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**Zach, Franz Xaver von.** Franz Xaver von Zach combined scientific expertise with great social and linguistic ability, making him an outstanding manager, organizer, and facilitator of international scientific and cartographic networks. He was born on 4 or 13 June 1754 in Pest, Hungary, son of Joseph Zach, a military doctor who was ennobled in 1765, and his wife Clara; his older brother Anton would, as an Austrian general, direct the mapping of Venetia. Franz Xaver's strict upbringing and education in a Jesuit monastery, which focused on mathematics, laid the early foundation for his later scientific works on astronomy, geodesy, and cartography.

Through his father's contacts, Zach joined the Austrian army as an engineer and officer in 1775 and participated in some campaigns and Austrian surveys. As an aide to Joseph Liesganig, SJ, he surveyed the newly acquired territory of Galicia and intensified his interest in geodesy and cartography. In this period, he acquired practical astronomical knowledge at the observatory in Lemberg (Lviv).

When his active military career ended in 1780, Zach devoted himself to scientific studies. After a short period as professor of mechanics in Lemberg, where he developed an astronomical calendar, he traveled to Italy and France where, among other notables, he met the astronomers Joseph-Jérôme Lefrançais de Lalande and Pierre-Simon de Laplace, who inspired his interest in astronomy. In London in 1783 he met scientists and mathematical instrument makers such as Nevil Maskelyne, Jesse Ramsden, and William Herschel. These experiences and encounters provided theoretical and practical knowledge as well as contacts that would help him later in Gotha.

Also in England he met the Saxon ambassador Hans Moritz von Brühl, an accomplished astronomer. Brühl immediately hired Zach as an associate and tutor. Dur-

ing their time in England, Zach continued his practical studies at Brühl's own well-equipped observatory outside London. With Brühl, Zach determined the astronomical coordinates of places first in the London region, then later in Paris, Brussels, Göttingen, Frankfurt, Berlin, and Dresden as he continued his travels through Europe.

In 1786 Brühl recommended Zach to Ernst II, Duke of Saxe-Gotha-Altenburg, to direct the planned astronomical observatory in Gotha. Zach entered the ducal court in 1787, built and equipped the observatory (opened in 1791), and initiated a prolific scientific and cartographic period that lasted until 1804. He calculated and published the majority of the coordinates for more than 2,800 places (fig. 952)—determinations that allowed others to correct and revise erroneous maps, eventually earning him the nickname “Gothaer kartographischer Gründer-Vater” (cartographic founding father of Gotha). He promoted a scientific approach to cartography by using astronomical observations and on-site measurements, later continued in Gotha by the nineteenth-century publishers Adolf Stieler, Justus Perthes, and August Petermann. In addition to terrestrial surveys, he prepared a new star catalog of 494 stars, the *Tabulae speciales* (1806–7). Zach undertook a triangulation of the Gotha region and topographical mapping of Thüringen based on a precisely oriented geodetic triangulation. He also determined differences of longitude by using gunpowder flash signals, modeled after César-François Cassini (III) de Thury's method to measure time, and by using a sextant to survey topography. Researchers such as Alexander von Humboldt successfully implemented Zach's methods to survey and map regions in America.

In 1798 he led the first astronomical conference with more than twenty international participants who dealt with topics essential to mapmaking, such as the unification of the measurement system and the comparison of measurement methodologies for geographic place determination. This conference led to many acquaintances and markedly improved communication among scientists. In 1800 Zach founded the Vereinigte Astronomische Gesellschaft in Lilienthal with Johann Hieronymus Schröter. He founded the first professional journals to promote collaboration and exchange among astronomical and

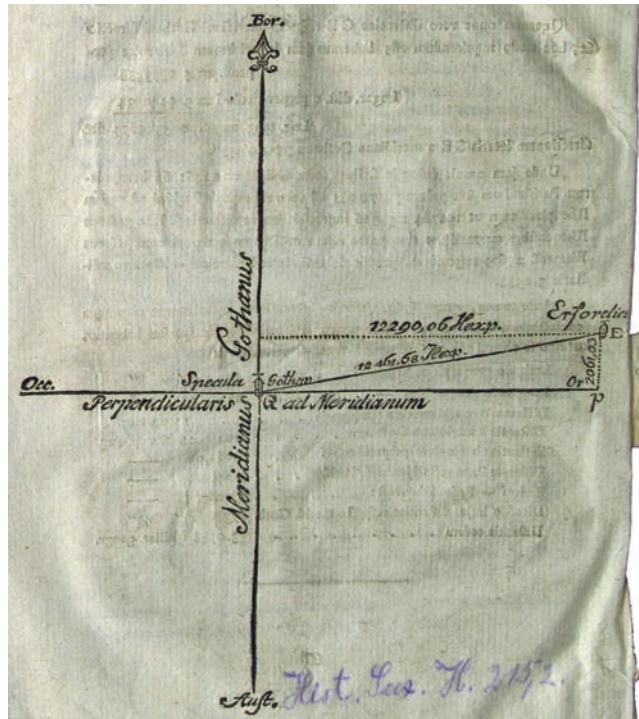


FIG. 952. A GRAPHIC DEMONSTRATION OF THE CALCULATION OF THE LATITUDE AND LONGITUDE OF ERFURT BY RELATION TO THE OBSERVATORY AT GOTHEN. From Franz Xaver von Zach, *De vera latitudine et longitudine geographica Erfordiae* (Erfurt: Georg Adam Keyser, 1790), 18.

Image courtesy of the Sächsische Landesbibliothek–Staats- und Universitätsbibliothek, Dresden/Deutsche Fotothek (Hist. Sax.H.215.2).

geographical scientists: *Allgemeine Geographische Ephemeriden* (1798–1816), *Monatliche Correspondenz zur Beförderung der Erd- und Himmelskunde* (1800–1813), and *Correspondance astronomique, géographique, hydrographique et statistique* (1818–27). Each journal provided detailed accounts of contemporary surveys and explorations, reviews of newly published maps and geographical books, and several historical accounts of early maps and explorations, all gleaned from Zach's extensive correspondence network.

Zach educated numerous young scientists throughout Europe in theory and practice and worked with them on joint projects, including Johann Gottlieb Friedrich Bohnenberger, Friedrich Ferdinand Karl Freiherr von Müffling, and Friedrich Wilhelm Carl von Schmettau. He supported and advised Humboldt, Carl Friedrich Gauss, and F. W. Bessel, among others. He was also in contact with luminaries from the business and literary world, such as Johann Wolfgang von Goethe, who visited him at the Gotha observatory. Renowned both nationally and internationally, Zach was appointed as

the foreign member of the Königliche Böhmisches Gesellschaft der Wissenschaften in Prague in 1793 and a few years later as canon of Stifts Walbeck by the king of Prussia.

After the duke's death in 1804, Zach left Gotha to accompany the duke's widow, Marie Charlotte Amalie, to live in France and Italy until her death in 1827. He conducted further surveys in this period and determined fixed-point networks, such as in Florence. He helped with the construction of astronomic observatories in Naples and Lucca and supplemented the sun tables and designed a star index with aberration and nutation tables. He spent his last years in illness with his physician, Jean Civiale, in Paris, where Zach died of cholera on 2 or 4 September 1832.

ROLF FALK HELBIG

SEE ALSO: Geodetic Surveying; Geographical Mapping; Longitude and Latitude; Science and Cartography

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**Zenith Sector.** See Instruments, Astronomical

**Zürner, Adam Friedrich.** Adam Friedrich Zürner exemplifies the new class of official and administrative surveyors and mapmakers that proliferated in the centralizing states of Enlightenment Europe. Born 15 August 1679, the second son of pastor Adam Zürner in Mariney, in the Vogtland region of Saxony, his initial home schooling awakened his interest in geography and the natural sciences. He attended both the Latin school at Oelsnitz and the *Gymnasium* in Hof, Bavaria. After briefly attending the University of Wittenberg, he transferred in 1703 to the University of Leipzig, which in 1704 awarded him the degree of Master of Theology. He then served as a pastor in Großenhain district (Amt). At his own initiative, and in order to secure the interest of the elector Friedrich August I, Zürner mapped the district at a scale of ca. 1:125,000 (fig. 953). The elector granted his

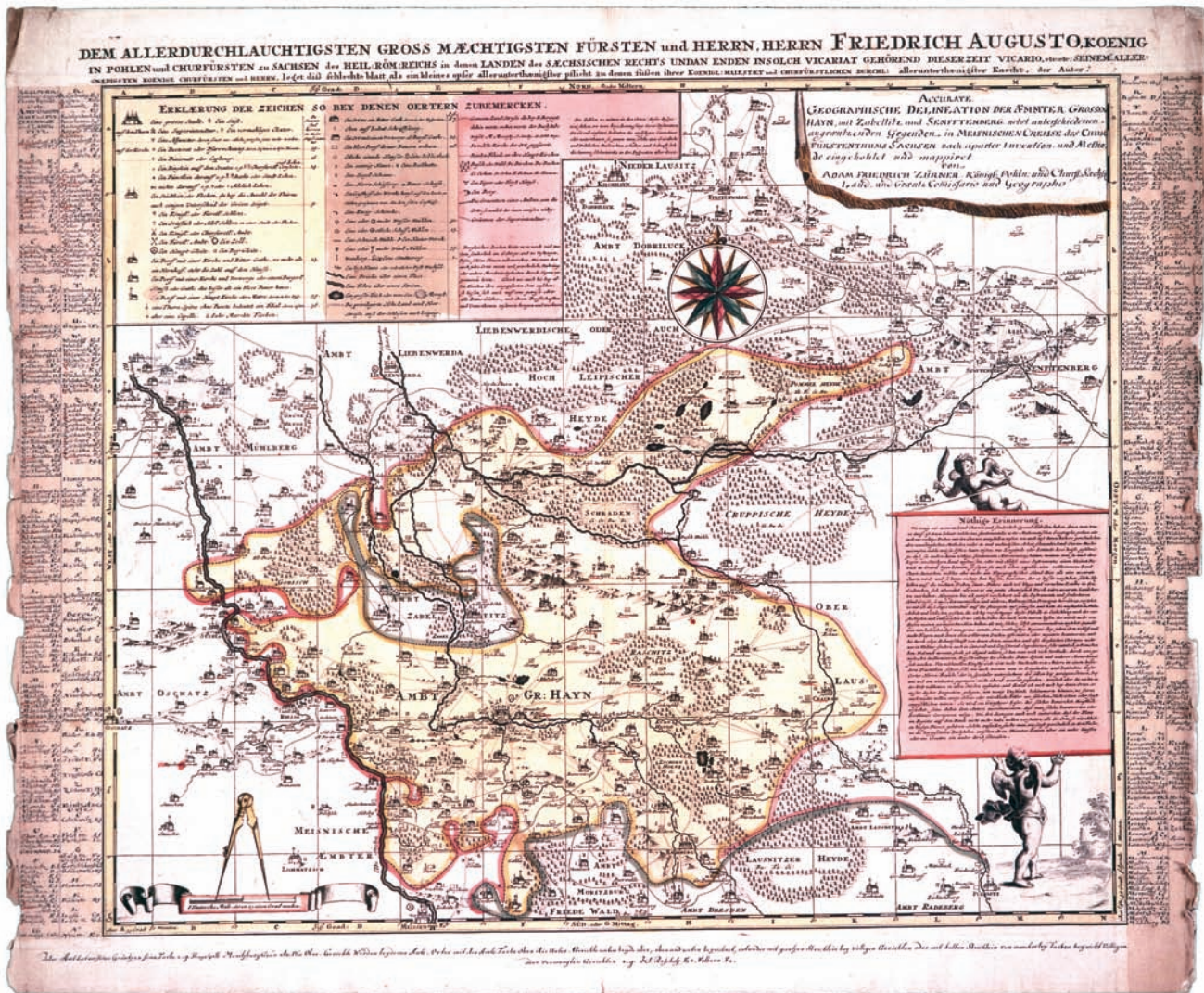


FIG. 953. LATER STATE (AFTER 1721) OF ADAM FRIEDRICH ZÜRNER'S ACCURATE GEOGRAPHISCHE DELINEATION DER ÄMPTER GROSSEN HAYN. First published in Amsterdam by Petrus I Schenk in 1711, the map includes the author's trademark combination of signs and an

alphanumeric manuscript index along its the left and right margins.

Image courtesy of the Hauptstaatsarchiv Dresden (12884 Karten und Risse, Schr. 1, F. 13, Nr. 10a, Bl. 2).

approval for the map's publication on 18 August 1711, and the map was soon thereafter printed in Amsterdam by Petrus I Schenk. August commissioned Zürner on 12 April 1713 to map the whole electorate and on 4 March 1716 appointed him "Churfürstlich Sächsischer Königlich Polnischer Geograph" (Dolz 2007, 37). Also in 1716, his mapping activities secured for Zürner membership in the Preußische Sozietät der Wissenschaften. After 1721, he also served as land and border commissioner. He continued mapping for the electorate until his death in Dresden on 18 December 1742.

In mapping Saxony, Zürner was ably assisted by Paul Trenckmann and influenced by his correspondent, the

Austrian military engineer Johann Christoph Müller. Zürner explained his methods in several letters to the Prussian academy and in his "Atlas Augustæus Saxonicus" (fig. 954). He provided geometric control by a rather simple graphic triangulation in which he drew sight lines between elevated positions on paper disks temporarily glued to a horizontal plate, a *Zollmannsche Scheibe* (see fig. 833). He reported in the atlas that he had "made around 2,000 paper disks from some 1,000 points" (Dolz 2007, 37). These disks were subsequently positioned on larger sheets of paper such that the sight lines intersected properly, thereby establishing the triangulation network. In surveying postal roads, for which



FIG. 954. TITLE PAGE TO THE MANUSCRIPT "ATLAS AUGUSTÆUS SAXONICUS" BY ADAM FRIEDRICH ZÜRNER (DRESDEN, BEFORE 1742). This title page shows several vignettes of Zürner's surveying and mapping procedures, from taking measurements in the field to compiling final maps in the office. A personification of Atlas holds both the heavens and the volume's dedication and explanation of its creation. Image courtesy of the Hauptstaatsarchiv Dresden (12884 Karten und Risse, Schr. 1, F. 13, Nr. 10a, Bl. II).

he erected sandstone mileposts at intervals of  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and 1 Saxon mile (9.06 km), he used a carriage fitted with an odometer.

By the end of Zürner's long career he had produced more than nine hundred maps, including his working manuscripts. In particular, the two manuscript copies of the "Atlas Augustæus Saxonicus," with eighty-one and fifty-nine leaves respectively, contain general maps, regional maps, and district maps (*Ämterkarten*) with scales ranging from 1:120,000 to 1:130,000. All have a graticule, and all stand out for the high density of their administrative, economic, and cultural information. Zürner combined up to 115 signs to characterize locations. His large four-sheet map of Saxony, at ca. 1:130,000, was also never published. However, Zürner's *Neue Chur Sächsische Post Charte* (1715) was published by Moritz Bodenehr in 1718, and his larger corpus formed the basis of the *Atlas saxonicus novus* published by Petrus II Schenk, which first appeared in 1752.

WOLFRAM DOLZ

SEE ALSO: Topographical Surveying: German States, with Geodetic Surveying

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