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Cataloguing and Presentation Tools for Old Maps and Map Series

Keywords: historical cartography, cataloguing, old maps, geographic search, map series

Summary: The paper describes online tools developed in recent years in the Moravian Library in Brno for cataloguing and presentation of old maps and map series. These tools allow users to easily acquire the metadata necessary for geographic indexing and a consistent presentation of old maps in online catalogues of memory institutions. The Scale Calculator tool can be used to easily calculate the map scale for cataloguing purposes while the MapSeries tool guarantees unified record description of individual map sheets belonging to particular map series. Both tools were developed to complement existing online tools, aiming to simplify bibliographic processing of old maps in institutions lacking expert map cataloguers.

Introduction

The Moravian Library in Brno (MZK) currently holds (November 2019) over 23,000 maps in its collection. In addition to contemporary cartographic materials acquired mostly through legal deposit, a large part of the collection consists of old maps which make up the Moll’s collection (Papp 2005), a number of atlases, as well as many sheets from the 19th and 20th century map series. One of the long-term priorities of the Moravian Library is digitization and user-friendly access to the digital surrogates, efforts to which the map collection is no exception. Therefore, between 2004 and 2010, the project “Historical Collections of the Moravian Library in Brno” laid foundation to further research and development activities concerning old maps. As a by-product, the project helped implement jpeg2000 and Zoomify support into IIPImage server, which in turn helped establish jpeg2000 as a standard format for both long term preservation and access in Czech libraries. This project was followed by the project EuropeanaTravel (2009 – 2011), during which a large part of the Moravian Library map collection was digitized, including the Moll’s collection, which was published online.1 A second complementary project was launched a year earlier: the Old Maps Online (2008 – 2011) produced a prototype of an online bounding box tool for cataloguers and a first version of an online georeferencing tool. The main aim of this tool was to lower the barriers for both memory institutions and the general public and allow online georeferencing of maps through crowdsourcing. In cooperation with Charles University in Prague and Masaryk University in Brno, the Moravian Library led a follow-up project TEMAP2, which helped establish the portal staremapy.cz as the crowdsourcing site for old maps from Czech memory institutions. The TEMAP project also produced a first version of a tool called MapSeries

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1 https://mapy.mzk.cz/en/
2 Technology for Accessing Map Collections of Czech Republic: Methodology and Software for the Protection and Utilization of National Cartographic Heritage Works (Technologie pro zpřístupnění mapových sbírek ČR : metodika a software pro ochranu a využití děl národního kartografického dědictví), 2011-2015
for collaborative cataloguing of large map series. In 2012, the digitized map collection of the Moravian Library also was one of the first five map collections indexed by the international OldMapsOnline.org project.

While processing maps from its own collection, the Moravian Library continues to participate in the development of online tools intended to work with maps. The tools described in this article facilitate and speed up the cataloguing of old maps and also help to make them more accessible to the public through spatial search. The Moravian Library has been amongst the first to implement the MapRank Search engine\(^3\), which has proved a very practical component of online presentations of map collections (Klokan Technologies 2014). Thanks to spatial search, the user does not necessarily need to know the exact title of the work, its author or the year of publication. It is sufficient to mark the desired area on the map and immediately obtain relevant results thanks to an algorithm. To further refine these results it is also possible to define the approximate date of origin of the searched document and to specify the scale of the searched map. The portal Mapy.mzk.cz\(^4\) as well as the OldMapsOnline.org\(^5\) search engine both still use this system. Currently, the Moravian Library is working on a transition from MapRank Search to a Solr-based spatial search index which will allow closer integration of spatial search technology into the library catalogue as well as into its digital library\(^6\).

However, in order to locate digitized maps using spatial search, it is necessary to supplement their bibliographic records with geometadata which describe these documents in more detail (Oehrli, Pridal, Zollinger & Siber 2011). For a successful spatial search engine, the key metadata are the coordinates defining the territory displayed in the map field and the map scale. Even though the best results can be expected from a precisely defined and georeferenced cutline (map field outlines), in reality this is not necessary in most cases. Most map sheets are at least roughly rectangular and aligned with the world coordinate grid so individual map sheets usually do not

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\(^3\) https://www.mapranksearch.com
\(^4\) https://mapy.mzk.cz/
\(^5\) https://www.oldmapsonline.org/
\(^6\) http://www.digitalniknihovna.cz/mzk
need more than a rectangular bounding box coordinates. Taking into account the inaccuracies of the very old maps, the most intuitive approach to spatial search is to use a rectangular map window on a web page as a search query. Spatial search results can then be filtered using secondary (bibliographic) metadata, which tend to be rather unique and can easily be shared among library systems through standard APIs and workflows. On the other hand, when processing large map series consisting of many individual map sheets it is important to standardize bibliographic records for individual map sheets. Time-consuming cataloguing of this type of document increases the need for faster and more automated record creation. In order to acquire this data more efficiently, it is possible to use the online tools developed by the Moravian Library in cooperation with the Geographic Institute of Masaryk University in Brno. These tools and the results achieved while they were being developed are presented below.

**BoundingBox and Georeferencer**

The map field is the most important part of a map and the geographical coordinates defining it are therefore an essential part of the bibliographic records of cartographic documents (Andrew, 2003). To help the cataloguers to quickly identify the coordinates bounding the map field, the Moravian library has developed a simple online tool called BoundingBox. The library started to add bounding box coordinates first into the records of its old map collection and in 2011 it was the first library in Czech Republic to include geographic coordinates into its routine map cataloguing processes. The first version of this tool was developed in 2008 and was later discontinued when a better version was developed by Klokan Technologies.

A bounding box is a set of coordinates specifying the extent of the map field. It uses geographic coordinates by indicating the northernmost and southernmost latitudes and the westernmost and easternmost longitudes, but can also be defined as geographic coordinates of two opposite corners of the bounding rectangle. The BoundingBox tool makes it very easy to get the correctly formatted coordinates very quickly. The cataloguer only needs to graphically indicate the area of a map field on a world map, and the tool automatically generates the corresponding metadata values. In the MARC format, the BoundingBox offers coded cartographic mathematical data necessary to fill in the subfields $d$, $e$, $f$ and $g$ of field 034 and subfield $c$ of field 255. Although the current version of the BoundingBox tool supports rectangle rotation and polygons, the Moravian Library will keep using standard rectangular bounding boxes aligned with the world coordinate grid as there are too few maps that would really need anything more sophisticated.

Making it easy to copy and paste the metadata directly into the cataloguing record was high on the priority list. In addition to formats suitable for the Aleph, VTLS or OCLC library systems, the tool currently supports more than a dozen other formats such as Dublin Core, a format required by the Czech Basic Rules for Archival Processing (Wanner 2015), CSV or several GIS oriented syntaxes.

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7 For example Z39.50, SRU or OAI-PMH.
8 [https://boundingbox.klokantech.com/](https://boundingbox.klokantech.com/)
9 In MARC, with RDA rules, polygon nodes can be stored in repeatable 034 $t$ and $s$ and in 255 $f$. 

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A different approach can be used for metadata enrichment of digitized map collections. In this case, Georeferencer is the tool to go. The first versions of this online tool were developed in the Moravian Library during the projects Old Maps Online and TEMAP and became the core of the StareMapy.cz map crowdsourcing portal for Czech libraries. Later, when Klokan Technologies unveiled its new Georeferencer, the Moravian Library migrated the data of all Czech libraries and integrated the new tool into its crowdsourcing portal. The new georeferencer allows more effective georeferencing through map overlay and rotation. Another significant improvement was adding support for multiple map fields on one map sheet. This functionality, once fully supported in indexing systems, will greatly improve the precision of spatial search. Ground control points (GCPs) added by volunteers and cutlines already allow researchers to compare maps through semi-transparent overlays or side-by-side. One of the advantages of using Georeferencer is also its proximity to the portal OldMapsOnline.org which attracts visitors to the library’s map portal.\(^\text{10}\)

Working closely with Klokan technologies, the Moravian Library initiated a new round of Georeferencer improvements in 2019, most notable of which is implementation of an API which will allow curators of digitised maps to manage their collection metadata in Georeferencer directly. This will allow the Moravian Library to establish closer and more up to date interaction between its digital library, which will soon gain a spatial search functionality and the metadata supplied by volunteers.

Although the new version of Georeferencer also supports transcription of toponyms, the Moravian Library does not currently encourage this endeavour yet. On the other hand, periodic competitions are organized by the library to attract volunteers, although it must be noted that 3 of the most productive volunteers did 75% of all the work. It must also be noted that relying on volunteers also means that it can take very long to get a particular map or collection finished and it is necessary to check the resulting data at least for gross errors. Hopefully, further development of the Moravian Library’s digital library will enhance the presentation of individual digitized map sheets.

\(^{10}\) https://mapy.mzk.cz/en/
MapSeries

Although the 18th century Moll’s collection consists mostly of standalone maps printed on a single sheet of paper, it also includes some examples of early map series. Later additions to the Moravian Library map collection contain a large number of map sheets which belong to various map series. Map series or map sets are defined as a group of topographic maps covering a larger contiguous area, which is spread over several map sheets because the display on a given scale is not possible on a single map chart. Map series are identified by their features such as a common map layout or a sheet index, consistent marking or numbering of map sheets, same map key, cartographic projection and a uniform scale. Particular sheets are individual self-sufficient cartographic documents, but can be assembled into one large map (Parker 1999). As far as cataloguing and search are concerned, sheets from large map series form a specific class of cartographic documents in memory institutions. However, individual sheets do not often share even basic information, such as the title, authorship or dating. Updated editions with revisions or reprints with corrections of individual map sheets were published by various institutions for decades without the edition order being explicitly given. Individual map sheets used to be stored separately in different places at the same institution simply because sometimes even curators were not aware of their correlation. The situation is further complicated by the quality of the original descriptive information, formerly stored on a library catalogue card and later on probably transcribed into an electronic catalogue. This reduces the likelihood of their uniform cataloguing, making it difficult to study such map series by library users.

A notable example of such maps in the collections of Czech memory institutions are the map series based on the Third Military Survey of the Austro-Hungarian Monarchy. The results of the survey conducted by the Austro-Hungarian K.u.k. Militärgeographisches Institut in Vienna between 1869 and 1885 provided the basis for map sheets published later in 1:25 000, 1:75 000, 1:200 000 and 1:750 000 scales in many updates. After the dissolution of the Austro-Hungarian Empire, these map series were edited and re-published by various institutions in the successor...
states well into the 1950s. Among the multiple publishers of these map series in Czechoslovakia were, for example, the Cartographic department of the Ministry of Defense, the Military Geographical Institute, and the Geographical Institute of the Ministry of the Interior or the Land Survey Office; at the same time the names of these publishers also varied over time (Boguszak & Císař 1961: 22-33). Moreover, there are also many map sheets printed by Protectorate institutions during the Second World War as well as map sheets printed by various institutions of neighboring states. Even within a single state, the very names of individual sheets were changed more than once; e.g. sheet 4668 of a Special Map 1: 75 000, which is located at Slovak-Hungarian-Ukrainian borders, was titled “Mándok a Csap”, “Čop a Mándok”, “Čop, Král’ Chlumec (Čop)” or “Král’. Chlmeč” just during the interwar period, not even mentioning the names of the Hungarian or Austrian editions from the same period. Even the identifiers of individual sheets were constantly changing. In 1917, the sheets of the Special Map 1:75 000 changed the form of the main sheet identifier from the designation of rows and columns into four-digit numbers. For example, a sheet of the Special Map depicting the surroundings of Brno used to be marked as Zone 9, Col. XV but in earlier editions it can be found under the number 4357. Likewise, the sheets of the General Map 1:200 000 used four-digit numbers as well as four-digit numbers divided with degree signs (3450 and 34°50’) (Novotná 2014). Thus, there is a complete absence of unifying data to be found on any of the sheets that can be used as unique descriptor of a map sheet when out of context of the other editions of the same sheet. Therefore, the cataloguers need to rely on their own knowledge and insight into the past cartographic production, which is oftentimes very limited as map collections usually form just a small part of their collection. The need for a simple and user-friendly helper tool for cataloguing map series is further emphasized by the growth of digitization activities and the need for reliable accompanying metadata.

In Czech Republic, the first step taken to handle this problem was creating a methodology for cataloguing cartographic documents in accordance with the RDA rules (Novotná, 2014a). Based on this methodology, the MapSeries tool has been developed to help cataloguers to create consistent bibliographic records for the most frequent map series from Czech map collections. In
addition to a more efficient cataloguing, the tool now also provides an interesting presentation of map series.

As mentioned above, there are several elements that all sheets from a particular map series have in common; these form the core of the MapSeries workflow. As most of these elements are cartographic in their nature, it was necessary to base the MapSeries tool primarily on a map view. The cataloguer first has to choose the right map series and pick a correct map sheet from a corresponding sheet index overlaid on the world map. Each sheet has an associated map sheet template that contains the information necessary to create a bibliographic record. The tool has three main parts: administration, cataloguing and presentation.

The administrative and cataloguing parts form the core of the tool. The administration helps create the sheet layout and predefined bibliographic record templates. The geodata used in the application were the results of the joint efforts of the Moravian Library and the Department of Geography of the Faculty of Science of the Masaryk University; both also participated in creating the first version of this tool within the TEMAP project (Duška, Kozel & Stachoň 2014). The spatial data are converted from the shapefile format into the GeoJSON format using the free Ogre tool. The metadata describing individual sheets are then added to create templates conforming to the cataloguing recommendation mentioned above. Finalized templates are then stored in a GitHub repository, which need to be approved by the MapSeries administrator before release. This way, the application is open to collaboration with other institutions as the GitHub repository allows anyone to propose changes and additions to the data stored within. Moreover, it also helps to track the history of changes to the template data.

The catalogue record templates are created in the administrative module through a table for entering data related to a specific map sheet, such as the map sheet designation, name, code and identifiers of a given geographical area and it also allows to interconnect corresponding fields in the bibliographic record. For example, if the cataloguer selects one of the predefined corporate

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11 https://ogre.adc4gis.com/
12 https://github.com/moravianlibrary/mapseries-data
authors in the prepared template in field 110, the location and language information in the field 008, the information about responsibility in field 245 and the publisher information in field 264 are all changed automatically. The templates are currently written in Czech and designed in accordance with the MARC21 format and Aleph library system. This, unfortunately, limits the current compatibility of the tool with other library systems; addressing this issue might be the direction of further development.

Unlike the administrative module, the module for cataloguers is open without the need to log in. After selecting the right map series and choosing a specific map sheet, the user gets a window with the predefined template which, among other things, already contains the bounding box metadata, information on the map scale and other data elements. The template then allows the user to enter metadata specific to the edition of the map sheet they are currently cataloguing. Subsequently, the cataloguer has to copy the record into their library system. Unfortunately, the way the Aleph cataloguing module works with Windows clipboard requires that the simple AlephClipboard\textsuperscript{13} application be installed on the cataloguer’s computer. This application, developed by the Moravian Library, tests whether a record in the MARC format has been inserted into the Windows clipboard. Once it detects a MARC record in text format in the clipboard, it changes the identifier of the data type in the clipboard to one recognized by the Windows cataloguing module client of Aleph and allows users to paste the entire record from the clipboard directly into the Aleph cataloguing interface. Because of the special way Aleph treats the 008 field, users must still copy and paste the 008 field separately. This specific aspect of the workflow is particular to the Aleph library system, but different solutions can be developed for other systems if necessary.

The newest addition of the MapSeries tool, the presentation view, was developed by the Moravian Library in 2018. This section was designed for public online presentation of map series from the Moravian Library’s collection and is, too, based on a map view. A home page with thumbnails of

\textsuperscript{13} https://github.com/moravianlibrary/AlephClipboard
individual map series with their names and short descriptions leads users to OpenStreetMap with an overlaid index. After selecting a particular map sheet, the tool offers all available editions of the given sheet, in chronological order. For each map sheet, there are thumbnails and key information that describe it. The users will also find links to the library catalogue and links to the digital library. Unfortunately, some of the digitized map sheets are copyright protected. Such maps are available only as thumbnails and can only be studied within the building of the Moravian Library.

![Figure 7: MapSeries presentation part. Selection of map edition.](image)

**Scale Calculator**

As noted above, information on the map scale is one of the most important data elements for both map identification and ranking of the search results. Unlike today, when a graphical scale is used or the scale is printed as 1:M, cataloguing old maps brings new challenges: the cataloguers often come across maps that have scale value written only in old units or there might simply be no scale at all. As the scale indicates the ratio between the reduced map image and reality, it gives users an approximate idea of the level of detail of the map being viewed and must not be omitted from the bibliographic record.

In 2018 the Moravian Library developed a simple tool, Scale Calculator\(^\text{14}\), which helps cataloguers calculate a map scale or to convert it through the metric system into a current scale format. The tool design was unified with the MapSeries tool, so the base map is a dominant element of the Scale Calculator as well. Cataloguers can switch from the underlying OpenStreetMap to current Orthophoto map or to the Base map of Czech Republic 1:10 000 for better orientation. The only other part of the tool is a sidebar made for converting scale values. If the scale of the map being catalogued is not specified on the map at all, the distance between two selected points has to be physically measured on a processed old map and this value has to be then entered into the corresponding form field in millimeters. In the second step, the cataloguer has to

\(^{14}\) https://scale-calculator.mzk.cz/
mark the corresponding points on the current map with a mouse. Thus the map scale will be calculated and displayed in the 1: M format.

Figure 8: New Scale Calculator tool design.

In the case of old maps with a graphical scale, the cataloguer selects the unit and the system of measurement used on the processed map. Then the cataloguer has to measure the length of the graphical scale and writes this value in millimeters into the corresponding field on the right sidebar. When the number of the graphical scale units is written in the second field, the scale of the catalogued map is calculated in the 1: M format. The Scale Calculator allows working with units used in Central Europe from the 18th century until the introduction of the metric system. So far it contains Czech length units used until 1765, Moravian units used from 1758, Slovak-Hungarian units from the 18th and 19th centuries, Silesian units used until 1750, and Prussian units from the 18th century. It also contains length units used in the Lower Austrian measurement system which was being introduced in the individual countries of the Habsburg monarchy since the second half of the 18th century and the metric system introduced in Austria-Hungary in 1871. The works of Gustav Hofmann (Hofmann 1984), Alexander Hůšťava (Hůšťava 1972) and Ivan Hlaváček (Hlaváček, Nový & Kašpar 2002) were used to create this converter. The Scale Calculator cannot of course replace the more accurate cartometric analysis, but provides an approximate calculation which is quick and accurate enough for cataloguing old maps.

Conclusion

Thanks to the participation in many related projects and the cooperation with multiple partners, the Moravian Library could bring together librarians, cartographers, and computer scientists to greatly influence the way old map collections are now processed and presented online. These activities also helped the Moravian Library establish a sustainable infrastructure for cataloguing, digitisation, and presentation of old maps. Further efforts will be directed towards greater interoperability, simpler work for map cataloguers and a more sophisticated research environment for users. Using MapSeries to process cartographic materials held in other memory institutions such as archives and museums seems to be a promising possibility. However, both Czech
museums and archives would first need to define and approve relevant cataloguing rules. Further development in the accessibility of maps stored in Czech archives depends on the finalization and approval of standards for describing cartographic documents which would be complementary with the Basic Rules of Archival Processing (Wanner 2013) and which should subsequently be implemented in emerging archival systems. The development of map collections in Czech museums cannot yet be foretold. In general, as in archives, it will depend on the standardization of their map records and the nature of their electronic catalogue systems. However, it is not possible to anticipate the integration of these resources in the foreseeable future just yet. In the meantime, the Moravian Library will strive to further improve its map tools and the relevant infrastructure in order to make accessible our cartographic heritage to cartographers, digital humanities researchers, as well as the general public.

References


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This article was funded by Institutional support for long term conceptual development of research organization (the Moravian Library) by Czech Ministry of Culture.