

Depiction of Line Features on Folded Maps on Example of Old Maps of the Vltava River

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Abstract: Under an ongoing research project being concerned with the Vltava river in Czech Republic, it is being dealt with various aspects of the riverine landscape, considering the significant changes that have taken place in its history and also the fact that the Vltava represents the most important and longest Czech river. This paper aims to introduce a narrow part of the ongoing research – selected old multi-sheet map works connected with the river and outline the process of utilizing similar cartographic works within greater projects processing geospatial data. These maps represent predecessors of general (‘military’) surveys of the whole Czech Lands and pose a great representative of hand-written large-scale maps created without any known geometric network and may be appropriately compared with the First Military Survey maps also lacking geometric network but bringing a great amount of topographic content.

Keywords: Topographic Maps, River Cartography, Folded Maps, the Vltava River, Bohemia, 18th Century

1. Introduction

Within the frame of the research project *Vltava – transformation of historical landscape as a result of floods, dams creation and land-use changes along with cultural and social activities in the river neighbourhood* funded by the Ministry of Culture of the Czech Republic, a large number of works, activities and phenomena connected with this important Czech river is being processed and researched.

The Vltava river represents the longest watercourse in the Czech Lands; it flows in the south-north direction roughly in the middle of the historic country of Bohemia and divides it into two halves, including its capital – Prague. The river has always been a major traffic artery and an object of special significance in both the nearer and wider surroundings, and its mapping was important not only from a purely hydrological, but also from a transport, economic and military-strategic point of view.

The object of interest is above all a pair of map works representing the Vltava River in a detailed scale over its entire length or at least in its substantial extent, both of them created in the latter half of the 18th century.

These maps were borrowed to be scanned by archival institutions, namely the National Archive of the Czech Republic in Prague and a department of one of the South-Bohemian regional archives, specifically the State Regional Archive in Třeboň, department in Český Krumlov.

In addition to these map works (which are without a signature, with incomplete dating and, first of all, hand-drawn), a number of other later maps, usually created after the establishment and putting into use of the so-called Stable Cadastre (1st half of the 19th century), have

been preserved. These later maps are usually based on cadastral maps of the Stable Cadastre, or are derived from later military survey maps. They do not show the river before industrialization.

Old river maps in the Czech and wider Central European areas were mainly dealt with by experts from social and cultural geography, less by cartographers or hydrologists. Czech Social cartographers involve the Vltava mainly in broader land-use and landscape studies such as the one of Fialová, Chromý & Marada (2007) or Bičík & Kupková (2015), allowing international comparative studies as shows Munteanu (2014).

From the cartographic point of view, partial analyses of river development and its depiction in maps were processed by Grossmannová (2015) in the case of the Morava River, or Hásek (2013), who used MapAnalyst to demonstrate development of the river network in Northern Bohemia.

The part of the project dedicated to the old maps of the Vltava River is thus innovative in terms of the methods used, the works studied and the involvement of interdisciplinary methods.

Most of the work exploring the development of the river network and its mapping begins as late as the 19th century along with more accessible and accurate cartographic works. As far as the authors are aware, similar map works related to the Czech rivers of the 17th and 18th centuries were not the subject of a continuous scientific study in terms of both the hydrological and cartographic aspects of the subject.

2. Old Maps of the Vltava River

The Vltava or its important parts have been mapped since the Middle Ages, but a significant part of the maps has not been preserved up to now or they represent very small scale maps, unusable for detailed research of the riverine landscape.

In addition to the maps mentioned hereinafter, the Vltava or its parts also appears on the overview maps of various manors, which were created within the individual dominions and, of course, is entirely captured on the map sheets of the First Military Survey maps (Fig. 1). However, with regard to the scale, this mapping does not provide a completely detailed view of the landscape and industrial or agricultural objects in the vicinity of the river, although in a wider context it represents an essential cartographic source, which also depicts the landscape around the Vltava before the taking up of the industrial revolution.



Figure 1. Cut-out of the First Military Survey map – area of today's Kamýk Dam.

2.1 Map I

The map I is called “Böhmische Generalien Mappen – Darstellung des Moldauflusses” (Bohemian General Map – Depiction of the Vltava river; Fig. 2) and dates back to the middle of the 18th century.

The map was created in the form of a book containing twenty individual map sheets of about 45×29 cm. The map covers practically the entire economically interesting part of the river and displays the territory from Prague to Vyšší Brod, behind which it is slightly unexpectedly discontinued.

The subject of the display are paths, bridges and weirs, settlements or individual buildings, tributaries, shallows or sandbanks, towpaths, simplified land-use natures and other content.

The map sheets are accompanied by rich descriptions mainly in German, partially in French. No layout of sheets is given within the work.

2.2 Map II

The map II (Fig. 4) with the same name as map I contains the date inscription of 1768. The work presents one long map sheet with dimensions of approximately 475×70 cm and renders the section of the Vltava between the two largest towns – Prague and České Budějovice (Budweis).

At first glance, the deformation of the river flow in the west-east direction is evident, probably related to the limit of the width of the paper on which the drawing of the entire river had to be placed.

Also this map work is accompanied by descriptions in German and more frequently in French. In one of the text fields within map sheets there is stated (in translation from old French) that “the work represents an ideal map of the Vltava depicting the section from Prague to České Budějovice where the distances are measured ‘à la vue’ and are roughly exact. This means that the difference on the whole distance could be between four to six thousand *loises*”. Furthermore, the description says that “the map is designed to identify towns where there are the largest obstacles; water mills and locations that would be most convenient for setting up a supply warehouse”.

2.3 Processing the maps

Both maps were provided by the state regional archive in Třeboň – the department at the Český Krumlov Castle. They have been scanned and their digital images are processed for further use within the project. The maps are accompanied by descriptions in French (the maps state French engineers as the drawers) and also in German, which, at the time, was the official language of the Habsburg Empire.

The maps differ somewhat in the level of graphic processing, but also in the degree of accuracy and completeness of the state of things. The main difference, however, is the technique of processing a multi-sheet work, when map I represents separate map sheets, loosely interconnecting each other with a small overlap, while map II is processed in the form of a concertina book. This also has a major impact on the global map accuracy characteristics, and especially in the case of the map II, its georeferencing is a challenge. Closely constituted works are mentioned in the literature, but their processing is not a widely-resolved issue. In particular, map II represents a relatively unprecedented and interestingly rendered work in the Czech Lands environment, giving a new perspective on line phenomena such as the river.

The map I was georeferenced, with RMSE of individual sheets ranging from 120 to 450 metres. It is astonishing that some parts of the map do not bind together and allow for interstices where the river is not mapped. However, the geometric shape of the river is unlikely to be reduced.

the Vltava is shown with all the bends and surrounding terrain as it actually flows.

2.4 Map accuracy evaluation

According to the initial survey of the map, they are not aimed towards providing accurate geometric information about the course of the river and the elements located at its shores. In view of the absence of a geometric—geodetic network in the Czech Lands, which started to build up almost half a century later, this was only hardly possible in the conditions of the measuring techniques at that time.

While map I could be evaluated using mean standard error of position of the transformation of its individual sheets, which ranged between 250 and 950 metres, in map II this procedure could not be easily applied, or it would only be necessary to use the standard error of the north-south direction. Instead, a chart of the scale number was compiled for the entire flow, which is partially aligned in a straight line (Fig. 3). There is a strong fluctuation of the scale number and therefore a large mismatch of the accuracy of the map apparent across the

parts of the river course. The map contains a graphical scale bar that represents a value of approximately 28,000, but it is clear that the author of the drawing was unable to render the whole course uniformly.

These maps represent only a mere part of the cartographic heritage of the Vltava River, of which only a fraction has been preserved, while even a part of it is still awaiting its exploration and research. In 1770s, the subsequent step was the publication of a comprehensive map of the Vltava River on 41 sheets (sometimes called Ebert's Map after J. Ebert – the then director of water ways construction commission), which was a comprehensive and accurate work containing, besides the cartographic part, also descriptions of navigability terrain adjustments. Many more map works depicting the Vltava and especially works and constructions done to improve its navigability continued to be issued within the latter half of the 18th century and also during the whole 19th century, when, after 1840s, the precision and accuracy of the maps significantly improved involving the cadastral triangulation measurements.

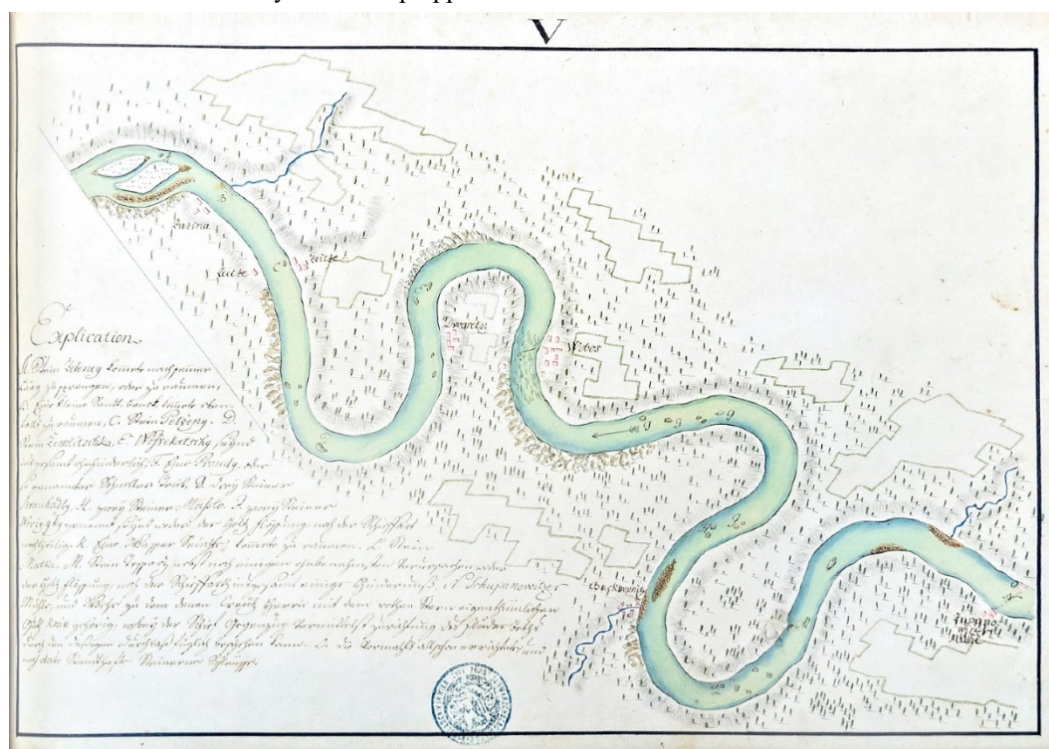


Figure 2. Fifth page from the book of map sheets (Map I).

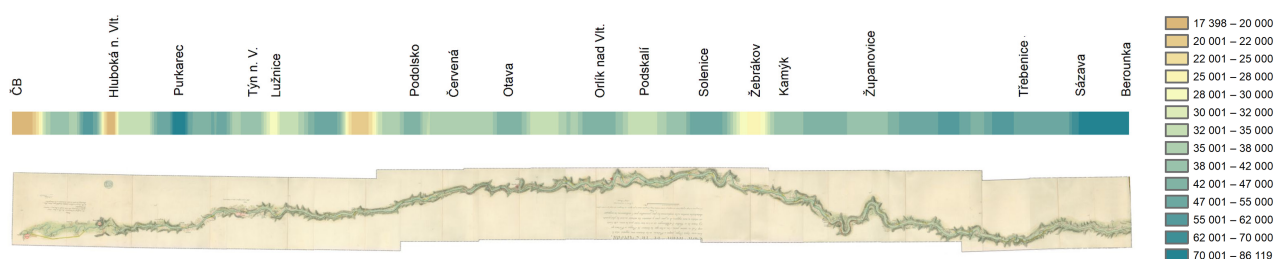


Figure 3. Progress of the scale number of Map II.

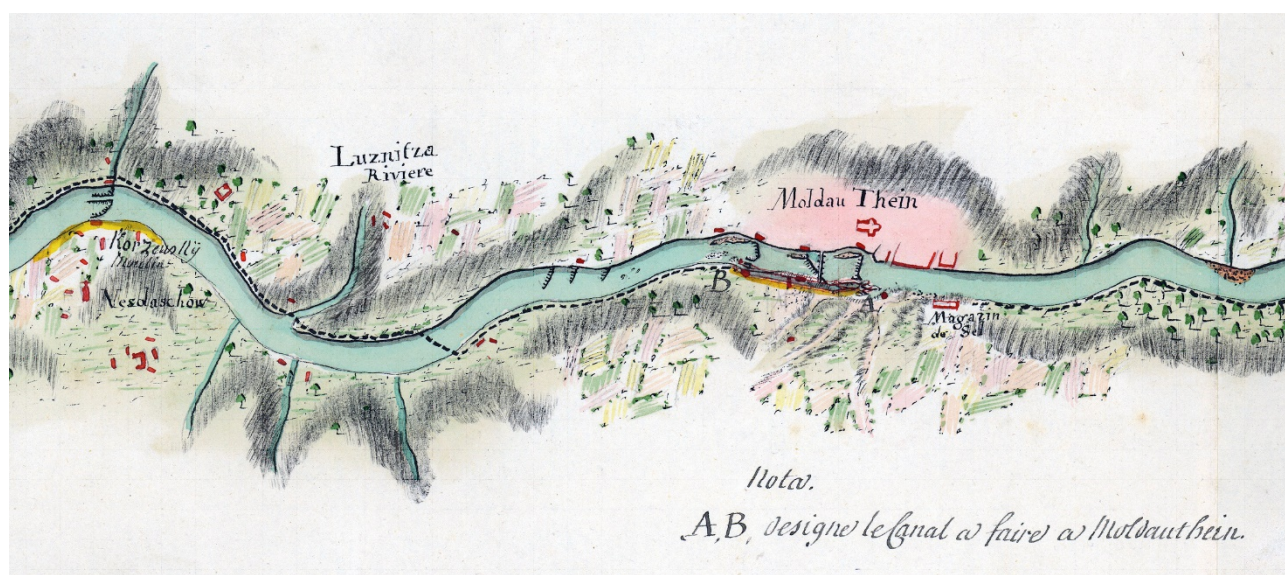


Figure 4. Map II – cut-out from an area of today's Týn nad Vltavou.

3. Conclusion

The maps are valuable for their thematic content, as they provide a view of the river and its surroundings (roughly a few hundred meters from the shoreline) at a time when no area-wide cartographic works for the Habsburg Empire (and even the Bohemia itself) are known, at least in a such detailed scale of around 25,000 in which the maps have been drawn. The content of a transport-economic significance in the form of riverine paths or structures of production is highly valued; on the other side the maps, for example, are completely lacking altimetry (when excluding rare hachures appearing in the Map I).

The subject of further research is also a relation to similarly drawn maps in France and other European countries. There may be a connection with selected map works compiled in Western Europe and these maps, to which, in addition to French descriptions and texts in maps and mutual contemporaneity, shows the fact that French measurers and military engineers participated in their processing, which emerges from the accompanying documentation. The fragmental state of the text sources does not yet allow to express more precise conclusions, though. Likewise, the involvement of French engineers in map creation corresponds to the involvement of French technicians in navigable works on the Vltava River in the second half of the 18th century

Analyses and georeferencing of these maps will contribute to the diversity of content processed within the above-mentioned project. It will also bring new insights into 18th-century cartographic techniques, which until now have been represented by only a few well-known and examined map works within the Czech environment, and will allow the next stage of study of the Vltava landscape as a natural, technical and social phenomenon.

4. Acknowledgements

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