of cataloguing in higher level sets. In this context, titles of map series are

³. The first edition of this map was published between 1832 and 1880. During this period, the sheet *Paris* was published for the first time in 1843, then updated and republished in 1864, 1869, 1872, 1873 and 1876 (*Rapport...*, 1889, 28-29).

considered as supplements to descriptions of the sheets they contain. This data is not checked either upstream, in lists of series, or downstream, after cataloguing. In this context, each librarian selects or composes the title that seems the most relevant on the basis of the information, usually partial, provided in the documents in the collection. When the process of cataloguing a series is carried out by several map librarians, it gives rise to disparities that cancel out the suitability of the title in gathering sets of sheets⁴.

This issue is of paramount importance with the emergence of civil and military authorities and of expansionism in several European countries, in the mid-nineteenth century, and as a result, series became the main method for map production. About 90% of sheets published since then have been produced in map series. The definition of the map series is another issue for the management of libraries and sharing of information. Map librarians carry out combinations and / or divisions that are even more difficult to operate when some of their collections are incomplete. They must decide between two options: gathering together documents that may have major differences, or dividing collections into multiple subcategories. It is not always easy to find a solution between these two extremes.

The definition of map series is also a challenge for sharing information. As each library uses different criteria, and there are no controlled and standardized lists, each institution or map curator proceeds as they think best, according to their existing collections and this is obviously not conducive to data sharing. It is no coincidence that, in the largest map libraries, the catalogs for most series have not yet been computerized.

According to these standards, the definition of map series is short enough to suggest that it could be operative immediately, but this is not always the case. In general, the larger the number of sheets in a series, the more its production was spread over a long period and the more exceptions there are to the rule. For example, for the most recent map of Bulgaria at scale 1:200,000, all 22 sheets were first published in 1994 by the same publisher, using the same graphic chart and a homogeneous system of sheet numbering. On the other hand, some series have required decades of work and, over such a long period, the political situation and / or the producing institutions may change, as may such information as titles of the map series or national boundaries.

A Recent Class

Map series were born from a technical constraint. In order to print these series, the area covered was divided into units defined by the size of the paper available and the capacity of the printing press, which relates back to the time when the engraving process

⁴. For example, the topographic map of Algeria at scale 1:50 000, published between 1882 and 1984 by the French authorities, constitutes a series. It was cataloged into the SUDOC (Système unifié de documentation universitaire) by different librarians who each holds a very partial collection. In the catalog, sheets of this map are organized under eight different titles: [Carte d'Algérie - 1:50,000]; [Carte d'Algérie au 1/50,000, (Type 1922)]; Carte d'Algérie - 1:50,000 (Type 1922); Carte d'Algérie (département de Constantine) 1:50,000 (Type 1922); Carte d'Algérie (département d'Oran) 1:50,000; Carte d'Algérie au 1:50,000; Carte d'Algérie échelle 1/50.000; Carte topographique de l'Algérie 1:50,000. Some titles are enclosed in brackets, others not. The result is a totally artificial impression of dispersion.

was developed. For example, the bird-eye's view of Rome published by A. Tempesta in the late sixteenth century (Tempesta, 1664) was divided into 12 engraved copper plates. The prints must be assembled to compose the whole picture, because their size far exceeds the capacity of machines and the paper size available at the time, i.e. 105 x 241 cm. This technique is also used for cartographic materials when their size exceeds that of the resources available, as shown in the next two examples. The first example dates back to the early 17th century: a map of France by François de la Guillotière published in 1613 on nine sheets. This document is a good example of a mixed mode of figuration including a bird's-eye view and maps. However, the printing units are not independent editorial units since they do not bear dates, nor any specific information such as titles, or a statement of responsibility. This information was printed on a single sheet with the general title of the map and the name of its author. On the contrary, a map of Corsica was published by Tranchot in 1824 on eight sheets (four large and four small sheets). The four small sheets were placed in pairs and engraved on two plates of copper. In other words, these four sheets were printed on only two pieces of paper. Neither Tranchot's, nor de la Guillotière's maps are not strictly speaking series, rather they are monographs whose division into sheets was first determined by the printing resources available at the time. The fact that these maps were not sold as separate sheets confirms their unity.

The earliest example of a major map series dates back to the second half of the eighteenth century: a map of France drawn up and published by the Cassini family in 1749. This map, at scale 1:86,400, covers no less than 180 sheets and its total surface area is 125 sq.m. Given its size, it was impossible to assemble all the sheets as a single layout. Each sheet is not only a unit in terms of its production, but also in terms of editorial criteria and commercial requirements. Depending on needs and resources, it was possible to buy a single sheet or a set of sheets for a given region, or the entire series. The Cassini map sheets have all the characteristics of a map series: they are cut according to a regular grid, and each map bears a specific title and number, an indication of scale, and its date of publication.

After 1760, the authors of this map had two activities. They produced additional sheets for the series and they are also responsible for updating previously published sheets by incorporating changes in the kingdom's territorial organization (Pelletier, 2013, p. 146). These updates were local and only affected sheets where changes in the area's spatial organization were substantial enough to warrant a new version. From then on, each sheet became a fully published unit. Maps of cities and ports, for example, were more likely to be updated frequently than those depicting sparsely populated and less exploited mountain regions. Thus, because it was technically impossible to produce all the sheets of a series simultaneously and each sheet was an updatable unit, assembling the series - as practiced for monographs with several cuts - became an aberrant monster in terms of temporal cohesion. The juxtaposition of the sheets, which placed surveys from different periods side by side, resulted in discontinuities in the depiction of new forms of infrastructure (roads, canals, etc.) and of urban areas.

Moreover, for some series, updates did not systematically cover all the elements portrayed on the original map. For example, in the early twentieth century, the French

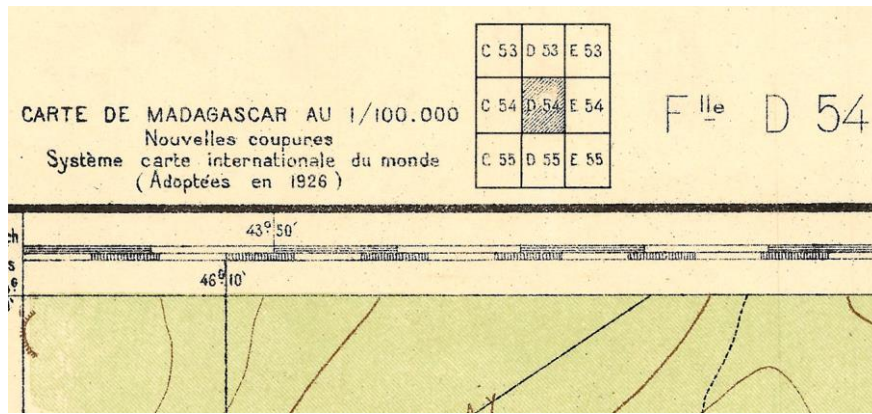


Figure 4. A “nine boxes” sheet index, the central box corresponds to the sheet where it is printed
 Source: Series *Madagascar 1:100 000*, sheet *Nosy-Ambositra* (1927). Tananarive: Service Géographique de Madagascar, by courtesy of the IGN's Map Library.

Service géographique de l'Armée (SGA) continued to publish nineteenth-century maps with poor geodetic control, but, in the absence of more recent documents, they were still useful. Until they were replaced by new maps using controlled geodetic data, they were regularly updated with the inclusion of railway lines, but other data remained unchanged⁵. This method was affordable because it did not require additional field surveys, but it produced diachronic figurations: the railway lines were drawn across an outdated topographic background. The dates assigned to these sheets could not correspond to the contents of such a diachronic monster. On other series, geographic names may be out of date. In this case, the sheets bear a statement of a specific date that corresponds to the initial survey of names on the map⁶. Thus, cutting a large document into multiple sheets constitutes in fact the first act in creating a map series. The second phase, which relates to the editorial autonomy of each sheet, is equally important and involves two separate categories: monographs with several cuts; and, series containing several sheets.

Geographic Aspects

Geographic aspects of a cartographic series are summarized in a specific document called the sheet index. This is a graphic document that shows the relative positions of individual sheets. It is drawn on a white background or is a small-scale map showing main landmarks such as coastlines, borders and major cities. It can be printed on a separate sheet or in the margin of each sheet of the whole map. In the latter case, it may be partial or show only the sheets adjacent to the sheet on which it is printed (Figures 4 and 5).

⁵. That is the case for example with the map of France at scale 1:320 000, for the version dated 1914 (*Rapport...*, 1921, 47).

⁶. That is the case for example with the map of Algeria at scale 1:50 000. Several sheets published at the end of the 1950s bear the statement “Toponymie mise à jour en 193- “.

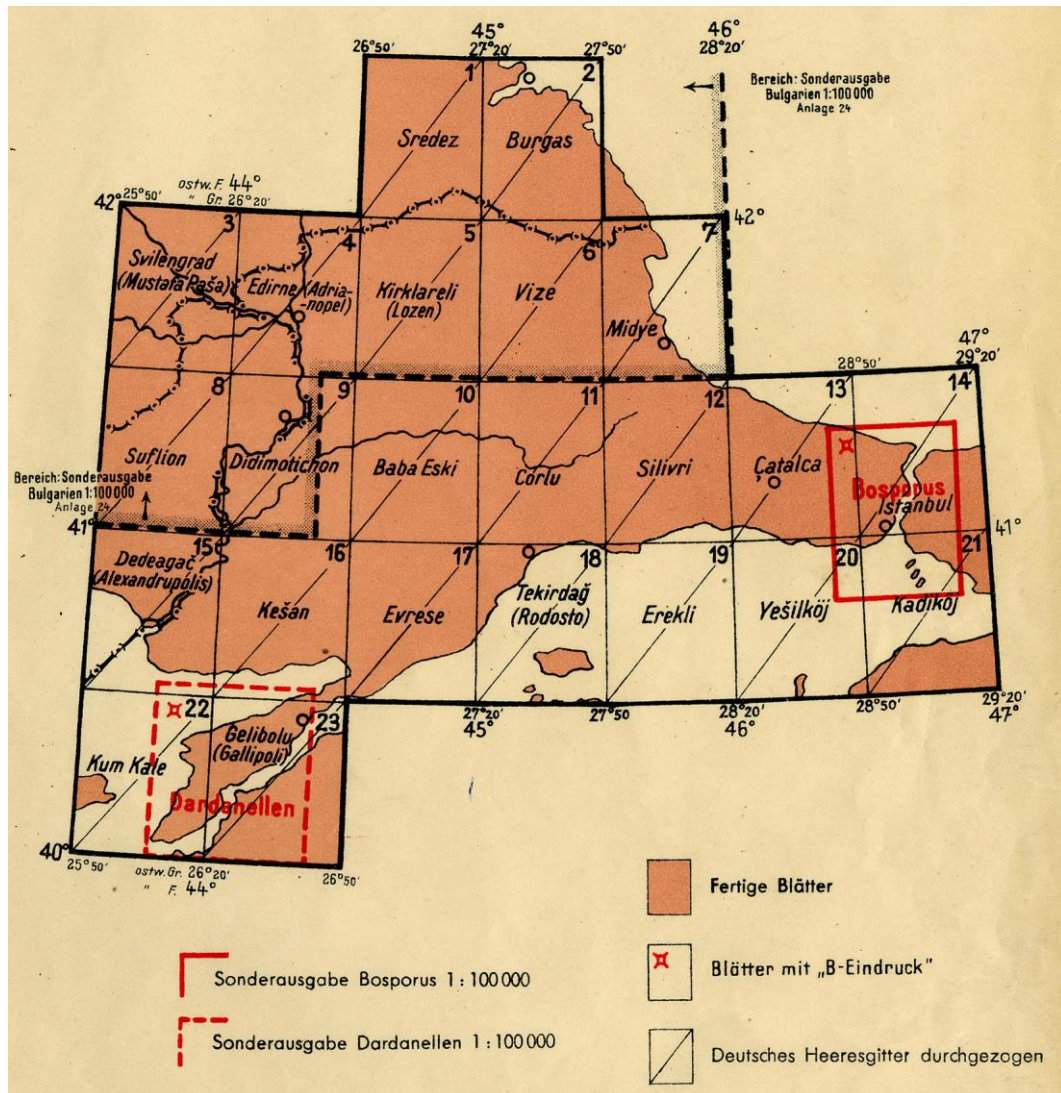
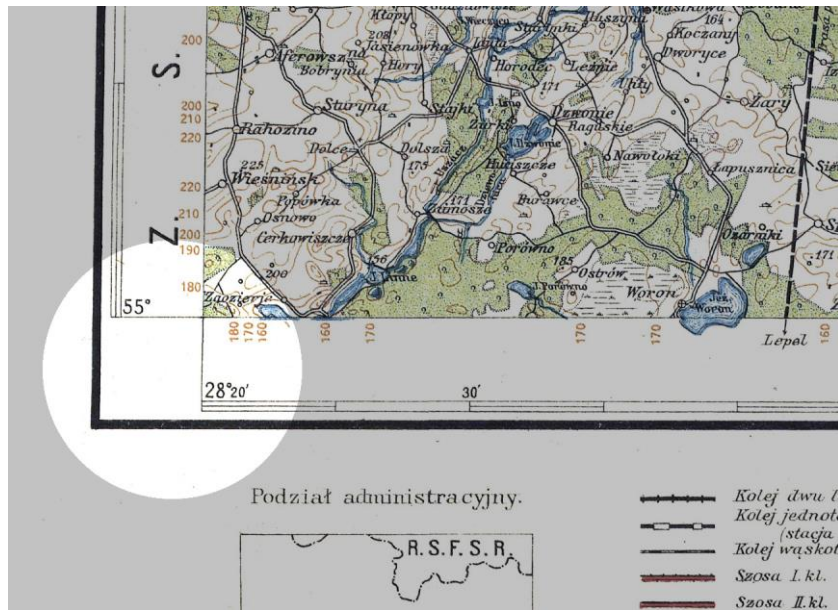


Figure 5. Example of a sheet index published into a German catalog during the Second World War
 Source : *Länderweise Zusammenstellung aller Karten und Mil-Geo-Arbeiten* .Berlin: Oberkommando des Heeres. General Staab, 1943, pl. 98.

For a monograph with several cuts, the sheet index acts as a guide for the bookbinder and disappears after use. Real sheet indexes are produced at the same time as the series and, most often, when each sheet becomes a separate editorial unit. They are used to evaluate the area represented by the series and by each sheet and include information on the title and / or number. As such, they are multipurpose tools and offer many solutions. For readers, they help to choose the sheets that are of specific interest to them. For librarians, they are very useful for recording the state of their collections while, for producers, they can be used to manage and organize the work schedule. Thus many publishers' catalogs and reports include sheet indexes which provide information on progress in geodesic operations, surveying, mapping, and printing for each series (Figure 5).

Whether printed or handwritten, sheet indexes are easy to use and to produce. Indeed, without special training, most map librarians know how to make a sheet index on



Figures 6-7. System of coordinates and type of dividing grids

6. Coordinates expressed in degrees: limits of the sheet follow a grid of meridians and parallels

Source: Series *Poland 1:300 000*, Sheet *Witebsk*. Warsaw: Wojskowy Instytut Geograficzny, 1931, by courtesy of the IGN's Map Library.

a piece of graph paper. It is no more complicated than drawing a game of Battleships. But while paper versions of sheet indexes are easy to use locally, they are difficult to record in a database. This difficulty is probably the main reason why a large proportion of bibliographic catalogs of map series have not yet been converted into databases. Thirty years ago, the tools needed to carry out digitalization programs did not exist but, over the last decade, several excellent software programs have been developed.⁷ However, this latest evolution has not yet resulted in significant changes in the work of most map librarians, although change is coming, as has been shown in several recent experiments (Arnaud, 2014).

Sharing the Territory

The first element in the diversity of map series is the way in which territory is divided into multiple sheets. Although there is endless geometric patterns for cutting up the plan, the aim of editors is not to create difficulties. They have developed several ways of sharing the territory, each of which provides solutions and is adapted to specific uses. For each series, authors have to choose the method that best suits their needs.

Independently of the method chosen, individual sheets in a series can be organized either edge-to-edge or overlapping. The most common method is edge-to-edge

⁷. Geographic information systems – GIS – are available since the early 1960s. From this period, they are very useful to build georeferenced sheet indexes but it remained difficult to share them online before the development of the method called *mashup*. This method allows to represent the perimeter of each document on a planisphere online. That was the last stage of development of the tools needed to implement online search engine by geographic location.



7. Coordinates expressed in linear units: limits of the sheet follow a flat grid, determined after projection

Source: Series *Rumänien 1:100 000*, Sheet *Beius*. Vienna: Militärgeographisches Institut, 1938, by courtesy of the Paris 8 University's Map Library.

which shows each part of the territory once and only once. This principle has the advantage of avoiding confusion when exchanging information. On the other hand, it is necessary to consult several sheets at the same time in order to have an overview of the geographic areas near the edges. The smaller the sheets, the greater the need to consult several documents simultaneously. For example, for the map of France at scale 1:200,000 published between 1881 and 1899, each sheet measures 42 x 30 cm. It is estimated that readers must consult two sheets at a time to see a fifth to a quarter of the whole map. The overlap system overcomes this difficulty, but usually increases the number of sheets and updating them becomes more complex because up to four documents must be changed for any place located in the corner of one sheet. Given the time lapses between updates, it is conceivable that the same place could be represented in four different ways. Such inconsistencies may be acceptable for a road map, but they are unacceptable for military, administrative or legal uses. For this reason, most editors prefer edge-to-edge sheets.

Apart from this first distinction, different systems may be used to draw the lines separating the sheets. Options include topographic, legal or administrative borders or a regular grid organized independently of the places represented. Topographic system is rare and used mainly for cadastral maps. The limits of the area displayed on the sheet follow streets or roads in order to delimit blocks. According to this method, property units (which are the main purpose of a cadaster) are never divided across several sheets. To optimize the use of paper, each section of the territory is drawn to fit onto the sheet. On a smaller scale, the current map of French counties is based on administrative boundaries,

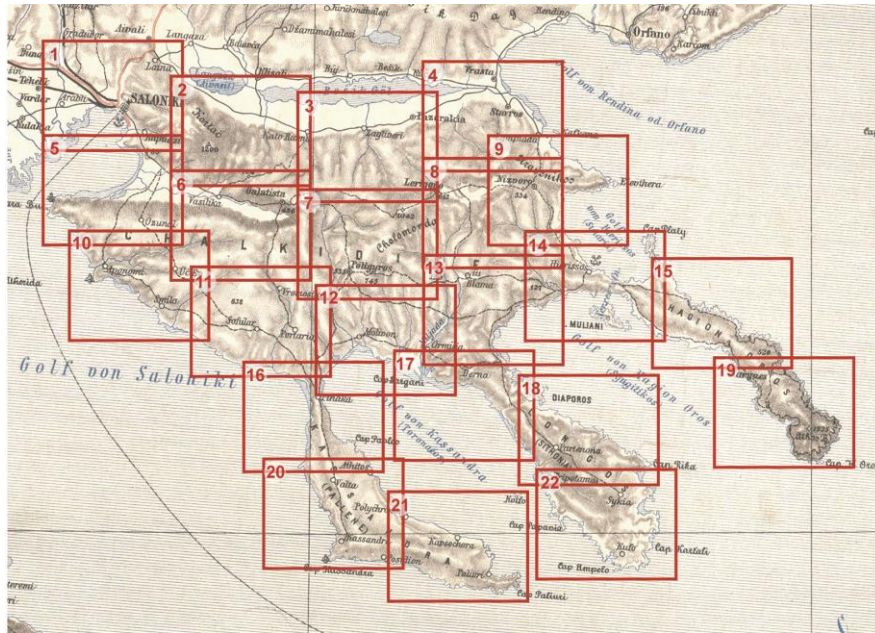


Figure 8. A sheet index with overlapped sheets

Source: drawing of the author, base map *Europe, 1:750 000*, sheet *Saloniki, Seres, Xanthi, Kastro, Pharsalos* (1897). Vienna: K.u.K. militär-geographisches Institut. By courtesy of the Paris 8 University's Map Library.

but creates a rather complicated sheet index and sheets can vary in size with a ratio of one to two⁸.

Regular grids are the most common way of dividing maps into several parts and this makes it possible to produce sheets of the same size. For larger series, regular grids are of paramount importance when working with or classifying a large number of sheets. However, the earth's surface is approximately spherical (i.e. three-dimensional) and sheets of paper are planar (two-dimensional) so transferring the earth's geometry onto a flat map has to be a projection. There are several methods for overcoming this difficulty, each with their specific properties. It is necessary to choose a system on a case-by-case basis taking into account the geographic area to be represented, the scale of reduction and the specific objective for the map. Thus, conformal projections (which display relative angles correctly) are favored for nautical charts; while equivalent projections (which display areas accurately) are preferred for topographic maps. Dividing lines between the sheets can be determined in two ways: either, where they are drawn on the terrestrial sphere before projection, they follow a grid of meridians and parallels and their limits are given as angular values, degrees or grades; or they are drawn after projection (i.e. as a two-dimensional drawing), in which case they make a flat grid for which the coordinates are expressed as linear values (meters, yards, miles, etc.). These options are very useful for identifying the type of division system to be used for each map (Figures 6-7).

Finally, the division of maps into sheets can also take advantage of a vague notion of territory, for example, a series of overlapped sheets as in the map of Macedonia (figure 8)

⁸. Series « Départementale, routière et administrative », Institut géographique national. Series in service since 2005.

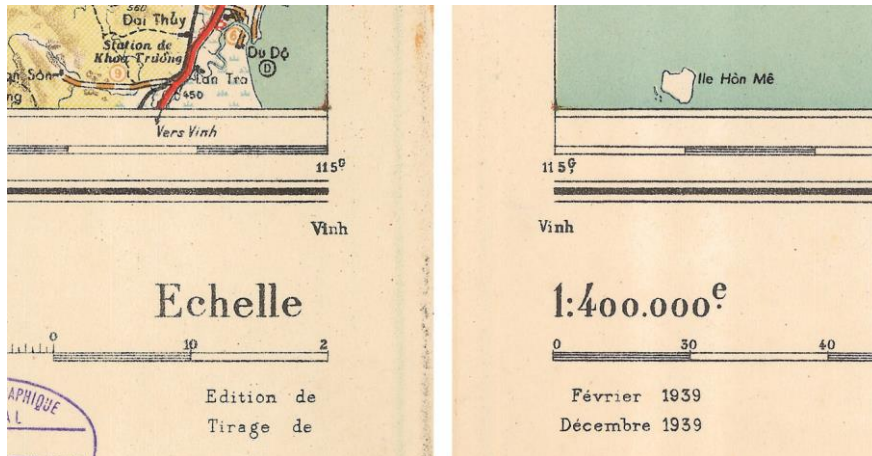


Figure 9. A sheet – unit of edition – divided into two units of production

Source: Series: *Indochina, 1:400 000*, sheet: *Hanoi*; Western part (ca. 1939); Eastern part (1939).

Hanoi: Service géographique de l'Indochine, by courtesy of the IGN's Map Library.

In addition, there are hybrid divisions, such as a cadastral map showing the area surrounding the city of Alexandria, at scale 1:1000, is divided into rectangular sheets using a metric grid, but each property appearing on two sheets is entirely redrawn in the margin of the sheet where the largest section is displayed.⁹

Producing sheet indexes becomes particularly complex when sheets in the series, even when divided, are still too large for the press. This is the case for several maps of Morocco and Indochina published between 1900 and 1930 by the French colonial authorities. For Indochina, and in particular the general map at scale 1:400,000, is probably the most interesting example. Each sheet was divided into two printing units, East and West. Next, these two sheets were bound together, each sheet having a frame on three sides and a simple ‘cutting line’ on the fourth. Thus, each editorial unit corresponds to two printing units.

Similarly, textual information is printed across both sheets with each statement placed in the middle of a sheet divided into two parts: for example, “*Edition de*” appears on the western unit (left side) and “*Juillet 1928*” on the eastern unit (right side). Moreover, with regard to the borders for the series, units representing the sea or an area outside the scope of the map were not included. On these sheets, the other unit was printed as a whole half-size sheet - with a four-sided frame (Figure 9).

Many collections of this map contain units that have not been bound together. In some cases, despite the plurality of editions, it is not possible to restore the original pairs. Thus, several Western parts, which are undated, are similar (according to their statements) although it is obvious that they were published at different times. For this series, ten years after its publication with two printed units per sheet, the publisher decided to match the publishing units (or sheets) with the printing units. This allowed each document to become a whole bibliographic unit with a much simpler description.

⁹ This map was published at the beginning of the 1930s by the Survey of Egypt. It has 175 sheets (Arnaud, 1989, p. 62).

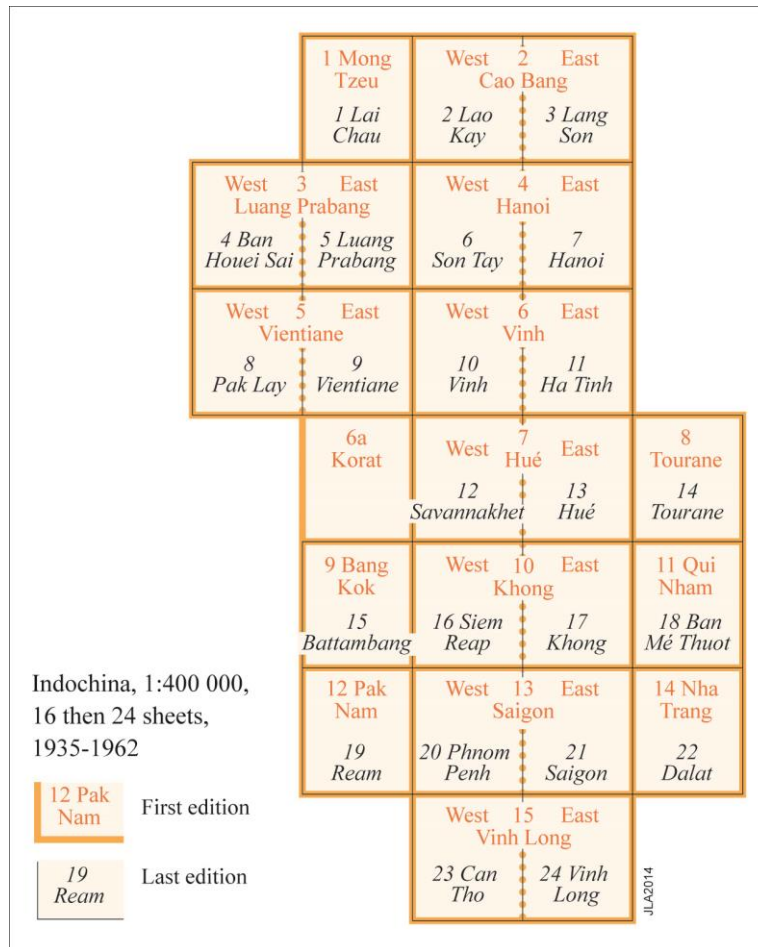


Figure 10. The sheet index a compulsory tool to understand the organization of each series

This series includes 16 then 24 sheets obtained without significant changes in its perimeter, but in changing the size of the sheets. The publication of this series is divided into three periods.

1. Between 1935 and 1945, in the original edition, each normal sheet represents 250 x 225 km and bears a serial number, from 1 to 15, plus 6a. Each sheet, unit of edition, of numbering and of titling is printed in two units: East and West. Each unit - which represents an area of 250 x 112.5 km - bears a frame on three sides only. On the edges of the sheet index, this edition also includes half-size sheets that are four sides framed.

2. Between 1945 and 1948, each half-sheet of the original edition become a complete publishing unit. It bears a complete frame and its title is completed by the statement East or West. But the numbering of the series remains unchanged despite the inconsistency to which it gives rise: different sheets bear the same number.

3. From 1948, additions to the proper titles of the sheets - East and West - are abandoned. Each sheet (half of the original) bears a new proper title and a new number (from 1 to 24). But several titles are similar for both editions despite they designate different geographic areas. Otherwise, the sheet 6a of the original issue does not seem to have been included in the following editions.

Source: author's drawing.

However, the titles of several sheets were common to both versions and it is therefore impossible to understand how this series was organized without a sheet index (Figure 10).

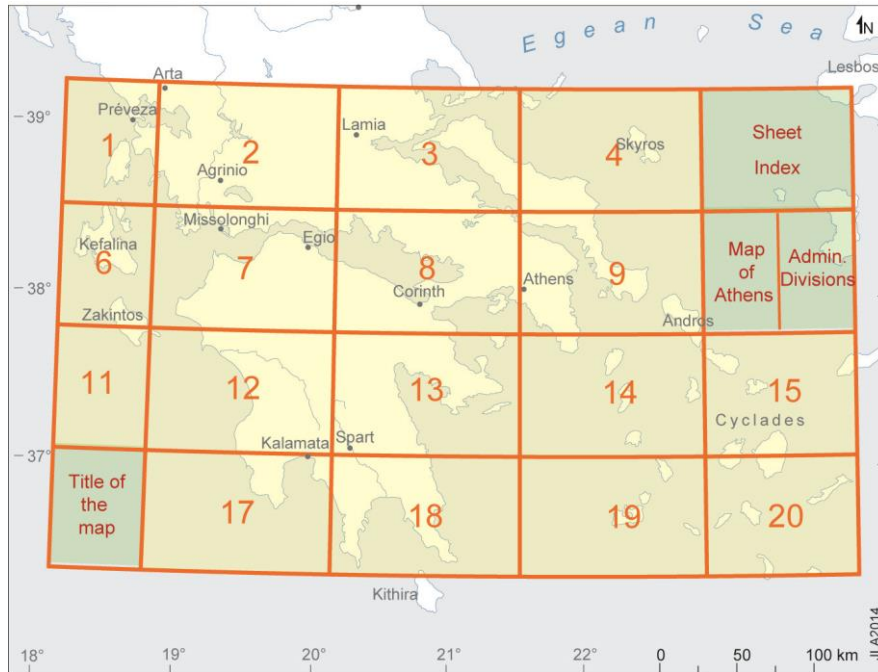


Figure 11. A monograph divided into 20 sheets which compose a complete tableau.

Source: author's drawing from *Carte de la Grèce rédigée et gravée au dépôt...* Paris: 1852, 20 sheets.

This diversity is of little interest to librarians cataloguing maps as currently practiced in most libraries. However, new online research tools using geographic locations are based on digital geo-referenced sheet indexes. Their construction requires the description of the area represented on each document. In other words, in the future, map librarians should incorporate this information when describing these documents.

Perimeter of a Series

All monographs divided into sheets and all series are characterized by the geographical area they cover: the perimeter. This is a key element in the description in that it provides users with a criterion for their search and selection of documents. However, it is not easy to define the perimeter of map series. In general, each monograph with several cuts forms a complete rectangular array. Assembling the sheets constitutes a tableau that can be framed and displayed. Thus, there are no blank spaces for unrepresented geographical and marine areas since these are filled with information that complements the main document, such as title, captions, sheet index, dedication, map details, notes, statistics and other data. For example, on the 20 sheets for the map of Greece published in 1852, the title is placed on Sheet 16 (bottom right of the picture). Sheet 5 (top left) contains the sheet index; Sheet 10 displays a plan of Athens and a map of Greece's administrative divisions. All this information is placed in the maritime areas on the map (Figure 11).

Moreover, monographs sheets are also characterized by the way framing lines are distributed. There are two options for drawing borders on map sheets. When placed along assembly lines, they are reduced to a single cutting line. In contrast, when they appear along the outer limits of the tableau, they are often quite broader and enhanced by

spandrels, gadroons, and interlaces. Whatever the chosen form or quality of execution for these borders, their inclusion clearly indicates that these sheets were not intended to be self-contained units. Each monograph is therefore the result of an overall project which determines both the scope of the area represented and the distribution of information in the tableau. They are designed as finished articles and the authors did not intend to extend the geographical area.

For map series, in so far as each sheet is conceived as a separate editorial unit, the perimeter of each series can take several forms and may change over time or even be increased or reduced in terms of the number of sheets used. All scenarios are possible. Some map series show territorial discontinuities, e.g. for countries with many islands (Greece, Indonesia) or, in rare cases, they may represent only the shore areas, leaving a ‘hole’ in the middle. A good example of this option is the map of the vast island of Greenland at scale 1:250,000.

For each series, several sheet indexes can contain different perimeters and were used as working tools. For this reason, they sometimes display projects, rather than the final result. During the production process for a series, the political or military context may change substantially and thus result in modifications to the original project. Such changes are particularly important when the publisher prepares a map of regions in another country, e.g. which a foreign country requires for military purposes. It is no coincidence that, in 1915, the British army extended a map series covering Eastern Turkey, produced at the beginning of the century, with additional maps to the south (Syria and Iraq)¹⁰. A more recent example is a map of Central Africa at scale 1:500,000. The French *Institut géographique national* (IGN)’s catalog for 1968 indicates that this series should have 31 sheets whereas in fact, there are only nine. This 1968 version is clearly the result of an underestimation of the ability of African countries (Cameroon, Central African Republic and Congo, which became independent in 1960) to establish their organizations for cartographic production. Thus, the scope of a map series will often have to be adjusted in response to changing governmental and political decisions.

When the numbering of sheets in a map series is not organized systematically, as it is the case with a map of the world which indicates *a priori* the perimeter and the number of each sheet, we can use this numbering system to identify the geographic changes of the series. For example, an early twentieth-century map of Transvaal published by Major Jackson, the numbering of the sheets clearly indicates the chronology of progress on the geographical survey (Liebenberg, 2014, p. 224).

Less obviously, and therefore more difficult to document, the perimeters of map series are often subject to adjustments at the margins, particularly for coasts and borders. Sometimes the application of a regular grid produces sheets representing very small areas. For this reason, these sheets are often removed and the areas they represent are integrated on neighboring sheets with wider perimeters. But such decisions are not easy to make and many examples attest to numerous hesitations. For example, the *Cap Sigli* sheet from a map of Algeria at scale 1:50,000 covers only a few square kilometers (the rest of the sheet

¹⁰. Series *Eastern Turkey in Asia*, published from 1901 in 34 sheets, extended by 16 sheets south from 1915 without change to the title of the series and to its proper number: IDWO 1522.

represents the Mediterranean to the north of the coast). It was published in four editions between 1888 and 1922, but for the period 1913 to 1964, this area was also included on the sheet covering *Djeblaa* immediately to the south. In this situation, it is not easy to identify how many sheets the series originally contained. The way the sheets are numbered increases the difficulties: the *Cap Sigli* sheet bears number 10 and the *Djeblaa* sheet is Number 25 between 1894 and 1921, while the extended sheet is entitled *Cap Sigli – Djeblaa* and bears the number 10-25. In other words, in terms of production units, this situation corresponds to two sheets but, in terms of publication units, there are several documents and three different perimeters.

The number of sheets in a series is very difficult to assess when the division is based on a theoretical grid for which certain cells become published sheets when necessary. This occurs on many large-scale maps of emerging countries where some regions (usually sparsely inhabited) do not require maps at the same scale. For example, a map of Tanzania at scale 1:50,000 has 1,803 sheets according to its sheet index. The index follows a standardized method of divisions based on the international map of the world and therefore the sheet numbers are allocated *a priori*. However, the current version has only 1,117 sheets, the rest going through a potentially evolving process. On the one hand, the objective is not to cover the whole country, but on the other, it is conceivable that new sheets will be added to the list in the coming years in response to future developments and needs. Here, the number of sheets in the series can be defined in two different ways, either by the 1803 boxes indicated in the sheet index, even though it is unlikely that all these sheets will in fact be published, or by the number of sheets published when the series is being catalogued, even though this figure will probably increase at a later date. In fact, it will only be possible to indicate a final number when this series is replaced by a new document based on a new method for dividing the territory or a different method of production.

Perimeters of map series are also influenced by political changes and areas covered by some series may be subject to sharing arrangements between different States due to the collapse of a common sovereignty. For example, at the end of World War I, the Austro-Hungarian monarchy was split up and its territories reorganized into several new states. The map of Central Europe at scale 1:200,000 published in Vienna at the end of the War was reproduced by Hungary, Czechoslovakia, Yugoslavia. Later, the sheets for this map were copied by most European armies during World War II. In total, more than 80 series, including 29 published in Czechoslovakia between 1918 and 1955, were produced from the same matrix.

Editor Catalogs and Real Publications

Several sheets include information on contiguous sheets. Their titles are written directly in the margins, e.g. the name of the eastern sheet is in the right margin. Sometimes, partial sheet indexes (in 3 x 3 boxes) indicate the titles of neighboring sheets. Where general indexes or lists are not available, this information is often valuable for constructing, step by step, the sheet index for the whole series. However, it also reflects the variability of a series' perimeter during its production. Comparison of these indexes

with lists of the published sheets sometimes shows that many sheets for the initial project were not published and/or their titles were changed several times. Thus, the perimeter for a series and the estimation of the number of sheets it contains must still be checked against lists of sheets currently preserved in several collections, regardless of the quality of this documentation.

In some rare cases, the series were combined for various reasons. For example, between 1910 and 1914, SGA published a map of Tunisia at scale 1:500,000 with seven sheets divided on the basis of the international system. After World War I, IGN, which replaced SGA in 1943, launched the publication of a new series using the same scale and the same division system as for a map series for Algeria. This series has 44 sheets, three of which are also included in the map of Tunisia. In IGN's annual reports, work on these two documents was covered in two separate chapters while, in the IGN's catalog of publications (1949), the two series are grouped together (*Catalogue*, 1949, 11). Given the small number of sheets for the map of Tunisia and its overlap with that of Algeria, it was decided to bring them together under a single title "*Carte d'Afrique du Nord*", which is only found in this catalog. At the same time, the titles printed on these sheets were not changed and did not take into account this consolidation which seems to be carried out only for commercial purposes. In addition, the sheets for the map of Algeria representing the Sahara regions, which are less well-documented than for the north, follow a different graphic chart and bear a different title. In other words, there are two major differences between the titles found in the catalog and those printed on the sheets. Obviously, production offices were organized into geographic divisions that do not correspond to the way the results of their work were displayed in the catalog of publications. Such differences indicate that each phase in the process has its specific requirements. Operating perimeters for the service of production - depending on terrain - are different from perimeters used by the sales department. Here, map curators have several equally relevant possibilities for organizing their collections.

In setting the scope for a series in its various interpretations, it is always fruitful to compare actual documents with reports and catalogs published by the production institution. This is even more important when individual sheets bear little information about the series in which they are published. These examples show that it is not enough just to give a description of all sheets in a series to describe the series itself. In other words, it is necessary to analyze the series from two perspectives in order to grasp the multiple peculiarities of a single series. A bottom-up approach (the printed units themselves, i.e. sheets) and a top-down approach must be used for establishing rules for organizing the relationship between lower-level sheets. The sheet index is one of the main tools for this analysis.

From Sheets to Map Series

Each sheet in a series bears several statements and the concepts of series and sheets correspond to two levels of description. Thus, depending on how each statement refers to these levels, it may be classified into three different categories:

1. Information common to the entire series or to a subset of sheets: title, collective responsibility, etc.

2. Information specific to each sheet which refers to the serial organization of the series: sheet number (spatial organization), and edition number (temporal organization);

3. Information specific to each sheet: individual title, person or agency responsible for its production, date, etc.

The first two categories are more likely to be used in describing and defining a map series. Like the sheet index, individual statements relating to the serial organization are a good source for understanding the relationship between individual sheets and the whole series. The following section discusses ways in which statements of the first two categories are used, but may lead to confusion.

Edition Number

In the field of cartography, the concept of edition is quite elastic. It can include prints, reprints, publications, and republications, and of course their equivalents in other languages and may vary from one publisher to another and from one map-maker to another. In addition, some sheets bear explicit edition numbers, generally, chronologically (the 3rd edition following the 2nd). On this basis, numbering can be used to set up a list of published versions for each sheet. However, this exercise is not as simple it sounds. In several cases, the first version of a sheet does not bear any edition number at all and it is only with the publication of the second version that the publisher adds a reference to, say, a second edition. In other cases, such as a map of Czechoslovakia at scale 1:200,000, versions of which have an edition number between two and six, depending on the quantity of versions estimated for each sheet published before the introduction of numbering¹¹. For many other series, the published sheets bear no edition statement. For example, for the Austro-Hungarian map of Central Europe at scale 1:200,000, the sheet *Laibach* bears no edition statement for the first eleven versions published between 1893 and 1907. The next version, published in 1909, is marked "*provisorische ausgabe*" [Provisional Edition]. After this, there are no statements of edition on the six versions published between 1910 and 1913. Finally, the five versions published between 1913 and 1916 are marked "*2 Ausgabe*" [Second Edition]. Moreover, this periodization is not related to dates indicated on the sheets and expressed by the terms "*Nachträge*" [additions] or "*Teilweise berichtigt bis*" [partially corrected to]. Further investigation shows that the concept of *Ausgabe* [edition] is used by the Austro-Hungarian Army's Geographic Institute to refer to changes in the geometric organization of the sheets, but is not related to updates of topographic contents on each sheet, which are expressed in the titles quoted above.

These examples are old, but a more recent experience shows that edition numbers printed on the documents can still be poor indicators. The civil version – there is also a military version – of the map of France at scale 1:50,000, published by IGN between 1974 and 2010, has a particular feature. For many sheets, the edition numbers are

¹¹. Topographic map of Czechoslovakia, 1:200 000, 1918-1938, 59 sheets. The sheets of this series does not bear proper title of the series.

discontinuous. For example, for the sheet *Molsheim* (No. 3716), the 5th edition was published in 1991, the 7th in 1999 but the 6th seems to have disappeared. This map, which was primarily designed for military purposes, was drawn up using a specific production process. In order to meet the needs of both civil and military users, a single printed matrix was produced for printing two separate versions without duplication of the production process. On this matrix, each sheet is framed by four wide margins in which information required for one or other type of user can be printed: statements for the civil edition are printed on the left margin; and those for military purposes on the three other margins. Once printed, the map will be cut differently with statements, legends and edition number that are specific to each type of end user. Thus, each new military edition has its civil equivalent.

However, when changes for military purposes are not sufficiently important to warrant a new civil version and/or there are still adequate stocks of this version, IGN has not always published an updated civil edition. In fact, the complete collection of civil editions is in the matrix, but they have not all been published. This explains discontinuities in the numbering for the civil version of this map. Finally, in 1995, changing the coordinates grid printed on the sheets (Lambert / WGS84) led to a renewal of the edition numbering for the military series, but not for the civil series. Thus, for the *Plouarzel - Ile d'Ouessant* sheet, No. 3016, the first new military edition (M762), dated March 2002, corresponds to the fourth civil edition (dated 2001), while the cartographic content of these two documents is exactly the same. In addition to the specific problem with edition numbers, this example shows that an investigation into the production process may lead to a better understanding of the peculiarities that appear *a priori* as anomalies. It also demonstrates the potentially misleading information in the date assigned to each document.

Series Titles

Generally, though not systematically, sheets of maps organized in series bear the title of the series in which they are produced and this title will be helpful for sorting the sheets. However, sometimes these titles can be misleading. For example, during the first half of the twentieth century, SGA issued a set of 60 sheets with the generic title "*Asie 1 000 000e*" without any additional information. Each sheet bears also its own title which corresponds to the name of the most important place within its perimeter and a number based on the geographic coordinates of its northeast corner. On this basis, these sheets are classified together in most map libraries. From a geographic point of view, they are organized into two groups. The first group covers a large part of Central Asia between Turkey and India, while the second represents northern Viet Nam, China and parts of Japan. In this context, map librarians think that the few sheets covering the twelve degrees of longitude that would ensure the connection between these two sets are missing in their collections. SGA's annual reports indicate that it is not the case and that the set is composed of two non-contiguous groups of sheets: the first group, corresponding to twenty sheets, is called "*Asie centrale*", the second, "*Asie orientale*". Sheet indexes published in the same reports confirm this geographic distribution. That is to say, when

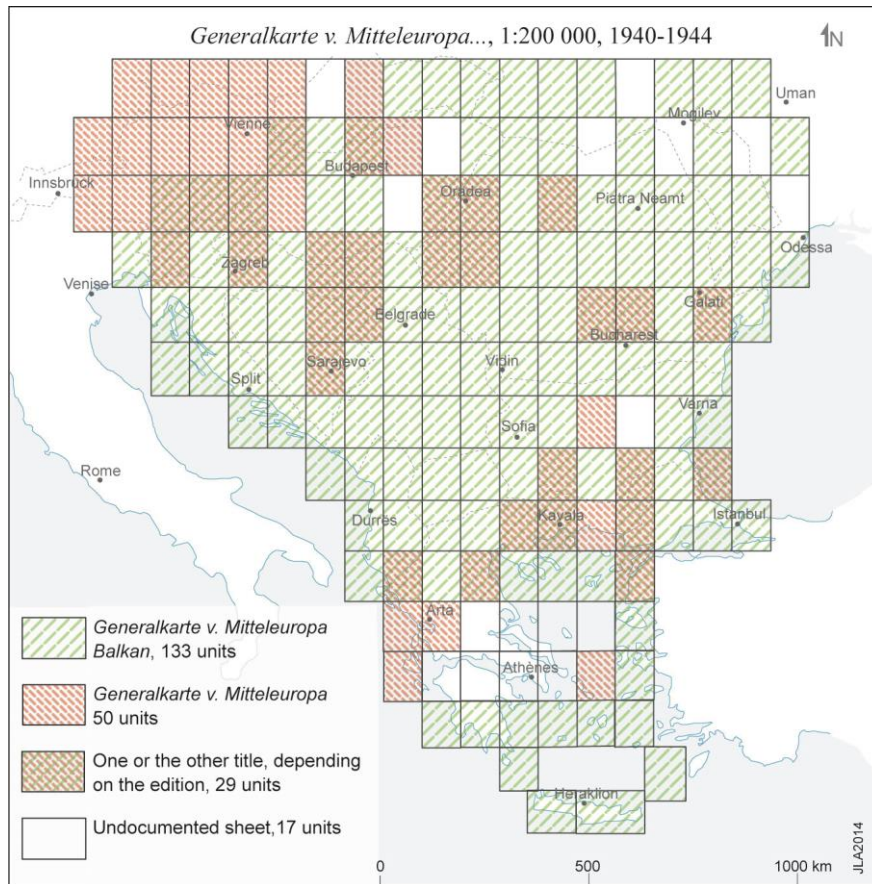


Figure 12. Two titles – One series. Mapping the proper titles of the series on the sheet index shows that all the sheets belong to the same series in spite of their different titles.

Source: author's drawing.

titles are similar, it does not always mean that the corresponding sheets belong to the same series. However, the reverse is more frequent.

Early in 1940, the German army published several Central European maps at scale 1:200,000, based on the same sheet index. A first group bears the title *Generalkarte v. Mitteleuropa* and contains sheets published between 1940 and 1944. Another set of sheets is designated *Generalkarte v. Mitteleuropa Balkan* and was published during the same period. Most collections are divided into two sets of sheets that match these designations. Unfortunately, this situation is not confirmed by the geographic distribution of the sheets, since the difference in titles does not correspond to a difference in the geographic location of the sheets. On the contrary, comparison of the two sheet indexes shows that all the sheets belong to a single series. In this case, the titles printed on the sheets are not relevant (Figure 12).

More recently, in France, a topographic map at scale 1:50,000 presents similar characteristics. This map covers the entire French territory in 1100 sheets. In 1974, the publisher, IGN, decided to fold the sheets and rename them "*Carte topographique 1:50 000*". In order to help with the identification and classification of sheets from different IGN series on the basis of scale, the series titles were printed in different colors, and orange was chosen for the map at scale 1:50,000. Ten years later, noting the effectiveness of this method of identification, each series was renamed according to its

color. Thus the "*Carte topographique 1:50 000*" became "*Série orange 1:50,000*" and this title was applied to all new editions for the next ten years. But from 1994 onwards, sheets for which no new edition had been issued during the previous ten years were reprinted, one or more times, under the original title. Of the 1100 sheets in the series, at least 240 sheets fall into this category. They do not present any particular geographic distribution. Thus, the two titles are by no means a sure basis for dividing sheets into two series. In general, when a series has been in service for a long time, the number of different series titles becomes increasingly important.

For example, for the map of Algeria at scale 1:50 000, whose production spanned almost a whole century, there are not less than twelve different series titles. One might be tempted to organize the collections on this basis and to share them into as many sets as there are titles. Because these titles do not correspond to a division of the Algerian territory, such a proposal would not withstand scrutiny of the geographic distribution for each set of sheets. Analyzing them in terms of their temporal distribution is not satisfactory either, since several titles were used simultaneously.

Similarly, there may be a wide range of statements of responsibility printed on sheets in the same series. This is the case for the map of West Africa at scale 1:200,000 produced during the French colonization period. Production of this map was shared among offices in Dakar, Brazzaville and Yaoundé. Designation of these offices varies according to the redactors. Without any explanation, they can be named "*Centre*", "*Annexe*" or sometimes "*Service géographique*" of Dakar, Brazzaville or Yaoundé, i.e. nine different designations. Serial numbers are more reliable. Generally, they are used by the military forces and take the form of one or more letters followed by a number: e.g. M 000 for the French *Military*; AMS 000 for the *US Army Map Service*; – or, GSGS 000 for the British Army's *General Staff Geographical Section*.

Series / Subsets

A map series can expand simultaneously in terms of time and of two horizontal dimensions of space. In addition to these three vectors of change, some series often contain a fourth dimension. From a "mother series", the publisher produces subsets that are relatively autonomous, but closely linked to the original series. The Central Europe map at scale 1:200,000, published by the Austro-Hungarian Army in the late nineteenth century, offers a particularly interesting example.

Each sheet of this series is designated by a specific title and a specific four-digit number based on the geographic coordinates of its center. Many sheets bear an additional number printed in bold and composed of one, two or three digits. Despite its apparent homogeneity, the second numbering system does not correspond to an easy-to-use list of the sheets. Indeed, some sheets representing the same geographic area may have additional numbers. For example, for the sheet *Bolgrad* (# 46° 46°), there are three additional numbers (15, 24 and 181) on three different versions, corresponding to different dates of issue: 1913, 1914 and 1916. In this example, one might think that the additional numbers relate to the date of publication for these sheets, but other examples contradict this first hypothesis. The *Odessa* sheet (# 48° 46°), is numbered 183 in 1910

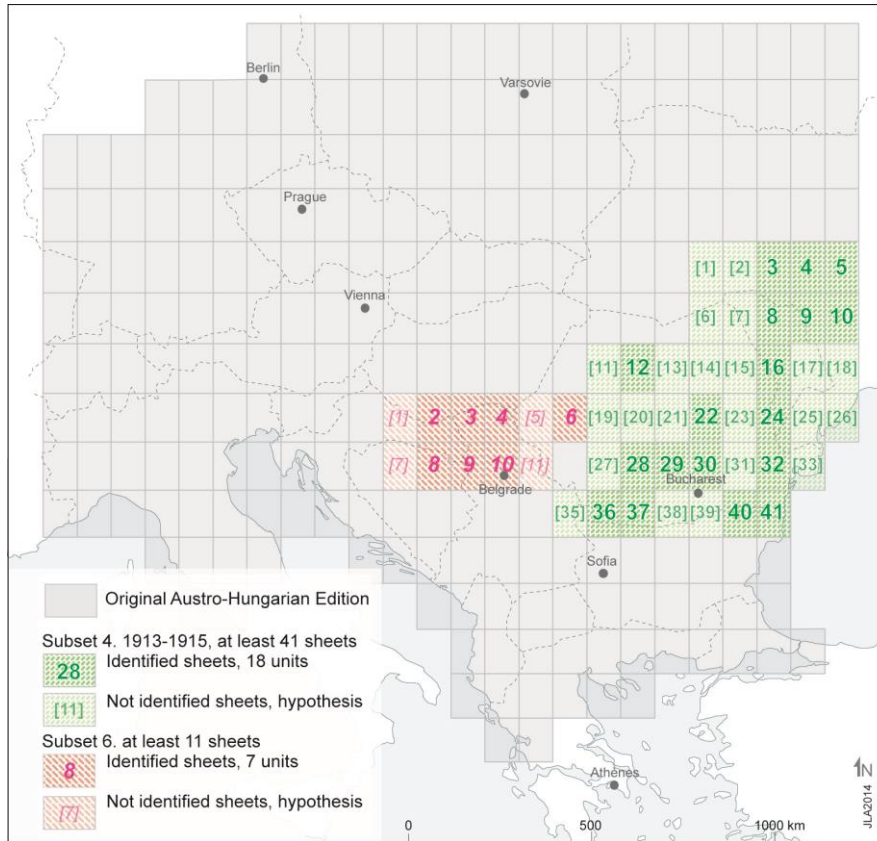


Figure 13. The sheet Index to deal with the organization of the series. For this series, not less than 10 subsets have been highlighted by mapping the additional numbers on a sheet index.
 Source: author’s drawing from Central Europe and Balkan 1:200 000 (1886-1919), 265 sheets – subsets numbers 4 and 6. Vienna: K.u.K. militär-geographishes Institut.

and 1916, and 17 for an interim edition in 1913. The transfer of these numbers to a sheet index suggests another hypothesis: the series may include multiple subsets, each corresponding to a particular geographic area (Figure 13).

The sheet index makes it possible to identify numbering continuities and discontinuities, since it allows librarians to group sheets into homogeneous sets. The sheet index also shows that the geographic distribution of additional numbers always uses the same system. For each subset, the first number corresponds to the north-west corner (upper-left on the sheet index), with each following number placed in ascending order from left to right, and so on down the page from top to bottom. Thanks to this method, no less than ten partial subsets, for which the cartographic representation and other statements have no distinctive elements, have been identified. Each subset contains between 10 and 49 sheets and covers a different territory, while the “mother series” has no less than 265 sheets. After 1908, annual reports issued by the Military Geographic Institute of Vienna gave long lists of specific works ordered by the Ministry of Defense or other ministries in order to meet civil claims. The subsets of this map seem to correspond to these commissions (*Mittheilungen*, 1911, 32).

Identification of these different sets of sheets is of obvious interest for the history of the Austro-Hungarian production. It also shows that, despite the apparent homogeneity of the series both in terms of the graphic charter and of statements of responsibility

attributed to each sheet, its production was perhaps not as centralized as it seems. Indeed, comparisons of the way the sheets were dated and shared into numbered sub-series show that some sheets were published simultaneously by different services within the Military Geographic Institute.

Question of Time

As explained earlier, it is not always easy to define the scope of a series. Its period of issue expressed as a range of years is also difficult to investigate. It is necessary to identify specific phases in the life of a series. The history of a series starts with the decision to launch its production. The relevant date is never transferred to the sheets but is usually found, though not always, in the activity reports. On the other hand, the most recent date will be that indicating the end of service for a map when it is replaced by another and / or removed from sale. It is also difficult to find this date because it was often not recorded. Moreover, once the decision is made to stop producing a series, the replacement version will be implemented sheet by sheet and it is only when all the sheets of the new series are available that the previous version will be withdrawn from service. Thus, substitution of a series is necessarily spread over a long period. For example, the first sheets of the geological map of France at scale 1:50,000 were published in the 1950s to replace the previous series at scale 1:80,000. Several sheets for the new edition have still not been published. Thus, while more of 260 sheets of the former edition are out of service, about a dozen of sheets from this edition remain the only detailed geological map of the regions concerned.

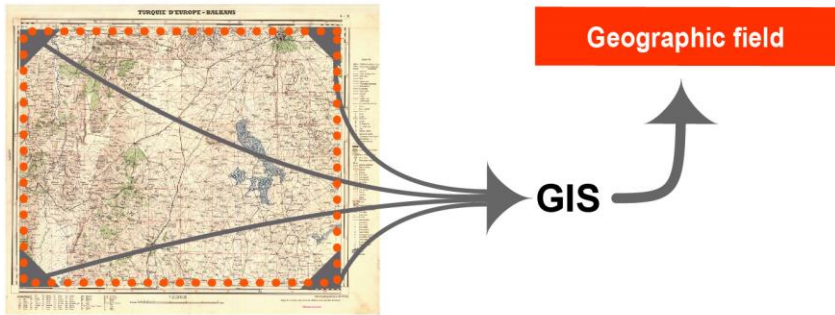
Pragmatically, map curators are more interested in a document's publication date. However, it is not the purpose of this chapter to go into details about the dating of documents. In order to identify a series, they generally use a range of dates corresponding to the initial and final dates of production assigned to the sheets. However, this system implies that the collection was almost complete but this is not always the case.

CartoMundi – A new Generation Platform

As pointed out in the introduction to this chapter, the program *CartoMundi* (Online Promotion of the Cartographic Heritage (<http://cartomundi.eu>)) offers great potential for handling changes in cartographic documentation that loom on the horizon¹². *CartoMundi* is a collective catalog dedicated to cartographic documents. Its principal feature, compared to other catalogs, is that it was developed by a research laboratory at Aix-Marseille University in France in collaboration with the French National Center for Scientific Research (CNRS). Thus, it was conceptualized by a social scientist, a historian and user of old maps who was not satisfied by responses to his searches in conventional

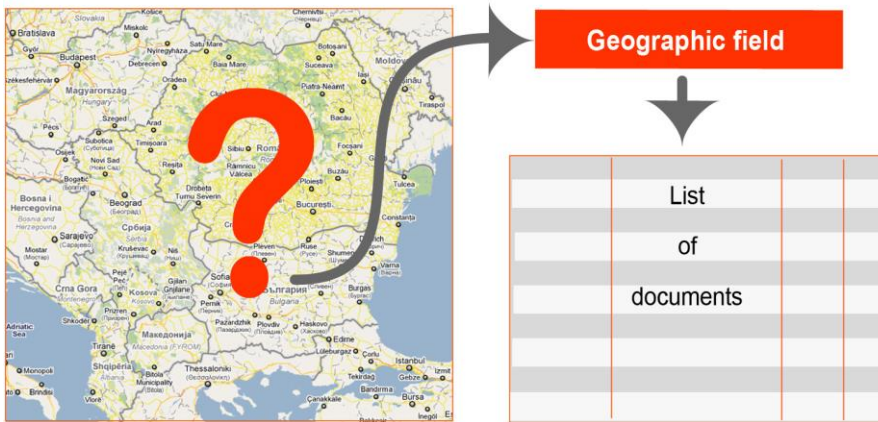
¹². *CartoMundi* is developed by the Mediterranean Center for Social Sciences in Aix-en-Provence, under the auspices of the University of Aix-Marseille, with the support of the French National Center for Scientific Research - CNRS and several local authorities. Participations to the collective catalog and/or to the state of production are organized by agreements.

■ A field generated by a GIS



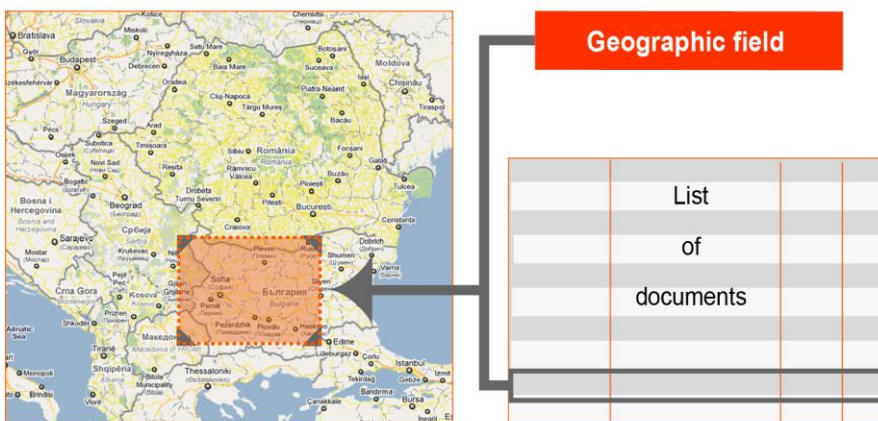
For each document, *CartoMundi* adds the description of the geographic zone it represents to its standard description. This information, recorded in a geographic field, is generated by a Geographic Information System - GIS

■ A field that can be queried



The geographic field can be queried by selecting a place on a planisphere. The system returns the list of the documents which represent the searched place

■ A field that can be displayed



For each document, the perimeter recorded in the geographic field can be displayed on an online planisphere

Figure 14. The geographic field, a new type of data at the heart of *CartoMundi*
Source: author's drawing.

map catalogs. *CartoMundi* has a number of features and offers a unique combination of various tools, such as databases, application programming interfaces, mashup, and a collaborative platform. There is no other equivalent system for map consultation. In other words, *CartoMundi* is the only collective georeferenced online catalog dedicated to cartographic documents. In addition, the system has been conceived for data sharing and is a central element in a network of map libraries, of which the most important partners are IGN and the *Bibliothèque nationale de France*. As at December 2014, some 15 other establishments, including universities, libraries, and museums in France and other countries, were involved in developing *CartoMundi*.

An Innovative Tool

The search interface for *CartoMundi* operates mainly with geographic locations. Users are invited to select the place for which they need maps on a planisphere. The textual data for each document also contains a description of the perimeter of the area represented. This data is recorded using a specific format in a geographic field which fulfills two major functionalities: 1. a geographic engine that compares the selected zone on the planisphere with the area represented by each document allowing searches by geographic location; 2. the search results can be displayed on the same planisphere indicating the zones covered by each document matching the chosen criteria (Figure 14).

In order to ensure interdependence between map series, on the one hand, and between sheets, on the other, the catalog is organized into two levels: the top level refers to descriptions of the series; and the bottom level searches on descriptions of the sheets. Each description for a series corresponds to several descriptions of sheets, while each description for a sheet corresponds to the description of a single series. To ensure *CartoMundi's* interoperability with other digital catalogs (only one level), the complete bibliographic notice for each document represents both the general bibliographic notice for the series and the specific notice for the sheet.

A Double Interface

CartoMundi consists of two complementary elements: a website largely open to the public, and a collaborative platform restricted to the site's partners and not accessible to most visitors. The public interface is first and foremost a tool for searching and consulting documents. It is organized around an interactive planisphere with which users can display any part of the world at different scales and select a specific location (Figure 15). This operation initiates a search that generates a list of cartographic documents by taking into account two variables: 1. the geographical zone selected; and 2. the scales offering a selected level of zoom for the planisphere. This second variable is one of *CartoMundi's* special features, as the user does not have to display references for detailed maps (of cities, for example) when consulting a large section of the planisphere, even though those cities are localized within the selected perimeter. When the user selects a narrow area on the planisphere (a city, for example), the results do not display references of general maps (of the world, for example), even if these maps also cover the city in question. As shown in figure 2, a user looking for a map of Istanbul is not interested in its representation at scale 1 million.

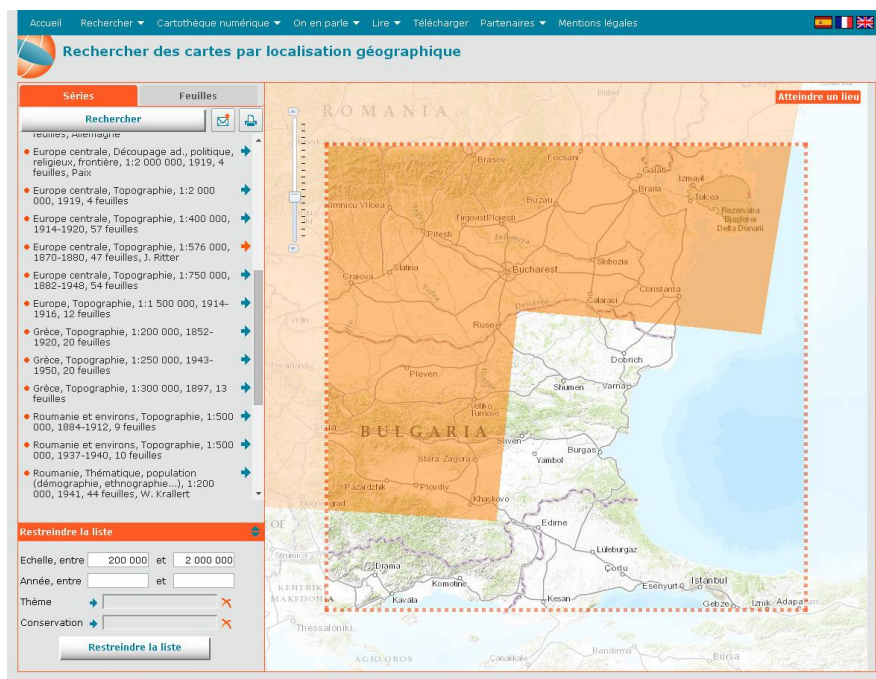


Figure 15. The main search screen of *CartoMundi* is composed of two closely related windows. Textual data are displayed on the left, geographic data are on the right. Source: <http://cartomundi.eu>

Four criteria allow the user to trim this list: 1. the reduction scale, through a range of limited / given values; 2. the period of publication, through a range of delimited / given dates; 3. the subject, through a thesaurus; and, 4. the place where the documents are stored, through a list of geographic zones organized in several levels (continent, countries, cities, institutions). Responses are organized into two lists: one for the series, and the other for the sheets. The user then selects an item in a list and a new screen displays the data related to the selected document (sheet or series). Textual information (ISBD block, list of institutions holding the document) are displayed in the left window; geographic information (sheet index, perimeter of the sheets) in the right window. Finally, if the document is free of rights and has been reproduced, it can be displayed with an impressive fluidity (Figure 16).

With regard to the second part of the interface, only map curators whose identity has been positively checked through a secure system will be granted access to this collaborative platform which, depending on each partner's activities and responsibilities, gives access to three levels of participation to *CartoMundi*.

1. International Directory. The directory is open to all institutions holding, producing or selling cartographic documents. This feature is expected to take over the directory by the International Federation of Library Association (IFLA)'s Geographic and Cartographic Section published in 2000.

2. State of production. This part of the database gathers together generic descriptions of cartographic series and sheets. It has been developed upstream from major collections or/and catalogs of editors. For each referenced series, the state of production presents a description of all the sheets, regardless of the state of the collection or catalog.

The interface allows online recording of data but, broadly speaking, the source files for the state of production are generated through external software (spreadsheet and



Figure 16. Display screen of *CartoMundi*. Several tools help the navigation into the series and inside each sheet

Source: <http://www.cartomundi.fr/site/E01.aspx?FC=47953>.

GIS). The interface includes several tools for data transfer: selection of files, configuration, checking, uploading, etc. For geographic data, the system also offers a generator of georeferenced sheet indexes for series in which the edges of sheets follow a grid of meridians and parallels.

3. Collective catalog. The collective catalog is mainly composed of links between the directory and the state of production (Figure 17). Each link records that a given member of the directory holds a given document registered in the state of production and will contain some additional data. The partners involved in the collective catalog can work directly online or by uploading files into the system. According to the possibilities of each partner, *CartoMundi* offers three ways to record a state of collection in the collective catalog: 1. simple declaration of a series whereby the institution indicates that it holds a certain number of sheets of a series without giving detailed information for each sheet; 2. recording of the state of collection through an interactive sheet index, this tool allowing entry of details on the geographical coverage of the collection on a sheet index by ticking boxes; and 3. recording of the state of collection sheet by sheet, which ensures that each sheet in the collection is documented with details on its edition and characteristics of the copy.

CartoMundi in the Future

CartoMundi is a young system. Its initial development was completed in June 2014. The database has (only) 40,000 entries covering all or part of 187 countries with a tropism for the Mediterranean basin, the one place in the world with the oldest and most diverse and complex maps. Of this total of 40,000 referenced documents, 4,000 are digital reproductions. Currently, *CartoMundi* only handles map series but the next stage of development will focus on the management of monographs and implementation of new tools which will help map librarians when handling geographic data. With these tools, they will be able to draw up the area covered by each document through a fairly simple

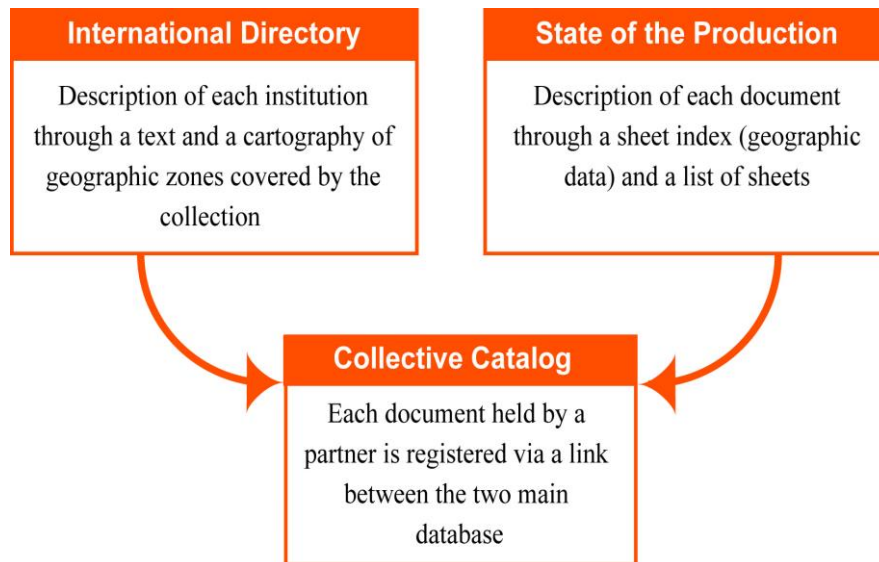


Figure 17. Between the Directory and the State of production, the Collective catalog is mainly a list of links

Source: author's drawing.

and intuitive interface designed to be used without prior training. This generator of "shape files" will also be operated independently, for example for use in cataloguing books or any other object category. Thus, it will be possible, and easy, to qualify any media with spatial data that take into account variations of geographic names and have the potential to integrate geographic search tools within a catalog.

Conclusion

As seen with the example of *CartoMundi*, recent technological changes allow the development of new IT tools that meet the expectations of both map librarians and users. However, these tools require difficult cataloguing and description processes which involve new expensive expertise such as geomatics. Furthermore, implementation of Functional Requirements for Bibliographic Records (FRBR) in coming years will lead to the inclusion, in the description of documents, of information on the context in which they were produced. According to these requirements, documents are divided into four categories classified from lower to upper level: Item, Manifestation, Expression and Work. Implementation of FRBRs raises no particular difficulties for the two first categories but, on the other hand, for the higher levels, Expression and Work, cartographic series present several significant problems. These categories relate not only to the sheets themselves, but also to the series, since their description and history are not merely a compilation of the individual descriptions and history for each sheet. This point is particularly relevant with regard to the general organization of each series: system of division into sheets, main methods for numbering sheets, etc. As we have seen earlier, these points can be understood only from the higher level of description for each series. This is why the cataloguing of sheets one by one, without any specific data at the series

level, is inadequate for meeting FRBR criteria. In this context, sharing experiences and pooling information are key issues.

As pointed out above, cartographic series suffer from neglect by libraries for decades. Card catalogs and paper sheet Indexes, still widely used to describe map series, were developed by each map library and reflected the particularities of its collection, needs and resources. The enormous diversity that results of this type of organization does not pose major problems as long as these catalogs are only used at the local level, but the new technical and conceptual framework based on sharing and interoperability that is now emerging will obviously impose many changes in these practices. Neither national institutions, nor production establishments have full lists of cartographic series. The only lists available have been produced as part of independent publications by libraries without any attempt at standardization¹³.

The few examples quoted above are not exceptions. Each series presents details that must be reported in order to understand the organization of the sheet index, the numbering and/or titles of sheets, and particular statements. This information is of little interest to map librarians working with conventional catalogs, but they are of paramount importance for the implementation of FRBR and, in particular, for defining the more abstract concepts of this model (*Work* and *Expression*) for cartographic series¹⁴. The first elements proposed in this chapter for defining map series are clearly part of this new context. But, almost everything remains to be done in order to provide a database of cartographic series on the basis of a shared structure.

International working groups are essential vectors for achieving such a goal. Unfortunately the International Federation of Library Association (IFLA)'s Geography and Map Libraries Section was dismantled at the end of 2009. Similarly, the Association of European Research Libraries (LIBER)'s Map Librarians Group was disbanded a few years ago. European map librarians are now gathered together under the umbrella of the International Cartographic Association (ICA)'s Commission on Digital Technologies in Cartographic Heritage but the construction of a common structure for listing (before describing) cartographic series produced by countries during the last two centuries is not on the agenda. The situation in the USA is the same with the American Library Association (ALA)'s *Map & Geospatial Information Round Table*¹⁵. Moreover, historians of cartography are not particularly interested in series printed by mass (military) production institutions on bad paper even though these maps constitute the largest proportion of cartographic production since the mid-nineteenth century. Currently, the context is not very promising and we may have to wait a few more years before map

¹³. The book of Nicholson and Sebert (1981), is a very good reference for the cartography of Canada. There are only few equivalents.

¹⁴. In their recent book P. Andrew, S. M. More and M. Larsgaard (2014) explain that the implementation of the FRBR to cartographic series is not an easy task. Then they give only one example about an American map published by the United States Geological Survey. Indeed, the European cases are even more complex for, at least, two reasons. In Europe, history of cartography begins long before the American one. During the nineteenth Century in Europe, a large part of the cartographic production of each national army was dedicated to abroad territories and established by copy of foreign sources, without corresponding statements.

¹⁵. P. Andrew (2015).

librarians develop an interest in cartographic series; this chapter can be seen as a first step towards this future.

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Key Terms and Definitions

Cartographic series: Map which represents a too large area – depending on its scale –and which is shared into several sheets.

Monograph: Map printed in a unique sheet.

Sheet index: Graphic document that shows the geographic distribution of the sheets of a cartographic series. It can be drawn on a white background or on a small-scale base map showing landmarks such as coastlines, borders or major cities.