Angeliki Tsorlini[1], Chrysoula Boutoura[2], Aikaterini Nasta[3], Evangelos Livieratos[4]

Searching for maps embedded in books in digital libraries environment

Keywords: digital map libraries, maps embedded in books, digitization, maps cataloguing, maps archiving

Summary

Historical maps consist the historical cartographic wealth and are an important part of the world's cultural heritage. They are used nowadays by many researchers from different scientific fields dealing with historical, archaeological, sociological, political, demographic, toponymic and other issues with emphasis on the area of Digital Humanities. These cartographic items in manuscript or printed form, independent or in map series, loose or embedded and bound in books are located in smaller or bigger collections mainly in libraries worldwide. Most of them, depending on the library, thanks to the development of digital technologies, are digitized, giving access to researchers, students as well as the general public to study and retrieve information from them.

A special case from these types of cartographic assets, is the maps which are embedded or bound in books. These maps are usually recorded within the books on the physical description or the comments field depending on the library or they are totally ignored. As a result, they cannot be detected during the searching procedure in the library's database system, thus they remain unknown to the academic community and the society. This becomes even worse when the digitization of these maps is not conducted in a proper way to show an image of them.

In this paper, we discuss problems and difficulties appearing when searching for maps embedded in a book in digital libraries. We use examples coming up from different digital libraries or providers, starting from the digital collections department of the Aristotle University of Thessaloniki Library & Information Centre (from now on: AUTH Library), to show and highlight these problems and in a second step, to overcome them proposing different solutions, in order to create a system in the AUTH Library to give access to more unknown maps, promoting in this way the cartographic heritage wealth stored in the library to researchers and the general public.

Introduction

Historical maps, atlases and other cartographic material existed in books, in manuscript or printed form, consist the cartographic heritage, which is regarded to be a considerable part of world's cultural heritage, that belongs and can be safeguarded by UNESCO (Novotná, 2016). These cartographic heritage items are important tools for researchers in the field of humanities, since they offer an image of the past and give the ability to see changes which are intrinsically linked to human activity, taken place in an area over time. Nowadays, the study of historical cartography and historical maps in a digital environment is among the interests of Digital Humanities and Scientific Cartography (Michev, 2016) and its development in recent years with the use of digital technologies and the application of new computational methods has given a new a dimension in the international research of Cartographic Heritage[5] (Livieratos, 2006, 2008; Livieratos et al, 2016).

These cartographic items in manuscript or printed form, independent or in map series, loose or embedded and bound in books, depicted in a variety of supporting materials such as parchment, paper or other

---

[1]Post-Doctoral Researcher, National Fellowships Foundation (IKY); CartoGeoLab, Faculty of Engineering, Aristotle University of Thessaloniki, Greece, [atsorlin@topo.auth.gr]

[2] Professor of Thematic and Digital Cartography, CartoGeoLab, Faculty of Engineering, Aristotle University of Thessaloniki, Greece, [boutoura@auth.gr]

[3] Head of Central Library, Aristotle University of Thessaloniki, Greece, [nasta@lib.auth.gr]

[4] Professor Emeritus, CartoGeoLab, Faculty of Engineering, Aristotle University of Thessaloniki, Greece, [livier@auth.gr]

[5] See the website of the relevant Commission of the International Cartographic Association (ICA) "Cartographic Heritage into the Digital: http://cartography.web.auth.gr/ICA-Heritage

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
AUTH CartoGeoLab, 2018, ISSN 2459-3893

writable or engravable material are located in smaller or bigger collections mainly in libraries worldwide, which are important parts of the infrastructure of humanities, since they are centres of information and knowledge management (Svensson, 2010). Thanks to the development of digital technologies and their inclusion in library's functions, the libraries have now new options and directions to manage and retrieve knowledge by digitizing all their deposit, giving access to researchers, students as well as the general public to study and retrieve information from it. In this frame, the digitization of cartographic assets existed in libraries and their inclusion and provision online to researchers and the general public in digital form are very important, since they offer new tools for researchers of many disciplines, particularly the humanities to expand the scope of research, giving them the opportunity to use new data extracted from the old maps (Tsorlini et al., 2017).

A special type of the cartographic items existed in libraries, is the maps which are embedded or bound in books. These maps can be part of atlases which are bound in books or they can be independent maps which are included in books because they refer to the textual information described in them. They can be of different sizes, fitting to the size of the page or being larger than that and folded inside the book. In any case they are connected with the books. For this reason, there should be a reference to them somewhere in the record of the book they belong; but this is not always the case.

The current experience shows that maps are usually treated and recorded following the rules related mainly to traditional descriptive methods applied in book-keeping and book-archiving (Boutoura et al., 2015; Boutoura, 2014), having as a result important information concerning the construction of the map to be totally ignored. This sometimes makes difficult the detection of maps with the same characteristics or the same cartographic standards or even the discovery of a particular map using as keywords only information which is not included in the library's database system. This becomes even worse if there is no particular section inside the library's searching system, dedicated to the inquiry of cartographic materials. As a consequence, these maps, although they are recorded somehow together with the books, remain unknown to researchers, the academic community and the society. Additionally, in some web providers which include maps and other cartographic items, even if the desirable map is detected, it is not possible to downloaded it and use it, because it is digitized folded inside the book or the final image is deformed. In this paper, we discuss all these problems and difficulties appearing when searching for a map embedded in a book in digital libraries or web providers of cartographic material. We have started this research from the digital library, AUTH Library, focusing on the very important *Ioannis Tricoglou* Library[6] and we have visited several other digital libraries and web providers of cartographic material, to study the the searching procedure and the way the maps are provided to the users. Searching for maps in books in different digital collections and libraries, helped us to determine the shortcomings on archiving maps and other cartographic material, as well as to find examples of good practice. Based on them, it is possible then to propose solutions to overcome these problems and improve the AUTH Library system concerning the cataloguing and archiving of the cartographic deposit, giving in this way access to more unknown maps and promoting the cartographic heritage wealth stored in the library to researchers and the general public.

Problems and examples of good practice in searching for maps embedded in books in digital libraries

Searching for maps embedded in books in digital libraries or web providers including digitized books such as google books[7] or the Internet Archive[8] is not always very easy task. The books are catalogued in the common standardised way following specific rules related mainly to traditional descriptive methods applied in book-keeping and book-archiving. For the maps, there is no dedicated standardisation as far as the cartographic material is concerned, fulfilling homogeneity and uniformity in the technical requirements for the providing of the digital map copies and the (eventually available) associated textual or other

---

[6] The *Tricoglou Library,* Aristotle University of Thessaloniki Library & Information Centre, http://www.lib.auth.gr
[7] Index of full-text books from libraries and publishers worldwide, https://books.google.com/
[8] Digital Library of Internet sites and other cultural artifacts in digital form, https://archive.org/

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
AUTH CartoGeoLab, 2018, ISSN 2459-3893

documentation (Boutoura et al., 2015, Boutoura, 2014). As a result, every library has set its own rules and model to follow for the inclusion of maps in their digital collections.

Some of the digital libraries catalogue the maps embedded in books seperately providing important information for the external recognition of the map, such as the title of the map, the cartographer, the engraver, the publisher, the scale, the thematic content and other special characteristics of the map as well as an image of the map, which can be downloaded directly by the researcher in low or in high resolution. There are digital libraries in which these maps are also georeferenced, showing to the users their exact location on the earth surface. In all these cases, the maps are connected to the books they belong and the text they may refer. Such standardization in the inclusion of maps in libraries' digital collections more or less exists in digital collection from important libraries worldwide such as the National Library of France[9] (Fig. 1), or the David Rumsey map collection[10] (Fig. 2). In libraries like this, it is easy for a researcher to find a map, to get further information about it and finally, download it to use it further in his study, if the resolution of map is sufficient for this purpose.
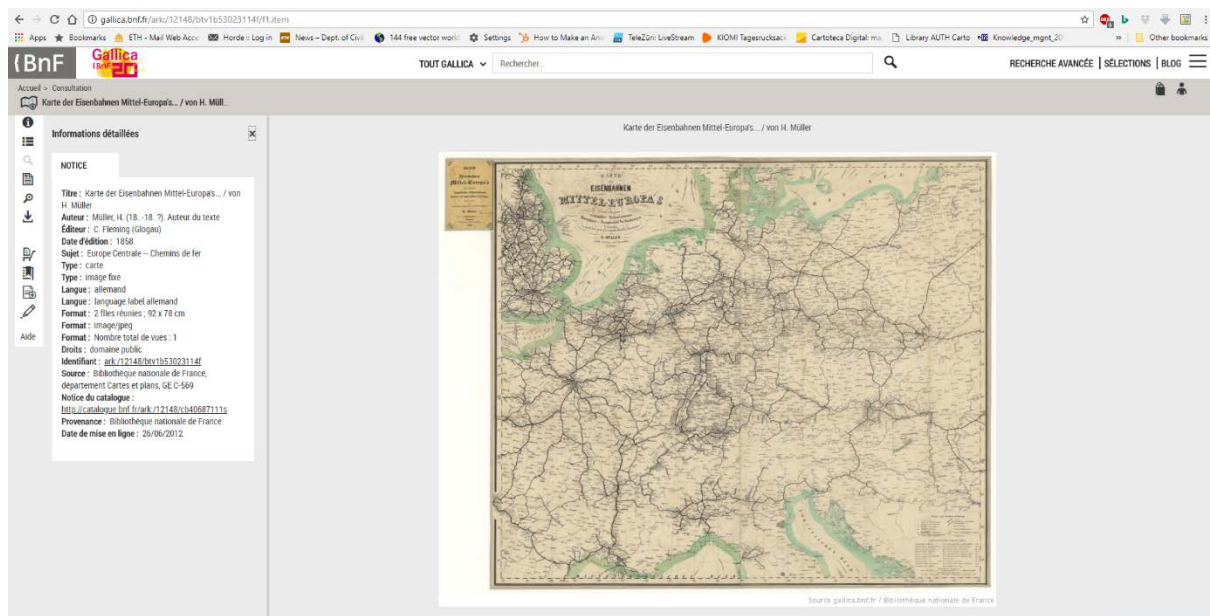

Figure 1. Searching for a map in the digital collection of National Library of France (BnF). The library provides useful information for the external recognition of the map and an image of the map, which can be downloaded unfortunately in low resolution. Additionally, next to the map, the user can see also the front page of the book in which the map is found [http://gallica.bnf.fr/ark:/12148/btv1b53023114f/f1.item].

---

[9] National Library of France – BnF, http://gallica.bnf.fr/accueil/?mode=desktop
[10] David Rumsey Historical Map Collection, Stanford University Library, https://www.davidrumsey.com/.

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
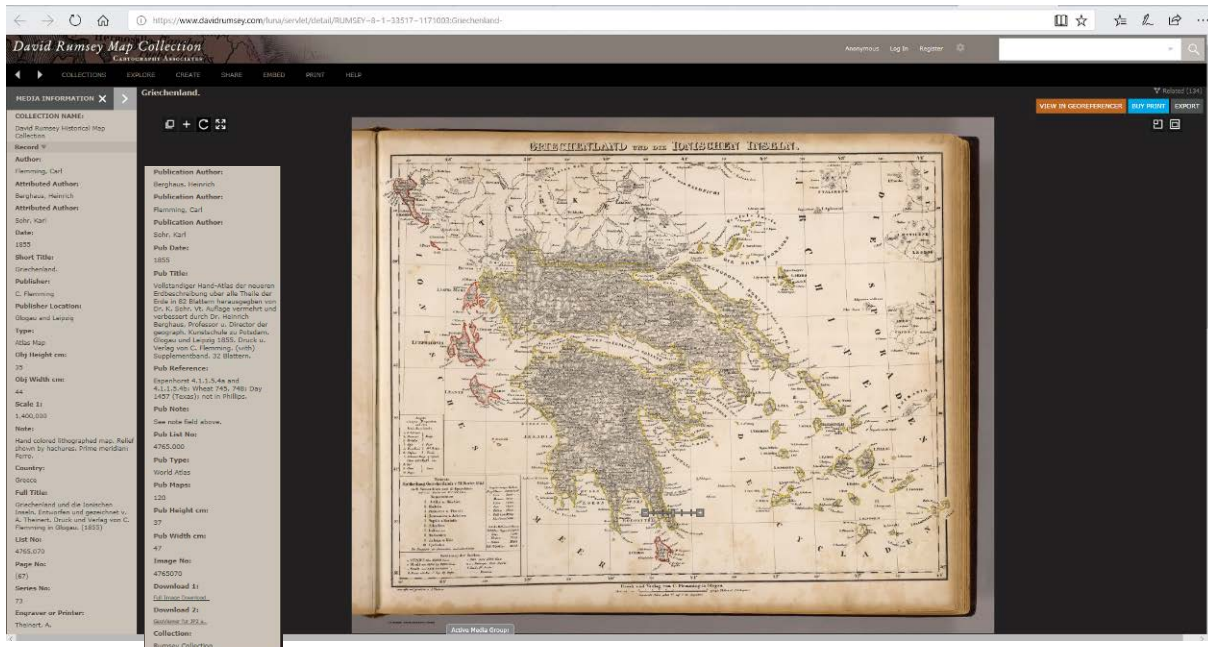AUTH CartoGeoLab, 2018, ISSN 2459-3893

Figure 2. Digital environment for the maps in David Rumsey Map Collection. In this case, there is more information provided for the map in the left side menu; the map can be downloaded in high resolution and through the georeferencer tool, it is possible to see the map georeferenced over a current background [https://www.davidrumsey.com/luna/servlet/detail/RUMSEY~8~1~33517~1171003:Griechenland-]

Unfortunately, this is not the case for all the digital libraries which include maps in their collections. In some digital libraries, the maps embedded in the books are not involved in their digitization process (Kotsiou & Ioannidis, 2017). Usually, only the existence of maps inside the book is mentioned in one of the fields used for the book's description, without any reference to the exact location of the map inside it. Even if the maps are recorded seperately, they are catalogued following the rules for book-archiving, providing only a few information about the map, sometimes even without showing its image (Fig.3).
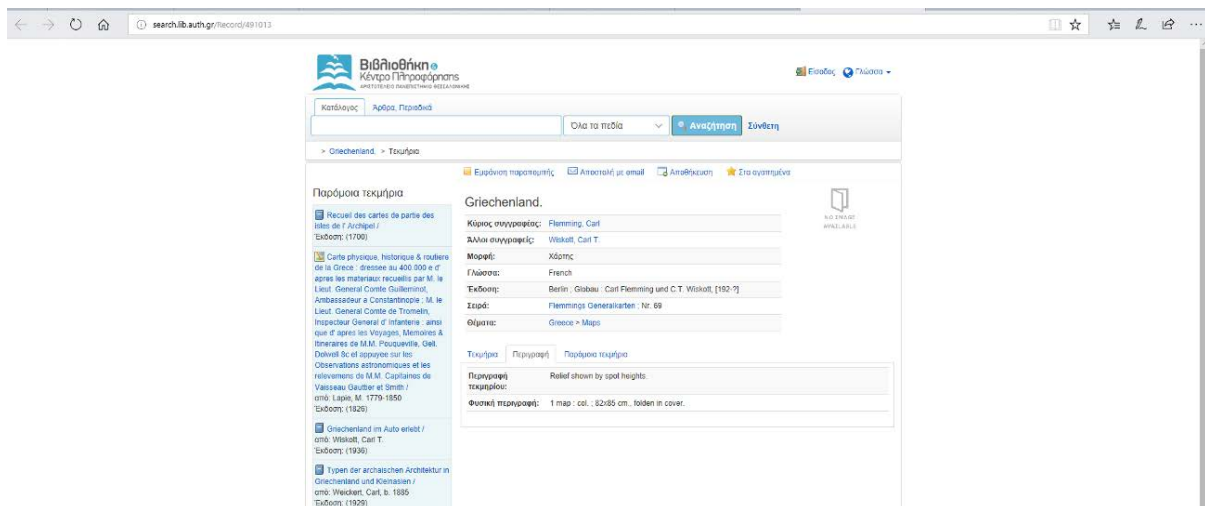

Figure 3. Digital environment of AUTH Library. The information provided for the map is not complete. Additionally, there are also mistakes such as the language of the map which is not only French but also German, something which is obvious from the title and other information of the map written in German [http://search.lib.auth.gr/Record/491013].

Additionally, there are cases where the provided information of the map is incomplete or there are mistakes on any of the fields referring to the map. In such digital libraries, the detection of a specific map which is included in a book is very difficult since there are no searching functions dedicated especially to

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
AUTH CartoGeoLab, 2018, ISSN 2459-3893

the inquiry of maps and their incomplete or sometimes erroneous cataloguing does not let the user to detect finally the map.

Moreover, sometimes there are different words used for the maps during their cataloguing in connection with the book (Fig. 4). For example, in the digital collections of AUTH Library, maps are recorded and can be found using the keywords "χάρτης", which is the map in Greek, "map", "plan" or "carte". This creates problem in the searching procedure, since each of these keywords gives different results and none of them can show all the relevant results at once.
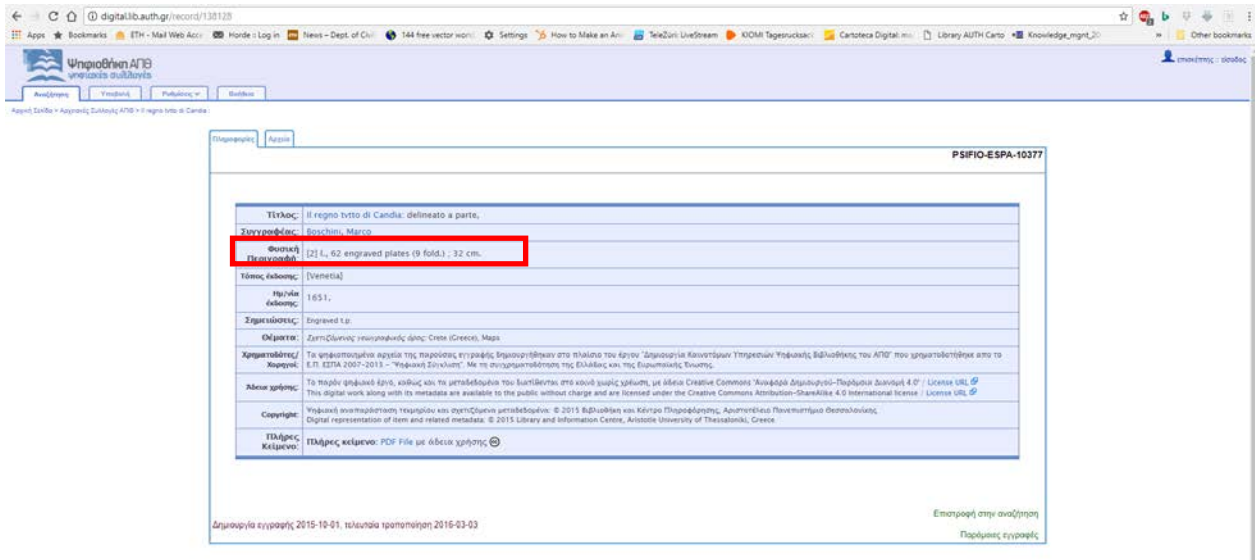
Figure 4. In the description of the book, the maps are recorded as plates [Digital collections department of AUTH Library, http://digital.lib.auth.gr/record/138128]

Finding map inside the book is also a challenging procedure. Since the location of the map (page) usually is not mentioned in the physical description of the book, the user has to go through the whole book, page by page, to find the desirable map (Fig. 5). In some digital libraries, there is the option for having an overview of all the pages of the book at once in order to find the map, but this function is provided only from some libraries.
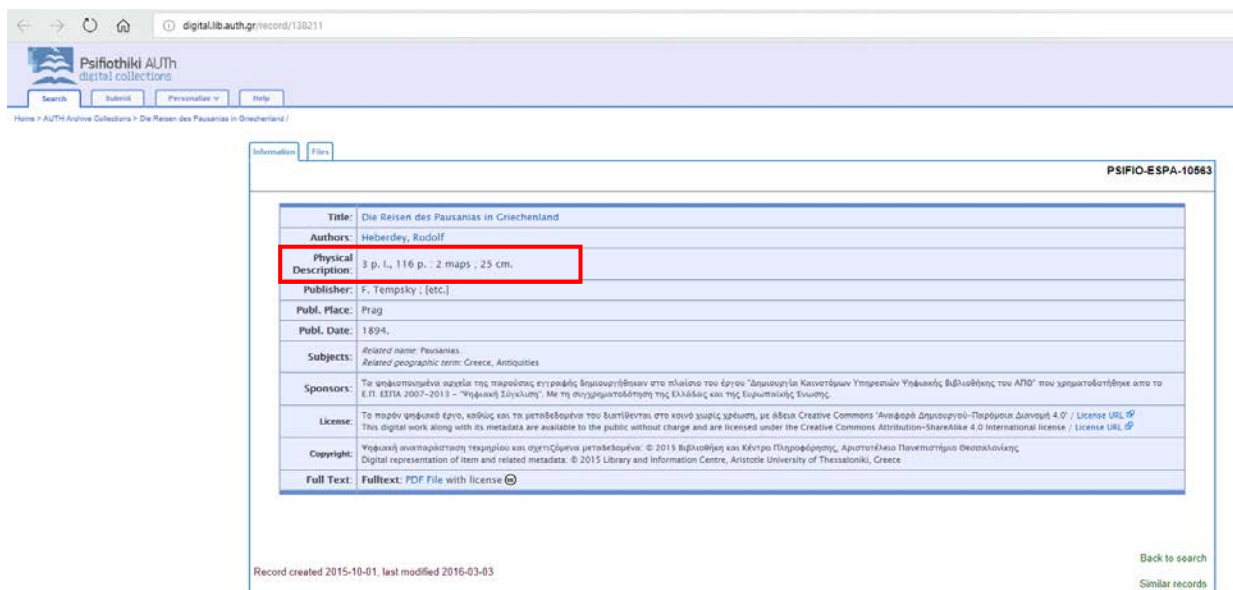

Figure 5. In the physical description of the book, the existence of two maps in the book are mentioned but their locations in the book remain unknown [Digital collections department of AUTH Library, http://digital.lib.auth.gr/record/138211].

Another problem appearing mainly in some web providers such as google books (Fig. 6) and the Internet archive (Fig. 7) concerns the digitization of the maps, which is a very important procedure that should be done taking into consideration the special characteristics of the maps. This is not always the case, since there are maps which are larger than the page size and they have been digitized without being unfolded. The problem especially with Google provider is that big libraries worldwide, for example the Harvard Library[11], as well as other web providers, such as the Internet Archive, use for some books the digitization by Google, which means that the problem with the maps digitized folded inside the book is perpetuated instead of being diminished.
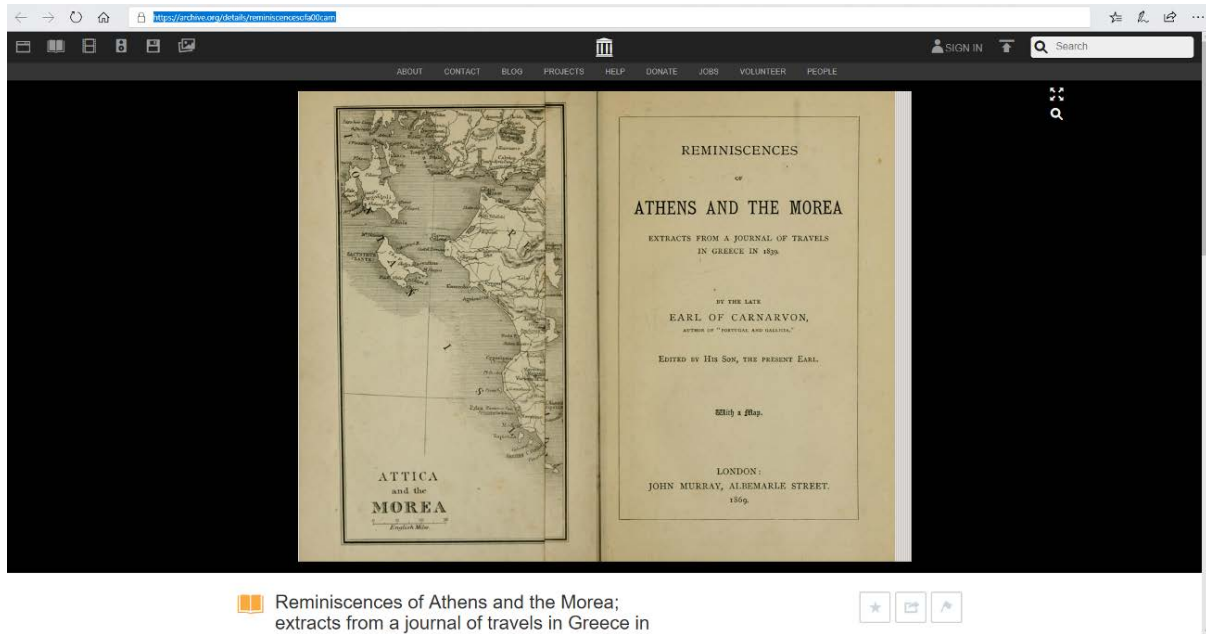
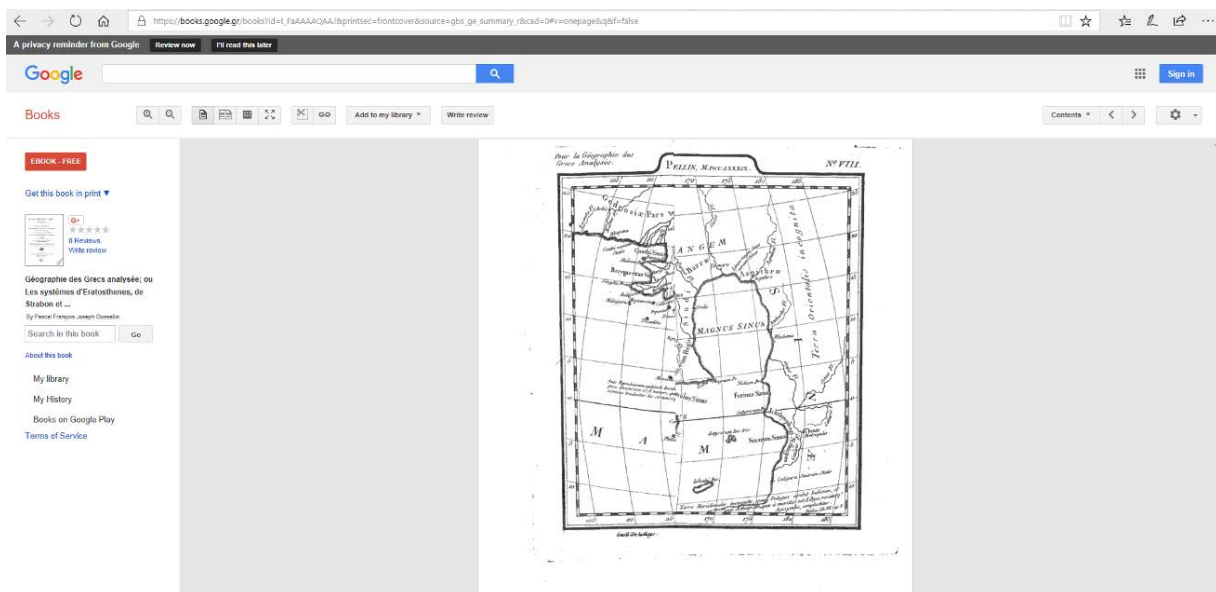Figure 6. Detecting a map digitized folded inside the book, in the web provider of Internet Archive [https://archive.org/details/reminiscencesofa00carn].

Figure 7. Detecting a map digitized folded inside the book, in the web provider of Google Books. [https://books.google.be/books?id=7cZYAAAAcAAJ&printsec=frontcover&hl=nl&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false].

---

[11] Harvard Library, HOLLIS Catalog, Cambridge, MA, USA, https://hollis.harvard.edu/primo-explore/search?vid=HVD2&sortby=rank&lang=en_US

Moreover, there are cases where the map was digitized correctly in its own dimensions but it is provided through internet deformed in order to fit to the page size (Fig.8). The image of the map in this case, although it shows the map and maybe has been download in high resolution, it cannot be used further for other purposes.
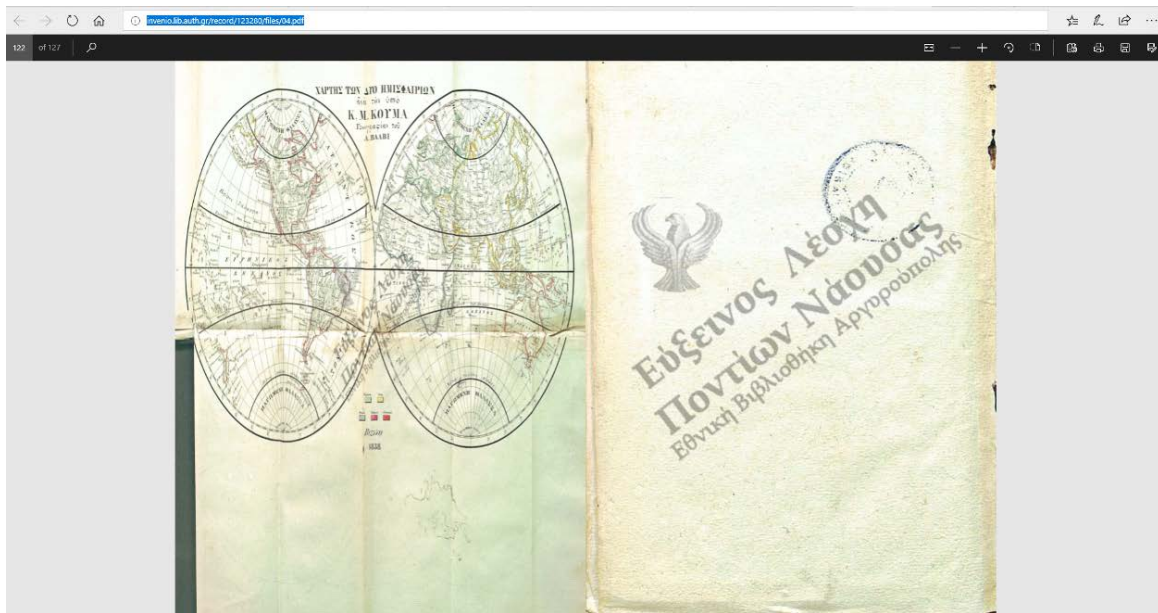

Figure 8. Detecting a map digitized unfolded inside the book, but deformed in order to fit to the page of the book in the digital collections department of the AUTH Library [http://invenio.lib.auth.gr/record/123280/files/04.pdf]

Last but not least, it is possible to find a map digitized in its correct dimensions but not correctly converted to the appropriate format. As a consequence, the map is uploaded to the digital environment destroyed in a way, thus not possible to be used further for other purposes. As an example, in this case is the digitized map below, depicting a part of Cephalonia island in Cristoforo Buondelmonti's book provided by Anemi Digital Library[12], which is destroyed in the bottom.
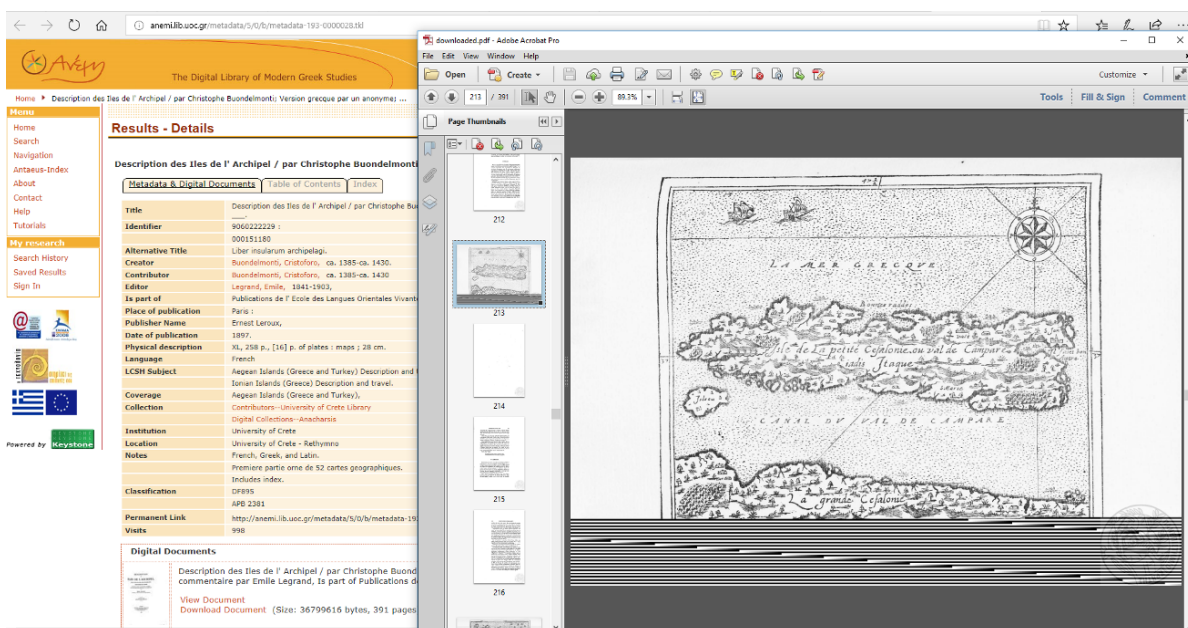

Figure 9. A map inside the Buondelmonti's book, which is not correctly shown in the pdf file downloaded from Anemi Digital Library [http://anemi.lib.uoc.gr/metadata/5/0/b/metadata-193-0000028.tkl].

---

[12] Anemi – Digital Library of Modern Greek Studies, University of Crete Library, Greece, http://anemi.lib.uoc.gr

Improving the AUTH Library digital collections system based on the problems and shortcomings existed in digital libraries worldwide

Having recorded all these problems and shortcomings existing in different digital libraries concerning independent maps and maps embedded in books, it is important to find solutions which can overcome these problems in order to improve the system of digital collections department of AUTH Library. In this way, the library can give access to cartographic material which remained unknown until today to researchers and the general public, promoting its cartographic wealth.

Considering the fact that the AUTH Library is the biggest academic library in Greece and the second in size after the National Library, our project was focused on the AUTH Library *Tricoglou* collection, which is catalogued and partly digitized.[13]

The first step in our work was to find and collect the cartographic material, i.e. historical maps in manuscript or printed form, loose or bound in books, atlases and other related material from the libraries searching system. Since the maps were also recorded as plates, plans or even gravures, we had to check all the possible keywords to find them. The most difficult task in this procedure was to detect the maps embedded in books, because most of the times, the only evidence we had for them was a reference for their existence inside the book. Additionally, there were cases in which there was no reference to a map inside the book, but the title of the book showed that it was possible to find a map inside the book. In these cases, we had to search the book page by page to find the maps inside it. Taking into consideration that only a part of the collection is digitized, we had to search the books which were not digitized, physically.

The next step was the documentation of the maps and the designing of a database which will include the necessary information for the external recognition of the map. The determination of the appropriate fields included in the database is influenced also by the fields existed in other digital libraries regarded as examples of good practice due to the completeness of information and functionalities they provide to users to study the included maps. Based on them, important fields which provide information for the maps in other digital libraries, were also included in our case. Some of these fields are: the identification number, the full title, the authors, engraver and the publisher of the map, the publication date and location, the scale of the map and its original dimensions, the type of the map, a reference to the thematic content of the map, the area it depicts, as well as information which connects the map with the book it belongs, such as the title and the author of the book, its location inside the book and an image of its front page.

It is also important to include an image of the map and to give the opportunity to users to download its digitized version. In order to do that, all the maps found in *Tricoglou* collection were correctly digitized, taking into consideration their special characteristics, dimensions, age and the situation they are (Daniil et al., 2003). Particular attention was paid to the maps that were embedded and folded into books in order to avoid any possibility of greater deterioration in the digitization process. For these reasons, each map was treated separately as a special case of digitization.

For the comparative study of historical maps with other historical or modern maps, it is also useful to georeference the maps, connecting them to the geographical space (Tsorlini & Hurni, 2015). In this way, converting the database to a geographic information system, it will be possible to see the area the maps cover and to compare the geometry of the map with its current counterpart.

Cataloguing the maps in this way, organizing and managing them through a database system, it will give the opportunity to the users, researchers, students or library's staff, to find easily maps and the books they belong, to get information about them and to retrieve combined information for them through proper queries in the database. Moreover, the information stored with the maps in the database will be connected with other related textual and pictorial sources, enriching the information provided for the maps to researchers and students, but also to library's staff, simplifying in this way the searching procedure.

---

[13] The collections of the *Tricoglou Library* in the AUTH Library consists of over 10.000 of books, 3500 works of art, such as paintings, engravings and lithographs, various personal items and precious objects as well as a large number of maps, rare atlases and books with cartographic content.

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
AUTH CartoGeoLab, 2018, ISSN 2459-3893

Conclusions

The availability of old maps, loose or embedded in books, atlases and other related cartographic material in digital form is growing continuously in the web by bigger and smaller providers such as public and private libraries, archives, collections and other institutions dealing with cartographic heritage. The cataloguing and archiving of maps in digital libraries or collections is not following common standards, fulfilling homogeneity and uniformity in the technical requirements for the provision of digital map copies, having as a result every library to set its own model concerning the amount of information provided to the users. As a concequence, there are different problems appearing while searching for maps in different digital libraries and web providers of cartographic material, especially if these maps are embedded in books.

These problems are mostly caused due to the fact that the maps inside the books usually catalogued by the librarians in the common standardised way following specific rules related to traditional methods applied in book-keeping and book-archiving. In this way, the library provides limited and sometimes misleading information about the map to the users, making difficult its detection in the library's digital system or even inside the book it belongs.

Based on these problems and the shortcomings noticed through searching for maps in the web, it is important to find solutions to overcome these issues and to standardize the cataloguing of maps so that the information provided to researchers and the general public is complete and correct concerning the technical documentation associated with the map and its digital copies. In this way, maps which remain unknown for years inside the libraries, will show their value and the cartographic heritage wealth stored in libraries will be promoted to researchers and the general pu-blic.

Acknowledgments

References

Boutoura C., N. Pantazi, N. Ploutoglou, M. Pazarli, E. Daniil, E. Livieratos, 2015. 'Setting Models of Good Practice for Cartoheritage Web Providers. Implementation on the Historical Archives of Corfu Map Collection'. In *Proceedings of 10th Jubilee ICA-Commission Conference + Workshop on Digital Approaches to Cartographic Heritage*, Corfu, Greece, 27-29 May.

Boutoura C., 2014. 'The course of Danube in some representative 18th century maps as given online in textual and image structures by a leading web provider of digital maps'. In *Proceedings of 9th ICA-Commission Conference on Digital Approaches to Cartographic Heritage*, Budapest, Hungary, 4-5 September.

Daniil M., V. Tsioukas, K. Papadopoulos, E. Livieratos, 2003. 'Scanning options and choices in digitizing historic maps'. In *New Perspectives to Save Cultural Heritage, Proceedings*, CIPA, XIX International Symposium, Antalya, Turkey, [http://cartography.web.auth.gr/Maplibrary/New/Scanning.pdf].

International Cartographic Association, Commission on Cartographic Heritage into the Digital
Proceedings 13th ICA Conference *Digital Approaches to Cartographic Heritage,* Madrid, 18-20 April 2018

Editors Chrysoula Boutoura, Angeliki Tsorlini
AUTH CartoGeoLab, 2018, ISSN 2459-3893

Kotsiou P., N.-D. Ioannidis, 2017. *Digitization and documentation of maps in rare books. Low-cost implementation in the AUTH Tricoglou Library*. Diploma thesis. School of Rural and Surveying Engineering, Aristotle University of Thessaloniki, Greece [In Greek].

Livieratos E., 2006b. 'A new ICA Working Group on merging cartographic heritage with digital technologies'. Welcome address at 1st International Workshop on Digital Approaches to Cartographic Heritage, Thessaloniki, Greece, [http://xeee.web.auth.gr/ICA-Heritage/Commission/Introduction.pdf].

Livieratos E., 2008. 'The challenges of Cartographic Heritage in the digital world'. Introduction speech in the 3rd International Workshop on Digital Approaches to Cartographic Heritage, Barcelona, Spain, [http://xeee.web.auth.gr/ICAHeritage/Commission/3rd_Workshop/Livieratos_Heritage_Barcelona.pdf].

Livieratos E., C. Boutoura, A. Kousoulakou, A. Nasta, M. Grigoraskou, A. Saragiotis, 2016. 'From library shelves of rare to cartographic unveiling: the manuscript maps of the 'Recueil des Cartes de Partie des Isles de l'Archipel levées sur les lieux par Sieur Raseau Ingénieur ordinaire du Roi', late XVII century'. In *Proceedings of 11th ICA-Commission Conference on Digital Approaches to Cartographic Heritage*, Riga, Latvia. ISSN 2459-3893.

Michev B., 2016. 'Map exhibits as an important tool for connecting Cartography and the Digital Humanities'. In *Proceedings of the 11th International Workshop on Digital Approaches to Cartographic Heritage*, ICA-Commission on Cartographic Heritage into the Digital, Riga, Latvia. ISSN 2459-3893.

Novotna E., 2016. 'Cartographic culture heritage belongs to UNESCO'. In *Proceedings of the 11th International Workshop on Digital Approaches to Cartographic Heritage*, ICA-Commission on Cartographic Heritage into the Digital, Riga, Latvia. ISSN 2459-3893.

Svensson P., 2010. 'The Landscape of Digital Humanities'. In *Digital Humanities Quarterly*, 4, (1), ISSN 1938-4122 [http://www.digitalhumanities.org/dhq/vol/4/1/000080/000080.html].

Tsorlini A., R. Sieber, L. Hurni, 2017. 'Combining current vector data with historical textual data and data extracted from old maps to study the development of the city of Zurich, Switzerland'. In *Proceedings of 12th Commission Conference on Digital Approaches to Cartographic Heritage*, Venice, Italy. ISSN 2459-3893.

Tsorlini A., Hurni L., 2015. 'On the georeference and reprojection of old maps in different application software: comparing methodology and results'. In *Proceedings of the 10th Jubilee Commission Conference on Digital Approaches to Cartographic Heritage*, Corfu, Greece, ISSN 1790-3769.

Digital Libraries

Anemi – Digital Library of Modern Greek Studies, University of Crete Library, Greece, http://anemi.lib.uoc.gr

David Rumsey Historical Map Collection, Stanford University Library, https://www.davidrumsey.com/.

Digital collections department of Aristotle University of Thessaloniki Central Library (Psifiothiki AUTH), http://digital.lib.auth.gr/?ln=el

Google Books, Index of full-text books from libraries and publishers worldwide, https://books.google.com/

Harvard Library, HOLLIS Catalog, Cambridge, MA, USA, https://hollis.harvard.edu/primo-explore/search?vid=HVD2&sortby=rank&lang=en_US

Internet Archive, Digital Library of Internet sites and other cultural artifacts in digital form, https://archive.org/

National Library of France – BNF, http://gallica.bnf.fr/accueil/?mode=desktop