Mapping the Theater of War in Southwestern Germany by k.k. Generalquartiermeister Heinrich v. Schmitt 1796-98

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Introduction

The new demands of staff work in the Napoleonic period promoted the military survey of the potential theatres of war. In France the three generations of the Cassini astronomers laid the foundations of the trigonometrical survey which took about 50 years to complete and was published in printed form as the "Carte géométrique de la France" in 1793. The scale of 1:86.400 was related to the duodecimal system (i.e., one inch to 6 x 12 x 12 x 100 inches) and was considered appropriate for military purposes.[1]

In the Austrian empire, another approach based upon the use of surveyor's tables was given preference. In the Austrian Netherlands (nowadays Belgium) Count Joseph Jean François Ferraris created a hand-drawn manuscript map for the use of the cabinet ("Carte de cabinet autrichien" 1764-1771) that was published as a copper print in the same reduced scale as the Cassini map. After the Seven Years War, Emperor Joseph II ordered a map of Austrian crown lands that became the "Josephinische Landesaufnahme" 1763-1787[2]. The successor to this map, the Franciscan Survey ("Franziszeische Landesaufnahme") of 1810-1850, was based upon triangulation like the Cassini map.

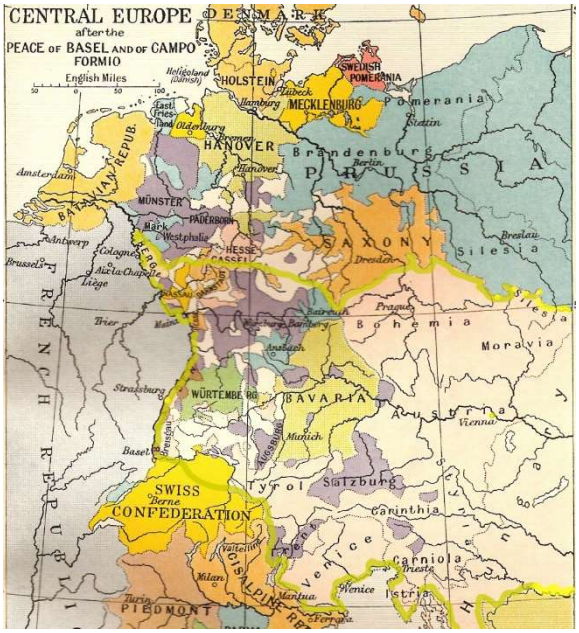

Figure 1: The Austrian sphere of interest i.e. potential theatre of war about 1796 is marked yellow. In the treaty of Basel (1795) Prussia left the 1st coalition, so the northern territories were neutral to the belligerent France, Austria and German Empire.

To compare: after the French occupation of the territories west of river Rhine, the four new French departments were to be included into the Cassini map by trigonometrical measurements and topographical surveying from 1804-1813 under the oversight of Colonel Jean Joseph Tranchot. The survey was still not finished 10 years later (!) and was finally completed in

[111] This article is based upon Paldus and Stigloher (see below for citations) as well as the author's personal experiments with period surveying techniques.

[2] Paldus, Josef, Die militärischen Aufnahmen der habsburgischen Länder aus der Zeit Kaiser Josephs II., Wien: Alfred Hölder, 1919.

1828 by the Prussian staff under General Karl von Müffling.[3]

The War of the First Coalition (1792-1797) made southwest Germany the theater of war. There were no maps for military use at hand for either of the belligerent parties. The printed map of Captain Johann Heinrich Haas (1758-1810) of the Hesse-Darmstadt territories was taken in parallel[4], but only covered a small fraction of the relevant territories.

Challenge

The strong demand for a complete map of Rhineland, Hessia, Palatinate, Baden, Württemberg, Bavaria, Vorarlberg and Salzburg led Archduke Charles to decide for a quick survey of these areas that should be completed in two years of armistice or peacetime. Speed was considered much more important than the precision that would have been provided by an exact trigonometric survey. Thanks to the experience of mapping the Belgium and Austrian crown lands, there was a well-trained staff at disposal for the survey by plane table. The head of imperial-royal staff (k.k. Generalquartiermeister) Heinrich von Schmitt[5] organised the crew of 70 officers[6] and their assistants as follows[7]:

Figure 2: k.k. Generalquartiermeister (imperial royal head of staff) Karl-Heinrich von Schmitt (1743-1805)

There was no measured consolidated grid of trigonometric points[8], instead the reference points were measured graphically upon the plane table on the fly. So, the projection to the earth's surface was defined by the plane table, that is, it was formed as a squared map[9]. The entire set of sheets was called skeleton ("Skelett" in Austrian German, meaning grid).

The latitude was controlled by adjacent sheets[10]; but the longitude was controlled by the size of adjacent sheets. So, a central position for the first sheet was chosen and surveying of the attached sheets propagated from central sheet to east and west as well as down from north to south step by step to the adjacent sheets. In order to achieve the graphical triangulation beyond the sheet's edges, six plane tables were coupled to generate the net of triangles that was completed by the topographical survey[11].

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[3] Excellent survey see: Torge, Wolfgang: Geschichte der Geodäsie in Deutschland, New Yorck: Walter de Gruyter, 2009, pp. 61

[44] "Haas´sche Karte: Militärische Situationskarte in XXIV Blättern von den Ländern zwischen dem Rhein Main und Neckar nebst den angränzenden Gegenden," 1:30 380, 1788-1813

[5] Stigloher, Wolfgang, "Die Militärgeographie in Bayern um die Wende des 18. Jahrhunderts unter besonderer Berücksichtigung der 'Schmittschen Karte von Südwestdeutschland'," Dissertation, Technische Hochschule, München: 1984, Appendix 2; and Wurzbach, Constantin von, Schmidt (also Schmitt), Heinrich Sebastian von, in *Biographisches Lexikon des Kaiserthums Oesterreich*, XXX, Vienna: Kaiserlich-königliche Hof- und Staatsdruckerei, 1875, pp. 252–256. He was the prototype of a scientifically educated officer: first trained as an engineer, he served for short period in the infantry regiment Pallavicini, then, as his talent was recognized, he was entrusted with mapping of Bohemia in 1763. He joined the newly formed Generalquartiermeisterstab (General staff) in 1769. He continued in mapping and distinguished himself in the 1788 war against the Ottomans to be promoted to major. He served in the War of the First Coalition and was appointed general–major in 1796 under Archduke Charles. He quit service in 1800 but was reactivated in 31 October 1805. He was guiding the Dokturov column during the Engagement at Dürnstein when he was killed most probably by friendly fire on 11 November 1805. Wurzbach and other period sources do not even mention the Schmitt map.

[6] This also included Bavarian officers of Colonel von Riedl, most probably also allied Hessian, Baden and Württemberg staff officers.

[7] Häberlein, Roland and Hage, Jürgen:l, *Die Schmitt'sche Karte von Südwestdeutschland 1:57.600 – Erläuterungen*, Stuttgart: Landesvermessungsamt Baden-Württemberg., 1987

[8] Stigloher, p. 35

[9] Stigloher, Appendix 8. "rechteckige Plattkarte."

[10] It seems, that according to Paldus, latitude was not controlled with the aid of sextants or octants

[11] Paldus, p. 15: Description and operation of Dumont's instrument, replacing the angular devices. A serious drawback of plane tables was that points beyond the edges which could not be taken, which was also critized by Austrian general staff officers who were more in favour of angular devices like the graphometre or theodolite.

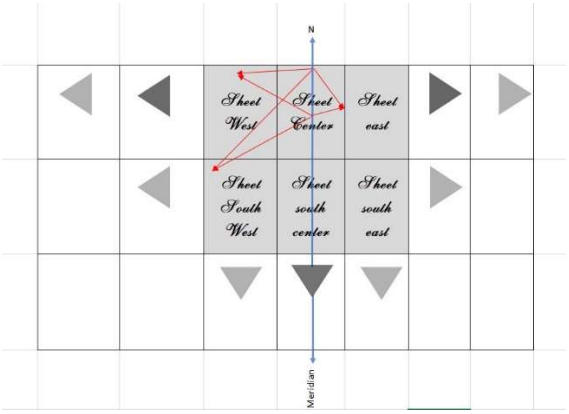

Figure 3: Supposed set-up of six plane tables for graphical triangulation of first order for adjacent sheets to control smooth transition at the edges, size and orientation by the Meridian in the terrain. The centre is also called principal column ("Haupt-Orientalkolonne") that is intended to control adjacent columns. Thin red lines represent triangles taken from base meridian. Each surveyor ("Mappeur") processed a section from North to South or vice versa.

Figure 4: Austrian general staff officer about 1800 (Mollo)

So, for topographical survey every surveying officer obtained a pre-designed sheet of triangles: this sheet was subdivided into smaller sheets of scale from about 1:5000[12] to 1:28.800 to make the survey practicable for the precision of the available alidades and resolution in the field[13]. These pieces were assembled and reduced to form the final requested sheet. Distances were simply taken by wooden sticks or paces (not by the iron surveyor's chain) or often even only estimated by eye ("à la vue"). The condensed net could be considered as triangulation of the 2nd or 3rd order. No lengthy trigonometric calculations were necessary which explains the speed of surveying.

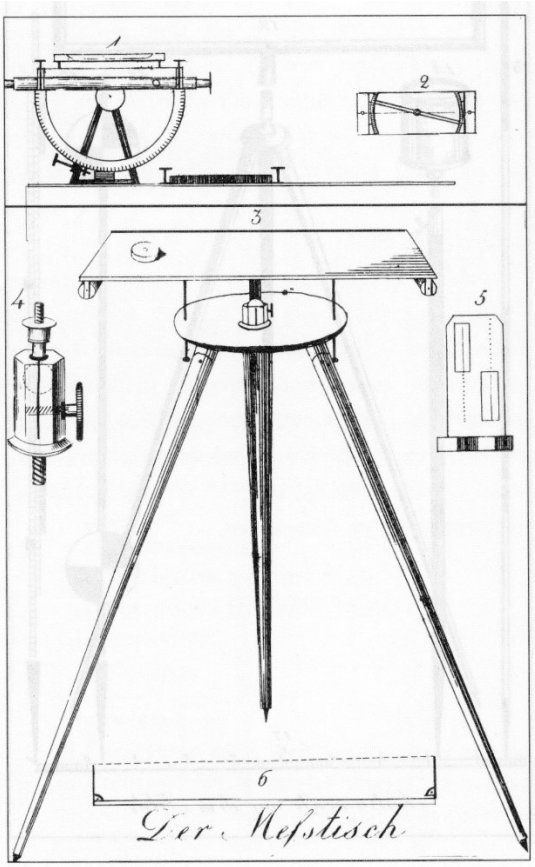

Figure 5: The surveyor's plane table (3), alidade with telescope (1) for larger distances, alidade with sight (5,6) for close distances, compass (2) and brass header (4) of plane table (Benzenberg[14], Table 3). The transversal scale was most probably engraved on the alidade.

[12] This is the typical scale of plane table survey used for cities and villages

[13] Stigloher, p. 36. Observation of the author: ranges of alidade with telescope up to 5 km distance, alidade with sight only about 1-2 km. In the mountains or on wooden terrain, lines of sight were much shorter.

[14] Benzenberg, Johann Friedrich: Instruction für die Landmesser aller Classen in dem Großherzogthum Berg. Düsseldorf: about 1806

Figure 6: Original surveyor's plane table from Marinoni, Lombardia, about 1770 (Vienna Technical Museum). Most probably the officers were equipped with a pattern of this type.

To ensure a standardized approach of graphical triangulation, an instruction was given to every officer[15].

The scale 1:57.600 was derived from 1 inch to 800 fathom (the Austrian "Klafter"), called half military scale ("Halbes Militärmaß") and was superior in resolution to the French maps of 1:86.400 or 1:100.000. Each of the 198 sheets measured approx. 63 x 42 centimeters, corresponding to about 35 x 24 kilometer's, or 833 square kilometers.

Final drawing was completed during the winter in headquarters or in billets until 1798. Due to the vast number of officers involved, drawing style is varying according to the individual skills.

Curiously, in order to face towards the adversary, these maps were oriented to the west, not to the geographic north like most other topographical maps of the period. Existing maps were included into the set[16].

When the War of the Second Coalition spread over the southwest Germany in 1798, the map was completed!

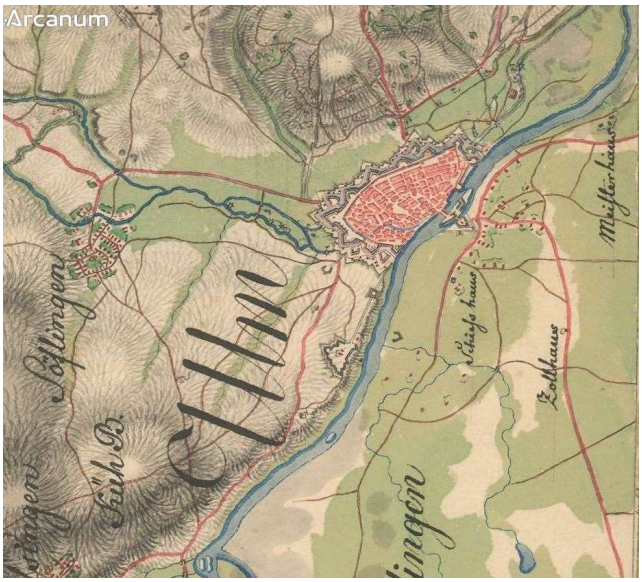

Figure 7: Section of Schmitt's final manuscript map of Ulm fortress about 1796, to be demolished after 1805 campaign. Orientation is to the West, i.e. facing France. Signs are self-explanatory, heights are represented by hachures (sheet No. 85, mapire).

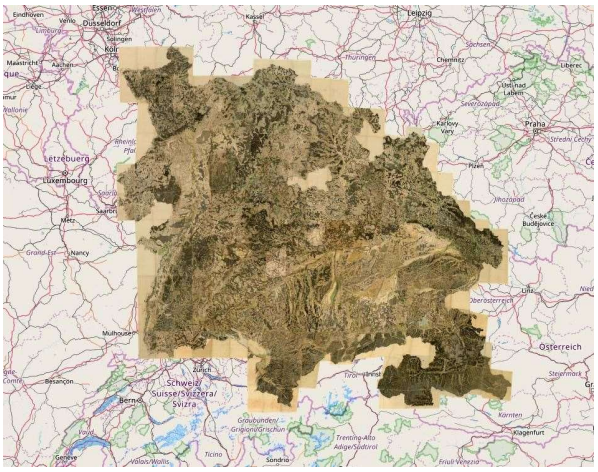

Figure 8: The final Schmitt map covering most territories of southwest Germany, Salzburg and Vorarlberg of modern Austria. The gaps in northern Bavaria represent the Prussian territories of Ansbach and Bayreuth (Mapire)

Precision

The map cannot be expected to bear the same precision as period triangulation maps[17]. The mean absolute positional error (compared to modern topographical maps) is about 2,5 km, the relative error is about 1,0 km.

Experimental verification

The area of the open-air museum Bad Windsheim in Bavaria was selected for an experiment. The author has verified the rapid surveying by taking about one square kilometre in 1 ½ days by the contemporary surveying techniques, that is, using the surveyor's plane table

[15] Stigloher, Annex 7, Dumont's instruction for triangulation.

[16] Stigloher, p. 62: probably incorporating the engineer plans of fortresses, Austrian maps of the Rhine valley, Chaussards Map of Germany, Amman's map "Karte von Oberschwaben", Adrian von Riedl's "Reiseatlas des Königreichs Bayern".

[17] Stigloher, Annex 8: Comparison of Schmitt's map and the "Carte de la Bavière" with a precision of 0,2 km.

and taking the central meridian of the sheet as base. The northern start of the meridian was the chimney of a tavern, to be continued to the south by two signals (flags) about several hundred paces apart.

However, the bushy and hilly terrain with very restricted range of sight did not permit direct measurement of the distances on the meridian, so indirect measuring from parallels of meridian was set up from a close plane. However, this did not yield the requested precision[18], so the alternative approach of "extended base" after Snellius was selected, i.e., putting the auxiliary base intersecting the meridian center which proved much more precise.

The direction of meridian was taken once at noon to measure the magnetic declination to the geographical north; so that the plane table could be aligned to the geographical north using a compass at any time of day. Common plane table techniques were applied with the alidade: for observation, side observation and stationing. The reduction by pantograph and coloured final drawing took about two hours.

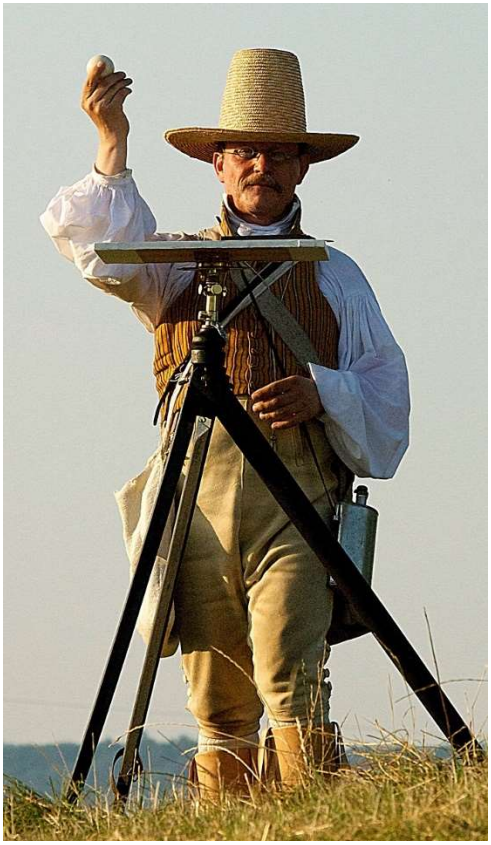

Figure 9: The author acting as surveyor at African temperatures with a light plane table. A billiard ball is used to adjust the table to the horizon.

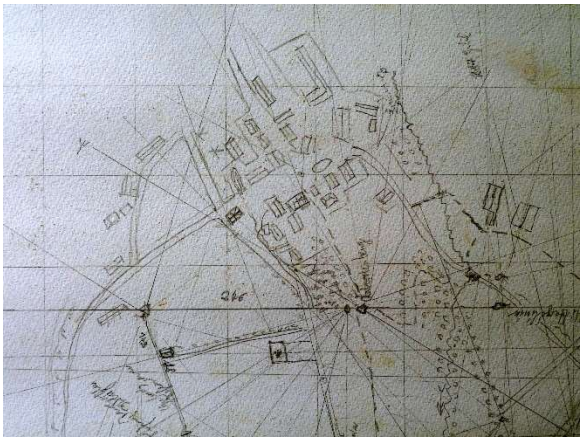

Figure 10: Section of a village with meridian from North to South, lines of sight drawn with the alidade to match the objects at the intersections. Orientation is to the west. This draft from plane table comes with scale 1:500, to be reduced by pantograph to final scale and assembled to form the final sheet.

Usage, re-discovery, replicas and digital copies

Unfortunately, there is not much documented evidence of how and when this splendid map was used for Austrian staff work in the 1798-1800, 1805, 1809 and 1814 campaigns. There is an indication that the map was used to plan the Rhine bridgehead of Altenheim south of Strasbourg in 1814. The detailed map could have served to plan the billeting, camps, dislocations, marching order of trains, divisions and corps ("Armeeabteilungen" in contemporary Austrian parlance), resources for forage and support, as well as, most importantly, reconnaissance of positions[19]. After the wars, it could have been used as basis for military studies of the campaigns[20].

Most probably, the precious manuscript maps never left the Vienna archive (except during the 1805 and 1809 campaigns when the French occupied Vienna) and so copies (*calques*) had to be taken for staff work during the campaigns.

However, the maps were never printed in reduced scale and were made redundant soon after 1815 by the printed map "Militairkarte von Süddeutschland" of the Bavarian staff, edited by geographical engineer Aloys von Coulon in 1818[21]. On the French side, these were the

[18] Stigloher, Sketch in Annex 7.

[19] Werklein, J. C. Freiherr von, Untersuchungen über den Dienst des Generalstabs oder über das Detail bei der Führung der Kriegsheere.: Nebst einem Entwurfe zur Dienstvorschrift für dieses Korps, Vienna: J. B. Wallishauser, 1823, pp. 6 and 8 „Rekognoszierungen". However, as Werklein pointed out, the best map does not replace reconnaissance, but does a vital support to it.

[20] For example, Recueil de cartes et plans pour servir l'Intelligence des principes de Stratégie develloppés par l'Histoire de la campagne de 1796 en Allemagne, Vienne, 1818.

[21] Coulon, Aloys von "Militair-Karte von Süd-Deutschland in 20 Sectionen: nach den besten astronomischen und trigonometrischen Orts-Bestimmungen und Hülfsquellen gestochen von J. B. Seitz" Munich, 1818.

printed “Carte de Bavière”[22] and “Carte de l’Allemagne” which were never completed[23]. Also turning Bavaria into an Austrian ally made this war map obsolete.

It was not until 1919, when archivist Josef Paldus of the Austrian “Kriegsarchiv” (the War Archive in Vienna) “re-discovered” this map[24] and made it known to the public. The cartographer Wolfgang Stigloher was among the few to investigate the surveying techniques used for this map in the 1980s.

Today, the complete set is preserved at “Kriegsarchiv Wien”[25]; printed replicas are available for the German federal states of Hessia, Rheinland-Pfalz, Saarland and Baden-Württemberg, but unfortunately not for Bavaria. However, the map can be investigated online based upon geo-reference technology (projection of historical maps to recent maps), which is a cooperation of archives in the former Austrian crown lands and sets up a unique and invaluable tool for researchers[26].

Acknowledgements:

The support of John Gill, Virginia, is kindly appreciated.

[22] Schiegg, Bonne et al, Carte de Bavière, Scale 1:100.000, Dépôt de la Guerre, Paris: about 1801-1818 (?). One original is preserved at the Bayerische Staatsbibliothek, Munich.

[23] Stigloher, Annex 15, status of sheets.

[24] Paldus, p. 13.

[25] Kriegsarchiv Wien, B IVa 72-1.

[26] Mapire: Digital high resolution map: URL http://mapire.eu/de/map/schmittsche-karte