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Georeferencing the topographic map of Walachia (1855–1864)

Keywords: Austrian topographic surveys; Fligely, Szathmáry

Summary: During the Crimean War (more accurately between 1855–1858) the Austrians surveyed Walachia, with August von Fligely as the leader of the topographic survey. They made a map of 112 sheets at a scale of 1: 57 600. The Walachian government bought the rights to copy the original Austrian map. Szathmári Pap Károly (Carol Pop de Satmari) lithographed the Romanian version, which was published in 1864. This was the first detailed Romanian topographic map of Walachia.
The authors are working on georeferencing and publishing on the web Szathmári's map. In this paper the authors relate the actual situation of their project. The authors describe the circumstances of survey and of map-making, give the datum and projection of the map. The authors present the methods of finding, scanning and georeferencing the maps, their plans to publish the georeferenced map sheets on web.

Historical background, topographical precedents

At the Balkan Peninsula in the 18th and 19th centuries the Ottoman Empire was in decline, the Habsburg Empire and the Russian Empire became stronger. Walachia (now the southern part of Romania) was a vassal state of the Ottoman Empire, but sometimes it was occupied by Austrians or by Russians. Between 1718 and 1739 Lesser Walachia (the western part of Walachia, now Oltenia) was under Habsburg rule, during this time Friedrich Schwantz made a simple topographical map of it in 1722. Between 1769 and 1774 Russia occupied Walachia, Friedrich Wilhelm von Bauer made the map for them, in 1781. The first detailed topographical survey and map of Walachia was made by the Austrians during their occupation between 1788–1792, the map was made by Specht at a scale of 1: 57 600, and it could be considered as part of the First Military Survey of the Habsburg Empire. (Docan 1912, Băcilă 1931, Buchholtzer 1937: 81–85, Popescu-Spineni 1978: 180–191, Timár 2008b)

The circumstances of the beginning of the survey

In July 1853, Russia occupied the Danubian Principalities (Moldavia and Walachia) which were under Ottoman control. Turkey declared war to Russia in October 1854 and many European powers, like Great Britain and France, supported Turkey. During this war, Austria remained neutral but as a peacekeeping force it occupied Moldavia and Walachia from August 1854. Thus, the location of the war moved to the Crimean Peninsula, that is why the name of the war is the Crimean War. Russia was defeated; the Treaty of Paris was signed in March 1856. The Austrian army left the Danubian Principalities in March 1857. (Tarlé 1952, Scafeş–Zodian 1981: 148–161, Ionaşcu – Bărbulescu – Gheorghe 1975: 157, Boicu 1972)
In April 1855 the Austrians offered to the governments of Moldavia and Walachia to make the topographic survey of their territory. The Moldavian government rejected the offer (that is why Moldavia wasn't surveyed), but Barbu Stirbey, the Prince of Walachia, agreed to it. Austria contracted with Walachia. According to the contract Walachia had to pay 120,000 Gulden (or Forint)

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to Austria and would get a copy of the map made by the Austrians. (Boicu 1972: 289–291, Buchholtzer 1937: 87, Popescu-Spineni 1978: 232, Dragomir 1986: 131, Rotaru 1989: 34) As a consequence of the contract the Austrian Institute of Military Geography (Militärgeographisches Institut, MGI) and its director, August von Fligely (1810–1879) had the task to survey Walachia. (Buchholtzer 1937: 91–93, Brătianu 1900, Kovács 2010)

The surveying organization

The surveying organization of Walachia was the same as for the Habsburg Empire, the MGI. All of the original documents of the survey are kept in the War Archives of the Austrian State Archive in Vienna (ÖStA-Kriegsarchiv). (Jankó 2007: 56–59)
According to these documents the astronomical observations at the Movila David (close to Slobozia) fundamental point were completed by Major Eduard Pechmann von Maahsen, the works at the baseline were directed by Colonel Iacob Marieni. The following topographic survey was carried out by majors Pechmann and von Rueber and captains Ritter von Ganahl, Némethy, Schmidt, Schönhaber, Grüner, Hittnern and Zaufel as well as Lieutenant Breimann.
The name of the leader of work is written on the map sheets. The leaders are the followings: Major Mündel (21.5 sheets), Captain de Vicq de Cumptich (19), Captain von Wanka (12), Major de Querlonde (11), Lieutenant-Colonel von Pürker (8), Major Manger von Kirschberg (8), Major Ritter von Kees (8), Major de Traux (8), Captain Kolb (7), Colonel Bach von Klarenbach (6.5), Major Schmidt (1), two map sheets are anonymous. (Fig. 1)

Figure 1: The names of the leaders of the works (Austrian series).

According to the Romanian publications, besides the Austrians, Romanian officer took part in the surveys too, among them Constantin Barozzi, later director of the Romanian military geographic institute and minister of defence. (Buchholtzer 1937, Popescu-Spineni 1978: 232, Rotaru 1994: 3–8, Rus 2008, Dragomir 1986: 131, Rotaru 1989: 34)

The territory and the period of the survey

At this period in the Habsburg Empire the Second Military Survey was in progress. Between 1853 and 1857 the works were in the southern part of Transylvania, bordering Walachia. The survey of Transylvania was interrupted in 1857 and was continued only in 1868. (Jankó 2007: 59–62)
The survey of Walachia was part of the same work as of Transylvania. The area of the survey was Walachia and some parts of Dobruja.
The survey started in April 1855 with astronomical positioning at Movila David, which continued until October 1855. The first measuring at the base line was in July 1855. 43 map sheets are dated from 1856, 22 sheets from 1856–1857, 30 map sheets from 1857, 3 map sheets from 1857–1858, 14 map sheets are undated. (Fig. 2) The documentation was closed in September 1859.

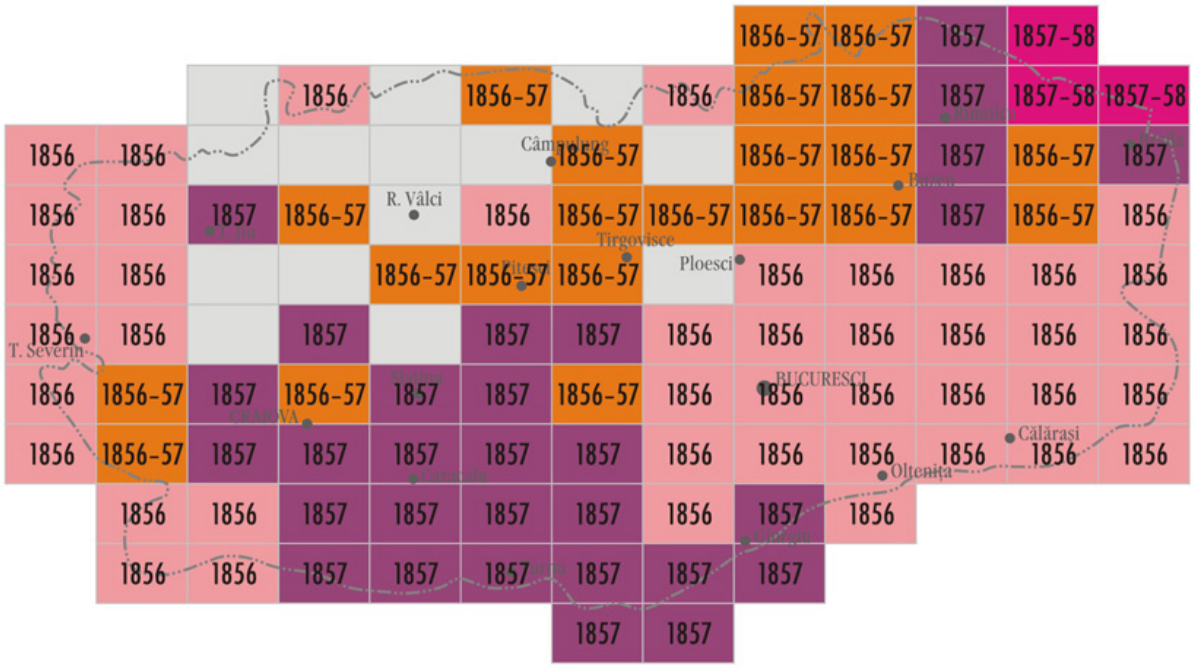

Figure 2: The years of the map sheets (Austrian series).

The geodesic basis

This survey had the first geodetic measurements in Walachia. The fundamental point was at Movila David, where they built a temporary astronomical observatory and made astronomical measurements, they had an azimuth fixed to Movila Păunei. A baseline was set up slightly to south, with the centerpoint besides Dragalina.
The triangulation network had frames along the Danube and the main tributaries from the Transylvanian Alps, the network was connected to the Hermannstadt observatory on Vízaknai-hegy (now Dealul Sibiului, close to Sibiu) fundamental point in Transylvania. The eastern end of the network was at Constanța (at that time in Turkey). The whole network was connected to Eastern Hungarian network parts, to the Sântana (near Arad) baseline. (Fig. 3)

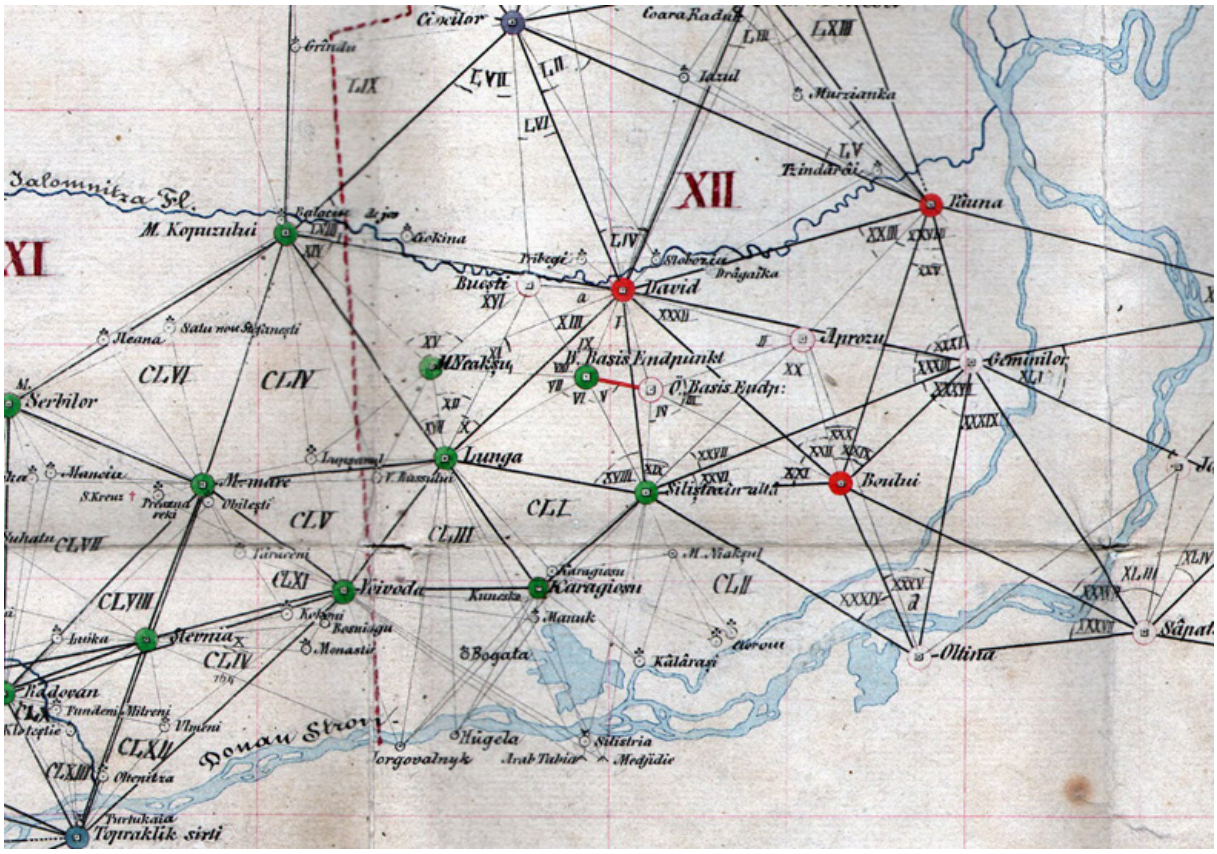

Figure 3: Detail from the map of the triangulation network.

According to the original documents (MGI 1859), for the survey of Walachia, the Walbeck 1821 ellipsoid was used (a=6376896 m, b=6355834 m). However, the survey was the continuing of the survey of Transylvania, where the Zach–Oriani ellipsoid was used (a=6376130 m, b=6355562 m). The prime meridian was Ferro. (Timár 2007, Timár 2008b)

The projection of the map

During the Second Military Survey of the Habsburg Empire the MGI used the Cassini-Soldner-projection with different centers for different lands. (Timár 2004, Jankó 2007: 64–66) For the survey of Walachia they used as center the same point as for Transylvania: Dealul Sibiului (lat.: 45.840255; long: 24.10832944 on the WGS84 ellipsoid). (Timár 2008a)

The scale of the map, the map sheets

The usual scale of the Second Military Survey of the Habsburg Empire was 1: 28,800, but because of the short time, the scale of these map sheets were halved to 1: 57,600, so 1 inch on the map equals 800 fathoms on terrain (the used length unit was the Viennese fathom: 1.89648 m). According to Năstase (1972), there were also 1:28,800 scaled Austrian survey sheets connected to this project but in the Vienna archive we haven't found any sign or trace of them.
During the Second Military Survey in the Empire the MGI used two kinds of dimensions for map sheets. The dimensions used here were the older ones, used in Transylvania and in Hungary, too. One map sheet represents 12800 fathoms x 19200 fathoms (24274.99 m x 36412.49 m) on the terrain and has a dimension of 16 inch x 24 inch (42.14 cm x 63.22 cm) on the sheet.

The Austrian series

The topographic map based on the survey was a secret manuscript map. One or two copies were compiled in Vienna. The map contains 112 sheets, the scale is 1:57,600. There is no title, or legend sheet.

Sheet labeling was given in two versions.

One version is the older one, (used during the First Military Survey), which used a single number (Arabic numeral) for every sheet, starting from the northwestern corner, numbers increasing from north to south, and then continuing to the northern end of the next sheet column to east. These labels were used only at the overview map; on the map sheets they are only hand-written.

The other version is similar to the Second Military Survey systems in the regions of the Empire. Because the sheets representing Walachia had a twice smaller scale, these sheets represent 2 x 2 normal map sheets. The origin of the numbering is Dealul Sibiului. The columns (Colonne) were labeled by Roman numbers increasing from this line, both to east and west. The most western column was the VIII–VII, the most eastern one was the XVII–XVIII. The rows (Section) were labeled by Arabic numbers, increasing from north to south. The most northern row was the 19–20, the most southern one was the 39–40 (thus the numbering was the continuation of the Transylvanian numbering). (Fig. 4)

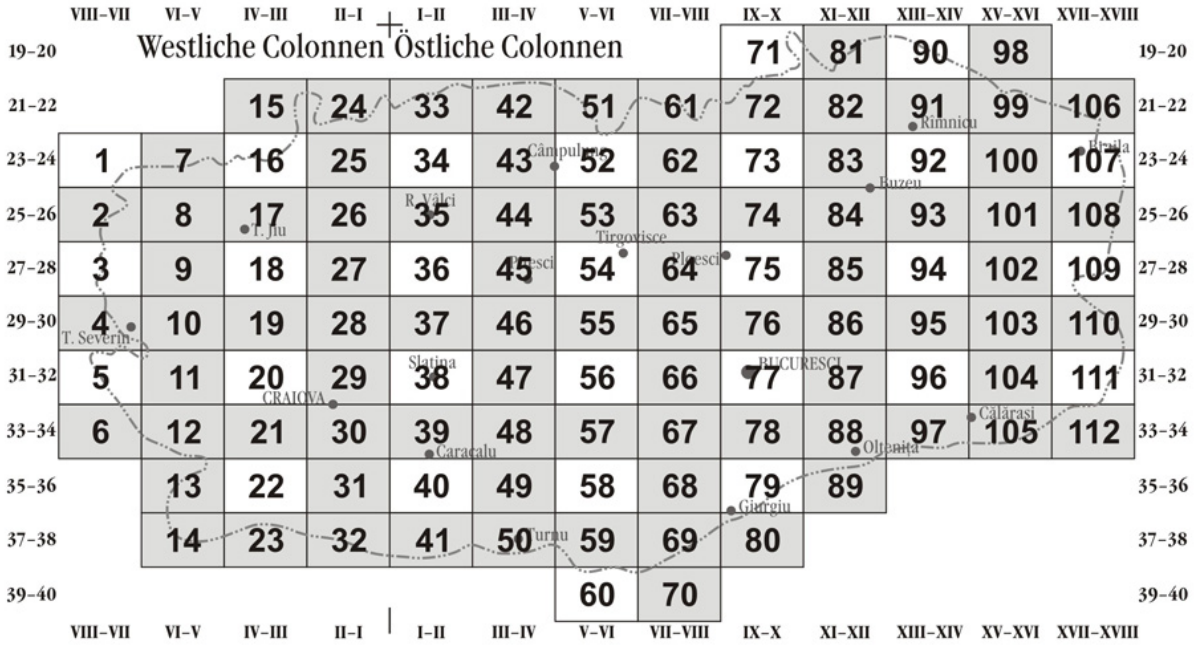

Figure 4: The labelling systems of the Austrian series.

Outside the map frame there were written the administration unit, the labeling, the scale and statistics. (Fig. 5)

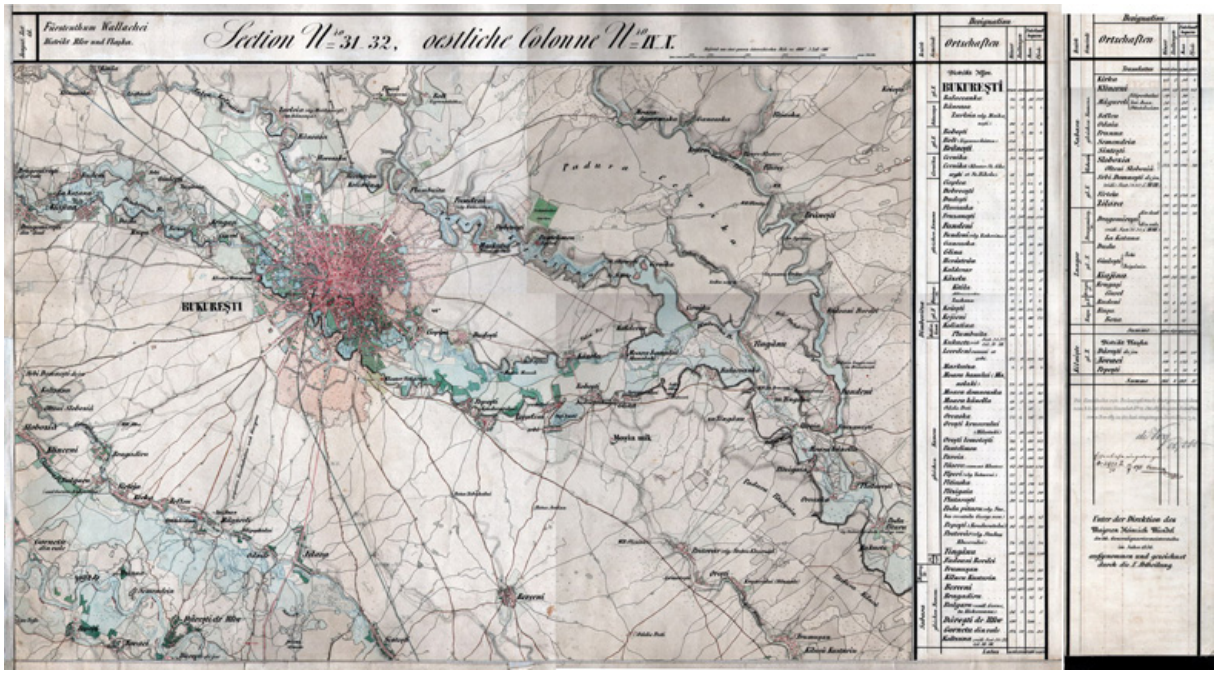

Figure 5: The Austrian sheet of Bucharest.

Szathmári's series

In accordance with the contract, Walachia got a copy of the map from the Austrians for the money paid. The map series was sent by the Austrians to Bucharest in the autumn of 1859. In February 1860 the painter of the court, Carol Pop de Satmari (in Romanian) or Szathmári Pap Károly (in Hungarian) was charged with lithographing the map.

Szathmári was born in Cluj-Napoca (at that time Kolozsvár, Transylvania) in a Hungarian family in 1812. He was a student in Cluj and in Vienna, as a painter he published several albums. In 1843 he was invited to Bucharest by ruling prince Gheorghe Bibescu to work at his court. This position of him was later extended by Barbu Stirbey, Alexandru Ioan Cuza and the first king of Romania, Carol I Hohenzollern-Sigmaringen, as court painter and photographer. He died in 1887 in Bucharest. (Oprescu 1941, Oprescu 1954, Murádin 2003)

Szathmári spent a month in Vienna and another month in Paris in the first half of 1860 to study, and purchased tools in Paris and London. (Murádin 2003) He copied the contents of the Austrian map and he translated the lettering to Romanian. Szathmári's map is not a manuscript map as the original Austrian one, but a color lithographed map duplicated in some copies.

The map was printed in 1864. According to Murádin (2003: 78), the sheets were printed in Bucharest, in the joint press of Szathmári and Károly Wallenstein, while according to Romanian sources (Buchholtzer 1937: 89–90, Popescu-Spineni 1978: 232, Bogdan 2010) it was printed in Vienna. In reality it was printed in Vienna and in Bucharest as well. On some sheets, the name of the Viennese lithographing manufacture Würbel is given, so the map sheets were duplicated there after Szathmári's copy in 8–10 copies. Apart from the 112 map sheets Szathmári's map was completed with title, legend and overview map. These three sheets were made in Szathmári and Wallenstein's press in Bucharest (on the title his name is written in Romanian, "Satmari"; on the overview his name is written in Hungarian, "Szathmáry").

In 1864 Szathmári – as a member of the delegation of Alexandru Ioan Cuza – gave the Romanian version of the map to the Sultan in Constantinople (now Istanbul), who gave him a tobacco box with brills and the Order of Medjedieh. (Murádin 2003: 77)
The Romanian version contains totally 115 sheets. The 112 map sheets are completed with title, legend and overview map.
The title of the Romanian version, provided by Szathmári, is *Charta României Meridionale* (Map of Southern Romania), this is the first map on which the name "Romania" appears. According to the title, the map was ordered by Alexandru Ioan Cuza, the source map is the survey map of 1856, surveyed by Austrian military engineers with the disposition of the local government, the work was made by Szathmári, in Bucharest, in 1864. We have to mention that the maps were compiled between 1855 and 1858, and part of the printing was made in Vienna. In the background of the text there is a drawing of Szathmári about the Târgul Moşilor ("fair of ancestors").
The legend is in Romanian, at the bottom of the page there are three graphical scales.
The overview map shows the simplified labeling system: the columns are indicated by Roman numbers from west to east (I–XIII) and the rows by Arabic numbers, from north to south (1–11). (Fig. 6)

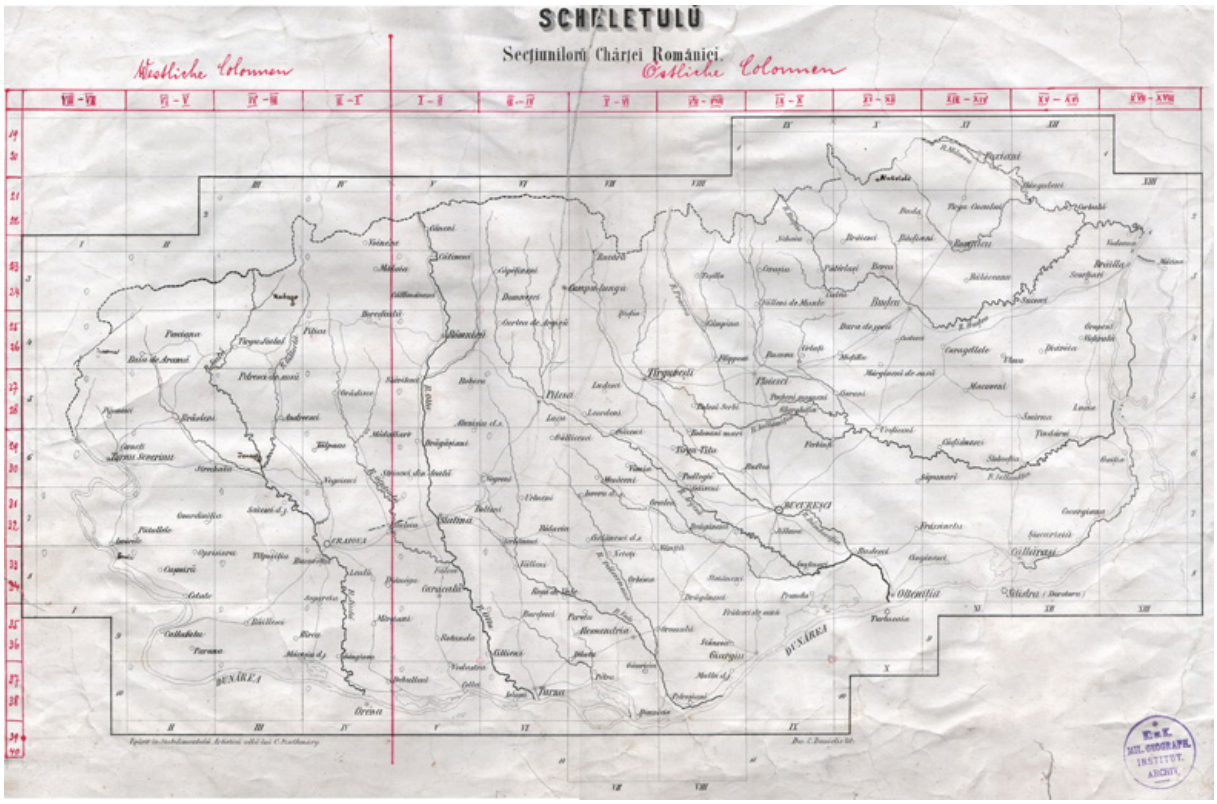

Figure 6: The labelling system of Szathmári (with handwriting the Austrian labelling).

The map sheets are slightly different from the original Austrian ones. The main difference is that here the lettering is in Romanian. There are some insignificant differences in symbols. (Fig. 7)

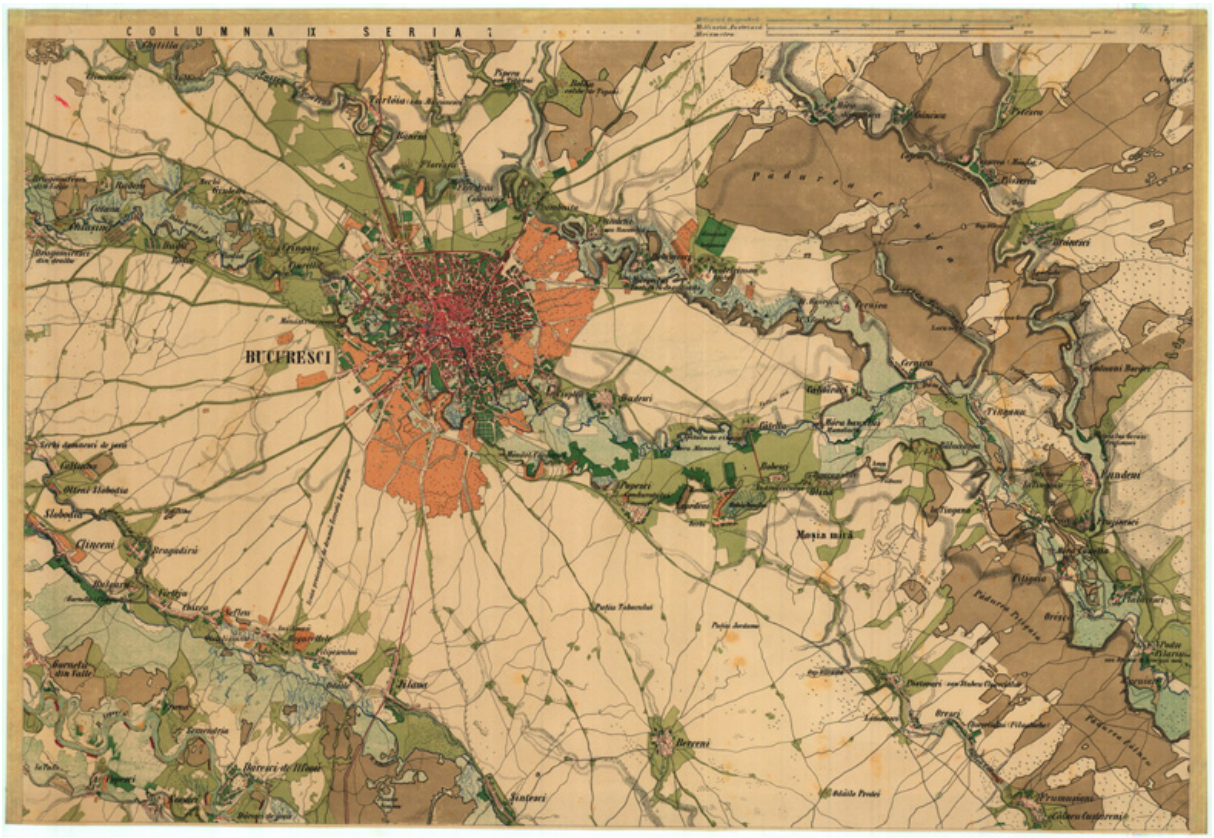

Figure 7: The Szathmári's sheet of Bucharest.

The content of the map

From 1827 the MGI used consistent symbols, totally 245 classes. The legend of Szathmári's map enumerates 38 symbols, but there may be more.
The representation of the relief is with Lehmann-hachures, the heights are in fathoms. The maps represent in detail the hydrography, the vegetation, settlements, routes, borders. On the Austrian ones the original Romanian toponyms in Cyrillic characters were transcripted to Latin ones, the other texts were in German. On Szatmári's version the Romanian toponyms are in the recently introduced Latin script, any other texts are in Romanian.

The reduced maps

A general map at a scale of 1:288,000 was compiled. The title is the following: *General-karte des Fürstenthums Walachei ausgeführt und herausgegeben durch das k.k. militärisch geografische Institut im jahre 1867* (General map of Principality of Walachia compiled and issued by the Imperial and Royal Military Geographical Institute in the year of 1867). It has 6 map sheets, each sheet has a dimension of 83 cm x 58 cm. It was compiled in 1867 in MGI. The place of publication is not mentioned, but it was Vienna. The names of the drawers aren't written either.
There was a Romanian edition in this scale, too. The title is the following: *Harta Țerri Românesci dupe reducția originală din harta ce' mare ridicate de Corpul de Geniu Geografic Austriac* (Map of Walachia after the original reduced map from the large map surveyed by the Austrian Corps of Geographic Engineers). The map is only one sheet, the dimension is 136 cm x 62 cm. The place of issue is Bucharest, but as lithography the Bielz is mentioned, which was in Sibiu (at that time

Hermannstadt / Nagyszeben, Transylvania). The author and the year of publication are not mentioned.

The consequences of the maps

In 1858 the Corps of Engineers (Biroul de Jeni, Corp de Geniu) was established. Their task was the preservation of the triangulation points and the continuing of the survey. This corps developed later to the Romanian Military Topographic Corporation. (Băcilă 1931, Buchholtzer 1937: 89–90, Năstase 1972, Popescu-Spineni 1978: 232)

The preservation of the maps

The map sheets of the Second Military Survey were kept at the MGI, and after 1924 in the War Archives (Kriegsarchiv). (Jankó 2007: 83–84) There is only one series of the Austrian version there, which is complete. Its archive-ID is B III a 203-4. Later, the newly constructed railway lines were drawn on them (1869, 1873, 1877). The working versions are also stored there.
Szathmári's map was duplicated in about 10 copies. At least 1 copy was sent to Istanbul, at least 3 copies to Vienna and the rest to Romania: to army, universities and to major libraries. In 1937 Buchholtzer (1937: 87) knew about 3 copies, all in Bucharest: in the Institute of Military Geography, The Military Museum and The Academic Library. We have identified 7 copies so far.
In Bucharest in the Academy Library there are 2 full copies, in Cluj-Napoca in the Cholnoky Map Collection there is one incomplete copy (88 map sheets) and in Iaşi at the university there is another copy.
The joint map collection in Vienna of the Austro–Hungarian Monarchy after the WWI was separated in two locations. In Vienna remained two complete series (B III a 203-5 and B III a 204), one incomplete series are in Budapest in the Map Room of Institute and Museum of Military History (99 map sheets, B III a 204).

Digitization

As the project has the best connection to Cholnoky Map Collection (Cluj-Napoca) and to the Map Room of Institute and Museum of Military History (Budapest), the scanning work was made on their collections. The full series in Cluj-Napoca and in Budapest were scanned, so most of the sheets are scanned in 2 versions. All of these maps were scanned in 300 dpi lossless format in large format scanners (e.g. A/0 or 42 inch width). The remaining few sheets, as well as the damaged ones in Cluj and Budapest, were scanned in Vienna in four parts each, at the A/3 format scanner of the Hungarian delegation at the Vienna Archive, as well as some auxiliary materials and some sheets of the original Austrian version of the maps. These sheets were put together later in Adobe Photoshop. The brightness and contrast of the sheets from different sources were not modified or equalized.

Georeferencing the map

For geo-referencing, we used the parameters of Zach-Oriani-ellipsoid. Using the coordinates of the fundamental point in both the WGS84 datum and the local datum of the Zach–Oriani ellipsoid, together with the geoid-undulation data and the nominal shift between the Ferro and

Greenwich meridians, we derived the abridging Molodensky parameters of the local Dealul Sibiului datum, which are: dX= 1722 m; dY= 376 m; dZ=595 m. (Timár 2004, Timár 2008b) Applying this ellipsoid – if used systematically in our GIS projects – causes much less horizontal error than half of a pixel in the scanned maps. Our project is continuing in defining a datum transformation parameter set between this ellipsoid and the modern Romanian geodetic datums.
The geo-reference of the sheets was based on:
a) the known/approximated parameters of the geodetic datum, discussed above;
b) the Cassini projection of the mapping, centered at the former Dealul Sibiului contemporary observatory site;
c) the known terrain extents of the map sheets, and
d) the sheet labeling system.
We defined four control points for each sheet; the four corners of the map contents. Together with their image pixel coordinates, the respective Cassini coordinates were calculated from the map label and the terrain extents of the sheets. The projection origin has (0,0) Cassini coordinates was the old Dealul Sibiului observatory site, however it is outside the mapped area, far north into Transylvania. Thus the sheets were resampled to the native Cassini projection of the map, providing exactly rectangular outline for all of the sheets. The mosaicking was accomplished in this coordinate system. Knowing the parameters of the geodetic datum and the map projection, any part of this mosaic can be reprojected to the modern reference systems (WGS84, UTM or Romanian Stereo-70).

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References

Băcilă I. (1931): *Hărți geografice asupra Țara Românească între 1800–1856.* Lucr. Inst. De Geogr. Univ. Cluj., vol IV., 1928–1929. Cluj.

Bogdan Mihai – Săvulescu Ionuț – Demeter Traian (2010): *Historical Maps (starting since the 18th century) integration in digital environment for land cover change analysis.* 5th International Workshop on Digital Approaches in Cartographic Heritage. Vienna.

Boicu L. (1972): *Austria şi principatele române în vremea războiului Crimeii 1853–1856.* Editura Academiei RSR. Bucureşti.

Brătianu, Constantin I. (1900): *Notițe despre lucrările cari au avut scop descrierea geometrică a României*. Academia Română. Bukarest.

Brătianu, Constantin I. (1901): *Note sur les opérations géodésiques et astronomiques entreprises pour l'exécution de la carte du royaume de Roumanie présentée à la XIIIe Conférence de l'Association géodésique internationale, tenue à Paris en 1900.* Brill, Leide.

Buchholtzer Corneliu – Rotaru Petre (1937): *Istoricul Cartografiei.* Institutul Geografic Militar. Bucureşti.

Docan, N. (1912): *Memoriu despre lucrările cartografice privitoare la răsboiul din 1787–1791.* Extras din Analele Academiei Române. Seria II. Tom. XXXIV. Memoriile Secțiunii Istorice. Bucureşti.

Dragomir Vasile – Rotaru Marian (1986): *Mărturii geodezice.* Editura Militară. Bucureşti.

Ionaşcu I. – Bărbulescu P. – Gheorghe Gh. (1975): *Tratatele internaționale ale României 1354–1920.* Editura Ştiințifică şi Enciclopedică. Bucureşti.

Jankó Annamária (2007): *Magyarország katonai felmérései 1763–1950.* Argumentum. Budapest.

Kovács Béla – Timár Gábor (2010): *The Austro–Hungarian triangulations int he Balkan Peninsula (1855–1875).* In: Gärtner Georg – Ortag Felix ed.: Cartography in Central and Eastern Europe. Lecture Notes in Geoinformatics and Cartography. Springer. Berlin–Heidelberg. pp. 535–544.

MGI, Militärgeographisches Institut (1859): *Trigonometrische Vermessungen in der Wallachei, ansgeführt durch Offiziere des k.k. Ingenieur-Geografen Corps, in der Jahren 1855, 1856 und 1857.* Manuscripts in the ÖstA-Kriegsarchiv, Wien, Archive ID: Triangulierung/194.

Murádin Jenő (2003): *Szathmári Pap Károly.* Kriterion. Kolozsvár.

Năstase, Anton (1972): *Contribuții la dezvoltarea cartografiei Țării Româneşti în secolele al XVIII-lea şi al XIX-lea.* Lucrări ştiințifice. Seria Geografie. Institutul Pedagogic. Oradea.

Oprescu, George (1941): *Carol Popp de Szathmary desenator.* Bucureşti

Oprescu, George (1954): *Szathmary.* Bucureşti

Plihál Katalin (2008): *A térképnyomtatás művészete a kezdetektől a 19. század végéig.* Hatágú síp. Budapest (CD-ROM).

Popescu-Spineni, Marin (1978): *România în izvoare geografice şi cartografice*. Editura ştiințifică şi enciclopedică. Bucureşti.

Rotaru, Marian – Anculete, Gheorghe – Paraschiva, Ion (1989): *Evoluția concepției geodezice militare în România.* DTM.

Timár Gábor (2007): *A ferrói kezdőmeridián.* Geodézia és Kartográfia Bucureşti.

Rotaru, Marian – Anculete, Gheorghe (1994): *Personalități ale geodeziei militare româneşti.* Bucureşti.

Rus, Ioan (2008): *Scurt istoric al măsurătorilor terestre în România.* http://earth.unibuc.ro/articole/scurt-istoric-al-masuratorilor-terestre-in-romania

Scafeş, Cornel I. – Zodian Vladimir (1981): *Barbu Ştirbei.* Editura Militară. Bucureşti.

Specht, Friderich (1791): *Militairische Karte der Kleinen oder Oesterreichische und Grosser Wallachei.* Wien.

Tarlé E. V. (1952): *Războiul Crimeii.* Editura de Stat pentru Literatura Ştiințifică. Bucureşti.

Timár Gábor – Molnár Gábor – Păunescu Cornel – Pendea Florin (2004): *A második és a harmadik katonai felmérés erdélyi szelvényeinek vetületi- és dátumparaméterei.* Geodézia és Kartográfia 2004/5: 12–16. Budapest.

2007/12: 3–7. Budapest.

Timár Gábor – Kovács Béla – Bartos-Elekes Zsombor – Păunescu Cornel (2008a): *The Dealul Sibiului base point of the Transylvanian surveys.* Geographia Technica 2008/1: 127–139. Cluj-Napoca.

Timár Gábor (2008b): *Habsburg geodetic and cartographic activities in the Old Romania.* Studii şi Cercetări, Seria Geologie–Geografie. Bistrița. 13: 93–102.