Alžběta Brychtová*, Angeliki Tsorlini**

Differences of Ptolemy based cartography of Central Europe with respect to recent Czech Republic representations

Keywords: Ptolemy's Geographia; Ptolemy maps; Greater Germania; map comparison; optimal fitting.

Summary
Claudius Ptolemy "Geographia" is a fundamental geographic and cartographic work of the 2nd century A.D. which influenced European cartography of the Renaissance. Ptolemy can be considered as one of the first who gave a "concrete" cartographic evidence to the region of central Europe a part of which is covered by today's territory of the Czech Republic. In this paper, we deal with the study of the correspondence between coordinates of geographic place positions given in "Geographia" for the region of "Great Germania" and their depiction on drawn maps, comparing ancient Ptolemaic representations with recent maps which recall Ptolemy's toponymy and identification of ancient toponyms with their modern counterparts.

Introduction

Ptolemy, in his *Geographia,* describes for the first time, textually and numerically, the geography of the known World in the 2nd c. A.D., by giving a list of geographic coordinates of spherical longitude and latitude of almost eight thousand point locations, on the earth surface, known at his times. These points are referred to geographic sites (i.e. towns, mountain ranges, river mouths, promontories and other) and their geographic coordinates, rounded-off in five minutes of arc, in both orthogonal primer directions (parallels and meridians), are following the known Ptolemaic reference system of parallels and meridians, the origin of which are respectively close to actual Equator and close to the Canary Islands almost 18 degrees west of today's origin at Greenwich (Dilke 1985, Harley and Woodward 1942).
In this paper, which is based on the research carried out the last years by the Cartography Group in the Faculty of Surveying Engineering at Thessaloniki, the interest was focused on Ptolemy's coordinates given in *Geographia* for the actual territory of Czech Republic and the correspondence of Ptolemy's toponyms with their modern counterparts was investigated by comparing ancient Ptolemaic representations with recent maps which recall Ptolemy's toponymy.

Area of Interest

Ptolemy can be considered as one of the first who gave a cartographical evidence of the region of Central Europe and nowadays Czech Republic. Geographia is a valuable artefact for the perception of history of this area since there is no other cartographical document dating from the 2nd century A.D., i.e. Ptolemy's era. During this period the territory of Central Europe was inhabited by Germanic tribes, in Czechia especially by Markomanni and Quadi, and a characteristic feature of this era is the interaction between those tribes and the Roman Empire (Čapka 2008).

* BSc Geography and Geoinformatics, Palacký University, Olomouc, Czechia [alzbeta.brychtova@upol.cz]
** Surv. Engineer, MSc Carto & Geogr., PhD, Aristotle University of Thessaloniki, Greece [atsorlin@topo.auth.gr]

Numerical and textual information about this area are contained in Book II, chapter X and the reference map is Tabula IV of Europe (Figure 1-2). In this case, we are talking about almost 200 pairs of coordinates, which refer to the regions of the current modern states of Germany, Poland, Czechia, Slovakia and partly to Hungary and Austria.

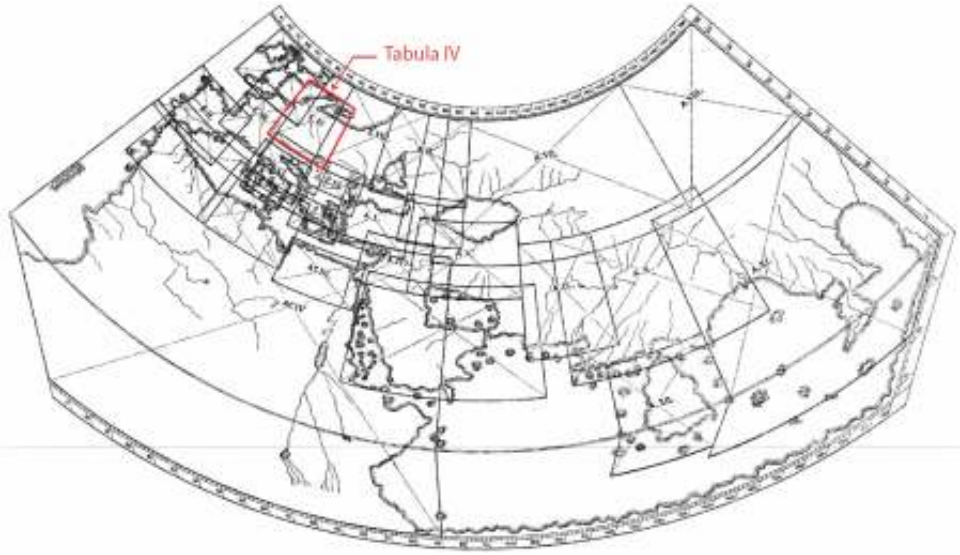


Figure 1. Tabulae in Ptolemy's Geographia. Tabula IV of Europe is highlighted with red colour.

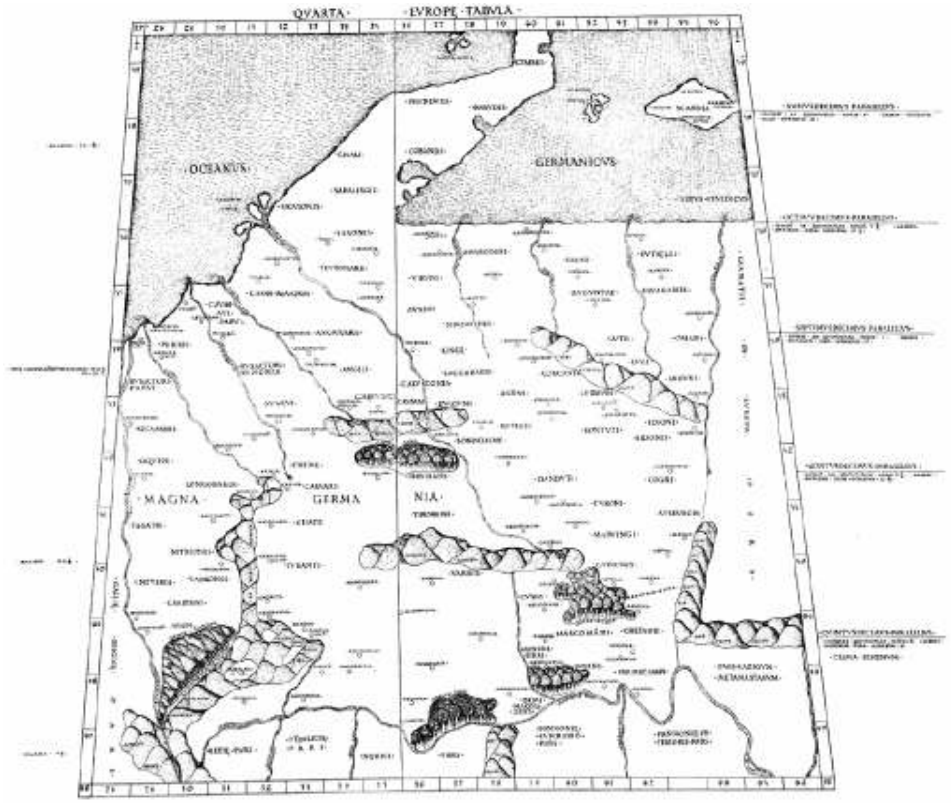
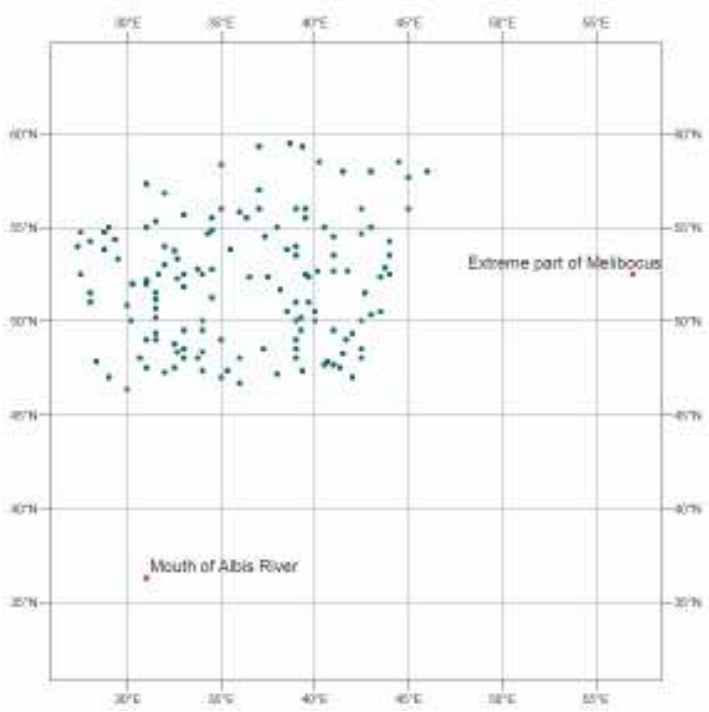


Figure 2. Tabula IV of Europe - Greater Germany.

Ptolemy coordinates

Stevenson's English translation of the Donnus Nicolaus Germanus mid-15th century manuscript of Ptolemy's Geographia (Codex Ebnerianus) was used for the purposes of the current study. Coordinates given in the text were digitized into a database and then projected onto a map. This step helped find gross displacement errors which were corrected through the comparison with other editions of *Geographia*. Mistakes in gazetteer of toponyms were probably caused by inaccurate transcription of the manuscript. In our case, two gross errors were first detected visually, namely "mouth of Albis river" and "extreme part of Melibocus river"[1], and then corrected by cross checking coordinates from six other editions of Ptolemy's Geographia, which are:

(a) the Vatopedian Codex, 13th - 14th century
(b) the Marciana Codex, 15th century
(c) the Urbinas Graecus 82, 13th century
(d) the Rome Edition, 1478
(e) the Ulm Edition, 1482
(f) the Venice Edition, 1598



	λ	φ
Stevenson's Edition	31:00	56:15
Vatopedion Codex	31:00	56:15
Marciana Codex	31:00	56:15
Urbinas Codex	31:00	56:15
Rome Edition	31:10	56:00
Ulm Edition	31:00	56:30
Venice Edition	31:00	56:15
corrected coords	31:00	56:15

Extreme part of Melibocus

	λ	φ
Stevenson's Edition	57:00	52:30
Vatopedion Codex	44:00	52:30
Marciana Codex	37:00	52:30
Urbinas Codex	37:00	52:30
Rome Edition	37:00	52:30
Ulm Edition	37:00	52:30
Venice Edition	37:00	52:30
corrected coords	37:00	52:30

Figure 3. Visualization of coordinates given in Stevenson's edition. By visual control, two gross errors were detected and then corrected by checking coordinates in six other editions of Geographia.

Figure 4 shows the spatial distribution of toponyms of Greater Germania in context of all European toponyms. Points in this figure are visualized raw, without any correction, just as they were given in Geographia, following the reference system of parallels and meridians, the origin of which was placed in 0°N, 17°39'46''W. The mismatch between point position and modern coastline is obvious.

[1] The English translation of the names of the toponyms are coming from Stevenson's edition of Ptolemy's *Geographia* (Stevenson 1991).

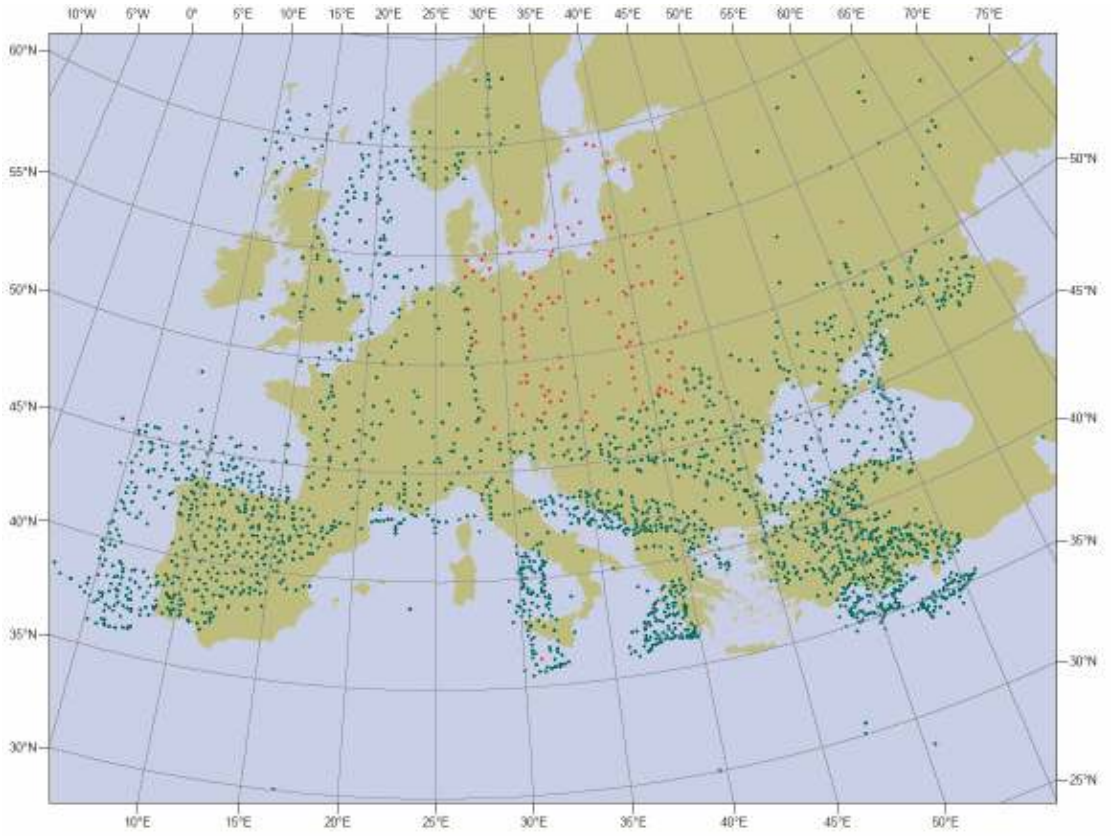


Figure 4. Visualization of coordinates (raw data) given in Book 2 and 3 of *Geographia* concerning all European regions. Greater Germania is highlighted in red colour. Both longitudinal and latitudinal displacements with respect to the coastline are obvious.

The distribution of coordinates and toponyms given in the gazetteer is not uniform. The density of them depends on the knowledge rate or importance of a specific region in Ptolemy's ages. Numerical representation of this predication is shown in Figure 5. The density of coordinate pairs is expressed as a number of points per square degree, which is due to longitudinal and latitudinal mistakes, the only relevant unit for that purpose.

Greater Germania, the area of interest in this study, described in Book II, Chapter X, shows one of the lowest density of toponyms which is less than 1 toponym per 1°x1° square in average, compared to Mediterranean regions which are of high density (such as Hispanic Tarraconensis, Corsica, Sicily and all regions of modern Greece). The average density, Europe-wide, is about 3 points per square degree.

Book	Chapter	Tabula of Europe	Region	Count of points	Area [square degrees]	Density [points/ square degree]
2	1	1	Hibernia island of Britannia	43	23	2
	2		Albion island of Britannia	134	78	2
	3	2	Hispanic Baetica	105	15	7
	4		Hispanic Lusitania	70	69	1
	5		Hispanic Tarraconensis	339	16	21
	6	3	Aquitanian Gaul	35	21	2
	7		Lugdunansian Gaul	39	30	1
	8		Belgic Gaul	50	42	1
	9		Narbonensian Gaul	62	22	3
	10	4	Greater Germania	143	193	<1
	11	5	Raetia and Vindelica	23	7	3
	12		Noricum	17	5	4
	13		Upper Pannonia	29	7	4
	14		Lower Pannonia	33	9	4
	15		Illyria or Liburnia and Dalmatia	78	20	4
3	1	6	All Italy	187	29	6
	2		Corsica Island	52	3	15
	3	7	Sardinia Island	63	8	8
	4		Sicily island	111	9	13
	5	8	Sarmatian Europe	73	204	<1
	6		Tauric peninsula	33	7	5
	7	9	Iazyges Metanastae	10	3	4
	8		Dacia	52	36	1
	9		Upper Moesia	18	6	3
	10		Lower Moesia	56	11	5
	11		Thracia and the Peninsula	70	16	4
	12	10	Macedonia	166	21	8
	13		Epirus	45	7	6
	14		Achaia	253	22	12
	15		Crete island	65	4	16

Figure 5. The European regions described in Geographia. The table shows the number of toponyms in each region, the approximate area given in square degrees and the density of points for each region.

Fitting Ptolemaic maps to the coordinates

Although all editions of Ptolemy's Geographia are derived from one primal publication, the cartographic representations of geographical places in the various editions suffer significant differences from numerical representation of those places given in the gazetteer by longitude and latitude coordinates. This fact can be proved by analysing variations between coordinates, as listed in Ptolemy's Geographia, and the same positions as they are graphically depicted in the later derived Ptolemaic maps. The comparison can be done only after georeferencing of maps to their proper coordinates.

In order to study differences in positioning, a gazetteer of toponyms from Stevenson's edition was used together with a digital copy of De Turre's Tabula IV (Rome 1490) taken from Nordenskiöld's (1978: 163-4) facsimile atlas. For this purpose, we use the method of 'georeference' as applied in modern cartography. De Turre's map, which has no reference to some geographic parameterisation, is transformed in its 'geo-parametric' form by calibrating points of known coordinates. The used points could be:

(a) punctual geographical places (i.e. towns, promontories, debouchments)

(b) intersections of the meridians and parallels as depicted on the map

In both cases the fully legitimate assumption is that, in the calibration process, the assigned values of coordinates are unprojected geographic coordinates referred to a sphere of unit radius. For the optimal fitting of the map using (a) punctual geographical places, a reference map derived from a list of coordinates given in Stevenson's edition was prepared (Figure 6) and for map fitting according to (b) intersections of graticule, a grid of parallels and meridians has to be constructed in the digital copy of that map, since the original map doesn't contain them. For the best fitting of the map, in both cases, a 2nd order polynomial transformation model was used (Boutoura and Livieratos 2006: 60-70). The map georeferencing process is shown in Figure 7.

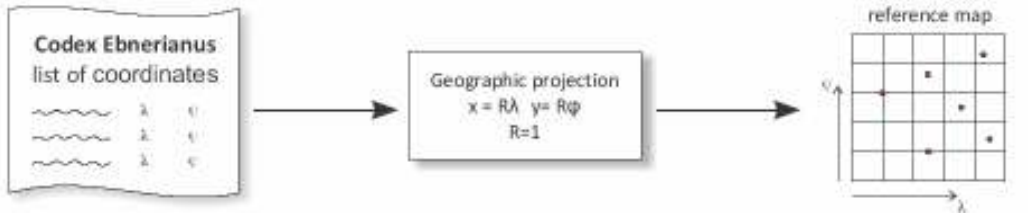


Figure 6. The construction of the reference Tabula IV map, from the coordinates given in Ptolemy's text.

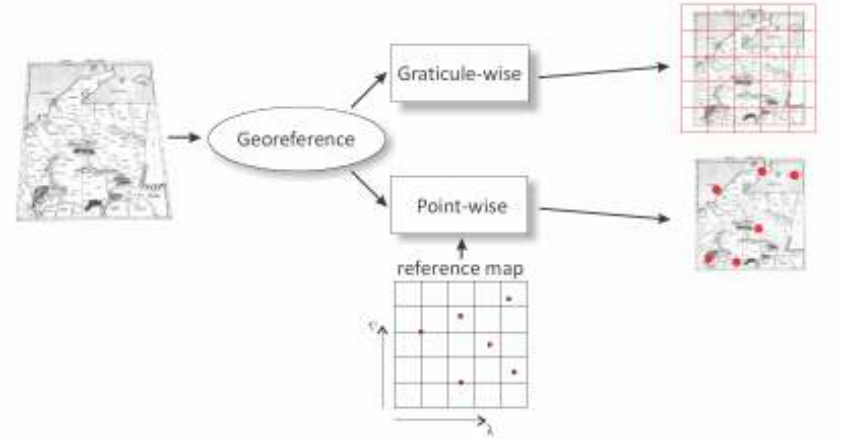


Figure 7. The point-wise and the graticule-wise georeference of de Turre's Tabula IV representation.

Comparing the two calibrated map-images, by a proper optimal fitting, we obtain the resulting field of displacements as shown in Figure 8.

The displacements in the two maps calibrated by two different methods (point wise and graticule wise) are more evident in Figure 9. The results show an inconformity between the two methods of calibration described above, which raise uncertainty on how the coordinates listed in Geographia were graphically transferred on the Ptolemaic maps. The displacements are not bigger than 10'. It is obvious that the majority of displacement arrows belong to category 0-5'. Taking into account that coordinates given in Geographia are rounded-off in five minutes of arc, the category of 0-5' cannot be considered as a mistake of graphical transfer of coordinates. Arrows in the category of 5,1-10' occur in the northern and southern margins of the map. Those displacements should be ascribed to the lack of points for map fitting on the borders. It can be estimated that the construction of the map quite follows Ptolemy's instructions on map construction.

The reference map (Figure 6) was used in order to test the fitting of de Turre's Tabula X representation in both point-wise and graticule-wise georeferencing. The results are shown in Figures 10 and 11. Arrows of displacements show differences between coordinates given in Germanus's Codex Ebenerianus and later Ptolemy based map of De Turre's Tabula IV.

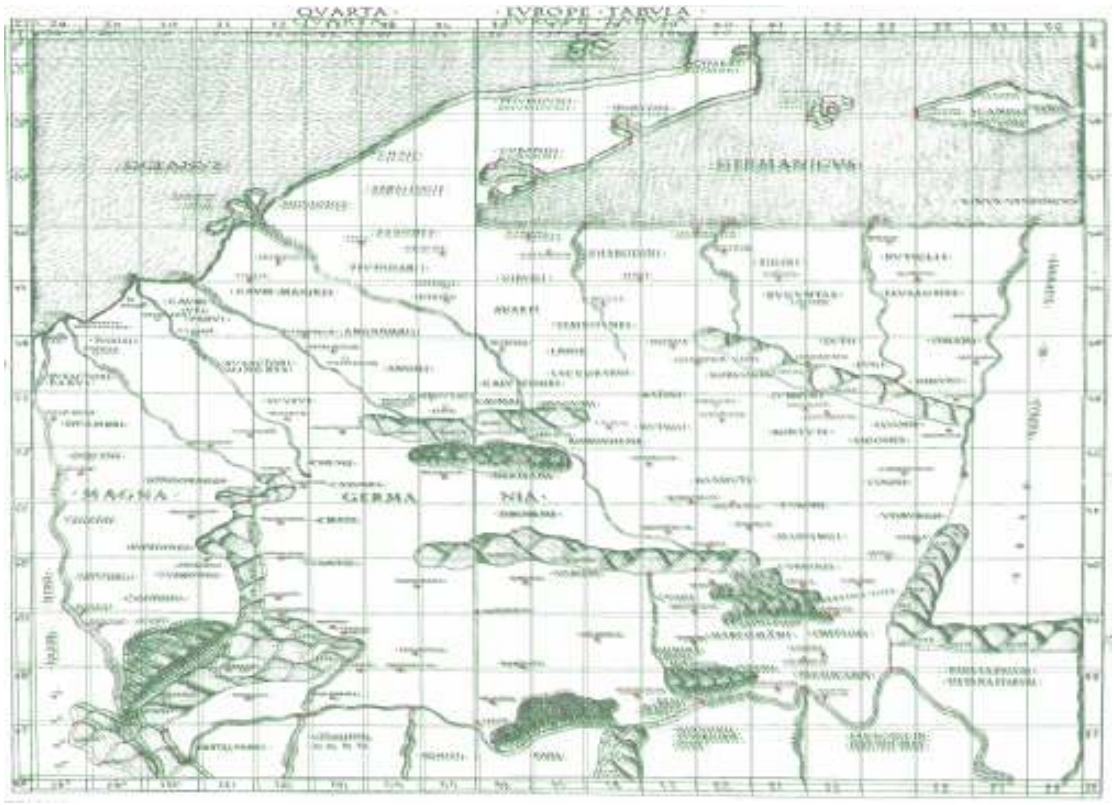


Figure 8. The comparison between point-wise and graticule–wise georeference of de Turre's Tabula IV representation. The deviations between the locations are depicted in red.

Figure 9. Deviations between point-wise and graticule-wise georeference of de Turre's Tabula IV. Green arrows show displacements lower than 5' of arc, red arrows show displacements 5,1'-10' of arc.

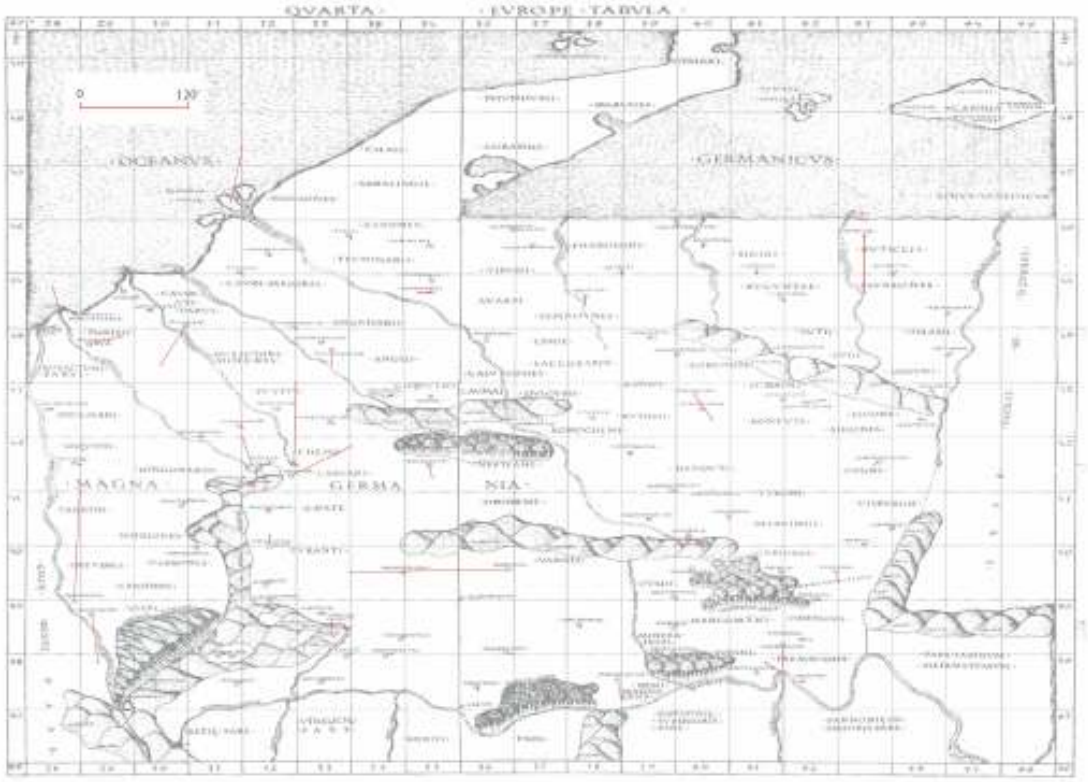


Figure 10. Displacements of points in graticule-wise georeference of De Turre's Tabula IV to the reference map derived from coordinates given in Stevenson's edition. The graticule of the reference map coincides with the graticule of digital version of Tabula IV, so there is no displacement.

Figure 11. Displacements of toponyms (red arrows) in point-wise georeferencing of De Turre's Tabula IV to the reference map derived from coordinates given in Stevenson's edition. The displacements in the intersections of the grid traced in digital version of Tabula (green arrows) are small.

Figure 12. Arrows of displacement for (a) graticule-wise and (b) point wise georeference of De Turre's Tabula; picture (c) shows displacements of the intersections of parallels and meridians of the graticule of the reference map.

The identification of ancient toponyms in later Ptolemaic maps

An interesting procedure is to identify ancient toponyms with their modern counterparts. An important intermediate procedure is to compare Ptolemaic maps with modern maps influenced in toponyms by Ptolemy, trying to find out their cartographical relationship (e.g. geometry, terminology). For this purpose De Turre's Tabula IV was used, as a representative of Ptolemaic maps, together with three later maps from the 19th century having the modern coastline but containing Ptolemy's toponyms. These maps are briefly described here:

(a) Germania magna: quae nunquam romanis paruit, D. and W. W. Macpherson (1806)

(b) Orbis Romanus ad Illustranda Itineraria, P. Lapie (1845)

(c) Germania Magna : Rhaetia, Noricum and Pannonia, O. Lindley, G. Welland (1857)

How the real connection is between those maps and Ptolemy's Geographia is not clear. By the fact that Ptolemy had influenced almost all cartography production of several centuries, it can be assumed that those maps are also derived from Geographia, but this is not for sure and maybe it will never be.

According to different mathematical bases (different coordinate system and prime meridian) of these three maps, they were digitally transformed to the same graticule using intersections of parallels and meridians as control points. By examining the transformed maps it was found that contrary to the coastlines and the rivers, which fit very well in all three cases, the positions of toponyms differ from case to case.

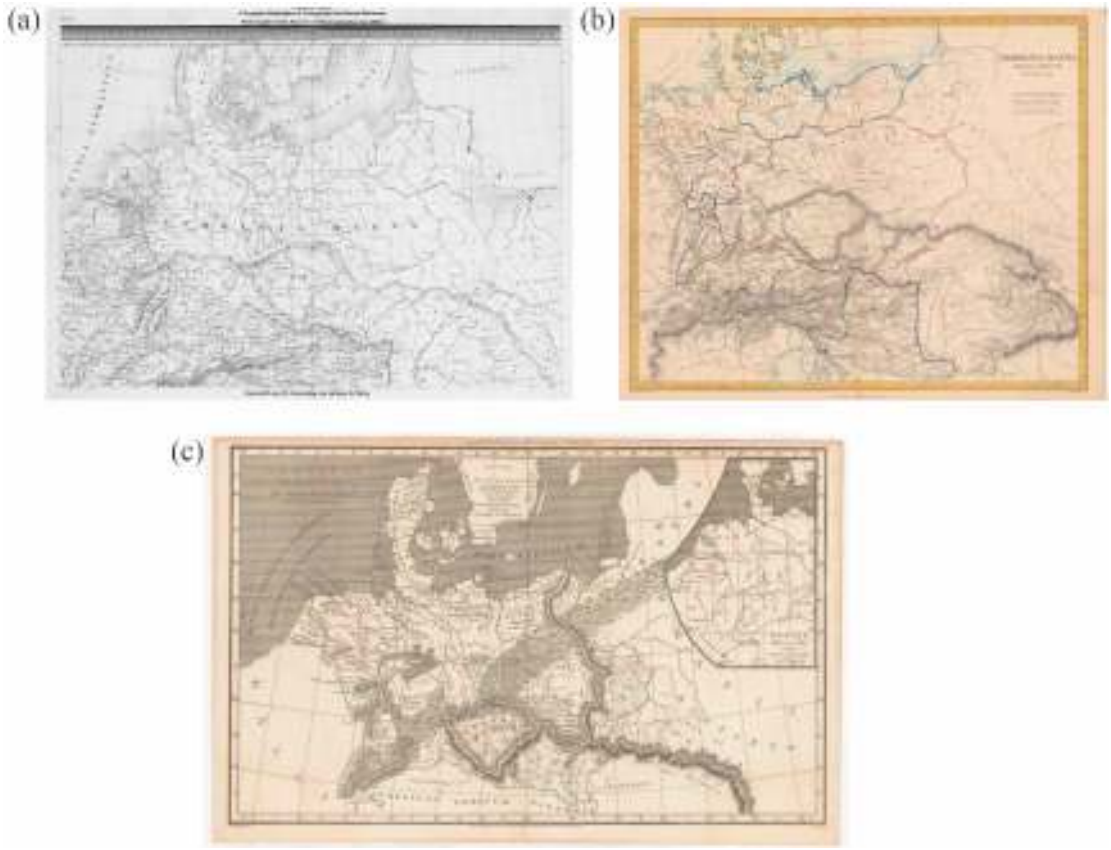


Figure 13. 19th century maps containing Ptolemy's toponyms: (a) Orbis Romanus ad Illustranda Itineraria, P. Lapie (1845), (b) Germania Magna: Rhaetia, Noricum and Pannonia, O. Lindley, G. Welland (1857), (c) Germania magna: quae nunquam romanis paruit, D. Macpherson, W. W. Macpherson (1806).

Figures below show differences between positions of toponyms of the aforementioned maps. For the comparison, only toponyms mentioned in Ptolemy's Geographia were used. The 19th century maps describe all the area that is also described by Tabula IV, but they do not contain all toponyms given by Ptolemy. There are also some other "non-ptolemaic" toponyms. The density of the map content differs from case to case.

In the view of the fact that Ptolemy coordinates show big inaccuracy in longitudinal and latitudinal parameters (Fig. 4), the only correct way for the comparison of an ancient map with the modern coastline is to fit the ancient map to the modern maps using as control points the identical toponyms. In the best fitting procedure, a 2nd order polynomial transformation model was used with 26 toponyms as control points. (Boutoura and Livieratos 2006: 60-70). The results of the best fitting procedure in its case, together with the common toponyms and their place in each map, are shown in the Figures that follow (Figs. 14-20).

Figure 14. Displacements of toponyms between Lapie's map (base) and Lindley&Welland's map. There are 32 punctual places (towns) named with Ptolemy toponyms which are common in both maps.

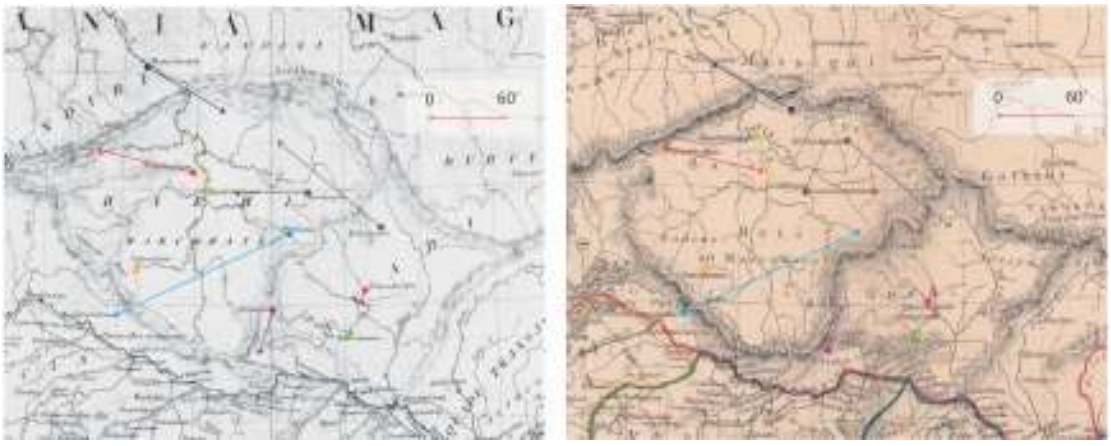


Figure 15. Displacements of toponyms between Lapie's map (left) and Lindley&Welland's map (right) focused on region of Bohemia and Moravia. For better perception, each toponym is depicted with different colour.

Figure 16. Displacements of toponyms between Lapie's map (base) and Macphersons's map. The Macphersons's map contains only 5 punctual places named with Ptolemy toponyms.

Figure 17. Displacements of toponyms between Lapie's map (left) and Macphersons's map (right) focused on region of Bohemia and Moravia. Only one toponym is common in the two maps.

Figure 18. Displacements of toponyms between Lapie's map (base) and De Turre Tabula IV. Lapie's map contains 32 punctual places (towns) named with Ptolemy toponyms.

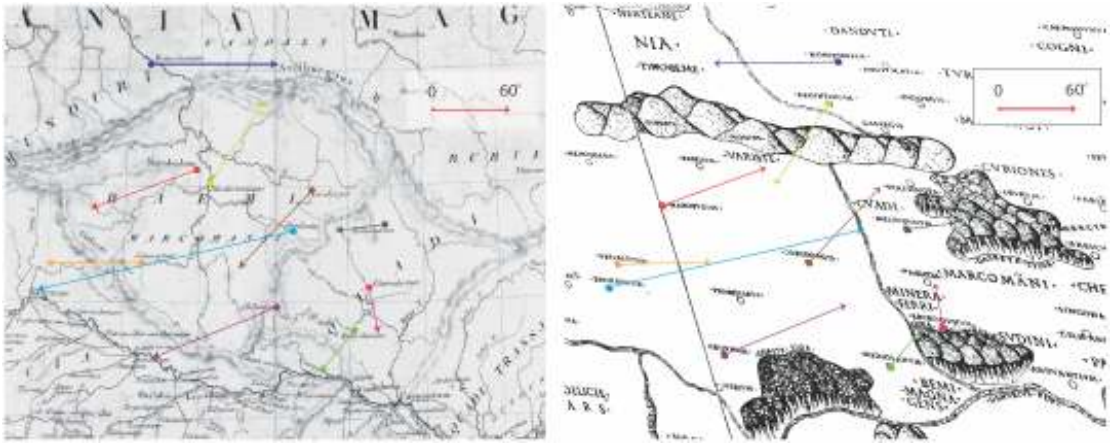


Figure 19. Displacement of toponyms between Lapie's map (left) and De Turre Tabula IV (right) focused on the region of Bohemia and Moravia.

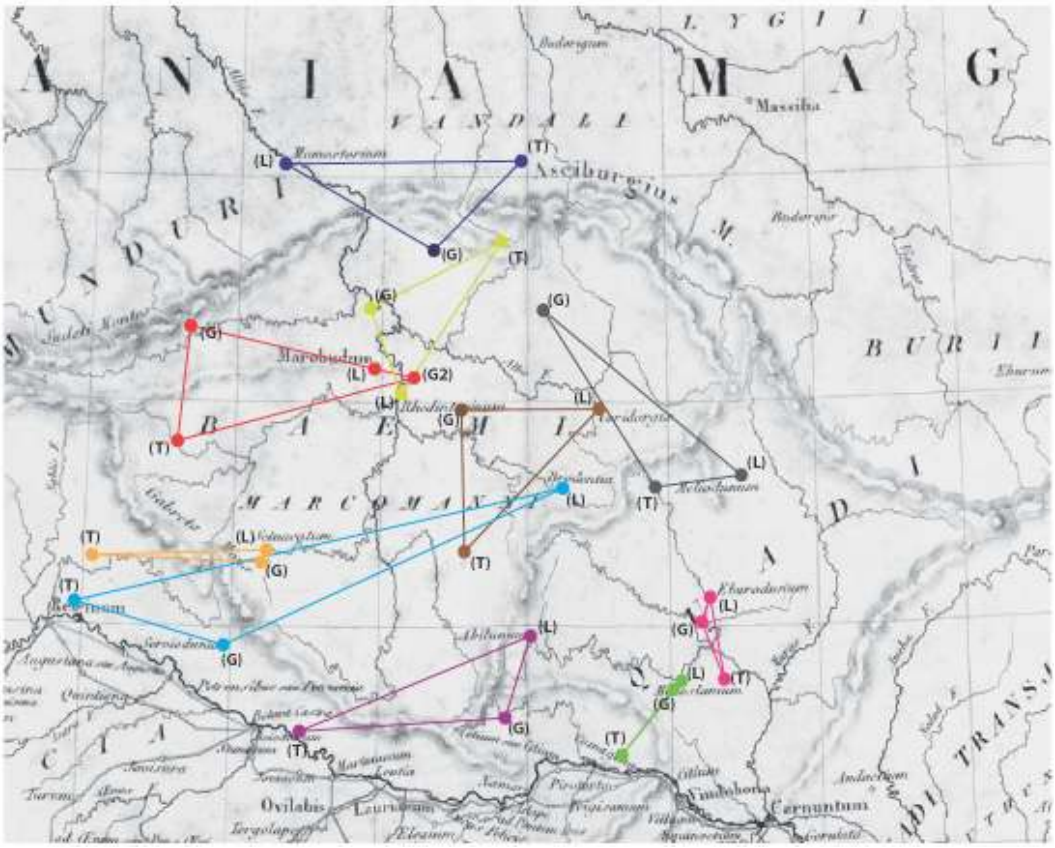


Figure 20. Localization of toponyms given in all mentioned maps on a base of Lapie's map (base), focused on the region of Bohemia and Moravia. (L) - Lapie's, (T) - De Turre's, (G) Lindley&Welland's, (G2) Macpherson&Macpherson's map.

The identification of ancient toponyms with their modern counterparts

Cooperation with historians and archaeologists and geodetic analysis of ancient maps can bring more light into the identification of historical sites. Some of the ancient cities mentioned by Ptolemy, are known since either they exist today (Thessaloniki, Veroia etc.), or they are identified through important findings (e.g. inscriptions) during archaeological excavations (Dion, Pella etc.).

However, many of Ptolemy's ancient cities are still unidentified. (Livieratos at. al. 2008: 36, deals with region of nowadays Greece)

Ptolemy was not the first ancient author, describing Central Europe, specifically the territory of Bohemia, Moravia and Silesia. His importance consists in fact because thanks to him we have for the first time at our disposal a series of toponyms, c. 30, attested in the middle of the 2nd cent. AD or earlier, which can be related with more or less probability to this territory. (Blažek 2005:1). Toponyms given in Geographia describe towns, rivers, mountain ranges and tribes.

Identification of toponyms is not an easy process. The area of interest had suffered great changes during the centuries. It is rather surprising that only one of Ptolemy's toponyms, namely Albis/Albia/Elbe/Labe (the biggest river of region), still exists at present time. There were at least three changes of dominant inhabitants in the Bohemian-Moravian area, from Celts (Boii) to Marcomanns, from Marcomanns to Langobards, from Langobards to Slavs. It is natural that the probability of preserving old toponyms is lower. The interruption in continuity of toponyms could be caused by dramatic reduction of the settlement (Blažek 2005: 12).

This project is focused on identification of 10 toponyms within the region of nowadays Czech Republic. No one of those toponyms could be directly identified with any modern site since there is no nomenclative similarity.

According to Blažek's research (2005) there are two authors, which described possible localization of Ptolemy's toponyms. Connections of 10 selected ancient toponyms with modern places are shown in Figure 21.

Ptolemy toponym	Localization according to Šimek (1935)	Localization according to Řehák and Květ (1993)
Momestorium	Zalužany	Praha - Zbraslav
Marobudum	Upper Malše	Plzeň
Setuacatum	Cham / Freudenberg	Domažlice
Brodentia	Tábor[2]	
Rhedinturium	Přešťovice	Stradonice
Coridorgis	Vitorazsko	Ševětín
Meliodunum	Špilberk / Obřany	Soběslav - Veselí n. Lužnicí
Eburodunum	Vyšehrad / Klášťov	Blučina - Brno
Medoslanium	Znojmo[3]	
Abilunum	no information about possible localization found	

Figure 21. Localization of the selected toponyms with modern names of cities. (Blažek 2009: 4-7)

Figures 22 and 23 show the identification of Ptolemy toponyms in the context of a modern map. Focus is put on the area of nowadays Czech Republic. Identification comes from localization of toponyms concluded in the previous section with comparing different Ptolemaic maps (Fig. 20) and from localizations that are allocated from Fig. 21.

[2] unverified source of information
[3] Peřinka 1904

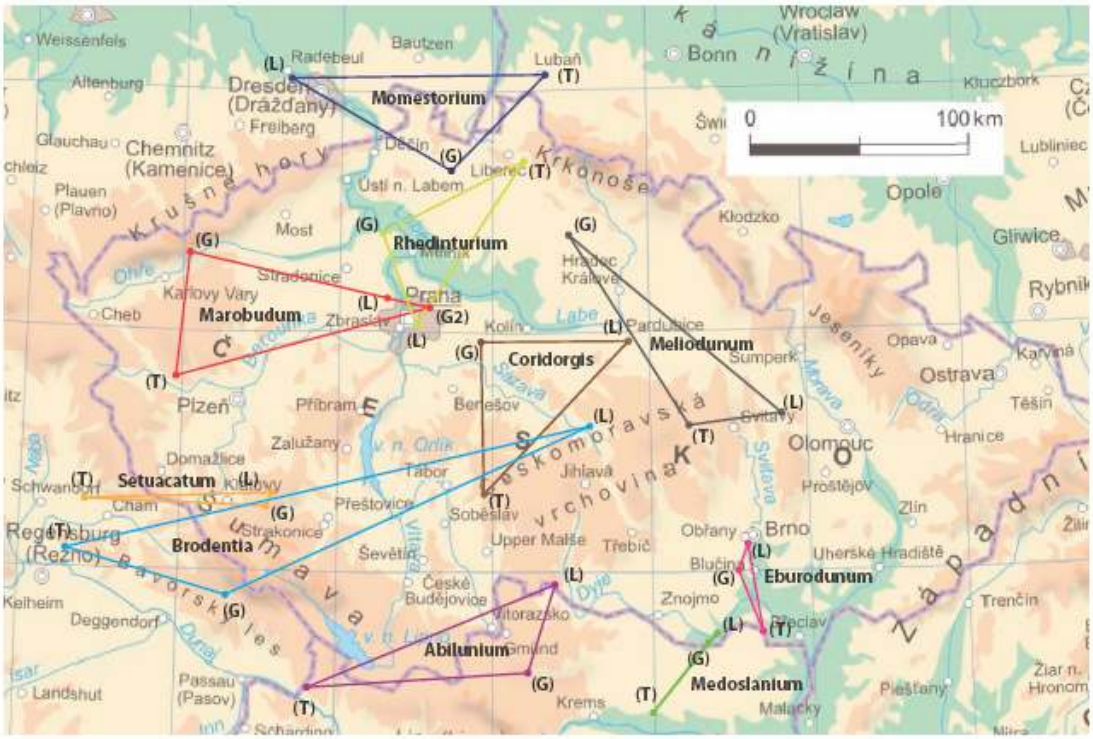


Figure 22. Localization of toponyms detected from Lapie's (L), De Turre's (T), Lindley&Welland's (G) and Macpherson&Macpherson's (G2) maps placed on the modern map of Bohemia and Moravia.

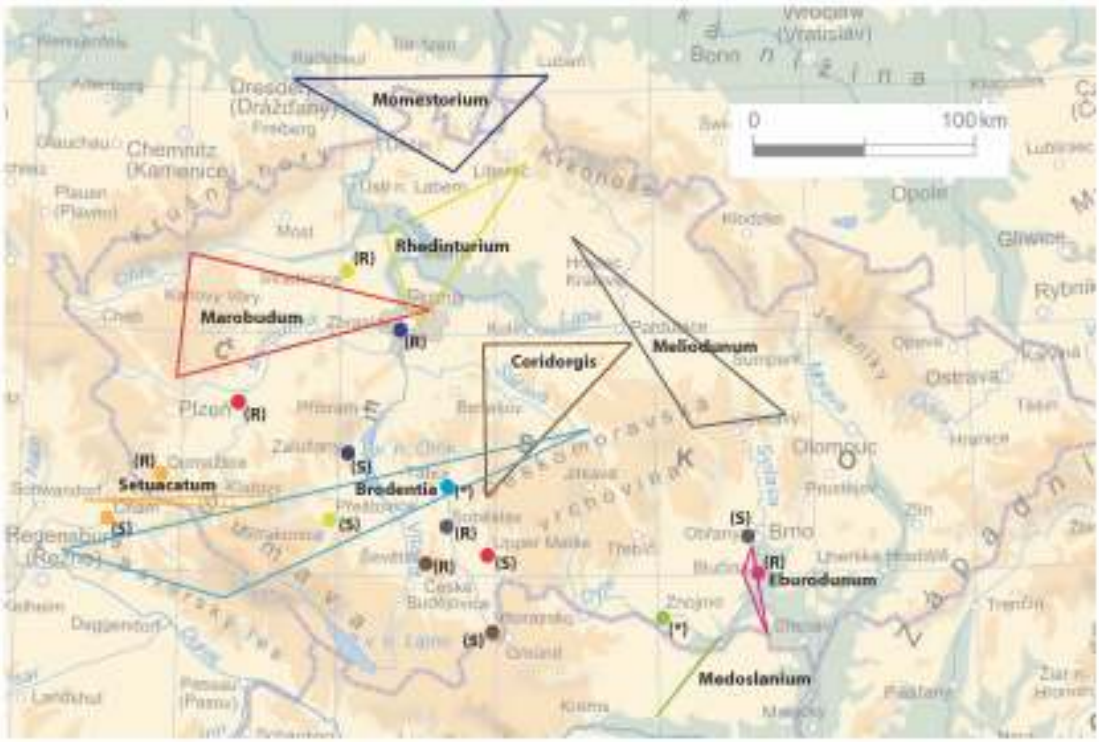


Figure 23. Possible locations of Ptolemy sites according to Šimek (S), Řehák and Květ (R), other or unverified sources (*) and the triangles of the toponyms detected from Ptolemaic and 19th century maps (Figure 22) placed on a modern map of that area.

By visual control of the previous outputs is clear that information about localization of Ptolemy sites represented by Blažek, didn't coincide with the localizations of toponyms that resulted from the comparison of the maps. Some concordance can be found in localization of Eburodunum in the Lindley&Welland's map and in the description of Řehák and Květ in Blažek about the same toponym, in the localization of Setuacatum according to De Turre's representation and Šimek's and Blažek's research and in the localiztion of the toponyms, Setuacatum and Medoslanium, in Lindley&Welland's and Lapie's map. Apart from the ten toponyms that were selected to be studied in this paper, Blažek presents several other toponyms which could have connection with the region of Bohemia and Moravia, but according to their depiction on Ptolemaic maps they don't fit at all.

In respect of big displacements of toponyms depicted in all used maps and sites localized by Blažek (2005), the result of this study brings plenty of questions about the localization of ancient sites and it could be poorly used for any archaeological research. But it is necessary to have in mind the world knowledge status in 2nd century A.D. and that the area of Greater Germania didn't belong to the broadly explored regions. Geographia is still a valuable artefact in the perception of history of this area.

Conclusion

The advances of digital computational and visualization technologies are massively available today allowing new approaches and techniques in studying such an extraordinary document of our cartographic heritage as Ptolemy's *Geographia.* A document survived and influenced many cartographers for many centuries.

The transformation of early maps into digital form and their comparison with modern maps using new processing methods and technologies is of great importance for the study of the geometric properties of early cartographic documents. Best fitting techniques are appropriate in order to compare early cartographic representations with their modern counterparts and identify ancient places with their modern counterparts.

References

Boutoura C., Livieratos E. (2006). *Some fundamentals for the study of the geometry of early maps by comparative methods*. e_Perimetron, Vol. 1, No. 1, 60-70.

Blažek V. (2005). Etymological analysis of Toponyms from Ptolemy's description of Central Europe. CELTO-SLAVICA Colloquium, Coleraine, Northern Ireland, 19 – 20 June.

Čapka F. (1998). *Dějiny zemí Koruny české v datech*. Praha: Libri. 820 p.

Dilke O.A.W., 1985. Greek and Roman Maps, Cornell University Press, Ithaca, New York.

Harley J. B. and D. Woodward, 1942. History of Cartography, Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean, Vol.1, The University of Chicago press, Chicago and London.

Livieratos E. 2006. Graticule versus point positioning in Ptolemy cartographies. *e_Perimetron* 1 (1): 51-59 [In digital form www.e-perimetron.org].

Livieratos E. 2006. On the Study of the Geometric Properties of Historical Cartographic Representations. *Cartographica (volume41, issue2)* 165-175.

Livieratos E., A. Tsorlini, C. Boutoura 2006. Coordinate analysis of Ptolemy's Geographia Europe Tabula X with respect to geographic graticule and point positioning in a Ptolemaic late 15th century map. ICA - First International Workshop *Digital Approaches to Cartographic Heritage*, Thessaloniki, 18 – 19 May. Published in *e_Perimetron* 2 (2): 80-91 [In digital form www.e-perimetron.org].

Livieratos E., A. Tsorlini, C. Boutoura, E. Manoledakis, 2007: Ptolemy's *Geographia in Digits.* ICA – 2nd Joint International Workshop Digital Approaches to Cartographic Heritage – A digital Look to Righas Charta, 1796-97, Athens, 18-19 May.

Manoledakis M., E. Livieratos 2006. On the digital placement of Aegae, the first capital of ancient Macedonia, according to Ptolemy's *Geographia*. ICA - First International Workshop *Digital Approaches to Cartographic Heritage*, Thessaloniki, 18 – 19 May. Published in *e_Perimetron* 2 (1): 31-41 [In digital form www.e-perimetron.org].

Peřinka V. (1904). *Vlastivěda Moravská, Místopis, Znojemský okres.* Brno: Musejní spolek v Brně, http://www.archive.org/details/vlastivdamoravs19brngoog (09/12/2009)

Tsorlini A., E. Manoledakis, C. Boutoura, E. Livieratos 2007: Thessaloniki Project on Ptolemy's *Geographia,* 22nd International Conference on the *History of Cartography*, Berne, 8-13 July.

Editions of Ptolemy's Geographia:

Stevenson E. L., ed. 1991. *Claudius Ptolemy, The Geography.* New York: Dover.

Vatopedion Codex 655, 13th century, in facsimilae, Athens: Militos Publ.

Marciana Codex 388 (Codex CCCLXXXVIII),15th century in facsimilae, Athens: Militos Publ.

Fischer J., 1932. Claudii Ptolemaei Geographiae codex Urbinas graecus 82 : phototypice depictus consilio et opera curatorum Bibliothecae Vaticanae. Lugduni Batavorum, E. J. Brill, Ottonem Harrassowitz, Lipsiae.

Theatrum Orbis Terrarum Series of Atlases in facsimile, 1966. Claudius Ptolemaeus Cosmographia (Claudii Ptolomei Alexandrini Cosmographia... Arnoldus Buckinck E Germania Rome…), Domitius Calderinus of Verona, trans. Jacobus Angelus, Arnold Buckinck & Conrad Sweynheym, Rome 1478. Introduction by R.A. Skelton. Reprint by Theatrum Orbis Terrarum Ltd, Amsterdam.

Theatrum Orbis Terrarum Series of Atlases in facsimile, 1963. Claudius Ptolemaeus Cosmographia (Claudii Ptolomei…Cosmographie...Opus Donni Nicolai Germani Secundum Ptolomeum Finit. Anno MCCCCLXXXII. ... Impressvm Ulme Per Ingeniosum Virum Leonardum Hol. Prefat. Oppidis Civis.), Lienhart Holle, Ulm 1478. Introduction by R.A. Skelton. Reprint by N. Israel & Meridian Publishing CO., Amsterdam.

Ruschelli G., 1564. La Geografia Di Claudio Tolomeo Alessandrino Nuovamente Tradotta Di Greco In Italiano, Da Ieronimo Ruscelli..., Appresso Giordano Ziletti, Al Segno Della Stella, In Venetia.

Maps:

De Turre, 1490. Tabula IV Greater Germania, Rome edition.

Nordenskiöld A. E. 1978. Facsimile. *Atlas to the early history of cartography.* New York: Dover.

Lapie P., 1845. Orbis Romanus ad Illustranda Itineraria, Paris.

Lindley O., G. Welland, 1857. Germania Magna: Rhaetia, Noricum and Pannonia, London. In digital form: http://cartotecadigital.icc.cat/ (01/11/2009)

Macpherson D. and W. W., 1806 Germania magna: quae nunquam romanis paruit, London. In digital form: http://cartotecadigital.icc.cat/ (01/11/2009)

Bičík I. at al. (2001). Školní atlas dnešního světa. Praha: Terra, 183 p.