

# MAPPING OF CZECH LANDS DURING THE 18<sup>th</sup> CENTURY

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## Abstract

The paper compiles the information on historical maps of Bohemia, Moravia and Silesia originated in the 16<sup>th</sup>, 17<sup>th</sup> and 18<sup>th</sup> centuries. The authors pay a special attention to the history of mapping of the Czech lands during the 18<sup>th</sup> century. The Müller's map of Bohemia at an approximate scale 1:132 000 originated in the years 1712 till 1718 as the result of the first systematic topographic mapping of the Czech lands. This map served as a base for the 1<sup>st</sup> Military mapping realized in the years 1763-1787 on the area of the whole Austro-Hungarian monarchy at scale 1:28 800 without any geodetic control. The paper presents a study of relations between the Müller's map of Bohemia, the maps from the 1<sup>st</sup> Military mapping and the present Basic map at scale 1:25 000. The test results are presented in a numerical and as well in a graphical form.

## INTRODUCTION

The maps of historical as well contemporary Czech Lands, i.e. Bohemia, Moravia and the Czech part of Silesia originated probably as a part of mapping of the Middle-European area at the beginning of the 2<sup>nd</sup> millenium, what results from some written sources (e.g. the chronicle of the Prague capitulary dean Kosmas from the beginning of the 12<sup>th</sup> century, which presents the geographic view of Bohemia gathered around by mountains). First preserved map documents appeared up to the 16<sup>th</sup> and 17<sup>th</sup> centuries as the works of individual cartographers, who necessarily based their maps on older map sources with a high informative value.

The series of preserved individual maps of Bohemia is represented in particular by the Claudianus' map of Bohemia from 1518. Its only one copy is kept in the episcopal library of the Litoměřice archdiocese in the Nord Bohemia. The topographic content of the map consists of 280 signs of topographic objects with their geographical names (from that 37 Royal towns, 53 feudal towns and 59 other towns and villages). The map scale is approximately 1: 637 000. The map was overprinted in the famous Münster's Cosmography. In the middle of the 16<sup>th</sup> century two other attempts were made to elaborate a new map of Bohemia (master of the Prague university Jan Zahrádka in 1545 and astronomer Tadeáš Hájek in 1563), which were not finished due to the lack of financial support. In the year 1568 Johann Criginger issued a map, which contains the sketch of 224 towns and villages at the scale approximately 1: 683 500. In comparison with the Claudianus' map, the Criginger's map shows more detailed altimetry which is given by the hill method. One copy of this map is kept in the library of the Prague Strahov monastery, the second one was found in Salzburg (Austria). The copy of the map is a part of the well known Ortelius Atlas Theatrum Orbis Terrarum. It was published in an improved form by the significant Dutch cartographer Gerhard Mercator as well. In the 17<sup>th</sup> century the Prague citizen Aretin issued a relatively detailed map of Bohemia (1619) with 1157 towns and villages, which was often published in Dutch and English atlases. The map scale was 1: 504 000. The map includes the political division of Bohemia into 15 districts. From other preserved maps we can mention the manuscript map prepared by Stich (1676) and the Vogt map (1712), which - except from towns and villages, rivers and main mountain chains - presents by conventional signs also the mining of mineral resources (gold, silver and other ores) and ironworks, glass factories and vineyards [1,2].

The oldest preserved map of Moravia is the map prepared in 1569 by Pavel Fabricius, who was a mathematician and the personal physician of the Emperor Rudolf II. The map includes as well a part of the Lower Austria and has an unusually large scale 1:288 800. The map shows 347 Moravian and 134 Austrian towns and other settlements and served evidently for military purposes due to the proximity of Moravia to Vienna, which was at that time threatened by Turkish troops. A very famous and most frequently published map of Moravia is the map prepared by the significant pedagogue Jan Amos Komenský (Comenius) at scale 1:470 000, which was for the first time printed in 1624 in Amsterdam. This map had been issued for 150 years in 101 editions from 12 original engravings.

The author of the first preserved map of the Czech and the Polish part of Silesia was Martin Helwig, the chancellor of the ecclesiastical school in Wroclaw. His map includes 242 towns, settlements, monasteries and castles. The map scale is 1:550 000; the map is oriented to the south and the altimetry is given by the hill method.

## MÜLLER'S MAPPING OF THE CZECH LANDS IN THE 18<sup>th</sup> CENTURY

The first systematic mapping of the Czech lands was done by the Austrian military imperial engineer, surveyor and cartographer Johann Christopher Müller, who lived in the years 1673 – 1721. He studied mathematics and map drawing by the Nürnberg astronomer and copper engraver G.C.Eimmart. After that he changed to military service at the imperial colonel L.F.Marsigli, who was an excellent natural scientist and geographer. Under his guidance Müller carried out astronomical measurements in Hungary and after the peace, concluded by Austria with Turkey in the year 1699, the mapping of new border areas, which fell to Austria. In 1708 he was entrusted by the elaboration of a big map of Hungary at scale 1:550 000, which included the territory of Slovakia as well.

Müller's further goal was to prepare a big atlas of the Austrian lands (Atlas Austriacus). The mapping began on the territory of Moravia, which was charted during the years 1708 – 1712 by individual regions at scale 1:180 000 and it was issued on 4 map sheets in the size 1374 x 974 mm. For mapping he used geodetic points, their position was measured astronomically. For drawing of topography he used the compass and the distances he measured by the number of turns of wheels of measuring cars pulled by horses.

The Müller's map of Moravia includes 3022 settlements, a nearly complete selection of water flows with their geographical names, but a relatively rare communication network. The altimetry is given by the hill method with western illumination. Geographic names of mountain areas and peaks are used quite seldom. In the map copies, printed from the original engravings after 1790, a rectangular orienteering grid was completed with letters and numbering, which enabled the search of the settlements in the index. For 10 years after its first printing the Müller's map of Moravia was protected by an imperial privilege against copying by foreign cartographers. Later it was captured by a number of European cartographic publishing houses. They issued on its base some map series, the most famous of them are the general map of Moravia and six special maps of Moravian regions, issued by the Nürnberg publishing house of J.B.Homann. These maps were additionally completed with geographic meridians and parallels.

The most popular work of Johann Christopher Müller is his map of Bohemia at scale 1:132 000, which consists of 25 map sheets in the size 557 x 473 mm. The whole territory of Bohemia takes up the total area of 2822 x 2403 mm. The map includes 12 493 settlements and contemporary administrative division of Bohemia into 12 regions. The map is drawn in the Cassini cylindrical projection with marked geographical meridians and parallels. The Müller's map of Bohemia includes the division of settlements into 10 basic categories (royal and other towns, towns with ramparts, townships, castles, mansions and knight palaces, small towns with a castle and a church, villages with a castle, villages with and without a church, individual farmyards, passable villages and scattered settlements). Further there are monasteries and lonely standing churches and farm buildings. Depicted are rivers and ponds, the altimetry is shown by the hill method. The thematic content of the map is very rich and it shows mining areas of various raw materials, glass factories, ferries, postal stations, medicinal and thermal springs, tilt-hammers, water mills, roads and vineyards. Geographical names are in German (Figure 1).



Figure 1 – A part of the Müller's map of Bohemia

The Müller mapping of Bohemia was guaranteed by the imperial patent of May 4<sup>th</sup>, 1712. The mapping proceeded step by step in individual regions until January 1718, when the fair draughts of all map sheets were finished. Then the maps were handed over to the regional commissioners for revision. As this action run into difficulties, Müller did the final revision himself and finished the final fair drawings in 1720 (incl. a map layout, called „compendium“). The copper engravings were done by the engraver M. Kauffer from Augsburg., who completed the maps by valuable engravings from V.V.Reiner (Figure2). At the beginning of 1721 Müller checked the engravings of the first 12 map sheets after original drawings. He did not live to see the printing of these maps, because he died on June 21<sup>st</sup>, 1721.

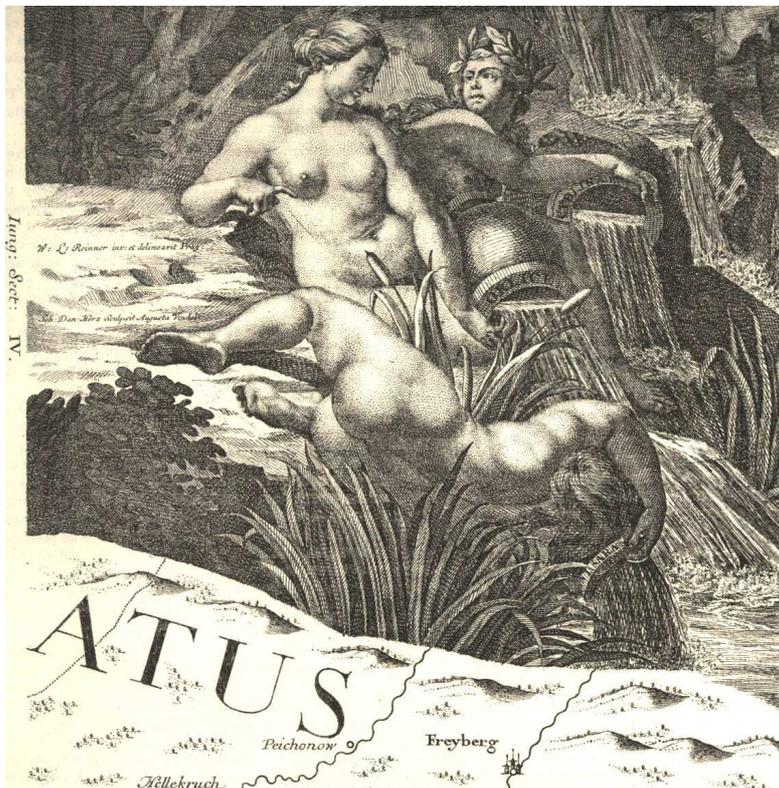


Figure 2 – Reiner’s engraving on the Müller’s map

Checking of remaining engravings and finishing of these works were taken over by a military engineer Johann Wolfgang Wieland. He was also charged with preparation of the printing of reduced map sheets at scale 1:231 000 and with elaboration of a general map of Bohemia at an approximate scale 1:650 000.

In the year 1720 Müller began to prepare the mapping of Silesia but it was not realized due to his death. The mapping had been entrusted to J.W.Wieland, who realized it during the period 1722-1732, when he finished all the map manuscripts. The maps included settlements, rivers and ponds, water mills, wayside inns and postal stations, sheepfolds and forests. The thematic content of these maps contained brickyards, paper mills, ironworks and mineral springs. The map scales were not unified and ranged at special maps between 1:93 000 and 1:154 000. The general maps were issued at scale approx. 1:577 000. The maps were issued until the end of 1736 in a form of 16 special and 2 general maps from engravings, prepared by the firm of J.B.Homann from Nürnberg. Wieland did not live to see the map printing, because he died in October 1736. Then the work was handed over to a military engineer Mathias Schubert, who checked in the next years all introduced maps. The results of his work were general maps of Lower Silesia (1745) and Upper Silesia (1746), issued by Homann. In 1752 all these Wieland’s maps were issued in the Atlas of Silesia.

## THE FIRST MILITARY MAPPING

Müller maps of Bohemia and Moravia are the first completed map work of the Czech Lands and they are the only maps available to the commanding officers of the Austrian army during the Seven Years’ War. While these maps step by step outdated and insufficiently corresponded to the needs of the military affairs and the development of the military techniques, the Empress Maria Theresia decided to elaborate a new integral map work of the whole territory of the Austrian Monarchy at scale 1:28 800. The scale was derived from the demand that the distance of one Vienna inch in

the map should equal to the distance of 400 Vienna fathoms (i.e.758,6 metres) in the reality, what corresponded to 1000 military marching steps.

The 1<sup>st</sup> military mapping was realized in the years 1763-1787. This mapping is also called Joseph's mapping, because it was finished by the reign of the Emperor Joseph I. As a graphical base for the mapping supposedly the enlargements of the Müller's maps were used [ 3 ] with graphically measured geodetic points, which Müller had determined astronomically. The mapping was done without any other geodetic control, in continuous map layout and supposedly with minimum of measuring. The territory of the whole monarchy was covered by 5400 map sheets, each of them included the area of approx. 209 sq km. A part of the 1<sup>st</sup> military map section is shown at the Figure 3.

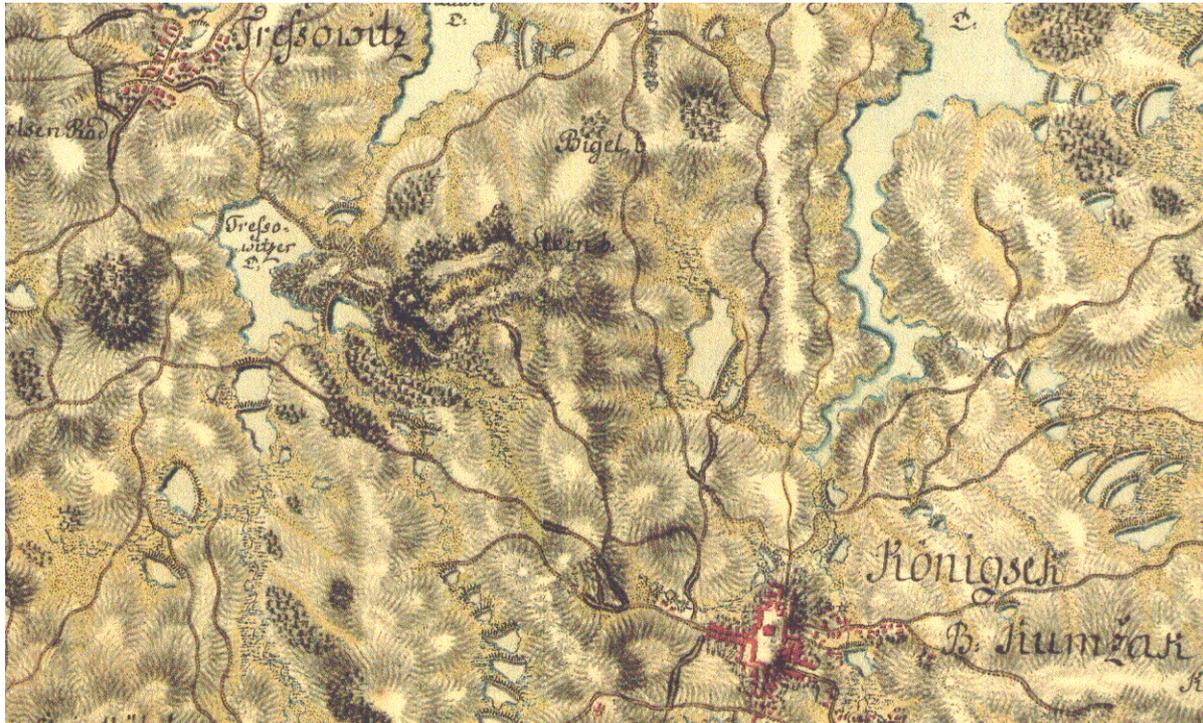


Figure 3 – A part of the 1<sup>st</sup> Military mapping – map section No. 245

The field mapping was done by imperial officers – military engineers, usually at a guess by riding on horses in the landscape (“à la vue” method), only some details were measured by spacing. The map content included settlements, roads and stone bridges, rivers, meadows, forests and grasslands. The altitude was presented by hachures, which indicated the topography of foots of significant terrain slopes.

## RESEARCH OF PRECISION OF THE MÜLLER MAP AND MAPS OF THE 1<sup>st</sup> MILITARY MAPPING

For verification of the relation between the Müller's map of Bohemia and the maps of the 1<sup>st</sup> military mapping a map cutout was chosen representing an area about 20 x 10 km of South Bohemian region (the surrounding of Jindřichův Hradec) [ 4 ]. In the testing area there were identified 29 settlements and their topographic positions on both maps were checked. It is necessary to mention that on the Müller's map of Bohemia the settlements are presented only by conventional signs (i.e. by a signature), while in the maps of the 1<sup>st</sup> military mapping they are shown by sketches of the settlements. The corresponding points were determined in such a way that the centre of the signature in the Müller's map was matched to point situated in the centre of the settlement. It was mostly the village square, the church or the crossing of main roads passing through the village. Consequently, a corresponding point was identified in the present Basic Map of the Czech Republic at scale 1:25 000.

The corresponding part of the Section XIII of the Müller's map at scale 1:132 000 was scanned and enlarged in the program Adobe Photoshop into the scale 1:28 800. This procedure followed the technology, which was supposedly used for the preparation of graphical map base for the 1<sup>st</sup> military mapping [3]. The enlarged Müller's map was printed on the plotter Hewlett-Packard.

Further the corresponding area on the maps of the 1<sup>st</sup> military mapping, i.e. on parts of the Sections 235 and 245 (Theil des Bechiner Crayses) was scanned and imported into the program Adobe Photoshop. After a digital montage of both map sheets it was printed in the original scale on the plotter Hewlett-Packard as well.

Four printed map sheets of the present Basic map of the Czech Republic at scale 1:25 000 were put together and the tested plane coordinates were compared with the enlargement of the Müller's map and with the maps of the 1<sup>st</sup> military mapping.

On the copies of the enlarged Müller's map of Bohemia at scale 1:28 800 the plane rectangular coordinates of the centre points of 29 selected villages were recorded using a digitizing device. The testing of plane coordinates was done in the digitizing device coordinate system. The same process was followed at the montage of the maps of the 1<sup>st</sup> military mapping at scale 1:28 800 and on the montage of the Basic maps of the CR at scale 1:25 000.

Successively the Helmert planimetric coordinate transformation was done in the program GEUS, on one hand between the coordinates checked on the Basic map of the CR at scale 1:25 000 and on the maps of the 1<sup>st</sup> military mapping at scale 1:28 800, on the other hand on the enlargement of the Müller's map into scale 1:28 800. The identical points for the transformation were selected in the centres of the villages Schamers – Číměř (point No.1) and Königsek – Kunžak (point No.10).

The results were graphically presented in the program OCAD

- a) by topographic data matching of villages depicted on the Basic map of the CR and corresponding villages depicted on map of the 1<sup>st</sup> military mapping and depicted on the enlargement of the Müller's map (Figure 4) and
- b) by topographic data matching of villages depicted on the enlargement of the Müller's map at scale 1:28 800 and corresponding villages depicted on the map of the 1<sup>st</sup> military mapping (Figure 5).

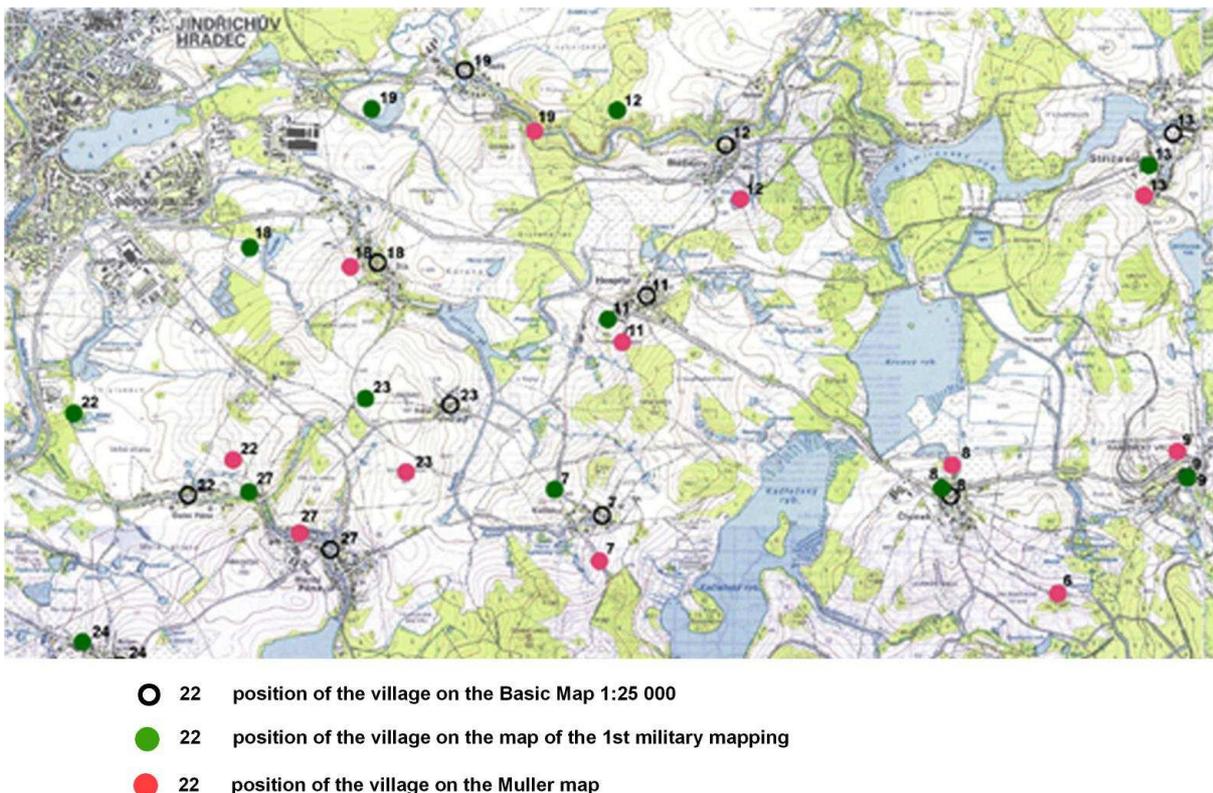


Figure 4 – Positioning of villages on the Basic Map 1:25 000

It was assumed, that the topographic position of the villages on maps of the 1<sup>st</sup> military mapping is more precise than their position on the Müller's map. The average deviation in positions of 29 checked points was 626 metres with extreme values up to 1564 metres. The positioning of villages on the Müller's map showed the average deviation 705 metres with extreme values to 2260 metres.



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## BIOGRAPHY OF THE PRESENTING AUTHORS

### **MIKŠOVSKÝ, Miroslav**

Born on 3.6.1932 in Prague, Czechoslovakia. He graduated from the Faculty of Land Surveying of the Czech Technical University in Prague (1950-54). He worked as a cartographer at Kartografický a reprodukční ústav (Cartographic and Map Printing Institute) in Prague (1954-56) and at Ústřední správa geodézie a kartografie (Central Office of Geodesy and Cartography) in Prague (1956-70). Further he worked as the technical director of the publishing house Kartografie Prague (1971-85), the director of the Research Institute of Geodesy, Topography and Cartography in Zdíby (1986), the general director of the Geodetic and Cartographic Enterprise in Prague (1987-90) and the technical director of Kartografie Prague, Inc. (1991-92). From September 1992 he is teaching at the Czech Technical University (CTU), Faculty of Civil Engineering in Prague and at the West-Bohemian University, Faculty of Applied Sciences in Plzeň.

He got the degree Engineer of Geodesy and Cartography (1954), Candidate of Technical Sciences – equivalent to Ph.D (1967) and Associate Professor of Cartography and Remote Sensing (1993).

He was a member of the Scientific Council of Geology, Geography and Mining of the Czechoslovak Academy of Sciences (1972-76), a member of the Scientific Council of the Dean of the Faculty of Civil Engineering (1997-99) and a member of the Academic Senate of the Faculty of Civil Engineering of CTU (1999-2002). He is until now a member of the Scientific Council of the Research Institute of Geodesy, Topography and Cartography in Zdíby, the Chair of the State Commission for MSc.degrees and a member of the Commission for Ph.D degrees at the Faculty of Civil Engineering CTU.

He worked from 1967 actively in the International Cartographic Association (ICA). He is the founding member of the ICA Commission on Map Production Technology (the member from 1972, the Vice-Chairman 1989-91, the Chairman 1991-95). In 1997 he received the ICA Honorary Fellowship. He worked from 1964 actively in the Czechoslovak National Committee on Cartography (the Secretary 1964-67, the President 1971-78 and 1982-90). From 1993 he is the President of the Cartographic Society of the Czech Republic.

He published more than 230 scientific works and articles, from its more than 60 were published abroad.

### **ZIMOVÁ, Růžena**

Graduated from the Faculty of Civil Engineering of the Czech Technical University in Prague in 1981 (MSc. degree, Ing., specialization Geodesy and Cartography). For approx. 10 years worked at the Geophysical Institute of the Czechoslovak Academy of Sciences, Dept. of Seismology. Since 1992 she has been teaching cartographic subjects at the Department of Mapping and Cartography, Faculty of Civil Engineering, CTU Prague. In 2001 she finished a doctoral degree study in Geodesy and Cartography (CTU Prague) and received a title Ph.D. For 1996-2001 she cooperated on the EU Phare projects for the Czech Office for Surveying, Mapping and Cadastre carried out by international experts from the EU countries. Since 1999 she is active as an executive secretary of the association Nemoforum founded in the Czech Republic as a national platform for discussion, co-operation and co-ordination of activities related to land- and real estate information. She is a member of the Cartographic Society of the Czech Republic, since 2002 in position of an executive secretary. Her pedagogical and research activities are focused on cartography, digital cartography, coordination of GI, spatial data infrastructures.

She published almost 50 scientific works and articles, from which more approx. 10 were published abroad.