Collectio Mineralium

The catalog of Holy Roman Emperor Leopold II's mineralogical collection

edited by
Annarita Franza, Johannes Mattes,
Giovanni Pratesi

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Prof. Curzio Cipriani (1927–2007)
In memoriam

Table of Contents

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Preface

Alessandra Petrucci

The manuscript, which constitutes the core of this volume, is the catalog of the mineralogical collection belonging to Archduke Peter Leopold of Habsburg-Lorraine, written at the end of 1765 after he was appointed as reigning Grand Duke of Tuscany.

Originally written in German, the text is now accessible in English, thanks to this work edited by Giovanni Pratesi, along with Annarita Franza and Johannes Mattes, the latter belonging to the Austrian Academy of Sciences.

This edition—curated by Firenze University Press—is an expression of the commitment of our University, and its publication was supported by our Museum System, whose staff also contributed with an opening essay.

The Florentine academic tradition also transpires from the dedication of the volume, entitled to the memory of Curzio Cipriani (1927–2007), who was, among his various prestigious positions, Director of the Natural History Museum, Italian representative in the "Commission of Museums" of the International Mineralogical Association, and Full Prorector of our University.

Cipriani was a reference figure in the national and international panorama of mineralogy, devoting part of his scientifically industrious and highly successful career to the enhancement of the mineralogical collections in Florence. Therefore, it is not by chance that in 2001, the species CIPRIANIITE $Ca_4(ThCa)_{\Sigma 2}Al(Be_{0.5}\square_{1.5})_{\Sigma 2}[B_4Si_4O_{22}](OH)_2$ was named after him. This would be enough to value Cipriani's commitment to mineralogy, not to mention his deep involvement in the broader field of scientific museology.

For these reasons, I greatly appreciate the fact that this publication—which represents the mineralogical collection catalog of Grand Duke Peter Leopold, later Emperor Leopold II—has been dedicated to Cipriani's memory, and his scientific activity, underlining his commitment to the enhancement of scientific museums, to which he gave new and powerful meanings.

Curzio Cipriani is also to be credited for today's rich Museum System of the University of Firenze that preserves various kinds of naturalistic, scientific, and artistic

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collections according to precise criteria of conservation, and following the principles of modern museology.

Many of the authors who signed the introductory essays of this volume were directly or indirectly students of Cipriani. Therefore, to all who contributed to this publication, and in particular to the editors, goes the gratitude of our University for having realized a work of great scientific value, and for remembering the example of a great Master.

Rector of the University of Firenze

Mining, collecting, knowing: Habsburg state-building, resources, and geographies in the context of Archduke Leopold's mineralogical catalog

Johannes Mattes

1. Three Habsburg Offspring in the Western Carpathians

On 28 July 1764, the Viennese newspaper *Wienerisches Diarium* reported in detail on an elaborately orchestrated visit by the rising generation of the Habsburg dynasty elite to the Lower Hungarian mining district around Banská Štiavnica (Schemnitz, Slovakia):

> Today is the second day that we will always remember with pleasure. On the third of June 1751, we were delighted by the personal presence of Her Imperial Roman Majesty Franciscus, but today by the happiest arrival of Her Royal Roman Majesty Josephus II. He has come here [...] in order to visit the local and surrounding gold, silver, copper, lead, and iron mines. It is well known how many interesting and admirable objects our mines offer. So many rare machines of art, which lift the surface and trench waters, drive ore and rock; so many pushing, dredging, and washing plants; silver and lead smelteries; [...] not less [interesting are] the sampling, extracting, and silver-burning laboratories. [...] As soon as His Royal Majesty and the two most illustrious princes [...] got off the carriage, they were most humbly welcomed [...] and received samples of gold and silver ore, placed in one entirely gold-plated and two silver-plated mining tubs.[1] (Anonymous 1764, 4–5)

[1] Translation of the original German quote: „Der heutige Tag ist nun der zweyte, dessen wir uns jederzeit mit Vergnügen erinnern werden. Den 3ten Junii 1751. sind wir durch die persönlich allerhöchste Gegenwart Ihro Röm. Kaiserl. Majestät FRANCISCI, heute aber durch die beglückeste Ankunft Ihro Röm. Kön. Majestät JOSEPHI II. erfreuet worden, als welche [...] anhero gekommen, um die hiesigen, als die umliegenden Gold- Silber- Kupfer- Bley- und Eisen-bergwerke zu sehen. Es ist bekannt, wie viel sehens- und bewundernswürdige Gegenstände diese unsere Bergwerke darbieten. So viele seltene Kunst-maschinen, welche die Tag- und Graben-wasser heben, auch Erz und Berg treiben: so viel Puch- Schlämm- und Wasch-werker: Silber- und Bley-schmelz-hütten: [...] nicht

Annarita Franza, University of Florence, Italy, annarita.franza@unifi.it, 0000-0003-3146-6957
Johannes Mattes, Austrian Academy of Sciences, Austria, johannes.mattes@oeaw.ac.at, 0000-0002-8546-7149
Giovanni Pratesi, University of Florence, Italy, g.pratesi@unifi.it, 0000-0001-6329-901X

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Figure 1 – Luigi Paradisi (d. 1893), *Portrait of the Archduke Peter Leopold, Grand Duke of Tuscany.* Firenze, sec. XIX. Museo Galileo, Ritratti di medici e scienziati *et al.*, n. 3718.

The royal entourage of the recently crowned Joseph II (1741–1790) was led by his brother Leopold (1747–1792), his future brother-in-law Albert Kasimir of Saxony-Teschen (1738–1822), and the top officials of the Viennese central administration. This included the Court Chamber of Coinage and Mining (*Hofkammer in Münz- und Bergwesen*), the supreme authority responsible for minting and mining in the Habsburg dominions. The two-week journey to Bratislava (Pressburg) and the rather peripherally located mining region in the Western Carpathians, about 200 km east of the capital city and imperial seat, was strictly business, not pleasure for the three Habsburg offspring. The visit of this lucrative industrial area, significant for the economy and financial power of the Habsburg Monarchy, took place at the dedicated request of the ruling couple, Maria Theresia (1717–1780) and Franz Stephan (1708–1765). The journey was to prepare the young men for their further involvement in governmental affairs and their later role as sovereigns. In fact, Joseph II was to inherit the imperial dignity from his father in 1765 and was installed alongside his mother as co-regent in the Habsburg dominions. Leopold married that same year with Maria Luisa of Spain (1745–1792), went to Florence as Grand Duke of Tuscany and succeeded his brother as Holy Roman-German Emperor in 1790 (Wandruszka 1965). At the same time, Albert Kasimir obtained a powerful position as Habsburg *Palatin* (Stadtholder) in Hungary and got married to Maria Christina (1742–1798), a daughter of Maria Theresa.[2] The dense program of the journey encompassed the inspection of several underground galleries and laboratories, the study of the technical infrastructure, and practical work on-site. During their stay, they were dressed entirely in miner's habit,[3] and the three young noblemen even extracted ore samples from veins using a pickaxe.

The historian Peter Konečný (2013a, 350–1) has analyzed the political and educational intentions of this journey and those of other Habsburg rulers to the Slovak mining towns in the context of the representational demands of stakeholders such as the Viennese court, the mining administration, and regional estates (*Landstände*). By "showing personal presence on ground", representatives of the Habsburg dynasty underpinned their direct control of the mining area as a significant source of state income. Thus, claims of the Hungarian Court Chamber and the kingdom's nobility arising at the Diet (*Landtag*) of Bratislava were to be fended off. Moreover, during the trip, Joseph II and Leopold were introduced to a "practical knowledge culture" complementing the education they had received at the Viennese court.

The so-called "Golden Mining Book" (Goldenes Bergbuch 1764), a handwritten description of the Lower Hungarian mining districts containing sketches of mines, smelters, and minting plants, bears witness to the political significance of this knowl-

minder die Probier- Solvier- und Silber-brenn-laboratoria. […] Sobald nun Se. Königl. Majestät mit denen Durchlauchtigsten zweyen Prinzen […] aus dem Wagen ausgestiegen waren, wurden Höchstdieselben […] allerunterthänigst bewillkommet, und auf einem ganz vergoldten und 2. andern ganz versilberte Berg-tröglen einige schöne Gold- und Silber-hältige Erz-stufen dargereicht." The reports continued in the following issues: 61 (1 August): 3–4; 62 (4 August): 4–5; 63 (8 August), p. 9; 64 (11 August): 3–4; 65 (15 August): 3–4; 67 (22 August): 3–4; 68 (25 August): 3–4; 69 (29 August): 9–11; 70 (1 September): 3–4; 71 (5 September): 9–10.

2 In later years, Albert Kasimir became a famous collector and founder of the "Albertina", today the world's largest collection of graphic art.

3 During the visit of the Lower Hungarian mining region the whole entourage was dressed in miner's habit (Leopold 1764, 110v). For the use of miner's habit and the professionalization of mining education in Saxony see Felten (2020, 133–6).

edge.[4] Made for the personal use of Joseph II and Leopold on this special occasion, the "Golden Mining Book" served to familiarize the two prospective rulers with mining, its technologies, and financial benefit in the run-up to the trip and to prepare and follow up the instructions on-site (Vozár 2000). In particular, a preserved travel diary of Leopold (1764), in which he excerpted the information provided in the "Golden Mining Book" and combined it with his observations of mines, machines, tools, and tasks of workers, demonstrates the interdependency of these fields of knowledge with imperial policy (Vozár 1990). This is how Leopold (1764, 141r–141v) summed it up:

> It is certainly not among the least advantages for the state that mining feeds so many souls and extracts the hidden gold and silver from the earth, so that [the metals] circulate throughout the monarchy and increase the universal mass of money and wealth in the country. Moreover the sovereign profits from the exchange of metals, which are all sold to the mint and are cheaper than if he had to either buy them from abroad […] or mine them at own expense in his own mines. Everybody understands clearly […] that mines have very significant advantages and their benefits are crucial to the country, the shareholders of the mines and the sovereign. Therefore, it is necessary […] to know what causes a well-experienced miner to choose this or that mountain and whether there is such or such metal in it.[5]

2. The Scope of this Volume

The archival document at the center of this volume is a handwritten catalog of a mineral collection dedicated to Archduke Leopold. It was made by the end of 1765 after the appointment of the eighteen-year-old prince, now calling himself "Petro Leopoldo", as the reigning Grand Duke of Tuscany (Franza *et al*. 2019).

Preserved in the Historical Archive of the Natural History Museum of the University of Firenze, the catalog presents a leather binding with a golden Habsburg double-headed eagle emblem, an elaborate title page and a half-page ink drawing of the Lower Hungarian mining town of Kremnica (Kremnitz)[6] served representational needs. The appendix

[4] Known today as the „Goldenes Bergbuch" (1764) due to its precious design, three exemplars of this manuscript have been preserved. The original title is *Beschreibung von denen sammentlichen Schemnitzer sowohl Kayserlich-Königlich- und gewerckschaftlichen Grüben, alß von der gesammten hierzu gehörigen Wercks-Operation, und Waldungen, wie folget*. The manuscript was commissioned by the Vienna Court Chamber and compiled by the mining authorities in Banská Štiavnica (Schemnitz), Kremnica (Kremnitz), and Banská Bystrica (Neusohl). It contains numerous mostly colored plans and construction drawings, including those of the mining machines by the technician *Oberkunstmeister* Joseph Karl Hell (1711–1789). See for an edition of the manuscript Vozár (2000).

[5] Translation of the original German quote: „[…] indeme die Ernehrung so vieller Seelen, das verborgene Gold und Silber, so aus der Erde herausgezohen wird und in der ganzen Monarchie circuliert, wodurch die Universalmassa des Geldes und des Reichtums im Land vermehret, gewiß nicht unter die geringste Vortheile eines Staats zu zehlen sind. Über dieß gewinnet noch der Landesfürst in der Auslösung dieser metallen, so ihme alle in die Münze verkaufet werden und auf solche Art ihme viel wohlfeiler zustehen können, als wennn er dieselbe entweder aus der Fremde erkaufen […] oder selbsten auf eigene Unkösten aus seinen eigenen Gruben ziehen solte. Jedermann siehet klar […], daß die Vortheile der Bergwerken sehr groß und deren Nutzen sowohl für das Land als für die Gewerken, wie nicht weniger für den Landesfürsten sehr groß seie. Derohalben wird es notwendig sein […] von der Kenntniß zu sagen, welche einen wohlerfahrenen Bergmann veranlasset, diesen oder jenen Berg für seinen Bau zu erwählen und daß dieser eheher als jener Metal führet, […]".

[6] Known especially for gold mining and its mint, Kremnica was originally the most influential of the seven Lower Hungarian mining towns and the seat of a Mining Chamber (*Münz- und Bergkammer*).

Figure 2 – Map of the Royal Mining Towns, in Lower Hungary 1760. Ministerstvo Vnútra Sr, Štátny Archív V Banskej Bystrici - Pobočka Banská Štiavnica.

consists of an index arranged according to types of metals and minerals as well as an explanation of chemical symbols used. The order of the objects within the catalog that comprised specimens from all significant mining districts of the Habsburg dominions (including two objects from the Americas and Saxony) was given without any recognizable principle. This may have been of secondary importance because, in collections, specimens could be subjected to rearrangement, whereas the catalog primarily served as a key to the knowledge associated with the objects (Findlen 1994, 36–7). However, the specimens originating from non-Hungarian mining districts such as in Bohemia, Carinthia, Styria, and Tyrol were added towards the end of the catalog and with less care. The index classified the specimens according to their value, with the gold-, silver-, and copper-bearing ores that were extracted largely in Lower Hungary listed first.[7]

The compilation of the catalog, which was executed at the Viennese Court Chamber of Coinage and Mining,[8] needs to be understood in the context of the aforementioned journey and Leopold's introduction to mining, metallurgy, and mineralogy.

The Main Chamber Earl (*Oberkammergraf*) also resided in the town, before he moved to Banská Štiavnica at the end of the sixteenth century. As the highest mining official in Lower Hungary, the Chamber Count was responsible for the three local Mining Chambers in Kremnica, Banská Štiavnica, and Banská Bystrica. In addition to Kremnica, the seven Lower Hungarian mining towns, which united for economic interests until 1453, included Banská Bystrica (Neusohl), Banská Štiavnica (Schemnitz), Pukanec (Pukanz), Nová Baňa (Königsberg), Ľubietová (Libethen), and Banská Belá (Dilln).

7 In the index, so-called "minor" metals such as iron, lead, mercury or cinnabar and "Berg-Arten" (colorful ores) were listed comparatively later.

8 An overview of the archival holdings of the Court Chamber and the Court Chamber of Coinage and Mining, preserved in the Austrian State Archive, provides Hutterer and Seitschek (2019, 165–96).

The president of the Court Chamber, Johann Seyfried von Herberstein (1706–1771),[9] presumably commissioned to request outstanding specimens from the local mining administrations in the Habsburg lands.[10] However, these did not only provide samples of ore and so-called "handstones" (beautifully crystallized minerals or ore specimens the size of a hand),[11] but also added information about finding places, circumstances of discovery, as well as the structure and purity of the respective veins. This information was supplemented with details about chemistry, natural history, and ore processing. The mid-level civil servant in charge of arranging the received objects, assembling the attached information, and compiling the inventory was *Raitrath* Johann Franz Pirk(h)ert (1725–1789),[12] a control official in the accounting department of the supreme coinage and mining authority. However, judging by the three handwritings used in the catalog, only the description of the first two thirds of objects originates from Pirkhert's pen. One of the other two authors, who was identified by his signature, was *Hofkammerrat* Igna(t)z Franz Kempf(en) von Angret (1704–1767).[13] Like Herberstein and presumably also Pirk(h)ert, Kempf was involved in the aforementioned journey of Joseph II and Leopold to Hungary and had been among the mining officials that had presented samples of ore as gifts upon the arrival of the entourage. Although it is unclear if these objects were later integrated into the collection, the catalog is above all the result of an exchange process of specimens that brought various actors, spaces, and fields of knowledge together. In the state-building process of the Habsburg Monarchy, which gained momentum during an era of reform in the second half of the eighteenth century (Szabo 2018), the Vienna Court Chamber, upgraded by Maria Theresa to the supreme financial authority of the Habsburg Monarchy in 1762,[14] rendered itself a "center of calculation" (Latour 1987, 235). Turning Vienna into a node of knowledge and power, expanded or newly established bureaucratic bodies, learned institutions, and imperial collections gathered resources through "cycles of accumulation" and hegemonic practices of exchange with the Habsburg dominions.

[9] Born in Graz, Herberstein belonged to the Order of Knights of Malta, resigned from the order due to marriage and made a career as an administrative official in Trieste and Carniola. Between 1762 and 1765, Herberstein served as the president of the Viennese Court Chamber.

[10] No reference to Leopold's catalog could be found in the archival indices of the Court Chamber of Coinage and Mining or in the indices of the holdings "Österreichisches Camerale" and "Camerale Ungarn" of the Court Chamber (1764–1766). Nevertheless, requesting ore samples from local mining authorities was a common practice of the Court Chamber and the Viennese Court. The holdings of the Court Chamber Presidium start with September 1797.

[11] The term "handstone" was also used to describe (artistically) carved ore specimens that were mounted on pedestals. This practice is documented particularly in Bohemia and Lower Hungary.

[12] Born in Vienna on 24 June 1725, Johann Franz Pirk(h)ert was the son of *Hofkammer-Concipist* Matthias Heinrich P. and married Philippina von Felsenberg (+1815). Similar to his father, he served as an official in the Viennese Court Chamber of Coinage and Mining. His death is recorded in the death register of the parish "St. Maria Rotunda" in Vienna on 22 September 1789.

[13] Born in Colmar (Alsace), Kempf started his career as an accountant of the Banat provincial administration in Timișoara in 1723. After joining the Viennese Court Chamber as a Counselor in 1741, he served as Commissioner of the mining towns in Lower Hungary and as Chamber Count in Banská Štiavnica in 1750–1754. In 1759, Kempf was ennobled for his services and obtained the status of a baron (Kneschke 1864, 63–4). At last, he held the position of a *Hofrath* in the Viennese Court Chamber.

[14] During the 'long' eighteenth century, the Viennese Court Chamber underwent numerous changes and reorganizations (Dickson and Rauscher 2019, 851–2). The administrative reforms that began in 1761 significantly strengthened its responsibility and increased its staff. In addition, the Court Chamber of Accounts and the General Cashier's Office were established.

Since the early 2000s, historians of science and scholars dealing with issues of mutual social, cultural and economic exchange made significant efforts to reframe the "traditional" mining history, which previously only rather small circles of specialists were discussing. A reconsideration of the early modern mining bureaucracy, cameralistic economy, and its actors under the aspects of knowledge and power opened the field to new research questions such as (underground) resources, sustainability, and environmental history. Jakob Vogel (2013) studied intersections between the knowledge worlds of European mining and the cameralist bureaucracy in the second half of the nineteenth century. "Enlightenment underground" was the framing Vogel used to interpret the scientific professionalization of education in mining academies as well as the tranches of natural history, technological, and practical knowledge that circulated among scholars, officials, societies, and mining journals. Based in particular on his study of Saxon mining, Andre Wakefield (2009) investigated cameralism as natural, economic, and technological sciences aimed at improving bureaucratic practices. A recent issue of the journal *Renaissance Studies* edited by Tina Asmussen and Pamela Long (2019) dealt with the "cultures of mining" as "cultures of knowledge", by referring to the concept of "trading zone" coined by Peter Galison (1997: 803) as "social, material, and intellectual mortar binding together the disunified traditions of experimenting, theorizing, and instrument building." Marianne Klemun (2007, 2013) examined the collection, exchange, and scientific study of minerals, especially by officials and scholars involved in the eighteenth-century Habsburg mining administration, such as the well-known naturalists Ignaz von Born (1742–1791), Belsazar Hacquet (1739–1815), or Nikolaus Joseph von Jacquin (1727–1817).

The majority of the aforementioned studies are based on the mining districts in Saxony and Hungary. The state educational institutions established there as the *Kurfürstlich-Sächsische Bergakademie* (1765) in Freiberg and the *Praktische Bergschule* (1762, since 1770 Academy) in Banská Štiavnica, responsible for the entire Habsburg Monarchy, became models for the founding or reorganization of mining schools in other parts of Europe (Brianta 2000; Vaccari 2009). In this regard, the contributions of Peter Konečný (2012, 2013b) and Hartmut Schleiff (2013a, 2013b) on the reformation of mining education and the emergence of scientifically trained functional elites in the administration of the mining state (*Bergstaat*) are particularly noteworthy. Through the example of Saxony, Sebastian Felten (2018) dealt with processes of "boundary-work" (Gieryn 1983) between the experts in and around the mines and their bureaucratic and scientific knowledge production. Despite the close cooperation between the guild-organized miners, the naturalists employed in the mining academies, and the bureaucracy, which, in case of the Habsburg Monarchy, consisted of professionally trained officials recruited from the nobility and the bourgeoisie, there were limits to the exchange of knowledge and specimens. In part, this was due to different professional interests and social backgrounds. By contrast, the private mineral trade between collectors and scholars flourished in the eighteenth and early nineteenth centuries (Klemun 2000; Vogel 2019).

Comparing the catalog dedicated to Leopold with his travel diary, the *Golden Mining Book*, and other eighteenth-century mineral collections raises questions regarding the circulation of specimens, their 'biographies', and the various actors and functions of the knowledge involved. Due to the catalog's context of origin, this volume refers to broader processes such as the reform of the mining education, the establishment of large natural history collections in both Firenze and Vienna, and a new self-image of 'enlightened' monarchs. We argue that the catalog represents a powerful tool to better understand the interplay between imperial practices of collecting and representing with specific regard to mineralogical, mining, and bureaucratic knowledge on the threshold

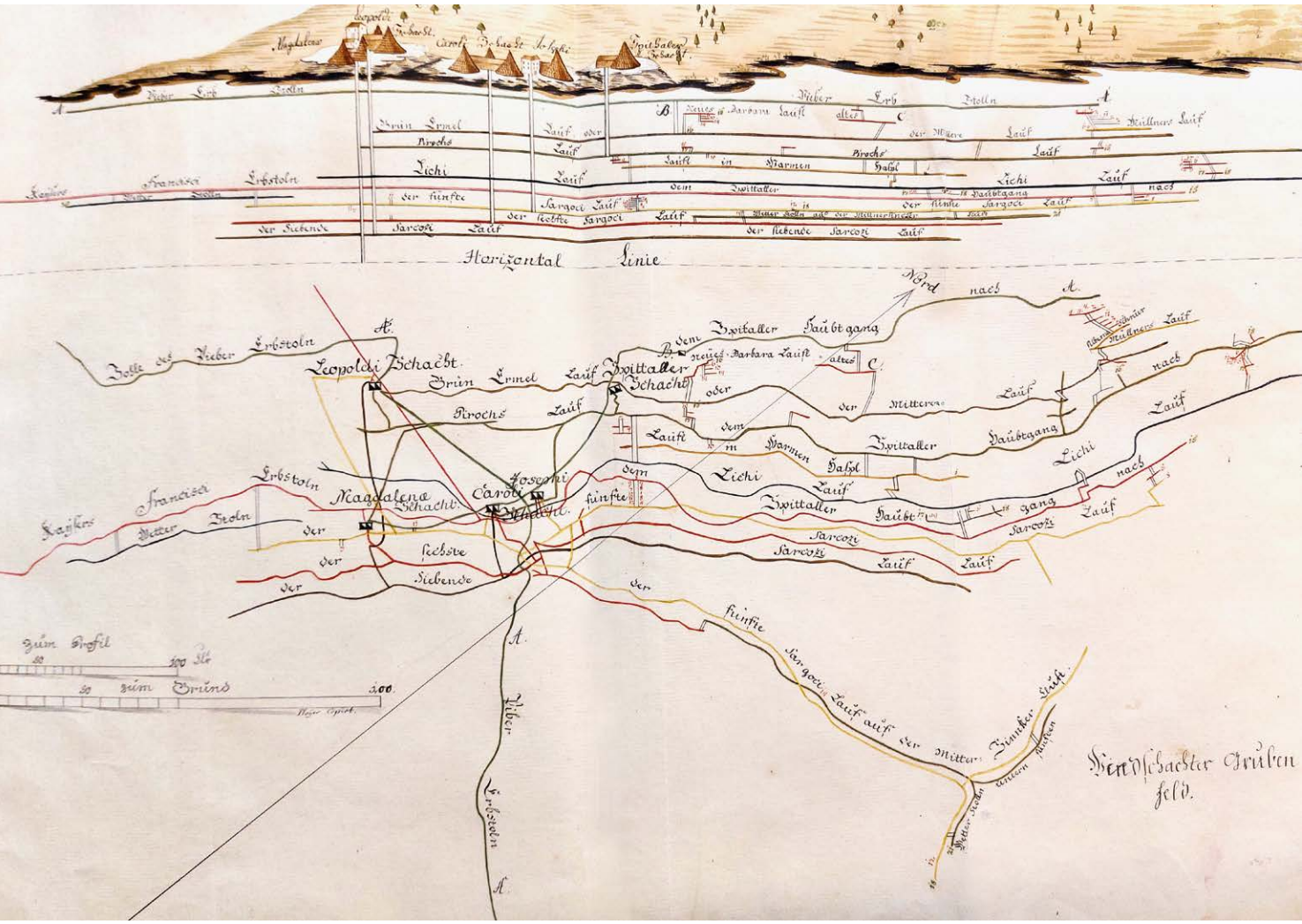

Figure 3 – Windschachter Pit in Banská Štiavnica. In: Goldenes Bergbuch, 1764, fol. 25. Courtesy of Ministero della Cultura/ Biblioteca Nazionale Centrale Firenze, Palatino 1094.

of the Enlightenment. Although the described collection has not been located yet, the comparatively small number of objects allows a detailed study of the mineralogical specimens and mining locations involved. In addition, the catalog illustrates the transformation process that objects underwent when they were sent to the Viennese Court by local mining authorities. Leopold's catalog, thus, is much more than a simple list; it provided a representative account of the collection, located the specimens spatially, temporally, and comparatively, and related the objects to knowledge outside the specific collection.

In the following, this essay aims less at a detailed examination of the catalog and the objects described, which will be undertaken in a later essay, but I would like to contextualize the catalog from three different angles. The first section describes the bureaucratic structures, geographies of power and knowledge[15] in which the catalog is embedded. This is followed by a brief outline of mining and the economy in the Habsburg dominions around 1750. Finally, imperial practices of collecting and representation will be discussed.

3. Geographies of Power and Knowledge

At the beginning of the eighteenth century, the Habsburg Monarchy did not form a unified state or nation, but a rather loose aggregation of different dominions held together by personal dynastic union, the military, and administrative authorities based at the imperial seat of Vienna (Evans 1979, 447). As was the case with most of Europe's early modern states, rulers of multiple monarchies could draw on resources from several countries during times of crisis or use them to maintain their control over a particular territory. Depending on the form of such a "composite monarchy" (Koenigsberger 1989; Elliott 1992), its various parts could be based on a common jurisdiction or on local legal structures and traditions, with a relationship of dominance often existing between the countries of an association. Efforts by sovereigns to achieve greater integration between dominions at the legal, cultural, or institutional level and to streamline administration also led to reservations and resistance of the regional nobility, as Emperor Joseph II had to learn in his later program of reform driven by enlightened despotism (Josephinism)[16] (Reinalter 2008; Elliott 2009). The Habsburg conglomerate of dominions, which had emerged in a long historical process, was constituted heterogeneously and each part faced individual challenges. As Peter Maťa (2019, 48) has pointed out, the Habsburg integration policy depended on the cooperation with the regional estates and the balancing of power relations within each region in order to stabilize the entire territory. The "asymmetrical process of internal consolidation" caused considerable territorial differences in the Habsburg state formation and led to a monarchy of "multiple speeds."

The geopolitical heartland of the Habsburg rule (Vocelka 2001, 21–3), clustered around the Danube stream, was formed by the Austrian Hereditary Lands, the Lands of the Bohemian Crown, and the Kingdom of Hungary. The first consisted of the Archduchy of Austria, the Duchies of Styria, Carinthia and Carniola, the County of Tyrol, as well as possessions at the Adriatic coast and in Swabia. Together with Bohemia, they were the most populous and economically productive dominions and more intercon-

[15] For a theoretical discussion, concepts, and research questions on the intertwining of knowledge and power, see Meusburger (2015).

[16] For the reception of "Josephinism" in the twentieth century see the volume edited by Fillafer and Wallnig (2016).

nected with each other than with the other parts of the monarchy. In Styria, Carinthia, Bohemia, and Tyrol, there existed a profitable mining industry. In the second half of the eighteenth century, the Styrian mines produced as much pig iron as the whole of England (Good 1984, 21). The Kingdom of Hungary, on the other hand, was primarily built on agriculture. With the exception of the industrialized mining areas in present-day Slovakia, the coastal towns on the Adriatic, and the area around Bratislava (seat of the Hungarian administration until 1783), it largely served as the monarchy's "breadbasket." The Banat of Timișoara and Transylvania (from 1765 Grand Duchy), which had fallen to the Habsburgs in the wars with the Ottoman Empire, were not governed by the Hungarian administration, but directly by the court offices in Vienna.[17] The territories were economically developed through reconstruction measures, investments, and the settlement of miners from eastern Slovakia and the Habsburg hereditary lands (especially Tyrol). Despite their significance for trade and commerce, the Austrian Netherlands and Lombardy were detached from the other Habsburg dominions and thus posed a geopolitical challenge. The Grand Duchy of Tuscany, which Franz Stephan von Lothringen had received in exchange for his ancestral lands on the occasion of his marriage to the emperor's daughter Maria Theresa, was not part of the Habsburg territories. Although Tuscany served as a source of funds for Habsburg warfare and the emperor's private undertakings, it retained a special status.[18]

Recent scholarship has introduced the analytical concept of the "fiscal-military state" (Storrs 2009) to the eighteenth-century Habsburg Monarchy (Godsey 2018; Godsey *et al.* 2021). Originally described as peculiar to Great Britain, historians now use the term to describe a phenomenon that applied to the major European powers of the eighteenth-century, namely the financing of the military in war- and peacetime as the core function of a state. For the Habsburg territories, warfare and its funding had lasting state-building effects.[19] Long-term armed conflicts fought against the Ottoman Empire and the War of the Austrian Succession (1740–1748)[20] had not only indebted the state budget and increased a tax burden, but also revealed the military and financial incapacity of the monarchy to effectively overcome such challenges. The provision of a powerful army even in peacetime and the transfer of responsibility for recruiting, training, and equipping soldiers from the estates to the crown was ensured by regular taxation of seigneurial demesnes. The centralization of bureaucracy and the reforms carried out under Count Friedrich Wilhelm von Haugwitz (1702–1765), who headed a joint supreme administrative and financial authority (*Directorium in publicis et cameralibus*) existing between 1749 and 1761, served to "mobilize resources" and to restrain the political power of the estates in the Habsburg dominions (Maťa 2019, 46). The Court Chamber, re-established as the supreme financial authority in 1762, had a significant integrative effect on the various Habsburg dominions. The tasks of the subordinated Court Chamber of Coinage and Mining involved the efficient exploitation

[17] As an inalienable crown property, the Banat (1718) was subject to the Viennese Court Chamber and the Court War Council (*Hofkriegsrat*). Transylvania, in turn, was governed as a crownland by the newly established Transylvanian Court Chancellery.

[18] Initially governed by Viennese and Lorraine officials on behalf of Franz Stephan, the Grand Duchy was fundamentally reformed under the reign of Leopold. See the other contributions on Leopold and his collections in Firenze in this volume.

[19] The Court War Council served as a central authority for all parts of the monarchy. For the execution of common tasks such as border protection, obligations were distributed to all dominions.

[20] The war was caused by the disputed succession of Maria Theresa to the lands of her father Emperor Karl VI (1685–1740).

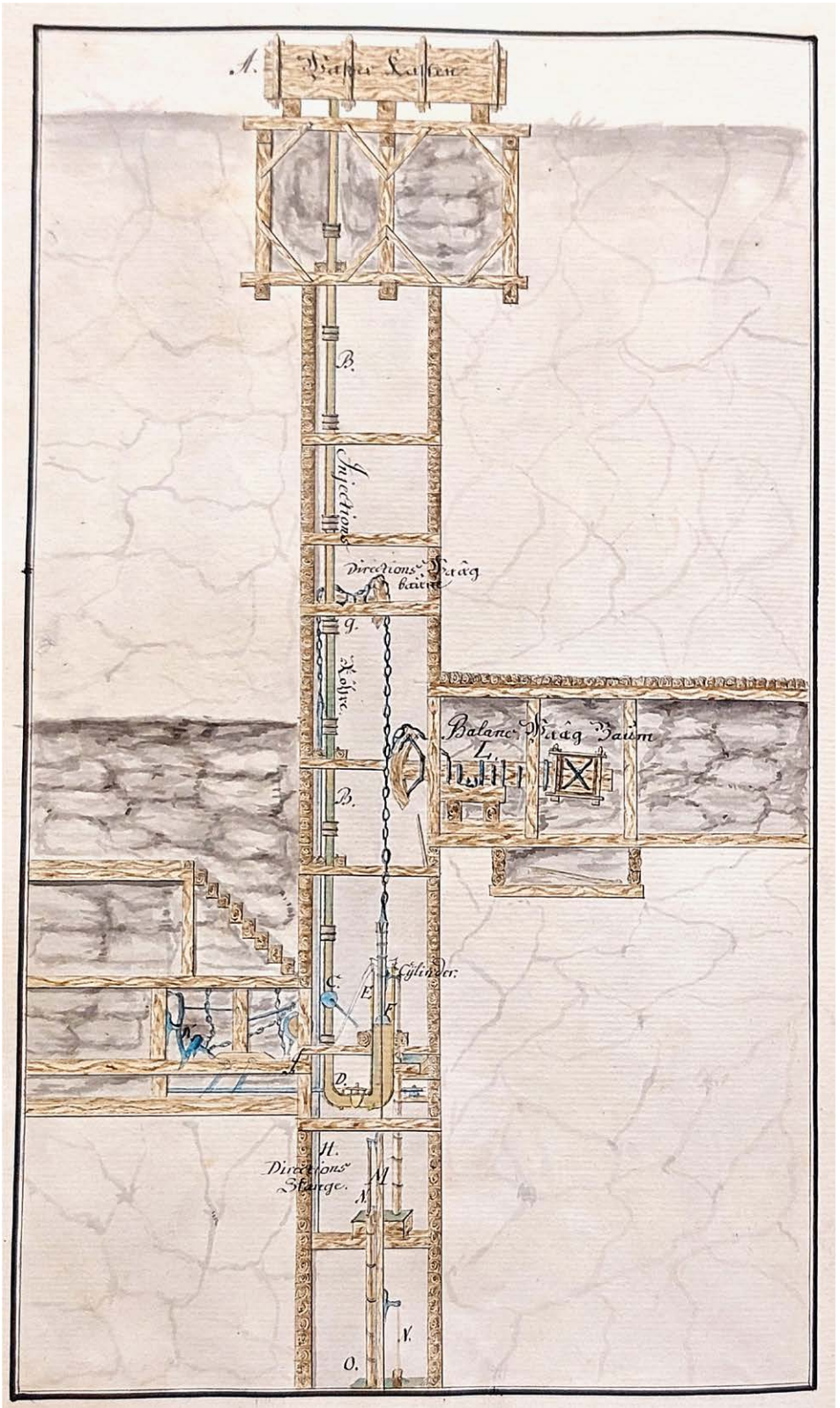

Figure 4 – Hydraulic, so-called "Carl Höllische" water machine in the Leopoldischacht in Banská Štiavnica. In: Goldenes Bergbuch, 1764, fol. 53. Courtesy of Ministero della Cultura/Biblioteca Nazionale Centrale Firenze, Palatino 1094.

of the dominions' mineral resources, which had helped to fund the costly Seven Years' War (1756–1763) for continental supremacy (Winkelbauer 2019, 773–4). Although it had not resulted in any significant border shifts for the Habsburg Monarchy, the war financed through bonds and high taxes worsened the meanwhile chronic state deficit[21] and deepened the rivalry with Prussia, which emerged from the conflict as a new European super power.

Leopold's catalog is embedded in this political geography and the bundling of power, space, and knowledge at one central spot to exercise control and authority over vast territories. Bringing together specimens and knowledge from all major mining districts of the monarchy, the catalog was created during a prolonged period of state crisis that required a fundamental reform of the monarchy, its bureaucracy, as well as financial budget planning.[22] Thus, the knowledge gathered in the catalog was practice-oriented. By offering insights in a profitable use of ore resources, technologies, and industrial infrastructure, it should meet the rising demands of absolutist sovereigns who began to consider such knowledge and its potential for governmental affairs. In his recent book on the Habsburgian Enlightenment (*Aufklärung habsburgisch*), the historian Franz Fillafer (2020, 18–9) examined different varieties of the Enlightenments and their influence on state-building, which he interpreted as a

> condensation of multi-stranded efforts by local actors who were active on different tracks. […] The state is thus no longer to be understood as an omnipotent regulatory and allocative instance that distributed resources and imposed guidelines; it appears much more as a kind of relay into which various actors infiltrated their content as they competed for feed-in priority and for the validity power of their concepts.

During the reforms of Maria Theresa, (scientific) knowledge useful to the state, its development and a higher efficiency of the monarchy's economy and administration were of special significance. Accordingly, by order of Maria Theresa, Gerard van Swieten (1700–1772), her Majesty's personal physician and prefect of the court library, initiated a reform of the autonomous universities that had fallen behind in European comparison. The reforms removed them from the influence of the Jesuit order and placed them as new state institutions under the supervision of public officials, so-called directors of studies (*Studiendirektoren*). All teaching materials, including Lecture Books (*Vorlesebücher*) that were read aloud during class required state approval and the new curricula focused on the training of public servants such as court officials, priests, advocates, or physicians (Mühlberger 2009, 71–3). The reforms also involved an upgrading of natural history education (*natura physica*), which was to provide basic instruction in botany, chemistry, mineralogy, and zoology. At the University of Prague as the oldest central European university, the chair of natural history was established in 1752 and

[21] While the state treasury was already empty when Maria Theresa came to power, the monarchy's debt amounted to 118 million florins in 1756 and to 376 million florins in 1780, the year of the regent's death. As countermeasures, the precious metal content of coins was reduced and, starting in 1762, paper money, so-called blank notes (*Blancozettel*), was put into circulation (Stermitz 2006, 111). By 1765, the interest on the bonds alone had already eaten up half of the state budget. All the more important for the state budget was the mining industry, which provided the precious metal for the minting of coins.

[22] This included, for example, the introduction of a central state accounting system as a controlling authority (*Hofrechenkammer*), a general treasury (*Generalkasse*) (both in 1761), and the annual preparation of a state estimate covering all military and civil concerns, which was first done for the military year of 1767.

Johann Baptist Bohadsch (Boháč) (1724–1768) was appointed to fill it. In 1762, by the orders of Franz Stephan, he traveled to the chamber estate (*Kammergut*) in Upper Austria. There he studied the area mineralogically and botanically as well as the local salt production (Lobitzer and Pošmourný 2010).[23] In 1763, the founding of a chair for mining sciences followed. It existed until the appointment of its holder Johann Thaddäus Peithner (1727–1792) to Banská Štiavnica in 1772. In addition, a Natural History Cabinet was established at the University of Prague in 1775, which comprised of (mineral) collections of Franz Josef Count Kinsky (1739–1805) and Ignaz von Born (1742–1791) and was further enriched by ore specimens provided by the Bohemian local mining administrations. In Vienna, a new university building (today the seat of the Academy of Sciences) was inaugurated in 1756. It housed an anatomic theatre and observatory, and was designed to bring together all faculties. The first chair of botany and chemistry was established at the medical faculty in 1749 and the Lorraine naturalist Robert-François de Laugier (1722–1793) was appointed to it. In 1763, the court decreed that more lectures were to be given on mineralogy at the Philosophical Faculty. Laugier's successor as professor and director of the Botanical Garden was the Belgian naturalist Nikolaus Joseph Jacquin. He had previously held the newly created chair of chemistry and mineralogy, metallurgy and docimastics in Banská Štiavnica from 1762 to 1768. The founding of a chair for general natural history at the University of Vienna did not take place until 1775 (Svojtka 2010, 2016).

Research was not the primary function of a university and its professors. Rather, it was above all the court collections and individual state authorities that developed into important centers of scientific practice and were closely interwoven with the state bureaucracy. These included the Court Library, the Natural History Cabinet, the Physical Cabinet, the Coin and Antiquities Cabinets, the Oriental Academy, the House, Court and State Archives as well as the Dutch botanical garden and menagerie at Schönbrunn. The imperial collections that, step by step, became centralized in Vienna were housed in the Court Palace (*Hofburg*) Augustinian Wing.[24] The Natural Cabinet, established by Franz Stephan as a private collection, became state property in 1765, and served as a place of instructions for the young archdukes. Similar to the other imperial collections, they were increasingly expanded and musealized under Franz Stephan, i.e. reorganized, cataloged, and made accessible to a wider circle of individuals.[25]

Besides the Italian dominions, Bohemia and Moravia also represented significant centers of scholarship in the Habsburg Monarchy. In Olmouc (Olmütz), the *Societas eruditorum incognitorum in terris Austriacis* was founded as the first learned society in 1746 by Joseph Freiherr von Petrasch (1714–1772), followed by the Bohemian Learned Private Society in Prague developed in 1770 around Ignaz von Born. The emergence of Vienna as a center of knowledge was above all connected to the imperial court. Its in-

[23] The report of the journey was published not before 1782 by the naturalist and mining official Ignaz von Born. See Bohadsch (1782).

[24] After the death of Emperor Franz Stephan (1765), the Coin, Physical and Natural History Cabinet, previously located in the Treasury and in the reading room of the Court Library respectively, was moved to the Augustinian Wing that had been substantially enlarged in 1764–1765. From the court rooms, one crosses the two rooms of the Natural History Cabinet to the two rooms of the Physical Cabinet and finally to the room of the Coin Cabinet. See Schönburg-Hartenstein (1987, 97), Hassmann (2015, 37–45).

[25] Fitzinger (1856, 447) states that the Natural History Cabinet was opened twice a week on Maria Theresa's order for "general visit", at first presumably only nobles and scholars. Verifiably, the Natural History Cabinet was open to the general public (including women and children) from 1769, and the Physical Cabinet and the Coin Cabinet from 1773 at the latest. See Hassmann (2015, 69–72); Koeberl *et al.* (2018, 143).


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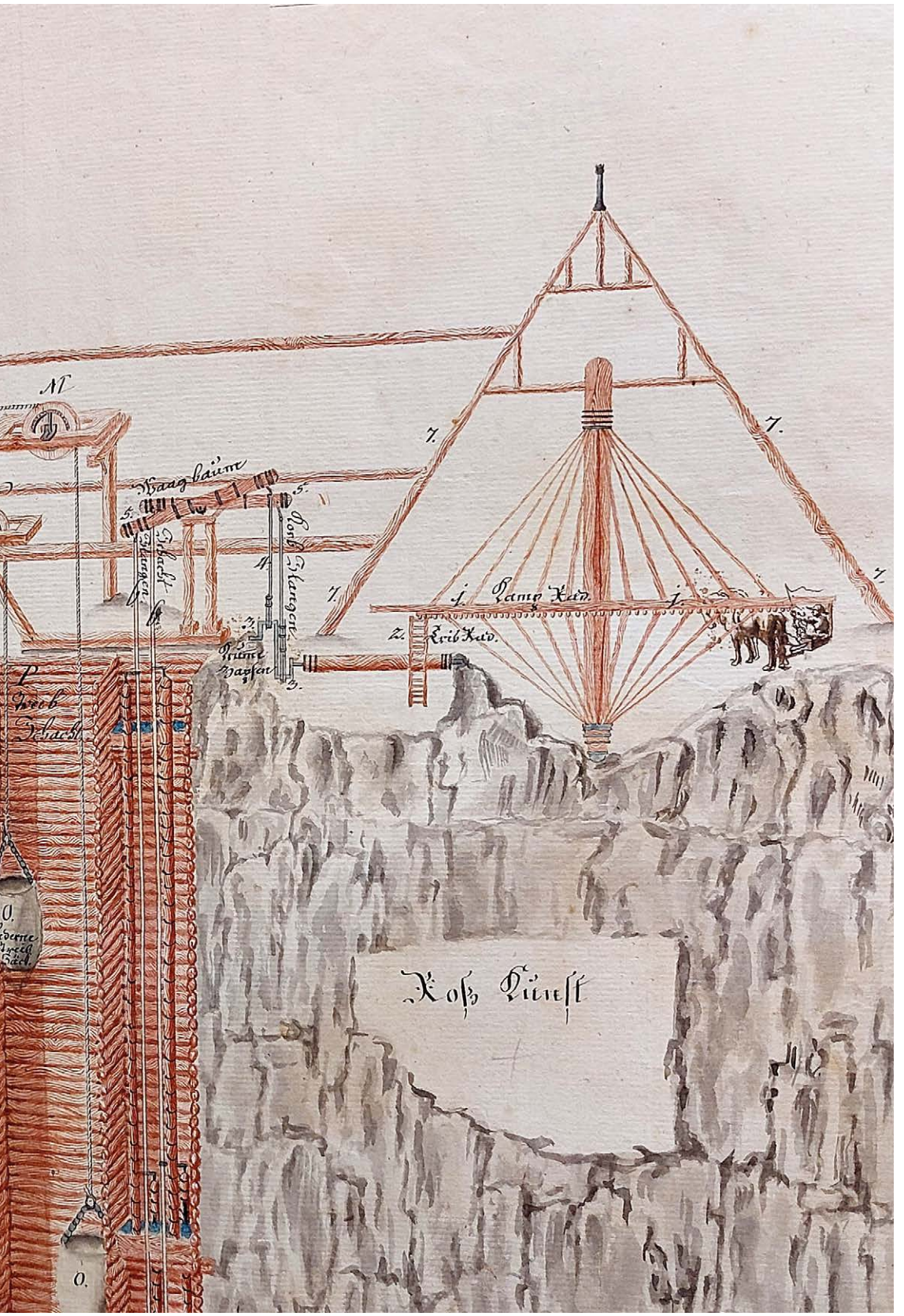

Figure 5 – Mining machines operated with horses. In: Goldenes Bergbuch, 1764, fol. 57. Courtesy of Ministero della Cultura/Biblioteca Nazionale Centrale Firenze, Palatino 1094.

Figure 6 – *Tabula Geographica Europae Austriacae Generalis sive Regionum Terrarumque Omnium ac Singularum Augustissimae Domui Austriacae Hereditariarum*. The first and for half a century the only printed map of the entire Austrian Hereditary Lands, 1725–30. Map author: Johann Christoph Homann. Woldan Collection, Austrian Academy of Sciences.

fluence on the scientific landscape of the Habsburg dominions was proving to be more durable than in other European cities. Besides the acquired control over the higher education infrastructure, the imperial administration was located here and the door-to-door agglomeration of scientific and bureaucratic knowledge was another contributing factor. The merging of these spheres manifests itself in the professional field of scholarly experienced higher court officials. For example, Johann de Baillou (1679–1758), director of the Natural Cabinet, or the Imperial Mathematician Joseph Anton Nagel (1717–1794)[26] were entrusted with both scientific and state-administrative tasks. By opening up the monarchy as a hub and resource for scientific practices, such imperial agents contributed to the spatial concentration of power and knowledge and the amalgamation of the different Habsburg dominions.

4. Economy and Mining in the Habsburg Dominions

The interest in minerals was not only fueled by a passion for the collection process, the aesthetics of the specimens, or their study. It was also of economic significance since minerals formed the basis of industrial products. As the information on the precious metal content, the yield of ore veins or the processing of ores in Leopold's collection catalog indicates, this kind of knowledge helped to manage the heavily indebted monarchy.[27] Not only the value of minerals, the profitability of mines and technologies, but also considerations on how the state could gather practical knowledge on-site and exploit the resources more efficiently by means of a service-minded and disciplined bureaucracy were of interest. Like Leopold, Joseph had intensively studied questions of administration and rulership during his time as crown prince (Plattner 2008). The goal of his later visions on government was the creation of a centralist-bureaucratic unitary state with a homogeneous body of subordinates.

However, the expansion of state authority, the elimination of intermediary powers between sovereign and subordinates, and the mobilization of economic resources for the purpose of a sovereign-ordained welfare program were rooted in the period before 1765 (Reinalter 2008, 19). Severe crises under Maria Theresa's rule, such as the Seven Years' War, had required an increase in tax revenue and had revealed the backlog in the administration of the Habsburg lands. This offered a field of action for various players. Besides those from the cameral estate administration, the army, monasteries and noble businesses,[28] the urban bourgeoisie and local scientific societies significantly contributed to the state-building process by providing resources such as knowledge, labor, and their

[26] In 1747–1748 Nagel was sent to Styria, Lower Austria, Carniola and Moravia by order of Franz Stephan to study the natural wonders there (including caves and mines) and to collect for the Natural History Cabinet founded in 1748 with the purchase of Baillou's collection. In 1750, further journeys followed to acquire natural specimens, presumably to England, France and the Netherlands, and in 1751 to collect minerals in the Hungarian Carpathians. In 1763 Nagel was sent to Hall in Tyrol to improve the salt brew system, where two years later the third brew pan was inaugurated in the presence of the imperial couple. Since 1772 Nagel served as the Director of the Physical Cabinet. See Schönburg-Hartenstein (1987), Mattes (2015, 47–9).

[27] The Napoleonic Wars, the occupations of Vienna and the cessions of territory and reparations agreed in the Peace of Schönbrunn (1809) finally led to the state bankruptcy of the Habsburg Monarchy in 1811.

[28] For example, Count Johann Gottlieb II. Stampfer (1733–1803), whose family operated (copper) mining in Carinthia, served as Chamber Count and head of the Mining Academy in Banská Štiavnica (1765–1774). His father had been employed as a high mining official and finally as Vice-President of the Vienna Court Chamber. See Salzmann 2007.

own interests (Fillafer 2020). Mercantilist, cameralistic, and physiocratic concepts justified interventions in agribusiness, trade, customs, commerce, and infrastructure policies, supervised by a constantly reformed bureaucracy (Hackl 2008). As each of the Habsburg dominions represented a separate economic area, political measures, such as the abolition of internal customs duties[29] and the expansion of transport routes, were meant to unify the monarchy economically. Similar to Leopold's catalog, which brought together specimens from all the important mining areas of the monarchy, the administration aimed at an organic management and even exploitation of all the raw materials of the monarchy, the labor force of its subordinates, as well as useful knowledge (Matis 1981).

The establishment and operation of state manufactories and workhouses, where the poor had to labor in a welfare regime instead of receiving alms, should increase the economic productivity. The export of raw materials as well as the import of industrial products were heavily taxed in order to improve the financial power of the state. The strengthening of the central state administration in the second half of the eighteenth century came at the expense of the guilds, manorialism, and municipal magistrates, whose powers were subsequently restricted. Often, state estates functioned as an "experimental field" and models for private landed estates (Fillafer 2020, 262). To promote enterprises and manufactures, monopoly rights were granted for production and technologies, and traditional state monopolies such as the sovereign mining regal, the salt monopoly, the mining and trading of mercury, or the tobacco monopoly were expanded. These cameralistic measures were contrasted by liberalizations in trade, the free movement of labor (abolition of serfdom) and restriction of landlord prerogatives, such as the processing and marketing of the products of subjects (Komlosy 2019, 997).

In each of their lands, the Habsburg sovereigns had private domain and regalian rights such as tolls, customs, mining revenues and profits from minting coins. This was accompanied by the salt monopoly[30] and the state-controlled trade of precious metals. The *Bergregal* (disposal of unexploited mineral resources) led to a separation of land ownership and mining rights. Either the sovereign reserved the privilege to exploit ores and minerals to himself (especially in case of salt and precious metals)[31] or he granted it to third parties such as landlords, estates and cities, who had to pay taxes for it (usually 10% of the extracted raw material). Oftentimes, mining operations were carried out by so-called "Gewerken", a form of private mining co-operatives, which united several shareholders with different shares in a joint tenancy. In some cases, the *Bergregal* included the privilege of the sovereign to buy the extracted ores in advance and at a lower price than the normal trade value.

The whole protoindustrial sector around resources extraction, metallurgy, and metal processing represented an important source of income, which was used to pay off the state debt and to finance the costly Vienna court household. Habsburg sovereigns thus had keen interest in an efficient, profitable, and safe operation of the mines they owned. Yet these mines had the advantage of being independent of the approval of the estates. Sovereigns also encouraged private ventures by providing financial subsidies or by granting privileges. The mining regions within the monarchy, together with Saxony and Lat-

[29] A unified customs territory, including most of the Austrian and Bohemian dominions, was created in 1775. However, this did not yet encompass Hungary, Tyrol, the Forelands, Belgium and Milano.

[30] The income from salt production and trade from the sovereign's chamber property (*Kammergut*) in the provinces above and below the Enns (Upper and Lower Austria) represented an essential part of the income of the salt monopole. See Rauscher (2019); Scheutz (2019).

[31] The mining of "minor" metals such as iron, copper and lead was also strictly regulated. See Brusatti (1979, 115).

Figure 7 – Detail of the plan of the imperial capital of Vienna, taken 1769–1772, Map author: Josef Daniel von Huber (1778). Woldan Collection, Austrian Academy of Sciences.

in America, from which the two 'foreign' objects in Leopold's collection originate, were among the most important in the world. These include the rich mercury mines of Idrija (Idria, Carniola), the iron production around the Styrian Erzberg, the iron, copper, and silver mining in Carinthia, the Bohemian silver and iron mines, the salt production in the *Kammergut* (Upper Austria), the silver, copper, and salt mining in Tyrol, and especially the Hungarian gold, silver, and copper mines. Banat and Transylvania directly administered by Vienna held a special position. After the conquest of these regions at the beginning of the eighteenth century, a prosperous mining industry was established there. The settlement of miners from other parts of the monarchy and Southern Germany was encouraged and the expertise and technologies from other mining regions was implemented. Precious metals, copper, and iron ore were exploited in the Banat region, and silver and salt in Transylvania (Slotta *et al.* 2002; Popescu and Wollmann 2013).

Before a general mining law was introduced in the Habsburg Monarchy in 1854, the legal provisions were laid down in numerous regional and local mining ordinances (*Bergordnungen*).[32] As Miroslav Lacko (2017a, 52) has pointed out by using the example of iron production, the monarchy's economic policy and regulatory engagement in the mining industry did not open up to liberal ambitions before the 1780s. Starting in 1781, state mining courts were established, limiting the rights of the sovereign over those of the landowner. In 1785, raw materials such as alum and cobalt were taken out of the mining regal, as were mercury and cinnabar, but it was not until 1840 that their sale was released (Brusatti 1979, 113–5).

In the Kingdom of Hungary, the state held a particularly powerful position and was able to enforce a state copper monopoly. Hungary therefore served as a "test area for cameralist reforms", which were later extended to other mining districts (Konečný 2013c, 162). Since the seventeenth century, private mining co-operatives in Hungary were obliged to sell their copper ores to state-owned smelters. Due to the price regulation by court authorities, the state gained control over private mining co-operatives, but also ensured that they could sell their products on fixed terms. After Hungarian revolts against Habsburg rule from 1703 to 1711, further state measures to ensure hegemony in mining, especially in iron smelting, were enforced (Lacko 2016, 2017b). In 1747, contracts with bankers and merchants, such as Jakob Küner von Künersberg (1694–1764), guaranteed stable sales of copper production on the European market. By means of integrating into the state budget system, part of the Habsburg dominions' mining revenues flowed directly into the Viennese court. In addition to the copper revenues in Smolník, the mercury production in Idrija was of particular significance for the state budget. The copper and mercury funds, which pooled the state mining revenues, served as a guarantee for the state bonds raised on the European financial market (Lacko 2017b). Due to the high debt burden, the funds themselves ran into financial difficulties and resulted in a backlog of payments to private mining co-operatives.

Overall, the mining industry in the Habsburg dominions faced considerable challenges at the beginning of the second half of the eighteenth century. In addition to the above-mentioned fiscal burden, a decline in production in several mining regions, a decrease in the quality of certain ores,[33] and the high investments required for mining

[32] Dating back to the Middle Ages, these included, in particular, regulations on mining and metallurgy, dues to the sovereign, privileges of miners, jurisdiction, and the structure, duties and control of mining authorities.

[33] For example, the silver production in Bohemia as well as silver and copper mining in Schwaz (Tyrol) declined and required state subsidies (Isser 1905, 171; Majer 2000, 8). Similarly, the copper production in Banská Bystrica decreased (Lacko 2017, 371). Around 1760, the Bohemian mines were

drainage, made several undertakings unprofitable and impaired the minting of coins. The resulting state interventions to increase productivity were intended to implement more efficient working and organizational methods. State measures included the centralization of production and decision-making processes and the introduction of new technological methods in ore mining and processing, which were also mentioned in Leopold's mineral catalog. Public subsidies and tax benefits were implemented to provide financial incentives and enable long-term investments. While visits by court officials to mining districts had previously served as an instrument to initiate technological innovations, the training of mining officials was now to be fundamentally reformed. According to the model of cameral sciences, the practical and local knowledge of miners and mining officials was to be standardized, systematized, made explicit in state-supervised teaching programs, and supplemented with knowledge from jurists, technicians, and naturalists, for example in mineralogy and chemistry (Konečný 2017, 68).

Until the end of the eighteenth century, a new body of experts employed as public servants and trained in reformed or newly established state educational institutions took over decisive functions in the higher mining administration. A milestone was the aforementioned founding of a chair of mining sciences (*Academia metallurgica*, 1763–1772) at the University of Prague, whose holder, Johann Thaddäus Peithner (1770), was to provide basic theoretical training to mining aspirants. Even more impactful was the transformation of the practical training school[34] (*praktische Lehrschule*) in Banská Štiavnica into the monarchy's Mining Academy, which took place between 1763 and 1770 (Konečný 2013, 102–5; 2017, 82–3). With its prosperous mining area, the technological potential demonstrated during visits of court officials, and close ties to the Viennese administration, Banská Štiavnica had the best prerequisites. While the curricula offered in Prague and Idrija were initially continued, Peithner and Giovanni Antonio Scopoli (1723–1788), who worked there as professors, were appointed to Banská Štiavnica in 1772 and 1769, respectively. By 1770, three chairs had been established at the Mining Academy, for metallurgical chemistry and mineralogy (1763, held by Nikolaus Joseph Jacquin), mechanics and hydraulics (1765, Nikolaus Poda von Neuhaus) and mining science and mining law (1770, Christoph Traugott Delius).[35]

The state training offensive and the institutional developments that occurred simultaneously with the emergence of Leopold's catalog did not follow a predefined plan. Rather, they were the result of several different political decisions and initiatives, especially those by Peithner. Yet, the reforms turned out to be highly effective. With the gradual centralization and standardization of education in Banská Štiavnica, mining knowledge in the Habsburg Monarchy was bureaucratized, ascribed a scientific status, and situated at the intersection of theoretical and practical approaches. Thus, Leopold's catalog anticipates later developments, namely the centralization and bureaucratic use of knowledge and the pooling, comparison, and evaluation of specimens.

operating at a loss, and in the Austrian territories, only the mercury production in Idrija (Carniola) yielded significant profits. See Konečný (2013a, 347).

[34] Precursors of these improvements were mining schools established in the Habsburg Monarchy in the first half of the eighteenth century in Jáchymov (Joachimsthal, Bohemia 1716), Banská Štiavnica (1735), Smolník (Schmöllnitz, Hungary 1747), Oravița (Oravitza, Banat 1747), and Idrija (Idria, Carniola 1763), as well as lectures on mining-related topics at the *Collegium Theresianium* in Vienna, an educational institution for public officials founded in 1746.

[35] The history of Delius' private mineralogical collection are described in the other catalog's essays.

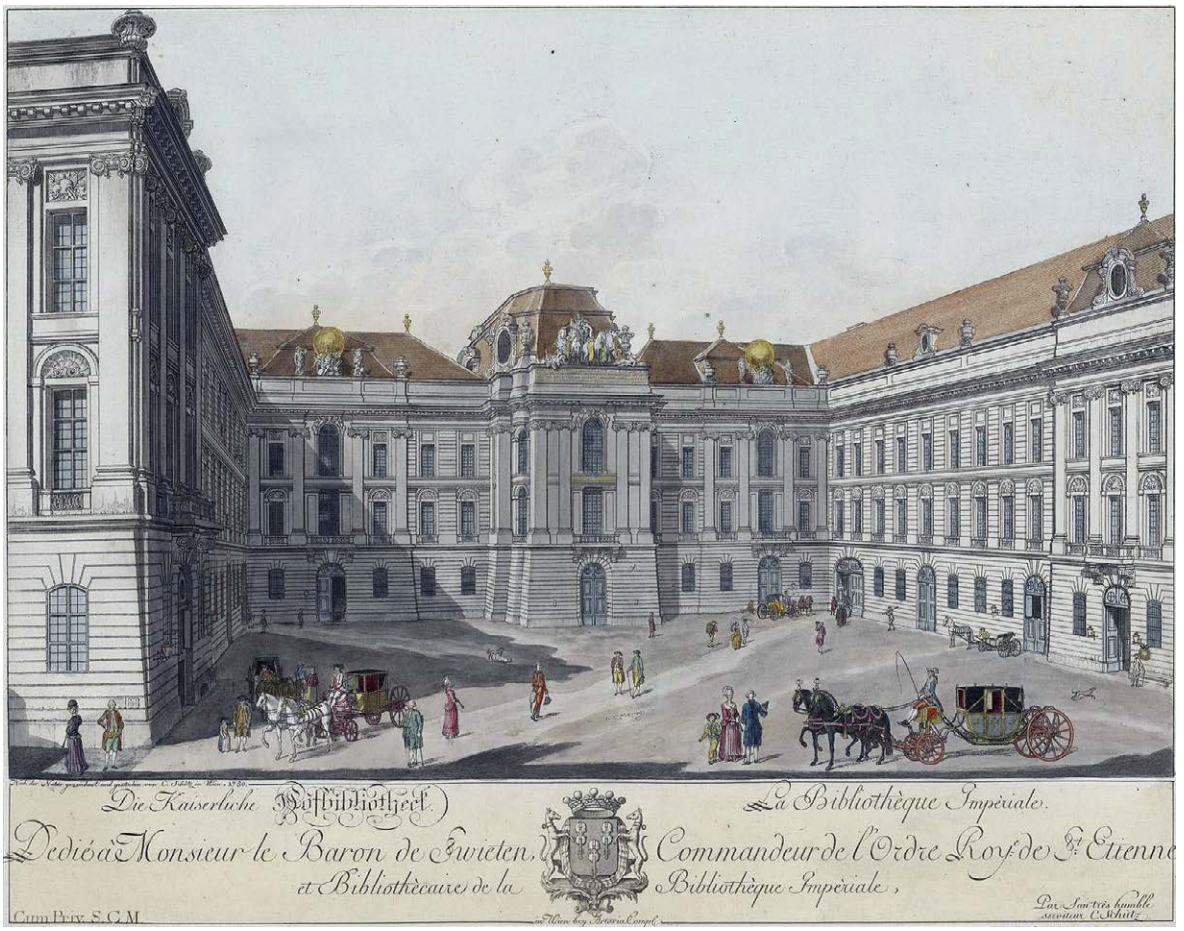

Figure 8 – Joseph Square with the Imperial Court Library in Vienna, on the left the Augustinian Wing, where the imperial natural history collection was housed (1779). Colored etching, in: Karl Schütz, Johann Ziegler, *Sammlung von Aussichten der Residenzstadt Wien von ihren Vorstädten und einigen umliegenden Oertern*. Vienna: Artaria 1798, Tab 6.

5. Collecting, Cataloging and Representing

The development of public and private collections is closely linked to the formation of mineralogy as a scientific discipline. Towards the end of the eighteenth century, mineralogy emerged distinct from natural history by methods of identifying minerals. In particular, Abraham Gottlob Werner (1749–1817) at the Freiberg Mining Academy had promoted these new methods (Werner 1772; Guntau 2009, 168–9). To quote Anke te Heesen and Emma Sparry (2001), collecting embodied a form of spatially organized knowledge acquisition and was closely linked to the practices of sorting, ordering, and cataloging. Without comparison and exchange of specimens that would not naturally occur side by side *in situ*, mineralogical knowledge acquisition and classification of nature was impossible. Knowledge was passed on not only by traveling mining officials and collectors, but also through the transfer of specimens and the catalogs enclosed when larger collections changed hands (Klemun 2013). According to the well-established division into the three "kingdoms" of nature adopted by Carl von Linné (1707–1778) in his *Systema Naturae* (1735)[36] mineralogical cabinets also included specimens that we do not count as such today, like fossils, conchylia (shells), and zoophytes (i.e., corals, anemones). All the more importance was placed on the ordering of the objects that were stored in glass cases or in subdivided drawers and often additionally packed in small paper boxes to protect them from dust. For contemporaries, collections did not represent a fixed unit, but were constantly expanded and supplemented through purchases, exchanges, sales of duplicates, and sometimes personal collecting trips. Therefore, cabinets and their catalogs always had an ephemeral character.

In this regard, mineral collections had multiple purposes, such as arousing aesthetic enjoyment, establishing social contacts between collectors, and linking the fields of "mining" and "mineralogy" that developed jointly in the second half of the eighteenth century (Klemun 2000; 2017, 306; Vogel 2015). According to Johann Georg Krünitz' (1803, 14–6) *Oeconomische Encyclopädie* (Economic Encyclopedia), mineral cabinets aimed at the "expansion of mineralogy" by striving for "order and completeness." Prestigious and rare objects increased the "fame of wealthy, tasteful and learned individuals", i.e., a status gain for collectors. This made the trade with mineralogical specimens a "lucrative business." Similarly, natural history cabinets open to the public influenced the taste of owners and visitors and offered instruction and expertise to professionals. Unlike zoological and botanical specimens, where "faithful illustrations [in textbooks] can still help out", the study of mineralogy was particularly dependent on experience and personal autopsy. Collections of economically useable ores, established at "universities, mining and trade academies, secondary schools and main mining sites", followed utilitarian goals. They served metallurgical and mining officials and cameralists for demonstration and instruction, and thus promoted "cameral and commercial science in general" (Krünitz 1803, 36, 39). As part of a 'patriotic' attitude, collecting increased the knowledge about the 'fatherland' and prevented "true rarities of nature from being taken out of the country" (Krünitz 1806, 581). Natural history cabinets were thus of state-level relevance. Their sovereigns and bureaucracy in particular promoted mineralogy as a "very useful science." According to the arrangement of specimens and the various branches of mineralogy, Krünitz (1803, 16–8, 32, 38) distinguished between five different types of collections:

[36] In the first edition of his work *Systema Naturae* (1735), Carl von Linné distinguished between the animal, vegetable and mineral "kingdoms" of nature and introduced the categories: *classes*, *ordines*, *genera*, and *species* for the classification of the specimens.

> The general knowledge of fossils or mineralogy includes first the knowledge of the characteristics of fossils (*Characteristica mineralogica*), second, the recognition of fossils (*Oryctognosia*), third, the mountain science (*Physica subterranea*), fourth, the mineralogical geography (*Geographia mineralogica*), and fifth, the economic mineralogy (*Mineralogia oeconomica*). A large mineral cabinet, which is to be used for the study of all these five special sciences, must therefore also consist of five special mineral collections, and these are: the first one according to the characteristics, the second one a methodical, the third one a physical, the fourth one a geographical or suite collection, and the fifth one an economic mineral collection. […] The establishment of large suite collections of minerals will therefore remain merely a work for princes and kings, who thereby find one of the best opportunities to erect immortal monuments to themselves for the benefit of their states, […]. The suite collections have become known only in recent times, and first in Saxony. The first one was established about 1764 at the Freiberg Mining Academy, and the other one was the former Stieglitz Mineral Collection in Leipzig, which was sold to the Collegium Theresianium in Vienna in 1770.[37]

Likewise, Leopold's catalog corresponds to a suite collection (*Suiten-Sammlung*).[38] It contained geographical information on the mountains, mining districts, pits, galleries, and veins, where the specimens were found, as well as details on the circumstances of their extraction, the precious metal content of ores and their processing.[39] The samples, in turn, provided important information about new ore deposits, their precious metal content, and mineability. Like other suite collections, the catalog assembled not only rare and valuable objects, but also non-precious mountain kinds, "if only the fossil, which it is supposed to show, can be seen well, and the usually breaking fossils, by which this kind is especially distinguished, can be seen in the proper proportion to it"[40] (Krünitz 1803, 30–1). However, supplying sources of the specimens, i.e. the local mining administrations in the Habsburg dominions and, as far as the two valuable samples from America and Saxony are concerned, (foreign) donors, dealers, or collectors, were not indicated in the catalog.

[37] Translation of the original German quote: „Die allgemeine Kenntniß der Fossilien oder die Mineralogie begreift aber erstlich, die Kenntniß der Kennzeichen der Fossilien (*Characteristica mineralogica*), zweytens, die Erkennungslehre der Fossilien (*Oryctognosia*), drittens, die Gebirgskunde (*Physica subterranea*), viertens, die mineralogische Geographie (*Geographia mineralogica*), und fünftens, die ökonomische Mineralogie (*Mineralogia oeconomica*), in sich. Ein großes Mineralien=Cabinett, das zu dem Studio aller dieser fünf besondern Wissenschaften angewendet werden soll, muß also auch aus fünf besondern Mineralien=Sammlungen bestehen, und diese sind: die erste eine nach den Kennzeichen, die zweyte eine methodische, die dritte eine physikalische, die vierte eine geographische oder Suiten=Sammlung, und die fünfte eine ökonomische Mineralien=Sammlung. […] Die Errichtung großer Suiten=Mineralien=Sammlungen wird also bloß ein Werk für Fürsten und Könige bleiben, die dadurch eine der besten Gelegenheiten finden, sich, zum Nutzen ihrer Staaten, verewigende Denkmäler zu errichten, […]. Die Suiten=Mineralien=Sammlungen sind nur erst in neuern Zeiten, und zwar zuerst in Sachsen bekannt geworden. Die erste ist ohngefähr 1764 bey der Freybergischen Bergakademie angelegt worden, und die andere war die ehemalige Stieglitzische Mineralien=Sammlung in Leipzig, welche 1770 an das Theresianische Kollegium in Wien verkauft wurde."

[38] See the catalog of the suite collection by Christian Ludwig Stieglitz (1724–1772) [Anonymous 1772], whose description of the specimens resembles those of Leopold's catalog.

[39] An illustration depicting the places of origin of ore and mineral samples from almost all parts of the monarchy can be found in section Catalog (Fig. 16) of this volume.

[40] Translation of the original German quote: „[…] wenn nur das Fossil, welches sie eigentlich zeigen soll, gut zu erkennen ist, und die gewöhnlich dabey brechenden Fossilien, wodurch sich diese Art besonders auszeichnet, in dem gehörigen Verhältnisse daran zu sehen sind."

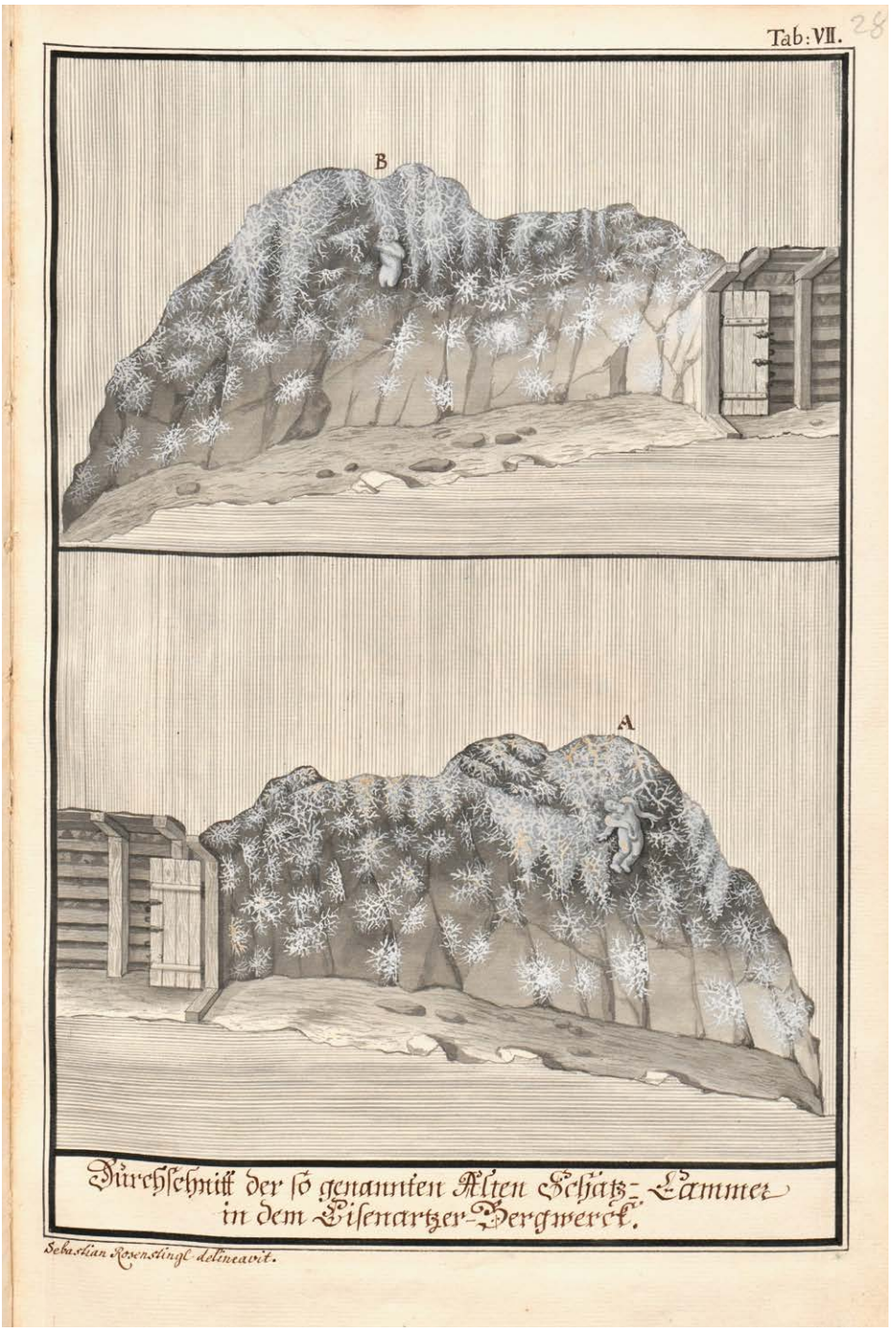

Figure 9 – Joseph Anton Nagel was commissioned by Emperor Franz Stephan to explore mines and caves in the monarchy and to collect minerals. In doing so, he also visited the so-called "treasure chamber" in a mine in Eisenerz (Styria). Sebastian Rosensting(e)l: Ink drawing of the "treasury chamber", containing aragonite in the shape of human figures, in: Joseph Anton Nagel: Beschreibung des Ötscherberges und anderer in Steiermark befindlicher Dingen. Manuscript. Vienna, 1747, Tab VII. Österreichische Nationalbibliothek, Manuscript Collection, Cod. 7920.

The arrangement of the objects by locality or by metal/mineral types for the purpose of instructing the young archduke can be guessed based on the information of the index. Thus, the catalog itself represents a snapshot of a cultural transformation process and indicates the change in meaning to which specimens are subjected when they are transferred from their context of origin to a mineral collection (Alberti 2005, 562). In this regard, the Court Chamber functioned as a transitional space. There, the knowledge associated with the objects was structured through its recording in the catalog—albeit not yet according to the criteria that developed as mineral collections were spreading and increasing in size.

Since the second half of the eighteenth century, Vienna became an important hub for the international exchange of mineral specimens (Stütz 1807, 35; Huber and Huber 1981; Vogel 2015, 308). This was not only due to the mineralogical expertise and the communication networks of mining officials and scholars converging here, but also to the growing number of private collectors such as civil servants, aristocrats, businessmen, bankers, pharmacists, clergymen, and professors, among them social climbers.[41] These included, for example, the well-researched merchant Jakob Friedrich van der Nüll (1750–1823) who, through generous purchases, built up an extensive mineral *collectio* described by the mineralogist Friedrich Mohs (1804) in three volumes (Flügel *et al.* 2011). Prior to the establishment of the first professional businesses for trading minerals by private individuals around 1800 (Fritscher 2012; Lacour 2014, 367–81),[42] the personal proximity of the collector to the state bureaucracy and mining administration played a decisive role. In many cases, traveling officials and naturalists residing in the different Habsburg dominions served as intermediaries for the trade of mineral specimens (Klemun 2000, 16; Vogel 2015, 309–10). They stood at the intersection of different fields of knowledge and maintained a lively communication with mining officials at home and abroad, the state bureaucracy, local mining operators and other sources of supply such as dealers and grinders. The channels of exchange maintained by mining officials and naturalists illustrate how the spheres of the public and the private were intertwined through the assembly of collections by sovereigns and numerous individual collectors (Hamm 2001). Higher mining officials understood the practice of collecting as part of their professionalization as academically-trained civil servants. They themselves often amassed extensive suite collections, organized the distribution or sale of collectibles from individual mines, and gave away pieces to teaching collections or fellows as a sign of their commitment to the scholarly community.

Since "collecting must be a difficult thing for most beginners" (Krünitz 1803, 39), only a small number of collectors are likely to have ventured into the field and visited the mining towns themselves. Although, in the Habsburg Monarchy, the Court Chamber of Coinage and Mining itself may have provided a semi-public platform for the acqui-

[41] Stütz (1807, 29–37) named over two dozen private mineral collectors in Vienna. For an impressive reference of 1,200 individuals, who collected minerals before 1800, see Wilson (1994).

[42] Johann Georg Krünitz (1806, 492) mentioned the mineral shop (*Mineralien=Tausch= und Handlungs=Comptoir*) in Hanau (Hesse, Germany) run by Carl Caesar Leonhard (1779–1862), "where one can get whole collections of 700 and more pieces, some of them 5–6 inches in size, for 400 Thaler, as well as small collections of 200 small pieces for 6 Thaler" and similar firms in Freiberg and Ilmenau. Carl Heinrich Titius (1783, 154–8), curator of the Electoral Saxon Natural History Cabinet in Dresden, stated in the report of his 1777 journey through Germany, England, and France that the German brothers Adolarius Jacob Forster (1739–1806) and Ingham Henry Forster (1725–1782) run mineral shops in London and Paris and trade with specimens from all over Europe. For example, important mineral collections of the Forster brothers were purchased by the Spanish king in 1792 and by the Russian tsar in 1802.

sition and exchange of minerals, private mineral dealers gradually took over this task. At the turn of the nineteenth century, Abbé Andreas Xaver Stütz (1807, 29–37), director of the Imperial Natural History Cabinet, mentioned an "auction institute [for minerals] with 4 to 5 auctions" annually as well as two stores in Vienna, located in today's *Gluckgasse* and at *Stephansplatz*. As advertisements in the Viennese newspaper *Wienerisches Diarium* indicate, the trade of minerals in the eighteenth century only to a small extent seemed to take place in the public sphere or in stores. Objects were offered for purchase in the private homes of collectors (Anonymous 1786, 965). Travelling dealers, who were frequently specialized in a mining region and provided catalogs of their specimens available for purchase, could be visited in their lodgings (Anonymous 1795, 1226). In many cases, the catalogs were created on the occasion of the sale of a collection.[43] Thus, in addition to their scientific and economic use, mineral objects were increasingly attributed a cultural significance as collectors' items (Fritscher 2012, 104).

Collections of mining authorities and their educational institutions, by contrast, served as "tools of state knowledge" (Vogel 2015, 301). Although the Court Chamber of Coinage and Mining did not create a central geognostic-mineralogical collection within its authority until 1835, it encouraged the establishment of collections at higher education institutions (Haidinger 1843, 1; Klemun 2017, 173). Mostly set up by individual professors on an institutional mandate or on their own initiative for the purpose of teaching students, they were gradually expanded through donations from patrons, exchanges with other organizations, collecting activities of professors, or through purchases of their private collections.[44] Almost simultaneously with the founding of the Freiberg Mining Academy (1765), where an own collection was built up, the Habsburg mining administration commissioned the establishment of a mineral collection for educational purposes at the mining school in Banská Štiavnica. Jacquin, who was appointed professor there in 1763, had been entrusted with this task at the expense of the Court Chamber of Coinage and Mining even before the classes began (Klemun and Hühnel 2017, 305). The collection of the academy was continuously enlarged, for example through the purchase of professor Peithner's collection in 1774.[45] In 1781, the collection was enriched by six boxes of specimens from Italy, which the mining academy received as a gift for shipping minerals to Grand Duke Leopold in Florence (Kašiarová 2004, 180–2). Likewise, samples of ore from Banská Štiavnica, indispensable in suite collections of Hungary, enriched the personal collections of Crown Prince Joseph (1763), Archduke Maximilian (1777), and Archduchess Maria Anna (1778) (Kašiarová 2004, 183).

The mineral trade strategies of the state bureaucracy, the Habsburg court, and other European ruling houses followed diplomatic considerations and were embedded in power-political relations. While the exchange or bestowals of minerals between royal courts must be understood as a diplomatic gesture, signaled solidarity and sealed alliances, the possession of extensive mineral collections also meant a not to be undervalued prestige gain for sovereigns. Exquisite and rare specimens fulfilled the representational needs of powerful dynasties. Since the middle of the eighteenth century, mineralogical collections were established at Europe's leading royal houses, e.g. in France (1739–

[43] See, for example, the catalog of *Geheimrat* Büchner's natural history collection, printed on the occasion of an auction: Anonymous (1771).

[44] On precursors of museum institutions in the Habsburg Monarchy see Raffler (2007, 167–8).

[45] Peithner's mineral catalog has been even preserved in the fund of the Main Chamber Earl's Office, stored in the Central Mining Archives in Banská Štiavnica.

Figure 10 – Portrait of Ignaz von Born. In: *Re Metallica Et Monetaria A Consilus Aulicis. Quae. Sitrerumnatura, Requirit. Ovid. Beirin pinx. Jacob Adam sculp. Viennae 1782.* Viennae apud Artaria Societ. Cum Priv. S.C.M. University of Oklahoma Libraries History of Science Collections.

1745), Russia (1767), Prussia (1770), and Spain (1771). A decisive factor in each case was the involvement of the state bureaucracy (Vogel 2015, 306). By requesting copies from local authorities or by conducting their own surveys, mining officials contributed significantly to the development of suite collections and supplied specimens for mineral exchanges with foreign countries.

The foundation of the emperor's Natural History Cabinet (*Naturalien-Cabinet*) in Vienna was laid by the aforementioned purchase of the private collection of the Florentine architect and scholar Jean de Baillou (1679–1758). It contained around 30,000 objects[46] including minerals, fossils and durable zoological specimens such as corals or crabs (e.g. Fitzinger 1856; Hamann 1976; Riedl-Dorn 1998; Koeberl *et al.* 2018). After the purchase, which took place around 1748, the former director of the Uffizi followed his collection to Vienna and was appointed by Franz Stephan as the first director of the Natural History Cabinet. Collecting trips undertaken in the following years, for example by Jacquin to the West Indies (1754–1759), led to its expansion (Klemun and Hühnel 2017, 45–128). Franz Stephan's collection, which became state property and opened to the public after the death of the emperor, was to be further expanded under the new direction of Baillou's son, Johann Ludwig Balthasar (1731–1802). This expansion should especially include mineralogical specimens from the Habsburg dominions, whose study was considered to be of special importance for the knowledge and the exploitation of soil resources. For this purpose, Maria Theresa ordered that the collection be reorganized according to current scientific knowledge and supplemented with samples of ore to be sent in by all mines of the monarchy (Fitzinger 1856, 447–8; Fischer *et al.* 1976, 2).

Since insufficient progress was made in cataloging the collection, this task was finally in 1776 entrusted to the influential Transylvanian naturalist and mining official Ignaz von Born. He worked at the Prague Mint and Mining Master's Office (*Münz- und Bergmeisteramt*) and had already published a two-volume catalog of his own extensive collection arranged after the Swedish mineralogist Axel Frederic von Cronstedt (1722–1765) (Born 1772–1775).[47] Due to his former service as a mining councilor (*Bergrat*) at the Main Chamber Earl's Office (*Oberkammergrafenamt*) in Baňská Štiavnica, his activity as a Freemason and his leading role in the founding of the Learned Society (*Gelehrte Gesellschaft*) in Prague, Born was very well connected to domestic and international naturalists.[48] Thanks to his relations to mining officials and donations of foreign scholars such as Georges-Louis de Buffon (1707–1788), Johan Christian Fabricius (1745–1808) or Friedrich Wilhelm von Trebra (1740–1819), Born was able to significantly expand the collections (Fitzinger 1856, 449). From 1878 to 1880, with the support of Karl Haidinger (1756–1797) and Johann Carl Megerle von Mühlfeld (1765–1842) he rearranged the mineral collection according to the principle of Cronstedt and Walle-

[46] A detailed description of the collection provides Saint Laurent (1746).

[47] In 1775, on the recommendation of the president of the Court Chamber of Coinage and Mining Count Franz Kolowrat-Novohradsky (1739–1802), it was considered to commission Nikolaus Joseph von Jacquin to catalog the holdings of the Natural History Cabinet. Jacquin himself owned a large collection of minerals, known abroad. See Koeberl *et al.* (2018, 143); Klemun & Hühnel (2017, 303–10).

[48] Promoted to Court Councilor (*Hofrat*) of the Court Chamber in 1779, Born introduced technological improvements in mining, such as the amalgamation method for separating silver and gold from ores, organized an international symposium for mining in Baňská Štiavnica (1786) and even initiated the first international association for mining science, the *Societät für Bergbaukunde* (1786–1791) (Lindner 1986, 185–7; Fettweis and Hamann 1989). Born was on friendly terms with the high state official, scholar and Freemason Joseph von Sonnenfels (1733–1817). On the biography of Born and his scholarly impact see in particular Reinalter (1991).

rius (Haidinger 1782). Of the plan to catalog the whole collection, Born (1778) finally could publish only the first volume on *Testacea* (shellfish). During the short reign of Emperor Leopold II (1790–1792), more space was allocated to the Natural History Cabinet and Andreas Xaver Stütz (1793) was entrusted with the rearrangement of the collection. However, it was not before 1797 that the handwritten inventory of the mineral specimens, the so-called *Catalogus Stützianus*, was begun, which was completed in 1806 (Riedl-Dorn 2021, 45).

6. Concluding Remarks

Collecting is a connecting endeavor. In the case of Leopold's collection, it linked the world of high aristocracy with the state agencies and the working environment of miners. As this essay suggests, catalogs can be understood as a materialization of complex exchange processes between persons, objects, and knowledge. They arose from natural-historical, representative, instructional, or practical needs, for example when specimens or whole collections changed hands and 'gaps' of a collection had to be identified. Even if the claim to completeness and order pursued by many authors of catalogs (especially in the case of published ones) could not be fulfilled due to the flourishing mineral trade, they can serve as sources for the interrelationships and circumstances in which they were created.

This also applies to Leopold's catalog. Its emergence is closely intertwined with the state-building process of the Habsburg Monarchy, the significance of mining technologies and mineralogical knowledge for 'patriotic' goals and state governance, the formation of mineralogy and mining as fields of scientific practice, and the professionalization of its players through the centralization and academization of their education. Thus, the creation of the catalog coincides with a period of transformation, where not only political and economic reforms considerably changed the relationship between state and citizen, public and private, but also imperial practices of rulership in the Habsburg Monarchy formed a long-lasting alliance with 'useful' fields of research. In this respect, the catalog also bear witness to social, spatial, and epistemic settings in which mining officials interacted and served as intermediaries between different knowledge contexts.

The catalog certainly did not serve exclusively to instruct the archduke. As the descriptions of the individual specimens indicate, it assembled objects with different places of origin, precious metal content and mineralogical characteristics. The focus was not exclusively on the curiosity, representative function, or aesthetics of the specimens, but also on their geographical comprehensiveness and value, which was indicated for numerous objects. By collecting the specimens and arranging them in the catalog, something like a 'mental map' of the natural resources, significant mining districts, and economic development of the Habsburg domains was created. In this respect, the specimens in Leopold's collection represented both an inventory of the monarchy's mining endeavors and a possible 'testing ground' for reform ideas how to improve mining and its benefit for the state.

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Collectio mineralium. Leopold's II mineralogical catalog between history, science and collecting

Annarita Franza, Giovanni Pratesi

1. Leopold II (1747–1792). An Emperor and a Man of Science

In his review of Wandruska's first volume on Leopold II's biography (1963), Del Pane (1964) stated that historiography had left the figure of Leopold II in the shade. According to the author, the fact that

> he ruled a little country for twenty-five years and then appeared just like a meteor on the scene of the Holy Roman Empire, [...] has been distracting scholars from investigating an extremely suggestive theme for those who study the problems of the Modern era.

However, even if Leopold II held the title of Holy Roman Emperor for only two years (1790–1792), his reign is regarded as one of the greatest eras of consistent and committed reform in the four-hundred-year history of the Habsburg monarchy (Szabo 2018). Furthermore, the historiographical gap pointed out by Del Pane (1964) appears all the more surprising if we consider that the first historical accounts on Leopold's II life were published at the end of the 18th-century (e.g., Rastrelli 1792; Becattini 1797), and at the beginning of the 19th-century, the historian and statesman Gino Capponi (1792–1876) collected documents and oral testimonies to write a "History of Peter Leopold." Sestan (1951) found that Capponi's project impressed various Italian 19th-century scholars such as Pietro Colletta (1775–1831), who strongly encouraged Capponi to complete Leopold's II biography.[1] Unfortunately, Capponi never finished his book, whose drafts are now preserved at the Central National Library of Firenze. Since then,

[1] Sestan (1951, 195) quoted a passage of the letter Colletta sent to Capponi on 19 December 1828: "Sii tu lo storico della Toscana novella; ma per amore di tutti i santi [...] oggi solo Leopoldo deve farti buco nella mente. Scrivi e scrivi. Ti dirò cosa impertinente, ma soffrila [...] riempi questo vuoto con un bel libro. O foss'io giovine quanto te! Quali speranze vorrei nutrire! E tu puoi più di quel che io potrei, sol che vorrai: e vuoi."

Annarita Franza, University of Florence, Italy, annarita.franza@unifi.it, 0000-0003-3146-6957
Johannes Mattes, Austrian Academy of Sciences, Austria, johannes.mattes@oeaw.ac.at, 0000-0002-8546-7149
Giovanni Pratesi, University of Florence, Italy, g.pratesi@unifi.it, 0000-0001-6329-901X

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Figure 1 – Martin van Meytens (1695–1770), Franz I. Stephan und Maria Theresia mit elf Kindern. Vienna, 1764–1765. Kunsthistorisches Museum Wien, Gemäldegalerie 3149.

numerous biographies on Leopold II have been printed, but a complete survey is beyond the scope of this study. However, it is worth mentioning Wandruska's (1963) classical critique, and Leopold's II biographical profile edited by Pasta (2015).

A search of the literature revealed that there is a large volume of published studies describing Leopold's II political, economic, administrative, and religious reforms as the Grand Duke of Tuscany (1765–1790) (e.g., Bellatalla 1984; Mangio 1988; La Rosa 1997; Rosa 1999; Capra 2005). Most of these works focus on his criminal justice reform, which made Tuscany the first country to abolish capital punishment (1786) in modern history (Berlinguer and Colao 1989; Edigati 2011; Dezza 2017). It has to be noted that diverse studies then examine the cultural background in which these reforms were carried out (e.g., Tacchi 1992; Contini 2002; Tazzara *et al.* 2020). However, few studies have investigated Leopold's scientific interests. This research topic can represent one of "those suggestive themes" that Del Pane (1964) hoped would be further explored in future studies on Leopold's II life.

This work is based on the investigation of primary sources along with museum objects (both artifacts and naturalistic specimens) that are currently preserved in diverse Italian and foreign institutions. Analyzing the link between these two different typologies of mute evidence (Hodder 2012) will help to unearth new facts about Leopold's scientific activities, as well as to understand their values and meanings in a broader transnational and cultural context. The findings shown in this study thus represent a relevant contribution to research on Leopold's II scientific biography, providing new insights into his interest in geo-mineralogical collecting. So far, very little attention has been paid to this aspect, although mineral collecting was definitely a relevant cultural and scientific practice in Europe between the late 18th and early 19th-century (e.g., Wilson 1994). The improvement of scientific mineralogy went hand-in-hand with the economic development of individual territories to the point that mineral collections, as outlined by Vogel (2015), became public pictures of a country's natural resources. Although mining and geo-mineralogical collecting represent well-established research themes in the history of the Habsburg monarchy (e.g., Mattes in this volume), these topics have not been adequately examined with reference to Leopold's biography, thus leaving in a "space of invisibility"[2] the interesting and fascinating catalog of his mineralogical collection.

Quoting the famous David Copperfield's incipit, "to begin my life with the beginning of my life, I record that I was born", Peter Leopold was born on 5 May 1747 at the Schönbrunn Palace. The story of his birth is reported in the *Diary* of the chamberlain Johann Joseph von Khevenhüller-Metsch (1706–1776), who recorded that the newborn was named Peter, after Peter the Great (1682–1725), and Leopold in accordance with the traditional Habsburg and Lorraine name (Khevenhüller-Metsch 1908). Leopold's mother, Maria Theresa of Habsburg (1717–1780) was the only female ruler in the history of the Habsburg dominions and under her reign the monarchy underwent a series of important institutional, financial, medical, and educational reforms.[3] Yonan (2011) argued that Maria Theresa has been styled by the literature

[2] Monti and Ratcliff (2004) described as "space of invisibility" ("spazio di invisibilità", in the original text) the conceptual category aiming to provide a critical revision of the lesser-known aspects, which underlaid the social and intellectual dynamics of scientific discoveries as well as the progress of empirical sciences (see also Long 2011 and 2017).

[3] Among them, the codification of the traditional criminal justice system (the *Constitutio Criminalis Theresiana*) in 1769, the establishment of new educational institutions (e.g., the *Theresarium* in 1746), and the promotion of a variolation campaign in 1767 (Byrne 1997; Beller 2006; Vocelka 2009; Weiss and Esparza 2015).

as the *Landesmutter* (the mother of her country), while Aliprantis (2019) stated that her reign greatly influenced the liberal reforms in 19th-century imperial Austria. Maria Theresa was then fond of science, whose practical importance she recognized for the government of the Habsburg territories. Mineralogy was one of her interests due to its importance for the development of mining science and the exploitation of raw materials. In 1776, she called Ignaz Edler von Born (1742–1791) to Vienna to manage the naturalistic collections belonging to her late husband, Holy Roman Emperor Francis I (1708–1765), who was passionate about chemistry, mechanics, and mineralogical collecting (Lhotsky 1941, 1945; Riedl-Dorn 1996; Zedinger 2008; Hassmann 2015). In this regard, Fischer *et al.* (1976), along with Mattes in this volume, reported that in 1748 Francis I acquired and transferred to the Hofburg Palace the naturalistic collection belonging to the Florentine scholar Ritter Johann von Baillou (1684–1758), which encompassed more than 30,000 minerals, fossils, shells, and snails. This collection, of which Baillou was in charge as Director for Life, became the basis of the emperor's private *Naturalien-Cabinet* together with the pre-existing Physical Cabinet and the Coin and Antique collection. Following Francis' death, Maria Theresa presented his collections to the Austrian state so they could be accessible to everyone interested in the natural sciences. They were open to visitors twice a week and can be considered as the founding of today's Naturhistorisches Museum. These collections also had the role of making familiar to the public the geo-mineralogical resources (and their economic value) available in the Habsburg dominions. Von Born thus organized the collections according to the latest scientific standards and checked that the most representative specimens of all the imperial mines were present (Koeberl *et al.* 2018). Therefore, mineralogy was not strange to Leopold's familiar, cultural and political environment.

The education of the young archduke was entrusted to counts Franz (1718–1766) and Anton (1723–1806) Thurn-Valsassina-Como-Vercelli, two educated officials attracted by the intellectual currents of the Enlightenment and whose family was passionate about mineral collecting (Meixner 1960). Leopold's portrait as a young student is given by Maria Theresa, who wrote an *Instruction* to Franz von Thurn to be sure of his son's proper education. Leopold had a sensitive nature, a generous heart, and was good in studies—wrote Maria Theresa—but he was also a rude lazy guy full of himself, and a gossip lover. On 15 May 1762, Franz von Thurn sent to the Maria Theresa a report entitled *Fidèle tableau de S. A. R. l'archiduc Léopold dans le temps qu'on me charge de la direction de sa conduite*, a document in which his pupil was described as a rebel teenager, but very fond of science and technology (von Arneth 1881). In this regard, the correspondence between Leopold and the Thurn brothers highlighted how he was particularly interested in chemistry and in visiting mines, factories, agricultural land reclamations, and port facilities (Wandruska 1963).

On 18 August 1765, after the sudden death of his father, Leopold was appointed as Grand Duke of Tuscany and on 13 September he arrived in Firenze along with his wife Maria Luisa of Spain (1745–1792). The literature on the cultural and scientific aspects of his governorship (e.g., Bellinazzi and Contini 2002; Bertelli and Pasta 2003) has revealed that Leopold was a patron of various scholars such as the botanist Giorgio Santi (1746–1822) (Bindi 2014) and an active supporter of the 'useful' sciences. In her analysis on this subject, Klein (2016) used the sciences of mining (*Bergwerkskunde*) and salts (*Salzwerkskunde*) as two examples to illuminate the concept of *nützliche Wissenschaften* (useful sciences), i.e., the knowledge generated by the sciences, which might improve a country's education, progress, and civilization. So, it was not by chance that Leopold financed the Livorno edition of the *Encyclopédie* (1770–1779)

Figure 2 – Magnifying glass belonging to Archduke Leopold. It is contained in a leather case that bears the initials "A. L. " (Archduke Leopold) and consists of two biconvex lenses, which are set in a short ivory tube. Museo Galileo, Imss n. 3561.

and the Italian translation of William Bailey's *Advancement of Arts Manufactures and Commerce* (1773) (Pacini Fazzi 2008); established a thermal center in Montecatini, which was open to the public and where hydrothermal treatments based on the chemical analysis of both thermal and mineral water were prescribed (Becagli 1985);[4] promoted the establishment of the Florentine *Specola Astronomica e Meteorologica* (Astronomical and Meteorological Observatory) with the assistance of Leonardo Ximenes (1716–1786) (Triarico 2000); built and maintained strong relationships with the natural philosophers belonging to the *Accademia delle Scienze di Siena detta de' Fisiocritici* (Manganelli and Benocci 2013). In this regard, between 1776 and 1777, Leopold along with the psychist Domenico Bartaloni (1750–1798) promoted the installation of two lightning rods in Siena, which were part of a network that the Grand Duke made installed in the major city centers. Bertucci (2009) found that the cultural debate on lightning rods was deeply connected to the 18th-century scientific investigations into the electricity's nature. This view is supported by Abbri (1987) who pointed out that lightning rods soon became a symbol of Leopold's enlightened politics.

McClellan (1985) outlined that the expression 'useful science' also included the establishment of institutions and university chairs to promote scientific research and new communication networks. As an example, Leopold instituted the first chair of chemis-

[4] In this regard, Vaccari (1996) pointed out that Giovanni Targioni Tozzetti (1712–1783) and Giovanni Arduino (1714–1795) made several journeys to detect the presence of mineral deposits in the Grand Duchy of Tuscany. Likewise, Burgassi (2012) described the discovery of boric acid made by Hubert Franz Hoefer (1728–1795) in both Lagone Cerchiaio and in the fumaroles near Pomarance.

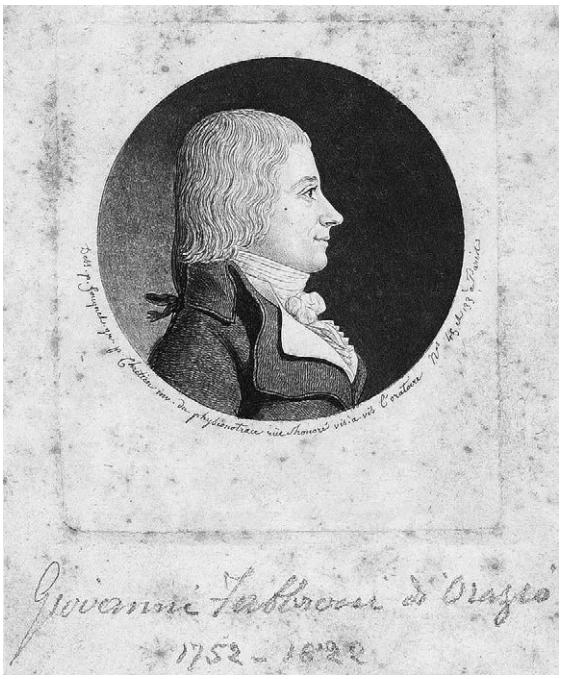

Figure 3 – Portrait of Giovanni Fabbroni (1752–1822). Courtesy of Fototeca-Accademia dei Georgofili.

try at the University of Pisa in 1757 and established the *Imperiale e Reale Museo di Fisica e Storia Naturale* (the Imperial and Royal Museum of Physics and Natural History) in Firenze on 22 February 1775. The latter should also include a scientific academy that he would have personally financed.[5] Almost every paper that has been written on the Imperial and Royal Museum of Natural history discusses its importance within Leopold's reforms to enhance science institutionalization and cultural renewal for the public good. Here, it will be discussed the role played by this institution within Leopold's scientific activities.

As stated before, Leopold was fond of science and grew up in an environment that seemed to be permeated by natural sciences and geo-mineralogical collecting. But did these solicitations turn into personal interests beyond the socio-political choices inspired by the Enlightenment? First response can be found in Leopold's private library held in the grand-ducal residence at Pitti Palace. In her interesting analysis, Knieling (2016) showed that Leopold preferred the purchase of contemporary books rather than rarities. Most of the volumes were acquired in France and concerned the topics of his administrative and political reforms. However, Franza *et al.* (2019) have found that natural sciences were also represented. The study of the library's catalog (*Catalogue des livres du Cabinet particulier,* 1771)[6] has revealed the presence of a section named *Sciences et Art*, which encompassed 876 volumes. Among these books, it is worth mentioning the *Dictionnaire universel des fossils* by Elie Bertrand (1793), the *De la fonte, des mines, des fonderies* by Christoph Andreas Schlüter (1750), and the *Lettre du duc de Noya Carafa sur la tourmaline* (1759).[7] But the catalogue also included the *Traites des pétrifications* by Louis Bourguet (1742), the *Oryctologie* and the *Conchyliologie* by Antoine Joseph Dezallier d'Argenville (1755 and 1757).

[5] Archivio Museo Galileo (AMG), Fab. 01, c. 147.

[6] The catalog is currently preserved at the Central National Library of Firenze, Manuscript and Rare Books Section (Rari Post. 153). A catalog's second copy that belonged to Maria Luisa of Spain is kept at the Newberry Library in Chicago (Z491.C277).

[7] The presence of this book within Leopold's library, along with Nollet's *Lettres sur l'électricité* (1753) and Franklin's *Expériences et observations sur l'électricité* (1751), provide information about his interest in the study of electrical phenomena. This finding is confirmed not only by the establishment of a Tuscan network of lightning rods but also by the scientific instruments he acquired for the Imperial and Royal Museums of Physics and Natural History. Most of these instruments are electrostatic, pneumatic, and mechanical devices that are now preserved at the Galileo Museum in Firenze. Among them, there is a device for demonstrating the properties of lightning rods (Inv. 2693), an ampoule to electrically simulate the northern lights (Inv. 423), and a Nairne cylinder electrical machine (Inv. 2736). The latter was custom-made for Leopold by Edward Nairne (1726–1806) in 1773. The following year, the Grand Duke awarded Nairne with a gold medal and a prize of 1,415 Tuscan lire. Cf. AMG, ARMU 001, aff. 153–154, cc. 114, 126. Further information about these electrical instruments can be found in Hackmann (1995). For an overview of the scientific collections present in the Imperial and Royal Museum of Physics and Natural History at the time of Leopold's rule see Contardi (2009).

Leopold's studies on the physics and chemistry of minerals found practical application in the research and experiments he performed at the Imperial and Royal Museum of Physics and Natural History. For instance, the investigation on the combustibility of gems (i.e., diamond, ruby, spinel, orient sapphire, water sapphire,[8] emerald, hyacinth, garnet, chrysolite, turquoise, rock crystal, orient amethyst, water topaz, opal, and pearls) through a concave mirror that he had been carrying out at the Physics Cabinet since 1773.[9] Here Leopold was assisted by the chemist Hubert Franz Hoefer (1728–1795), who was the administrator of the Court pharmacy from 1767 to 1790. Drawing on an extensive range of sources, Piccardi (2004) provided an in-depth analysis of Hoefer's scientific work showing its relevance to the chemical knowledge of the time. In particular, the author analyzed the *Tabula affinitatum* (1766), i.e., a table showing chemical affinities between substances modeled on both Étienne-François Geoffroy's *Table des differents Rapports observés entre differentes substances* (1718) and Anton Rüdiger's *Systematische Anleitung zur reinen und überhaupt applizierten oder allgemeinen Chymie* (1756), that Hoefer commissioned in 1766 for the grand-ducal apothecary's shop. The table is now preserved at the Galileo Museum in Firenze together with Leopold's chemistry workbench. Scorrano *et al.* (2002) described its complex arrangements outlined that it was openable and presented, on the lower part, a cupboard fitted with pedal-driven bellows for improving the substances' combustion. On both sides, there were drawers and shelves for the storage of scientific instruments and chemical preparations. Some of these compounds were prepared by the Grand Duke himself under the supervision of Felice Fontana (1730–1805) and Giovanni Fabbroni (1752–1822), who were the director and vice-director of the Imperial and Royal Museum of Physics and Natural History (Pasta 1989; Knoefel 1990). Leopold was therefore a regular visitor[10] to the museum's laboratories and established with Fabbroni a fruitful scientific collaboration.[11] Fabbroni was a go-between Leopold and various French chemists such as Antoine Baumé (1728–1804) and Jean Antoine Claude Chaptal (1756–1832) (Horn and Jacob 1998; Barnard and Fones 2012). For example, Leopold asked for the catalog of the chemical preparations sold by Baumé in 1787[12] and ordered Fabbroni to make several purchases the following year.[13] On 4 November 1788[14] Fabbroni asked Chaptal to send to the Grand Duke from his apothecary shop in Montpellier[15] 63 pounds of

[8] Water sapphire is a deep blue variety of the mineral cordierite.

[9] AMG, Fab. 14, 14 cc.

[10] As an example, Giovanni Tommaso Mannucci (1750–1814) sent a letter to Fabbroni on 3 September 1789 to inform him of the Grand Duke's visit the next day. Mannucci wrote that the Grand Duke would have arrived half past two in the afternoon, passing through the door that faced the street. Cf. AMG, Fab. 04, c. 3.

[11] Besides assisting in his chemical experiments, Fabbroni was also a key figure for Leopold's mining interests. For instance, he supervised, on behalf of the Grand Duke, the excavation and polishing of some crystals from the mountains in the surroundings of Pistoia. Leopold was so pleased with his scientific relationship with Fabbroni that he instructed his personal secretary, Ranieri Fulger (dates uncertain), to send to Fabbroni a letter (4 December 1789) in which he thanked the Florentine scholar for his services. Fabbroni replied with a heartfelt letter for Leopold's commendation the following day. Cf. AMG, Fab. 04, cc. 2–4 and c. 113.

[12] AMG, Fab. 04, c. 71.

[13] AMG, Fab. 04, cc. 20, 25, 28–29, 56.

[14] AMG, Fab. 04, c. 2.

[15] AMG, Fab. 04, c. 49.

Figure 4 – Leopold's chemistry cabinet. Museo Galileo, Room X.

diverse compounds, among these 5 pounds of spirit of hartshorn (ammonium carbonate), and 3 ounces of hellstone (silver nitrate) (Testi 1980). Fabbroni's letters to Chaptal, formed a part of a very interesting correspondence that highlighted how Leopold was interested not only in buying compounds for his experiments, but also in keeping posted on the last advancements in chemistry in France,[16] such as the vitriol oil (sulfuric acid, according to Testi 1980) crystallization process. On 17 June 1788 Fabbroni handled the shipment of 17 pounds and 2 ounces of Venus' crystals (copper acetate) from Lyon by the chemist François Bonafous (dates uncertain). A good example of Leopold's direct involvement in the preparation and execution of chemical experiments is the purchase of a supply of lute in late December 1786. On this occasion, Leopold was not in Firenze and thus asked Fabbroni to put the compound in a box and sent it to Pisa where he was at that time.[17] The lute was a compound of clay mixed with oil, which was used in chemical distillation to seal vessels to prevent the dispersion of steam and to protect the surfaces from the heat (e.g., Linden 2003). The fact that Leopold asked for a quantity of lute while he was away from the Imperial and Royal Museum of Physics and Natural History shows that he continued to carry out experiments even outside of his chemical cabinet.

On 1 March 1790 Leopold came back to Vienna to be crowned as Holy Roman Emperor. His chemical cabinet was therefore transferred to the museum on 27 July, and then arranged in three purpose-built rooms on 30 November of the same year.[18] Its contents were detailed in *Laboratorio di chimica* (Chemical Laboratory), i.e., a catalog of more than 100 pages collecting all the preparations, books, and scientific instruments that were present in Leopold's cabinet.[19] In the first room were placed the chemical compounds for a total of ca. 1013 preparations displayed on 13 shelves. In the second room were stored the samples that—as noted by the anonymous cataloguer—"were obtained analyzing the three kingdoms of nature." The writer also pointed out that most of these preparations needed to be renovated because they were evaporated or altered. In the closet on the left were kept the substances of animal and/or human origin (e.g., cow's milk serum, gelatinous part of dried human blood, urine salts) for a total of ca. 130 specimens. Subsequently, substances of vegetal origin (i.e., ca. 299 samples among which various essential oils) were listed. The closet on the left preserved the chemical preparations of mineralogical origin (e.g., diverse samples of sulfur alum, mercury, arsenic, and realgar) for a total of ca. 440 specimens. In the closet, there were also kept ca. 106 books about chemistry, most of them in German or French. At the end of this list, a note outlined that both the side and the floor shelves contained the reagents and substances useful for experiments, which were not part of the general catalog. Various utensils, tools, and scientific instruments were then stored in all the three rooms devoted to the cabinet's exhibition.

Considering all this evidence, it seems that Leopold felt a genuine interest in chemistry and its relations with mineralogy, as the analysis of the catalog of his mineralogical collection seems to confirm.

[16] AMG, Fab. 04, cc. 80, 83.

[17] AMG, Fab. 04, cc. 126, 131.

[18] AMG, ARMU 004, aff. 73, c. 307. The document also reported the economic estimate made by Fabbroni of Leopold's chemical cabinet for a total of 7217 lire.

[19] AMG, Fab. 10, cc. 1–99.

2. Unpacking Leopold's mineralogical catalog

As stated by Swinney (2011, 31), catalogs are themselves museum objects, more precisely "meta-objects, collections of records about collections, an archive of an archive." Swinney (2011) also noticed, quoting Latour (1987, 2), that catalogs are usually perceived as "working tools" whose reliability is usually unquestioned and taken for granted. On the contrary, the author suggested critically examining these sources to investigate what kind of knowledge can be acquired and reconstituted through their analysis. Catalogs are indeed both material objects and media throughout a collection is constructed and constituted, and the specimens encompassing it are arrayed. Furthermore, catalogs recorded the existence of those samples that are no longer available for a variety of reasons (i.e., lost, decay, damage, theft and so on).

The catalog of Leopold's mineralogical collection, which is preserved at the Historical Archive of the Natural History Museum of the University of Firenze,[20] has been transcribed and translated in this volume. Latour (1987) and Spivak (2000) remarked how both transcription and translation are not simply copying processes, but they involve the creation of new meanings[21] in changing language, temporary perspective, and cultural backgrounds. By drawing on the concept, Lynch (1999) stated that catalogs present the documentary representation of a specimen as the results of a selection of diverse information identifying and describing that object. As an example, catalogs contain data about hierarchical relations such as who oversaw compiling them. In this regard, the genesis of the catalog of Leopold's mineralogical collection bearing the title *Collection Mineralium or Collection of domestic and foreign ore metals – semi-metals – mountain juices – native mountain colors. Ores and mountain kinds*[22] was analyzed in Mattes (this volume), who highlighted the presence of three handwritings.

It is interesting to note that the writers used distinct styles that revealed a diverse mineralogical knowledge as well as a different awareness about mineral collecting. For instance, Samples Nos. 186–187 present interesting gemological considerations regarding the possibility to use these specimens as polished stones. Whilst the vagueness of other accounts (e.g., Samples Nos. 218, 220, and 227) seems to coexist with the notes on minerogenetic processes shown in Sample No. 232. These findings indicate the last author was a more skilled expert than the previous ones. He knew how to identify minerals, assess their quality, and spot their differences. What has just been stated is proven by the description of Samples Nos. 197–200 in which the min-

[20] Archivio Storico del Sistema Museale di Ateneo, Università degli Studi di Firenze (AS-SMA), *Collectio Mineralium oder Sammlung in- und aus-Ländischer Erzte Metallen – Halb-Metallen – Berg-Säfften – Nativ-Berg-Farben. Erzt- und Berg-Arten.*

[21] The catalog of Leopold's mineralogical collection was migrated from a paper- and manuscript-based medium to digital media by its digitalization. Subsequently, its text was transcribed, translated, and then printed into hard copy. At each stage, the catalog is re-materialized. As DeSilvey stated (2007, 41) these stages constitute "a moment of mimetic labour [which] opened up a channel of communication that tracked along former networks of relation and resonance."

[22] The catalog's original title is *Collectio Mineralium oder Sammlung in- und aus-Ländischer Erzte Metallen – Halb-Metallen – Berg-Säfften – Nativ-Berg-Farben. Erzt- und Berg-Arten. Mit einen beygefügten Inhalts-Verzeichnis Für Ihro königl. Hochheit dem Durchleuchtigsten Erz-Herzog PETRO LEOPOLDO Erz-Herzog von Oesterreich etc. etc. Auf Hohen Befehl verfasset, und in die Ordnung gesetzet von Joanne Francisco Pirkhert Im Jahr 1765. PRAESIDE Camerae Caesareae & Caesareo Regiae Aulicae Comite Seifrido ab HERBERSTEIN Erklärung nachfolgender Mineralien und Berg-Arten.*

Figure 5 – Pompeo Batoni (1708–1797), Kaiser Joseph II und Großherzog Pietro Leopoldo von Toskana. Rome, 1769. Kunsthistorisches Museum Wien, Gemäldegalerie 1628.

Figure 6 – The mining overcoat Leopold wore on the occasion of his visit to the Banská Štiavnica mines in 1764. Slovenské Banské Múzeum, SH 926, 1968/00922, Fárací plášť Leopolda II, 1764. Photo by B. Babiaková.

eralogical and economic considerations are supported by reflections on the collecting value of the specimens. Furthermore, it should be noted the use of new terms to define some minerals such as *greis*, *roßzahn*, and *plinz*. The latter replaced the term *Eysen Spath* (e.g., Sample No. 129) and it was used to indicate siderite.[23] The same goes for the identification of cinnabar, which was indicated as *zinopel* (Sample No. 148), *zinopl* (Sample No. 149), *zinober* (Sample No. 155), and at last with the term still in use of *zinnober* (Sample No. 201).

Since *Collectio Mineralium* is not mentioned in any bibliography or library indexes,[24] it is useful to provide its physical description, following the standards proposed by the International Federation of Library Associations and Institutions (2011). The catalog, consisting of 110 pages, contains a case-by-case list of Leopold's mineral collection for a total of 242 specimens. The volume size is 33 cm tall by 21.5 cm wide by 1.5 cm thick. The binding is a full blinded-tooled calf with border decoration formed of golden fleurons. In the center, there is the golden engraving of the House of Habsburg's emblem (Kusler 2017). The text was written on a watermarked paper, which was produced by the Dutch paper company founded by Cornelis (1683–1755) and Jan (1688–1757) van Honig in 1738.[25] The page layout is in two columns and the manuscript's language is a variant of the Early New High German (Steger 2019), while the calligraphic style is Fraktur (Baltolu 2018). The title page, which is the only catalog's page printed in full, shows the title and the year of issue (1765). It should also be noted the presence of three stamps that can help in the reconstruction of the volume's collecting history. The first stamp on the frontispiece—which is also the oldest—reports the wording "Museo di Fisica e Storia Naturale Firenze." The second stamp is only partially decipherable and bears the word "Instituto" together with a label showing the date 1889. The last one says "Istituto di Studi" and "Gabinetto di Geologia." These findings suggest that *Collectio Mineralium* was first deposited at the Imperial and Royal Museum of Physics and Natural History. The deposit reasonably occurred in 1771 when Leopold gave all the literary books and oriental manuscripts preserved at the Pitti's Palace respectively to the Magliabechiana and Laurenziana libraries. The scientific volumes were donated to the brand-new established Academy of Philosophical Sciences and to other scientific institutions. The catalog of Leopold's mineralogical collection was thus presumably transferred from the Grand Duke's personal library to the Imperial and Royal Museum of Physics and Natural History's archive on this occasion. Later, the catalog was acquired by the Institute of Advanced Practical Studies and Specialization in Firenze (*Istituto di Studi Superiori Pratici e di Perfezionamento*), which was founded in 1807. The Institute consisted of three main sections: Medicine and Surgery, Natural Sciences, Philosophy and Philology (Rogari 2005). The catalog of Leopold's mineralogical collection thus became part of the library of the Natural Sciences Section and more precisely it was preserved in the Geology Cabinet.

Within the catalog there is only one engraving representing the Lower Hungarian mining town of Kremnica (Kremnitz).[26] At the end of the volume, an index[27] groups the

[23] See endnote to Sample No. 217.

[24] The only studies to date that have investigated the catalog of Leopold's mineralogical collection are Fabozzi (2019) and Franza *et al.* (2019).

[25] Further information on the Honig paper company can be found in Beals (1995, 51).

[26] See Mattes in this volume and his note 7. See also Štefánik (2016) and Cembrzyński (2017).

[27] It is interesting to note that each section of the index shows diverse blank pages. This finding may indicate an interest in adding new specimens to Leopold's collections.

samples according to their nature[28] and extraction site.[29] The page number of the relative catalog description is also reported. It should be noted the presence of a second index showing the "chemical signs", i.e., the alchemical symbols[30] that are present in the catalog.[31] To each cataloged mineral was assigned a progressive number providing a link between a single specimen and its documentary representation. Unfortunately, Leopold's collection has not been located yet and therefore this relation cannot be reconstructed.[32]

As mentioned before (Mattes, this volume), the genesis of Leopold's catalog is related to the journey he made, together with his brother Joseph (1741–1790) and his future brother-in-law Albert Kasimir von Sachsen-Teschen (1738–1822),[33] to visit the mining districts in Lower Hungary in 1764. Before their departure, Leopold and Albert Kasimir received diverse gifts[34] coming from the Vienna Court Chamber of Coin-

[28] The specimens were divided into *Gold-Erzt* (i.e., samples containing gold), *Electrum oder Göldisches Silber-Erzt* (i.e., specimens containing golden silver), *Silber-Erzte* (i.e., samples containing silver), *Kupfer-Erzte* (i.e., specimens containing copper), *Bley-Erzte* (i.e., samples containing lead), *Zinn-Erzte oder Zwitter* (literally, tin-ores or hybrids), *Eißen Erzte oder Stein* (literally, iron-ores or rocks), *Queck-Silber* (i.e., samples containing mercury), *Zinober* (i.e., samples containing cinnabar), *Küeß* (pyrite specimens), *Marcasiten* (marcasite samples), *Schwefel* (i.e., specimens containing sulfur), *Antimonium* (i.e., samples containing antimony), *Wißmuth* (i.e., specimens containing bismuth), *Zink oder Spiauter* (i.e., samples containing zinc), *Kobold* (i.e., samples containing cobalt), *Arsenicum* (i.e., samples containing arsenic), *Saltz* (salt), *Vitriol* (i.e., specimens containing vitriol), *Alaun* (i.e., specimens containing alum), *Stein-Kohlen* (stone coals), *Brennende Materien* (literally, burning matters), *Berg-Arten* (literally, mountain kinds), *Nativ-Berg-Farben* (literally, Native-Mountain-Colors), *Aus unbekanten Orten* (i.e., specimens whose provenance is unknown).

[29] The greater part of the specimens came from the Carpathians area with a few exceptions such as Sample No. 63, which came from Bohemia, and Sample No. 164 coming from America. The latter was described as a fine gold specimen from Potosí, which can be identified with the state of San Luis Potosí in Mexico, where gold and silver deposits were discovered starting from the 16th-century (e.g., Brown 2012).

[30] A complete survey of the use of alchemical symbols in the 18th-century is beyond the scope of this work (see Crosland 2004 for an overview). However, it is worth noting that the presence of alchemical symbols to indicate metals and metallic compounds in Leopold's catalog are evidence of the analytical definition of simple substances, and thus of the determination of mineral composition by analytically determining procedures. The latter derived, as Porter has shown in his seminal work (1981), from both the practical activities of mineral assayers and the theoretical analysis of chemically literate scholars who were involved in mining industries. On both alchemy and the knowledge of minerals and metals at the Habsburg court see Smith (1994).

[31] For instance, alchemical symbols are present in Samples Nos. 60 and 64.

[32] Cipriani *et al.* (2011), Mottana *et al.* (2012, 105) and Fabozzi (2019) assume that Leopold's collection may have merged into the mineralogical collections preserved at the Florentine Natural History Museum. Fabozzi (2019) hypothesizes that Samples Nos. 3, 9, 12, 58, and 64 can be identified with the minerals bearing the inventory numbers 498, 1037, 114, 1031, 1044. This assumption is based on the similarity of the specimens' cataloging descriptions reported in both *Collectio Mineralium* and *Inventario del Reale Gabinetto di Fisica e Storia Naturale* (1793). However, no document explicitly mentions these samples as belonging to Leopold's mineralogical collection. Further research has been carried out within the *Mineraliensammlung* at the Naturhistorisches Museum in Vienna, where the Habsburg mineralogical collections are preserved. Even in this case, ancient catalogs and museum inventories have shown no reference to Leopold's collections. The same holds for the investigations performed at the Institute of Mineralogy and Petrography of the University of Innsbruck. However, the current exhibition does not preserve any specimens that can be identified as part of Leopold's mineralogical collection.

[33] Albert Kasimir von Sachsen-Teschen was Leopold's brother-in-law since he married Maria Christina (1742–1798), who was Maria Theresa's fifth daughter, on 8 April 1766. Albert Kasimir was a keen collector of works of art and part of his graphics collection is now preserved at the Albertina Museum in Vienna (e.g., Koschatzky and Krasa 1982).

[34] In her interesting article, Čelková (2004) described the items that are now preserved in the *Kammerhof* of the Slovak Mining Museum and have been collected on the various visits of the Habsburg family to Banská Štiavnica. The items belonging to Francis I, Leopold, Joseph, and Albert Kasimir are listed on pages 55–60.

Figures 7–8 – Details of the hammer Leopold used to mine some silver ores in Banská Štiavnica (1764). Slovenské Banské Múzeum, UH 2338, 1968/03508, Kladivko Leopolda II, 1764. Photo by K. Patschová.

age and Mining in Banská Štiavnica (Schemnitz, Slovakia). Among these items, there were three copies of the *Goldenes Bergbuch* (Golden Book),[35] which contained the descriptions of Lower Hungarian mining districts together with 16 models of mining, metallurgical and minting machines (Vozár 1983, Janetschek 1998). The first stage of the journey (20 July 1764) was in Siglisberg, near Banská Štiavnica. Here the princes received some gold and silver ores together with medals and commemorative coins minted in the Kremnica Mint. Subsequently, they arrived in Windschacht and, even on this occasion, they were greeted by the local authorities with fine silver and gold specimens, while the mining officers instructed the princes in reading mining maps. In Banská Štiavnica, they received gold and silver ores as a present and, after being equipped like miners,[36] they spent most of the day visiting mining tunnels.[37] They even knocked off[38] some silver ore specimens. In the afternoon, they visited Nicolaus Joseph von Jacquin's (1727–1817) chemical laboratory (Klemun and Hühnel 2017) where he carried out chemical experiments for more than three hours using local ores. The next day, the princes visited the *Kaiser-Franz-Erbstollen*, i.e., a mining tunnel that opened on the occasion of Francis' I visit in 1751. On Tuesday, they made a tour of the above ground works and learned about the different technologies of ore processing and smelting.[39] Subsequently they were instructed on administrative and economic man-

[35] Leopold's copy is preserved at the Central National Library of Firenze (Palatino 1094). The volume counts 235 pages, among these 78 plates concern city views (e.g., at cc. 3–4 is a Banská Štiavnica's view depicted by Carlo Giovanni Della Martina in 1764, while at c. 161 is a Kremnica's view), maps, prospects, ink drawings, and watercolors relative to the mines described in the text. Some plates are on two pages, whilst the larger are folded within the volume. The most important plates are then signed by their respective authors, who were also mining technicians such as Carl Ployer, Joachim Miller, Gottfried Deschau, Andreas Marini, Johann Göllner, and Benedict Feil. The volume is bound in crimson velvet, with paperback covers engraved in gold and gilt cut. It is written in German and different handwritings are easily recognizable throughout the manuscript. On the first page is visible the stamp of the Museum of Physics and Natural History in Firenze, which is also present on the fifth page together with Leopold's stamp.

[36] In her review of Schemnitz's renewed visitors, Kasiarová (2000) reported some of the events surrounding the royal journey. Among these, there was Leopold's and Joseph's visit to the Glanzenberg mine that was documented, in addition to archival records, by the stone plaque walled in this gallery. Kasiarová (2000) pointed out how the custom of displaying these celebratory plaques was reserved for the rulers that had visited the mines. There are various maps showing the places where these plates were located with their original inscriptions. During their visits to the underground mines, important guests used to wear mining dresses that were sewn in the local villages. The Slovak Mining Museum still preserves Leopold's overcoat (i.e., a pink-gold brocade overcoat with damask plant decoration in green silk, Inv. No. SH 926).

[37] In this regard, the catalog description of Sample No. 150 reported that "His Majesty, the Roman King himself, even worked in these chams", mentioning the Joanni Chasms in the Pacher Gallery. This is a reference to Francis' I visit in 1751 during which (just as Leopold, Joseph, and Albert Kasimir) he visited the tunnels and knocked off an ore. Kasiarová (2000) noticed that the shafts in which the rulers had worked were named after them. On this basis, the Leopold Gallery, which was mentioned in the catalog description of Sample No. 253, can be potentially identified as the shaft he visited in 1764.

[38] Kasiarová (2000) noticed that important visitors used beautifully decorated irons and mallets, which were either made by local craftsmen or brought by guests from Vienna. Leopold and Albert Kasimir's hammers are preserved at the Slovak Mining Museum (Inv. Nos. UH 2337, UH 2338).

[39] In the underground, Joseph, Leopold, and Albert Kasimir were shown different types of mining activities. They were acquainted with the production processes as well as with the resulting mineralogical products. A reference to these techniques is given in the description of Sample No. 154, in which the processing of the mineralogical specimen was carried out according to the "usual techniques." Probably the author did not detail the method that was used to determine the various metal

Figure 9 – The handstein that was given to Archduke Joseph on the occasion of his visit to Kremnica in 1764. Kunsthistorisches Museum Wien, Handstein mit Bergwerk, Kremnica, 1764, Kunstkammer 4146.

Figure 10 – The handstein Leopold received as a gift during his visit to Kremnica in 1764. Matthias Scarwuth, Franz Xaver Glantz (attributed to), Handstein aus den mittelslowakischen Bergbaustädten, 1764. Magyar Nemzeti Múzeum, Budapest.

agement of a mining site. Banská Štiavnica seemed to be the most important part of the royal journey consisting of big representation events, factory and mine visits, and a torchlight procession with up to 1200 miners. On Thursday, the whole entourage went to Kremnica where they visited the Royal Mint. According to the *Wienerisches Diarium* of 29 August 1764, each prince received a "costly and beautiful" handstone (*Handstein*) representing the Kremnitz mine that contained different kinds of ore.[40] However, Balážová (2017) pointed out that only two handstones were made: one for Joseph, the other for his brother Leopold. The first was donated to the imperial treasury on 14 March 1765, and it is preserved at Kunsthistorisches Museum (Inv. No. KK_4146). As stated by Balážová (2017), the identification of the handstone given to Leopold is still open, even if the author assumed that a *Handstein* was kept in the Magyar Nemzeti Múzeum (Budapest) (Inv. No. D 3154) could be the one he received in Kremnica. The next day, the princes set off for Banská Bystrica where they visited diverse metallurgical facilities. On 31 July 1764 Joseph, Leopold, and Albert Kasimir came back to Vienna. The visit to the Hungarian mines was a formative experience, especially for Leopold who had the possibility to acquire on-site new knowledge on mineralogy, chemistry, and mining sciences. While Joseph was portrayed as the ambitious heir to the throne, Leopold—as stated by Konečný (2017, 362) —"was shown as an inquisitive young man who knew how to handle minerals."

A closer investigation of Leopold's catalog reveals other interesting insights.[41] As mentioned earlier and in Mattes (this volume), the specimens were grouped according to their nature, which represented the amount of valuable minerals potentially extractable from a mining deposit.[42] For instance, skeletal galena from the Transylvania area weighing 20 pounds in pure lead was valued at 134 scruples in fine gold (No. 11). Whilst a specimen of azurite extracted from the mines of St. Philip and Jacob (No. 12) was cataloged as representative of the copper's good quality that could be mined in the Romanian mountains of Oravița (i.e., 6 pounds of copper were estimated at 4 lots in fine silver). A sample of chalcopyrite with a mixed schist and quartz matrix then represented with its 10 pounds of copper, the valuable mineral that was present in the St. Ferdinand mine in Upper Hungary (No. 16). This approach showed how the practice of mineral collecting in Leopold's catalog combined scientific and utilitarian goals. The mineral descriptions are evidence not only of the scientific knowledge of the time, but also of the economic and political power of the House of Habsburg through the exploitation of the natural resources that were present in its dominions (Wakefield 2009).

contents since it had already been shown to Leopold during his visit. In the same vein, the author did not illustrate either the brass-manufacture processing that was mentioned at Sample No. 156 or the construction of a gateway reported in the description of Sample No. 158. Other references to mining equipment and practices can be found at Sample No. 49 where a mining compass was described. Interesting hints on extractive metallurgy are then mentioned in Samples Nos. 193, 194, 198, and in the *Notandum* at the end of the main text.

40 Balážová (2017) described the *handstein* as a selected piece of ore the size of a human hand, that was valued for its rarity based on its appearance and high-quality composition. From the end of the 17th-century, these kinds of objects were modified into more fashionable works of art (*Tafelaufsatz*) representing motifs of the Central Slovak mining towns.

41 A more comprehensive analysis of the mineralogical samples listed in the *Collectio Mineralium* is given in the catalog's endnotes.

42 As an example, Sample No. 127 represented a specimen of pyrargyrite, and marcasite evaluated up to 500 lots in fine silver and 6 pounds in refined copper.

Another interesting aspect of Leopold's catalog is the investigation of the terms used for describing the specimens. The transcription and translation of the text reported the word-for-word translation, while the endnotes presented a historical and scientific analysis aiming to characterize the specimens according to the contemporary mineralogical terminology. As an example, and according to Haditsch and Maus (1974), the term *Eisenblüte* meant aragonite, even if in the early 19th-century literature it was used to indicate the crystal growth in caves (i.e., stalactites and stalagmites). *Röschgewächs* usually identified a sample of stephanite, but it could also mean argentite and acanthite. *Gelf* referred to marcasite, even if this species is described with both the term *malachitische* (Sample No. 10), and the expression *grün und braun Kupfer* (Sample No. 38). Another term frequently used is *glanz*, which means 'shining'. So, the term *Bleiglanz*, literally "shining lead", indicated galena. This mineral could also be identified through the exclusive use of *Glanz*. *Glanze* was then used as a descriptive term for all sulfur minerals, relatively soft, dark-colored, with a metallic luster. *Glanzerz* identified argentite or sillimanite. To distinguish between the different mineralogical species, it was necessary to compare the definition given in the text with other information reported in the catalog such as the locality where a sample was mined. Subsequently, these data were compared with the information present in both the IMA database—which includes information on more than 5400 approved mineral species and their properties—and the Mindat.org data source containing more than 1 million species/locality information on minerals found at more than 300.000 localities (Hazen *et al*. 2019). However, the absence from Mindat.org database of a species presented in the Collectio Mineralium Leopold's catalog, may have two different meanings: (1) the species may have been reanalyzed in the following centuries and thus ascribed to a different mineralogical species; (2) some areas (e.g. gossan cap, leached zone, oxidized zone, enriched zone) of the historical mines where the specimens were collected in the mid-1700s could now be exhausted.

Finally, another intriguing aspect of Leopold's catalog is the presence of 4 specimens (Samples Nos. 140–144), whose description could indicate the discovery of meteorite fragments. These specimens were recovered in Hronec, which is a village now located in the Banská Bystrica Region. Sample No. 143 was described as an "ironstone of a rare kind, striking in clay-like sediments", while Sample No. 144 as a "very compact ironstone." All the samples contained a high quantity of pure iron. However, the Meteoritical Bulletin Database, which is the official database—managed by the Meteoritical Society—gathering information for all the meteorites known, does not show any specimens that have been found in Hronec so far.

3. The Vienna-Firenze connection: rocks and minerals between science and art

In the previous section, the catalog of Leopold's mineralogical collection has been investigated from different points of view. The analysis has revealed an unknown page of Leopold's scientific biography, i.e., his interest in mineralogy, mining science and mineralogical collecting. However, some might say that *Collectio Mineralium* just represents the natural progression of a 'family passion'. Therefore, it remains to be investigated whether Leopold expressed an interest in these subjects other than the catalog of his mineral collection. The analysis of the period that he spent in Firenze is a privileged viewpoint to answer this question. As mentioned above, Leopold established the Imperial and Royal Museum of Physics and Natural History in 1775 and worked in the chemistry cabinet, while building a positive scientific relationship with Fabbroni. However, it is still to be investigated whether Leopold had a concrete inter-

Figure 11 – Il trionfo d'Europa e le Quattro Stagioni, Firenze, 1771. Palazzo Pitti, Appartamento degli Arazzi, Inv. O.d.A. 1911, 835.

est in the museum's administration,[43] especially in the management of the geo-mineralogical collections.[44]

For instance, it was found that Leopold acquired on 12 November 1771 the naturalistic collection belonging to the late merchant Peter von Spreckelsen (d. 1771) (Schröder 1851), which has been described in Benvenuti *et al.* (this volume). In this regard, it has to be noted that the acquisitions promoted by Leopold continued in the years to come. As an example, on 14 October 1780 he donated to the museum a collection of "microscopic" fossil shells, which were preserved in tiny glass jars within a wooden box. This collection was gifted to him by the abbot Ambrogio Soldani (1736–1808), who is primarily known for his studies on the meteorite shower that fell on Si-

[43] As the Grand Duke of Tuscany, Leopold was directly involved in the museum administration. For instance, on 14 April 1777, he approved a new regulation regarding the museum's janitor based on the suggestions proposed by the director's assistant Giuseppe Pigri (d. 1804). Whilst from August to November 1789 he dedicated himself to improving the museum management from an economic and organizational perspective. These reports followed the museum rules Leopold issued on 9 March 1782 to complete the general regulation dated 1775. Cf. AMG, ARMU 002, aff. 2, c. 5; aff. 7, c. 84; Fab. 01, cc. 393, 398, 415; ARMU 001, aff. 1, c. 3.

[44] In this regard, it has to be noted that Leopold dealt with mineralogical collections also besides the acquisitions he patronized for the Imperial and Royal Museum of Physics and Natural History. As an example, he deposited in the Royal Cabinet the catalog about the geo-mineralogical specimens and fossils collected in the Volterra area that was written by Abbot Giuseppe Gherardini (1713–1786) from the Abbey of St. Giusto. The specimens are divided into five groups (e.g., Soils, Stones, Metals, Concretions, and Petrifications). The volume is accompanied by a rich set of notes concerning the diverse kind of specimens, among which there are various samples of alabaster, quartz, diasper, cinnabar, antimonium, sulfur, saltpeter, pumice stone, corals, and various animal fossils. It is interesting to note that the group named as Metals in the catalog's index is then titled as Minerals in the main text. Cf. BNCF, Palatino 1121.

ena in 1794 (Marvin 1998; De Gregorio 2008). On the same day, Leopold sent to the museum 57 "pieces of natural history" ("pezzi di storia naturale") that he received from "Lagusius"[45] on behalf of the naturalist Francesco Bartolozzi (1750–1817).[46] The von Spreckelsen's collection and the acquisitions made in 1780 showed Leopold's interest into the enrichment of the geo-mineralogical collections since the early days of the Imperial and Royal Museum of Physics and Natural History's foundation.

As discussed in Benvenuti *et al.* (this volume), the Habsburg dominions represented the main areas from which the new museum acquisitions were coming.[47] For instance, on 6 December 1784 a mineral dealer known as Epstein (dates uncertain) informed Leopold on the shipment from Vienna of the mineral collection he sold to the museum.[48] The next year, more precisely on 10 February 1785, Leopold paid 300 "zecchini" (pure gold coins) for a mineralogical collection to Johann Weiss (dates uncertain),[49] who was both a mineral dealer operating in Vienna and the owner of a rich collection of gems that included, according to Wilson (1994, 103), some really fine specimens such as 46-cm green beryl from Siberia.

After his return to Firenze from a long stay in Vienna (1778–1779), during which he had the opportunity to visit some iron deposits in Carinthia, Leopold found out that the iron mines[50] present in the Grand Duchy of Tuscany were not adequately exploited. So, he invited some Habsburg mining experts, such as Thaddeus Rauscher (dates uncertain), to visit the local iron mines on 7 October 1779. In this project, Leopold was helped by Fabbroni.[51] In a first report[52] Fabbroni recorded, without mentioning any name, how one of those experts went back to Carinthia and another, who stayed in Firenze seemed unable to continue with the work. So Baron Ecker, who was the owner of extensive foundries in Carinthia and had also escorted Leopold in his visit abroad, came to Firenze along with his most experienced colleagues. After receiving Rauscher's report in 1780, Fabbroni wrote to Leopold stating that Rauscher was not aware of the

[45] Lagusius is the translation into Hellenizing Latin of Johann Georg Hasenöhrl's (1729–1796) surname. He was the Viennese physician who vaccinated Leopold's family against smallpox in 1769 (Contini 2003).

[46] AMG, ARMU 001, aff. 3, c. 338. In the Imperial and Royal Museum of Physics and Natural History's history, Francesco Bartolozzi hit the headlines because he was banned from entering the museum by Grand Ducal order, after Luigi Gagli (dates uncertain), who was the museum's cashier and guardian, sued him for slander in 1782. Bartolozzi asked for the revocation of this measure in both 1791 and in 1792 without succeeding. Fontana readmitted him only in 1799. Cf. AMG, Fab. 01, cc. 338–341, c. 556; ARMU 006, aff. 54, cc. 206–209; ARMU 003, aff. 6, cc. 29–32.

[47] In this regard, it should be noted that also renewed collectors, who came to visit the Florentine mineralogical collections, were from the Habsburg territories. For instance, on 16 February 1784 the Prince of Liechtenstein visited the Imperial and Royal Museum of Physics and Natural History. He was welcomed by Gagli replacing Fontana, who was absent due to illness. Gagli wrote to Leopold that the Prince of Liechtenstein was so satisfied with the tour that he gave him a medal as a present. Gagli hoped that the prince's kindness did not contravene the Grand Ducal provisions that prohibited the museum staff from accepting gratuities from visitors. Cf. AMG, Fab. 01, c. 546; ARMU 001, aff. 26, c. 458. Wilson (1994, 102) included the two Princes of Liechtenstein—Johann (1760–1836) and Louis (1780–1833)—among the most well-known Austrian aristocrats who were also mineral collectors. Unfortunately, the documents do not report the Prince of Liechtenstein's name in full.

[48] AMG, ARMU 002, aff. 23, c. 124.

[49] AMG, ARMU 001, aff. 174, c. 174.

[50] On the history of Tuscan mines in the 18th-century see Mori (1958), Arrigoni (1984, 1985, 1989), Vitali (1992), Nesti (2006).

[51] AMG, Fab. 02, c. 1. On 27 June 1777, Fabbroni ordered the manufacturing of some metal rods to Giorgio Holzer (dates uncertain), who worked for the Reale Magona (i.e., the Royal Mines). Cf. AMG, ARMU 002, aff. 47, c. 208.

[52] AMG, Fab. 02, cc. 9–11.

Figure 12 – L'Allegoria dell'Acqua. Firenze, 1765.a The State Hermitage Museum, St. Petersburg Inv. n. Epr-5318. Photograph © The State Hermitage Museum. Photo by Vladimir Terebenin.

advancements in iron-making processes outside his homeland.[53] As an example, Rauscher criticized the use of three fires to produce iron in the Mammiano mines without reflecting, according to Fabbroni, on the fact that the local iron ores are bigger than those extracted in Carinthia. And again, Rauscher stated that the quality of the iron produced in Livorno was too malleable and therefore unsuitable for the manufacture of nails and plowshares. Conversely, Fabbroni considered this defect easily fixable. Fabbroni agreed with Rauscher on the necessity to reorganize the wood production for supplying the furnaces in Val di Cecina. Both then acknowledged the excellent quality of the local coal deposits, a finding that encouraged the search for new mining veins. In the years to come, Fabbroni studied the coal deposits in Val di Cecina on Leopold's request. For instance, on 26 December 1788[54] he received from the Secretary of the State Council Alessandro Pontenani (dates uncertain), two boxes encompassing 20 presumed coal samples found by Francesco Henrion (dates uncertain) in the northern and southern surroundings of Cecina to verify their nature and, in case of positive findings, whether the quarries deserved to be excavated. Leopold was so interested in this research that on 21 January 1789 he ordered Fabbroni to go to Montecatini Val di Cecina to examine the local coal deposits.[55] On 14 May 1789 Leopold asked Fabbroni to write a book that reported the quarries' exact location, data about their quality, the excavation methods, together with all the information Fabbroni considered useful to promote the coal extraction in the Grand Duchy of Tuscany. Fabbroni was also asked to analyze some ores mined from the Lagoni of Monte Cerboli to ascertain the presence of borax.[56] Leopold then suggested that Francesco Giovannini (dates uncertain), who was a mineral prospector known as Il Pollacco, should also participate to the field research.[57] On 12 November 1789, Fabbroni sent to Francesco Grobert (dates uncertain) his instructions for starting the excavation of the coal deposits in Val di Cecina.[58] At the beginning of the new year, on 30 January 1790, Fabbroni informed Pontenani to have finished writing the book Leopold requested, which he entitled *Dell'antracite o carbon di cava detto volgarmente carbon fossile* (On anthracite or quarry coal, commonly called hard coal).[59] However, coal was not the only mineral species that aroused Leopold's interest. As an example, he sent to Fabbroni a silver ore from Anghiari, a parish near Arezzo, so he could characterize the specimen in the museum laboratories.[60]

[53] AMG, Fab. 02, cc. 3–8.

[54] AMG, Fab. 03, cc. 8–9.

[55] AMG, Fab. 03, c. 21–25. The instructions Leopold sent to Fabbroni were to analyze the quality of the soil on the hill where the quarry was located. Subsequently, he had to investigate the deposit's size, its features and ascertain the presence of other quarries. Leopold recommended that Fabbroni repeat his instructions for all the discovered deposits. Fabbroni had then to send a detailed report to the Grand Duke stating whether it was convenient to start the excavation works. Leopold granted in advance Fabbroni the amount of 12 pure gold coins to cover his travel expenses. See also AMG, ARMU 002, aff. 90, c. 368.

[56] AMG, Fab. 03, c. 6.

[57] In 1789, Il Pollacco personally sent a letter to Leopold to inform him about his findings. Fabbroni cherished this prospector, who had found several local specimens (e.g., diverse minerals coming from Volterra) for the enrichment of the museum collections, to the point of asking Leopold to give him extra money for his services. Il Pollacco was hired as the museum's first outside employee, as shown in Cipriani *et al.* (2011, 52), in December 1790. Cf. AMG, Fab. 002, cc. 250–253 and 255; ARMU 004, aff. 71, c. 299.

[58] AMG, Fab. 03, cc. 2–3.

[59] AMG, Fab. 03, cc. 7, 11–13, 23–28. Fabbroni sent a heartfelt letter to thank Leopold for the generous reward he was given for the writing of the volume on 12 February 1790. Fabbroni's book was printed in 250 copies by Gaetano Cambiagi (dates uncertain).

[60] AMG, ARMU 004, aff. 15–16, c. 112.

Leopold was also interested in the use of minerals in artworks. To investigate this further aspect, we need to virtually move to the Galleria dei Lavori, the Florentine hardstone and semiprecious stone workshop that was founded by Ferdinando de' Medici (1549–1609) in 1558 (Giusti 2005). When Francis I was crowned Grand Duke of Tuscany in 1737, it was feared that the Galleria dei Lavori would have closed its doors: the royal court would have not left Vienna, the grand-ducal finances were going through a moment of crisis, and Giovanni Battista Foggini (1652–1725), who was the Galleria's headmaster, had died without leaving an 'heir' up to his skill and inventiveness (e.g., Spinelli 2019). However, as stated by Giusti (2006), everything was about to change when Louis Siries (1686–1754), i.e., the *orfèvre du roi* at the court of Louis XV (1710–1774) (Avisseau-Broustet 1996), was hired as a goldsmith and engraver in 1732. Brini and Pioppi (2010) noticed that Siries was a fine and polyhedric craftsman as demonstrated by his huge collections of more than 2000 chisel punches.[61] Siries also worked on glyptic and in 1746 he realized a lapis lazuli and gold cameo, based on a drawing of Giuseppe Zocchi (1711–1767) (Tosi 1997), showing Empress Maria Theresa as protector of art, science, and craft (Vienna, Kunsthistorisches Museum, Inv. n. XII 695). From that moment on, a strong relationship was established between the Galleria dei Lavori and the House of Habsburg-Lorraine, which would last over time.[62] In 1759, Cosimo Siries (died 1789) succeeded his father Louis in the direction of the Galleria dei Lavori. Like his father, Cosimo was a medalist, an engraver and a skillful bronzesmith. He established a positive relationship with Leopold and realized for the Grand Duke, as pointed out by Masala (1997, 57), various trinkets, snuffboxes, tabletops in hardstones and even diamond rings between 1766 and 1782. Among the works he made it has to be noted a ciborium (1782) with pillars and frames in lapis lazuli, friezes in Spanish coralline, agata bezels, and a jasper small door. The host was realized using pure oriental chalcedony (Giusti *et al.* 1978, 443). Unlike is father regency, Leopold commissioned diverse works also for the Pitti Palace's grand-ducal residency such as gold cutlery, soup tureens and bowls (Gonzales-Palacios 1986, 109), and a hardstone *commode* (1769–1771) showing the *Trionfo di Europa* and the *Quattro Stagioni* as auspicious subjects for his rule (Firenze, Palazzo Pitti, Appartamento degli Arazzi, Inv. n. O.d.A. 1911, 835). Leopold was also fond of hardstone artworks illustrating allegories and marine subjects such as the two tabletops that represented the allegories of water and air realized in 1765 and in 1766. Both the works were stolen by the Napoleonic troops and are currently preserved respectively at the Musée du Louvre (Inv. n. MR. 407) and at the Hermitage Museum (Inv. n. 5318). Leopold was then interested in

[61] The chisel-punches represented diverse subjects such as architectural vedutas (Firenze, Museo dell'Opificio delle Pietre Dure, depositi).

[62] This is exemplified by the white and brown onyx plate that Maria Theresa sent to Siries from Vienna in 1755 to make a cameo portraying the royal family (Vienna, Kunsthistorisches Museum, Inv. n. XII, 74). It should also be mentioned the catalog encompassed 168 engravings Siries released in 1759 and that were acquired by Maria Theresa (Giusti 1992, 113). Among these, there were diverse cameos realized in carnelian and gold (e.g., Vienna Kunsthistorisches Museum, Inv. n. XII, 556, 564, 566, and 619). A copy of Siries'catalog is preserved at BNCF, *Catalog des pierres gravées, par Louis Siriès, orfèvre du roi de France, présentement directeur des ouvrages en pierre dure de la galerie de S. M. impériale à Florence*. Florence: chez André Bonducci, 1757. Misc. Magl. 1103.1. Francis I was also interested in Siries' works and during his visit to Firenze purchased a painting of semi-precious stones with a marine subject for his father-in-law Charles VI (1685–1740), a tray, and a table with the top in semi-precious stones with a gilded bronze frame. Siries realized for Francis I a series of more than 60 paintings in semi-precious stones, which were adorned with a gilded bronze frame, illustrating countries architecture and human figures. All the paintings were sent to Vienna and they are still preserved at the Hofburg Palace (Giusti 2006).

Figure 13 – L'Allegoria dell'Aria. Firenze, 1765. Musée du Louvre, Inv. MR 407.

the use of scagliola to illustrate neoclassical subjects such as the tabletop representing the Titus' quadriga (1768, Firenze, Palazzo Pitti, Galleria Palatina, Inv. n. MPP 1911, 19443, 19483), and the two panels showing the Dance of the Hours and the Maidens that adorned a candelabra (1772, Firenze, Palazzo Pitti, Galleria d'arte moderna, Inv. n. 827, 828). These works were made by Lamberto Cristiano Gori (1727–1801), who was appointed by Leopold as the court's "scagliolista" (i.e., scagliola artist). Gori held this position until 1795 (Bono 2004; Colle 2004).

The Galleria dei Lavori had professional connections with the Imperial and Royal Museum of Physics and Natural History. For instance, the artisans of the Grand Ducal mint were involved in the restoration and manufacturing of both instruments and furniture for the museum.[63] And again, the offcuts from the working of semi-precious stones should be sent to Fontana by order of Leopold's secretariat.[64] Between the two institutions was also evidenced by the exchange of craftsmen specialized in the processing of mineralogical specimens. For instance, Cristofano Perini (dates uncertain), who was a lapidarist, was transferred on Cosimo Siries' suggestion to the museum in June 1787.[65] Leopold's interest in the use of hard stones, precious and semi-precious stones in art works was not limited to the Galleria dei Lavori but also included several items[66] stored in the Treasury of the General Wardrobe (*Stanza del Tesoro della Guardaroba Generale*).

[63] AMG, ARMU 001, aff. 10, c. 412.

[64] AMG, ARMU 002, aff. 107, c. 409.

[65] AMG, ARMU 002, aff. 49, c. 212.

[66] From the reading of the general inventory of Leopold's Treasury General Wardrobe is learned that he had a huge box inlaid with semi-precious stones (Wardrobe 1); a hardstone snuffbox along with tiny boxes for an apothecary use (Wardrobe 2); various hardstones painting to be kept next to the bed, a small gold crucifix with semiprecious stones that has been described as "bello assai" (very beautiful), tiny hard stones paintings to be kept next to the bed showing the Madonna of the Ss. Annunziata; other paintings and some small piles of hard stones, and a lapis lazuli chessboard (Wardrobe 3). In the second part of the same wardrobe, there was a touchstone painting to be kept

Figure 14 – *Ciborium* with flower decoration in bas-relief of semi-precious stones and gilded copper canopy, ca. 1782. Courtesy of Ministero per i beni e le attività culturali e per il turismo - Museo dell'Opificio delle Pietre Dure di Firenze, Inv. n. 345.

After leaving Firenze in 1790, Leopold did not give up his interest in mineralogy and mineralogical collecting. According to Fitzinger (1856 and 1868), he dedicated himself to the valorization and enrichment of the Habsburg mineralogical collections. For instance, he acquired from Andreas Graf von Hadik (1710–1790) (von Arneth 1877) a mineral collection encompassing gold, amethyst, jasper, opal specimens in addition to silicified wood samples and diverse fossils. Leopold II also donated to the imperial cabinet the mineralogical collection he received from Friedrich Samuel von Rossan Schmidt (1737–1794)[67] for his crowning ceremony. This collection was transferred to Vienna by Federico Manfredini (1743–1829).[68] Afterwards, he ordered to move the Habsburg mineralogical collections in the larger Hofburg's rooms and to reorganize the entire exhibition. The collection was open to the general public every day of the week except on Tuesdays. Unfortunately, Leopold II never got to see the new exhibition because he suddenly died on 1 March 1792.

4. Conclusions

Behind the curtains of naturalistic museums worldwide are a great number of historical catalogs. These volumes describe the specimens and the processes through which the collections were established (e.g., Alberti 2005). These data often remain unknown to the public because catalogs are rarely part of museum exhibitions. However, they represent unique sources of information, whose study shows how collections are the results of complex cultural, social, and scientific practices within networks of varied persons, places, and things (e.g., Byrne *et al.* 2011). Furthermore, as shown in this paper, their analysis problematizes the act of collecting through the investigation on how a collection developed, the impact it has had during the centuries and the roles it continues to play in both historical and scientific research.

next to the bed showing a golden-silver Madonna, an urn to be used during the Holy Week made of gold leaf and precious stones, a tray realized with precious stones, diverse crowns in hardstones, a cup inlaid with semi-precious stones, some "modern" hardstones. This last type of stone material was also used to make some "beautiful" tiny cups that were kept in Wardrobe 5. In Wardrobe 6 there was a tiny cup that was described as "beautiful and modern" ("bella e moderna") and it was used to preserve a set of crystal balls and buds ("bocciuoli") made in golden silver. Other two similar cups were stored in Wardrobe 8. 207 pounds of silver in bars and 85 pounds of golden silver were then preserved in the room downstairs. Národní Archiv (Prague National Archive), Inventario delle robe esistenti nella stanza del tesoro detta della Guardaroba Generale, cc. 199–202. For an overview of Leopold's archive, a part of which is currently stored at the Prague National Archive, while the other one at the Firenze State Archive see Gori and Toccafondi (2013).

[67] Friedrich Samuel von Rossan Schmidt held commercial relationships with the Imperial and Royal Museum of Physics and Natural History. Between 9 January and 6 March 1793, when Ferdinand III (1769–1824) was the Grand Duke of Tuscany, Rossan sold to the museum a collection encompassing minerals, fossils, and other natural specimens. The negotiation was supervised by Fabbroni and the acquisition seemed to be a great one since it counted three boxes of minerals and books, for the settlement of which Fabbroni is forced to ask Luigi Bartolini (1745–1800) for an advanced payment of 7000 lire. Another mineral collection provided by Rossan was acquired in 1794. Cf. AMG, ARMU 007, aff. 5, c. 30; Fab. 05, c. 210, 212, 216; ARMU 009, aff. 6, c. 13.

[68] Like Schmidt von Rossan, Manfredini was among the providers of the Imperial and Royal Museum of Physics and Natural History. For instance, he was involved in the so-called "agata affair", concerning a specimen of agata that Carl Fredrik Fredenheim (1748–1803), director of the Swedish Natural History Museum, sent to Felice Fontana. The latter assumed that the sample had been sent to him as a purchase proposal and, considering it to be a fake, he proposed to Fredenheim a very low economic valuation. At the end, the Swedish minister Johan Claes Lagersvärd (1756–1836) was forced to request the formal restitution of the specimen. Cf. AMG, ARMU 005, aff. 48, c. 142.

This paper has shown that the investigation of historical catalogs provides useful information not only for understanding the formation of naturalistic collections in the past, but also to acknowledge they are relevant to contemporary museum studies, thus promoting a more meaningful historical approach to both geosciences and geo-heritage.

Archives

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Archivio Museo Galileo (AMG), ARMU 001, aff. 1, c. 3; aff. 3, c. 338; aff. 10, c. 412; aff. 26, c. 458; aff. 147, c. 97; aff. 153–154, cc. 114, 126; aff. 168, c. 150; aff. 174, c. 174.
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Beyond borders. The mineralogical collecting between the Grand Duchy of Tuscany and the Habsburg territories at the end of the 18th century

Marco Benvenuti, Vanni Moggi Cecchi, Luciana Fantoni, Rosarosa Manca

In his interesting analysis of mineral collections in 18th-century France, Simon (2002) stated how history of science has reserved to 18th-century mineralogy the uncomfortable status of a "latter-day dark ages that bridges the gap between the enchanted, mystical world view of the Renaissance and the objective analytical sciences of the 19th-century", which often[1] tends to be absorbed into larger narratives such as the development of geology and the emerging branch of crystallography (e.g., Laudan 1987; Rappaport 1997; Salvia 2013). However, 18th-century mineralogy had a pivotal role in the history of natural sciences, following the debate over the nature of minerals and their taxonomy, and was also of great economic importance in the development of mining science (e.g., Dym 2008; Malaquias and Pinto 2011). According to Simon (2002), another important aspect of eighteenth-century mineralogy, which represents the core of this chapter, is mineral collecting. In this regard, Klemun *et al.* (2018) highlighted how naturalistic collections and museums, along with botanical gardens (Klemun 2008), can be considered as multi-coded spaces of knowledge, in which epistemes are represented by cognitive elements as well as by diverse practices and visual forms. This view is supported by Vogel (2015) who underlined how mineral collections are markers of social, cultural, and political spaces in 18th-century European societies. The act of collecting minerals is not only a scholarly practice but also a tool of state knowledge through which to exhibit a country's natural resources and economic development. In this setting, the investiga-

[1] As stated by Simon (2002), one of the few exceptions avoiding this tendency are the studies that focus on the contribution of 18th-century mineralogy to Antoine-Laurent de Lavoisier's chemical revolution (e.g., Rappaport 1967; Oldroyd 1998). A complete survey of the connections between mineralogy and chemistry in the 18th-century is beyond the scope of this chapter, nonetheless it is noteworthy to mention the work of the English naturalist John Walker (1731–1803) (Eddy 2008).

Annarita Franza, University of Florence, Italy, annarita.franza@unifi.it, 0000-0003-3146-6957
Johannes Mattes, Austrian Academy of Sciences, Austria, johannes.mattes@oeaw.ac.at, 0000-0002-8546-7149
Giovanni Pratesi, University of Florence, Italy, g.pratesi@unifi.it, 0000-0001-6329-901X

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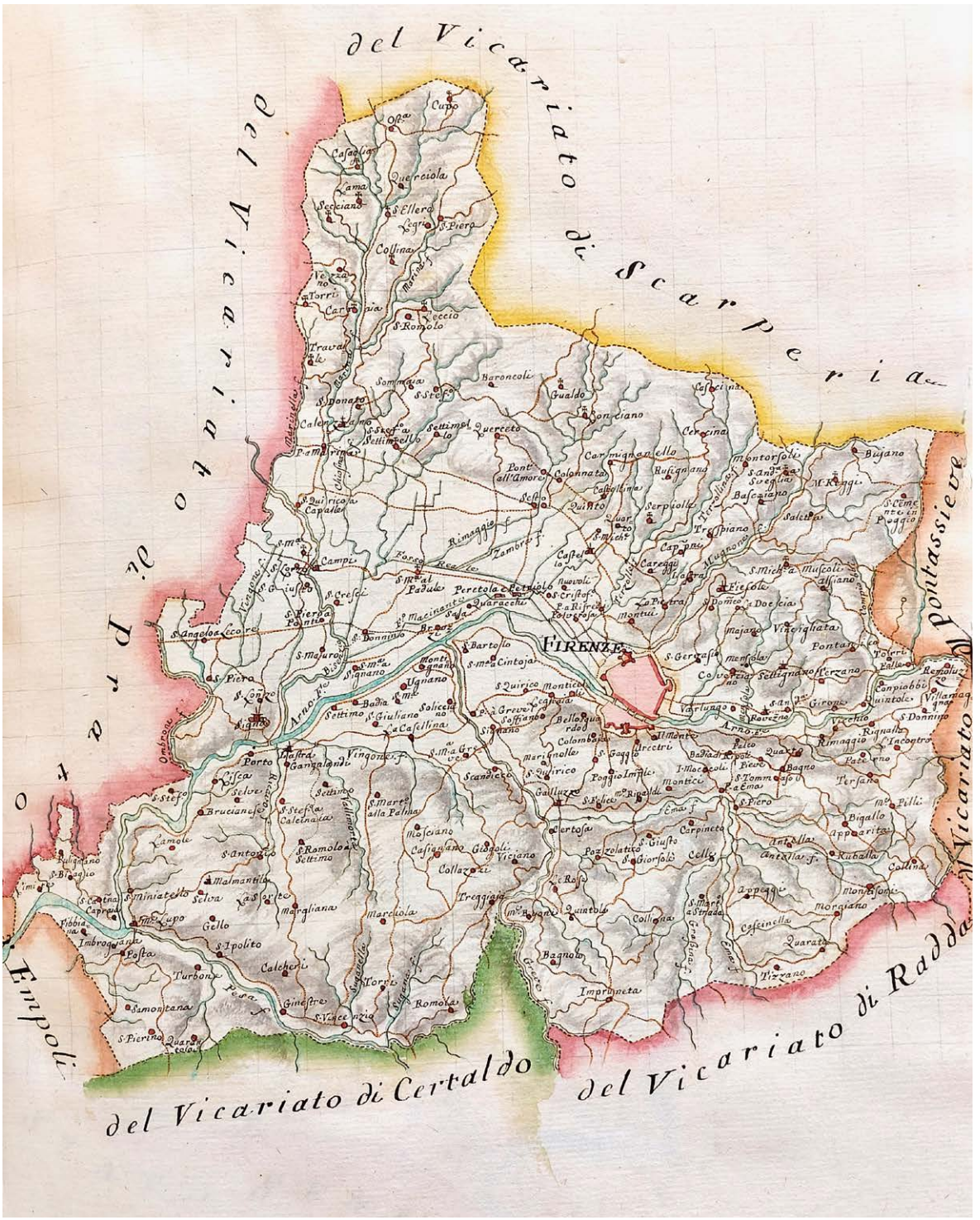

Figure 1 – Map of the Supreme Court of Justice of Firenze. In: Luigi Giachi, Descrizione Geografica dello Stato Fiorentino nel Granducato di Toscana diviso nelle sue vere Giurisdizioni di ciascun Vicariato. 1782, Tomo Primo, n. 29. Courtesy of Ministero della Cultura/ Biblioteca Nazionale Centrale Firenze, Palatino 1093.

tion of the notion of "motion" in reference to the specimens and their circulation become of great importance for an in-depth understanding of the multifaceted spatial and heuristic interconnections that characterized 18th-century mineral collecting. On this subject, Klemun (2012) showed how natural history cabinets and museums represent "scientific spaces", where the specimens became scientific and culturally determined objects. However, before entering a museum display, they physically crossed what Klemun (2012) defined as a "space in between", i.e., the route that encompasses the different spaces of knowledge (the place where a specimen was recovered and the museum location), spatial entities (e.g., means of transportation), and all the ephemeral phenomena (such as gaining, preserving, and documenting) that are involved in the acquisition and circulation of the specimens. The "space in between" is thus an analytical category that comprises scholars, mineral dealers, collectors, the practices of packing, transport, and transformation, as well as all the different forms of documentation (letters, notes, labels, and inventories) that were part of a specimen's journey.

Based on the concept of the "space in between", this chapter examines the way in which the mineralogical specimens from the mining territories of the House of the Habsburg became collector's items within the Florentine Imperial and Royal Museum of Physics and Natural History between 1771 and 1790.[2] Data for this study were gathered analyzing the 18th-century inventories and catalogs currently preserved at the Historical Archive of the University Museum System in Firenze. In addition, this study has investigated the documents relative to the museum's administration that are kept in other local research institutions such as the Archive of the Galileo Museum, and the Firenze State Archive.

One of the first collections coming from a German-speaking country that was acquired by the Imperial and Royal Museum of Physics and Natural History belonging to the Hamburg merchant Peter von Spreckelsen (d. 1771). The purchase, which was made by the museum director Felice Fontana (1730–1805) between 4 and 7 October 1771, is well-described in a report he wrote from Livorno—where von Spreckelsen lived and died—to the Grand Ducal Secretariat of Finance. Here, Fontana stated that he had bought all von Spreckelsen's collection (including showcases and shelves), which he had personally packed in 20 wooden boxes. The latter were loaded onto a river ship departing from Pisa, which would have reached Firenze in one day.[3] Van Spreckelsen's collection encompassed ca. 220 mineralogical specimens, for the greater part metallic minerals coming from the German territories, but samples from the Hungarian min-

[2] This timespan indicates the beginning of the relocation (1771) of the naturalist collections that were housed in the Royal Gallery (today the Uffizi Galleries) to Palazzo Torrigiani, i.e., the building where the Imperial and Royal Museum of Physics and Natural History would have been accommodated. The year 1790 can be considered as the date that marked the drawing up of the museum inventory. The inventory of the naturalistic and anatomical collections was proposed by Giovanni Fabbroni (1752–1822), who was the museum's vice-director at that time, and approved by the Grand Ducal Secretariat on 9–13 January 1790. The writer in charge of the inventory of the mineralogical and anatomical collections was the "Maestro di scritto" (Master of the Writing) Giovacchino Frosini (dates uncertain). Attilio Zuccagni (1754–1807), who was a professor of natural sciences, physician, explorer, and Superintendent at Botanical Garden, inventoried the specimens that were part of the museum exhibition. Archivio Museo Galileo (AMG), ARMU Affari 004, aff. 6, c. 70. On the origin of the naturalistic collections that were preserved at the Royal Gallery, which were arranged by the members of the Medici family, see Barocchi and Ragionieri (1983), Tongiorgi Tomasi (1988), Barocchi and Bertalà (1993), Vaccari (1996), Filetti Mazza and Tomasello (1999), Cipriani *et al.* (2004), Cipriani and Scarpellini (2007).

[3] Archivio di Stato Firenze (AS-FI), *Segreteria di Finanze,* f. 480.

Figure 2 – Portrait of Felice Fontana (1730–1785). In: Giulio Provenzal, Profili bio-bibliografici di chimici italiani: sec. XV- sec. XIX. Roma, Istituto nazionale medico farmacologico Serono, 1930, Tav. VIII. Museo Galileo, Cons. Biografie F003.

ing districts were also present.[4] Six specimens have actually been identified in the collections of the Florentine Museum of Natural History.[5]

In his seminal work of 2011, Cipriani found that the acquisitions made to increase the mineralogical collections kept in the new-established Imperial and Royal Museum of Physics and Natural History were described in detail in the *Cataloghi di produzioni naturali passate al Real Museo di Firenze prima dell'anno 1792*,[6] i.e., a volume comprising diverse catalogs[7] relative to the museum acquisitions that were made between 1771 and 1792. Among these, there was the mineralogical collection that Baron Friedrich Samuel von Rossan Schmidt (1737–1794)[8] proposing for acquisition in 1787; a list of minerals that were acquired by a German merchant[9] including diverse specimens from the Habsburg territories;[10] and a brief inventory (both in German and in Italian) of six minerals[11] coming from Vienna which were sent to the Grand Duke Leopold by Count

4 Cipriani (2011) stated that the inventory of von Spreckelsen's collection is reported in an undated register entitled *Cataloghi e Fogli relativi ai prodotti naturali esistenti nel R. Museo; ed ad alcune macchine o Istrumenti pervenuti al medesimo,* which is currently preserved at the Historical Archive of the Galileo Museum. Here the specimens belonging to von Spreckelsen's collection are listed under the capital letter V.

5 These are a copper specimen from Bad Lauterberg im Harz (Inv. No. G38), two samples of chalcopyrite from Blankenburg and Hohegeiss (Inv. Nos. G1379 and G1444), a clinochlore from Brocken (Inv. n. G11768), a tetrahedrite from Ruis in Switzerland (Inv. No. G1516), and a malachite from Naila in Upper Franconia, Germany (Inv. No. G7992).

6 Archivio Storico–Sistema Museale di Ateneo (AS-SMA), *Cataloghi di produzioni naturali passate al Real Museo di Firenze prima dell'anno 1792*. A copy of this document can be found in the Galileo Digital Library.

7 The volume contains 24 catalogs and inventories of naturalistic collections that were acquired by the Imperial and Royal Museum of Physics and Natural History at the end of the 18th-century. Some of them belonged to Italian naturalists such as Ermenegildo Pini (1739–1825), Giovanni Mariti (1736–1806), Giovanni Fabbroni (1752–1822), Pietro Rossi (1738–1804), and Stefano Andrea Renier (1759–1830). Others belonged to foreign scholars as Déodat de Dolomieu (1750–1801), Adolf Modéer (1739–1799), and Abraham Gevers (1712–1780).

8 The catalog reported a list of 17 minerals (e.g., lead and antimony samples) that Schmidt von Rossan sent to Luigi Dithmar Schmidweiller (dates uncertain) on 3 September 1787. This inventory represents the second part of a mineralogical collection (the first part was sold in 1786) that von Rossan tried to sell to the Imperial and Royal Museum of Physics and Natural History without succeeding. AS-FI, Imperiale e Reale Corte Lorenese, f. 399.

9 The inventory was entitled *Nota di alcune Pietre e Minerali acquistati da un mercante tedesco per questo R: Museo di Firenze*. The merchant's name was unspecified, but the minerals the museum acquired on this occasion were marked with a capital letter "O" that was crossed twice by the copyist. The collection was purchased for 1007 French lire and most of the 103 specimens were ore minerals. Among them, there was a "heavy and calcareous spar", and a specimen of "colorful Icelandic chalcedony" which should have been remarkable judging by their price (60 French lire). Another note, which was written in Latin, mentioned the acquisition of samples from an anonymous German merchant. It referred to 39 minerals without any data on their monetary value. Among them there was a specimen of native gold from Transylvania. Finally, a third list reported the purchase from a German dealer named Dolmar (dates uncertain) of 25 specimens that came from diverse European areas.

10 Among these, seven minerals came from the Hungarian areas (e.g., a spat specimen from Banská Štiavnica), six from Carinthia, three from Ischl in Upper Austria, while a lead specimen and a pseudo-galena came from Bohemia and Transylvania.

11 The specimens were extracted from the caves located in Obervellach as well as from the quarries situated in *Bleiberg* ("Montagna di Piombo"). They were a specimen of iridescent yellow ore ("miniera di rame gialla a guisa di coda di pavone"); a copper silica stone ("pietra silicea di rame" – *Kupfer Kies*); a red and yellow sulfur from the copper mines in Obervellach ("zolfo rosso e giallo come nasce dalle miniere di rame di Obervellach"); a molybdenum with white crystallized lead spatum from Bleiberg ("molybdena con lo spato bianco di Piombo cristallizzato di Bleyberg"); a yellow lead spathum from Bleiberg ("spato di piombo giallo di Bleiberg"); molybdenum with transparent lead spathum crystals ("molybdena con cristalli di spato di piombo trasparenti"). The specimens were placed in the museum exhibition according to their mineralogical classes together with a copy of their original paper labels.

Figure 3 – Chalcopyrite, Blankenburg, Germany, Inv. n. G1379 (size 6x3x4 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 4 – Chalcopyrite, Hohegeiss, Germany, Inv. n. G1444 (size 6x9x6 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 5 – Clinochlore, Brocken, Germany, Inv. n. G11768 (size 4x2x2 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Amedeo di Stampfer (dates uncertain), who was the Vice-President of the Aulic Chamber for the Monetary and Mountain Affairs.[12] The register also contains the catalog[13] of the mineralogical collection belonging to Christoph Traugott Delius (1728–1779), and two catalogs illustrating the mineralogical collections that were acquired with the mediation of Ignaz von Born (1742–1791) on Leopold's order.

Around November 1780, the Imperial and Royal Museum of Physics and Natural History acquired the mineralogical collection belonged to Christoph Traugott Delius (1728–1779), who was a professor at the Bergakademie in Schemnitz (today Banská Štiavnica, Slovakia) and the author of one of the first academic mining handbooks (Delius 1773; Battek 2015). The acquisition of Delius' collection was formalized on 20 December 1780 and approved by the Viennese authorities eight days later for a prize of 2000 "zecchini". However, there is no further news of the acquisition until 13 September 1783 when Luigi Dithmar Schmidweiller (dates uncertain), who was the Director of the Finance Secretariat of the Grand Duchy of Tuscany (1780–1794), wrote a letter to Albrecht Meyer (dates uncertain), an Imperial Councilor in Vienna (1783–1785), stating that—by order of the Grand Duke Leopold—Delius' heirs would have received their

[12] *Camera Aulica per gli Affari Monetari e Montanistici*. Cf. *Il Mentore Perfetto de' Negozianti, ovvero guida ed istruzione per rendere più agevoli le loro speculazioni*, vol. 2, 1793: 12. On the scientific activity of Amedeo Stampfer, who was also in contact with Giovanni Antonio Scopoli (1723–1788), see *Opuscoli scelti sulle scienze e sulle arti tratti dagli atti delle accademie, e dalle altre collezioni filosofiche e letterarie, dalle opere più recenti inglesi, tedesche, francesi, latine, e italiane, e da manoscritti originali, e inediti*. Presso G. Marelli, Milano: 226; *Archeologia Romana,* vol. 5 (1779): 269–71; *Gazzetta Universale* (1793): 431.

[13] This catalog was entitled *Catalogo originale di una copiosa Raccolta di Minerali posseduta dal Consigl:re Delius e passata dopo la sua morte a questo R: Museo di Firenze.*

payment when all the minerals had been formally delivered to Ignaz von Born.[14] A document dated ten days later reported the payments that had been done for the transport of the minerals by sea from Trieste to Livorno, and then by river from Pisa to Firenze.[15]

The catalog of Delius' collection was written in German and translated into Italian[16] by Leopoldo de Lagusi (dates uncertain) with the scientific collaboration of Giovanni Fabbroni. On the front cover, a note informed that all the minerals were numbered and provided with chemical signs showing their qualities. The specimens were listed according to their mineralogical class,[17] order, genre, and species. The Italian copy of Delius' catalog is written in very clear handwriting up to the section *Genre 6 – Lead* ("Genere 6 – Piombo"). Subsequently, different handwriting—more difficult to decipher—can be discerned. Alchemical symbols are reported for some metals (e.g., the Moon for silver, Venus for copper, Mars for iron). The total number of the specimens listed by 'genres' is 2708, including some of considerable economic value and 36 precious stones. A complete survey of Delius' collection is out of scope here; however, it has to be noted that almost all the minerals described in the catalog came from the Habsburg territories. Currently, 21 specimens have been found in the collections of the Natural History Museum of Firenze.[18]

The mineralogical collections that were acquired with Born's mediation were delivered in two shipments and described in two different catalogs. The first one was entitled *Catalogue des Mineraux achetés pour Son Altesse Royale le Grand Duc de Toscane*, and was written in German despite the French title. This register, which was followed by an Italian translation,[19] encompassed 1066 specimens, whose greater part came from the Habsburg mining districts. The minerals were listed in a progressive numerical order, grouped according to a systematic criterion, and briefly described.[20] A note on the title page of the Italian translation informed that all the specimens were labeled with a printed number with a tiny red line. The second shipment encompassed ca. 920 minerals, which were listed in a Latin inventory.[21] The total number of the minerals purchased by von Born was about 2000 specimens, the majority of which came from the Habsburg mining territories, especially from areas such as today Austria, Hungary, Transylvania, and Slovakia.

[14] On Born's scientific works and his relationships with the House of Habsburg see, for example, Seidler (2019). For the acquisition of Delius' collection on behalf of Leopold, Born was rewarded by Leopold with a snuffbox that was made by Persian lapis lazuli. It was very precious (its value was estimated at over 100 "zecchini") because the gemstones were of a "very good" color. Furthermore, it was carved from a single stone and manufactured in Rome. AMG, ARMU Affari 001, aff. 168, c. 150.

[15] AMG, Filze negozi, 1789B.

[16] *Introduzione Italiana del precedente Catalogo di Minerali di Delius, fatta in Pisa dal Sig: Leopoldo de Lagusi con l'assistenza del Sig:re Gio' Fabbroni.*

[17] The mineralogical classes reported in the catalog of Delius' collection are Earths ("Terre"), which included the rocks, Salts ("Sali"), Flammable ores ("Corpi Infiammabili)", Metals and Semi-metals ("Metalli e Semimetalli").

[18] Eight marble specimens (Inv. Nos. M831, M837, M842, M846, M851, M870, M901, M921), three quartz specimens (Inv. Nos. G4690 comprising two specimens and G4695), two calcite specimens (Inv. Nos. G7089, G7175), a specimen of opal (Inv. No. G1151), fluorite (Inv. No. G3204), actinolite (Inv. No. G11118), biotite (Inv. No. G11619), and amber (four specimens, Inv. No. G12718).

[19] *Introduzione Italiana del preced:e Catalogo di minerali spediti al R: Museo dal Cav:e De Born.*

[20] The catalog reported basic information such as a mineral's identification and its geographical provenance. No taxonomic data were listed.

[21] *Catalogus Fossilium quae Florentine Museum transmittuntur ab Equite Born Musei Caesarei Vindobonensis Praeside.*

Figure 6 – Tetrahedrite, Ruis, Switzerland, Inv. n. G1516 (size 3x5x3 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 7 – Malachite, Naila, Germany, Inv. n. G7992 (size 4x6x4 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

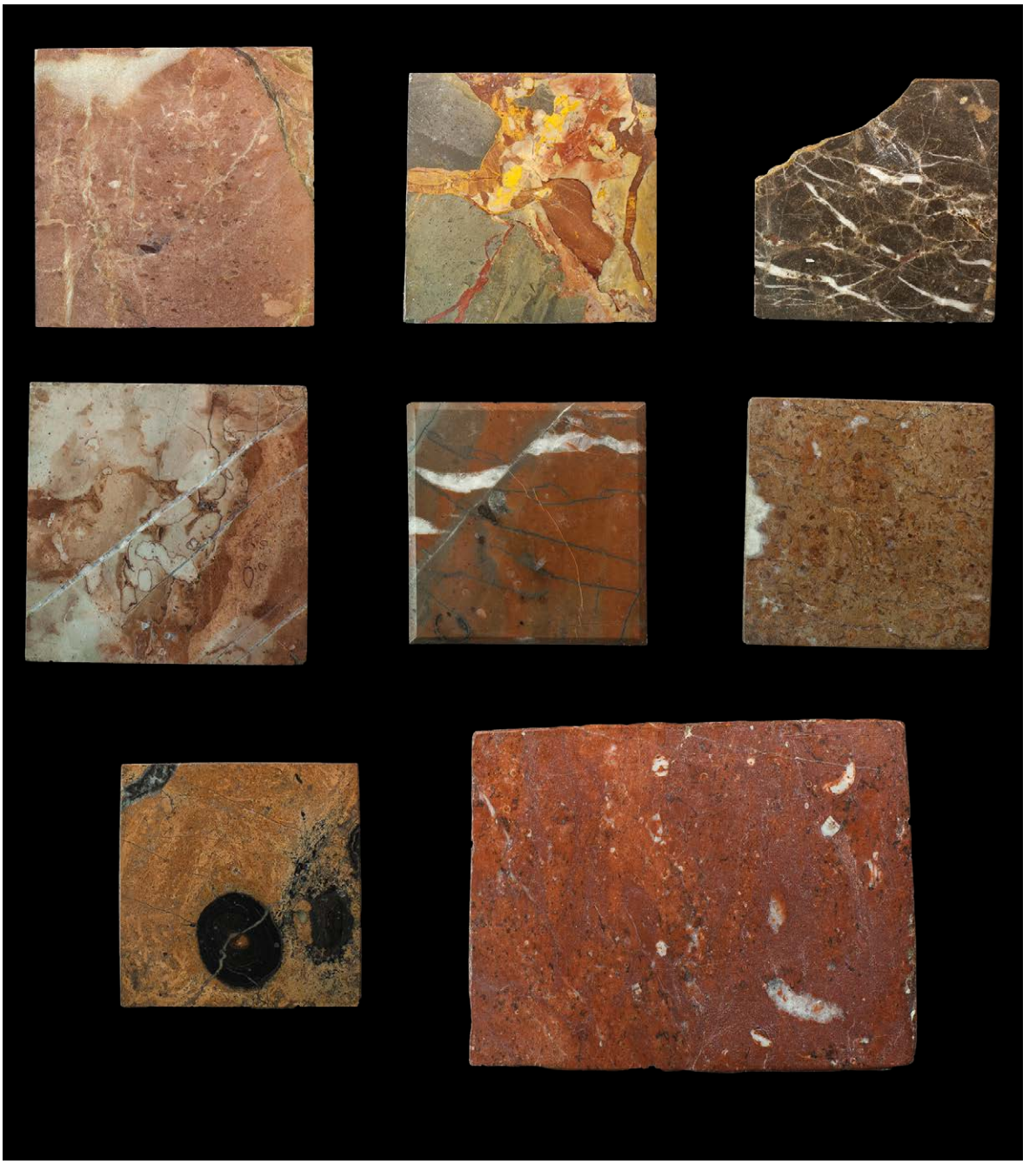

Figure 8 – Group of marble tiles belonging to the Delius Collection. From left-right, top to bottom: pink marble, Seravezza, Apuane Alps, Tuscany, Italy, Inv. n. M901 (size 8x8x0.5 cm); red-brown marble with red and yellow spots, Transylvania, Romania, Inv. n. M851 (size 7x7x0.5 cm); gray-black marble with white veins, Tyrol, Austria, Inv. n. M842 (size 7x7x0.5 cm); red and white marble, Sicily, Italy, Inv. n. M846 (size 8x8x0.5 cm); red marble with green veins and fractures filled with white calcite, Moravia, Czech Republic, Inv n. M921 (size 7x7x0.5 cm); yellow-green marble with red and white spots, unknown provenance, Inv. n. M837 (size 7x7x0.5 cm); green-brown marble with black spots, Tyrol, Austria, Inv. n. M831 (size 7x7x0.5 cm); red marble with white spots, Bohemia, Czech Republic Inv. n. M870 (size 13x10x0.5 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 9 – Quartz, Unknown provenance, Inv. n. G4690 (size 12x8x3 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Another interesting source of information regarding the topic of this study is the museum's General Catalog that reported the mineralogical specimens kept in the Imperial and Royal Museum of Natural History over the time. On 21 February 1775, i.e. when the museum was open to the public, Leopold ordered with a *motuproprio* a complete inventory of all the specimens preserved in the museum at that time. The inventory was organized according to the diverse species and reported the number of the shelves where the specimens were on display, and how many samples of each species were owned. Giuseppe Pigri (d. 1804), a professor of mechanics and an expert in mathematics (Pigri 1758) as well as the assistant of the museum's director, and Giuseppe Panzanini (dates uncertain), Minister of the Audit Office and Unions of the Grand Duchy of Tuscany (1775–1777), were appointed to compile the inventory, while Alessandro Cerchi (dates uncertain) and Bartolomeo Coppini (dates uncertain) oversaw writing the text under dictation and then copied it into the inventory.[22] Its drafting was completed in a very short time (July 1775) and turned out to be a topographical inventory, which described a specimen's exact location and how many samples encompassed the museum collections.[23] The volume reported that the geo-mineralogical collections comprised ca. 24284 specimens. Since it was completed quickly, several specimens were not inventoried. To fill these gaps, a new survey was carried out.[24] In

[22] AMG, ARMU Affari 002, aff. 36, c. 168. Alessandro Cerchi and Bartolomeo Coppini were two copyists who were assigned by the Grand Ducal administration to the Imperial and Royal Museum of Physics and Natural History. Cerchi was at the museum from 1775 to 1784, while Coppini worked just for the compilation of the first museum inventories (1774–1777).

[23] AS-SMA, *Inventario generale del Real Museo, 1775*.

[24] AS-FI, Imperiale e Real Corte Lorenese, f. 5257. The new inventory was entitled *Aumento all'Inventario generale del Real Gabinetto. Nota dei generi che appartenevano al Real Gabinetto prima del 13 luglio mille-settecento-settanta-cinque*. A copy of this inventory is preserved at the Historical Archive of the Firenze University Museum System.

Figure 10 – Quartz (*var. ferruginous*), Unknown provenance, Inv. n. G4695 (size 13x8x1 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

a further book[25] are listed the so-called "appendices" ("appendici"), which contained all the items that had been acquired or received by other cabinets (e.g., the Royal Cabinet) from 13 July 1775 until December 1777.

On 19 November 1789, Leopold ordered that a catalog of all the specimens held in the museum—whether in storage or on display—was compiled.[26] The cataloging of the mineralogical collection began between May and June 1793[27] and resulted in 8 volumes that corresponded to the rooms in which the collections were displayed.[28] The specimens were listed following a topographical criterion, starting from those on the top shelves. The descriptions, which sometimes were also very detailed, concerned the specimens' external features, but did not give information about their collecting history apart from the specimens acquired before 1792 (e.g., Delius' and von Spreckelsen's collections). The total number of the cataloged specimens was 25243, to which had to be added the artifacts realized with semi-precious stones (e.g., tables) as well as the carved rocks representing the various activities that were performed in the Habsburg silver mines. With respect to the research question, the analysis of these catalogs showed that most of the samples came from Central Europe, i.e., from Saxony to Transylvania, from Bohemia to Slovakia. A comparative study between these specimens and those that are preserved at the Firenze University Museum System, showed that 4200 specimens described in the 18th-century catalogs are still kept in the museum collections (Tab. 1).

Table 1 – Number of the specimens listed in 1793 catalogue that are still preserved in the Firenze University Museum System grouped by continent.

Continent	Nos. of specimens
Africa	59
Asia	100
Europe	3302
Americas	60
Oceania (New Zealand)	3
Unknown	676
TOTAL	4200

[25] AS-FI, Imperiale e Real Corte Lorenese, f. 5258. This further inventory was entitled *Continuazione dell'Inventario del Real Gabinetto e sua Biblioteca a tutto il Dicembre 1777. Prima parte nella quale sono descritti tutti i generi pervenutili tanto dalla Real Guardaroba che da qualunque altra parte alla riserva dei Generi provvisti dal medesimo Gabinetto (dopo il 13 luglio mille-settecento-settanta-cinque a tutto dicembre mille-settecento-settanta-sette).* A copy of the inventory is preserved at the Historical Archive of the Firenze University Museum System. Differently from the aforementioned inventory, which was just a list of samples sorted by numbers, the latter described the specimens according to the date of their acquisition and geographical provenance. A capital letter (A, B or C) was assigned to the specimens to indicate in which room they were displayed.

[26] More information about this new catalog can be found in Endnote No. 2.

[27] AS-SMA, *Continuazione dell'Inventario generale del R. Museo. Nota delle Produzioni acquistate in aumento della Raccolta di Storia naturale dentro questi – Anno 1793*.

[28] The rooms that were devoted to the exhibition of the mineralogical collections (i.e. rooms from IX to XVI) were located on the second floor of Palazzo Torrigiani.

Figure 11 – Calcite, Unknown provenance, Inv. n. G7089 (size 10x8x5 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 12 – Calcite, Unknown provenance, Inv. n. G7175 (size 7x12x5 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 13 – Fluorite, Saxony, Germany, Inv. n. G3204 (size 5x5x5 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 14 – Actinolite (Amphibole supergroup), Banat, Romania, Inv. n. G11118 (size 5x12x7 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

A significant contribution to the collection was given by specimens coming from Germany, mainly from Saxony and Harz, but also from Romania, with Transylvania and Banat as main places of origin. These are followed by the specimens coming from Slovak Republic, with the region of Banská Štiavnica as prevalent area, Austria (Tyrol, Carinthia, Styria) and Czech Republic (the Bohemian territories included between Příbram and the Joachimsthal, today Jáchymov). It should be also noted that few minerals that are today part of the mineralogical collections came from the Hungarian areas. This inconsistency may be due to the geopolitical changes that occurred during the centuries that have brought to reassign the localities of provenience according to the new spatial organization of politics.

The high incidence of minerals from the Habsburg domains listed in the 1793 catalog is not surprising, considering that many of these mining localities were already present in the *Collectio Mineralium*, the catalog of Leopold's mineralogical collection that is preserved in the Historical Archives of the Firenze University Museum System. These localities are mostly mining basins located along the Carpathian Mountains, extending from Central to Eastern Europe across the territories of present-day Czech Republic, Slovakia, Poland, Hungary, Ukraine, and Romania (Tab. 2).

Table 2 – Localities listed in the *Collectio Mineralium* corresponding to the localities reported in the 18th-century catalogs present at the Firenze University Museum System. Ancient names of the localities are reported with the modern names in brackets.

Locality	Mineralogical species
Eisenerz, Styria, Austria	Pyrite
Joachimstal (Jáchymov), Bohemia, Czech Republic	Acanthite, Arsenic, Bismuth, Bismuthinite, Cobaltite, Gold, Hematite, Erythrite, Pyrargyrite, Realgar, Silver, Wad
Schlaggenwald (Horní Slavkov), Bohemia, Czech Republic	Andradite, Cassiterite, Scheelite, Wolframite
Annaberg, Lower Austria, Austria	Galena, Silver, Wulfenite
Idria (Idrija), Carniola, Slovenia	Calcite, Cinnabar, Epsomite, Melanterite, Mercury, Pyrite
Schemnitz (Banská Štiavnica), Slovak Republic	Mainly: Acanthite, Barite, Calcite, Chalcopyrite, Chalk, Cerussite, Cinnabar, Dolomite, Hematite, Fluorite, Galena, Limonite, Melanterite, Miargyrite, Pyrargyrite, Pyrite, Quartz, Siderite, Silver, Sphalerite, Stibnite, Tetrahedrite
Kremnitz (Kremnica), Slovak Republic	Acanthite, Barite, Dyscrasite, Galena, Pyrargyrite, Pyrite, Quartz, Silver, Sphalerite, Stibnite, Tetrahedrite
Magurka, Slovak Republic	Gold
Spišská Nová Ves, Slovak Republic	Tetrahedrite
Štós, Slovak Republic	Limonite
Oravicza (Oravița), Banat, Romania	Cuprite, Tennantite, Tremolite
Moldova (Moldoua Nouă), Banat, Romany	Azurite, Cuprite, Malachite

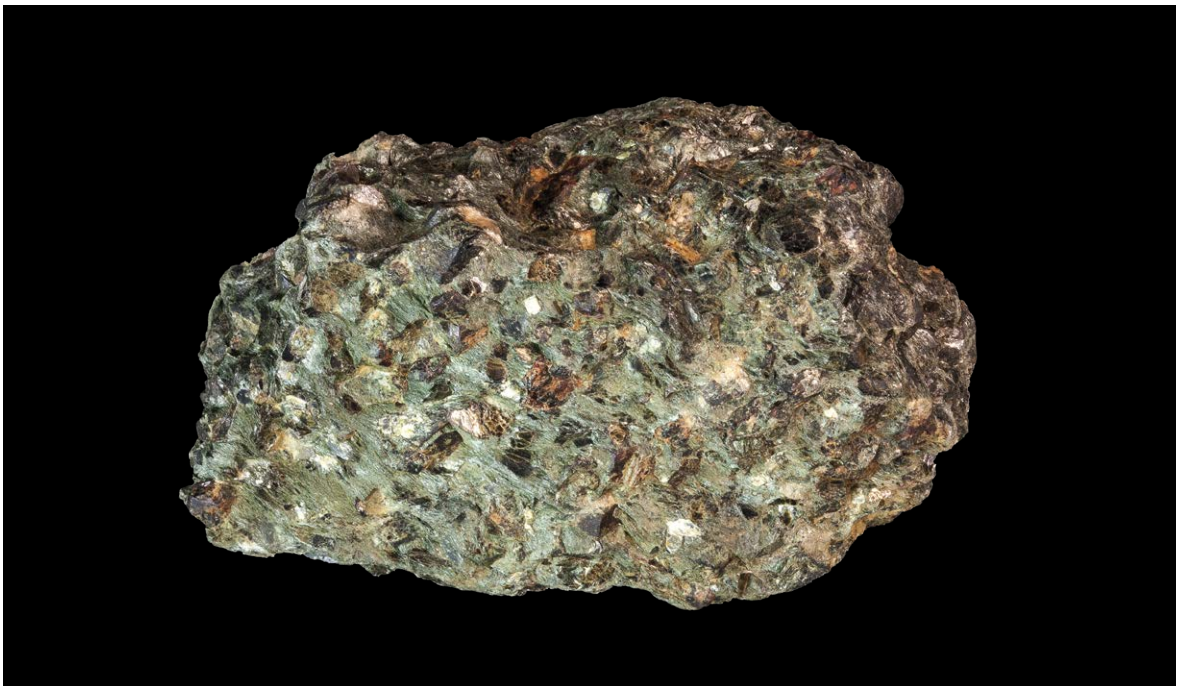

Figure 15 – Biotite (Mica group), Bohemia, Czech Republic, Inv. n. G11619 (size 4x9x7 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

Figure 16 – Amber, Unknown provenance, Inv. n. G12718 (various sizes; max. 2x1x1 cm). Natural History Museum – Museums System, University of Firenze. Photo by Stefano Dominici.

These findings, while preliminary, may help us to understand how the material and cultural dimensions of mineralogical museum collections represent a precious source of data not only to investigate the history of mineralogy and mineral collecting, but also to reconstruct the knowledge development processes. As Klemun (2012) stated: "collections are no longer seen as immutable entities, but rather as things and their meaning in flux." These historiographical changes are well represented by the social, cultural, administrative, and economic perspectives emerging from the analysis of the circulation of the mineralogical specimens between the House of the Habsburg and the Imperial and Royal Museum of Physics and Natural History.

Another marked observation to emerge from the data is the correlation between mineralogical collecting and the advancements of mining science in the 18th-century. As noted by Wilson (1994), mines are historically the preferred places for acquiring new specimens for mineral collections. However, as pointed out by Rudwick (1996) and Klemun (2004), in the 1770s a new trend aroused in the German-speaking countries that saw collectors and scholars becoming interested in samples coming from mines to increase the geological knowledge of the territories. In this context, the collections that were sent to the Imperial and Royal Museum of Physics and Natural History and arranged by Ignaz von Born are paradigmatic of how mining played a pivotal role in both mineralogy and collecting.

As put forward by Vogel (2015), the evidence found in this study also confirms the emergence of an enlightened practice of mineral collecting throughout Europe that was associated with both scientific interests and utilitarian goals as the development of a country's economic power. Investigating the making of the mineralogical collections, which contained specimens coming from the Habsburg territories, opens new doors not only for understanding the wide array of practices involved in the 18th-century collecting, but also for comprehending the processes of communication that link collectors, collections, and institutions. In this casestudy, the specimens whose place of origins can be traced in the Habsburg dominions, can therefore be considered as a key element of the identity-building of the Imperial and Royal Museums of Physics and Natural History in Firenze.

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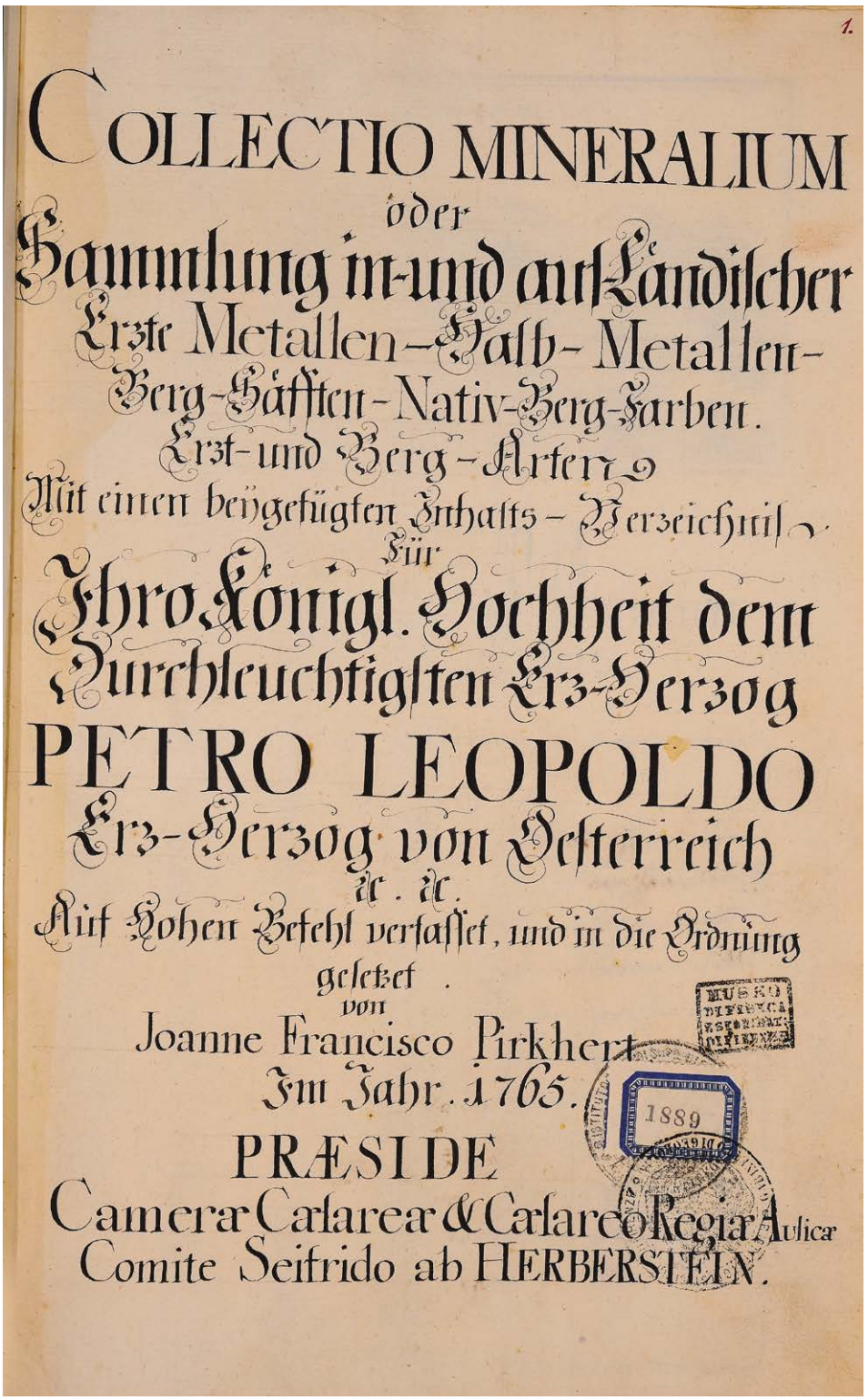
German Transcription – English Translation

Figure 1 – Catalog's leather cover with golden Habsburg coat of arms.


1.

COLLECTIO MINERALIUM
oder
Sammlung in- und ausländischer
Erzte Metallen – Halb- Metallen-
Berg-Säfften - Nativ-Berg-Farben.
Erzt- und Berg - Arten
Mit einen beygefügten Inhalts – Verzeichniß
Für
Ihro Königl. Hochheit dem
Durchleuchtigsten Erz-Herzog
PETRO LEOPOLDO
Erz-Herzog von Oesterreich
&c. &c.
Auf Hohen Befehl verfasset, und in die Ordnung
gesetzet
von
Joanne Francisco Pirkhert
Im Jahr. 1765.
PRÆSIDE
Cameræ Cæsareæ & Cæsareo Regiæ Aulicæ
Comite Seifrido ab HERBERSTEIN.

Figure 2 – Catalog's frontispiece.

COLLECTIO MINERALIUM
oder
Sammlung in- und aus-Ländischer Erzte Metallen – Halb-Metallen – Berg-Säfften – Nativ-Berg-Farben. Erzt- und Berg-Arten.
Mit einen beygefügten Inhalts-Verzeichnis Für Ihro königl. Hochheit dem Durchleuchtigsten Erz-Herzog PETRO LEOPOLDO Erz-Herzog von Oesterreich etc. etc.
Auf Hohen Befehl verfasset, und in die Ordnung gesetzet von Joanne Francisco Pirkhert Im Jahr 1765.
PRAESIDE Camerae Caesareae & Caesareo Regiae Aulicae Comite Seifrido ab HERBERSTEIN

COLLECTIO MINERALIUM
or
Collection of domestic and foreign ore metals – semi-metals – mountain juices – native mountain colors. Ores and mountain kinds.
With an attached table of contents For His Royal Highness the Most Serene Archduke PETRO LEOPOLDO Archduke of Austria amongst others
Written and put in order by Joanne Francisco Pirkhert in 1765.
PRAESIDE Camerae Caesareae & Caesareo Regiae Aulicae Comite Seifrido ab HERBERSTEIN

Figure 3 – Catalog's first page with the engraving of the Kremnica mines.

Erklärung nachfolgender Mineralien und Berg-Arten

1. Cremnitzer Hand-Stein von einer Edlen schaar-Clufft[i]. Muglicht mit fixen Gold durchzohen. Woran sich das Gold in dem zwischen beyden Saal-bändern[ii] sehr gestaltig offenen zart quarzigten Crystal Clüfften trusigt Kern-graugpigt, ganz gediehen eingesesßen vorzeiget.

2. Cremnitzer Blätter Creysigt Corporalische Gold-Stufe[i] in Quartz und liechtgrauen Sand Spath, mit Silber Erzt ädrichen durchzohen, trusigt und mit blenth Äugel eingesprängt.

3. Cremnitzer Creyßigte Gold-Erzt Schwarte. Vormahlens aus dem Maria Hylff Schacht erschrotten, in grobgrauen Horn-Gestein[i].

4. Aus Siebenbürgen unweith Száláthnyá Ein in zarten Quartz durchzohener mit Silber-Gelf gemengter feiner Bley-Glanz[i] pr: Cento 12 löthig[ii] in Silber. Davon die Mark 120 Pfennig fein Gold hält.

Explanation of the below-mentioned minerals and colorful ores

1. From *Kremnica* [U2]* a specimen from a noble parallel running joint with fine gold plated through. The gold reveals itself in the area between both salbands very shapely in open delicate quartzous crystal joints, drusy, granular, and very solidly incorporated.

2. From *Kremnica* [U2] a specimen of crusty gold leaves in quartz and light grey sandy spar, veined with silver ore, drusy and disseminated with eye-shaped blende ore.

3. From *Kremnica* [U2] a crust of gold ore. Formerly carved out of the *Mariahilf Shaft*, in a coarse grey hornblende.

4. From *Transylvania* not far from *Zlatna* [T4], a sample of finer lead glance disseminated with fragile quartz and mixed in silver copper ore, containing up to 12 lots per centner in silver. Of this, the mark contains 120 dinars in fine gold.

* The initials in brackets (e.g. U2) indicate the location of the mine within the map shown in figure 16.

Annarita Franza, University of Florence, Italy, annarita.franza@unifi.it, 0000-0003-3146-6957
Johannes Mattes, Austrian Academy of Sciences, Austria, johannes.mattes@oeaw.ac.at, 0000-0002-8546-7149
Giovanni Pratesi, University of Florence, Italy, g.pratesi@unifi.it, 0000-0001-6329-901X

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5. Aus Siebenbürgen Ein Handstein mit blenth und Marcasiten gemengt durchaus mit Rösch-Erzt und Bley-Glanz in Quartz eingesesßen pr: Cento in Rein Bley 8 pfundig in gaar[ii] Kupfer 10 pfundig in fein-Göldischen Silber 130 löthig wovon die Mark 164 Pfennig fein Gold hält.

6. Ein mit klein speisigen[i] Bleyglanz gemüschter Silber Gelf. in eben zarten Quarz aus Siebenbürgen de Sancta Victoria pr: Cento 70 löthig an Göldischen Silber, wovon die Mark 254 Pfennig in feinen Gold hält.

7. Von einem ganzen Gefährten[i] mit beyden Sal-bändern aus Siebenbürgen pr: Cento in Göldischen Silber 60 löthig dessen die Mark 158 Pfennig in feinen Gold hält.

8. Aus Siebenbürgen unweith Száláthnyá pr: Cento 108 Löthig in fein Göldischen Silber, dessen die Mark bis 154 Pfennig in fein Gold hält.

9. Schemnitzer Reich bis 300 löthig an fein Silber pr: Cento hältige Rösch-Gewüx[i] Erzt-Stufe[ii], in Kalchartigen[iii] mitweiß und grauen Spath gemüschten Gestein, worin das feine Silber wie gespunnen Faden gegraüselt zu ersehen.

10. Eine grün Malahitische Stufe in Eysen brändiger Berg-Art[i], aus dem Czicklovaer Geburg S. Nicolai Grube pr: Cento 12 pfundig in gaar Kupfer.

11. Siebenbürgischer mit Gelf-Küeß[i] eingesprangter Bley-Glanz. 20 pfundig in Rein Bley, 18 löthig in Silber, wovon die Mark 134 Pfennig in fein Gold enthält.

12. Eine blaue Lasur-Stufe[i] mit braune vermengt aus dem Oraviczer Temi[s]cher Geburg der S. Philipi und Jacobi Grub. pr: Cento 6 pfundig in gaar Kupfer und 4 Löthig in feinen Silber.

5. From *Transylvania* a specimen mixed with blende and marcasite, also containing crusty silver and lead glance in quartz. In pure lead 8 pounds per centner, in refined copper 10 pounds, in fine auriferous silver 130 lots, of which the mark contains 164 dinars in fine gold.

6. A specimen of silver copper ore mixed with lead glance with small shiny cubes, incorporated in a very fragile quartz from *Transylvania De Sancta Victoria*, 70 lots per centner in auriferous silver, of which the mark contains 254 dinars in fine gold.

7. Taken from a parallel vein with both salbands being from *Transylvania,* 60 lots per centner in auriferous silver, of which the mark contains 158 dinars in fine gold.

8. From *Transylvania* not far from *Zlatna* [T4], 108 lots per centner in fine auriferous silver, of which the mark contains up to 154 dinars in fine gold.

9. From *Banská Štiavnica* [U1], silver ore specimen, contains up to 300 lots per centner in fine silver, in a calcareous rock mixed with white and grey spar, in which the fine silver looks like puckered-spun thread.

10. A specimen of green malachite, as found in iron-burnt mountain ore, from *Ciclova Montană* [B3] from the *St. Nicholas Mine*, containing 12 pounds per centner of refined copper.

11. From *Transylvania* a lead-glance ore specimen with yellow copper pyrite. 20 pounds of pure lead, 18 lots of silver, of which the mark contains 134 dinars in fine gold.

12. A blue azurite-specimen, mixed with brown, from the *Oravița* [B2] and *Timiș Mountain*, extracted from the *St. Philip* and *Jacob's Mine*. The sample contains 6 pounds per centner in refined copper and 4 lots in fine silver.

13. Aus Siebenbürgen von dem Kayl. Königl. gewerkschafftlichen Nagy Ayer [Nagyayer] Berg-Bau. S. Bernardi Stolln. Von der weisßen Clufft ein ordinari mit Küeß Äugel eingesprangtes Poch-Erzte. pr: Cento 2 löthig in fein Göldischen Silber. Deßen die Mark 128 Pfennig Gold enthält.

13. From *Transylvania*, extracted from the *St. Bernardi Gallery* of the *Imperial-Royal Mining Company* in *Sacarîmb* near *Hunedoara* [T3]. From the white chasm, a common crushed ore specimen, disseminated with eye-shaped pyrite. The sample contains 2 lots per centner in fine auriferous silver, of which the mark equates to 128 dinars in gold.

14. Aus Schemnitz von Siegließ-Berg. Ein in Kalch artigen Löthen pr: Cento bis 1000 löthiger Handstein.

14. From *Stiavnické Bane* in *Banská Štiavnica* [U1]. A limestone-type specimen containing up to 1000 lots per centner [in silver].

15. Schmölnizer Spiegl spathiger[i] Gelf. Aus dem S. Ladislai Stolln von Roten-Berg. pr: Cento bis 36 pfundig in gaar Kupfer.

15. From *Smolník*, a specular-spar yellow copper ore specimen. From the *St. Ladislaus Gallery* in *Poráč* [U7]. The sample contains 36 pounds per centner in refined copper.

16. Aus Ober Hungarn eben von Schmölnitz aus dem S. Ferdinandi-Schacht. Ein in Schyfer und Quarz Gestein cum Matrice gemüschte Gelf Erzt[i] Stufe. pr: Cento bis 10 pfundig in gaar Kupfer.

16. From *Upper Hungary*, precisely from *Smolník* [U10], from the *St. Ferdinand Shaft*. A sample of yellow copper ore integrated in a matrix of slate and quartz stone. 10 pounds per centner in refined copper.

17. Schmölnitzer Engl Schachter Handstein mit Quarz gemüscht. pr: Cento bis 40 pfundig in gaar Kupfer, und ½ löthig in feinen Silber.

17. A specimen mixed with quartz from the *Angel Shaft* in *Smolník* [U10]. It contains up to 40 pounds per centner in refined copper and ½ lot in fine silver.

18. Ein braun Pech-augiger spröder Kupfer Erzt[i] Stufen, aus der Oraviczer Pauli Bekehrung-Grube, in dem Wadarner Gebürg. Welche 1 ½ pfundig gaar Kupfer und ½ löthig in fein Silber pr: Cento hältig.

18. A brown pitch-eyed, brittle copper ore specimen, from the *Paul's Conversion Mine* in the *Wadarner Mountain* [near *Oravița*, B2], which contains 1 ½ pounds per centner of refined copper and ½ loth in fine silver.

19. Ein Küeßige Gelf Erzt[i] Stufe, aus dem Oraviczer Coschoviczer [Koschovitzer] Gebürge S. Philipi Grube. Welche pr: Cento 20 pfundig in gaar Kupfer.

19. A specimen of yellow copper pyrite ore from the *Oravița Koschovitzer Mountain* [B2], carved out the *St. Philipp Mine*. It contains 20 pounds per centner in refined copper.

20. Eine Gelf-Stufe mit feinem Hangend[i]-Gestein, aus dem Oraviczer Gebürg S. Philipi-Grub. pr: Cento 21 pfundig in gaar Kupfer.

20. A specimen of yellow copper ore with delicate top layers, from the *St. Philipp Mine* in the *Oravița Mountain* [B2]. It contains 21 pounds per centner in refined copper.

21. Schemntizer Klein speisig-Bley-schüssige-Stufe[i]. pr: Cento bis 20 löthig in fein Silber und 30 pfundig in Rein Bley.

21. From *Banská Štiavnica* [U1] a fine-shiny lead-laced ore specimen, containing up to 20 lots per centner in fine silver and 30 pounds in pure lead.

22. Eine Gelf Erzt Stufe, mit grün und blauer Lasur gemüscht, von einem streichenden Gefährten, aus dem Oravitzer kleinen Dilfaer-Gebürge. S. Servati et Ignati Grub. Welche 26 pfundig pr: Cento in gaar Kupfer hältig.

22. A specimen of yellow copper ore with mixed green and blue azurite, taken from a parallel running strand, from the *Dilfaer Mountain* in *Oravița* [B2]. It comes from the *St. Servant and Ignatius' Mine*, and contains 26 pounds per centner of refined copper.

23. Ein Schwarz-Speisiger Stuf aus dem Oraviczer Wodarner Gebürge. Pauli bekehrung Grube 2 pfundig gaar Kupfer und 1 ½ Loth pr: Cto in fein Silber hältig.

23. A black-shiny specimen from the *Mine of Paul's Conversion* in the *Wadarner Mountain* near *Oravița* [B2]. It contains 2 pounds per centner in refined copper and a content of 1 ½ lot per centner in fine silver.

24. Ein Handstein aus Ober Hungarn Szlovinkar Gebürg von Schwarzen Berg genannt, in grauen Blenth-Spath mit etwas Gelf Erzt eingesprangt, pr: Cento bis 18 pfundig in gaar Kupfer, und 2 ½ löthig in fein Silber.

24. From *Ciclova Montană* [B3], also named *Schwarzer Berg*, in *Upper Hungary*. A specimen disseminated in grey blende-spar with some yellow copper ore. It contains up to 18 pounds per centner in refined copper and 2 ½ lots in fine silver.

25. Ein Schwarz blentig Eysen-schuß[i]-brütige Stufe – grün angeflohen, aus dem Oraviczer kleinen Dilfaer Gebürge, Maria Anna Glück auf [Grube]. Von einem ganzen Gefährten mit dem Sal-band. pr: Cento 20 pfundig in gaar Kupfer.

25. A black blende-type valueless rock specimen, with a tinge of green, from the *Maria Anna Glück auf* [Mine] in the *Dilfaer Mountain* near *Oravița* [B2]. Taken from the parallel vein, including the sal-band. It contains 20 pounds per centner in refined copper.

26. Von Schmölnitz aus dem Spitzen-berg Creutz erfündung Schachte ein mit Quarz gemüschte sehr fein Speißige[i] Gelf Erzt Stufe, pr: Cento bis 40 pfundig in gaar Kupfer.

26. From *Smolník* [U10] coming from the *Spitzenberg Creütz erfündung Shaft.* A finely mispickel yellow copper ore mixed in with quartz. It contains up to 40 pounds per centner in refined copper.

27. Aus dem Banath. Von dem neu erschrottenen S. Elia spath-Gang mit Gelf und pfauen Schweifigen[i] Erzt Flözle aus dem Cornu Dilfer Gebürg. pr: Cento in Kupfer gaar halt 1 ½ pfundig.

27. From the newly shattered *St. Elijah Gallery* of the *Cornudilfer Mountain* [Oravița, B2] in the *Banat,* a spathic gangue with yellow copper and peacock tarnish ore. It contains 1 ½ pounds per centner in refined copper.

28. Schmölnitzer Caroli Schacht spathiges fahl Gelf-Erzt[i] pr: [Cento] bis 18 pfundig in gaar Kupfer, und 2 löthig in feinen Silber.

28. From *Carol's Shaft* in *Smolník* [U10] a spathic yellow and grey copper ore. It contains up to 18 pounds per centner in refined copper, and 2 lots in fine silver.

29. Schmölnitzer S: Joannis-Baptisto-Schachter Pfauen Schweifige Stufe. pr: Cento bis 40 pfundig in gaar Kupfer.

29. From the *Shaft of St. John the Baptist* in *Smolník* [U10], a peacock tarnish ore specimen. It contains up to 40 pounds per centner in refined copper.

30. Ein in braunes Gestein bestehender Stufen, welcher sowohl Gelf als pfauen Schweifig dann Schwarz eingesprangt, aus dem Banath Oravitzer Arschitzer Gebürge von der Friderici Grube pr: Cento 12 pfundig in gaar Kupfer und 2 löthig in feinen Silber.

30. A specimen embedded in a brown rock, which has both yellow copper and peacock tarnish ore then black mineral disseminated into it. From *Arschitzer Mountain* near *Oravița* [B2] in the *Banat*, mined in the *Federic Shaft*. It contains 12 pounds per centner in refined copper and 2 lots in fine silver.

31. Ein mit [the word is not readable] und blenth gemüschter Marcasitischer Hand-Stein [aus dem Banat] mit Gelf und schwarz Erzt[i] durchzohen. pr: Cento in Silber bis 11 löthig und in gaar Kupfer bis 8 pfundig.

31. A marcasite [from the Banat] specimen mixed with [the word is not readable] and blende, laced with yellow copper ore and black silver-ore. It contains up to 11 lots per centner in fine silver and up to 8 pounds in refined copper.

32. Aus dem Banath Oraviczer Vodarner Gebürge. Von der Maria Hülf Grub. Eine Eysen brutig[i] sehr flüssiger Schmölz[ii] Art mit Gelf Erzt eingesprangter Handstein pr: Cento 2 ½ pfundig in gaar Kupfer.

32. From the *Oravița Wadarner Mountain* [B2] in the *Banat*. From *Mary Help of Christians Mine*. A flos ferri type, very fluid like smelted ores, with yellow copper ore disseminations. It contains 2 ½ pounds per centner in refined copper.

33. Eine mit grün-blau Leber Erzt[i] gemüschte Lasur Stufe. Von dem Oraviczer Rakoviczer Gebürge, aus der S: Margaretha Grub pr: Cento 8 ½ pfundig in gaar [Kupfer] halt.

33. A specimen of azurite mixed with green-blue Leber Erzt. It comes from the *St. Margherita Mine* in the *Rakovița Mountain* near *Oravița* [B2], containing 8 ½ pounds per centner in refined [copper].

34. Pfauen-Schweif in Schwarzen Schüfer Gestein aus dem Schmölnitzer S: Joannis Baptisto Schacht pr: Cento bis 38 pfundig in gaar Kupfer.

34. A peacock tarnish ore in black slate rock from the *Pit of St. John the Baptist* in *Smolník* [U10], containing up to 38 pounds per centner in refined copper.

35. Gelf Erzt pfauen Schweifig angeflohen[i] [aus Schmölnitz] pr: Cento bis 36 pfundig in gaar Kupfer.

35. A sample of yellow copper ore, with a tinge of peacock tarnish [from Smolník, U10] containing up to 36 pounds per centner in refined copper.

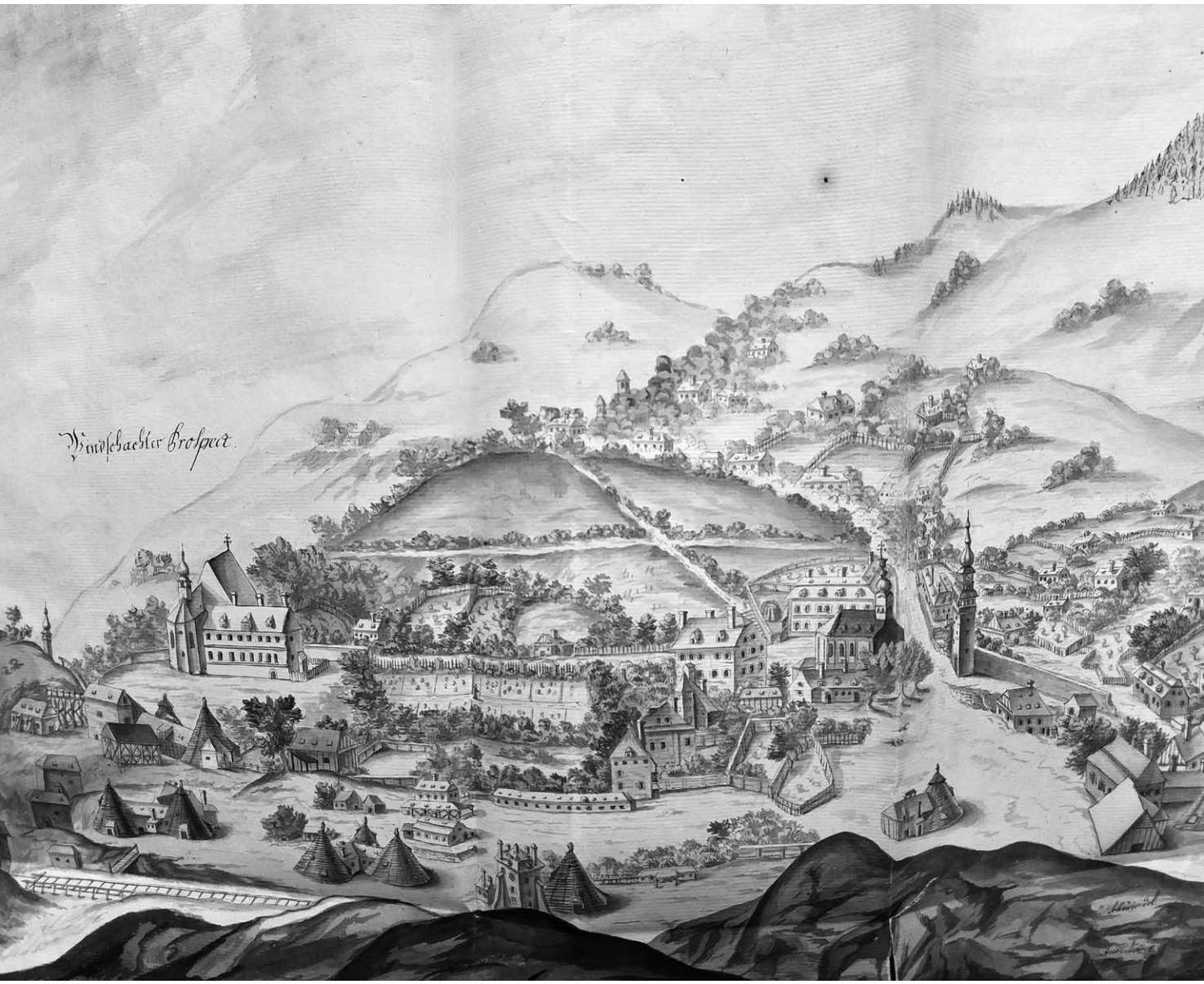


Figure 4 – Windschachter Prospect, Banská Štiavnica. In: Goldenes Bergbuch, 1764. Courtesy of Ministero della Cultura/ Biblioteca Nazionale Centrale Firenze, Palatino 1094.

36. Schmölnitzer S: Elisabetha Schachter Gelf und Schwarzer Kueß, welchen entscheydet die Mitte durchstreichende Gelf Glanz-Erzt Gefährte, pr: Cento bis 36 pfundig in gaar Kupfer, und ½ löthig in fein Silber. Diese Stuf zeiget ihre liegende Ablösung.

36. A sample of yellow copper ore and black pyrite that divides the parallel strand of yellow copper ore glance at the center. It comes from the *St. Elisabeth Shaft* in *Smolník* [U10] and contains up to 36 pounds per centner in refined copper and ½ lot in fine silver. Horizontal detachment can be observed in this specimen.

37. Banather Gelf Erzt. pr. Cento bis 30 pfundig in gaar Kupfer.

37. A sample of yellow copper ore from *Banat*, containing up to 30 pounds in refined copper.

38. Von einer putzen Klufft. Eine grün und braun Kupfer Erzt[i] Stufe. Aus dem Vadarner Gebürge. Von der Danieli Florian Gruben pr: Cento 5 pfundig in gaar Kupfer.

38. From a delicate chasm. A green and brown copper ore specimen. It comes from the *Wadarner Mountain* [near Oraviţa, B2]. It was carved out of the *Daniel Florian Mine*, and it contains 5 pounds per centner in refined copper.

39. Cremnitzer Nüern graupigter Gold Marcasiten[i] Handstein. pr: Cento bis 3 Pfennig in fein Gold haltig und 40 pfundig in rein Schwöfl.

39. From *Kremnica* [U2] a new specimen of raw gold-bearing arsenian pyrite. It contains up to 3 dinars per centner in fine gold and 40 pounds in pure sulfur.

40. Oraviczer mit Spath durchzohener Gelf Erzt Handstein pr: Cento 36 pfundig in gaar Kupfer und 1 ½ löthig in feinen Silber.

40. Yellow copper ore specimen with a spar vein from *Oraviţa* [B2], containing 36 pounds per centner in refined copper and 1 ½ lot in fine silver.

41. Von dahero ein Lasur Gelf Glanz Erzt. pr: Cento bis 40 pfundig in gaar Kupfer.

41. From that place [Oraviţa, B2], a blue and yellow copper glance ore containing up to 40 pounds per centner in refined copper.

42. Schmölnitzer S. Elisabetha Schachter fein speisiger gelf-Küeß-Handstein[i], pfauen Schweifig gewüttert. pr: Cento bis 34 pfundig in gaar Kupfer.

42. From the *St. Elisabeth Shaft* in *Smolník* [U10], a finely shiny specimen of pyrite rich in silver, studded with peacock tarnish colors. It contains up to 34 pounds per centner in refined copper.

43. Von Schemnitz aus dem Wind-Schacht Ein mit Bleyglanz und Gelf eingeprangter Hand-Stein pr: Cento bis 140 löthig in fein Silber.

43. From the *Wind Shaft* in *Banská Štiavnica* [U1], a sample disseminated with lead glance and yellow copper ore containing up to 140 lots per centner in fine silver.

44. Antimonialisch et Arsenicalisch stark Eysen Schüssiges[i] Fahl-Erzt aus Siebenbürgen von Faczebayer Gebürge gewerkschaftlichen Sigismundi Stolln unweith Száláthnyá. pr: Cento: in feinen Silber 12 löthig, in gaar Kupfer 14 pfundig, in Antimonio bis 30 pfundig. und hält ein Mark Silber deßen 146 Pfennig fein Gold.

44. A sample of antimonial and arsenical valueless rock with compact grey copper from the *Faczebayer Mountain* in *Transylvania*, not so far from *Zlatna* [T4]. The sample comes from the *Sigmundi Gallery Mining Company*. It contains 12 lots per centner in fine silver, 14 pounds, and up to 30 pounds in refined copper. The sample contains also a silver mark that values 146 dinars in fine gold.

45. Aus dem Banath von Szászkaer Gebürg aus der Prinz Joseph-Grub ein an gaar Kupfer bis 60 pfundiger Handstein von sehr artig gemüschten weiß Gelf grün und blauen Lasur Erzt, ist zugleich an feinen Silber pr: Cento bis 5 löthig.

45. From the *Banat*, precisely from *Sasca Montană* [B5], carved out of *Prince Joseph's Mine*. The very fine specimen contains up to 60 pounds in refined copper and is well mixed with white pyrite and green-blue copper. It also contains up to 5 lots per centner in fine silver.

46. Gelf-Glanz Kern[i] Erzt Handstein. Aus dem Banath, in gaar Kupfer pr: Cento 24 pfundig, in Eysen brutigen lethen Schüffer gebrochen.

46. A specimen of yellow copper ore, silver glance, iron spar from the *Banat*. It contains 24 pounds per centner in refined copper, extracted from valueless, iron-containing slate.

47. Aus dem Banath aus dem Moldaver Florimundi Gebürge, aus der Grube Joseph in der Neu genannt, eine besondere Art in Eysen bruthigen löthen Schmunde[i], pr: Cento an gaar Kupfer bis 14 pfundig.

47. From *Banat*, precisely from the *Florimundi Mountain* in *Moldova Nouă* [B4], it comes a specimen from the so-called *Joseph in der Neü Mine*. It is a special type within valueless iron-capped rock residue and contains up to 14 pounds per centner in refined copper.

48. Eysen-Stein[i] aus Steuermark. pr: Cento 2 löthig in fein Silber.

48. Ironstone from *Styria*, containing 2 lots per centner in fine silver.

49. Aus Ober Hungarn von Schmölnitz aus dem S. Elisabetha Schacht von dem Stund 6 Morgen streichenden Haubtgang. ein sehr artig trusigter mit Quartz und Spiegl Spath gemüschter Handstein. pr: Cento bis 36 pfundig in gaar Kupfer.

49. A sample from *Smolník* [U10] in *Upper Hungary*, precisely from the *St. Elizabeth Shaft* on the east side of the main entrance. A very fine druse with a sample of mixed quartz and specular spar, containing up to 36 pounds per centner in refined copper.

50. Aus Ober Hungarn von Göllnitz aus dem Tourszony Schacht. ein weiß-Spathiger mit Gelf Erzt Reich eingesesßener Handstein. pr: Cento bis 22 pfundig in gaar Kupfer.

50. A sample from *Upper Hungary*, precisely from *Gelnica* [U8], and that has been carved out of the *Tourszony Shaft*. A specimen of white spar, abundantly disseminated with yellow copper ore, containing up to 22 pounds per centner in refined copper.

51. Fein speisiges Glanz Gelf Erzt mit weisßen Spiegl-Spath eingesprangt aus dem S. Leopoldi Schacht, von Schmölnitz. pr: Cento bis 40 pfundig in gaar Kupfer.

51. Finely mispickel silver-glancing yellow copper ore disseminated with white specular spar that has been carved out of the *St. Leopold Shaft* in *Smolník* [U10], containing up to 40 pounds per centner in refined copper.

52. Aus dem Zipser Comitat nächst Schmölnitz eine aus dem Territorio des Bergfleckens Stooß. mit Eysenstein gemüschte sehr feine Gelf Erzt Kernstufe[i]. mit artigen Eysen brand[ii] trusen[iii] versezt, woran die Vütterung[iv] ganz ausnehmend zu ersehen. hält pr: Cento bis 50 pfundig. das allergeschmeidigste Rosetten Kupfer.

52. From the *Szepes Comitatus* near *Smolník*, a specimen from the territory of the mining town *Štós* [U9]. Very fine yellow copper ore specimen with brown ironstone. Embedded with bituminous cinnabar-ore spare, which clearly exhibits the impact of weathering. The sample contains 50 pounds per centner of the most pliable rose copper.

53. Aus Ober Hungarn von dem Caroli Boromdi Gewerkschafftlichen Grubenbau zu Schwädler. Ein fahl-Erzt Handstein, pr: Cento in fein Silber bis 10 löthig und bis 30 pfundig in gaar Kupfer.

53. From *Upper Hungary,* by the *Caroli Boromdi Mining Company*, which is near to *Švedlár* [U5]. A specimen of gray copper, up to 10 lots per centner in fine silver as well as up to 30 pounds in refined copper.

54. Aus Schemnitz Eine in fein Silber pr: Cento bis 30 löthige Stufe. in Quarz und Spath Gestein.

54. From *Banská Štiavnica* [U1], a silver specimen, containing up to 30 lots per centner, embedded in a matrix of quartz and spar.

55. Eine weisße sehr klüftige Spiegl-Spath-Trusen [aus Schemnitz] mit Gelf Kupfer Erzt Graupen[ii] eingesessen.

55. [From Banská Štiavnica, U1]. A specimen of white, very coarse specular spar disseminated with yellow and copper ore in form of granules.

56. Aus Ober Hungarn von dem 78. Lachter tieffen Anbruch aus dem Kayl: Königl: Heil: [Heilige] 3 fältigkeiter Schacht zu Göllnitz. eine pr: Cento bis 40 pfundig in gaar Kupfer hältige Gelf Erzt Stufe.

56. From *Upper Hungary* at the depth of 78 fathom from the beginning of the mining deposit of the *Imperial-Royal Holy Trinity Shaft* in *Gelnica* [U8], a specimen of yellow copper ore containing up to 40 pounds per centner in refined copper.

57. Aus Schömnitz Rösch Gewüx Stufe, pr: Cento bis 400 löthig in fein Silber. mit Gelf eingesprangt, gräußlicht und grün angeflohen.

57. From *Banská Štiavnica* [U1], a specimen of brittle silver glance, disseminated with yellow copper ore, with greyish-green tinges, containing up to 400 lots per centner in fine silver.

58. Sieglißberger Schemnitzer Stufe. Ein Rösch-Gewüx mit einer Crystall-Truße und grün angeflohen. pr: Cento in fein Silber bis 17 löthig.

58. From *Banská Štiavnica* [U1], precisely from *Stiavnické Bane*. A specimen of brittle silver glance with a rock crystal and tinges of green. It contains up to 14 lots per centner in fine silver.

59. Ein Handstein aus dem Szászkáer Gebürg. pfauen Schweifig klein speisiges Glanz-Erzt[i]. pr: Cento bis 60 pfundig in gaar Kupfer.

59. A specimen from *Sasca Montană* [B5]. Finely mispickel, peacock tarnish, specular mineral containing up to 60 pounds per centner in refined copper.

60. Fahl und Gelf Erzt gemengter Handstein aus dem S: Michaelis Schacht von Göllnitz in Zipser-Comitat. pr: Cento in gaar Kupfer 40 pfundig und in fein Silber 2 ½ löth.

60. A specimen of grey and yellow copper ore from the *St. Michael Shaft* in *Gelnica* [U8], precisely in the *Szepes Comitatus*. It contains 40 pounds per centner in refined copper and 2 ½ lots in fine silver.

61. Kupfer Nückl[i] Coboltische blenthe mit wülden Granaten eingesessen, von Spitz aus Unter Österreich.

61. A sample of copper-nickel blende exhibiting cobalt impurities and natural garnets, from *Spitz* [A3] in *Lower Austria*.

62. Von einer gewerkschaftl: Gruben Aron genannt. aus dem Höchsten Vadarner Gebürg nächst Oravicza. Ein Silber und Bley haltige Stufe von einen früsch erschurften Pochgang[i].

62. From the *Aron Mining Union*, located on the highest part of the *Wadarner Mountain* near *Oravița*, [B2]. A specimen containing silver and lead from a recently extracted, but not yet processed ore.

63. Zwitter[i] mit einer Schwarzen zün [Zinn] Graupen[ii] Schwarte aus Böheim [Böhmen].

63. Hybrid mineral of rock and ore with a black tin material from *Bohemia*.

64. Von Schemnitz Ein an feinen Silber halt pr: Cento gegen 260 löthiger Hand-Stein. mit gräußlichten Clüften eingesessen, in zart quarzigter Ganz art, So zugleich bis 7 pfundig in Kupfer gaar ist.

64. A specimen from *Banská Štiavnica* [U1] containing about 260 lots per centner in fine silver. With light grey fractures embedded in an almost quartz-like glance. Also up to 7 pounds in refined copper.

65. Aus dem Banath ein in mülden Eysen Brutigen Sandgestein Blaue Lasur Erzt-Stufe, von dem Temischer Gebürge nächst Oravitza. pr: Cento bis 10 pfundig in gaar Kupfer.

65. A moderately iron-capped blue-tinged [bornite] sandstone ore specimen from the *Timiș Mountain* near *Oravița* [B2] in the *Banat*, containing up to 10 pounds per centner in refined copper.

66. Fahl oder weiß Kupfer Erzt[ii] aus Ober Hungarn von Göllnitz aus der Vahs Casparischen Grube. pr: Cento an Kupfer gaar halt 40 pfundig und 2 ½ löthig in fein Silber.

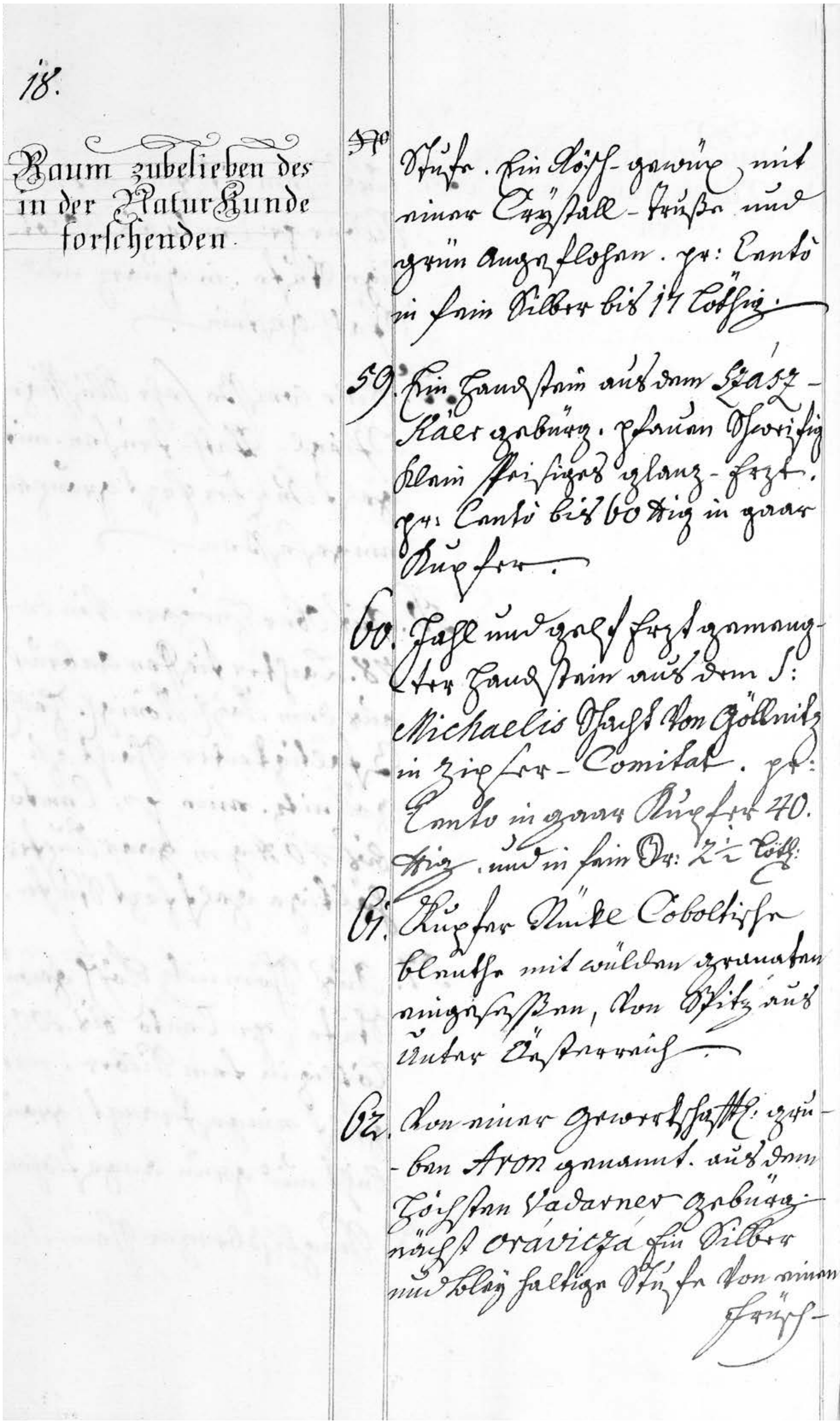
66. Grey or white copper ore from *Upper Hungary*, precisely from *Gelnica* [U8] that has been carved out of the *Vahs Casparischen Mine*. It contains 40 pounds per centner in refined copper and 2 ½ lots in fine silver.

67. Eysen, Antimonium, Kupfer und Silber hältige Minera [von Ungarn].

67. Minerals that contain iron, antimony, copper and silver [from Hungary].

68. Küeßiges Gelf Erzt mit grauen Spiegl-Spath eingesesßen, pr: Cento bis 40 pfundig in gaar Kupfer. Und ½ löthig in fein Silber aus dem Hl: [Heilige] 3 fältigkeit Schacht zu Göllnitz.

68. A pyritiferous yellow copper ore, disseminated with grey specular spar, from the *Holy Trinity Shaft* in *Gelnica* [U8], containing up to 40 pounds per centner in refined copper and ½ lot in fine silver.


18.

Raum zubelieben des in der NaturKunde forschenden.

No Stufe. Ein Rösch-gewächs mit einer Crystall-drüße und grün angeflogen. gr: Canto in fein Silber bis 17 Löthig.

59. Ein Gangstein aus dem Hasz-Käer gebürg. grauen schwärzig klein speisiges glanz-Erzt. gr: Canto bis 60 Pfund in gaar Kupfer.

60. Gelb und gold Erzt gemengter Gangstein aus dem S: Michaelis Schacht von Göllnitz in Zipser-Comitat. gr: Canto in gaar Kupfer 40. Pfund. und in fein Silber: 2½ Löth.

61. Kupfer Nickel Cobaltische blaue mit wilden Granaten eingeschlossen, von Schlitz aus unter Österreich.

62. Von einer Gewerkschaft genannt Aron genannt. aus dem Höchsten Vadarner gebürg nächst Oravicza ein Silber und bley haltige Stufe von einem Gang-

Figure 5 – Catalog's page nos. 59–62.

69. Schemnitzer Bley Schüsßiger Rösch Gewüx Erzt Stufe, in Roth spathigen Gestein mit Trusen angeflohen. pr: Cento in fein Silber bis 150 löthig.

70. Küeß aus dem alten Wünd Schacht von Schmölnitz. pr: Cento 40 pfundig in Rein Schwefl. 2 löthig in fein Silber und 1 ½ pfundig in gaar Kupfer.

71. Aus Unter Österreich von dem S: Anna Berger gewerksch[aftlichen] Gruben Bau, von der Theresia Cluft. pr: Cento bis 50 löthig in feinen Silber.

72. Aus dem Wündschacht von Schemnitz eine mit Crystal Creyßen durchzohene Rösch Gewüx Erzt Stufe, pr: Cento bis 600 löthig in fein Silber.

73. Von Schemnitz aus dem Pacher-Stolln, eine in fein Silber pr: Cento bis 20 lötig Stufe.

74. Banather Joannes in der Wüste Stollner Gelf Erzt, in grau hornigen mit Quarz gemengten Spath Gestein pr: Cento bis 14 pfundig in gaar Kupfer.

75. Silber, Kupfer und Bley hältige Stufe mit einer blentigen Rösch Gewüx Schwarte von Schemnitz.

76. Eine Eysen Brandige mit Trausen untermüschte sehr artige pfauen Schweifige feine Gelf Erzt Stufe. in Quarz Gestein gebrochen, aus einer alten Zöch des S. Margaretha Schachts zu Schmölnitz. pr: Cento bis 50 pfundig in geschmeidigsten Rosetten Kupfer.

77. Schmölnitzer S. Josephi Schacht pfauen Schweif[1] aus einer 164 Lachter sayger teif, mit hangend und liegend Schwarz Schüfer Soll-Band, pr: Cento bis 30 pfundig an gaar Kupfer.

69. From *Banská Štiavnica* [U1], a mixed specimen of lead ore with brittle silver glance in red spar rock with druse, containing up to 150 lots per centner in fine silver.

70. A sample of pyrite from the old *Wind Pit* in *Smolník* [U10], containing 40 pounds per centner in pure sulfur, 2 lots in fine silver and 1 ½ pounds in refined copper.

71. A sample from *Lower Austria* that has been carved out of the *St. Annaberg Mining Union* [Annaberg, A2], precisely from the *Teresa Chasm*, containing up to 50 lots per centner in fine silver.

72. From the *Wünd Shaft* in *Banská Štiavnica* [U1] an ore specimen of silver glance with rounded crystals, containing per centner up to 100 lots in fine silver.

73. From the *Pacher Gallery* in *Banská Štiavnica* [U1], an ore specimen, containing per centner up to 20 lots in fine silver.

74. Yellow copper ore from the *St. John the Baptist in the Desert Gallery* in the *Banat*, embedded in grey corneous spar rock mixed with quartz, per centner up to 14 pounds in refined copper.

75. Ore specimen containing silver, copper and lead with a layer of blende and silver ore from *Banská Štiavnica* [U1].

76. A discontinuously iron-burnt, nicely peacock tarnish fine specimen of yellow copper ore, extracted from quartz rock, from an old mine of the *St. Margaretha Shaft* in *Smolník* [U10], per centner up to 50 pounds in very pliable rose-copper.

77. An ore specimen with peacock tarnish from *Smolník's St. Joseph Pit* [U10], from a perpendicular depth of 164 fathom, with an overlaying and horizontal salband of black slate, containing per centner up to 30 pounds in refined copper.

78. Wacke aus Böheim [Böhmen] von St. Joachim. Bley und Eysen Schüsßig. pr: Cento in feinen Silber bis 14 löthig.

78. Wacke from *St. Jáchymov* [B7] in *Bohemia*. Containing lead and iron. Containing per centner up to 14 lots in fine silver.

79.-80. Klein speisiger Gelf Küeß von Cremnitz. Glanz trusigt, pr: Cto 40 pfundig in Rein Schwefl, und bis 2 ½ löthig in göldischen Silber.

79.-80. Yellow copper ore (and) pyrite, consisting of small shiny cubes, from *Kremnika* [U2]. Glance, drusy, containing per centner 40 pounds in pure sulfur and up to 2 ½ lots in golden-like silver.

81. Eine bis etwelch 80 Loth an fein Silber pr. Cento hältige Schemnitzer Stufe.

81. Ore specimen containing per centner about 80 lots in fine silver, from *Banská Štiavnica* [U1].

82. Schemnitzer Ametisten blendig[i] quarzigte Crystal Creyße mit Roth gülden Erzt[ii] blumen angeflohen.

82. Amethyst from *Banská Štiavnica* [U1], containing zinc blende, very quartzy rounded crystals. With tinges of reddish-golden ore flowers.

83. Trusigte Eysen Gur[i] [aus der Steiermark] bis 30 pfundig pr: Cento an Rein Eysen.

83. Drusy ferruginous mud [from Styria], containing per centner up to 30 pounds pure iron.

84. Aus der S. Bernardi Grub in dem Schwädler Territorio nächst Schmölnitz ein mit grünen blumen angeflohener Gelf Kern Erzt Hand-Stein in Eysen Brutigen weisen Spath[i] und Quarz Gestein, woran eine Truße mit Brand Erzt Graupen eingesessen, zu ersehen. hält pr: Cento bis 40 Pfunde gaar Kupfer und 3 Loth fein Silber.

84. From the *St. Bernard Pit* in *Švedlár* [U5] territory close to *Smolník*, a specimen with a yellow ore core, with tinges of green flowers, in iron-containing white spar and quartz rock, exhibiting an embedded druse with bituminous cinnabar-ore granules. Containing per centner up to 40 pounds refined copper and 3 lots of fine silver.

85. Aus Ober Ungarn von Schmölnitz aus.

85. From *Smolník* [U10] in *Upper Hungary*.

86. Asvestus oder Berg auch Stein Flax. Aus dem Abaujvarer Comitat in Ober Hungarn unweith Schmölnitz.

86. Asbestus or "Berg-" or "Stein-Flachs." From the *Abov Comitatus* in *Upper Hungary* near *Smolník* [U10].

87. Aus Tyroll am Valckenstein genannt, aus der 14 Nothhelffer Grube, ein sehr gestaltige fahl Erzt Stufe. Von einem streichenden Haubt Gefährte, mit beydanhabenden Saalbandten. pr: Cento in gaar Kupfer 28 pfundig und in fein Silber halt 3 ½ löthig.

87. From the *14 Nothhelfer Pit* in *Falkenstein* [Schwaz, Tyrol, T1], a very textured grey copper. Taken from a neighboring main parallel strand with salbands touching on both sides. Containing per centner 28 pounds in refined copper and 3 ½ lots in fine silver.

88. Gewachsen Kupfer, oder Cuprum Virgineum[i] genannt, aus dem Gräußel Schacht von Schmölniz, woran die Anima Veneris[ii] ganz Glaß[iii] artig ausgewüttert zu ersehen.

88. Grown copper or "Cuprum Virgineum" from the *Gräußel Shaft* in *Smolník* [U10], where the anima of copper is exhibited very glass-like.

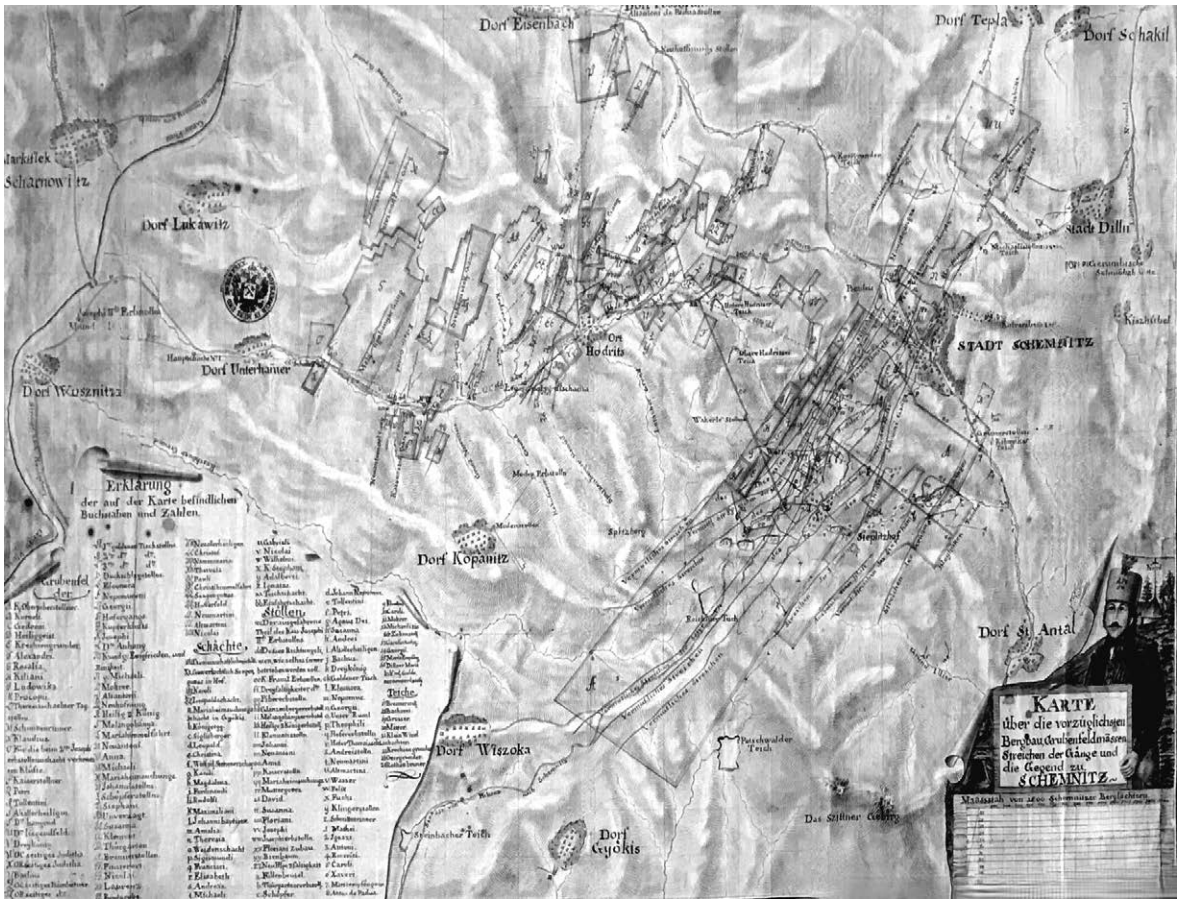


Figure 6 – Map of the Banská Štiavnica mines. Ministerstvo Vnútra Sr, Štátny Archív V Banskej Bystrici - Pobočka Banská Štiavnica.

89. Neusohl Herrengrunder Cement Kupfer[i] Schwarte ungemein artig gestaltet. Es ist hieran ausnehmend zu ersehen, wie nicht das Eysen zu Kupfer wird, sondern nur das Eysen eine speiße ist, mitelst welcher die Atomi veneris (So in denen Cement oder Vitriolischen Wässern die sich in denen alten Zöchen deren Gruben gesamlet hatten) sich anhalten, und sofort compact werden, daß ein Ctn derley Cement Kupfer, ordinaire eingeschmolzen an gaar Kupfer 98 pfundig ist.

89. A very well shaped layer of cement copper from *Baňa Dolina* [U11] near *Banská Bystrica*. It can very clearly be seen how it is not the iron that is transforming into copper, but instead, how the iron represents only a pinch, to which the atoms of copper (if cement or vitriolic waters of old mines and pits were accumulated in those) attach themselves and immediately become so compact that a centner of melted cement copper contains 98 pounds of refined copper.

90. Granaten aus Hungarn wie solche aus denen Flüssen von Schlam aus gewaschen werden.

90. Garnets from *Hungary*, like those that are washed out of the mud of rivers.

91.-95. Aus Idria Queksilber und Cinober hältig in weisen Spiegl Spath einbrechend.

91.-95. From *Idrija* [C7], a specimen containing mercury and cinnabar, slightly breaking into white specular spar.

96. Aus Cremnitz Eine Cinober mit Rösch Gewüx gemüschte Stufe. pr: Cento 40 löthig in fein Silber und 3 ½ Pfennig in feinen Gold hältig.

96. From *Kremnica* [U2], a cinnabar mixture specimen with silver glance. It contains per centner 40 lots in fine silver and 3 ½ dinars in fine gold.

97. Truße [aus Kremnitz] mit einer auf terben Sand Gestein Silber hältig angeschosßen sehr artigen Crystal Creyße.

97. A druse [from Kremnica, U2] with a very well-rounded crystal on rough sandstone, silver-containing.

98.-112. Schemnitzer verschiedene Crystal Creyßen mit ihrer Bergart, wovon solche aus offenen Clüften angestandten[i] gebrochen worden hin [und] wieder mit feinem Silber halt angeflohen.

98.-112. Samples of colorful ores with rounded crystals from *Banská Štiavnica* [U1]. Those extracted from open chasms are partly tinged with fine silver.

113. Aus Siebenbürgen unweith Száláthnyá Eine in zarten Quarz mit Rösch-Gewüx, Gelf und klein speisigen Bleyglanz unterzohne Stufe, in fein Silber 10 löthig. Desßen die Mark in feinen Gold 130 Pfennig hält.

113. A sample of ore with fine quartz, yellow and lead glance and underlaid with silver glance with small shiny cubes. From *Transylvania* near *Zlatna* [T4]. It contains 10 lots in fine silver. One mark contains 130 dinars in fine gold.

114.-116. Berg oder Stein Mulch[i] Trußen von Schemnitz die proprie eine Silber Erzt Gur Seynd.

114.-116. Druses of moonmilk, which was found in argentiferous mud, from *Banská Štiavnica* [U1].

117. Banather aus dem Oraviczer Arschitzer Gebürge Leber brand Erzt-Stufe, woran eine artig angewütterte Eysen Truße zu ersehen, hält pr: Cento 10 Pfunde gaar Kupfer, und 4 ½ Loth in fein Silber.

117. Brown-colored silver ore, where a very well effloresced iron druse is visible. From the *Arschitzer Mountain* in *Oraviţa* [B2] in the *Banat*. Containing per centner 10 pounds of refined copper and 4 ½ lots in fine silver.

118. Frauen Eyß[i] Stufe aus Hungarn.

118. A specimen of gypsous spar from *Hungary*.

119. Blau und Weisßes Crystal Salz mit der Berg-Art aus Ober Österreich von Hall-Stadt.

120. Eine lauttere Weisße Crystal Salz Stufe von dahero.

121. Eben von dahero Eine Rothe Crystal Salz Stufe weiß gemüscht.

122. Die Berg Art nebenst und aus welcher zu Hall-Stadt daselbst das Salz gebrochen wird.

123. Petrificirtes Holz, welches in dem Hall-Städter Salz-Berg, in dem alten Johanna Wöhr gefunden worden ist, woran die Öffnung von denen Ästen artig zu ersehen.

124. Ein grössßeres Stücke dahero, gleicher Art.

125. Ein Petrificirtes Stücke Holz, aus dem Charpatischen Gebürge weisßer Art. besonders compact dahero verschieden zu appliciren.

126. Eine Stein-Kohle aus unter Österreich von Göttweich an Donau Strom.

127. Von Schemnitz aus dem Brenner-Stolln eine mit Roth gülden Erzt-Graupen eingesesßene Stufe, Marcasitisch angeflohen, hält pr: Cento bis 500 Loth fein Silber und 6 Pfunden gaar Kupfer.

128. Ein Handstein von Cremnitz aus sogenannter Ihro Mayst: Gold-Kunst Handlung, von einem mächtigen gefährte Roth gülden-Erzt. mit dem Sall-band Crystal Creyßen Clüftig. Pr: Cento bis 300 Loth fein Silber haltig.

129. Eben von dahero ein Plachmann[i] Stufe in Glaß artigen Quarz mit Eysen Spath gemüscht pr: Cento bis 800 Löthig an feinen Silber.

130. Von Schemnitz aus dem Kayl: Königl: Pacher Stolln so genannt Bley Schweifiger[i] Handstein pr: Cento wegen seiner Kleinspeisßigkeit bis 60 pfundig in Rein Bley. Diese Art Bley Erzt ist so geschmeidig, dass es sich schneiden läst.

119. Blue and white crystal salt with colors like those from *Hallstatt* [A1] in *Upper Austria*.

120. A specimen of purer white crystal salt from the above-mentioned location [Hallstatt, A1].

121. A specimen of red crystal salt mixed with white color from the above-mentioned location [Hallstatt, A1].

122. A sample of colorful ore near and from the mine in *Hallstatt* [A1], where the salt is extracted.

123. Petrified wood, where the knotholes are highly visible. It was found in the old *Johanna Gallery* in *Hallstatt's* [A1] salt mining territory.

124. A larger sample of the same kind from the same location [Hallstatt, A1].

125. Petrified wood of white color from the *Carpathian Mountains* [Hungary]. Particularly compact and therefore applicable in various ways.

126. A sample of stone coal from *Göttweig* [A4] at the *Danube* stream in *Lower Austria*.

127. An ore with reddish-golden ore granules, with tinges of marcasite, from the *Brenner Gallery* in *Banská Štiavnica* [U1]. Containing up to 500 lots in fine silver and 6 pounds in refined copper.

128. A handstone from the so-called *His Majesty's Gold-Art-Company* in *Kremnica* [U2], of a heavy strand of reddish-golden ore that runs parallel to the main corridor. Running parallel to the salband round crystals are fissured. Containing per centner up to 300 lots in fine silver.

129. From the above-mentioned location [Kremnica, U2], a rather pure silver ore in glass-like quartz, mixed with iron spar. Containing per centner up to 800 lots of fine silver.

130. A handstone of striated galena from *Banská Štiavnica's Imperial-Royal Pacher Gallery* [U1]. As the handstone consists of small shiny cubes, it contains up to 60 pounds of pure lead. This kind of lead ore is so smooth that it can be cut.

131. Kupfer und [the word is not readable] Schüssiger Röscher Bley Glanz pr: Cento bis 50 pfundig an Rein Bley. aus ob ermelten Pacher-Stolln, von einem neben dem Haubtgang streichenden Gefährte.

131. A sample of red striated lead glance containing a low amount of copper and [the word is not readable]. Containing per centner up to 50 pounds of pure lead. From a strand that runs parallel to the main corridor in the above-mentioned *Pacher Gallery* [Banská Štiavnica, U1].

132. Von Schemnitz aus dem St. Catharina-Stolln Kayl. Königl. Ober Piber Stollner Handlung. Eine mit Eysen Bruth angeflohen und Kupfer blumen Creysigte Stufe in Glaß artigen Quarz Gestein pr: Cento an feinen Silber bis 30 Löthig.

132. From *Banská Štiavnica's St. Catharina Gallery* of the *Imperial-Royal Ober-Piber Gallery's Company* [U1]. A specimen of ore with a tinge of copper flower circles in glass-like quartz rock. Incubated iron is laid on very thin. Containing per centner up to 30 lots of fine silver.

133. Eine Stufe in grau und Blachen Horn[i] Schüfergestein [aus dem Banat], mit Hell grünem Kupfer blumen angeflohen, Ein Eysen Bruth trusigtes Schwarz oder Fall Erzt. Pr: Cento 30 pfundig an Kupfer gaar halt, und bis 21 Lötig in feinen Silber.

133. A specimen of grey and blue-colored horn schist [from the Banat]. Light and green copper flowers are laid on very thin. Grey copper or a drusy black ore with incubated iron. Containing per center 30 pounds of refined cooper, and up to 21 lots in fine silver.

134. Ein petrificirtes Stüke Holz aus dem Charpatischen Gebürge, weisßer sehr gestaltig gesunder Art. wesentwegen ein solches besonders zu Appliciren bequem ist.

134. A petrified sample of wood from the *Carpathian Mountains* [Hungary]. Of a white, very textured and healthy kind. Thus, it is easily applicable.

135. Eine in Eysen brutigen lethen eingesesßen geweste sehr gestaltige offene Cluft Creyße, Violet Amatisten farbig. Von Schömnitz aus dem gewerkschaftl. Brenner Stolln.

135. Circles originating from iron-breeding clay-like sediments in a very textured open pit. They have the color of violet amethysts. From *Banská Štiavnica's Brunner Gallery Mining Company* [U1].

136. Eben von dahero eine Solche Creysen Amatisten offene Cluft Schwarte.

136. Layer of such round amethysts from an open chasm in the above-mentioned location [Banská Štiavnica, U1].

137. Eine Machtige Crystal Creyße, worunter die mit unterzohenen Silber Erzte [aus Schemnitz] pr: Cento in einem bis 16 löthigen Silber halt sehr artig (wegen trusigter wütterung) zu ersehen.

137. Thick crystal circle [from Banská Štiavnica, U1], where the underlying silver ores, containing per centner up to 16 lots silver, can be seen very clearly due to its drusy weathering.

138. Eine aus dem Magurkár Gebürg des Liptauer Comitats (eine tage reyß von Neusohl) gebro[c]hene Gold, Silber und Antimony Stufe. So in Antimony bis 40 pfundig, in fein 23 Carathigen Gold bis 1000 löthig und in feinem Silber bis 8 löthig. Diese Art ist eine ganz besondere Seltenheit.

138. An extracted specimen of gold, silver and antimony from the *Magurka Mountain* [Osada Magurka, U3] in *Liptov Comitatus*, a day's long travel from *Banská Bystrica*. Containing up to 40 pounds in antimony, up to 1000 lots of fine 23 carat gold. And up to 8 lots in fine silver. This specimen is a very special rarity.

139. Minera Antimony oder Spieß Glaß[i]. in Kalchartigen Gestein mit zarten Glaß Quarz gemüscht aus Cremnitz.

140. Von Rohnitz nächst Neusohl in Unter Hungarn. Eine trusigte Eysen-Creyße, welche auf Einem Acker, oben auf dem Berg bey Stalte gefunden worden ist. Diese Art Eysen-Stein hält pr: Cento bis 50 Pfunde an Rein Eysen.

141. Von Rohnitz aus dem nächst Somlin Reichen Eysen Gebürge gebrochener Stein pr: Cento bis 40 pfundig in Rein Eysen.

142. Von Rohnitz unweit Danisovach Ein Eysen Stein besonderer Art wegen leichten Fluß in Schmölzen pr: Cento 40 pfundig an ♂ [symbol of the planet Mars/Iron].

143. Von Rohnitz aus dem Schmolowaer Gebürge Ein Eysen Stein – seltner Art im letten[i] streichend, pr: Cento bis 36 pfundig.

144. Unweith Rohnitz von Stalter Gebürg ein sehr Compacter Eysen Stein pr: Cento bis 60 pfundig an Rein Eysen.

145. Ein sogenannter Adler Stein[i], oder Eysen Nüern [Niere] Erzt, worinne des Fixe Eysen fast maleabl inwendig Kugl weiße gefunden wird, diese Eysen Nürn Erzt Hülsche[ii] [aus Niederungarn] ist pr: Cento in Rein bis 30 Pfunde hältig.

146. Nativ-Berg-Grün[i-ii] von Neusohl aus Herrengrund, wie solches in einer offenen Wand Cluft angestandten erbrochen worden.

147. Von Schemnitz Ein Sieglißberger Handstein aus dem Piber Stolln ein fast gediehener Gefährte mit beyden Saal bandten in Spath und Quarz Gestein etwas Gelf eingesprangt, pr: Cento bis 1200 löthig in fein Silber.

148. Schemnitzer Pacher Stollner Stufe, von S. Joanni Clufft verschiedener Berg-Arten: als Roth-Spath, Quarz, Zinopel[i] mit Küeß vermüscht pr: Cento 2 ½ löthig in feinen Silber.

139. A mineral of antimony or antimony glance. In calcareous rock, mixed with tender quartz glass from *Kemnica* [U3].

140. A drusy iron circle from *Hronec* [U4] near *Banská Bystrica* in *Lower Hungary*. It is found on a field located on a mountain near a place called *Stalte*. This kind of ironstone contains per centner up to 50 pounds of pure iron.

141. A stone from *Hronec* [U4] extracted from a mountain rich in iron located close to *Somlin*. Per centner up to 40 pounds of pure iron.

142. An ironstone from *Hronec* [U4] close to *Danisovach*. Due to its easy flow in the cast, the ironstone is of particular kind. Containing per centner 40 pounds of pure iron.

143. An ironstone of rare kind, striking in clay-like sediments, from *Hronec* [U4] in the *Schmolowa Mountain*. Containing per centner up to 36 pounds of pure iron.

144. A very compact ironstone in the *Stalter Mountain* near *Hronec* [U4]. Containing per centner up to 60 pounds of pure iron.

145. A so-called "eaglestone" or kidney-shaped iron ore, wherein white, almost malleable internal beads of fixed iron could be found. This kidney-shaped iron ore cover [from Lower Hungary] contains per centner from 0 to 30 pounds [of pure iron].

146. Malachite from *Baňa Dolina* [U11] near *Banská Bystrica*, mined as protruding from an open shaft.

147. A handstone from the *Piber Gallery* in *Stiavnické Bane* close to *Banská Štiavnica [U1]*. Extracted from a nearly [prospered] corridor, which runs parallel to the main corridor, with both salbands in spar and quartz rocks, with disseminated yellow copper ore. Per centner up to 1200 lots in fine silver.

148. A specimen from *Banská Štiavnica's Pacher Gallery* [U1], from the St. *Joanni Chasm* containing different colorful ores, such as red spar, quartz, cinnabar mixed with pyrites. Per centner up to 2 ½ lots in fine silver.

149. Von Schemnitz. Pacher Stollner Stufe, von Spitallergang Zinopl und Rösch Bley Glanz Schüßig gemüscht. pr: Cento 20 pfundig in weich oder Rein Bley, wovon der Cten bis 2 löthig in feinen Silber.

149. A specimen from *Banská Štiavnica's Pacher Gallery* [U1]. From the *Spitaller Gallery* cinnabar, containing coarse lead glance. Containing per centner 20 pounds in soft or pure lead and up to 2 lots in fine silver.

150. Von Schemnitz aus dem Pacher-Stollen von der Joanni Clufft, ob den 3 Fältigkeiter Erb-Stolln Eine Erzigte weiß-Spath-Stufe. pr: Cento bis 5 auch 7 löthig in feinen Silber. Auf dieser Clufft haben Ihro Mayst. der Römische König Selbst gearbeidet.

150. A specimen of ore of white spar from the *Joanni Chasm* (above the *Holy Trinity Gallery*) in *Banská Štiavnica's Pacher Gallery* [U1]. Containing per centner up to 5 and also 7 lots of fine silver. His Majesty the Roman King himself even worked in this chasm.

151. Von Schemnitz aus dem Sieglißberg [Siglisberg] von dem Piber Stollner Gang ein mit Roth gülden Erzt Graupen und Rösch Gewüxnester weiß eingesesßener Hand-Stein. pr: Cento bis 60 löthig in feinen Silber.

151. A handstone with disseminated reddish-golden ore in form of granules and white nests of silver glance from *Banská Štiavnica's* [U1] *Piber Gallery* in *Stiavnické Bane*. Containing per centner up to 60 lots in fine silver.

152. Eine braun quarztige Erzt Stufe in der Thiergartner gewerkschafftlichen Grube [in Schemnitz] gebrochen, hieran ist zu ersehen, wie in dem derben Gestein eine offene Clufft gleichsam mit einer Rösch Gewüx Erzt Schwarte überzohen eingesesßen ware, welche mit Roth gülden Erzt raupen untermüschte Rösch Gewüx Erzt Schwarte pr. Cento in feinen Silber bis 700 löthig.

152. A specimen of brown quartzous ore from the *Thiergartner Pit Mining Company* [in Banská Štiavnica, U1]. It is obvious, how an open pit covered by a layer of silver glance was disseminated in the rough rock. The layer of silver glance (intermixed with reddish-golden ores in form of granules) contains per centner up to 700 lots in fine silver.

153. Aus Sachsen von Harzischen Gebürge Eine Roth gülden Gewüx-Erzt[i] Stufe. pr: Cto. 3000 löthig in feinen Silber mit einer Glanz Spath[ii] Trußen zwischen denen Lauteren Roth gülden Glaß Erzt[iii] Graupen eingesessen.

153. A specimen of reddish-golden ore from the *Harz Mountains* in *Saxony*. Containing per centner up to 3000 lots in fine silver. A druse of sillimanite is disseminated in reddish-golden silver glance in form of granules.

154. Aus Kärnthen von der von Ihro Majestäten im bauführenden Ledellnig ein rothgüldig[i] bluthmahlig[ii] quartzige silber stuffen wovon der Centner nach der gemeinen prob 20 Loth silber und die marck silber 2 Loth in gold haltet.

154. A specimen of reddish-golden, blood-colored, quartzous silver ore from the *His Majesty's* [*Mine*] in *Ledellnig* [near Kleblach-Lind, Carinthia, C2]. According to the common method to take a sample, a centner contains 20 lots of fine silver and the silver core contains 2 lots of gold.

155. Aus Kärnthen von dem von Ihro Majestätt führenden stoggenboger [Stogenbog bei Paternion] hoffnungsbau Zinober Erzstuff in blau und weißen quartz.

155. A specimen of cinnabar ore in blue and white quartz from your Majesty's mine in *Stogenbog* near *Paternion* [C3].

156. Aus Kärnthen von einem zu behuff der Messing fabrique in Mehlbrucken pro aerario vor behaltenen Kupferschurff zu Lessach bestehend in gelff Vitriol anflieglich und brandig stuffen so 10 Pfunde Kupfer halten.

156. A specimen of rusty ore in yellow-tinged vitriol from a copper mine in *Lessach* [C5] that is used by the authorities for the brass-manufacture in *Möllbrücke*. Containing 10 pounds of copper.

157. Bley stuff aus Kärnthen von dem K. K. bergbau in Reibel.

158. aus Kärnthen von der graf Beroardische bleygruben an Kollen derbe bleystuffen unter dieser gruben wird von dem aerario ein Zubau[i] geführt.

159. Aus Kärnthen von dem K. K. quecksilber gewältigungs stollen zu Dellach quecksilber ärtz mit Mercurio virgineo eingesprängt wovon die abgenommen gemeine prob zeuget das der Centner 8 Pfunde mercury haltet.

160. Ein weise Calmeyen[i]. *

161. Reschweise Calmey. *

162. rother Calmey. *

163. Ockerfarb Calmey. *
* aus Kärnthen von K. K. bergbau in Reibel.

164. Eine sehr merckwürdige aus America von den bergwercken in Potosi kommende goldstuff welche besonders reich in gediehenen gold in harten gestein ist.

165. aus Kärnthen von Roseck graf Rosenbergischen Herrschaft silber stuff so sich in Mitführenden Milden[i] in Subtilen gäng steinen befinden, das bessre ärtz laut prob haltend 34 Loth silber und 10 Pfund Kupfer der Centner das mindere haltet 9 Loth 1 [unit?] 2 Pfennig silber und 4 Pfund Kupfer.

166. Aus Tirol ein sehr reiche von der besten gattung Kupfer Erzt stuffen wovon der Centner Kupfer in sich enthalt. *1

167. Eine andere reiche gatung sogenantes nieder ärtz mit denen schönsten Regenbogen oder pfauen farben angepflogen mit einem schwartz grauen schister der Cent[ner] hält Kupfer. *1

*1 aus Tyrol vom berg Rotten bach in ärner Thal. des puster Thal.

157. A specimen of lead from the *Imperial-Royal Mine* in *Cave del Predil* [C6].

158. A rough lead ore in coal from *Count Bernard's Lead Mine* in *Carinthia*. The authorities are constructing a gateway underneath the pit.

159. A sample of mercury ore with disseminated virgin mercury from the *Imperial-Royal Mercury Mine* in *Dellach* [C1]. According to the common method to take a sample, a centner contains 8 pounds of mercury [pure lead].

160. A sample of white calamine.*

161. A sample of coarse white calamine.*

162. A sample of red calamine. *

163. A sample of ochre-colored calamine.* From the *Imperial-Royal Mine* in *Cave del Predil* [C6].

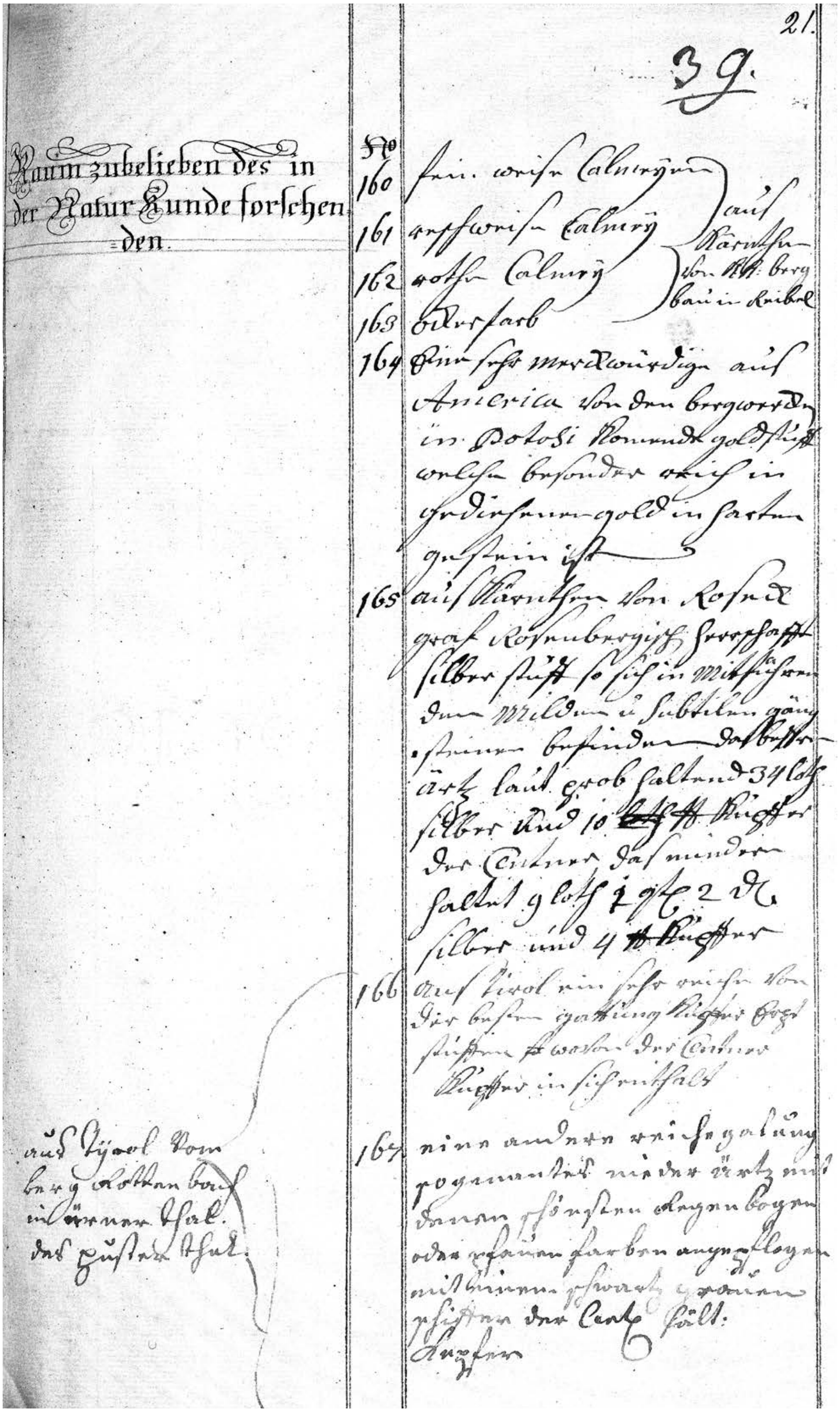
164. A very strange sample of gold from the mines in *Potosí* in *America*. It is particularly rich in flourished gold in solid rock.

165. A specimen of silver ore from *Rosegg* [C4], the dominion of Count Rosenberg. In narrow galleries of soft rock, samples of ore could be found. According to a sample, a centner of the richer ores contains 34 lots of silver und 10 pounds of copper. A centner of the poorer ores contains 9 loth, 1 [unit?], 2 dinars silver and 4 pounds of copper.

166. A specimen of very rich copper ore of the best kind from *Tyrol*. A centner contains [an uncertain amount of] copper.*1

167. Another rich kind of so-called "lower ore" tinged with the most beautiful colors of the rainbow or a peacock, with a black grey schist. A centner contains [an uncertain amount of] copper.

*1 from the *Rottenbach Mountain* in the *Ahrn Valley* [Valle Aurina, T2] of the *Puster Valley* [Val Pusteria].


Raum zubelieben des in der Natur Kunde forschenden.

21.

39.

No

160 fein weiser Calmeyen

161 gelbweiser Calmey

162 rother Calmey

163 bleyfarb

aus Kärnthen vom [illegible] bergbau in Raibel

164 Eine sehr merckwürdige aus America von den bergwerken in Potosi kommende goldstuff welche besonders reich in gediegenem gold in harten gestein ist

165 aus Kärnthen von Rosenegg graf Rosenbergischen herrschaft silber stuff so sich in mittlern den wilden u. subtilen gäng steinen befinden das bessere ärtz laut prob haltend 34 loth silber und 10 [illegible] kupfer der Centner das mindere haltet 9 loth [illegible] silber und 4 [illegible] kupfer

166 aus tirol ein sehr reicher von der besten gattung kupfer [illegible] stuffen [illegible] der Centner kupfer in sich enthalt

167 eine andere [illegible] kupfer [illegible]

aus tyrol vom berg [illegible] in [illegible] thal.

Figure 7 – Catalog's page nos. 160–167.

168. In grauer schieffer eingesprenckt ärmeres Nieren ärze wovon der Cent[ner] enthält [blank space] Kupfer. *2

168. Gray schist containing poorer kidney-shaped ore. A centner contains [an uncertain amount of] copper. *2

169. Kupfer Erz mit Eysen schuß und weiß grauen Schieffer enthalt der Cent[ner] [blank space] Kupfer. *2

169. Copper ore containing iron and white-grey schist. A centner contains [an uncertain amount of] copper. *2

170. Noch ärmeres Kupfer erz eingesprenckt und sogenanten mehreren Eysen Schuß enthält der Cent[ner] [blank space] Kupfer. *2

170. Even poorer copper ore containing iron. A centner contains [an uncertain amount of] copper. *2

171. Kieß Erz ein von bessern gattung so der Cent[ner] enthält [blank space] Kupfer. *2

171. A better kind of pyrite. A centner contains [an uncertain amount of] copper. *2

172. Eine schlechtere Kiß Erz gattung, so der Cent[ner] enthalt Kupfer. *2

172. A poorer kind of pyrite. A centner contains [an uncertain amount of] copper. *2

173. So genanter wasser Kieß so sehr wenig oder gar kein ♀ [symbol of the planet Venus/Copper] hält, jedoch sehr schwewelt und dessen Cent[ner] enthält [blank space]. *2

173. So-called marcasite. A center contains very little or no copper, but it sulfurizes and a center contains [blank space]. *2

174. Grauer schieffer sehr arm mit etwas Kupfer Erz eingesprenckt zum Pucherz [oder Mittelerz] gehörig enthält der Cent[ner] [blank space] Kupfer. *2

174. Very poor grey schist containing copper ore. It belongs to the medium quality ores. A centner contains [an uncertain amount of] copper. *2

175. Sogenanter schwarz Kupfer[i] aus obgemelten Erzen erzeuget der Cent[ner] [blank space] in Kupfer. *2

175. So-called black copper of the above-mentioned ores. A centner contains [an uncertain amount of] copper. *2

176. Sogenanter Rosete Kupfer[i] aus obgedachter Kupfer Erz in schwarz Kupfer getrieben dessen Cent[ner] enthält [blank space] in Kupfer. *2

176. A so-called rose copper of above-mentioned copper ore driven through black copper. A centner contains [an uncertain amount of] copper. *2

177. Kupfer König aus obgemelten Rosette Kupfer dessen Cent[ner] enthält [blank space] Kupfer. *2

177. Melted, pure copper from the above-mentioned rose copper. A centner contains [an uncertain amount of] copper. *2

178. Grau Schieffer worinn eine gattung Eyßen grenaten und welche sich in ahrnerischen Bergwerck befinden auch neben hin bey gebrauchend und anhaltenden magnäten an einander hengend[,] übrigens 6 Ecken und acht ebene haben. *2

178. Grey schist, wherein a kind of iron garnets can be found, from a mine in *Ahrn* [Valle Aurina, T2]. Also noteworthy, when used and put next to a magnet, they stick together. *2

*2 aus Tyrol von der Berg Rottenbach in ährner Thal des puster Thal so bloß allein Kupfer hält.

*2 The *Rottenbach Mountain* in the *Ahrn Valley* [Valle Aurina, T2] of the *Puster Valley* [Val Pusteria] contain only copper.

Figure 8 – Glanzenberg Adit in Banská Štiavnica. Here Archduke Leopold served as miner on the occasion of his royal visit in 1764.

179. Strahlen[i]-graupen mit darauff stehenden Zinn graupen, dem sogenanten Mahlwerck[ii] von dem stock in schlackenwald.

179. Ore in form of granular crystals with protruding tin granules, the so-called "Ma(h)lwerk" [black clear tin ore in schist rock] from the *[Huber]stock Mountain* in *Horní Slavkov* [B8].

180. Reine derbe Zinngraupen von dem Pingerschacht aus schlaggenwald.

180. Pure raw tin ore granules from the *Pinger Pit* in *Horní Slavkov* [B8].

181. Ebenfals eine derbe Zinngraupen wobey ein weisses Zinngräupel steht von Pingerschacht aus Schlaggenwald.

181. Likewise, raw tin ore granules (a white one is pointing upwards) from the *Pinger Shaft* in *Horní Slavkov* [B8].

182. Ein gediegener[i] derber Zwittler von dem mächtigen streichenden St. Conrader gang in Plathen [Platten].

182. A pure raw hybrid type of rock and ore from the great *St. Conrader Gallery* in *Horní Blatná* [B6].

183. Zinngraupen mit vermängten strahlen dann dem [D?]ermiste Mahlwerk von dem Neuwasser schacht aus schlaggenwald.

183. Tin ore granules with blended crystals and the [Dermiste?] Mahlwerk from the *Neuwasser Shaft* in *Horní Slavkov* [B8].

184. 6 stück roth und gelber Schweffel von dem Kayl. Königl. Schmölnizer Kupfer bergwerck aus Oberhungarn.

184. 6 samples of red and yellow sulfur from the *Imperial-Royal Copper Mine* in *Smolník* [U10] in *Upper Hungary*.

185. Ein Eisenstein[i] mit greisen[ii] von [Zipser] Neudorf in Oberhungarn ohnweith schmölniz.

185. An ironstone with quartz and glimmer from *Spišská Nová Ves* [U6] close to *Smolník* in *Upper Hungary*.

186. Granatstein aus obersteuer von Frauenberg heiß genannt, welcher sich poliren last.

186. A so-called garnet stone from *Frauenberg* [S2] in *Upper Styria* that can be polished.

187. Ein außerhalb Neusohl einer Niederhungarischen bergstadt in dem sogenannten Herrngrund sehr reich in silberhalt einbrechendes weißes Kupfer Ertz so sich gleichfals polliren last.

187. A breaking white copper ore, very rich in silver. From a place called *Baňa Dolina* [U11], outside *Banská Bystrica*, a mine town in *Lower Hungary*. Likewise, the ore can be polished.

188. Eisenstein gwix [Gewächs] von dem Rudibanjer gebürg aus ober Hungarn in Boschoder Comit[at].

188. Ironstone containing silver from the *Rudabánya Mountain* [U12] in the *Borsod Comitatus* in *Upper Hungary*.

189. Aus oberhung[arn] von gölniz steinglaß[i] in etwas silberhaltig-Kupfer schüssiger Eisenstein.

189. Ironstone containing glass impured by minerals and argentiferous copper from *Gelnica* [U8] in *Upper Hungary*.

190. 3 stufen bleyschuss von Neubaujen.

190. Three specimens of lead glance from *Neubaujen*.

191. Eisenstein aus N[ieder] Hung[arn] mit grün Kupfer Lazur[i] von Rochniz.

191. Ironstone with green azurite from *Hronec* [U4] in *Lower Hungary*.

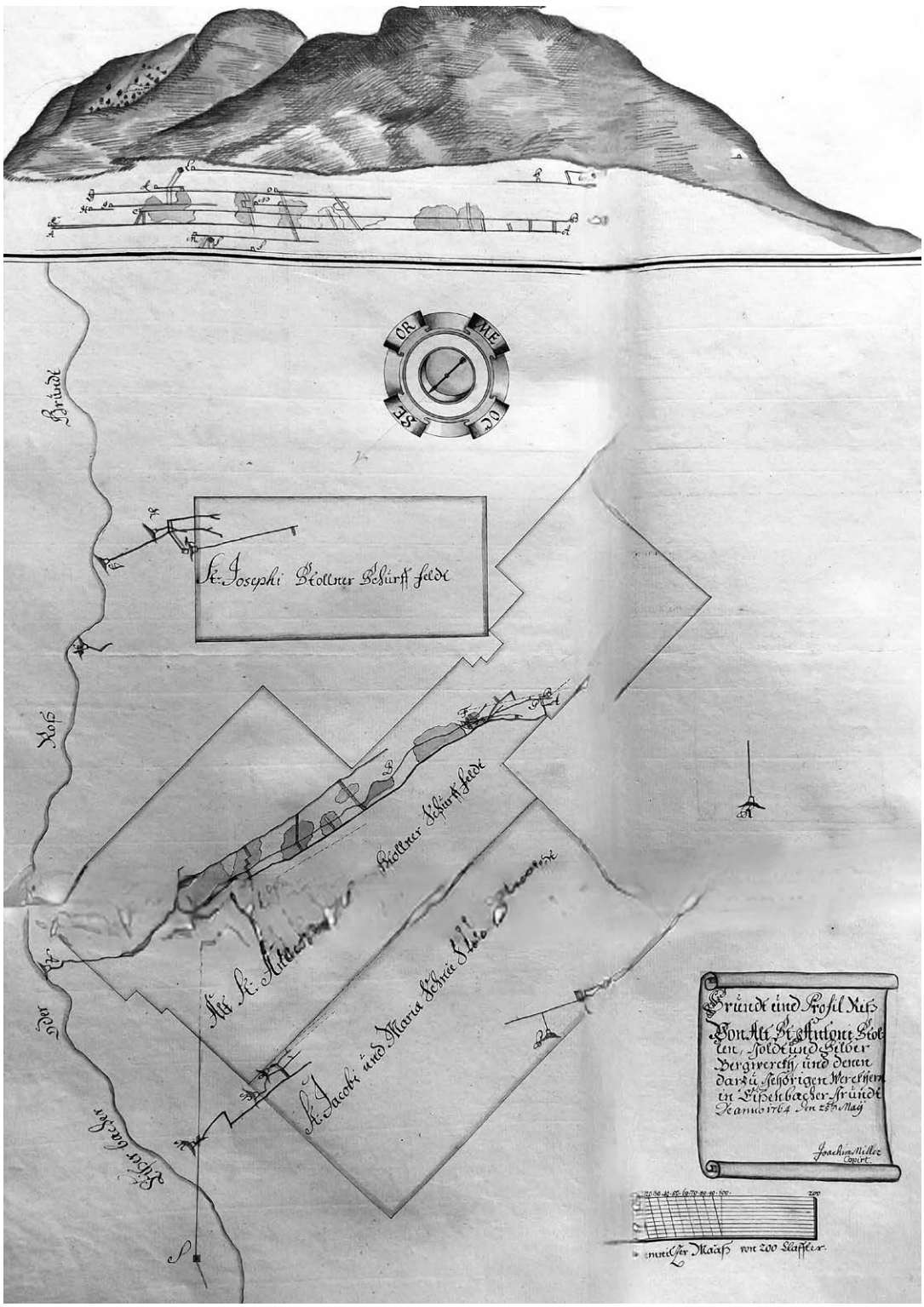


Figure 9 – Josephi Stollner. In: Goldenes Bergbuch, 1764. Courtesy of Ministero della Cultura/ Biblioteca Nazionale Centrale Firenze, Palatino 1094.

192. Eisenstein gwix [Gewächs] von Moravizer gebürg ohnweith Zochshan aus dem Temeswarer bannat.

192. Ironstone from the *Moraviţa Mountain* [B1] near *Zochhan* in the *Timişoara Banat.*

193. Gemeine, und eine art zwitter Mahlwerckh von darumen genandt, vielen dies Ehe, und bevor [das] Stempel[i] Pochen erfunden worden ist zwischen zweien Mühlsteinen, wie das getreyd gemahlen worden, denen 1 Rost über 1 ½ Cent[ner] zinn, od. 1 Cent[ner]. Von diesen Minerva über 5 Loth nicht viel hergiebet.

193. Common rock and a kind of rock-ore-hybrid, therefore named "Mahlwerk." Due to this marriage, the "Stempel" (a tool to crush the ore) was invented. The ore is milled like grain between two millstones. One grate contains 1 ½ or 1 centner tin. It is impossible to extract more than 5 lots [of tin] from these ores.

194. Besseres, oder reiches Mahlwerck, oder guette zwitter dergleichen gibt ein rost ungefehr 600 Cent[ner] 10, und mehrere Cent[ner] Zinn, wann diese durch das Stempel Pochen in Nassen Process aufbereitet das ist, wann die Materia oder die Taube gangarthen von den Zinn-stein (welcher an der braunlichen schwärze zu erkennen); mitelst des schlemen, und des waschen abgetriben so fort seiner arth nach die darinn befindliche zinnstein rein gemacht. Nach der Hand der also praeparirte und ganz rein gemachte Zinn-stein geschmolzen, und das davon kommende Zinn in kleine Pallen zerflösst wird. 2 Cent[ner] reiner Zinn-stein geben die Helfte oder ein Cent[ner] Zinn.

194. Better or rich "Mahlwerk" [black clear tin ore in schist rock] or good rock-ore-hybrid. One grate contains 610 and some centner tin. First, the wet ore is crushed. To remove the gangue contents of the tin ore, which can be recognized by their brownish black color, the ore must be elutriated, washed and rubbed off. Then, the prepared and crushed tin is melted. And finally, the extracted tin is filled into small casks. 2 centners of tin ore contain 1 centner of pure tin.

195. Gediegene schwarze Zinngraupen seynt von der besten qualitet, und am reichesten an den gehalt, welche über die helfte Zinn geben, aber wenig werden gefunden.

195. Pure black tin ore granules. Those of the best quality and richest in content, however, can hardly be found outside the very bright-lit tin pit.

196. Zinn-stein, und Kupffer beysamen.

196. Tin ore and copper [are tied] together.

197. Wolfram[i], ist eine von zinn-stein der Farb, und schwere nach zwar ähnliche, in sich aber eine taube, und nichts haltende unarth[ii].

197. Wolfram. It has a similar color and weight as tin ore, but it is an unprofitable and valueless gangue.

198. Seynt drussigte, zu weilen findende arthen von verschiedenen gattungen, der halt darinen ist nicht so wohl, als das Wunderliche gewächs zu consideriren.

198. Drusy and occasional kinds of different ores of which the content is not as valuable as these curious silvery specimens seem.

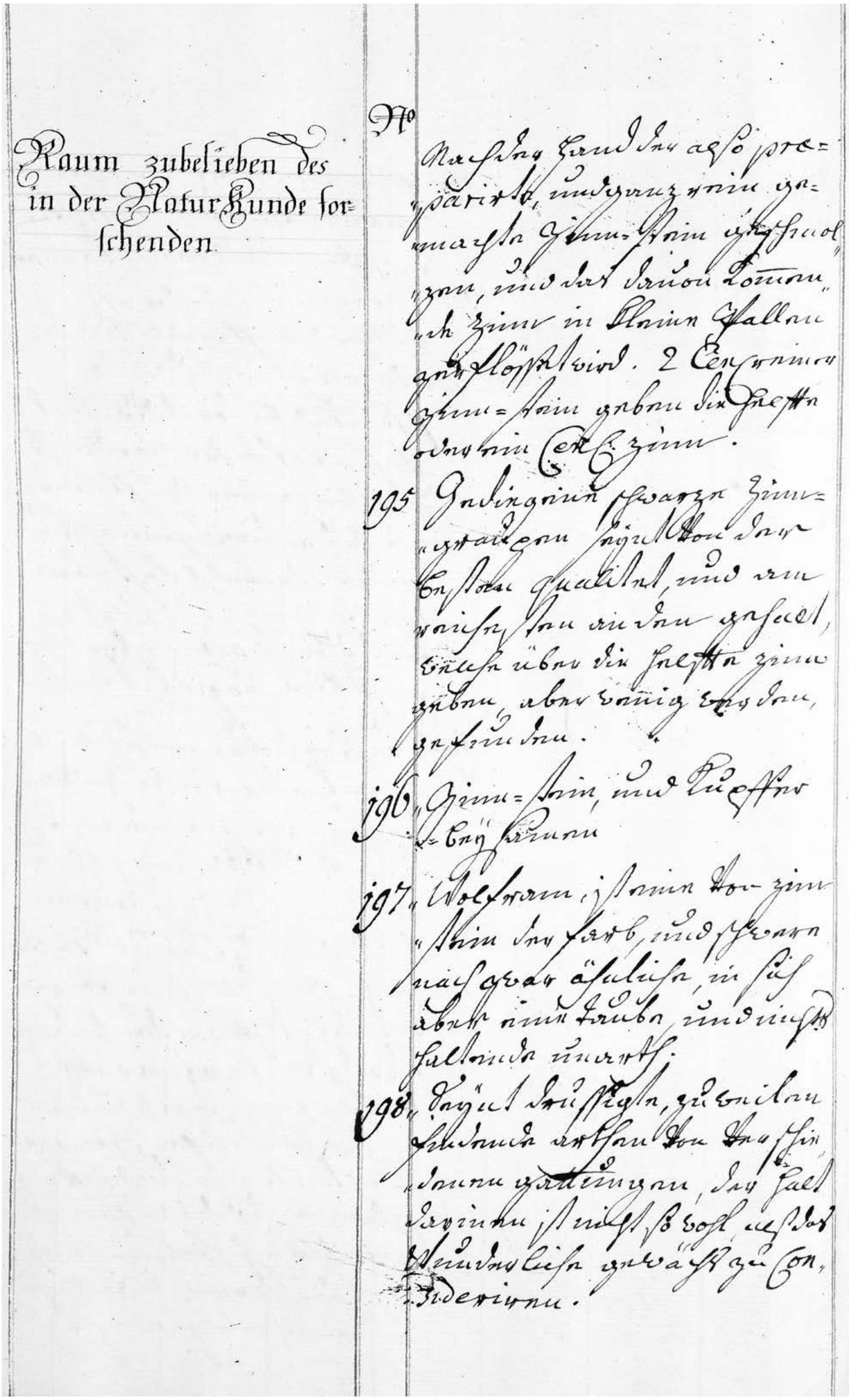

Raum zubelieben des in der NaturKunde forschenden

Figure 10 – Catalog's page nos. 195–198.

199. Gemeine Poch-gänge von streichenden gängen.

199. Common ore to be processed from neighboring galleries.

200. Bessere, so reicher sint.

200. Better and richer samples than the above-mentioned.

201. Weise zinn[i] graupen halten zinn aber nicht viel, pfleg zwar selten, und fast immer zu brechen.

201. White tin ores in the form of granules. They do not contain much tin, despite them not needing much care or labor to mine them.

202. Ein mit einen feinen barth greiss überzogener blauer Eissenstein.

202. A blue ironstone covered with a fine 'beard'-like mixture of quartz and glimmer.

203. Ein mit Erzt unterzogener mitterer Christallen Kreiss.

203. A large crystallized mixture of quartz and glimmer.

204. Ein groß Christallige greiss.

204. A large crystallized mixture of quartz and glimmer.

205. Ein Erbeis[i] greiss.

205. Very hard mixture of quartz and glimmer.

206. Ein mit Erzt unterzogener Nadl-greiss.

206. A "needle" mixture of quartz and glimmer undergone by ore.

207. Zwey mit Erzt untermengte Grotengreiss.

207. Two "grotto" mixtures of quartz and glimmer, containing ore.

208. Ein Zappa-greiss.

208. A "Zappa" mixture of quartz and glimmer.

209. Ein Erz stiffel mit einen sauberen greiss welche eine artige Figur machet.

209. A sample of ore in form of a boot with a well-shaped clean mixture of quartz and glimmer. It is of rose color.

210. Ein schrott[i], und bart greiss.

210. [Iron] grains and a "beard"-like mixture of quartz and glimmer.

211. Ein christalisirte Nadel greiss.

211. A crystallized "needle" mixture of quartz and glimmer.

212. Eine mit hell durchsichtigen christallisirten zarten nadel-greissbedecktes Blau Erzt[i].

212. A sample of blue ore covered by a bright, translucent and crystallized "needle" mixture of quartz and glimmer.

213. Einige arthen von wilden Amatisten.

213. Some kinds of natural amethysts.

214. Von eben der art.

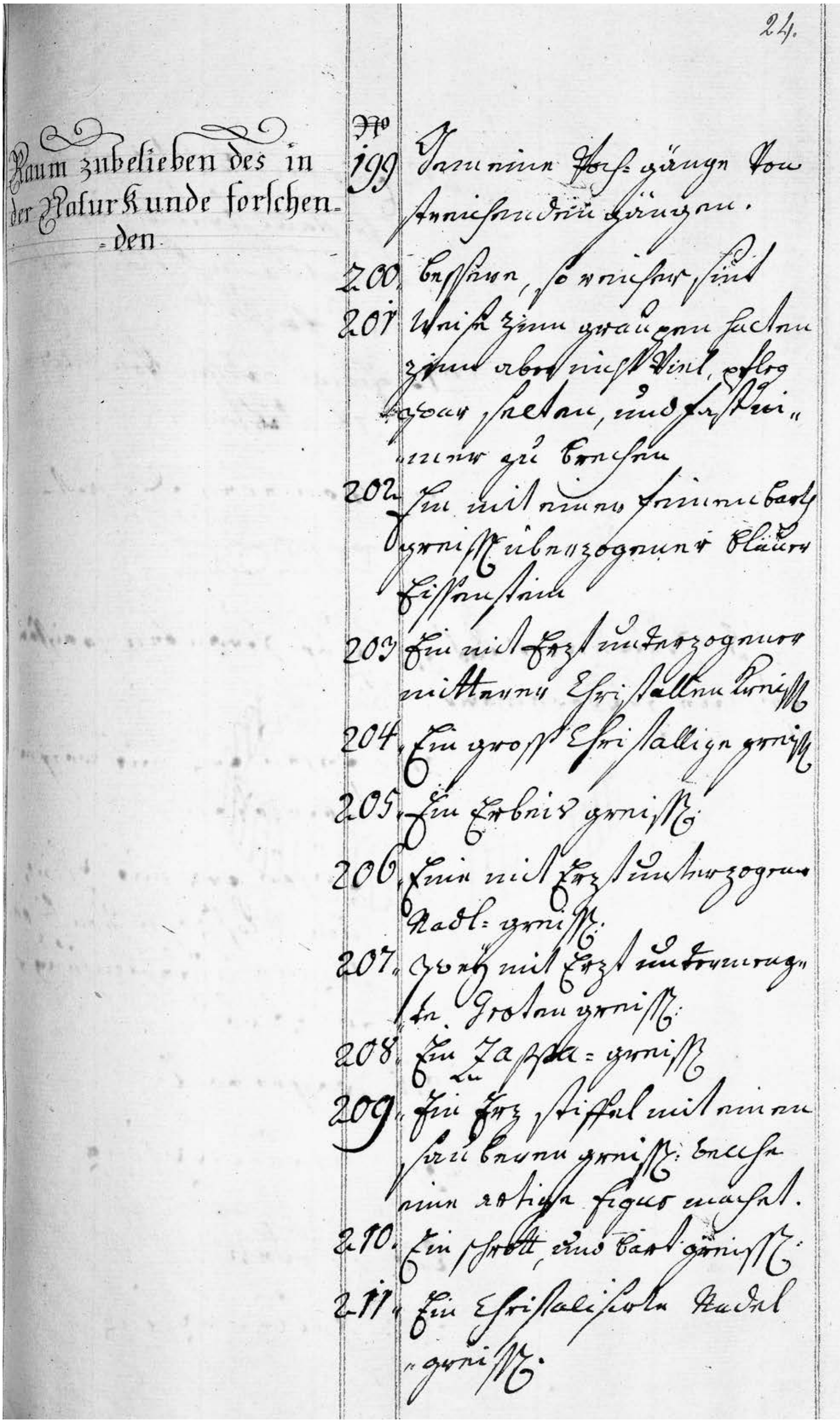
214. Of the same kind.

215. Eine strauben Greissen. *3

215. A spiral-shaped mixture of quartz and glimmer. *3

216. Eysen Erz mit wasser überzogen. *3

216. Iron ore covered by water. *3



24.

Raum zubelieben des in der NaturKunde forschen-den

No

199

200

201

202

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204

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206

207

208

209

210

211

Figure 11 – Catalog's page nos. 199–211.

Figure 12 – Kremnica Prospect. Goldenes Bergbuch, 1764. Courtesy of Ministero della Cultura/ Biblioteca Nazionale Centrale Firenze, Palatino 1094.

217. Eysen Erz mit Plinz[i] und Roßzahn[ii] von St. Constantia untersuchungs Haupt Bau. *3

217. Iron ore with iron spar and ankerite from the *St. Constantia Mine*. *3

218. Wasser fall. *3

218. Water fall. *3

219. Grauer Plinz. *3

219. Gray iron spar. *3

220. Moder[i]. *3

220. Moldiness. *3

221. Gelber Plinz. *3

221. Yellow iron spar. *3

222. Glassig oder großspeisiges Plinz. *3

222. Glass-like or rough-square iron spar. *3

223. Erzt, und mit wasser überzogener Stuffen von Leopoldi Stollen. *3

223. Ore and sample of ore covered by water from the *Leopold Gallery*. *3

224. Erzt und Plinz v. Stullegg. *3

224. Ore and iron spar from *Stuhlegg* [near Rettenegg, S3]. *3

225. Blau stuffen v. St. Erasmi Stollen. *3

225. Specimen of blue ore from the *St. Erasmus Gallery*. *3

226. Weisser Plinz. *3

226. White iron spar. *3

227. Erzt v. St. Magnus Stollen. *3

227. Ore from the *Magnus Gallery*. *3

228. Ein greissen artig überzogene Stuffen. *3

228. Piece of ore covered by a mixture of quartz and glimmer. *3

229. Rothbrüchiges Eisen Stein[i]. *3

229. Red-breaking ironstone. *3

230. Quarz oder Roßzahn. *3

230. Quartz or ankerite. *3

231. Leberfarber Stuffen[i]. *3

231. Specimen of liver-colored ore. *3

232. Weisser sehr feiner Plinz von St. Barbara Stollen mit einen schon gezeitigten Blau Erzt, wo also zeitig und unzeitig beysammen. *3

232. White and very fine iron spar with an already matured blue ore from the *St. Barbara Gallery* (compounds of different ages are tied together). *3

233. Leimlassig auch theils mit Plinz durchfahrener Stuffen von St. Maximiliani Stollen Soberhaggen. *3

233. A sample of ore driven through loam and partly iron spar from the *St. Maximilian Gallery* at *Söbberhaggen* [near Eisenerz, S1]. *3

234. Eysen Stochen. *3

234. Tapped iron. *3

235. Marchesit von Eisenerzterischen leimgrub. *3

235. Marcasite from the clay pit in *Eisenerz* [S1]. *3

236. Blaues Eysen Erzt[i] von St. Sebald Stollen. *3

236. Blue iron ore from the *St. Sebald Gallery*. *3

237. Grün plinziger Eisenstein. *3

237. Green iron-spar-like ironstone. *3

238. Spiegel Plinz. *3

238. A "mirror" iron spar. *3

239. Rother Plinz. *3

240. Erzt und Plinz von St. Antoni Stollen. *3

241. Ausgewittert oder überzeitiger Eisen stuffen. *3

242. Mit Roßzahn eingesprengter Plinz und Eysen Erzt von St. Melchior Stollen. *3

*3 aus Steiermark das Eysene Erz bergwerk.

Notandum: Bey dem Eysen schmelzen werden keine stuffen proben, sondern nur gemeine proben genommen, weilen die obbeschriebene Erzte in der Vermischung geforderet und auch so auf geschmolzen werden, aber der mittelhalt der Verschmelzung in groß[en] auf etlich 40 Pfund Eysen von Centen Erzt sich beläuft. jedoch wird seit einigen monath angefangen auch stuffen proben zu machen, und überhaupt mehrere Versuche alß in vorigen Zeit vorzunehmen, wie dann auch ein sechsel theil eines Hochofens zum probiren allhier nach aller proportionen seit kurzer zeit errichtet worden ist.
Kempf [Signature]

239. Red iron spar.

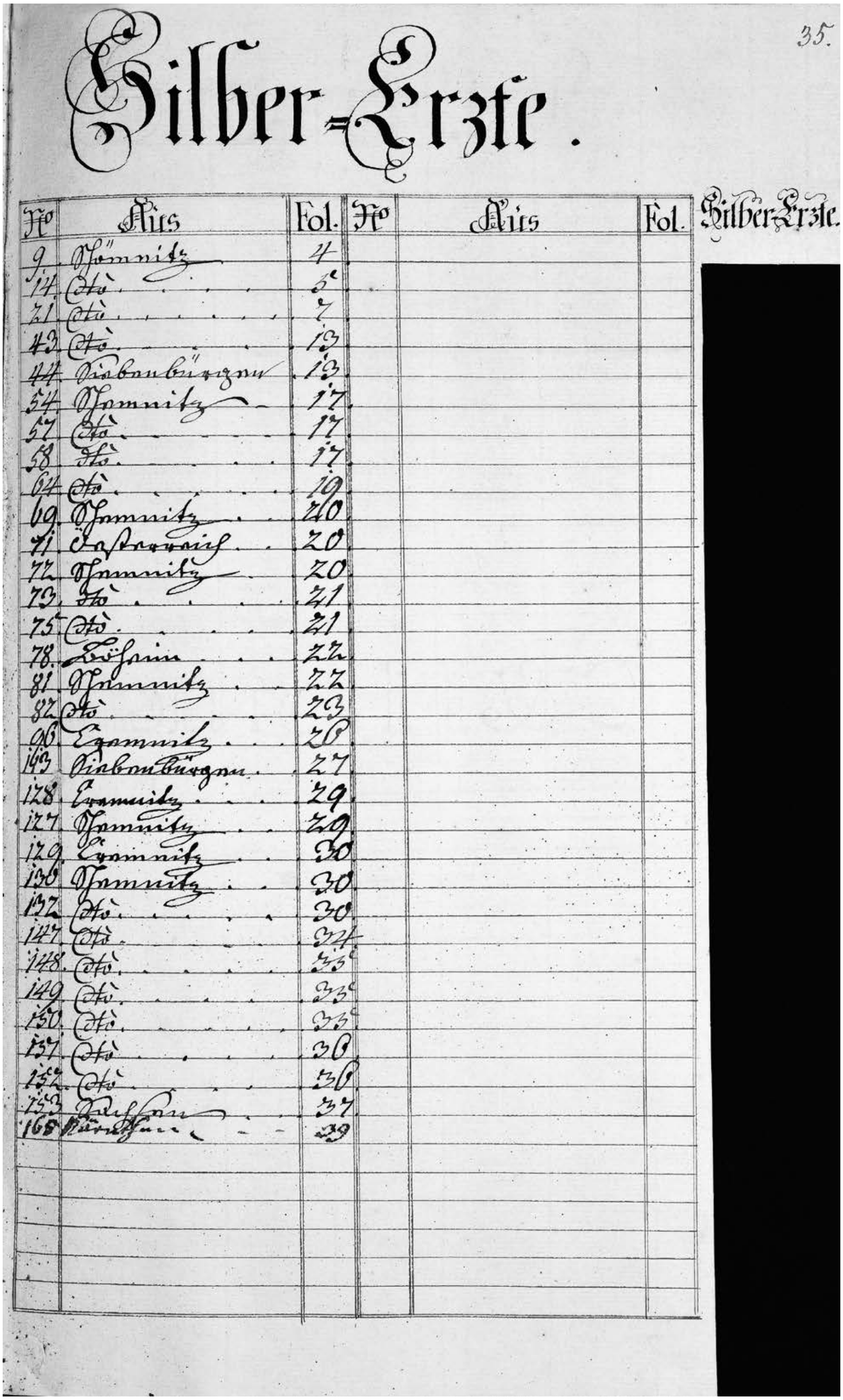
240. Ore and iron spar from the *St. Anthony Gallery.* *3

241. Effloresced and overriped iron ore. *3

242. Iron spar and iron ore containing ankerite from the *St. Melchior Gallery.*

*3 From the Iron Ore Mine in *Eisenerz* [S1] in *Styria*.

Note: When melting iron, no samples of a specific ores are taken, only common samples. This is due to the ores being extracted, processed and melted together. However, one centner of ore contains on average 40 pounds of iron. However, for a few months now, samples of a specific ores have been taken for the first time and various attempts to improve ore processing were made. A sixth part of a blast furnace was constructed to conduct the experimental process there.
Kempf [Signature]



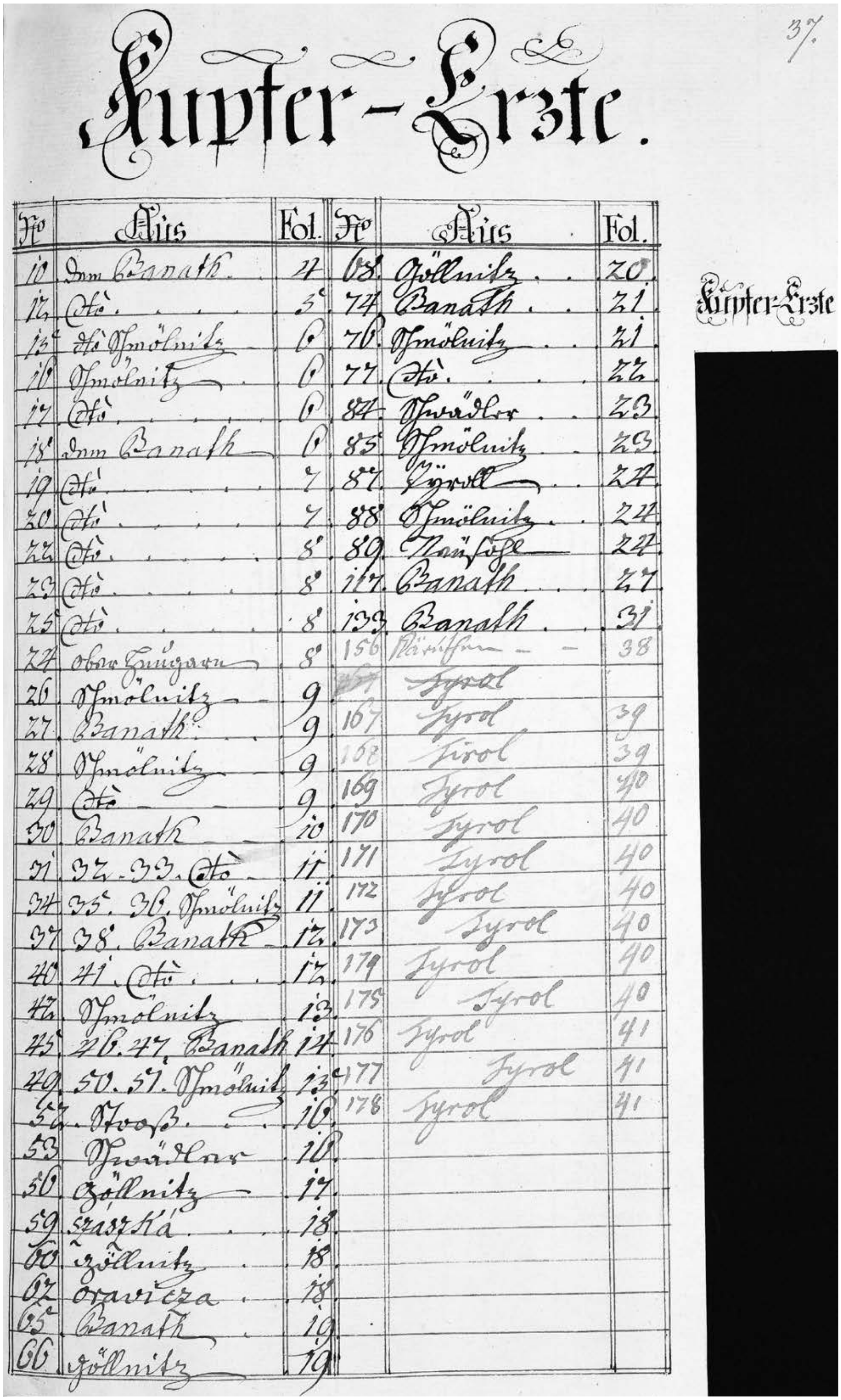
35.

Silber-Erzte.

Silber-Erzte.

No	Aus	Fol.	No	Aus	Fol.
9.	Chömnitz	4			
14.	dto.	5			
21.	dto.	7			
43.	dto.	13			
44.	Siebenbürgen	13			
54.	Chemnitz	17			
57.	dto.	17			
58.	dto.	17			
64.	dto.	19			
69.	Chemnitz	20			
71.	Oesterreich	20			
72.	Chemnitz	20			
73.	dto.	21			
75.	dto.	21			
78.	Böhmen	22			
81.	Chemnitz	22			
82.	dto.	23			
96.	Chemnitz	26			
103.	Siebenbürgen	27			
128.	Chemnitz	29			
127.	Chemnitz	29			
129.	Chemnitz	30			
130.	Chemnitz	30			
132.	dto.	30			
147.	dto.	34			
148.	dto.	35			
149.	dto.	35			
150.	dto.	35			
151.	dto.	36			
152.	dto.	36			
153.	Sachsen	37			
168.	[illegible]	39			

Figure 13 – Index.



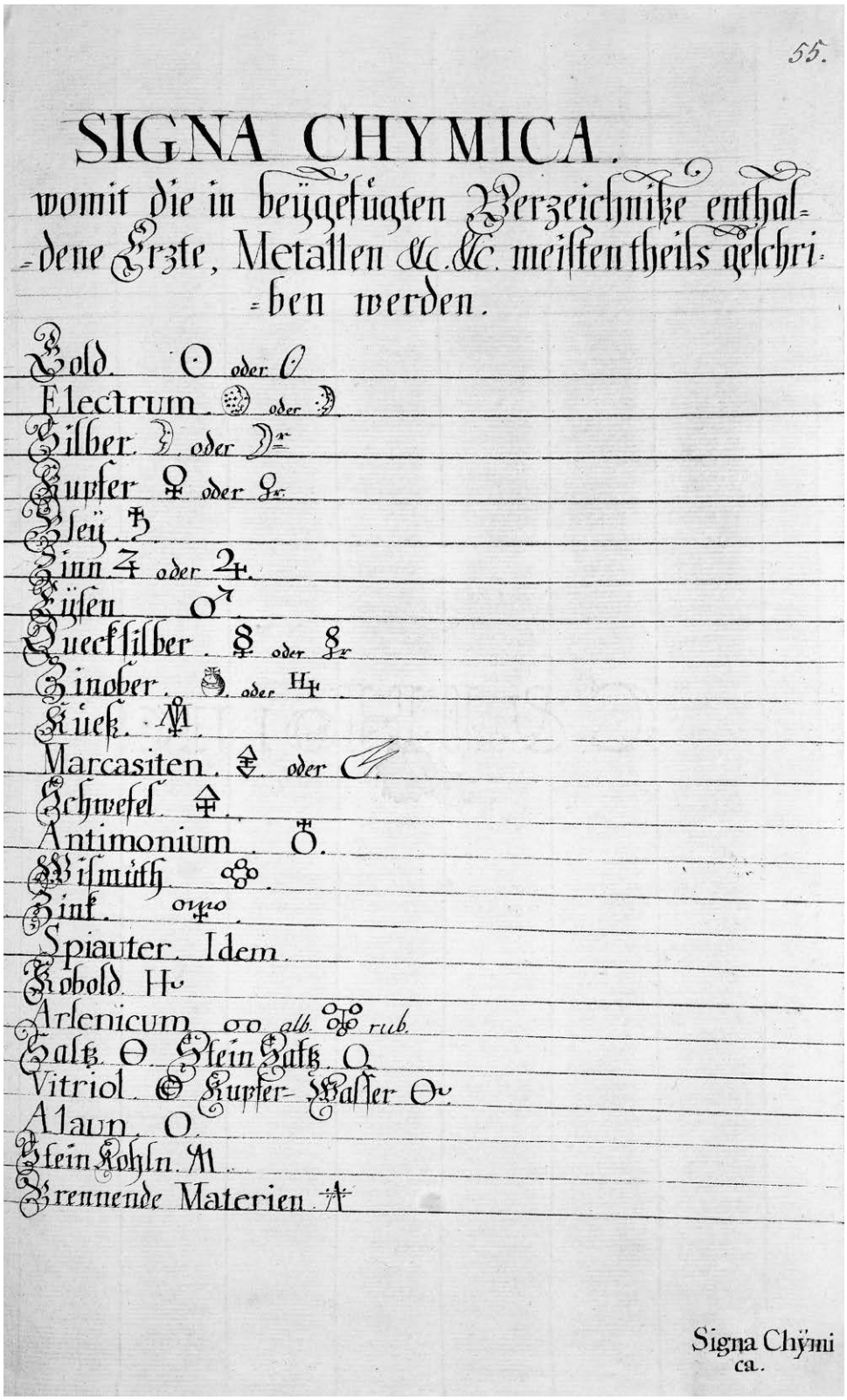
37.

Kupfer-Erzte.

No	Aus	Fol.	No	Aus	Fol.
10	Vom Banath	4	68	Göllnitz	20
12	Detto	5	74	Banath	21
13	do Schmölnitz	6	76	Schmölnitz	21
16	Schmölnitz	6	77	Detto	22
17	Detto	6	84	Schwädler	23
18	Vom Banath	6	85	Schmölnitz	23
19	Detto	7	87	Tyroll	24
20	Detto	7	88	Schmölnitz	24
22	Detto	8	89	Neusohl	24
23	Detto	8	117	Banath	27
25	Detto	8	133	Banath	31
24	Ober Hungarn	8	156	[illegible]	38
26	Schmölnitz	9	~~161~~	~~Tyrol~~	
27	Banath	9	167	Tyrol	39
28	Schmölnitz	9	168	Tirol	39
29	Detto	9	169	Tyrol	40
30	Banath	10	170	Tyrol	40
31.	32. 33. Detto	11	171	Tyrol	40
34.	35. 36. Schmölnitz	11	172	Tyrol	40
37.	38. Banath	12	173	Tyrol	40
40.	41. Detto	12	174	Tyrol	40
42	Schmölnitz	13	175	Tyrol	40
45.	46. 47. Banath	14	176	Tyrol	41
49.	50. 51. Schmölnitz	13	177	Tyrol	41
52	Ross	16	178	Tyrol	41
53	Schwädler	16			
56	Göllnitz	17			
59	Szaszka	18			
60	Göllnitz	18			
62	Oravicza	18			
65	Banath	19			
66	Göllnitz	19			

Kupfer-Erzte

Figure 14 – Index.



55.

SIGNA CHYMICA.

womit die in beygefügten Verzeichnike enthal-
-dene Ertze, Metallen &c. &c. meistentheils geschri-
-ben werden.

Gold. ☉ oder ☌
Electrum. ⚮ oder ⚭
Silber ☽ oder ☽ᵛ
Kupfer ♀ oder ♀ᵛ
Bley ♄
Zinn ♃ oder 2♃
Eysen ♂
Quecksilber ☿ oder ☿ᵛ
Zinober ⚮ oder ☿♄
Kiesch ♍
Marcasiten ♎ oder ♎
Schwefel ♎
Antimonium ♁
Wismuth ⚯
Zink ♃♀
Spiauter Idem
Kobold ♏
Arsenicum ♁♁ alb. ♁♂ rub.
Salz ☉ Stein Salz ☉
Vitriol ☉ Kupfer-Wasser ☉
Alaun ☉
Stein Kohln ♍
Brennende Materien ♐

Signa Chymi
ca.

Figure 15 – Index-Signa chymica.

Figure 16 – Map of the mines cited in the *Collectio Mineralium*. Map by Johannes Mattes.

Origin of the Objects	Amount	Map Symbol
Non-Habsburg Dominions		
Latin America		
Potosí (MX)	1	
Germany		
Harz Mountains (Saxony) (D)	1	
Habsburg Dominions		
Archduchy of Austria		
Hallstatt (A)	6	A1
Annaberg (A)	1	A2
Spitz (A)	1	A3
Göttweig (A)	1	A4
Banat		
no specific location	5	
Moravița (RO)	1	B1
Oravița (RO)	17	B2
Ciclova Montană (RO)	2	B3
Moldova Nouă (RO)	1	B4
Sasca Montană (RO)	2	B5
Bohemia		
no specific location	1	
Horní Blatná (CZ)	1	B6
Jáchymov (CZ)	1	B7
Horní Slavkov (CZ)	4	B8
Carinthia		
no specific location	1	
Dellach (A)	1	C1
Ledellnigg near Kleblach-Lind (A)	1	C2
Paternion (A)	1	C3
Rosegg (A)	1	C4
Lessach (A)	1	C5
Cave del Predil (I)	5	C6
Carniola		
Idrija (SLO)	5	C7
Hungary		
no specific location	6	
Banská Štiavnica (SK)	46	U1
Kremnica (SK)	10	U2
Osada Magurka (SK)	1	U3
Hronec (SK)	6	U4
Švedlár (SK)	2	U5
Spišská Nová Ves (SK)	1	U6
Poráč (SK)	1	U7
Gelnica (SK)	6	U8
Štós (SK)	1	U9
Smolník (SK)	19	U10
Baňa Dolina (SK)	3	U11
Rudabánya (H)	1	U12
Styria		
no specific location	2	
Eisenerz (A)	27	S1
Frauenberg (A)	1	S2
Stuhlegg (bei Rettenegg) (A)	1	S3
Tyrol		
Schwaz (A)	1	T1
Valle Aurina (I)	13	T2
Transylvania		
no specific location	4	
Sacarîmb near Hunedoara (RO)	1	T3
Zlatna (RO)	4	T4
No location information provided	23	

Endnotes

1. Gold, quartz.
[i] The term "Schaar-Cluft" indicates a slot that joins with another. See: Beurard, Jean Baptiste. 1809. *Dictionnaire Allemand-Français contenant les termes propres à l'exploration des mines, à la minéralogie et à la minéralogie*, p. 382. Paris: Chez Mongie, jeune, Libraire.
[ii] Franz Zippe describes the term "Saal-Band" as follows: "The minerals have either grown directly on the rock of the mountain mass in the corridors or there is a peculiar, sometimes clayey mass between the rock and the grown minerals, which is usually called the band." See: Zippe, Franz Xaver. 1846. *Anleitung zur Gestein- und Bodenkunde oder das Wichtigste aus der Mineralogie und Geognosie*, p. 383. Prague: J. G. Calve'sche Buchhandlung. The historical English term "rider" or "rither" means an ore-deposit overlying the principal vein.

2. Gold, quartz, calcite, sphalerite.
[i] In mining, the term "Erz-Stufe" indicates a "hewn or chipped specimen of ore or stone, a handstone." See: Krünitz, Johann Georg. hrsg. von. 1841. *Oeconomische Encyclopädie*, vol. 177, p. 186 [article: Stufe]. Berlin: Pauli. Krünitz Enzyklopädie online: <http://www.kruenitz1.uni-trier.de/>.

3. Gold, ferro- or magnesio-hornblende.
[i] The term "Horn-Gestein" indicates hornblende. See: Reuss, Franz Ambrosius. 1798. *Dictionnaire de minéralogie*, p. 84. Hof: G.A. Grau. It is worth mentioning that the term "Hornstein" means quartz (var. *chalcedony, chert*). See: Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 152.

4. Quartz, silver-bearing chalcopyrite, galena.
[i] The term "Bleiglanz" is a synonym for common lead glance. See: Leonhard, Carl Caesar. 1809. *Handbuch einer allgemeinen topographischen Mineralogie,* vol. 3, p. 321. Frankfurt am Main: Bei Johann Christian Hermann.

Annarita Franza, University of Florence, Italy, annarita.franza@unifi.it, 0000-0003-3146-6957
Johannes Mattes, Austrian Academy of Sciences, Austria, johannes.mattes@oeaw.ac.at, 0000-0002-8546-7149
Giovanni Pratesi, University of Florence, Italy, g.pratesi@unifi.it, 0000-0001-6329-901X

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[ii] The term "löthig" means "having or containing one lot or half an ounce, from the word 'lot', a certain weight." See: Küttner, Carl Gottlieb, Nicholson, William. 1809. *New and complete Dictionary of the German language for Englishmen. According to the German Dictionary of Mr. J. C. Adelung*, vol. 2, p. 490. Leipzig: E.B. Schwickert. Translated in the following as "lots." In this regard, it is worth analyzing the weight units cited in the text. According to Metrà (1793–1797), the unit to measure gold and silver in Vienna divided as follows: Mark, Loth, Quintel, Ducaten, Pfennige, Mandel Gran. One mark corresponds to 16 lots, which are equivalent to 256 Pfennige (dinars). See: Metrà, Andrea. 1793–1797. *Il Mentore perfetto de' negozianti, ovvero Guida sicura de' medesimi, ed istruzione, per rendere ad essi più agevoli, e meno incerte le loro speculazioni*, 5 voll. Presso Wage Fleis e Comp.: Trieste. These observations are also reported in a manuscript dated back at the beginning of the 19th-century that is now preserved at the Central National Library of Firenze. The volume, which shows the stamp of the Museum of Physics and Natural History, is entitled *Pesi, misure e monete delle principali piazze dell'Europa* ("Weights, measurements and moneys of the main Europe's marketplace"). At page 112, it is said that there is only one weight unit in Vienna, i.e. the lot worthing diverse pounds depending on the object's quality. For example, the common pound (i.e., the weight unit employed to evaluate any kind of merchandise with the exception of gold, silver, jewellery, and apothecaries' products) is worth 32 lots, the pound utilized by apothecaries 24 lots, while the pound used by the jewellers is estimated to be 16 lots. The mark, which represents a precious metals weight unit from the 11th-century, is valued at 16 lots. See: Biblioteca Nazionale Centrale di Firenze, Palatino 1030, cc. 112–113.

5. Sphalerite, marcasite, stephanite, galena, quartz.
[i] The production of copper containing cuprous oxide in a special furnace is known as "Gaarmachen" (nearly equivalent to "refining"), and the copper is called "Gaar Kupfer" (nearly equivalent to "dry" copper). Quotation of Schnabel, Carl. 1905. *Handbook of Metallurgy. Translated by Henry Louis. 2nd Issue, vol. 1: Copper – Lead – Silver – Gold*, p. 238. London: Macmillan.

6. Galena, silver-bearing chalcopyrite, quartz.
[i] "Klein-speisig" means that an object is consisting of small shiny cubes or leaves. See: Krünitz, Johann Georg. hrsg. von. 1787. *Oeconomische Encyclopädie*, vol. 40, p. 327 [article: Klein=speisig]. Berlin: Pauli.

7. *Gold-bearing silver minerals.*
[i] In mining, a "Gefährte" is a vein or chasm, which runs parallel to the main corridor. See: Hartwig, Otto Ludwig. hrsg. von. 1782. *Johann Karl Gottfried Jacobssons Technologisches Wörterbuch*. Part II, p. 37. Berlin-Stettin: Nicolai.

8. *Gold-bearing silver minerals.*

9. Stephanite and/or achantite, calcite, silver.
[i] The term "Rösch-Gewüx" means silver ore containing arsenic, iron and copper or black silver-glance. See: Sporschil, John. edited by. 1830. *A complete dictionary of the English and German and German and English Languages*, vol. 2, p. 503. Leipzig: A.G. Liebeskind; and Lucas, Newton Ivory. 1868. *Englisch-Deutsches und Deutsch-Englisches Wörterbuch*, vol. 2, p. 1597. Bremen: Schünemann. See also: Zepharovich, Victor von. 1873. *Mineralogisches Lexicon für das Kaiserthum Österreich*, vol. 2: 1858–1872, p. 309.

Wien: W. Braumüller. In Hungarian mining towns, accumulations of small crystals of stephanite or polybasite are usually called "Rösch gewächs", in contrast to argentite, called "Weichgewächs."
[ii] The term "Erz-Stufe" indicates a "hewn or chipped piece of ore or stone, a handstone." See: Krünitz, Johann Georg. hrsg. von. 1841. *Oeconomische Encyclopädie*, vol. 177, p. 186 [article: Stufe]. Berlin: Pauli.
[iii] "Kalch"/"kalchartig" (or "Kalk"/"kalkartig") is a synonym for chalk/calcareous. See: Krünitz, Johann Georg. hrsg. von. 1784. *Oeconomische Encyclopädie*, vol. 32, p. 610 [article: Kalk]. Berlin: Pauli.

10. Malachite, goethite.
[i] The term "Bergart" means different kinds of ore (mountain kinds). See: Jablonski, Johann Theodor. 1748. *Allgemeines Lexikon der Künste und Wissenschaften*, p. 123. Königsberg-Leipzig: Hartung.

11. Galena, chalcopyrite.
The term "Küeß" means pyrite. As stated by Petrini (1792), it also indicates an iron ore mineralized by sulfur and arsenic (i.e. white pyrite, gray pyrite, gray-turquoise pyrite, and marcasite). See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 365. Roma: presso I Lazzarini.

12. Bornite/azurite (?).
The term "Lasurerz" means bornite, whereas "Lazur" indicates azurite. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 540.

13. Pyrite.

14. Calcite.

15. Chalcopyrite.
[i] The term "Spiegel spath" indicates "specular spath." It is a kind of spar, which consists of smooth, reflecting leaves. According to Demidov (1806), "Spiegel-Spath" is a calcareous spar formed by three-sided pyramids of yellow and sparkling brown color. See: Krünitz, Johann Georg. hrsg. von. 1833. *Oeconomische Encyclopädie*, vol. 137, p. 506 [article: Spiegelspath]. Berlin: Pauli. Demidov, Pavel Grigorevic. 1806. *Minéraux et pétrifications*, vol. 2, p. 100. Moscow: Schildbach; Valentini, Francesco. 1836. *Gran dizionario grammatico-pratico italiano-tedesco, tedesco-italiano*, vol. 2, p. 1054. Lipsia: Barth.

16. Chalcopyrite.
In mining, the term "Gelf-Erz" (or "Kupferkies") indicates yellow copper ore, which is chalcopyrite. The term also indicates a copper gold mine. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 72. Roma: presso I Lazzarini; Joyce, Frederick. 1827. *Praktische Anleitung zur chemischen Analytik und Probierkunst*. Translated by Joseph Waldauf von Waldenstein, p. 204. Vienna: Mörschner und Jasper; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 129.

17. Quartz, *copper- and silver-bearing minerals*.

18. Tenorite, chrysocolla, goethite, malachite, manganese oxides.
[i] The term "Pech Kupfer Erzt" (copper pitch ore or pitchy copper ore) indicates a mixture of tenorite + chrysocolla + goethite + malachite + MnO. See: Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 276. Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 238.

19. Chalcopyrite.
[i] The expression "Küeßige Gelf Erzt Stufe" indicates "a specimen of yellow copper pyrite ore", i.e., chalcopyrite. See: Egleston, Thomas. 1886. *Catalogue of Minerals and Synonyms*, p. 42. Washington: U.S. Government Printing Office.

20. Chalcopyrite.
[i] "Hangend" is a mining term meaning a location designation for rock that overlays a reference layer. In mining, it normally indicates the roof of a gallery. See: Murawski, Hans, Meyer, Wilhelm. edited by. 2010. *Geologisches Wörterbuch. 12th Issue*, p. 70. Cham: Spektrum Akademischer Verlag.

21. Galena.
According to Duhamel (1800), in Hungarian mines, the term "Bleyschuss" means galena. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*, p. 32. Paris: chez Courcier.

22. Chalcopyrite, malachite, bornite/azurite (?).

23. *Copper- and silver-bearing minerals*.

24. Sphalerite, calcite, chalcopyrite.

25. Sphalerite, aragonite (var. *flos ferri*), malachite.
[i] The term "Eisenschuß" or "Eisenmal" indicates a "dark, brown, valueless mountain type" or "similar valueless rock, which breaks with the hermaphrodites or tin ores." See: Krünitz, Johann Georg. hrsg. von. 1785. *Oeconomische Encyclopädie*, vol. 10, p. 690 [article: Eisenmal]. Berlin: Pauli.

26. Quartz, chalcopyrite, arsenopyrite (?).
[i] According to Petrini (1792), the term "Speiss" indicates "mispickel", i.e. white arsenical pyrite. The term "mispickel" actually refers to arsenopyrite. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 100. Roma: presso I Lazzarini; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 231.

27. Calcite, chalcopyrite, *copper-bearing minerals*.
[i] The term "pfauen Schweifigen" means peacock tarnish, which is a balanced assemblage of yellow, green, blue, and red colors with a dark shade of brown. Blue and yellow generally predominate, and yellow seems to be the ground color. It is sometimes found on yellow copper ore. See: Hoffmann, Christian A. 1811. *Handbuch der Mineralogie*, vol. 1, p. 87. Freiberg: Craz und Gerlach; Werner, Abraham Gottlob. 1849–1850. *A Treatise on the External Characters of Minerals*, edited by the Wernerian Club, p. 59. London: Wernerian Club.

28. Calcite, chalcopyrite, tetrahedrite/tennantite.
[i] "Fahlerz" or "Fallerz" means grey copper. It may indicate tetrahedrite or tennantite. See: Freiesleben, Johann Carl. 1848. *Vom Vorkommen der Kupfererze in Sachsen*, p. 132. Freiberg: Engelhardt; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 310.

29. *Copper-bearing minerals*.

30. Chalcopyrite, *silver-bearing minerals*.

31. Sphalerite, chalcopyrite, alabandite.
[i] The term "Schwarzerzt" means "black silver-ore." It may indicate alabandite, stephanite, and tetrahedrite. See: Beil, Johann A., Karmarsch, Karl. 1853. *Technologisches Wörterbuch der deutschen, französischen und englischen Sprache*, p. 519. Wiesbaden: Verlag von Christian Wilhelm Kreidel; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 862.

32. Aragonite (var. *flos ferri*), chalcopyrite.
[i] The term "Eisenblüte"—and all its spelling variants, the most common being "Eisenblüth"—is an old German name for "aragonite." In the early 19th-century literature it also indicates the growth of mineral formations in caves as stalagmites and stalactites. Melzer used it to describe an unspecified mineral sample. According to Petrini (1792), "Eisen bluth" indicates "flos ferri." See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 82. Roma: presso I Lazzarini.
[ii] The term "Schmölz" does not refer to a location, but to the modern German term "Schmelze" that means smelted ores in a smeltery. See: Newton, Ivory Lucas. 1868. *Englisch-Deutsches und Deutsch-Englisches Wörterbuch*, p. 1712. Bremen: Schünemann.

33. Cuprite, azurite.
[i] The term "Lebererz" can indicate various types of minerals as brown and liver-colored "feather ore", liver- and yellow-colored copper ore or red-colored ironstone. See: Adelung, Johann Christoph. 1796. *Grammatisch-kritisches Wörterbuch der Hochdeutschen Mundart. 2nd Issue,* vol. 2, p. 1959. Wien: Bauer.

34. Chalcopyrite (?).

35. Chalcopyrite.
[i] The term "angeflohen" means "tinge." See: Archivio Museo di Storia Naturale di Firenze (AMSN). … *Cataloghi delle produzioni naturali passate al Real Museo prima del 1792.* …

36. Chalcopyrite, pyrite (?).

37. Chalcopyrite.

38. Bornite, malachite.
[i] The term "braun Kupfer" indicates bornite, whereas "grün Kupfer" means malachite. The latter term indicates what in Hungarian mines is known as mountain-green ("verd de montagne"), which is found within copper strands. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*,

p. 113. Paris: chez Courcier; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 151, p. 386. Both of the above-mentioned minerals are not listed in the Mindat database for Oravița.

39. Gold-bearing pyrite (*arsenian*)/marcasite/arsenopyrite.
Despite the fact that today marcasite is a well identified mineralogical species, in the 18th-century the term "marcasiten" meant arsenopyrite ("arsenic-kies"). On this basis, it is difficult to determine which mineralogical species the author was referring to, because gold may be contained in arsenian pyrite, marcasite, and arsenopyrite. See: Reuss, Franz Ambrosius. 1798. *Dictionnaire de minéralogie*, p. 386. Hof: G.A. Grau.

40. Chalcopyrite, calcite.

41. Bornite, chalcopyrite, achantite/galena.

42. Pyrite.
[i] According to Bayliss (2011) the term "Gelf-Erz" means Ag-rich chalcopyrite or Ag- or Au-rich pyrite. In this case, the link between the terms "gelf" and "Küeß" emphasizes the occurrence of a pyrite with a high content of silver. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 367.

43. Galena, chalcopyrite.

44. Berthierite (?), arsenopyrite (?), tetrahedrite/tennantite.
[i] "Schüssig" is a term used by miners and means "haltig" ("containing an uncertain/low amount of"). See: Wünsch, Christian Ernst. 1781. *Briefwechsel über die Naturprodukte. Part I: Von den Mineralien*, p. 356. Leipzig: Breitkopf.

45. Pyrite, bornite, azurite (?), malachite.

46. Chalcopyrite, achantite, siderite.
[i] The term "Kern" is a synonym for "Spatheisenstein", which means siderite. See: Reuss, Franz Ambrosius. 1798. *Dictionnaire de minéralogie*, p. 92. Hof: G.A. Grau; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 920.

47. *Iron-bearing minerals*.
[i] The expression "löthen Schmunde" most likely refers to "valueless rock residue."

48. *Iron-bearing minerals*.
[i] The term "Eisenstein" means ironstone. However, iron-bearing specimens usually do not contain silver-bearing minerals (in particular, if they are oxides or oxyhydroxides, like in this case).

49. Quartz, calcite.

50. Calcite, chalcopyrite.

51. Achantite/galena, chalcopyrite, calcite.
The Mindat database do not report achantite among the mineralogical species that have been found in this locality so far.

52. Hematite, goethite, chalcopyrite.
[i] The term "Kernstufe" indicates "brown hematite", which means goethite. See: Cuyper, Antoine Charles de. edited by. 1869. *Revue de l'exposition de 1867: publiée par la revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie*, vol. 3, p. 571. Paris: Noblet; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 52; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 157.
[ii] "Branderz" means bituminous cinnabar-ore. See: Ebers, John. edited by. 1796. *The new and complete dictionary of the German and English dictionary*, vol. 1, p. 452. Leipzig: Breitkopf and Haertel.
[iii] Volkelt describes "drusen" as different "types of spar, in a holey structure, or caves and fissures in the mountains." See: Volkelt, Johann Gottlieb. 1775. *Historische Mineralogie oder Beschreibung der Mineralien*, p. 109. Breslau-Leipzig: Gutsch.
[iv] It is very likely that the term "Vütterung" is an old expression of "(Ver)Witterung" (weathering). Or it means "Fütterung" (filling).

53. Tetrahedrite/tennantite.

54. Silver (native), quartz, calcite.

55. Calcite, chalcopyrite, chalcocite.
[i] The term "Graupen" indicates an ore in form of granules. See: Minerophilus, [Johann Caspar Zeisig]. 1743. *Neues und Curieuses Bergwercks-Lexicon*, p. 274. Chemnitz: Joh. Christoph und Joh. David Stößeln/Stößel.

56. Chalcopyrite.

57. Stephanite and/or achantite, chalcopyrite.

58. Stephanite and/or achantite, quartz (var. *hyalin*).

59. Achantite/galena.
[i] The term "Glanz-Erzt" usually indicates achantite. In the 18th-century scientific literature it also means galena. However, it is unlikely that the cataloguer referred to these mineralogical species, while describing the sample. Indeed, it contained up to 60 pounds of refined copper.

60. Tetrahedrite/tennantite, chalcopyrite.

61. Nickeline, almandine.
[i] The term "Kupfer Nückl" indicates nickeline. In 1694, Urban Hjärne (1641–1724) named it "Kupfernickel" after Old Nick, a mischievous and deceptive spirit of German mythology. The ore seemed to contain copper but yielded none. The term also refers to the German words meaning "copper nickel" due to ore's pale color and nickel content. According to Petrini (1792), "Kupfernickel" indicates a nickel specimen containing sulfur, arsenic, iron and cobalt. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 201. Roma: presso I Lazzarini; Howard-White, Frank Buller. 1963. *Nickel, an historical review*, p. 31. London: Van Nostrand.

62. *Silver- and lead-bearing minerals.*
[i] The term "Pochgang" or "Pocherz" means ore that is already extracted, but not yet crushed or further processed. In: Tolhausen, Alexandre. edited by. 1878. *Technological Dictionary in the English, German & French Languages: Containing about 76,000 Technical Terms and Locutions Employed in Arts, Trades and Industry in General. 2nd Issue*, p. 429. Leipzig: B. Tauchnitz.

63. Cassiterite.
[i] The term "Zwitter" goes back to the idea that there exists a hybrid type between rock and ore, called "Zwitter." In most cases, the term indicates cassiterite or tinstone. See: Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 392.
[ii] The term "Zinn Graupen" indicates a tin ore showing large granules. Crystals small in size are called "Zinn Zwitter". See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 116. Roma: presso i Lazzarini.

64. Stephanite and/or achantite, quartz, *copper-bearing minerals*.

65. *Copper-bearing minerals,* bornite, azurite (?).
According to the Mindat database, it is worth mentioning that neither bornite nor azurite are mineralogical species found in this area so far.

66. Tennantite/tetrahedrite/chalcocite, marcasite.
[i] The term "fahlerzt" means dark and white copper. See: AMSN. … *Catalogo delle produzioni naturali passate al Real Museo di Firenze prima dell'anno 1792*. …
[ii] The term "weiß Kupfer Erzt" means white copper, which is marcasite. According to Petrini (1792), the term also indicates a copper ore that has been mineralized by sulfur, and arsenic with a minimum iron content. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 69. Roma: presso I Lazzarini; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 377.

67. *Iron-, antimony-, copper- and silver-bearing minerals.*

68. Chalcopyrite, pyrite (?), calcite.

69. Galena, stephanite and/or achantite, rhodochrosite.

70. Pyrite.

71. *Silver-bearing minerals.*

72. Stephanite and/or achantite.

73. *Silver-bearing minerals.*

74. Chalcopyrite in calcite and quartz (on calcium amphibole subgroup).

75. *Silver-, copper-, and lead-bearing minerals* with achantite and/or stephanite.

76. Chalcopyrite.

77. Chalcopyrite.
[i] The term "Seiger[-]tiefe" means perpendicular depth. See: Grieb, Christopher Friedrich. 1873. *Dictionary of the German and English Languages. 7th Issue*, vol. 2, p. 781. Stuttgart: Neff.

78. *Lead- and iron-bearing minerals* (silver was probably contained in galena).

79.–80. Chalcopyrite and pyrite.

81. *Silver-bearing minerals.*

82. Quartz (*var. amethyst*), sphalerite, pyrargyrite.
[i] The term "blending" indicates a piece of ore that contains zinc blende. See: Anonymous. hrsg. von. 1854. „Vereinsnachrichten für den Monat November 1854". *Verhandlungen und Mitteilungen des siebenbürgischen Vereins für Naturwissenschaften* 5 (11): 175.
[ii] The term "Roth gülden Erzt" indicates a red silver-rich ore. According to Duhamel (1800), this kind of mineral, whose crystals are transparent like a ruby ("durchsichtig"), is hard to recognize if the sample has not been cut with a knife. The term indicates pyrargyrite. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*, p. 149. Paris: chez Courcier; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 305.

83. *Iron oxide-hydroxide minerals.*
[i] In mining, the term "Gur" or "Guhr" describes a mushy, earthy liquid: "In mining, the word 'Guhr' is used to refer to a moist, greasy substance that emerges from the rock and mountain fissures, which looks like a very finely powdered white chalk or lime-like earth but is of liquid constancy like porridge. Oftentimes, it looks like buttermilk. The miners consider the 'Guhr' a fairly certain sign of the presence of a metallic vein." See: Ersch, Johann Samuel. 1877. *Johann Gottfried Gruber: Allgemeine Encyclopädie der Wissenschaften und Künste*, vol. 96, p. 240. Leipzig: J.F. Gleditsch.

84. Chalcopyrite, *iron-bearing minerals*, calcite, quartz, malachite (?), cinnabar.
[i] The expression "Weiss Eisen Spath" is a synonym for "Stahlstein", which means white or spathic iron. According to Petrini (1792), it was a mixture of iron brown lime with manganese white lime and air lime in different proportions. This kind of ore has granules, and it is often mixed with quartz and pyrite. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 81. Roma: presso I Lazzarini.

85. No mineralogical features are described for this specimen.

86. *Asbestos.*
The term "Stein-Flachs" means "Asbestos." See: Krünitz, Johann Georg. hrsg. von. 1733. *Oeconomische Encyclopädie*, vol. 2, p. 492 [article: Asbest]. Berlin: Pauli.

87. Tennantite and/or tetrahedrite.

88. Copper.

[i] The term "Cuprum virgineum" means "native copper." See: Lenz, Johann Georg. 1794. *Versuch einer vollständigen Anleitung zur Kenntniss der Mineralien: Metalle und Gebirgsarten*, vol. 2, p. 11. Leipzig: Crusius.
[ii] The expression "Anima Veneris" means anima of Venus/Copper. Similarly, it refers to a former preparation of copper. See: Hopper, Robert. 1845. *Lexicon Medicum, or Medical Dictionary*, vol. 1, p. 69. New York: Harper & Brothers.
[iii] The specimen's mineralogical features suggests that the cataloguer described a "Kupfer glassertz" (vitreous copper). It indicates a copper ore that had been mineralized by sulfur and has no iron content. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 65. Roma: presso I Lazzarini.

89. Copper.
[i] Zincken (1762) describes the term "Cement Kupfer" ("cement copper") as follows: "Cement copper: in the Hungarian mine near the mountain town of Neusel, there is a spring in the so-called "Herrengrund", deep in the mountain. If you put iron in this water, the iron is covered with a crust of small copper particles and is increasingly lost under this copper crust, until it is completely consumed. The copper, which has remained in the form of iron, like a nutshell, is so fine that it can be worked and driven like silver and is called cement copper. When it gets gold plated, it is easy that [costumers] will be cheated, because they don't realize the smoothness of copper in goldsmithing." See: Zincken, Georg Heinrich. 1762. *Curieuses und reales Natur-Kunst-Berg-Gewerck- und Handlungs-Lexikon*, p. 449.

90. Almandine-pyrope.
The specimen's provenance is not specified. Nevertheless, many localities, where almandine-pyrope garnets were found, are well known in Hungary starting from Medieval time. See: Horváth, Eszter, Bendő, Zsolt. 2011. "Provenance study on a collection of loose garnets from a Gepidic period grave in Northeast Hungary." *Archeometriai Muhely* 8: 17–32.

91.–95. Mercury, cinnabar, calcite.

96. Cinnabar, stephanite and/or achantite.

97. Silver.

98.–112. *Iron- and copper-bearing minerals,* silver.
[i] In mining, the term "angestandten" means an ore that is exposed in a gallery.

113. Quartz, stephanite and/or achantite, galena, wulfenite (?).

114.–116. Calcite/aragonite/dolomite.
[i] Bergmilch" (or "Höhlenmilch", "Mondmilch", "Nix", "*Lac Lunae*", in English "moonmilk") is a pasty or crumbly form of calcite or other calcareous mineral, which is microcrystalline. See: Krünitz, Johann Georg. hrsg. von. 1803. *Oeconomische Encyclopädie*, vol. 93, pp. 378–9 [article: Mondmilch]. Berlin: Pauli.

117. *Silver-, copper- and iron-bearing minerals.*
The specimen's description seems to refer to "miniera bruna" (brown ore). This ore contains copper, sulfur, arsenic, a minimum content of iron and antimony, and up to

5 parts of silver. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 365. Roma: presso I Lazzarini.

118. Gypsum.
[i] The term "Frauen-Eis" (or "Marien-Eis", "Marien-Glas") indicates gypsous spar or selenite. See: Krünitz, Johann Georg. hrsg. von. 1795. *Oeconomische Encyclopädie*, vol. 67, p. 392 [article: Frauen-Eis]. Berlin: Pauli.

119. Halite.

120. Halite.

121. Halite.

122. Halite.

123. *Petrified wood.*

124. *Petrified wood.*

125. *Petrified wood.*

126. *Anthracite*.

127. Pyrargyrite, marcasite.

128. Pyrargyrite.

129. Achantite, quartz, siderite.
[i] "Pachmann" or "Pachma(h)l" indicates "pure pieces of silver ore, similar to Glaserz." See: "Letter of Johann Christoph Götz, 16 January 1737." 1795. In *Mineralogische, Chemische und Alchymistische Briefe von reisenden und andern Gelehrten an den ehemaligen Churs ächsischen Bergrath J. F. Henkel*, hrsg. von Anonymous, vol. 3, p. 281. Dresden: Walther.

130. Galena.
[i] The term "bley-schweif" is used to indicate a sample of galena with a lower content of sulfur. The term also indicates a lead ore that is similar to galena, which has not a distinct shape. This kind of ores are transparent, and greasy to the touch. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 32. Roma: presso I Lazzarini.

131. Crocoite (?).
Crocoite was recognized by Mikhail Vassilyevich Lomonosov (1711–1765) in 1763 as a "red lead ore." However, no crocoite has been found in Banská Štiavnica so far. Other orange/red lead minerals, such as vanadinite or wulfenite, have been only recently recovered in Banská Štiavnica. Moreover, wulfenite was originally named as "plumbum spatosum flavo-rubrum" in 1772 by Ignaz von Born (1742–1792) and vanadinite was discovered only in 1801. See: Auer, Christian. 1998. "The Annaberg District: Lower Austria." *Mineralogical Record* 29: 177–89.

132. Chalcanthite, quartz, aragonite (var. *flos ferri*).

133. Chalcanthite (?), tetrahedrite/tennantite/ chalcocite, aragonite (var. *flos ferri*).
[i] The term "Hornschiefer" indicates a "kind of horn rock (Corneus fissilis), which consists of leaves and slices, and has a blackish, dark brown, red or other color." See: Krünitz, Johann Georg. hrsg. von. 1789. *Oeconomische Encyclopädie*, vol. 6, p. 761 [article: Horn-Felsstein]. Berlin: Pauli.

134. *Pietrified wood.*

135. Quartz (*var. amethista*).

136. Quartz (*var. amethista*).

137. Achantite.

138. Gold, silver, antimony.

139. Antimony or stibnite.
[i] The term "Spießglas" is a synonym for antimony (glance). See: Ludwig, Christian. 1765. *Teutsch-Englisches Lexicon. 3rd Issue*, col. 120. Leipzig: Gleditsch.

140. *Iron-bearing minerals.*
The samples reported in the records 140–144 are very interesting. In fact, the writer used some phrases (e.g. "found on a field"; "ironstone of rare kind, striking in clay-like sediments"; "pure iron"; "very compact ironstone") that recall the physical characteristics of iron meteorites. However, according to the Meteoritical Bulletin Database, no meteorite occurrences have been reported for this locality so far.

141. *Iron-bearing minerals.*

142. *Iron-bearing minerals.*

143. *Iron-bearing minerals.*
[i] The term "letten" indicates an unusable "tough, fat and greasy mountain kind, like clay." It is also used as synonym for damp-muddy soil, loamy mud. Krünitz, Johann Georg. hrsg. von. 1799. *Oeconomische Encyclopädie*, vol. 77, p. 296 [article: letten]. Berlin: Pauli.

144. *Iron-bearing minerals.*

145. Goethite.
[i] The term "Alderstein" means "Aetites." See: Franke, [Traugott]. 1855. *Technologisches Wörterbuch der deutschen, französischen und englischen Sprache: mit Bezug auf Gewerbe, Physik, Chemie, Nautik, Bergbau, Mineralogie und sonstige mechanische und industrielle Wissenschaften*, p. 3. Wiesbaden: Kreidel.
[ii] In German, the term "pülsche" was used for liquids that become turbid when mixed. See: Müller, Josef. hrsg. von. 1944. *Rheinisches Wörterbuch*, vol. 6, col. 1184–5. Bonn: F. Klopp.

146. Malachite.
[i] The term "natürliches Berg-Grün", produced in Hungary, indicates a copper mineral. See: Krünitz, Johann Georg. hrsg. von. 1792. *Oeconomische Encyclopädie*, vol. 56, p. 115 [article: Kupfer]. Berlin: Pauli.
[ii] The term "Berg-Grün" (verde di montagna) means malachite. See: AMSN. … *Catalogo delle produzioni naturali passate al Real Museo di Firenze prima dell'anno 1792 …*; Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 58. Roma: presso I Lazzarini.

147. Calcite, quartz, iron oxide-hydroxide minerals.

148. Rhodochrosite, quartz, hematite/pyrite.
[i] The term "Zinopel" may indicate both a red massive quartz + hematite and a mixture of iron-rich quartz [Jasper] and pyrite. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 1090; Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 391.

149. Quartz, hematite, galena.

150. Calcite, *silver-bearing minerals.*

151. Pyrargyrite, stephanite and/or achantite, silver.

152. Quartz (*var. aventurine*), stephanite and/or achantite, pyrargyrite.

153. Pyrargirite, sillimanite, achantite/chlorargyrite.
[i] In mining, the term "Gewächs-Erz" or "Unter-Erd-Gewächs" is used as a synonym for mineral specimens. See: Weber, Johann Anton. 1745. *Lexicon Encyclion. Oder kurzgefaßtes Lateinisch-Teutsches und Teutsch-Lateinisches Universal-Wörterbuch*, p. 832. Chemnitz: Stößel.
[ii] The term "Glanzspath" means sillimanite. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 376.
The term "Glaserz" indicates silber glance. See: Siegl, Walter. 1951. „Erzmikroskopische Studie des Glaserzes des Radhausberges bei Gastein". *Mitteilungen der Österreichischen Mineralogischen Gesellschaft* 112: 131–43. However, this term might also indicate chlorargyrite, a mineral that is often found in the Harz mountains (Germany). See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 376.

154. Proustite.
[i] The term "Rothgulden Bluth" indicates a red radiated or streaked silver ore. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 35. Roma: presso I Lazzarini.
[ii] The term "blutmahlig" was hardly used and indicates the color of a red/blood mole. Short (1931) stated that "proustite is a lighter red in hand specimen than pyrargyrite." The specimen analyzed here has been described as "reddish-golden, blood-colored." So it is possible to identify the specimen as a proustite sample. See: Short, Maxwell Naylor. 1931. *Microscopic Determination of the Ore Minerals, USGS Bulletin 825*, p. 136.

155. Cinnabar.

156. Jarosite, *copper-bearing minerals*.

157. Galena.

158. Galena.
[i] In mining, the term "Zubau" means the construction of a gallery that leads to a main gallery or shaft.

159. Mercury.

160. Hydrozincite.
[i] See for the German term "Galmei" or "Galmey": Krünitz, Johann Georg. hrsg. von. 1788. *Oeconomische Encyclopädie*, vol. 15, p. 800 [article: Galmey]. Berlin: Pauli. The term indicates smithsonite and/or hydrozincite. See: Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 128.

161. Hydrozincite.

162. Smithsonite.

163. Smithsonite.

164. Gold.

165. Achantite, *copper-bearing minerals.*
[i] In mining, a rock or mountain is called "mild" if it offers low resistance, is soft and easily fragile.

166. Chalcopyrite.

167. Chalcopyrite.

168. Chalcopyrite.

169. Chalcopyrite, pyrite.

170. Chalcopyrite, pyrite.

171. Pyrite.

172. Pyrite.

173. Marcasite.

174. Chalcopyrite.

175. Cuprite (?).
[i] The term "schwarz Kupfer" means "black copper." It may indicate cuprite or teno-

rite. Cuprite is a copper ore so it is possible that the cataloguer was describing a cuprite sample. However, no cuprite has been found in the Ahrn Valley (South Tyrol) so far according to the Mindat database. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 864.

176. Copper, *copper-bearing minerals.*
[i] The term "Rosette Kupfer" indicates "rose-copper", which means refined copper. See: Franke, [Traugott]. 1855. *Technologisches Wörterbuch der deutschen, französischen und englischen Sprache: mit Bezug auf Gewerbe, Physik, Chemie, Nautik, Bergbau, Mineralogie und sonstige mechanische und industrielle Wissenschaften*, p. 126. Wiesbaden: Kreidel.

177. Copper.
The term "Kupferkönig" means "le régule de cuivre", which is the regulus of copper. It indicates the finer and most weighty part of a copper ore, which settles at the bottom during the melting process. See: Schwan, Christian Friederich. 1784. *Nouveau dictionnaire de la langue allemande et Françoise*, vol. 2, p. 135. Amannheim: Schwan et Fontaine; Krünitz, Johann Georg. hrsg. von. 1792. *Oeconomische Encyclopädie*, vol. 56, p. 250 [article: Kupfer-König]. Berlin: Pauli; Küttner, Carl Gottlieb, Nicholson, William. 1809. *New and complete Dictionary of the German language for Englishmen. According to the German Dictionary of Mr. J. C. Adelung*, vol. 2, p. 387. Leipzig: E.B. Schwickert.

178. *Schist.*

179. Cassiterite.
[i] The term "Strahlen" is an old synonym for crystals. See: Nemnich, Philipp Andreas. 1821. *Neues Waaren-Lexikon in zwölf Sprachen*, vol. 3, col. 157. Hamburg: Müller.
[ii] The term "Ma(h)lwerk" indicates black clear tin ore in schist rock. See: Anonymous. hrsg. von. 1772. *Vollständiger Catalogus einer Suiten Mineralien-Sammlung*, p. 198. Leipzig.

180. Cassiterite.

181. Cassiterite.

182. Cassiterite.
[i] The mineralogical term "gediegen" means pure.

183. Cassiterite.

184. Realgar (?), sulfur.
The expression "roth und gelber Schweffel" indicates red sulfuret of arsenic, which means realgar. However, any realgar samples have been found in Smolník so far according to the Mindat database. See: Fourestier, Jeffrey de. 1999. *Glossary of Mineral Synonyms. The Canadian Mineralogist, Special Publication*, p. 299.

185. Hematite, quartz, *mica minerals group.*
[i] The term "Eisenstein" means iron-ore, which is hematite. See: Franke, [Traugott]. 1855. *Technologisches Wörterbuch der deutschen, französischen und englischen Sprache: mit Bezug auf Gewerbe, Physik, Chemie, Nautik, Bergbau, Mineralogie und sonstige mechanische und industrielle Wissenschaften*, p. 275. Wiesbaden: Kreidel.

[ii] The term "Greis" indicates a mixture of quartz and glimmer. See: Leonhard, Carl Caesar. 1809. *Handbuch einer allgemeinen topographischen Mineralogie*, vol. 2, p. 357. Frankfurt am Main: Hermann.

186. Andradite.
According to the Mindat database only andradite garnets have been found in Frauenberg so far.

187. Marcasite.

188. Hematite.

189. Hematite, *silver-rich copper-bearing minerals.*
[i] The term "Steinglas" indicates glass impured by minerals.

190. Galena.

191. Hematite, azurite, malachite (*pseudomorph after azurite*).
[i] As stated by Duhamel (1800), the term "Kupfer Lazur" means "mountain-blue." It derives from the decomposition of Cu-rich pyrites. The term describes a blue-copper ore that has been mineralized by sulfur. The term indicates azurite. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*, p. 113. Paris: chez Courcier; Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 529. Roma: presso I Lazzarini.

192. Hematite.

193. Cassiterite.
[i] The term "(Poch)Stempel" indicates a tool to crush the ore during the process of beneficiation. See: Beil, Johann A., Karmarsch, Karl. 1853. *Technologisches Wörterbuch der deutschen, französischen und englischen Sprache*, p. 438. Wiesbaden: Kreidel.

194. Cassiterite.

195. Cassiterite.

196. Cassiterite, *copper-bearing minerals.*

197. Ferberite and hübnerite (*a mixture of*).
[i] The term "Wolfram" indicates a mineral that is usually found in tin mines. It is black or brown, shiny, and layered. This kind of ores, although very heavy, can be crushed with the fingers. According to Lehmann (1761), the term indicates a mixture of silica and iron lime with a minimum content in tin lime. It means Mn-rich ferberite or Fe-rich hübnerite. See: Lehmann, Johann Gottlob. 1761. *Physikalisch-chymische Schriften, als eine Fortsetzung*, p. 356. Berlin: Wever; Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 102. Roma: presso I Lazzarini; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 1064.

[ii] The term "unart" indicates the so-called gangue, a commercially worthless material that surrounds, or is closely mixed with a wanted mineral in an ore deposit. The separation of minerals from gangue is known as mineral processing. See: Krünitz, Johann Georg. hrsg. von. 1848. *Oeconomische Encyclopädie*, vol. 195, p. 227 [article: Unart (Bergbau)]. Berlin: Pauli.

198. The mineralogical features of the analyzed specimen have not been described.

199. The mineralogical features of the analyzed specimen have not been described.

200. The mineralogical features of the analyzed samples have not been described.

201. Cassiterite, arsenopyrite.
[i] The term "Weiss Zinn" means "white tin." It indicates a white or gray, sometimes greenish or yellowish ore, semi-transparent and crystallized in pyramids or irregular shapes. See: Petrini, Giovanni Vincenzo. 1792. *Gabinetto mineralogico del Collegio Nazareno descritto secondo i caratteri esterni e distribuito a norma de principi costitutivi*, vol. 2, p. 116. Roma: presso I Lazzarini.

202. Quartz, *mica minerals group.*

203. Quartz, *mica minerals group.*

204. Quartz, *mica minerals group.*

205. Quartz, *mica minerals group.*
[i] In mining, the term "Erbeis" means that the material is very hard so that the miners have to interrupt their work. See: Grimm, Jacob, Grimm, Wilhelm. hrsg. von. 1862. *Deutsches Wörterbuch*, vol. 3, col. 713–5. Leipzig: S. Hirzel.

206. Quartz, *mica minerals group.*

207. Quartz, *mica minerals group.*

208. Quartz, *mica minerals group.*

209. Quartz (*var. rose*), *mica minerals group.*

210. Quartz, *mica group minerals*, *iron-bearing minerals*.
[i] In mining, the term "Schrot" indicates iron grains that remain in the slag, when the iron melts in the furnace. See: Grimm, Jacob, Grimm, Wilhelm. hrsg. von. 1899. *Deutsches Wörterbuch*, vol. 15, col. 1775. Leipzig: S. Hirzel.

211. Quartz, *mica group minerals*.

212. Quartz, *mica group minerals,* siderite.
According to De Fourestier (1999), the term "Blau-Erz" means siderite. Bayliss (2011) noted that the term also indicates "altered siderite." On this topic see Prochaska, Walter. 2012. "Siderite and magnesite mineralizations in Palaeozoic strata of the Eastern Alps (Austria)." *Journal of Alpine Geology*: 309–22. See Fourestier, Jeffrey de. 1999. *Glossary*

of Mineral Synonyms. The Canadian Mineralogist, Special Publication, p. 45; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 134.

213. Quartz (*var. amethyst*).

214. Quartz (*var. amethyst*).

215. Quartz, *mica group minerals.*

216. *Iron-bearing minerals.*

217. *Iron-bearing minerals*, siderite, ankerite.
In mining, the term "Plinz" (or "Flinz", "Plönz") is a synonym for iron spar ("Eisenspat"). See: Schiller, Erich. edited by. 1878. *Technological Dictionary. English, German, French*, p. 357. Wiesbaden: Bergmann.
[ii] In mineralogy, the term "Roßzahn" (or "Rohwand", "Wandstein") is a synonym for ankerite. Niederrist, J[osef]. 1857. *Naturgeschichte des Mineralreiches für den practischen Bergmann*. Part I, p. 145. Brünn: Winiker.

218. Opal (*var. hyalite*).

219. Siderite.

220. Goethite and/or ferrihydrite.
[i] The term "Modererz" means goethite ± ferrihydrite. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 637.

221. Siderite.

222. Siderite.

223. *Iron oxide-hydroxide minerals*, opal (*var. hyalite*).

224. Siderite, *iron-bearing minerals.*

225. Azurite (?).

226. Siderite (covered by quartz or calcite?).

227. The mineralogical features of the analyzed samples have not been described.

228. Quartz, *mica group minerals.*

229. *Iron-bearing minerals.*
[i] The term "Roth stein" indicates a red ore ("pierre rouge"). Its color is due to the high content of metal oxides, especially iron. According to Duhamel (1800), the iron content is so high in this kind of minerals that even the soil and the plants surrounding their place of recovery are "tinted" in red. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*, p. 150. Paris: chez Courcier.

230. Quartz, ankerite.

231. *Iron oxide-hydroxide minerals pseudomorph after pyrite.*
As stated by Duhamel (1800), the term "Leber-farben" indicates a liver-colored mineral. It may indicate either an assemblage of cuprite ± chrysocolla ± goethite or an assemblage of cinnabar ± idrialite ± clay. See: Duhamel, [Jean-Pierre-François Guillot-]. 1800. *Dictionnaire portatif allemand et français des termes de mines*, p. 116. Paris: chez Courcier; Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 561.

232. Siderite (covered by quartz or calcite?).

233. Siderite, *iron-bearing minerals.*

234. *Iron-bearing minerals.*

235. Marcasite.

236. Vivianite.
[i] The term "Blau-Eisen-Erz" indicates vivianite. See: Bayliss, Peter. 2011. *Glossary of obsolete mineral names. The Mineralogical Record. 2nd Issue*, p. 133.

237. Vivianite.

238. Siderite.

239. Siderite.

240. *Iron-bearing minerals,* siderite.

241. *Hydrated iron sulphate minerals.*

242. Siderite, hematite.

Note
For "Stuffen-Probe" see: Krünitz, Johann Georg. hrsg. von. 1820. *Oeconomische Encyclopädie*, vol. 117, p. 470 [article: Probe]. Berlin: Pauli.

Index of names and places

Index of names

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Index of Places

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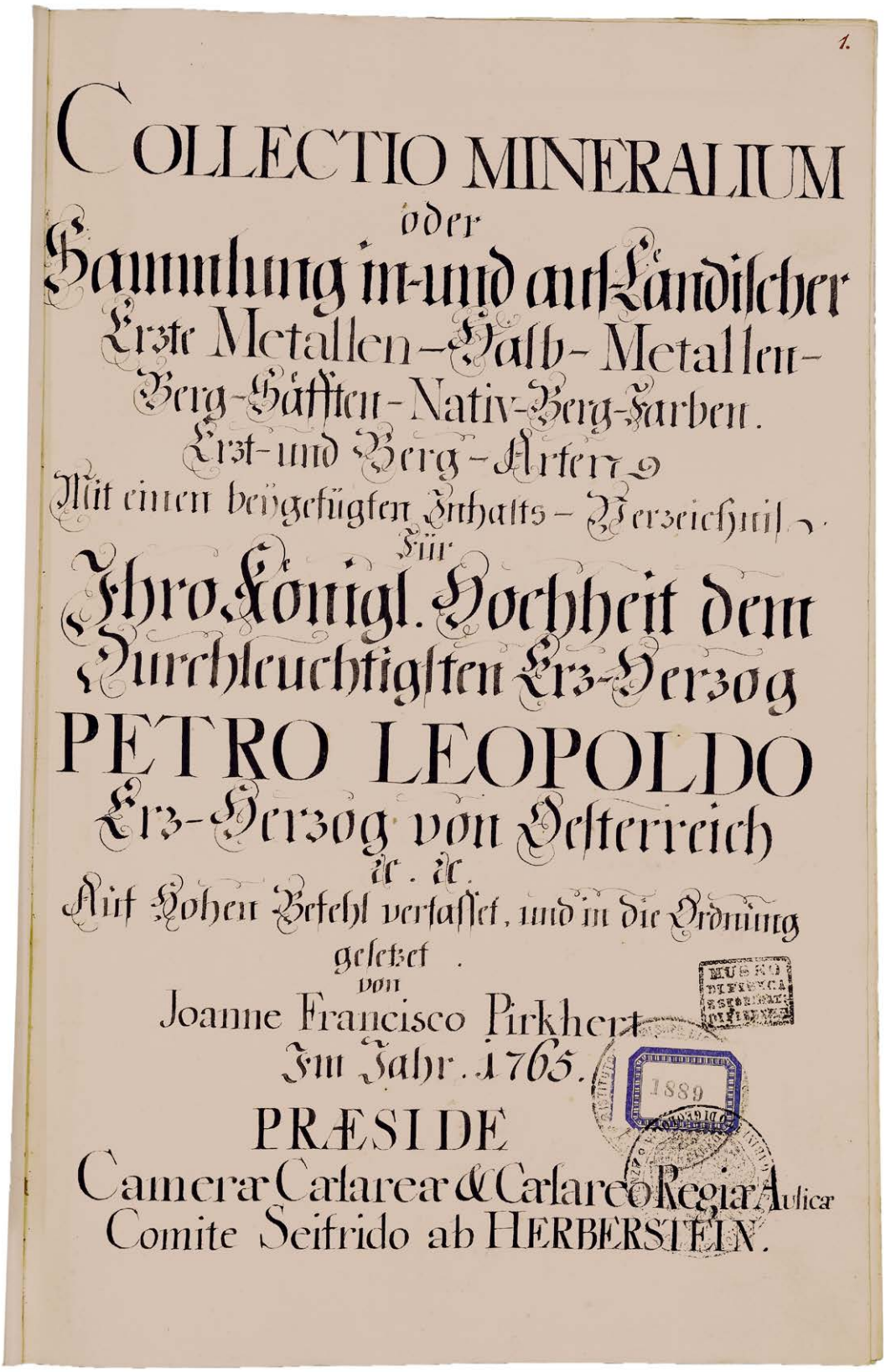


1.

COLLECTIO MINERALIUM

oder

Sammlung in- und aus-Ländischer

Erzte Metallen – Halb- Metallen-

Berg-Säfften - Nativ-Berg-Farben.

Erzt- und Berg-Arten,

Mit einen beygefügten Inhalts – Verzeichniß,

Für

Ihro Königl. Hochheit dem Durchleuchtigsten Erz-Herzog PETRO LEOPOLDO

Erz-Herzog von Oesterreich

&c. &c.

Auf Hohen Befehl verfasset, und in die Ordnung

gesetzet

von

Joanne Francisco Pirkhert

Im Jahr 1765.

PRÆSIDE

Camerar Carlarear & Carlareo Regiæ Aulicæ

Comite Seifrido ab HERBERSTEIN.

2.

Erklärung Nachfolgender Mineralien und Berg-Arten.

Raum zubelieben des in der Natur-Kunde forschenden.	No	
	1.	Cremnitzer Gang- Stein von einer Edlen Quarz-Klüfft. Müglicht mit sichbar Gold- durchzohen. Woran ich das Gold in den zwischen beyden Saal-bändern sehr gestaltig offenen zart quarzigten Crÿstal Klüffte bemerkt, Stern- graüzigt, ganz ge- diehen eingeschlossen vor- zeiget.

2.

Raim zubelieben des in der Natur-Kunde forschenden.

No	
2.	Cremnitzer blätter Erzsicht Corporalische Gold-Stufe in quartz und lichtgrauen Sand Stein, mit Silbergefärbt ädrichen durchzohen, Erz sicht und mit blauch äugel eingesprengt.
3.	Cremnitzer Erzsichte Gold-Erzt Quarta. Vormahlen aus dem Maria Zech Schacht erschrotten, in grob-grauen Horn-Gestein.
4.	Aus Siebenbürgen unweit Szalathnya ein in zarten quartz durchzohener mit Silber-gelb gemengter feiner Bley-glanz pr: Cento. 12. Löthig in Silber. daher die Mark 120 d. fein Gold hält.
5.	Aus Siebenbürgen ein Hornstein mit blauch und – Marcasiten.

Raum zubelieben des in der Natur-Kunde forschenden.	No	gemengt durchaus mit Kießkozt und Bley-glanz in quarz eingefaßten gr: Cento in Stein Bley 8. Pfund. in grau Kupfer 10. Pfund. in feingöldischen Silber 130 löthig. wovon die Mark 104 d. fein gold hält.
	6.	Ein mit klein speißigen Bley-glanz gemischter Silber gelf. in eben zarten quarz aus Siebenbürgen de Sancta Victoria gr: Cento 70 löthig an göldischen Silber, wovon die Mark 254 d. in feinen Gold hält.
	7.	Von einem ganzen gefährte mit bugden Sal-bändern aus Siebenbürgen gr: Cento in-göldischen Silber 60. löthig. dessen die Mark 158 d. in feinen Gold hält.
	8.	Aus Siebenbürgen imweil Szálathnya. gr: Cento 108. - Löthig-

4.

Raum zubelieben des in der Natur-Kunde forschenden.

No

in fein göldischen Silber, dessen die Mark bis 15 Loth in fein Gold hält.

9. Schemnitzer Reich bis 300 Löthig an fein Silber gr: Centn: hältige Rösch-gewächs-fest-Stufe, in Kalchartigen mit weiß und grauen Quarz gemischten Gestein. worinen das feine Silber wie gesponnen Fäden gezeichnet zu ersehen.

10. Eine Grün-Malachitische Stufe in Eysen bräundiger Berg-Art, aus dem Gieck-Covaaer Gebürg S. Nicolai Grube gr: Cento 12 Pfd. in gaar Kupfer.

11. Siebenbürgischer mit Gelf-Kieß eingesprengter Bley-glanz. 20 Pfd in Kein Bley. 18. Löthig in Silber. wovon die Mark 13 Loth in fein Gold-anthält.

4.

5.

Raum zu belieben des in der Natur-Kunde forschenden.

No

12. Eine blaue Lasur-Stufe, mit brauner Vermengt, aus dem Oraviczer Te-micher gebürg der S. Philipi und Jacobi grub. per: Cento 6. Pfü in gaar Kupfer. und 4. Löthig in feinen Silber.

13. Aus Siebenbürgen von dem Kays: Königl: Ge-werkschaftlichen Nagy Ager. Berg-Bau. S. Bernardi Stolln. von der weißen Klufft ein ordinari mit Küßangel eingesprengtes Poch-Erzte. per: Cento 2. Löthig in fein göldischen Silber. dessen die Mark 128 d. gold-enthält.

14. Aus Schemnitz von Sieglisberg. Ein in Kalchartigen Löthen per: Cento bis 1000 löthiger Handstein.

6.

Raum zubelieben des in der Natur-Kunde forschenden.

No

13. Schmölnitzer Ziegel haltiger Gelf. aus dem S. Ladislai Stollen der Rotan-berg. pr: Cento bis 36 Pfu in gaar Kupfer.

16. Aus Ober Hungarn eben der Schmölnitz aus dem S: Ferdinandi-Schacht. Ein in Schiefer und Quarz gestein cum Matrice gemischte Gelf Erzt Kupfer. pr: Cento bis 10. Pfu in gaar Kupfer.

17. Schmölnitzer Kugel Schachter Sandstein mit Quarz gemischt. pr: Cento bis 40 Pfu in gaar Kupfer, und ½ Löthig in feinem Silber.

18. Ein braun Lach-äugiger Feder Kupfer Erzt Kupfer, aus der Oraviczer Pauli bekehrung-grube, in dem

5.

7.

Raum zu beschreiben der in der Natur-Kunde forschē den.	No	
		Nodarner Gebürg. Welche 1½ Pf. gaar Kupfer, und ½ löthig in fein Silber pr: Cento. hältig.
	19.	Eine Kießige Gelferzt Stufe, aus dem Oravitzer Coschovitzer Gebürge, S: Philipi Grube. Welche pr: Cento 20 Pf. in gaar Kupfer.
	20.	Eine Gelf- Stufe mit seinem Hangend- Gestein, aus dem Oravitzer Gebürg S: Phi- lipi- Grub. pr: Cento 21. Pf. in gaar Kupfer.
	21.	Schemnitzer Klein speisig- Bley- schüssige- Stufe. pr: Cento bis 20 Löthig in fein Silber und 30 Pf. in Klein Bley.
	22.	Eine Gelferzt Stufe, mit Grün und blauer Lasur- gemischt,

8.

Denen zubelieben des in der Natur-Kunde forschenden.	No	von einem streichenden ge- - fährte, aus dem Oravitzer kleinen Silber-Gebürge. S: Servati et Ignati grub. Welche 26. Pfd. pr: Cento in gaar Kupfer hältig.
	23.	Ein Schwarz-Steiniger Stuf aus dem Oravitzer Weder- - ner Gebürge. Pauli be- - kehrung Grube 2 Pf. gaar Kupfer und 1½ loth pr: Cto. in fein Silber hältig.
	24.	Ein Sandstein aus ober Hungarn Szlovinkaer gebürg von Schwarzenberg genannt, in grauen blaulich - Schel mit etwas gelb fast hingestreut. pr: Cento bis 18 Pfd in gaar Kupfer, und 2½ Löthig in fein Sil:
	25.	Ein Schwarz blaulig Eisen - schuß- bräunliche Stufe - grün angeflossen, aus dem Oravitzer

6.

9.

Raum zu belieben des in der Natur-Kunde forschenden		
	No	Kleinen Silber-gebürge, Maria Anna glück auf. Von einem ganzen geschüttn mit dem Saal-band. gr: Cento 20 Pfd. in gaar Kupfer.
	26.	Von Schmölnitz aus dem Spitzen-berg Crantz erfindung Schacht ein mit quarz gemischte sehr fein speisige gelf-Erzt Stufe, gr: Cento bis 20 Pfd. in gaar Kupfer.
	27.	Aus dem Banath. Von dem Neü erschrottenen S: Elisabeth-gang mit gelf und grauen Speisigen Erzt Flözle aus dem Cornu Silber-gebürg. gr: Cento in Kupfer gaar halt 1½ Pfd.
	28.	Schmölnitzer Caroli Schacht: Spathiges fahl gelf-Erzt. gr: bis 18. Pfd in gaar Kupfer, und 2. Löthig in feinem Silber.
	29.	Schmölnitzer S: Joannis-Baptiste

10.

Raum zubelieben des in der Natur-Kunde forschenden	No	
		Weichter schauer Schweifige Küpfer. gr: Cento bis 240 Pfund in grauer Kupfer.
	30.	Ein in braunem Gestein bestehender Küpfer, welcher sowohl gelb als schauer Schwei-fig dann Schwarz einge-sprengt, aus dem Banath Oravitzer Arschitzer Gebürge von der Friderici grube gr: Cento 12 Pfund in grauer Kupfer, und 2 Löthig in feinem Silber.
	31.	Ein mit Kalzani und blaulich gemischter Marca-sitischer Sand-Stein. mit gelb und Schwarz fast durch-zogen. gr: Cento in Silber bis 11 Löthig. und in grauer Kupfer bis 8 Pfund.
	32.	Aus dem Banath oravi-czer Vodarner Gebürge. von der Maria Hülf grub. Ein Eysen bintig

11. 7.

Raum zubelieben des in der Natur-Kunde for-schenden.

No

sehr flüssiger Schmölz art mit gelb-Erzt eingesprengter Sand-stein hr: Cento 2½ Pfd in gaar Kupfer.

33. Eine mit grün- blau und Leber-Erzt gemischte Lasur Stufe. Von dem Oravitzer Rakovitzer Gebürge, aus der S: Margaretha Grub hr: Cento 8½ Pfd in gaar hell.

34. Schauer-Schweif in schwarzer Schiefer Gestein aus dem Schmölnitzer S: Joannis Bap. Stolln Schacht hr: Cento bis 38. Pfd in gaar Kupfer.

35. Gelb-Erzt, Schauer Schweif eingeflossen hr: Cento bis 36. Pfd in gaar Kupfer.

36. Schmölnitzer S: Elisabetha Schachter gelb und schwarzer Kieß, welchen entscheidet das Mitte durchstreichende gelb glanz-Erzt gefährte, hr: Cento bis 36 Pfd. in gaar Kupfer, und ½ Lothig in fein Silber. diese Stuf zeiget ihre Eigend ablösung.

12.

Raum zubelieben des in der Naturkunde forschenden	No	
	37.	Banather Gelf Erzt. pr Cento bis 30 Pfund in gaar Kupfer.
	38.	Von einer guten Kluft. hier grün und braun Kupfer Erzt Stufe. aus dem Vadarner Gebürge. Von der Danieli Floriani Gruben pr. Cento 5 Pfund in gaar Kupfer.
	39.	Cremnitzer Quarz gangiger gold Marcasiten Sandstein. pr. Cento bis 3 ₰ in fein gold haltig. und 40 Pfund in klein Schwefel.
	40.	Orawitzer mit Spath durchzogener gelf Erzt Sandstein pr. Cento 36 Pfund in gaar Kupfer und 1½ Lothig in feinen Silber.
	41.	Von daher ein Lasur gelf glanz Erzt. pr. Cento bis 40. Pfund in gaar Kupfer.

13. 8.

Raum zubelieben des in der NaturKunde forschen=den.	No	
	42.	Schmölnitzer S: Elisabetha Schachter sein speisiger gelb- Ruß- Hornstein, schauer Schweitzig zerwittert. gr: Cento bis 34 Pfd. in gaar Kupfer.
	43.	Von Schemnitz aus dem Wind-Schacht sein mit bley glanz und gelb eingesprengter Horn- Stein gr: Cento bis 140 löthig in fein Silber.
	44.	Antimonialisch et Arsenicalisch stark kiesig schüssiges fahl- Erzt aus Siebenbürgen von Facebayer gewerkschaftl. Sigismundi Stollen. unweith Szalathnya. gr: Cto: in feinem Silber 12 löthig. in gaar Kupfer 14 Pfd. in Antimonio bis 30 Pfd. und hält die Mark Silber dessen 140. d. fein gold.

14.

Raum zubelieben des in der Natur Kunde forschenden.

No

45. Aus dem Banath von Szasz-Kaer gebürg aus der Prinz Joseph-Grub ein an grauer Kupfer bis 60 Pfund haltiger Hand stein von sehr artig gemischter weiss gelb grün und blauer Lasur Farbe. ist zugleich an feinen Silber pr Cento bis 5 Löthig.

46. Gelb-glanz Kupfer Erzt Handstein. aus dem Banath, in graue Kupfer pr: Cento: 24 Pfund. in Eisen braunigen Letten stücker gebrochen.

47. Aus dem Banath aus dem Moldaver Florimundi gebürge, aus der grube Joseph in der Neu genannt, eine besondere art in Eisen braun-haltigen Letten Schmunde, pr: Cento an grauer Kupfer bis 14 Pfund.

9.

13.

Raum zu belieben des in der Natur Kunde forschenden.	No	
	48.	Eisen-Stein aus Steuer-Markt. gr: Canto 2 Löthig in fein Silber.
	49.	Aus Ober Hungarn von Schmöl-nitz aus dem S: Elisabethe Schacht von dem Stund 6 Morgen streichenden Haubtgang. ein sehr artig bekiester mit Quarz und Spiegl Spath gemischter Hangstein. gr: Canto bis 36 Pfd in gaar Kupfer.
	50.	Aus ober Hungarn von Göll-nitz aus dem Toursgony Schacht. ein weiß-Spathiger mit gelf Erzt Reich eingesprengter Hangstein. gr: Canto bis 22 Pfd in gaar Kupfer.
	51.	Fein speisiges glanz gelb Erzt mit weissen Spiegl-Spath eingesprengt aus dem S. Le-opoldi. Schacht

16.

Raum zubelieben des in der NaturKunde forschenden

No

Von Schmölnitz. gr: Cento bis 40. Pfd in gaar Kupfer.

52. Aus dem Zipser Comitat nächst Schmölnitz eine aus dem Territorio des Berg fleckens Stoosz. mit Kiesen stein gemischte sehr feine gelf Ertzt Kern stücke. mit artigen Kiesen braun Fün-ken versetzt, woran die Aus-breitung ganz ausnehmend zu ersehen, hält gr: Cento bis 50 Pfd. das allerge-schmeidigste Rosetten Kupfer.

53. Aus ober Hungarn von dem Caroli Boromei Gewerkschafft. grubenbau zu Schwedler Ein Kahl-Ertzt Gang-stein, gr: Cento in fein Silber bis 10 löthig. und bis 30 Pfd in gaar Kupfer.

10.

17.

Raum zubelieben des in der Natur Kunde forschen-den.

	No	
	54.	Aus Schemnitz eine in fein Silber gr: Canto bis 30 löt-hige Stufe. in quarz und Spath gestein.
	55.	Eine weiße sehr klüfftige Spiegel- Spath- drusen. mit gelb Kupfer Erzt gräupen eingesessen.
	56.	Aus Ober Hungarn von dem 78. Lachter tieffen anbruch aus dem Kayß: Königl: Heil: Dreÿfaltigkeiter Schacht zu Göllnitz. eine gr: Canto bis 40 ttig in schwer Kupfer hältige gelb Erzt Stufe.
	57.	Aus Schemnitz Rösch gewinn Stufe, gr: Canto bis 200. Löthig in fein Silber. mit gelb eingesprengt, graulicht und grün angeflohen.
	58.	Siegelsberger Schemnitzer

16.

Raum zubelieben des in der NaturKunde forschenden

No

von Schmölnitz. pr. Cento bis 40. Pfund in gaar Kupfer.

52. Aus dem Zipser Comitat nächst Schmölnitz eine aus dem Territorio des Berg-fleckens Stoss. mit Eisen-stein gemischte sehr feine gelbfärzt Kern Stufe. mit artigen Eisen braun hin-sen verhagt, woran die Aus-trägung ganz ausnehmend zu ersehen, hält pr: Cento bis 50 Pfd. das allerge-schmeidigste Rosetten Kupfer.

53. Aus ober Hungarn von dem Caroli Borromäi Gewerkschafts-grubenbau zu Schwedler. Ein fahl-Erzt Gang-stein, pr: Cento in fein Silber bis 10 löthig. und bis 30 Pfund in gaar Kupfer.

10.

17.

Raum zubelieben des in der Natur Kunde forschen-den.

No

54. Aus Schemnitz fein in fein Silber pr: Cento bis 30 löt-hige Stufe. in quarz und Spath gestein.

55. Eine weisse sehr kleinstiftige Spiegl- Spath- drusen. mit gelb Kupfer Erzt gräupen eingefassen.

56. Aus Ober Hungarn von dem 78. Lachter tiefsten anbruch aus dem Kaÿs: Königl: Heil: Dreyfältigkeiter Schacht zu Göllnitz. eine pr: Cento bis 40 tig in einer Kupfer hältige gelb Erzt Stufe.

57. Aus Schömnitz Rösch gewinne Stufe, pr: Cento bis 400. löthig in fein Silber. mit gelb eingesprengt, graüß-licht und grün angeflogen.

58. Sieglißberger Schemnitzer

18.

Raum zubelieben des in der NaturKunde forschenden.

No

Stufe. Ein Rösch-gewächs mit einer Crystall-druse und grün angeflogen. gr: Cento in fein Silber bis 17 Löthig.

59. Ein Gangstein aus dem Szasz-Kaer gebürg. grauen Schwefig klein speisiges glanz-Erzt. gr: Cento bis 60 Pfund in gaar Kupfer.

60. Fahl und gelb Erzt gemengter Gangstein aus dem S: Michaelis Schacht von Göllnitz in Zipser-Comitat. gr: Cento in gaar Kupfer 40. Pfund. und in fein Sr: 2½ Löth:

61. Kupfer Nickel Coboltische Blauthe mit wilden granaten eingeschossen, von Schitz aus Unter Oesterreich.

62. Von einer Gewerkschaftl: grü-ben Aron genannt. aus dem Höchsten Vadarner Gebürg nächst Oravicza ein Silber und bley haltige Stufe von einem Gäng-

11.

19.

Raum zubelieben des in der Natur Kunde forschen den.

No. erschürften Pochgang.

63. Zwitter mit einer schwarzen zu grauen Schörle aus Böheim.

64. Von Schemnitz hin ein feiner Silber halt pr: Cento gegen 260 löthiger Sand-Stein, mit weiß-lichten Klüften eingefaßten, in zart quarziger gang art, so zugleich bis 7 Qtg. in Fegaar ist.

65. Aus dem Banath ein in mildern Eisen keutigen Sandgestein blaue Laser, Erzt-Stufe, von dem Te-mescher gebürge nächst Ora-vitza. pr: Cento bis 10 Qtg. in gaar Kupfer.

66. Fahl oder weiß Kupfer Erzt aus Ober Hungarn von Göll-nitz aus der Hoss Casparischen Grube. pr: Cento an Kupfer gaar halt 20 Qtg. und 2½ löthig in fein Silber.

67. Eisen, Antimonium, Kupfer und Silber hältige Minera.

20.

Raum zubelieben des in der Naturkunde forschenden

No	
68.	Kupferiges gold ertzt. mit grauen Spiegl-Glaß einge-sprengen, pr: Cento bis 40 Pfund in gaar Kupfer. und ½ löthig in fein Silber aus dem H: Dreyfaltigkeit Schacht zu Göllnitz.
69.	Schmölnitzer Bley Schüssiger Stöß gewöhne ertz Stufen. in Roth fahligen gestein mit Kießen angeflogen. pr: Cento in fein Silber bis 150. löthig.
70.	Kieß aus dem alten Mund Schacht von Schmölnitz. pr: Cento 40 Pfund in Rein Schwefel. 2. löthig in fein Silber. und 1½. Pfund in gaar Kupfer.
71.	Aus Unter Oesterreich von dem S: Anna berger gewerckh: gruben bau, von der Theresia Klufft. pr: Cento bis 50 löthig in feinen Silber.
72.	Aus dem Mund Schacht von Schem-nitz.

12

21.

Raum zu belieben des in der Naturkunde forschenden.

No

eine mit Crystal Crayßen durchzogene Röschgewächs Erzt Stufe, gr: Cento bis 600 Löthig in fein Silber.

73. Von Schemnitz aus dem Ge-her Stollen. eine in fein Silber gr: Cento bis 20 Löthige Stufe.

74. Banather Joannes in der Küsten Stollner gold Erzt. ein grau hornigen mit quarz gemengten Spath gestein gr: Cento bis 14 Pfündig in gaar Kupfer.

75. Silber, Kupfer und Bley hältige Stufe. mit einer blaulichen Röschgewächs Schwarte von Schemnitz.

76. Eine Eisen brandige mit Kupfer untermischte kohl artige grauen Schwefige feine gold Erzt Stufe. in quarz gestein gebrochen, aus einer

ZZ.

Raum zubelieben des in der Natur Kunde forschenden.

ZZ.

76 alten Zöch. des S: Margarethe
Schachts zu Schmölnitz. gr: Canto
bis 50 Proz in geschmeidigsten
Rosetten Kupfer.

77. Schmölnitzer S: Josephi Schacht-
gehauen Schurf aus einer 104.
Lachter tieffen Teuf, mit han-
-gend und liegend Schwarz Schü-
-fer Saal-band. gr: Canto bis
30. Proz an gaar Kupfer.

78. Weiße aus Böhmen von St.
Joachim. bley und Eisen
Schüßig. gr: Canto in feinem
Silber bis 14. Löthig.

79 } Klein speißiger gelb Kieß von
80 } Cremnitz. glanz körnigt, gr:
Cto: 40 Proz in Rein Schwefel
und bis 2½ Löthig in göldischen
Silber.

81. Kies bis etwelche 80 Loth an
fein Silber gr: Canto Sächsi-
-ge Schemnitzer Stufe.

13. 23.

Raum zu belieben der in der
Natur Kunde forschenden.

No

82. Schemnitzer Amethisten
bläulich quarzigte Crystall
Drüsse mit Roth gülden
Ertz blümen angeflogen.

83. Kiesigte Eysen Ertz. bis
30 Pfünd pr: Cento an Eisen
hälten.

84. Aus der S. Bernardi grub.
in dem Schwedler Territorio
nächst Schmölnitz ein mit
grünen blümen angeflog-
-ner gelb Kern Ertz Sand-
-Stein. in kiesen brüchigen
weissen Spath und quartz
gestein, woran eine Drüse
mit braun Ertz graupen
eingeschlossen, zu ersehen.
hält pr: Cento bis 40 Pfd.
gaar Kupfer. und 3 loth
fein Silber.

85. Aus Ober Hungarn von Schmöl
-nitz aus-

24.

Raum zubelieben des in der Naturkunde forschenden.

No 86. Asbestus oder Berg auch Stein flachs. aus dem Abaujvarer Comitat in Ober Hungarn unweith Schmölnitz.

87. Aus Tyroll am Kalkenstein genannt, aus der 14. Nothhelfer Grube. eine sehr gestaltige schöne fast Stufe von einem streichenden Gängl geführte, mit beyderseits habenden Spathbanden. Per: Cento in gaar Kupfer 28 lb und im fein Silber halt 3½ Lothig

88. Gewachsen Kupfer, oder Cuprum Virgineum genannt, aus dem Grausrot Schacht von Schmölnitz, woran die Anima Veneris ganz glaß artig ausgewittert zu ersehen.

89. Neusohl Herrengrunder

Raum zubelieben des in der Naturkunde forschenden.

14.

Z 5c.

89 Cement Kupfer Schaarte
ungemein artig gestal-
tet. Es ist hieran aus-
nehmend zu ersehen, wie
nicht das Eisen zu Kupfer
wird, sondern nur d. Eisen
eine Beize ist, mitelst
welcher die Atomi veneris /:
so in denen Cement oder
Vitriolischen Wäßern
die sich in denen alten
Zechen deren Gruben
gesamlet hatten :/ sich an-
halten, und sofort Compact
werden, daß ein Stein der-
ley Cement Kupfer, ordi-
naire eingeschmolzen
ein gaar Kupfer 98 Pfd.
ist.

90. Granaten aus Hungarn
wie solche aus denen
flüssen von Schlam aus
gewaschen werden.

91. 92. 93. 94. 95. aus
Idria

26.

Raum zubelieben des in der NaturKunde forschenden.

No quecksilber und Cinober
hältig in weißen Spiegel
Spath einbrechend.

96. Aus Cremnitz Feine Cino-
-ber mit Kies gewachsene ge-
mischte Stufe. per: Cento
40 Löthig in fein Silber
und 3½ d. in feinem gold-
hältig

97. Drüße mit einer auf
freien Sand gestein Sil-
-ber hältig angeschossenen
sehr artigen Crystal
Drüßen.

98 = 108. Schemnitzer Ver-
99 109. schiedene Crystal
100. 110. Drüßen mit ihrer
101. 112. Berg art, wovon
102
103. welche aus offenen
104. Klüfften angestanden
105. gebrochen worden
106. sie wieder mit feinem
107. Silber halt angeflossen.
=

15.

27.

Raum zubelieben des in der Naturkunde forschenden.

570
113 Aus Siebenbürgen un-
weit Szálátnya feir
in zarten quarz mit-
Kieß-gewüre, gelf und
klein speisigen Bleyglanz
unterzogene Stufe. ein-
fein Silber 10 löthig
dessen die Mark in fei-
nen Gold 130 d. hält.

114. Schwarz oder Stein Milch
115. bruß bey den Schemnitz
116. die propriè eine Silber
Erzt zur Gegend.

117. Banather aus dem
oravitzer Arschitzer
gebürge Leber braun
Erzt-Stufe, woran eine
artig angewitterte Eisen
krusse zu ersehen, hält
pr: Cento 18 lb gaar Kup-
fer, und 4½ loth in fein
Silber.

118. Frauen Eiß Stufe aus
Hungarn.

28.

Raum zubelieben des in der NaturKunde forschenden.

No

119. Blau und Weisses Crystal Salz mit der Berg-art aus ober Oesterreichischen Hall-Stadt.

120. Ein lauteres Weisse-Crystal-Salz Stuke von dahero.

121. Eben von dahero ein Rothe Crystal Salz Stuke, weiss gemischt.

122. Die Berg art nebenst und aus welcher zu Hall-Stadt daselbst das Salz gebrochen wird.

123. Petrificirtes Holz, welches in dem Hall-Städter Salz-berg, in dem alten Johanna Wöhr gefunden worden ist, woran die öffnung von denen ästen artig zu ersehen.

124. Ein grösseres Stuke dahero, gleicher art.

16.

29.

Raum zubelieben des in der NaturKunde forschenden.

No

125. Ein Petrificirtes Stük̈e Holz, aus dem Charpatischen gebürge weisser art. besonders Compact und dahero verschieden zu appliciren.

126. Eine Stein-Kohle aus unter Österreich von Göttweich an Donau Strom.

127. Von Schemnitz aus dem Werner-Stollen eine mit Roth güldenErzt-gängen eingeschlossene Stufe, Marcasitisch angeflogen, hält pr: Cento bis 500 loth fein Silber und 6 Pfd an gaar Kupfer.

128. Ein Handstein von Cremnitz aus so genannter Ihro Mayst: gold-Kunst Handlung, von einem mächtigen gefährte Roth gülden-Erzt. mit dem Voll-band Crystal Crystallen Klüfftig. pr: Cento bis 300. loth fein Silber haltig.

30.

Raum zubelieben des in der Natur Kunde forschenden.

129. Eben von dahero ein Flach-
menn Stufe in glaßartigem
quarz mit hohem Spath ge-
mischt gr: Cento bis 800.
Löthig an feinem Silber.

130. Von Schemnitz aus dem Kays:
Königl: Sachsen Stollen so ge-
-nannt blau Schwefigen
Sandstein gr: Cento wegen
seiner klein feinstigkeit
bis 60 Mrk in Klein blau.
diese art blau farb ist so
geschmeidig daß es sich schnei-
-den läst.

131. Kupfer und Kalkfarb Schi-
-figer Röther blau glanz
gr: Cento bis 50 Mrk. an
Klein blau. aus obermel-
-ten Sachsen-Stollen, von ei-
-nem neben dem Haubt gang
streichenden gefährt.

132. Von Schemnitz aus dem

17.

31.

Raum zubelieben des in der Natur Kunde forschenden	No	
		St: Catharina Stolln. Kays: Königl: Ober Silber Stollner Handlung. Eine mit Kupfer bruch angeflogen und Kupfer blumen Erzeigte Stufe. in glaß artigen quarz gestein gr: Canto an feinen Silber bis 30 Löthig.
	133.	Eine Stufe in grau und blauen horn Schiefer-gestein, mit hell grünnen Kupfer blumen angeflogen, ein Kupfer bruch frey sichtes Schwarz oder hell farb. gr: Canto 30 Lotig an Kupfer gaar halt, und bis 4. Lötig in feinen Silber.
	134.	Ein petrificirtes Stück holz aus dem Charpatischen gebürge, welches sehr gestaltig gesunder art. wessentwegen ein solches besonders zu Ex-plicieren bequam ist.

37.

Raum zu belieben des in der Naturkunde forschenden.

570

135. Eine in Eisen häutigen Letten eingewachsene gewachse sehr gefaltige Schöne Cluft Crÿste, Violet Amatisten farbig. Von Schemnitz aus dem gewerkschaftl. Brenner Stolln.

136. Eben von dahero eine solche Crÿstallen Amatisten Schöne Cluft Quarze.

137. Eine Mächtige Crÿstal-Crÿste, worunter die mit untergezogenen Silber Erzte zu: Cento in einem bis 16 löthigen Silber halt sehr artig; wegen künftiger Wetterung zu ersehen.

138. Eine aus dem Magurkár gebirg des Liptauer Comitats, eine lange weiß von Neusohl, gebrochene gold, Silber und Antimonij Stufe. So in Antimony bis 40 Pfund, in feinen 23 Caratigen gold bis 1000 löthig

18.

33.

Raum zubelieben des in der Natur Kunde forschenden.

No

und in feinem Silber biß 8 löthig. diese art ist nun ganz besondere Seltenheit.

139. Minera Antimony oder Spießglaß. in Kalchartigen gestein mit zarten glaß quartz gemischt aus Cremnitz

140. Von Rohnitz nächst Neusohl in Unter Hungarn. Eine bräusichte Eysen-Ertzstüffe, welche auf Einem Acker, oben auf dem Berg bey Stalte gefunden worden ist. diese art Eysen Stein hält pr: Cento biß 50 ℔ an Rain Eysen.

141. Von Rohnitz aus dem nächst Domlin Reichen Eysen gebürge gebrochener Stein pr: Cento bis 40 ℔ in Rain Eysen.

142. Von Rohnitz unweit Danisovach Ein Eysen Stein beson-

derer

34.

Raum zubelieben des in der NaturKunde for-schenden.

No

art wegen Laichten flüß in Schmölzen ge: Cento 40 Pfund an St.

143. Von Rosnitz aus dem Smolowa-
-er gebürge Ein Eisen Stain-
felsner art im Letten streichend
ge: Cento bis 36 Pfund.

144. neüerlich Rosnitz von Stalter
gebürg ein sehr Compacter
Eisen Stain ge: Cento bis 60 Pfund
an Roh Eisen.

145. Ein so genanter Adler Stain,
oder Eisen Nieren Erzt, wo-
rinen das fixe Eisen fast ma-
teabl inwendig Kügl weise zu
finden wird, diser Eisen Nieren
Erzt Gülsche ist ge: Cento in Stain
bis 30 Pf hältig

146. Natur-Berg-grün von Neüsohl
aus Herrengrund, wie solches in
einer offenen Stand Klufft an-
gestandten erbrochen worden.

147 Von Schemnitz Ein Stiglitzberger

19.

35.

Raum zubelieben des in der NaturKunde forschenden.

No

Handstein aus dem Silber Stolln ein fast gediegenes gefährte mit beyden Erzel banden in Spath und quarz gestein etwas gelb eingesprengt gr: Conto bis 1200 Löthig in fein Silber.

148 Schemnitzer Sacher Stollner Stufe, von S. Joanni Kluft verschiedener Berg-Arten: als Roth-Spath, quarz, zinnober mit Kieß vermischt gr: Conto 2½ Löthig — in feinen Silber.

149 Von Schemnitz. Sacher Stollner Stufe, von Spitaller gang zinopl und Röschblay glanz Schüssig gemischt. gr: Conto 20 Löthig in weichodes Stein blay, woran der Centner bis 2. Löthig in feinen Silber.

150. Von Schemnitz aus dem Sacher-Stolln

36.

Raum zu belieben des in der NaturKunde forschenden.

150 Von der Joanni Klüfft, ob dem
3. Heiligkeiter Erb-Stollen Eine
Erzigte weiß-Stahl-Stufe.
Hr: Canto bis 5 auch 7 löthig
in feinen Silber. Auf die-
ser Klüfft haben Ihro Mayt der
Römische König selbst gear-
beitet.

151. Von Schemnitz aus dem Sieg-
lisberg von dem Biber
Stollner Gang ein mit Roth
gülden Erzt Gewinnen und
Kiess gewinn nebst weiß
eingesprengter Hand-Stein.
Hr: Canto bis 60 löthig in
feinen Silber.

152. Eine braun quarzigte Erzt
Stufe in der Thiergartner
gewerkschaftlichen Grube
gebrochen, hieran ist zu
ersehen, wie in dem derben
Gestein eine offene Klüfft
gleichsam mit einer Kiess-

Raum zubelieben des in der Natur Kunde forschenden.

20.

37.

No

gewächs Erzt Quartz über-zohen eingefaßen ware, welche mit Rothgülden Erzt gräupen untermischte Röth-gewächs Erzt Quartz pr: Cento in feinen Silber bis 700 löthig.

153 Aus Sachsen von Harzischen gebürge feine Roth gülden gewächs-Erzt-Stufe, pr: Cto 5000. löthig in feinen Silber mit einer glanz Stahl drußen zwischen dennen lauteren Roth gülden glaß Erzt gräupen einge-faßen.

154 aus Kärnthen von der von Ihro Majestäten im baufühernden Lerdlnigg ein rothgüldig bluthschwefflig quärtzigen silber stüffen wovon der Centner nach der gemeinen grob 20 loth silber und die marck silber 2 loth in gold haltet

38.

Raum zubelieben des in der Natur Kunde forschenden	No	
	155	auf Kärnthen von dem von Ihro Majestätt führenden stoggen bayer hoffnungsbau Cobolt Erzstüff in blau und weisen gspart —
	156	auf Kärnthen von einer zu brsüff der Messing fabrique in Mösslbruckhen pro aerario vorbehaltenen Kupfer schurff zu Lassach bestehend in gelb Vitriol anflieglich und brandigen stüffen so 10 ℔ Kupfer halt
	157	bley stüff auf Kärnthen von dem K.K. bergbau in Kreibel —
	158	auf Kärnthen von der graf. breoardischen bley gruben an Kollern derbe bleystüffe unter dieser gruben wird von dem aerario ein zubau geführet
	159	auf Kärnthen von dem K.K. quecksilber gewältigungs stollen zu Dellach quecksilber ärtz mit Mercurio virgineo eingesprängt wovon die abgenommen gemeine prob zeuget daß der Centner 8 ℔ mercur haltet

21.

39.

Raum zubelieben des in der Natur Kunde forschen=den.

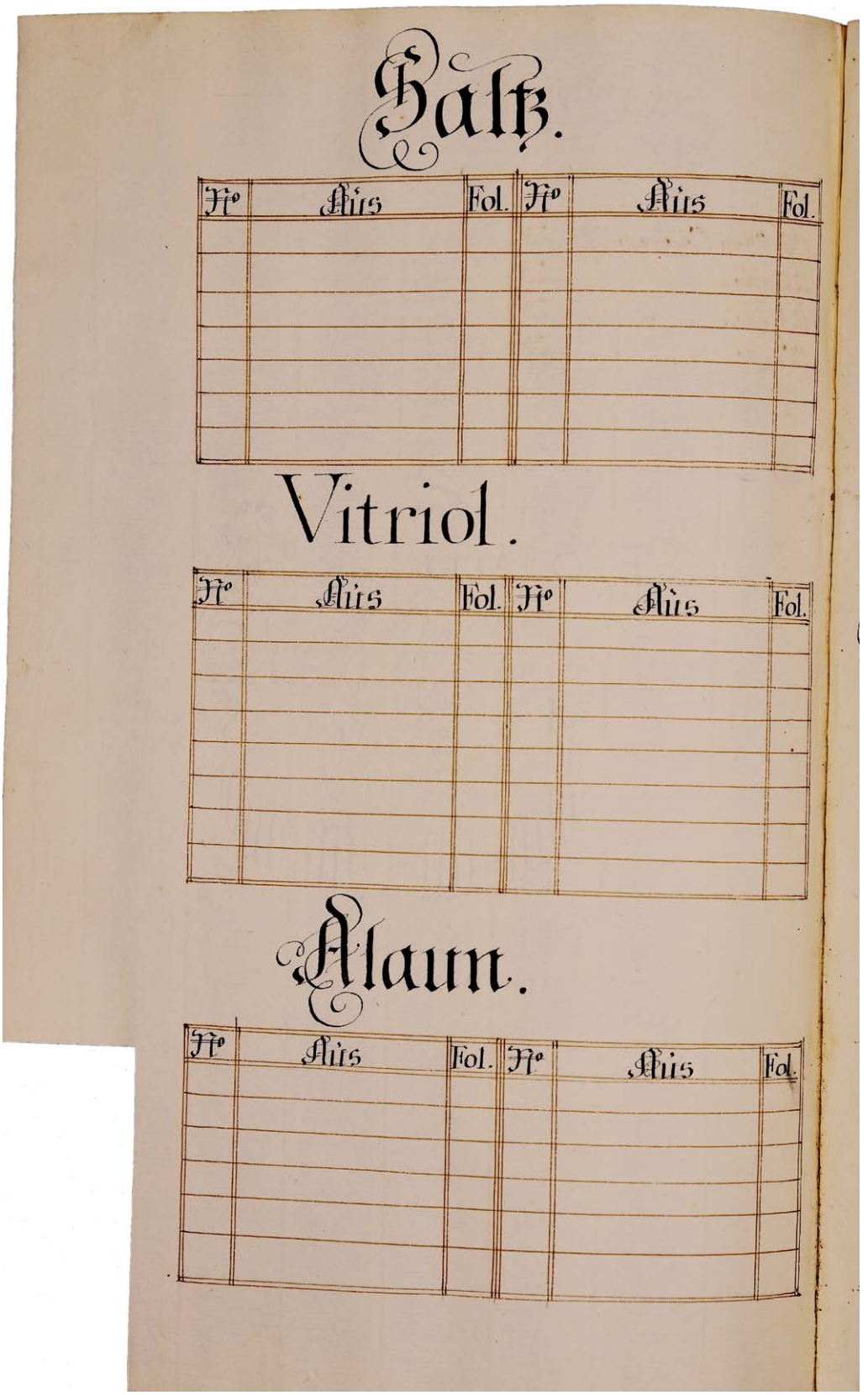
No	
160	fein weisse Calmeyen } aus Kärnthen von Ktl. berg bau in Raibel
161	gelbweisser Calmey
162	rother Calmey
163	Ockerfarb
164	Ein sehr merkwürdige aus America von den bergwerken in Potosi kommende goldstuff welche besonder ~~reich~~ in gediegenen gold in harten gestein ist
165	aus Kärnthen von Kosnek graf Rosenbergisch herrschaft silber stuff so sich in mitführenden wilden u. subtilen gäng=steinen befinden das bessere ärtz laut prob haltend 34 loth silber und 10 ~~lb~~ lb kupfer der Centner das mindere haltet 9 loth 1 qtl 2 d. silber und 4 ~~lb~~ kupfer
166	aus tirol ein sehr reiche von der besten gattung kupfer ertz stuffen ~~lb~~ wovon der Centner kupfer in sich enthält
167	eine andere reiche gattung gegenwärtig mit der ärtz mit denen schönsten Regenbogen oder pfauen farben angeloffen mit einem schwarz grauen schiefer der Centr. hält kupfer

aus tijrol vom berg Rotten bach im Zimmer thal. das Zuster thal.

22.

Raum zubelieben des in der NaturKunde forschenden.

	No	
Güßner Schul zu kloß allein Kupfer licht	176.	Sogenanter Roset Kupfer aus obgedachter Kupfer Erz in schwarz Kupfer getrieben dessen Gehalt enthält in Kupfer —
	177.	Kupfer König aus obgenanten Rosette Kupfer dessen Gehalt enthält Kupfer —
	178	grau Schiefer worinne eine gattung Eysen granaten und welche sich in ofenerischen bergwerk befinden auch neben sie bey gebrauchen und anhaltenden magnaten an einander hangend übrigens 6 Ecken und acht ebene haben.
	179	strahlen graupen mit darauf stehenden Zinn graupen, dann sogenanten Wolfram von dem stock in schlaken walde
	180	kleine derbe Zinngraupen von dem Schinger schacht auf Schlaggen wald
	181	ebenfalls eine derbe Zinngraupen wobey ein weisser Zinngraupel steht von Schingerschacht auf Schlaggenwald
	182	ein gediegener derber Zwittler von dem mächtigen streichenden St: Conradi gang in Schlaken



Saltz.

Nr°	Nits	Fol.	Nr°	Nits	Fol.

Vitriol.

Nr°	Nits	Fol.	Nr°	Nits	Fol.

Alaun.

Nr°	Nits	Fol.	Nr°	Nits	Fol.

23.

Raum zubelieben des in der Natur Kunde forschenden.	No	
	192	Eisenstein gewiß vom Moravitzer gebürg schwärzlich Rothfarb auf dem Temeswarer bannat
	193	Zinnwaine, minera, ord: zwitter (: Maßwerkstein da= rumen genandt, weilen dieß schwer, und braun so Bergleut zeichen nach der vorderist zerschlagenen Mühlstein ein das getragne gewaschen worden, davon 1 Kastenüber 1½ Cent: zinn, od 1 Cent: von dieser Minera über 5 loth nicht viel herausgibt.
	194.	Wolfram, oder weißes Maß= mineral, oder unter Zwittern dergleichen gibt ein roth (: ungefähr 600 Cent: / 10, und mehrere Cent: Zinn, wann diese durch das Zinngießer sehr im nassen Process zu schmelzen, das ist, wann die Materie oder die trübe ganz erst von den zinn= stein (: welcher an dessen bräunlichen schwärze zu erkennen :) mittelst der Flammen, und des Wassers ab= getrieben – so fort gänzlich nach dem darin befindliche zinn=stein rein gemacht

Raum zubelieben des in der Natur Kunde forschenden.

No

Nachdem Sand der also pre=
parirt, und ganz rein ge=
machte Zinn=stein ist geschmol=
zen, und das davon komen=
de Zinn in kleinen Schallen
ausgeflösset wird. 2 Centner
Zinn=stein geben die Helfte
oder ein Cent: Zinn.

195 Dergleichen schwarze Zinn=
graupen sind von der
besten Qualitaet, und ein
reicher Stein an dem gehalt,
welche über die helffte Zinn
geben, aber wenig werden
gefunden.

196 Zinn=stein, und Kupfer=
=Erz beysammen

197 Wolfram, ist ein der Zinn
stein der farb, und schwere
nach zwar ähnlich, ist sich
aber eine taube, und nichts
haltende unarth;

198 Dazu das Drüssgeln, zu weilen
scheinende arthen von verschie=
denen gattungen, der Halt
darinnen ist nicht so wohl als der
Wunderliche gewächs zu Con=
siderieren.

24.

Raum zubelieben des in der Naturkunde forschen-den.	No	
	199	Dennen Stoß-gängen von verschiedenen Gängen.
	200	bestehen, so weiters sind
	201	Weiße Zinn graupen sollen zinn aber nicht viel, solche zwar selten, und sehr klei„nen zu brechen
	202	Ein mit einem feinen bach Geweiß überzogener blauer Eisenstein
	203	Ein mit Erzt untermengter mit weißen Christallen Geweiß
	204	Ein großes Christalliges Geweiß
	205	Ein Erbsen Geweiß:
	206	Ein mit Erzt untermengtes Nadl-geweiß.
	207	Grob mit Erzt untermeng„ten Drusen geweiß:
	208	Ein Zapfen-geweiß
	209	Ein Erzstuffel mit einem feinen braunen Geweiß: welches eine rotige figur machet.
	210	Ein schrott, und hart geweiß:
	211	Ein Christallischen Nadel „geweiß:

Raum zubelieben des in der NaturKunde forschenden.	No	
	212.	Eine mit fall durchsichtigen Christallisierten zarten nadel-gewächs überdeckten Stuf blau. Erzt.
	213.	Einige arthen von silbern Amatisten.
	214	Von eben der art —
aus Steyrmark das Eysenerz bergwerk	215	Eine trauben Geristen
	216	Eysen Erz mit wasser überzogen.
	217	Eysen Erz mit Glinz und Rostzahn von St Constantia unterpenhangs haupt bau
	218	Wasser fall
	219.	grauer Glinz
	220	Moder
	221	gelber Glinz —

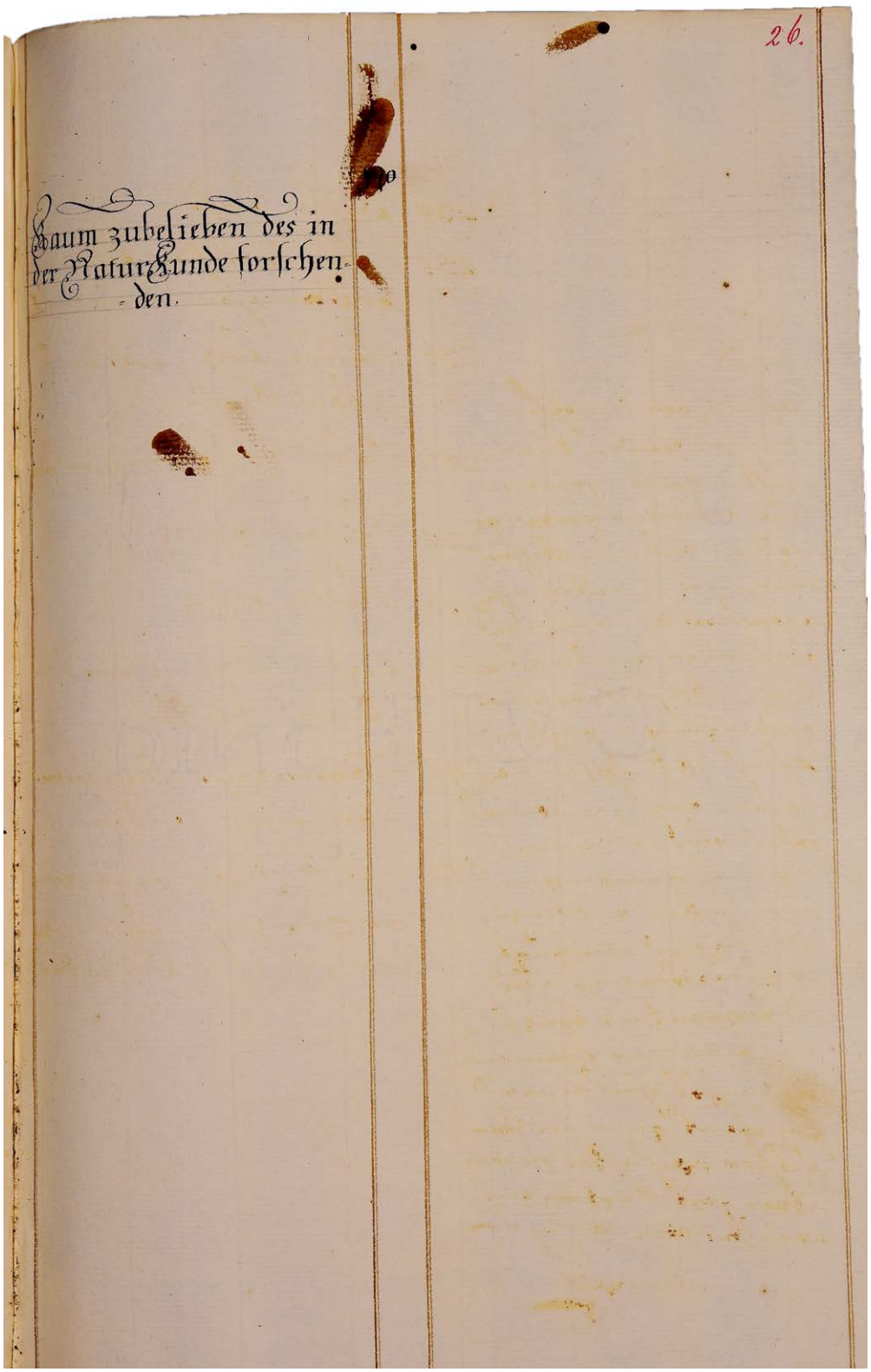
Raum zubelieben des in der Natur Kunde forschenden.	No	
	222:	Glassig oder grosspeisiges Glinz
	223.	Kozt, und mit weisser überzogenen Stuffen von Leopoldi Stollen
	224:	Kozt und Glinz v. Bullnig.
	225	blau Stuffen v. St Erasmi Stollen
	226.	weisser Glinz
	227	Kozt v. St Magnus Stollen.
	228.	Ein greisten artig überzogenen Stuffen
	229.	Rothbräunliges Eisen Stein.
	230.	Quarz oder Roßzahn
	231.	Laberfarbe Stuffen –
	232.	weisser sehr feiner Glinz von St Barbara Stollen mit einem schon gezeitigten blau Kozt, wo also zeitig und unzeitig beysamen
	233.	Leimlassig auch theils mit Glinz durchzogener Stuffen von St Maximiliani Stollen Sobersaggen —

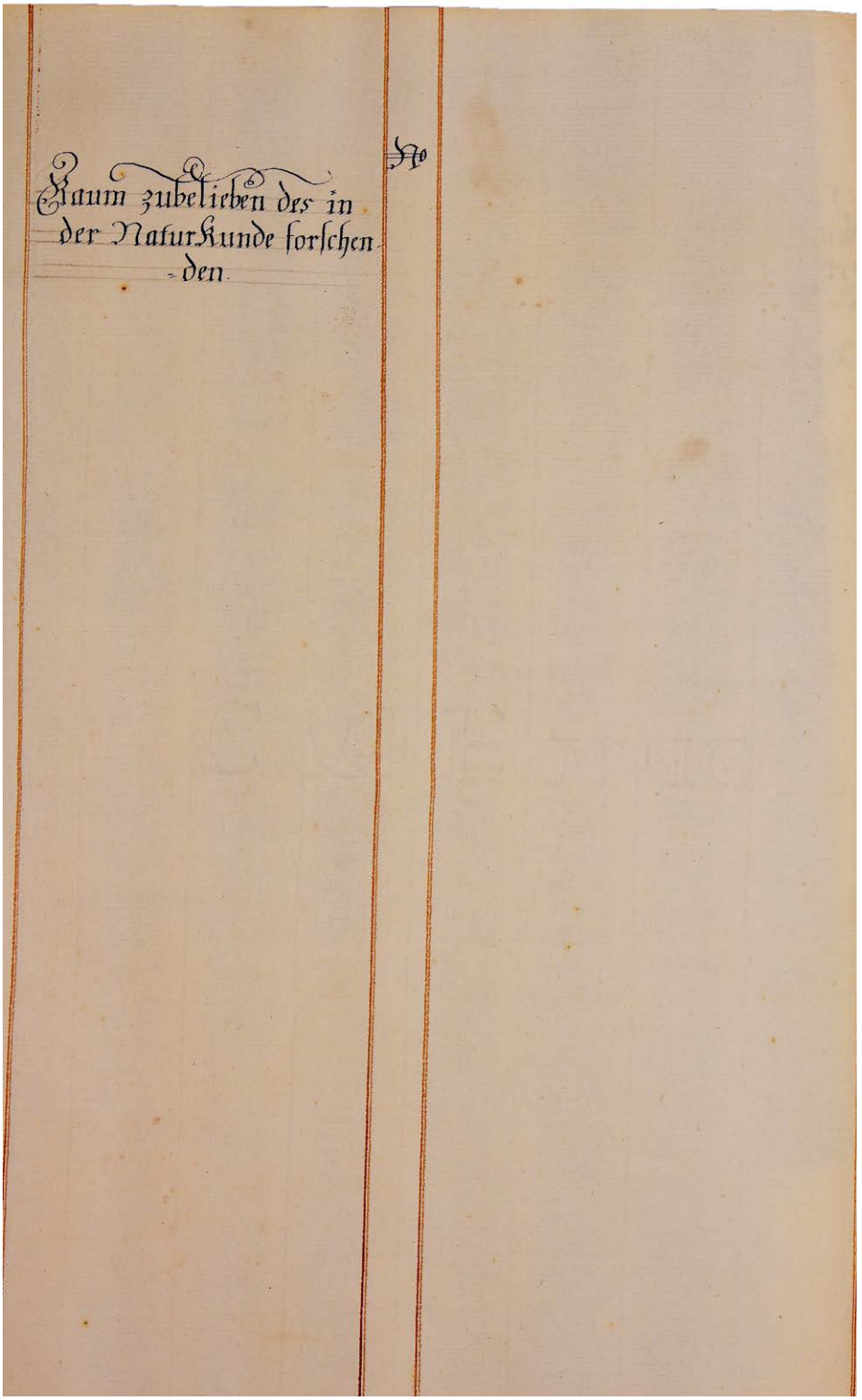
Raum zubelieben des in der Natur Kunde forschenden

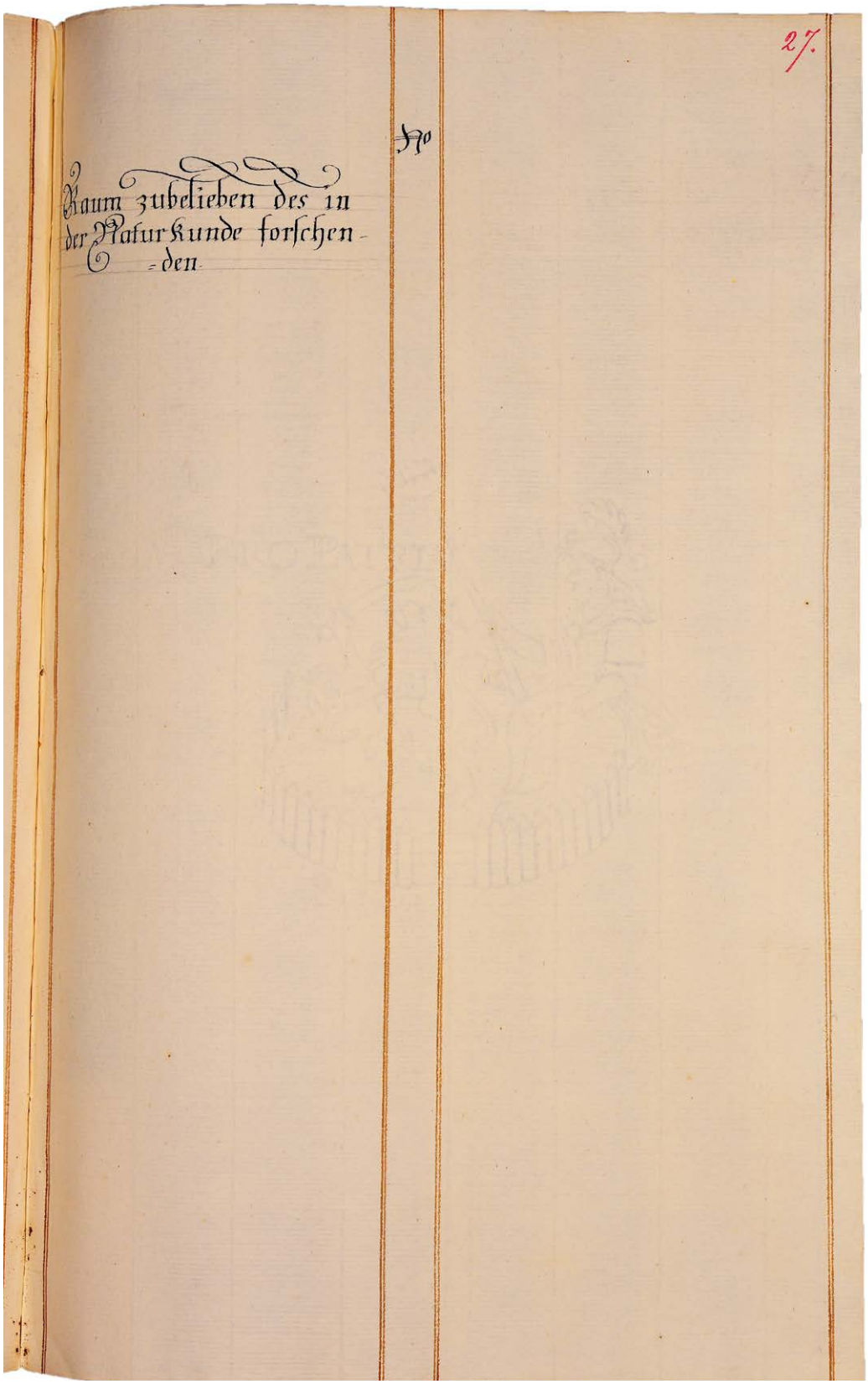
	No	
	234	Eysen Drusen
	235	Marchesit von Eysen ertzartigem leim grau ub
	236	blauer Eysen Ertzt von St Sebald. Stollen –
	237	grün glinziger Eysen stein
	238	Spiegel glinz.
	239	Rother glinz.
	240	Ertzt und glinz von St Antoni Stollen.
	241	ausgewittert oder übergentiger Eysen Stuffen
	242	mit Roß zahn eingesprengter glinz und Eysen Ertzt von St Melchior Stollen

Notandum: bey dem Eysen schmelzen werden keine Stuffen proben, sondern nur gemeine proben genohmen, weilen die obbeschriebenen Ertzte in der Vermischung gefordert und auch so auf geschmolzen werden, aber der mittelhalt der Verschmelzung in grosß auf ablich 40 lb Eysen vom Centner Ertzt ausbelauft. Jedoch seind seit einig Monath angefangen auf Stuffen proben zu machen, und ebenfalls entsprechende Versuch als in vorigen Zeit vorzunehmen, wie dann auch ein sechstel theil eines hohofens zum probieren [illegible] proportionierten Zeit [illegible] errichtet worden ist.

[illegible]


26.
Baum zubelieben des in
der Naturkunde forschen-
den.


Raum zubelieben des in
der NaturKunde forschen
den.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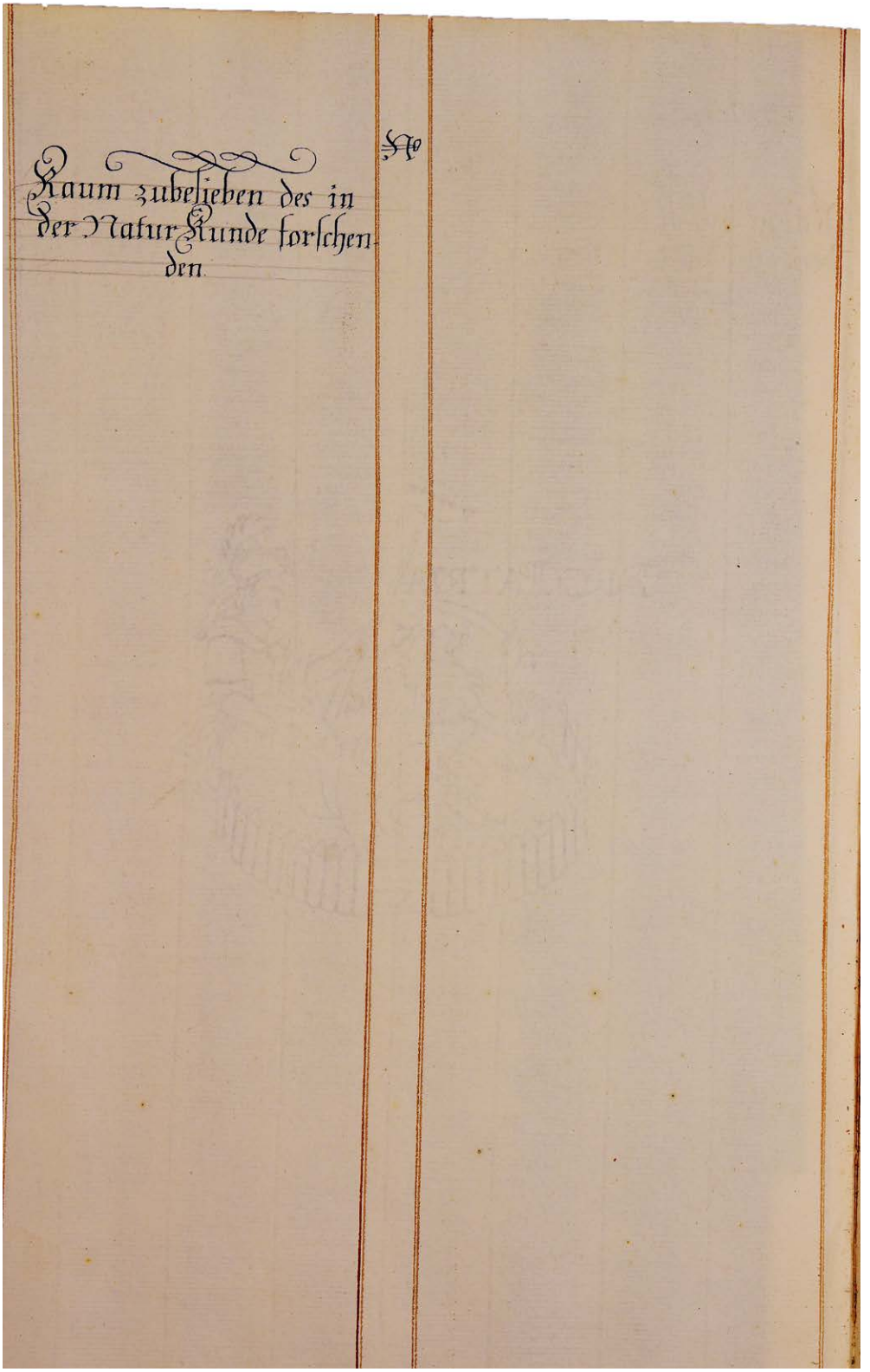
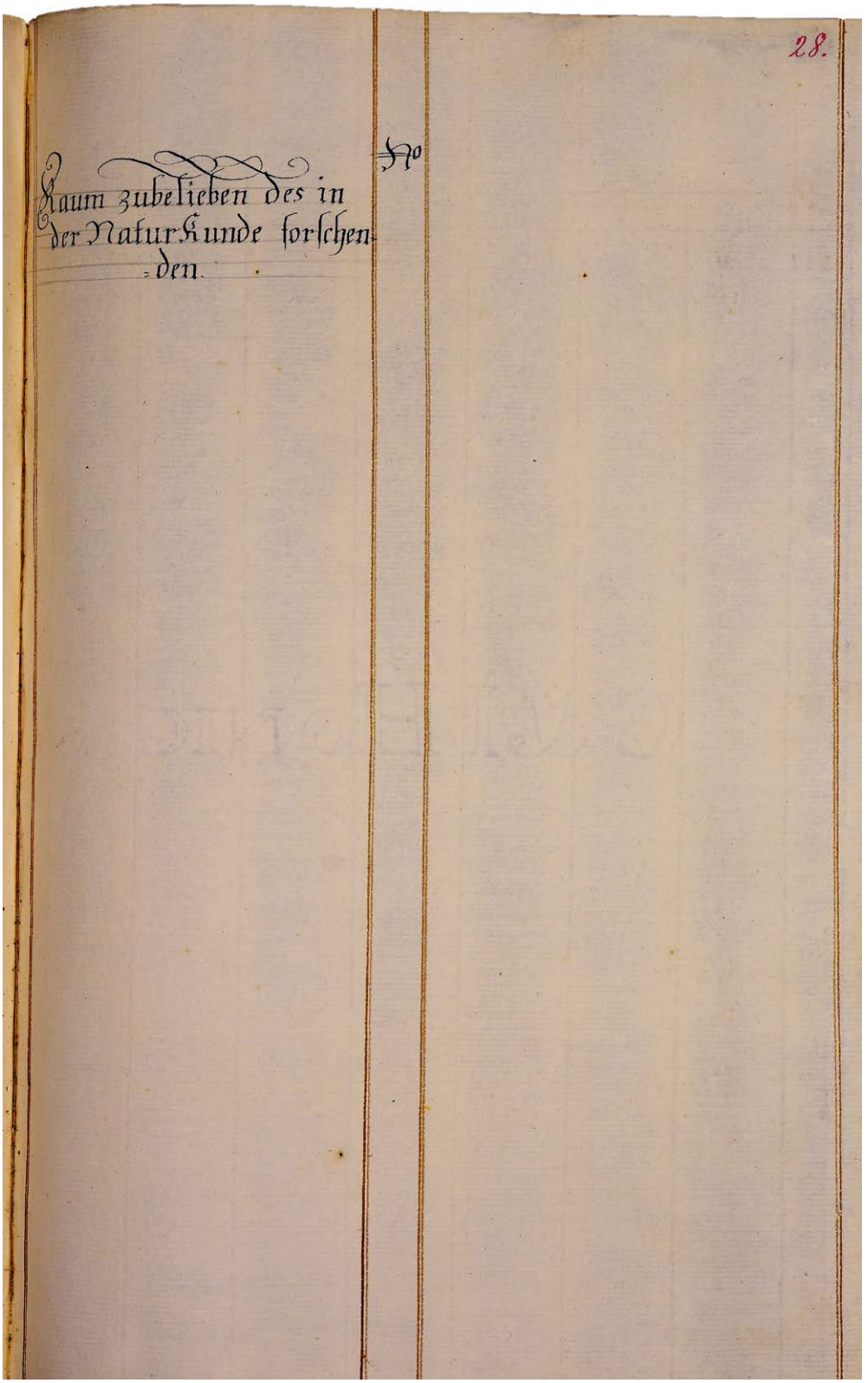
der Natur Kunde forschen-
den


Raum zubelieben des in
der Natur Kunde forschen-
den


28.

No

Raum zubelieben des in
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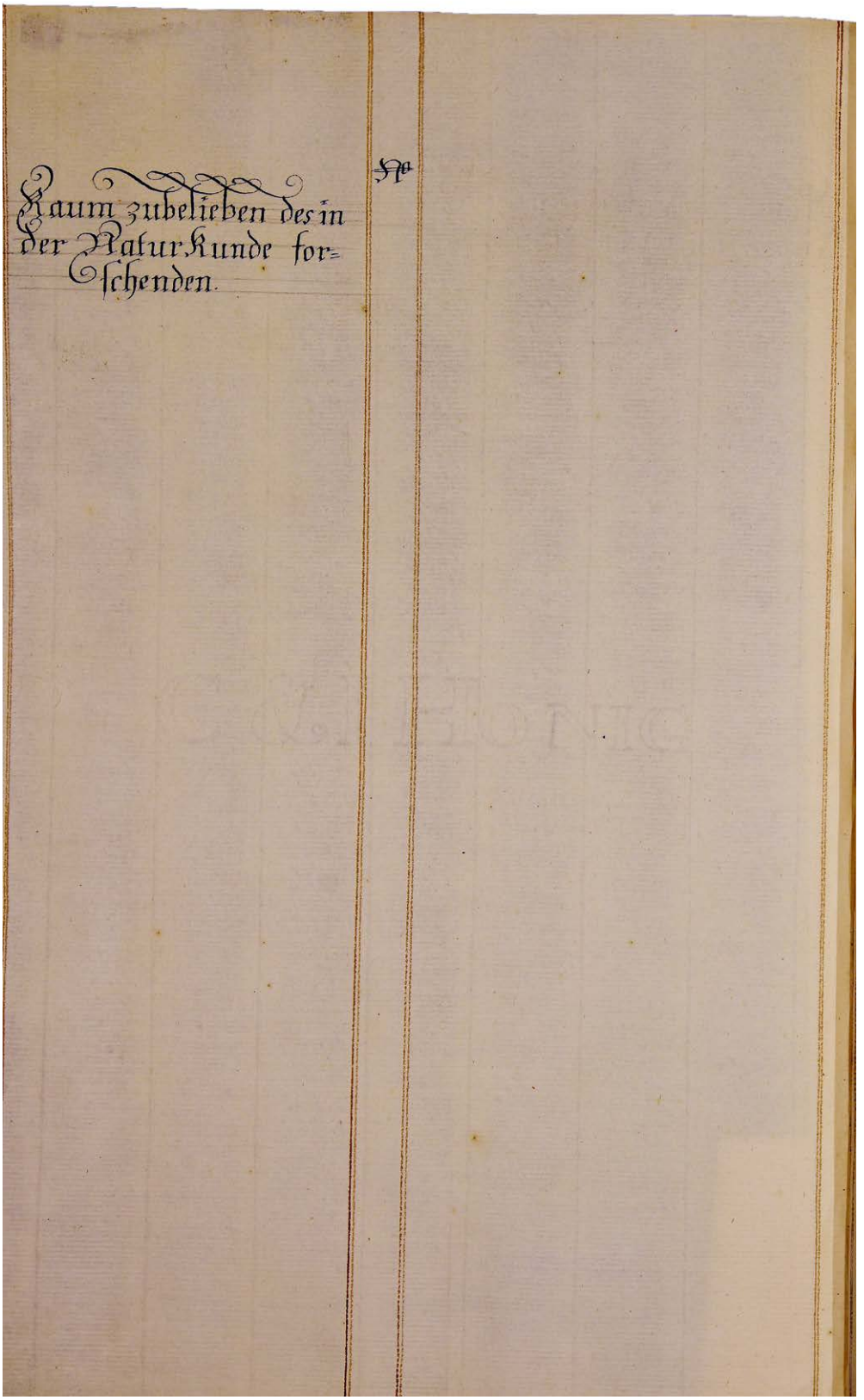
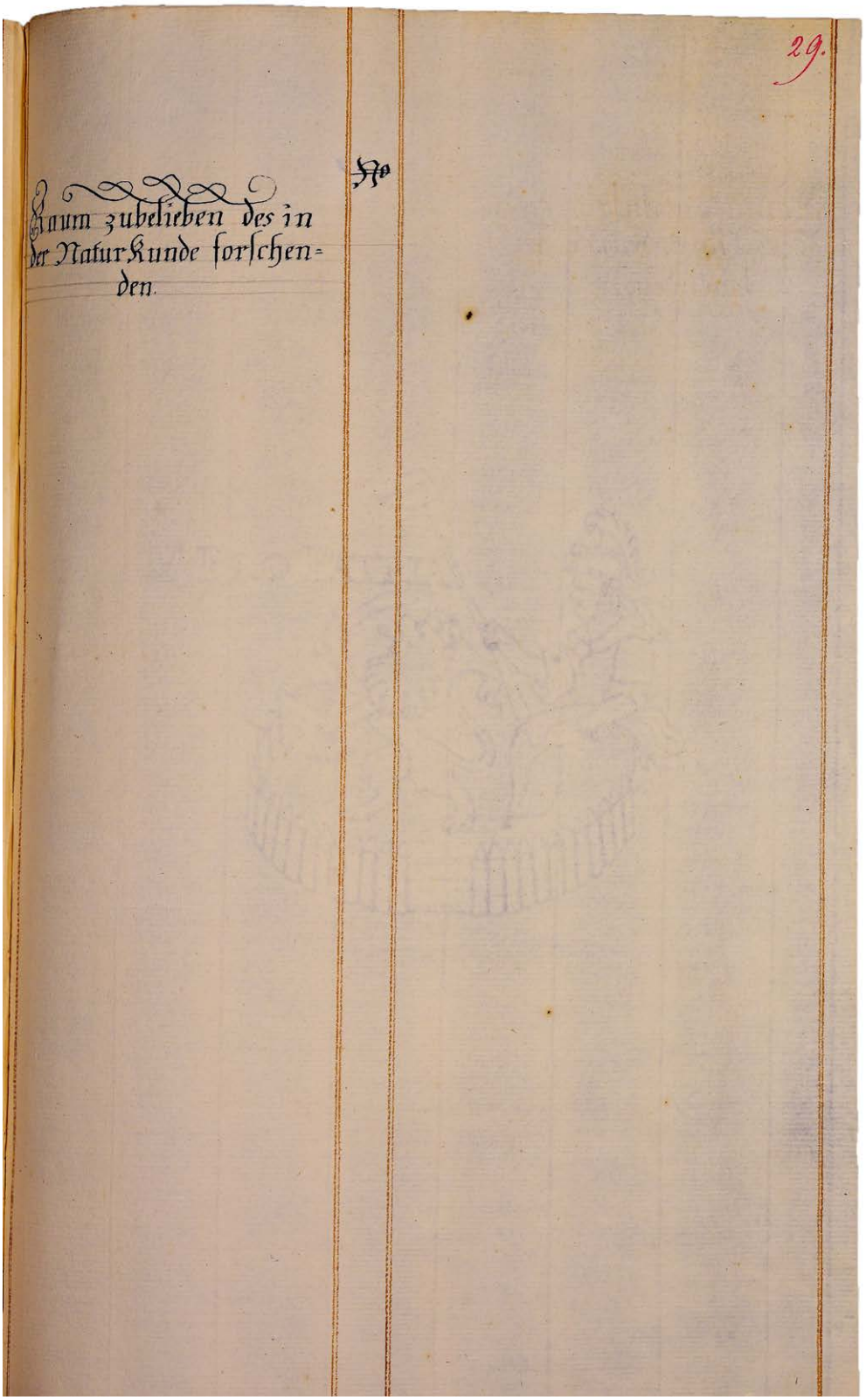
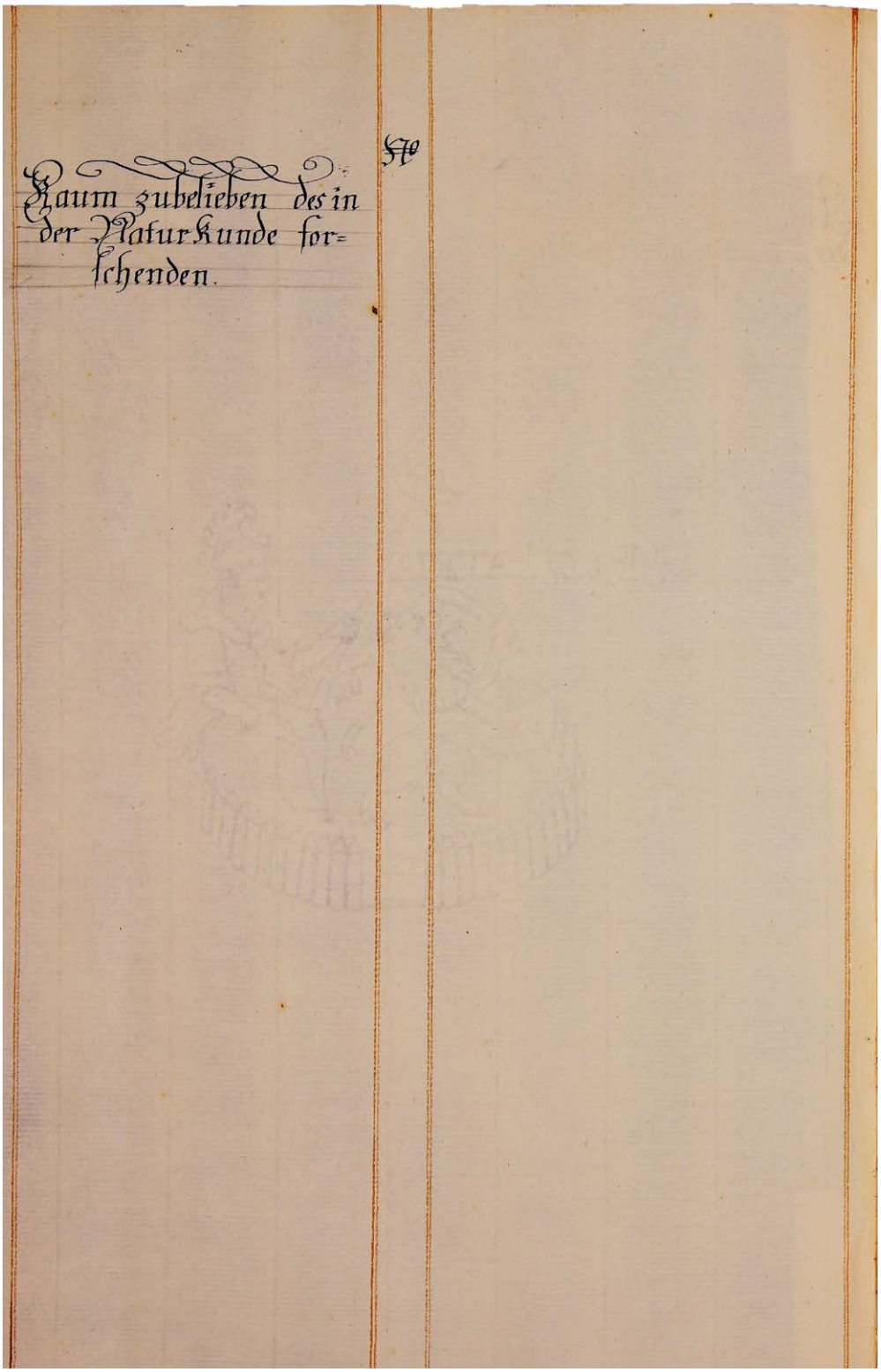

Raum zubelieben des in
der Natur Kunde for=
schenden.



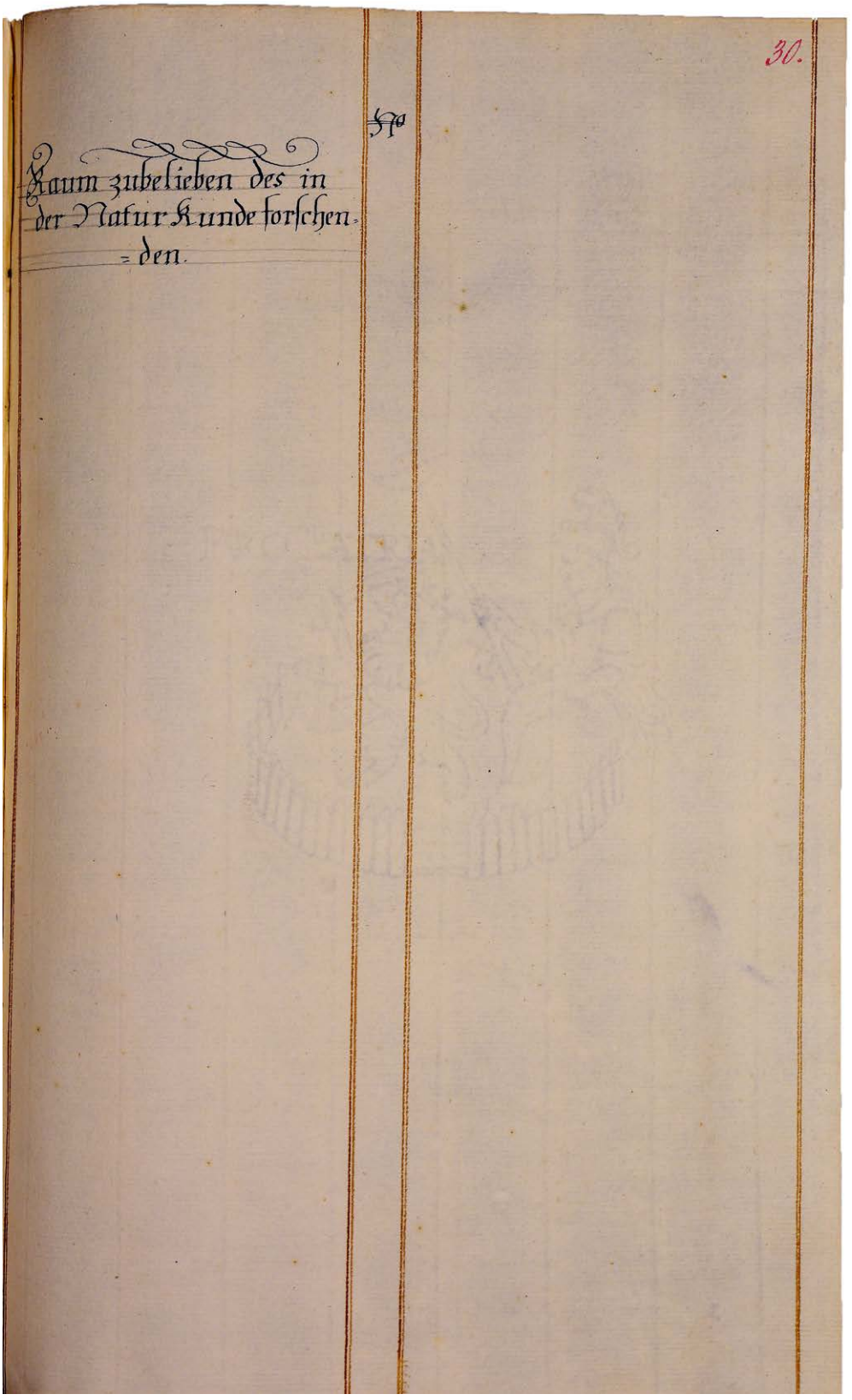
29.

Raum zubelieben des in
der NaturKunde forschen-
den.

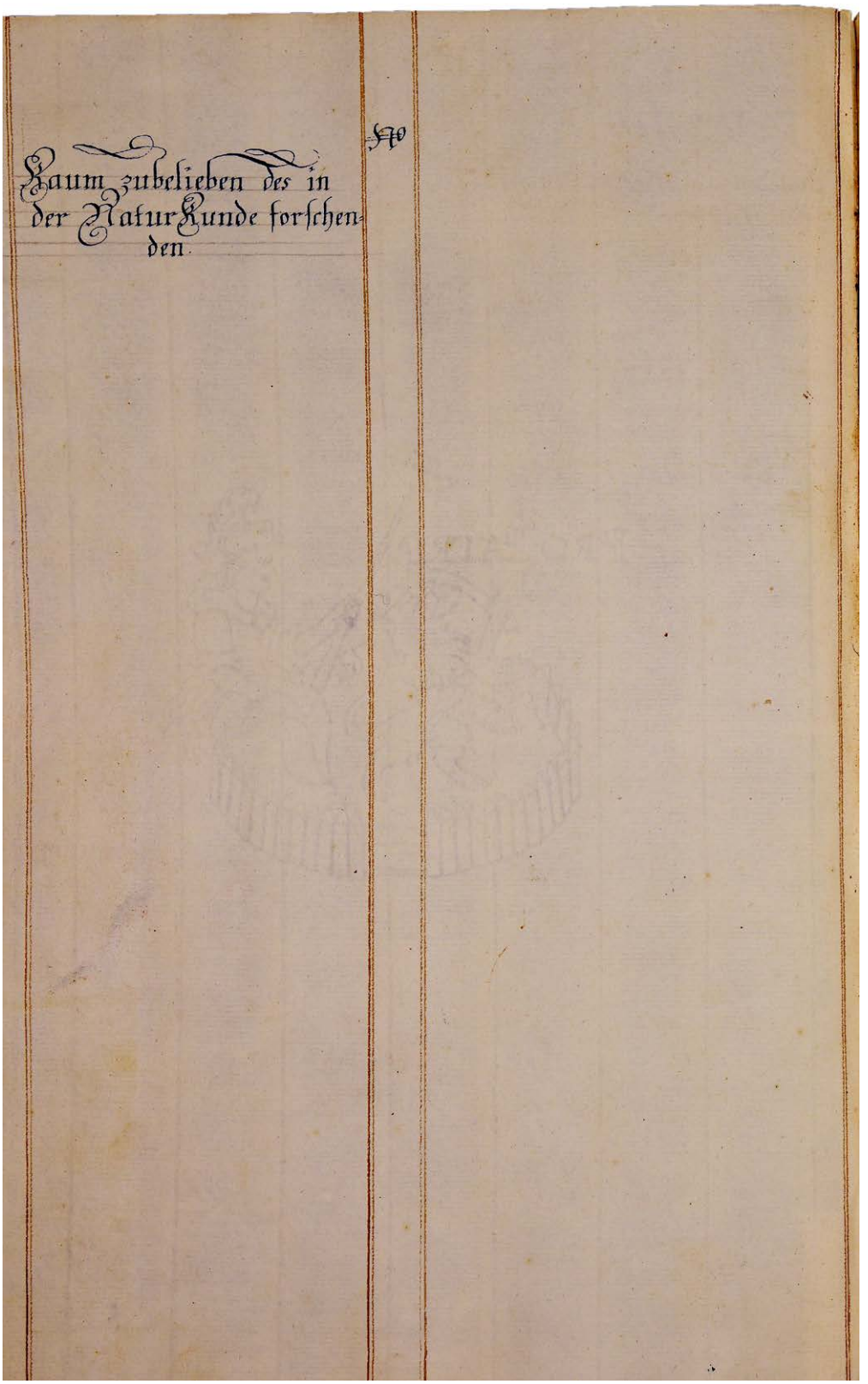


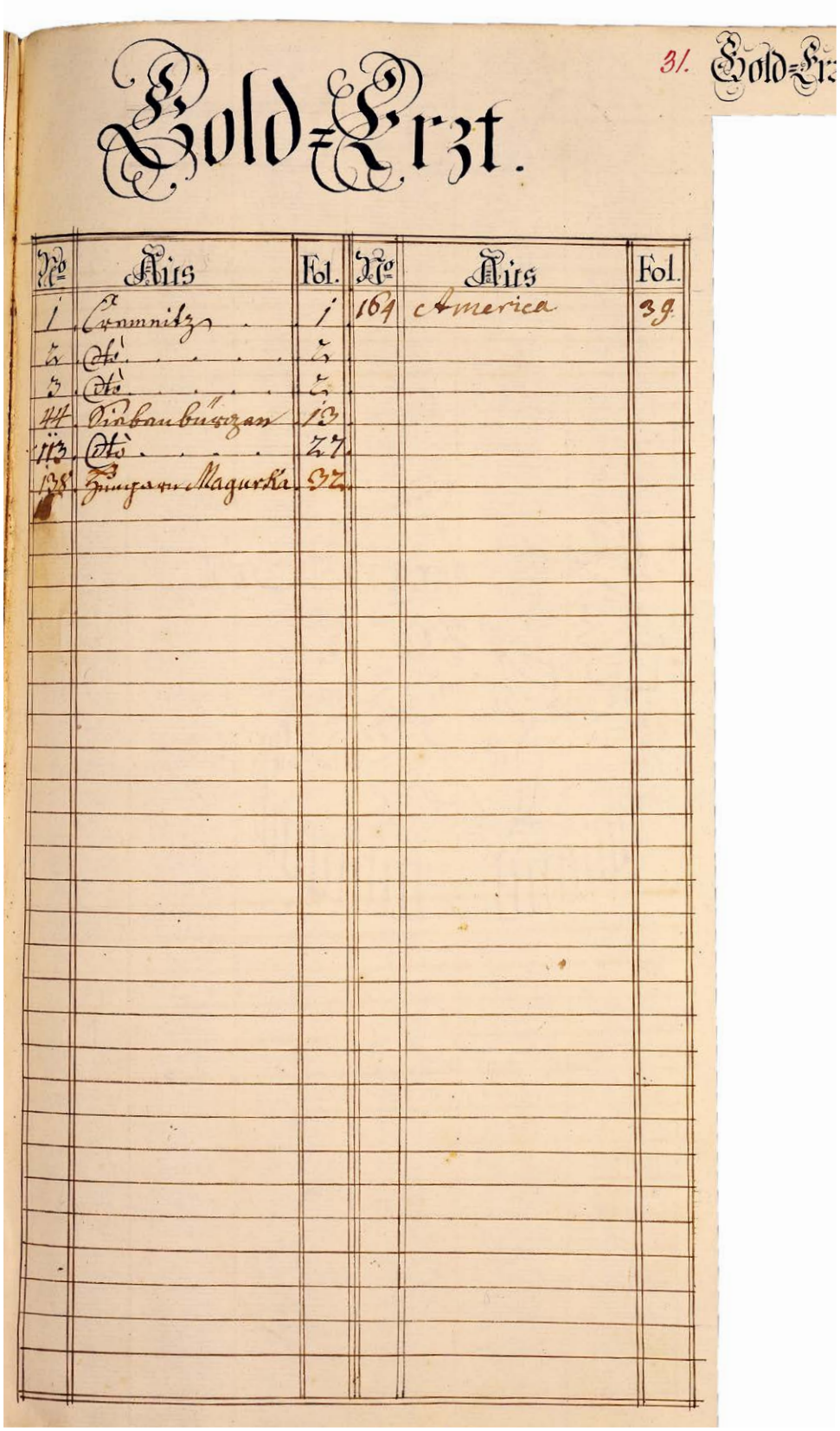
Raum zubelieben des in
der Naturkunde for=
schenden.

57


30.

Raum zubelieben des in
der Natur Kunde forschen-
=den.

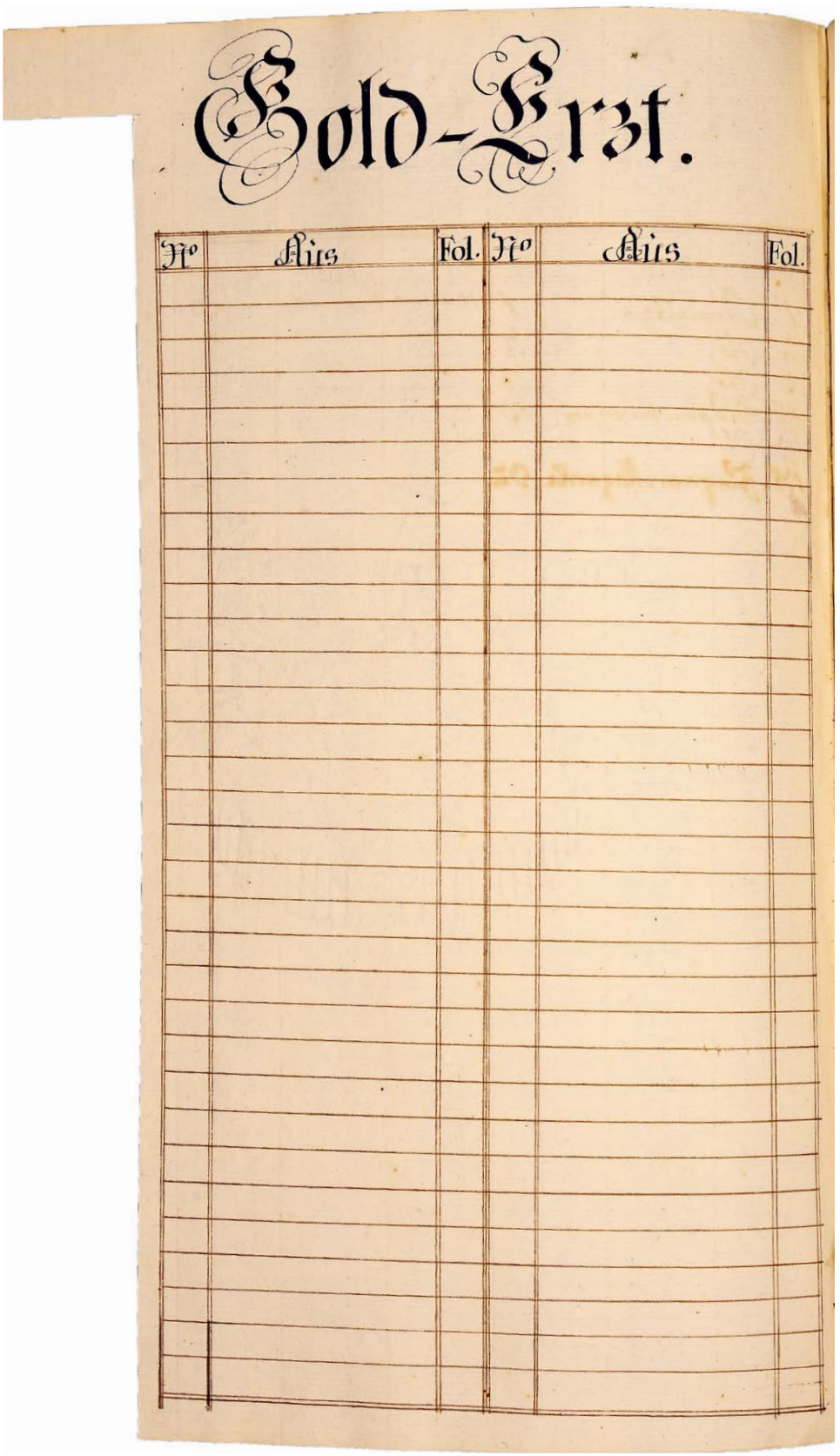

Raum zubelieben des in
der NaturKunde forschen-
den.



31. Gold=Erz

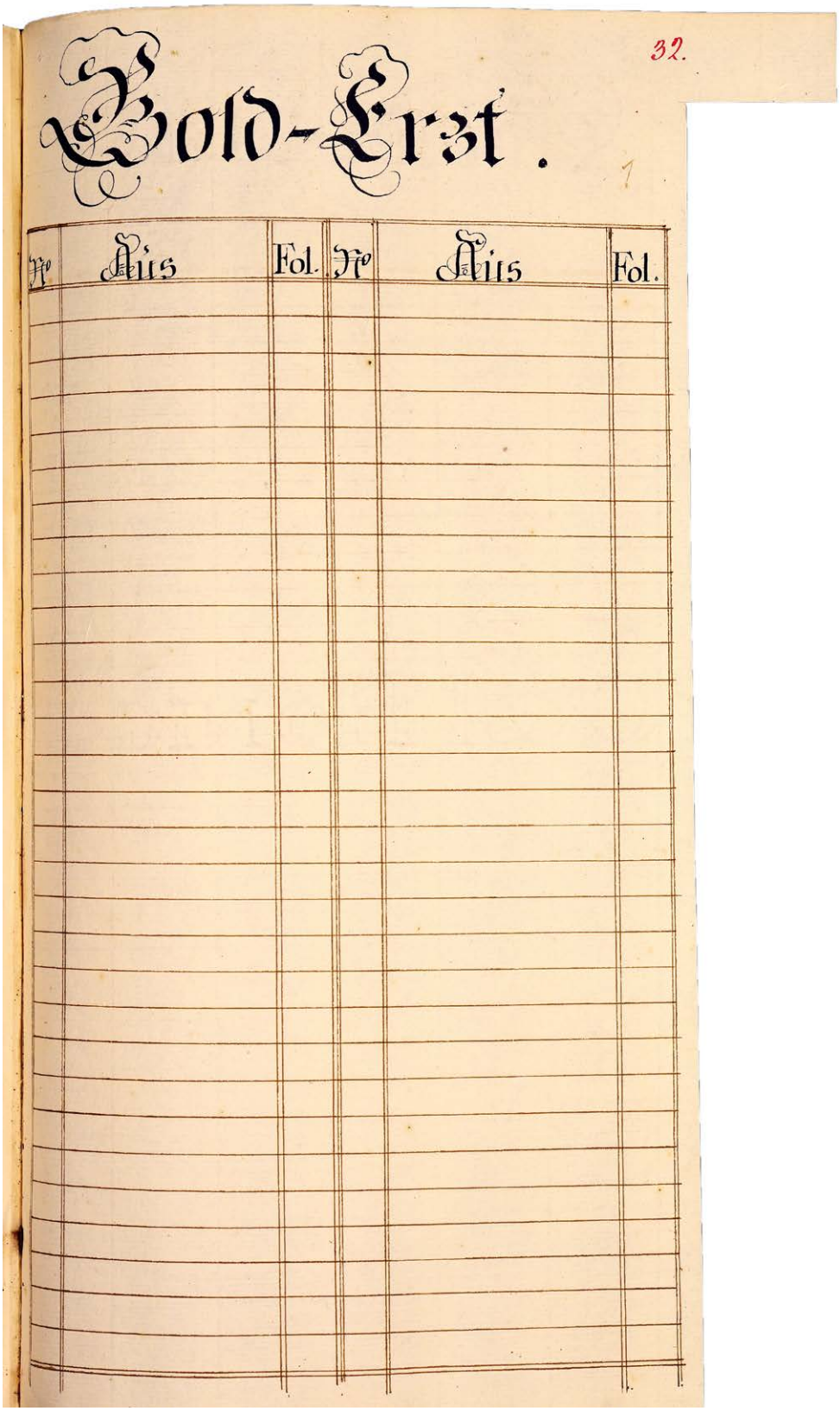
Gold=Erzt.

No.	Nits	Fol.	No.	Nits	Fol.
1	Cremnitz	1	164	America	39
2	Dto	2			
3	Dto	2			
44	Vinbaubuszan	18			
113	Dto	27			
138	Hungarn Magurka	32			



Gold-Erzt.

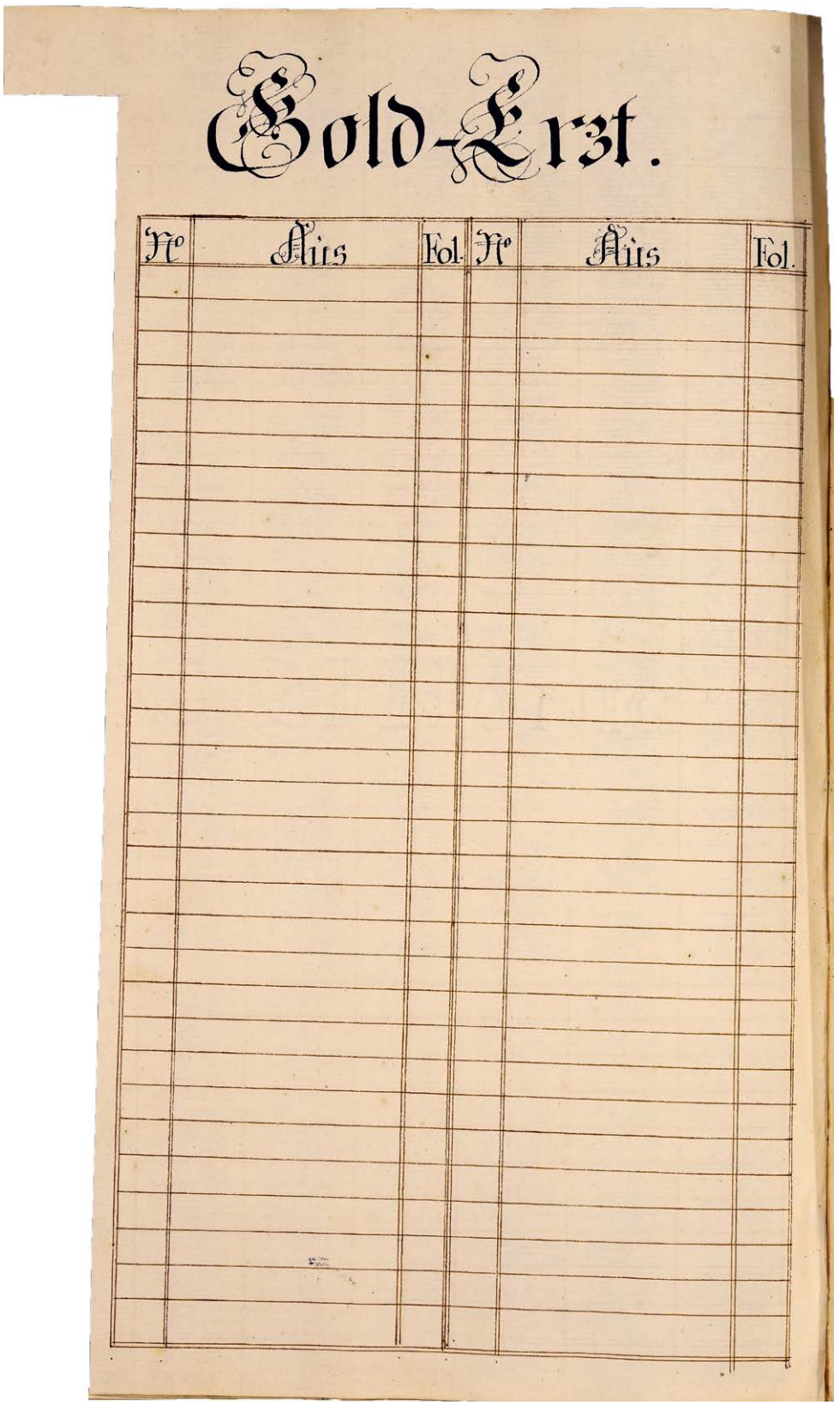
No	Nits	Fol.	No	Nits	Fol.



32.

Bold-Erst.

№	Aus	Fol.	№	Aus	Fol.



Gold-Erzt.

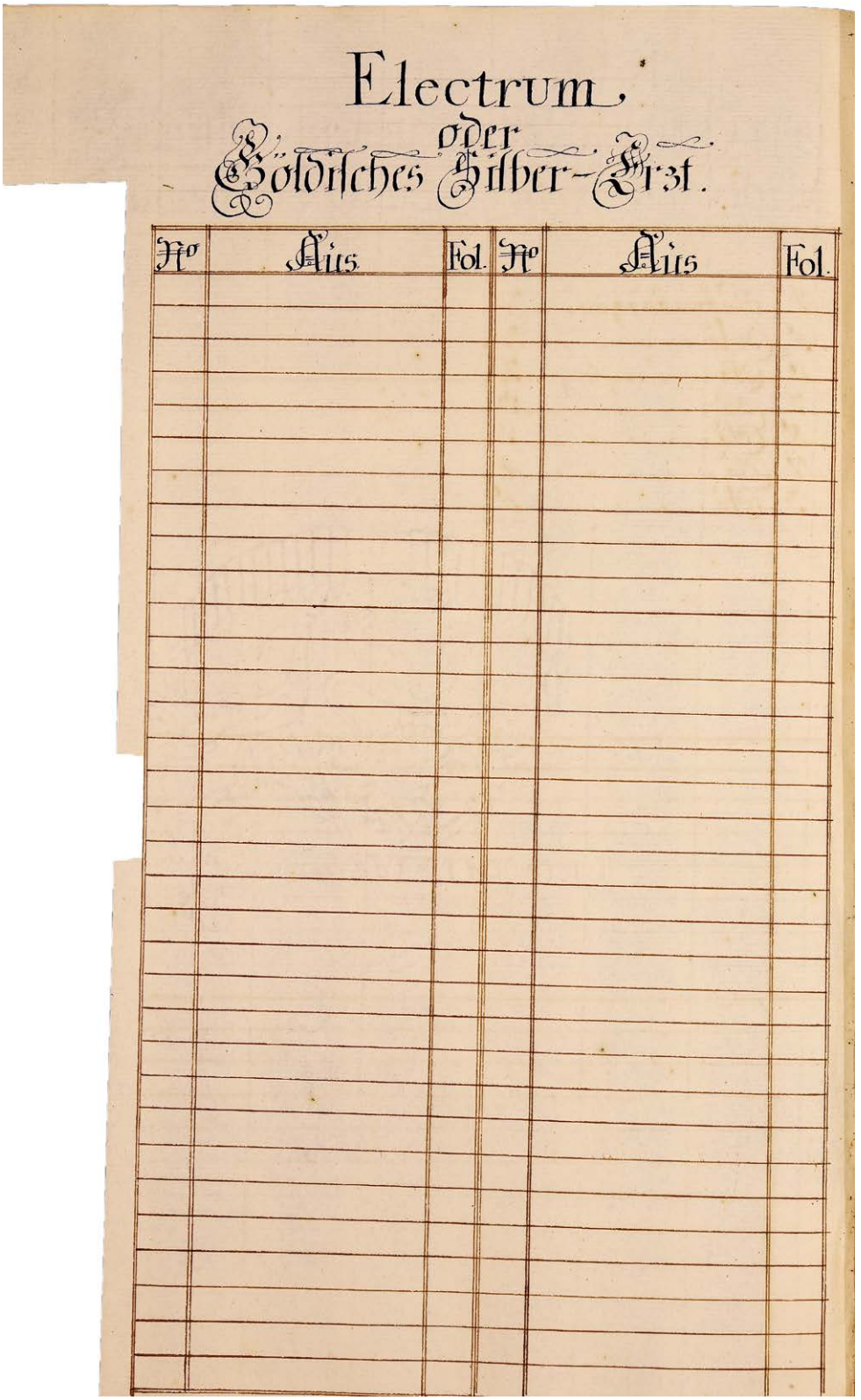
№	Airs	Fol.	№	Airs	Fol.

33.

Electrum
oder Gold und Silber zugleich haltende Minera, Göldisches Silber Erzt genant

Electrum oder Göldisch-Silber Erz.

No	Nits	Fol.	No	Nits	Fol.
4	Siebenbürgen	2			
5	Detò	2			
6	Ditò	3			
7	Ditò	3			
8	Ditò	3			
9	Ditò	4			
10	Ditò	5			
154	Mexico	37			



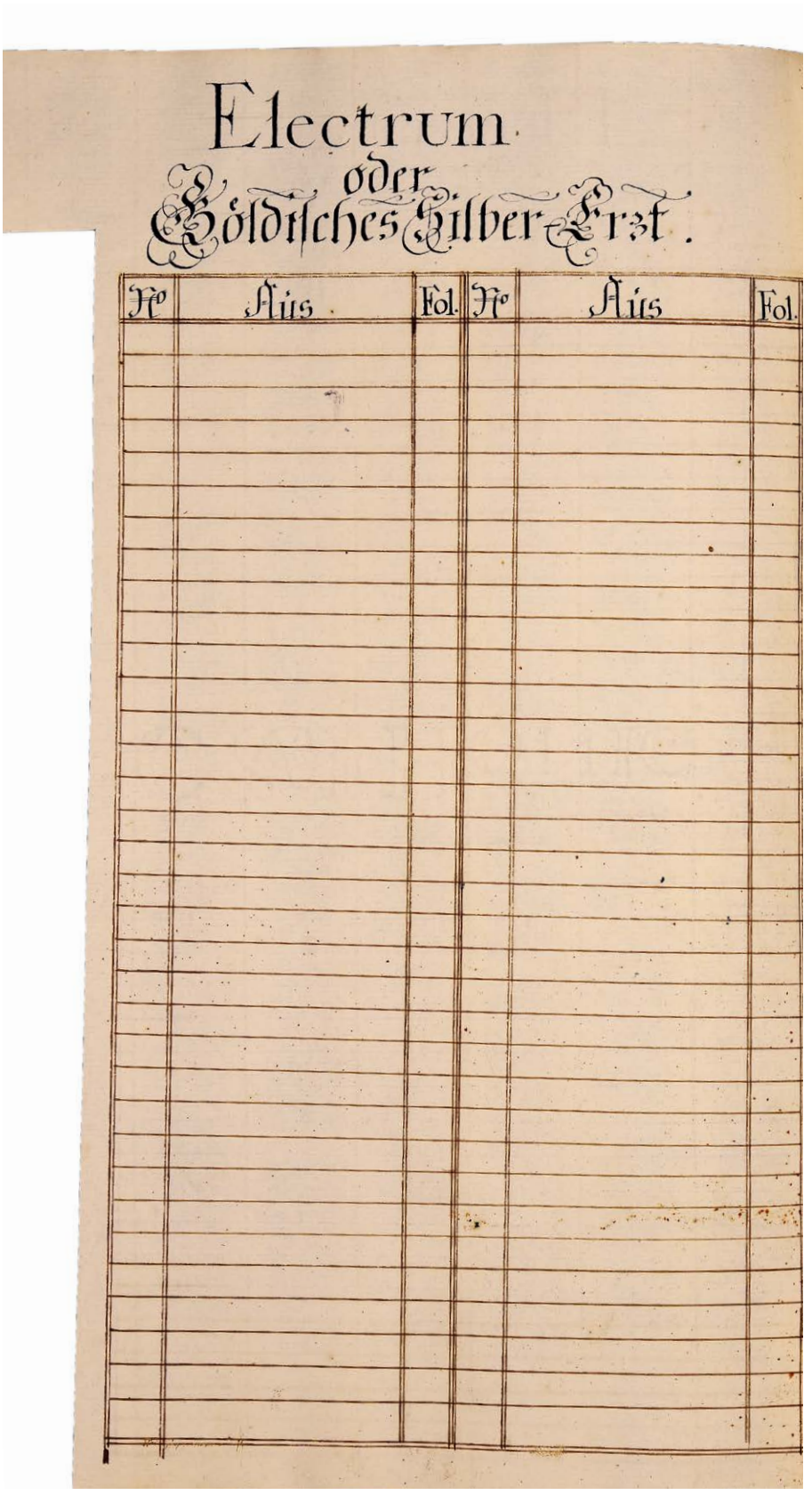
Electrum, oder Goldisches Silber-Ertz.

No	Aus	Fol.	No	Aus	Fol.

34.

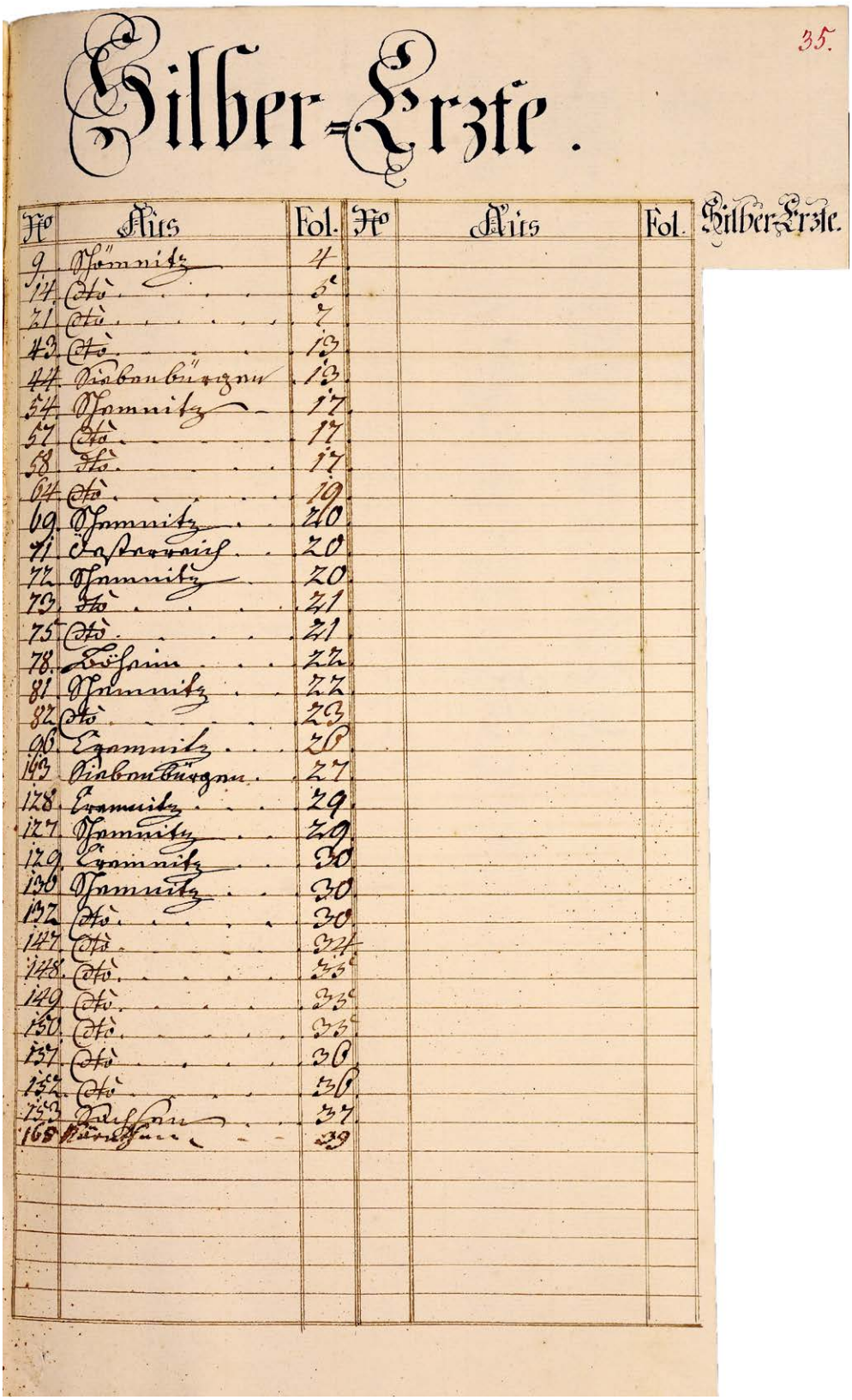
Electrum.
oder
Göldisches Silber-Ertz.

№	Nits	Fol.	№	Nits	Fol.



Electrum
oder Göldisches Silber Ertz.

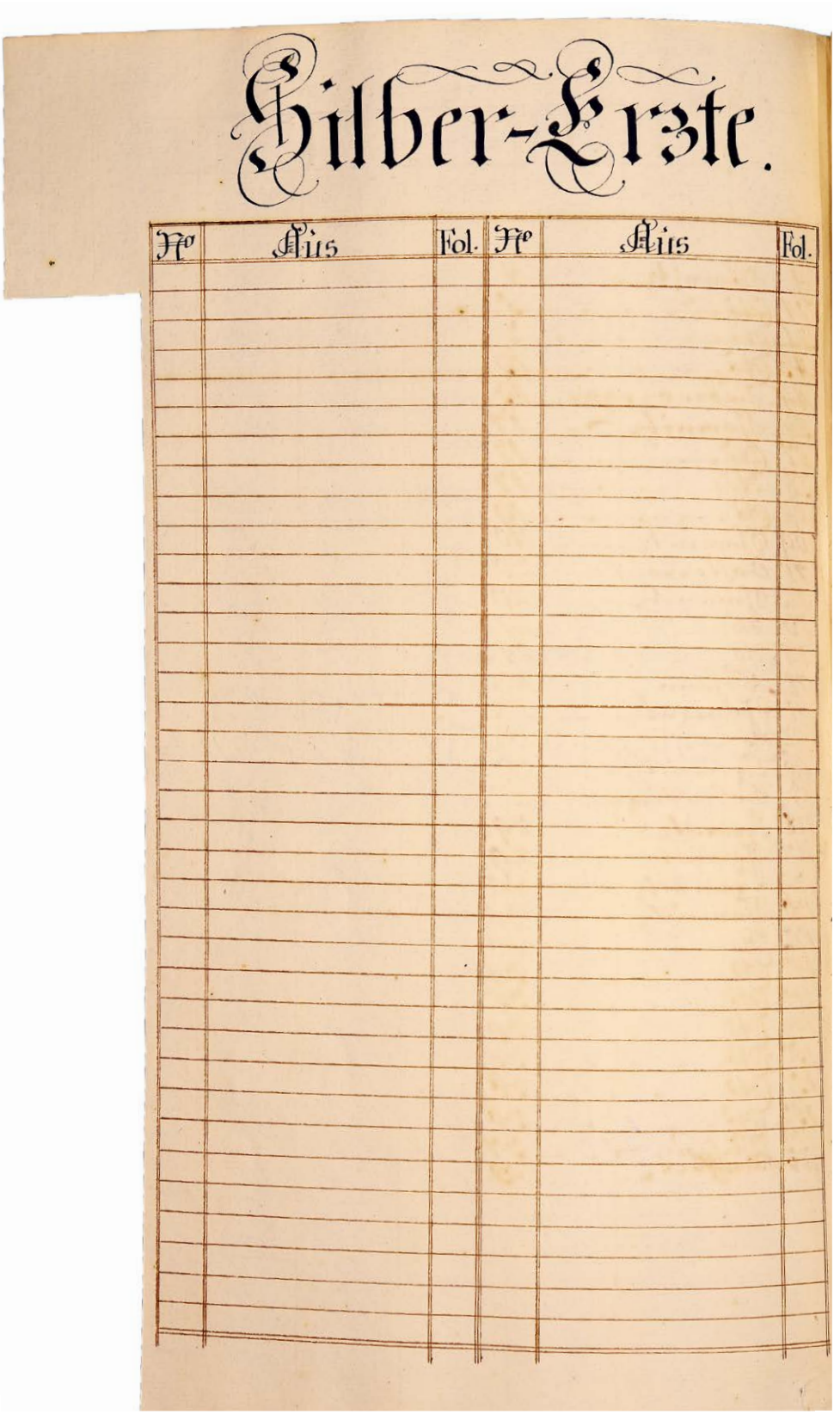
No	Aus	Fol.	No	Aus	Fol.

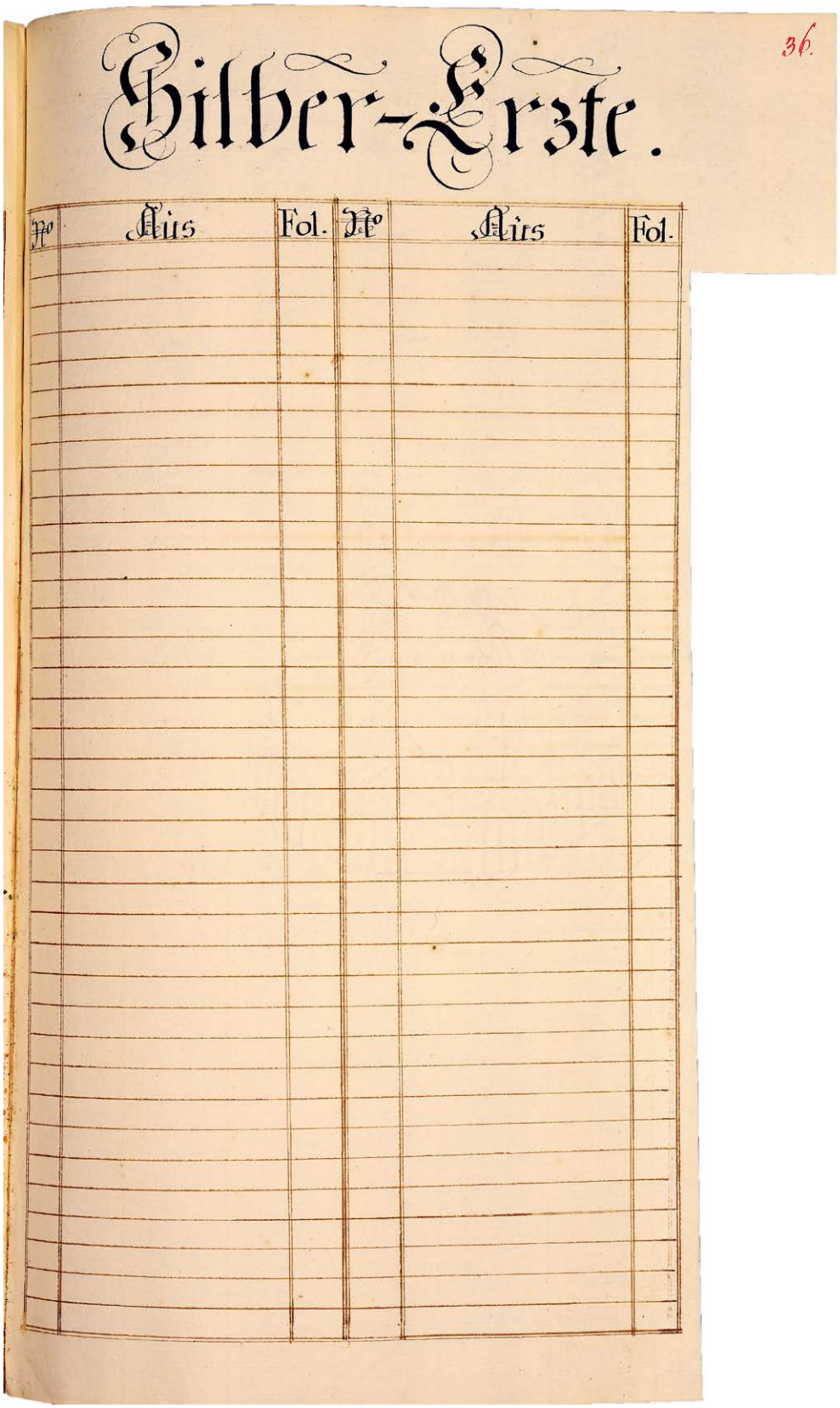


Silber-Erze.

35.

No	Nits	Fol.	No	Nits	Fol.	Silber-Erze.
9.	Schmnitz	4.				
14.	Ctò	5.				
21.	Ctò	7.				
43.	Ctò	13.				
44.	Siebenbürgen	13.				
54.	Schmnitz	17.				
57.	Ctò	17.				
58.	Ctò	17.				
64.	Ctò	19.				
69.	Schmnitz	20.				
71.	Caschau	20.				
72.	Schmnitz	20.				
73.	Ctò	21.				
75.	Ctò	21.				
78.	Eschau	22.				
81.	Schmnitz	22.				
82.	Ctò	23.				
96.	Cremnitz	28.				
103.	Siebenbürgen	27.				
128.	Cremnitz	29.				
127.	Schmnitz	29.				
129.	Cremnitz	30.				
130.	Schmnitz	30.				
132.	Ctò	30.				
147.	Ctò	34.				
148.	Ctò	35.				
149.	Ctò	35.				
150.	Ctò	35.				
151.	Ctò	36.				
152.	Ctò	36.				
153.	Eschau	37.				
165.	Kremnitz	39.				

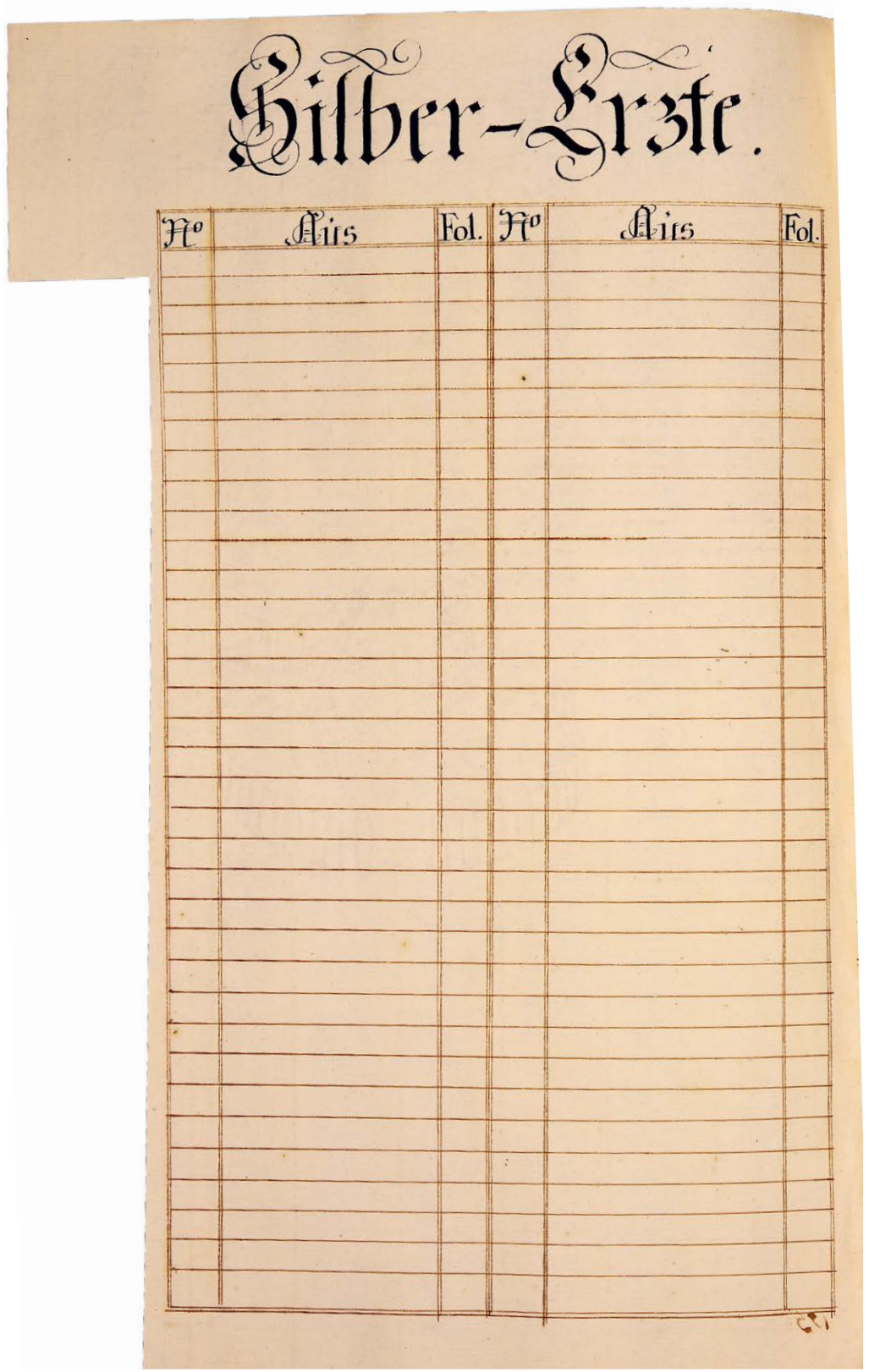

Silber-Erze.
No
Nis
Fol.
No
Nis
Fol.



Silber-Erze.

36.

№	Nus	Fol.	№	Nus	Fol.



Silber-Erzte.

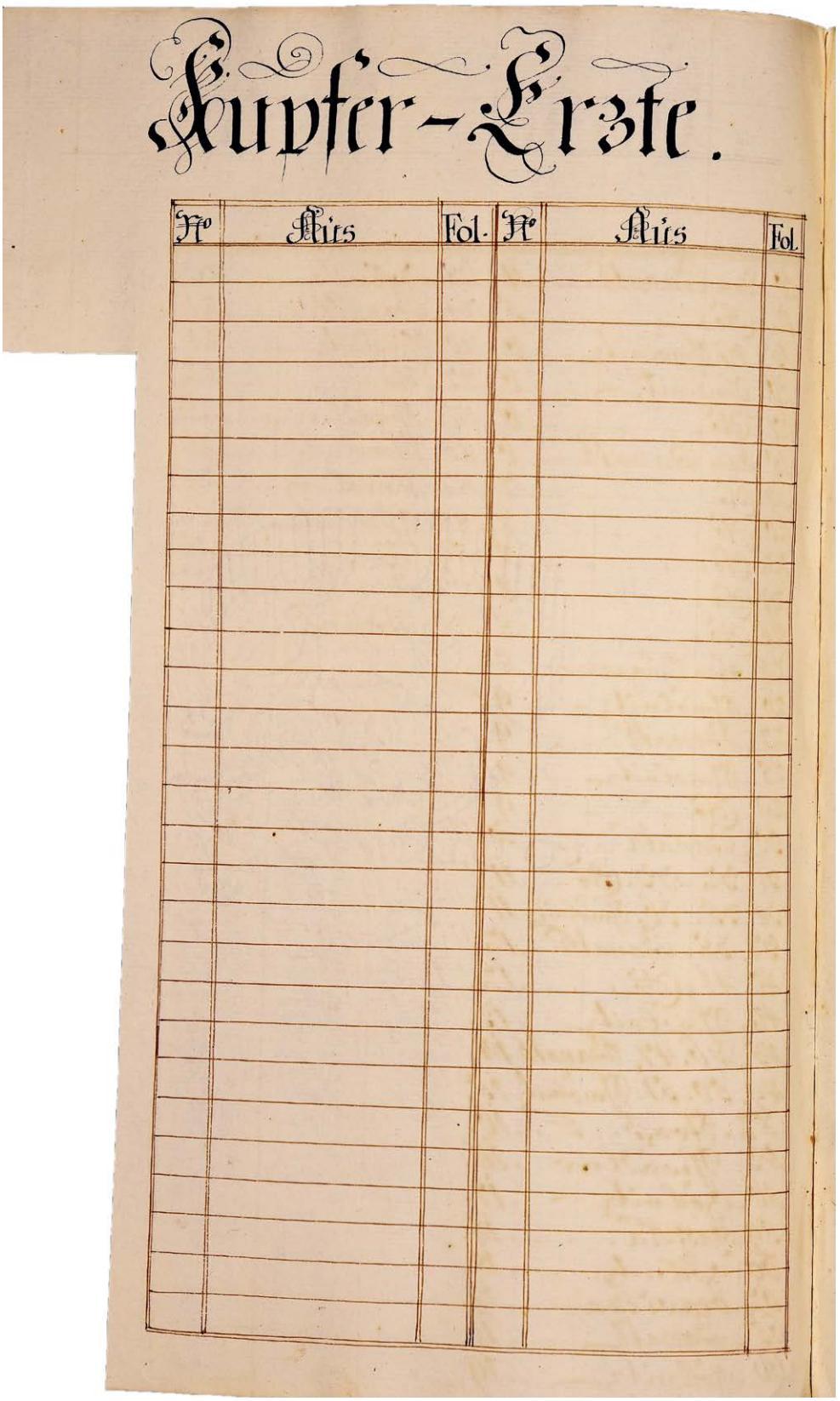
No	Nits	Fol.	No	Nits	Fol.

37.

Kupfer-Erzte.

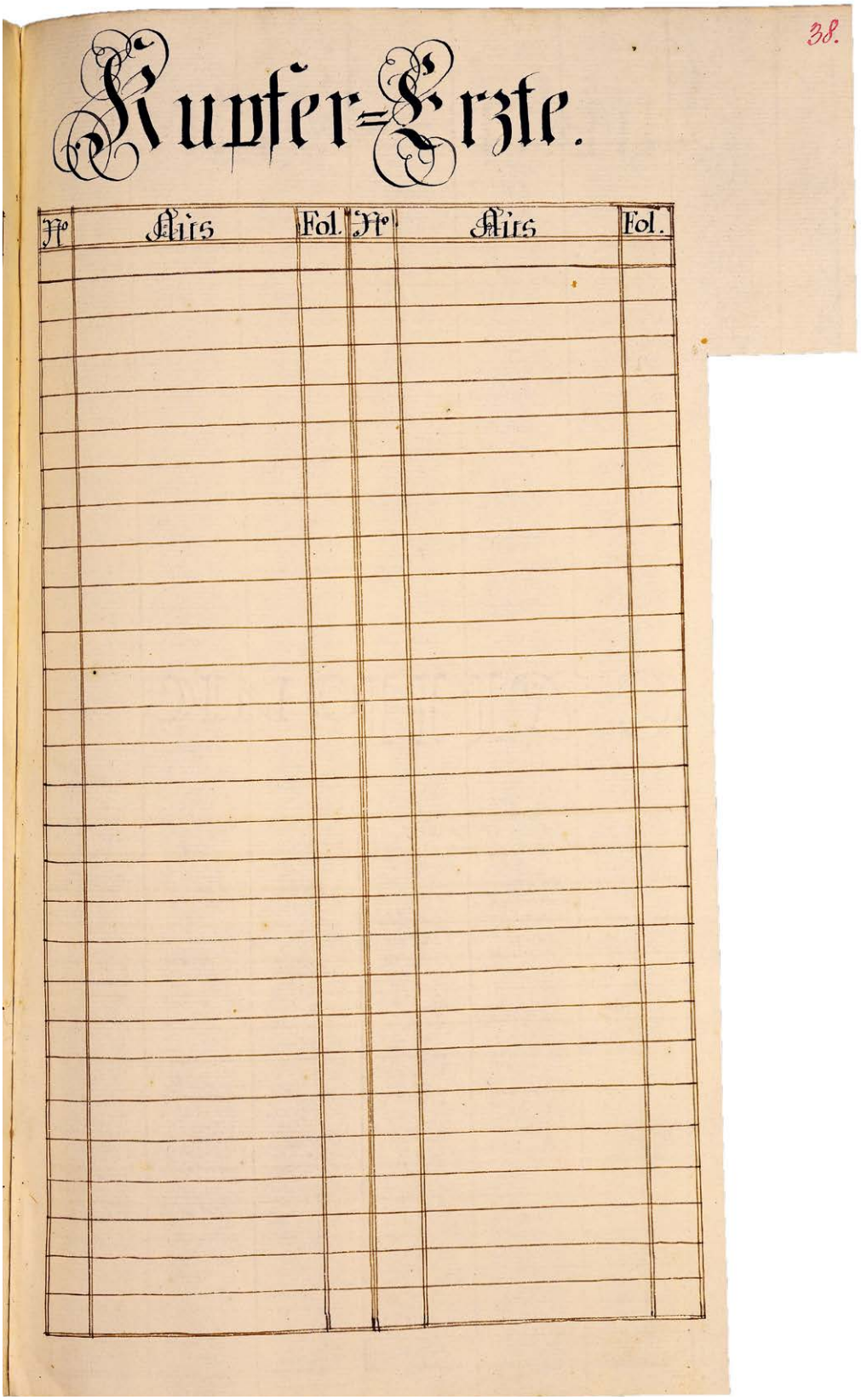
Kupfer-Erzte

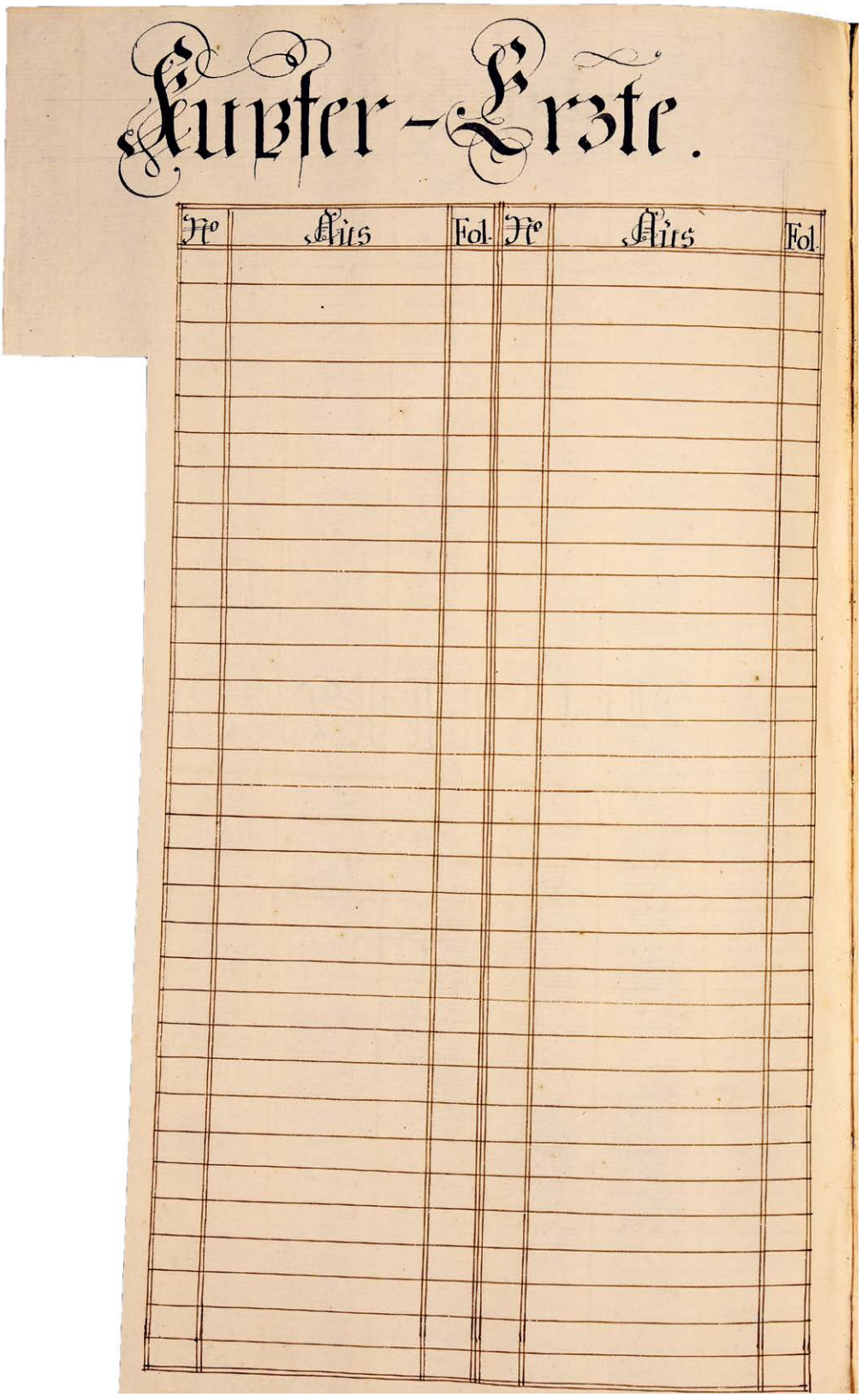
No	Aus	Fol.	No	Aus	Fol.
10	dem Banath	4	68	Göllnitz	20
12	dto	5	74	Banath	21
13	dto Schmölnitz	6	76	Schmölnitz	21
16	Schmölnitz	6	77	dto	22
17	dto	6	84	Schwädler	23
18	dem Banath	6	85	Schmölnitz	23
19	dto	7	87	Tyroll	24
20	dto	7	88	Schmölnitz	24
22	dto	8	89	Neusohl	24
23	dto	8	117	Banath	27
25	dto	8	133	Banath	31
24	ober Hungarn	8	156	Kärnthen	38
26	Schmölnitz	9	~~[illegible]~~	~~Tyrol~~	
27	Banath	9	167	Tyrol	39
28	Schmölnitz	9	168	Tirol	39
29	dto	9	169	Tyrol	40
30	Banath	10	170	Tyrol	40
31	32. 33. dto	11	171	Tyrol	40
34	35. 36. Schmölnitz	11	172	Tyrol	40
37	38. Banath	12	173	Tyrol	40
40	41. dto	12	174	Tyrol	40
42	Schmölnitz	13	175	Tyrol	40
45	46. 47. Banath	14	176	Tyrol	41
49	50. 51. Schmölnitz	15	177	Tyrol	41
52	Stoß	16	178	Tyrol	41
53	Schwädlar	16			
56	Göllnitz	17			
59	Szaszka	18			
60	Göllnitz	18			
62	Oravicza	18			
65	Banath	19			
66	Göllnitz	19			



Kupfer-Erzte.

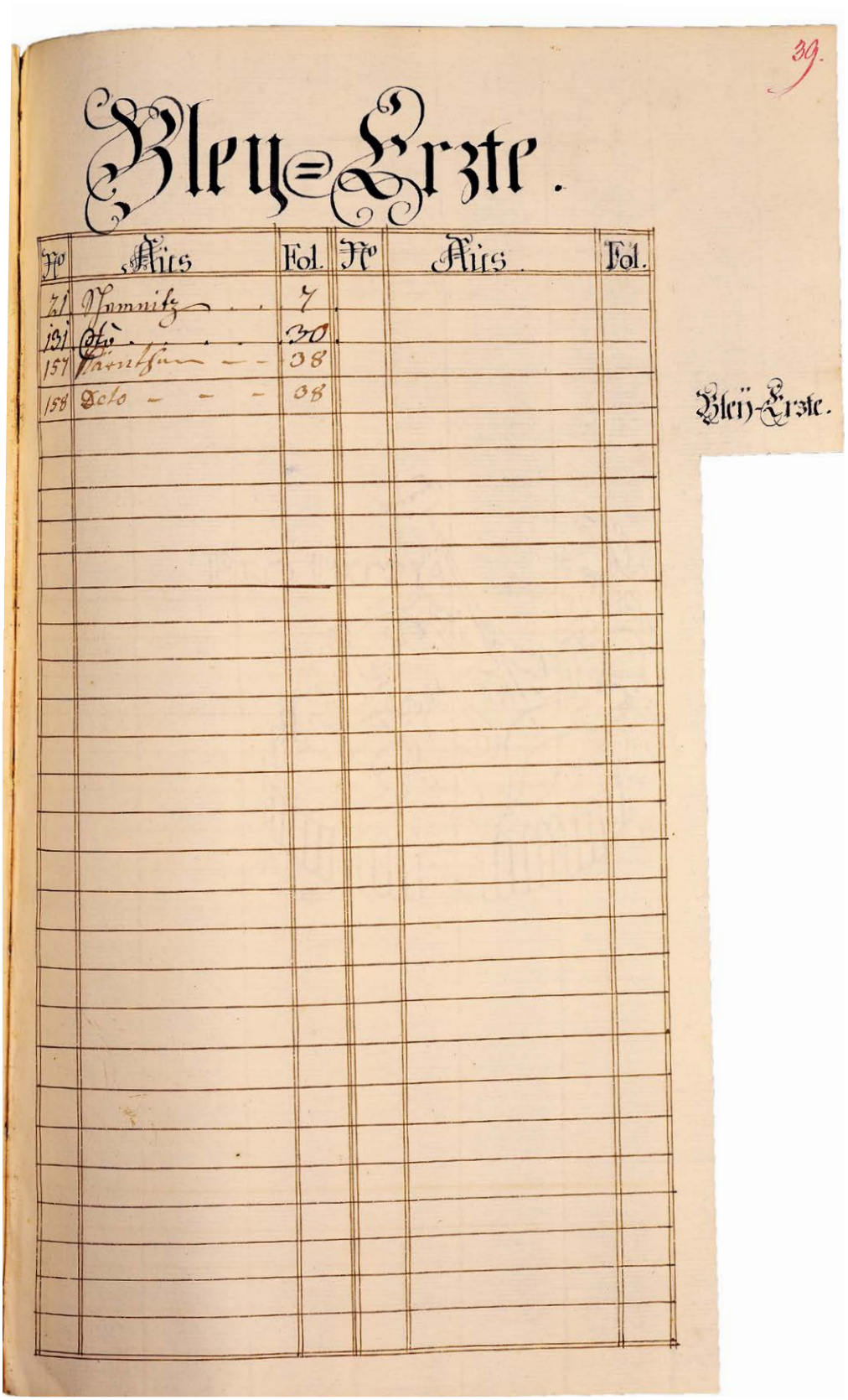
No	Nits	Fol.	No	Nits	Fol.


38.
Kupfer=Erzte.
№ Mirs Fol. № Mirs Fol.



Kupfer-Erzte.

Nr	Nits	Fol.	Nr	Nits	Fol.

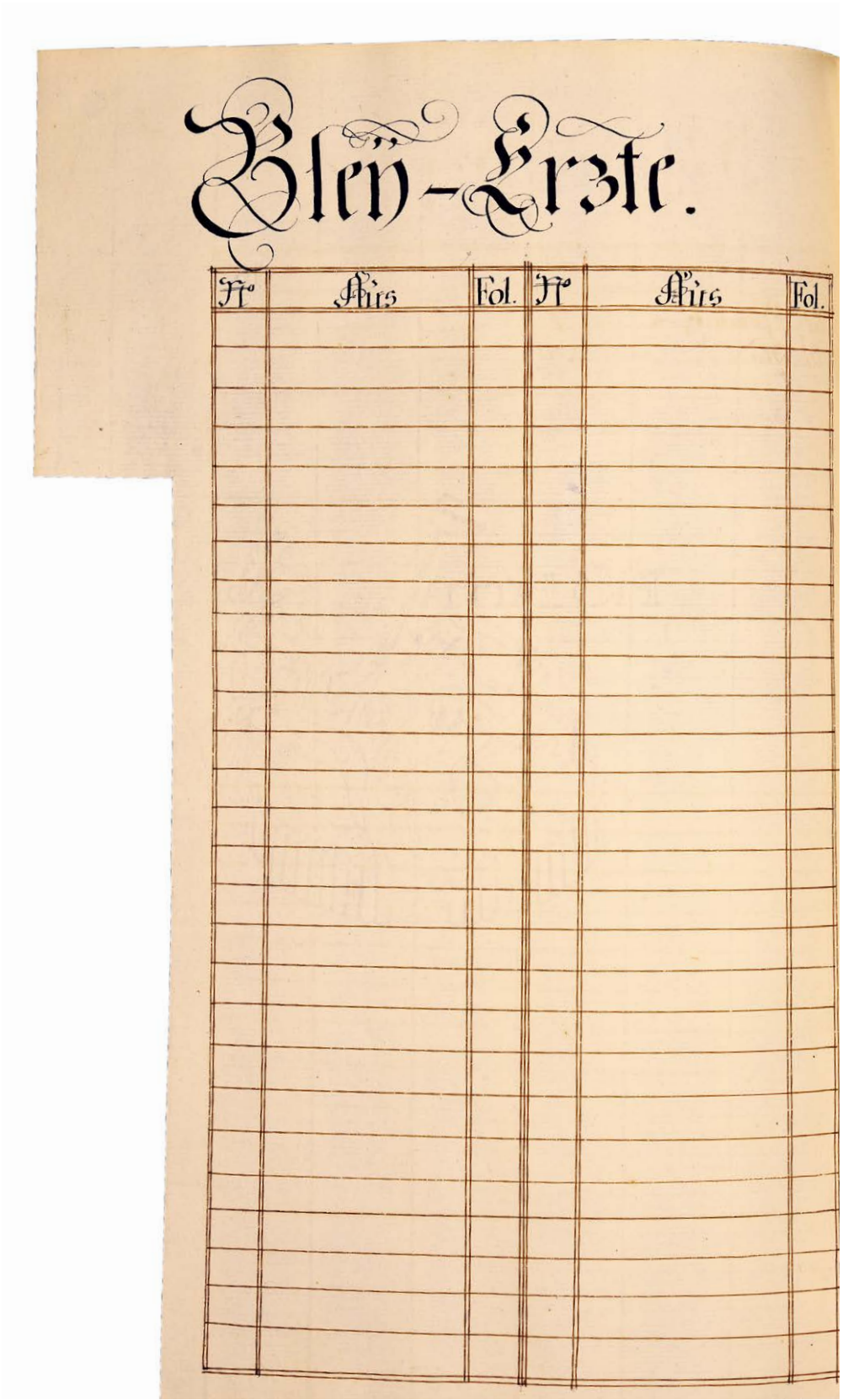


39.

Bley=Erzte.

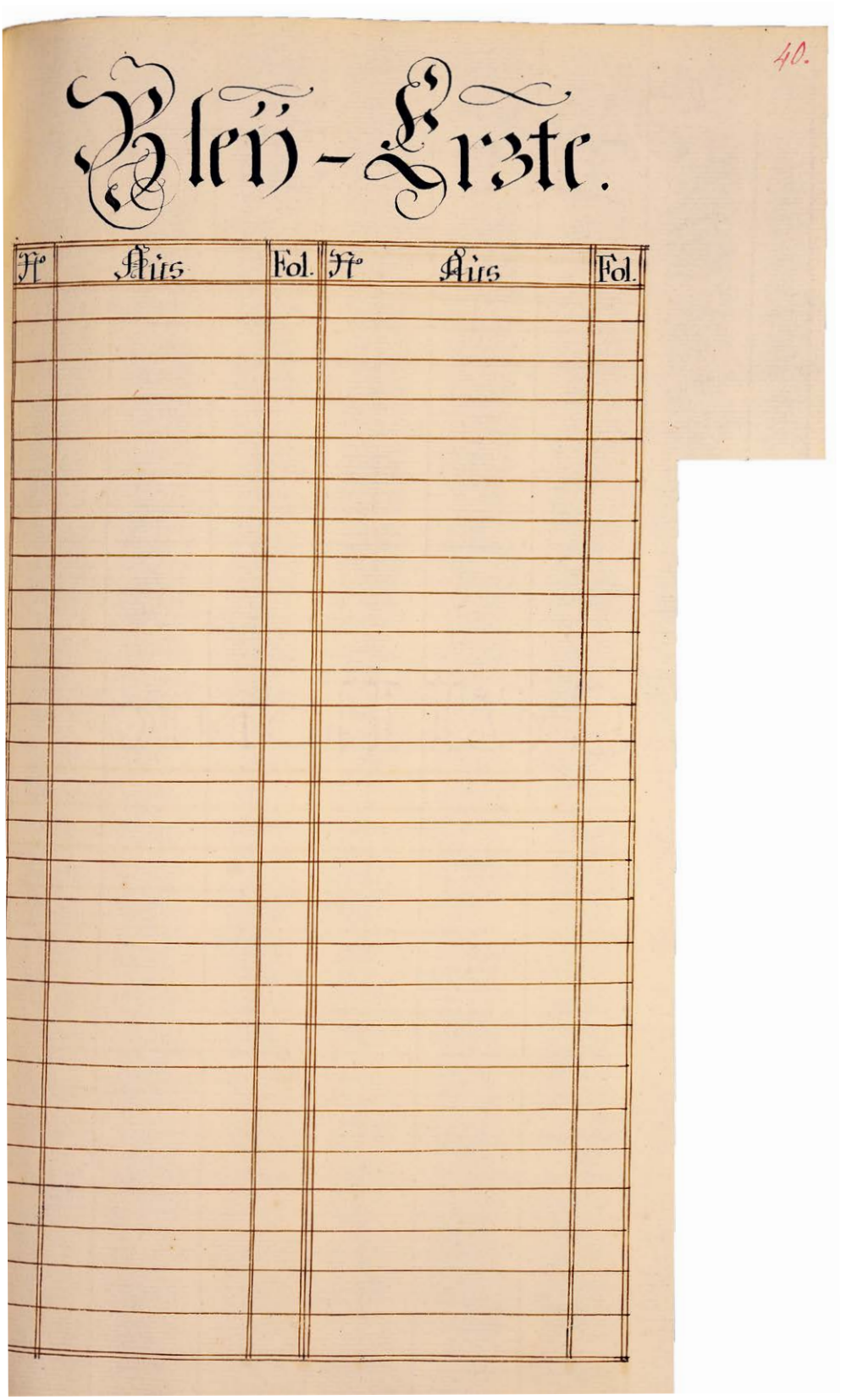
Nro	Nits	Fol.	Nro	Nits	Fol.
21	Ysmnitz	7			
131	Ehe	30			
157	Tarnhan	38			
158	Dito	38			

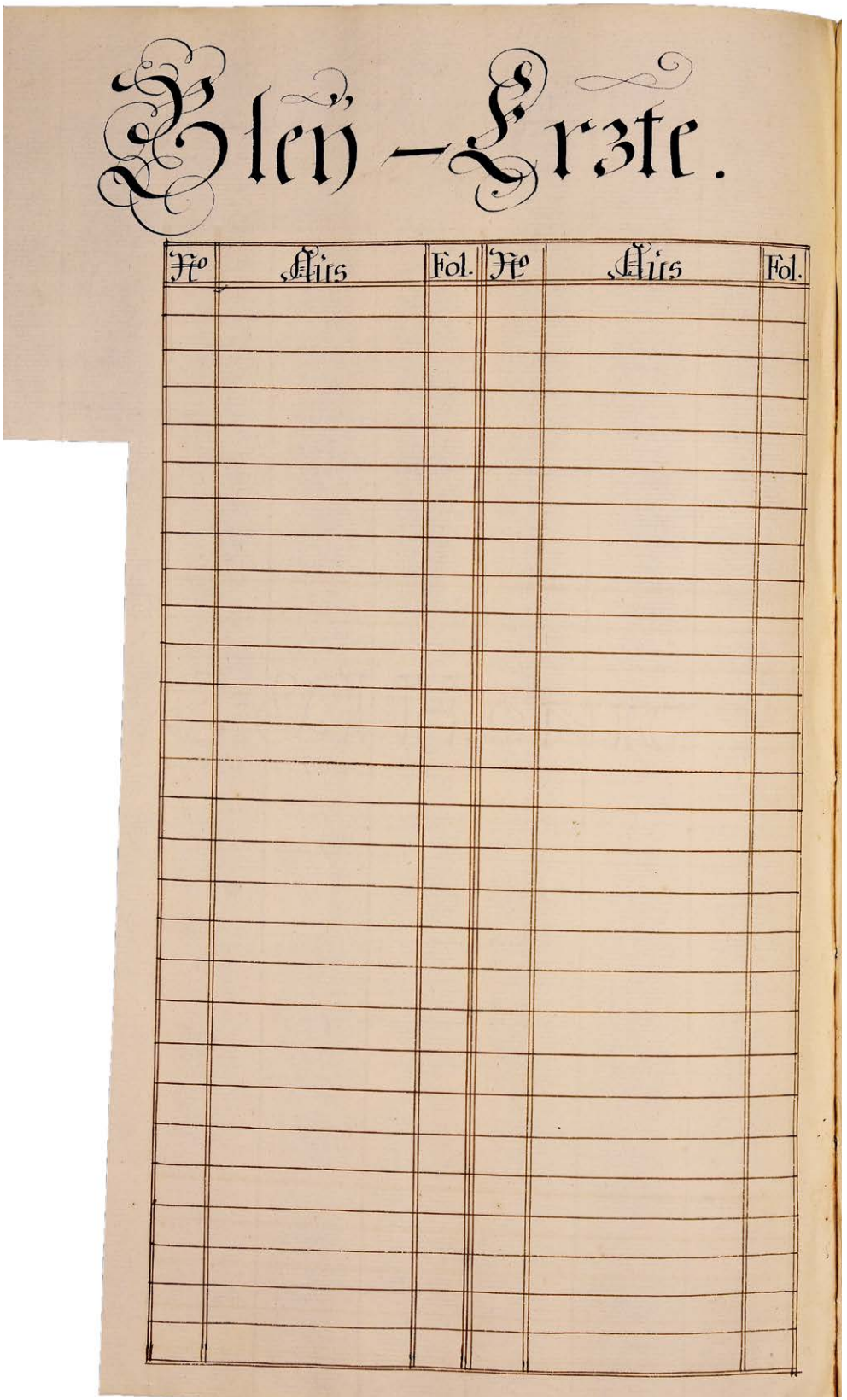
Bley-Erzte.



Bley-Erzte.

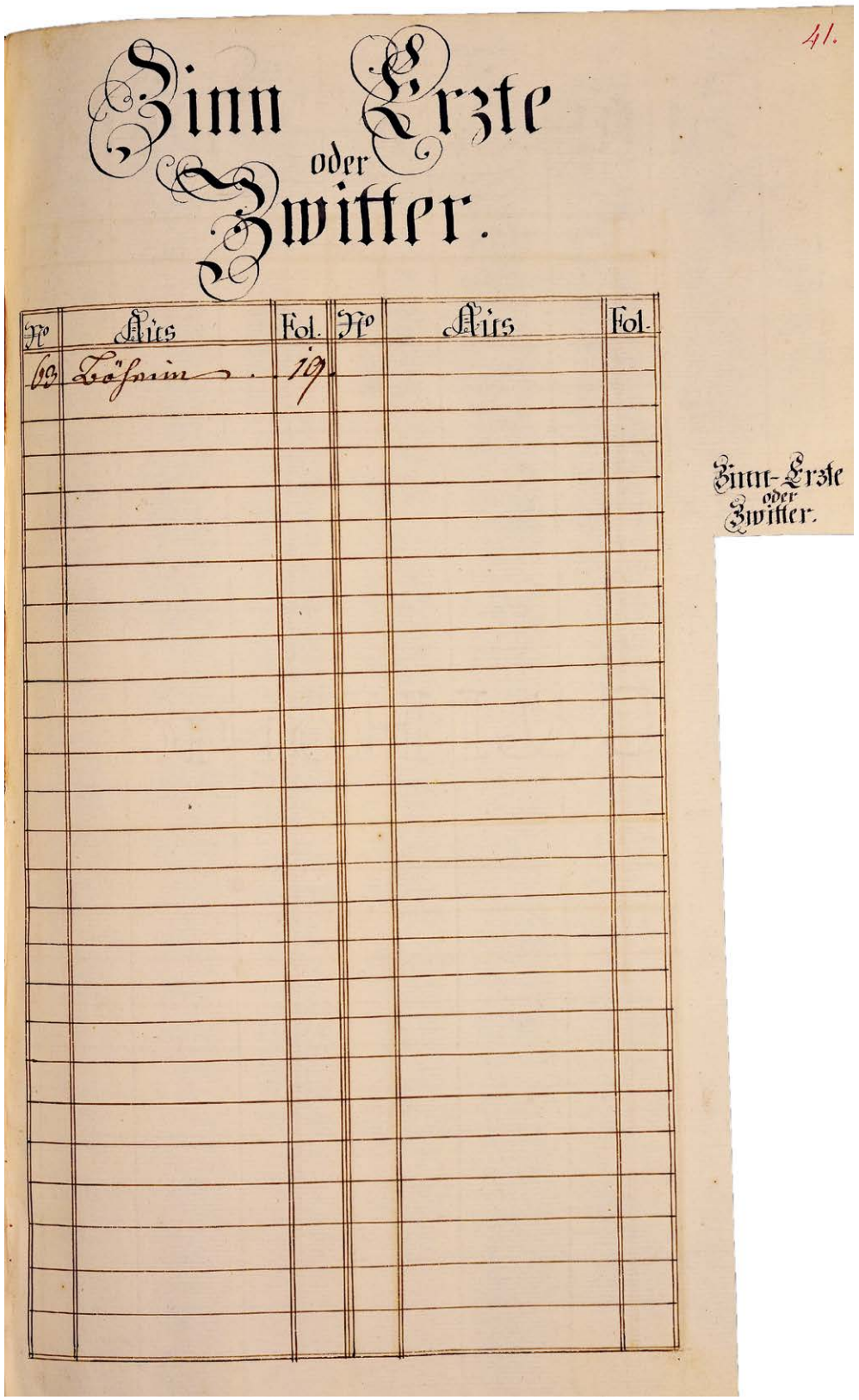
Nr	Nirs	Fol.	Nr	Nirs	Fol.


40.
Bley-Erzte.
N° Nits Fol.
N° Nits Fol.



Bley-Erzte.

Nro	Aus	Fol.	Nro	Aus	Fol.

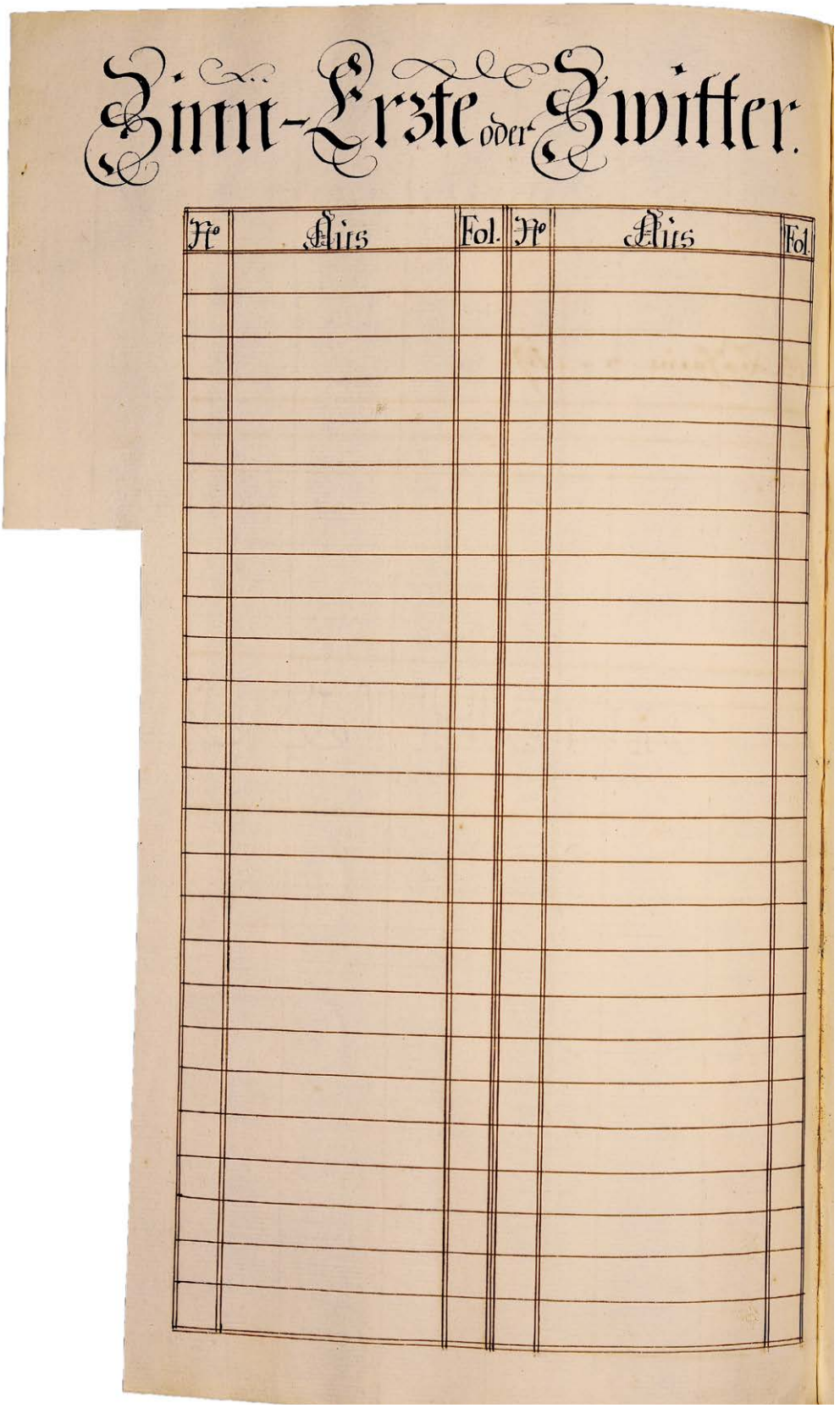


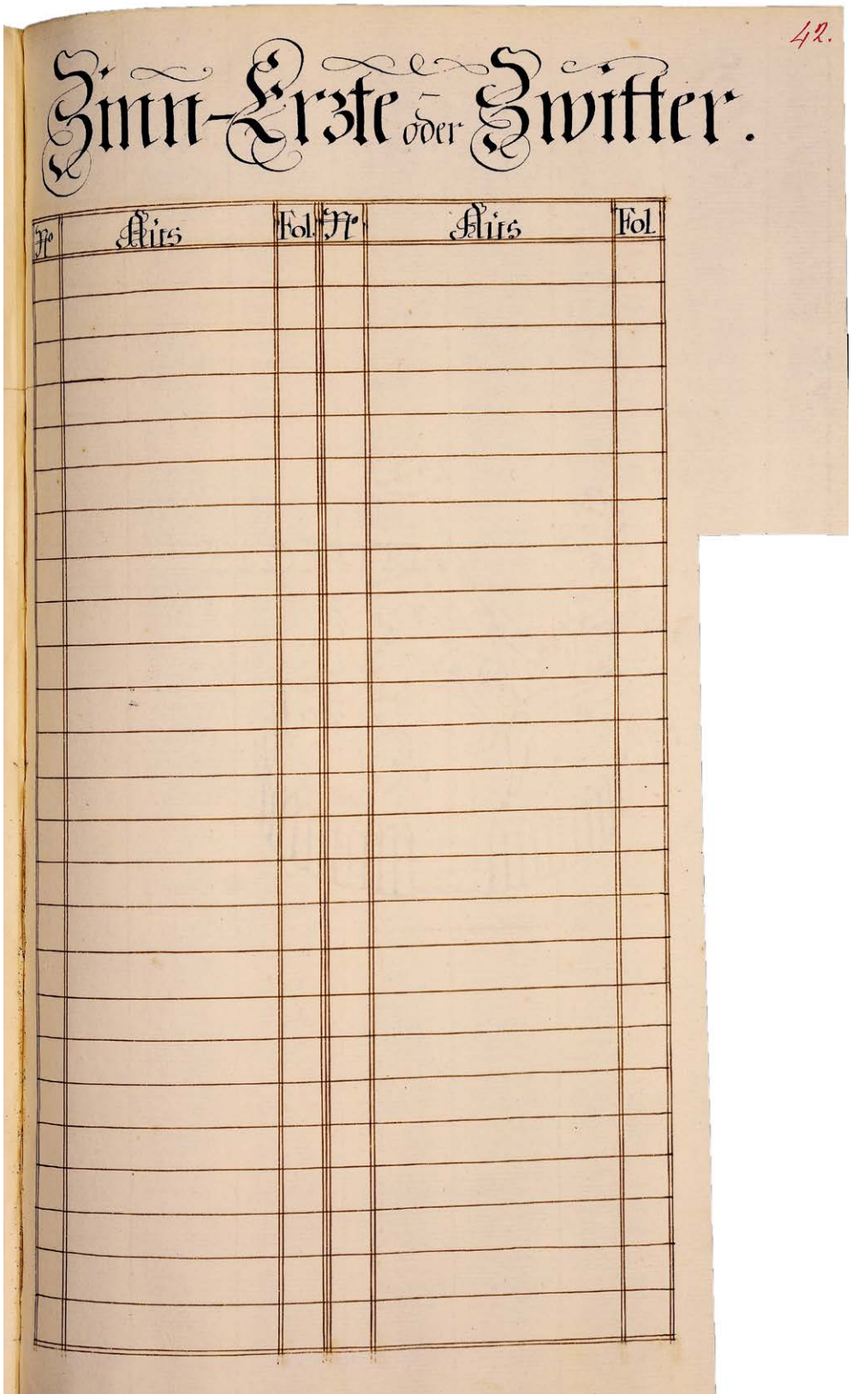
41.

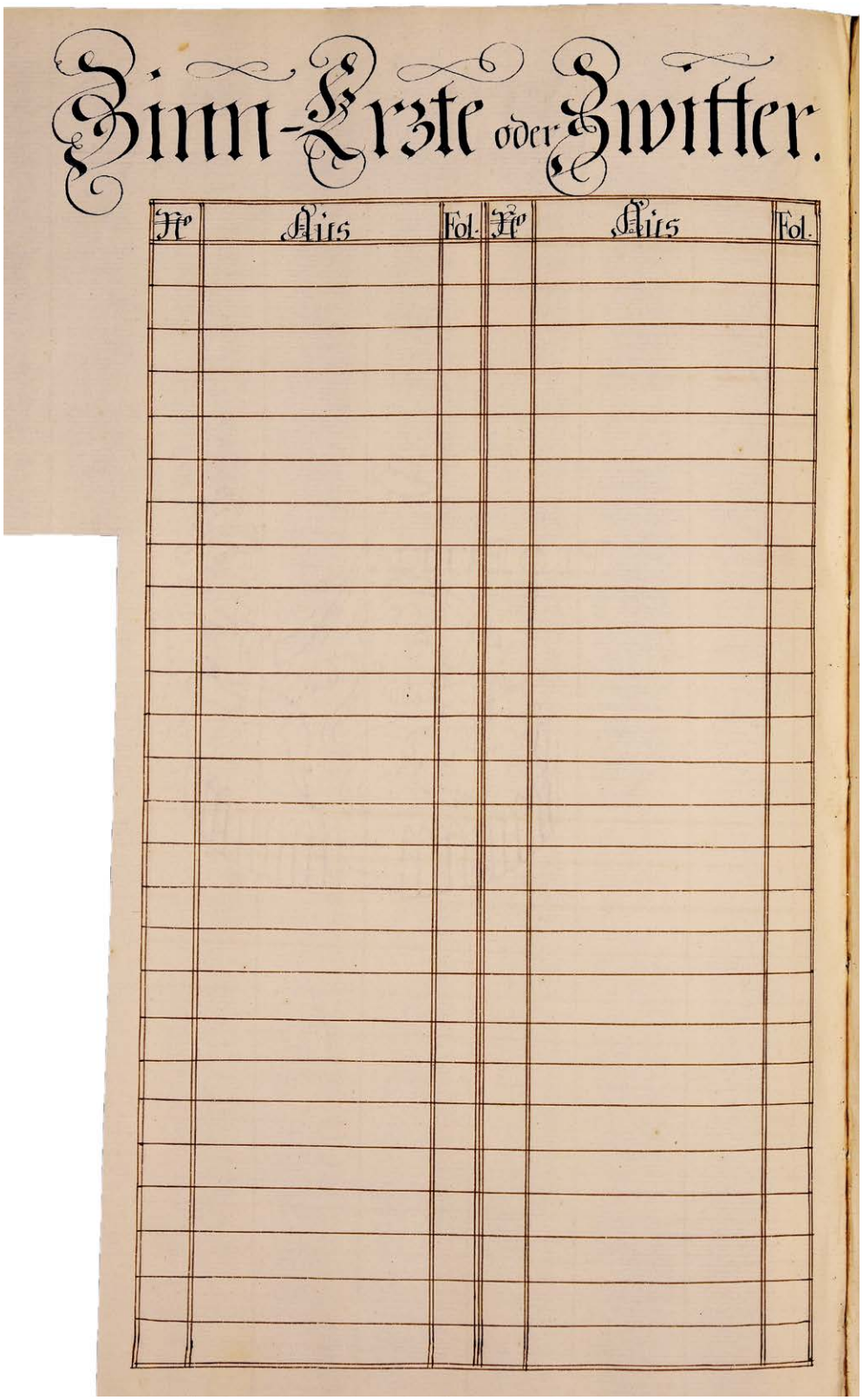
Zinn Erzte oder Zwitter.

No	Nits	Fol.	No	Nits	Fol.
69	Löhnin	19.			

Zinn-Erzte oder Zwitter.


Zinn-Erzte oder Zwitter.
No
Nis
Fol.
No
Nis
Fol.


42.
Zinn-Erzte oder Switter.
Nr.
Nirs
Fol.
Nr.
Nirs
Fol.

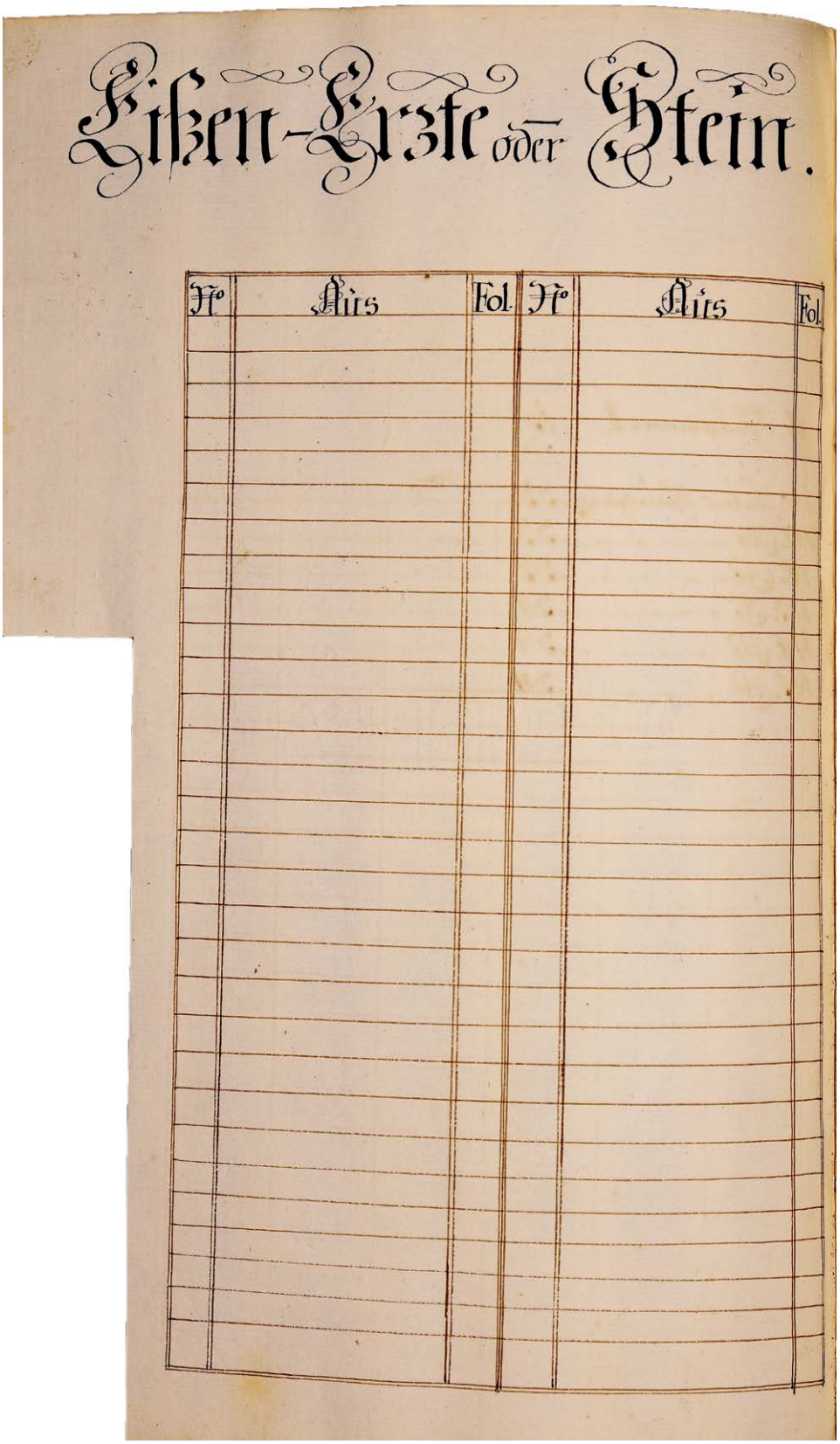


Zinn-Erzte oder Zwitter.

Nr	Nits	Fol.	Nr	Nits	Fol.

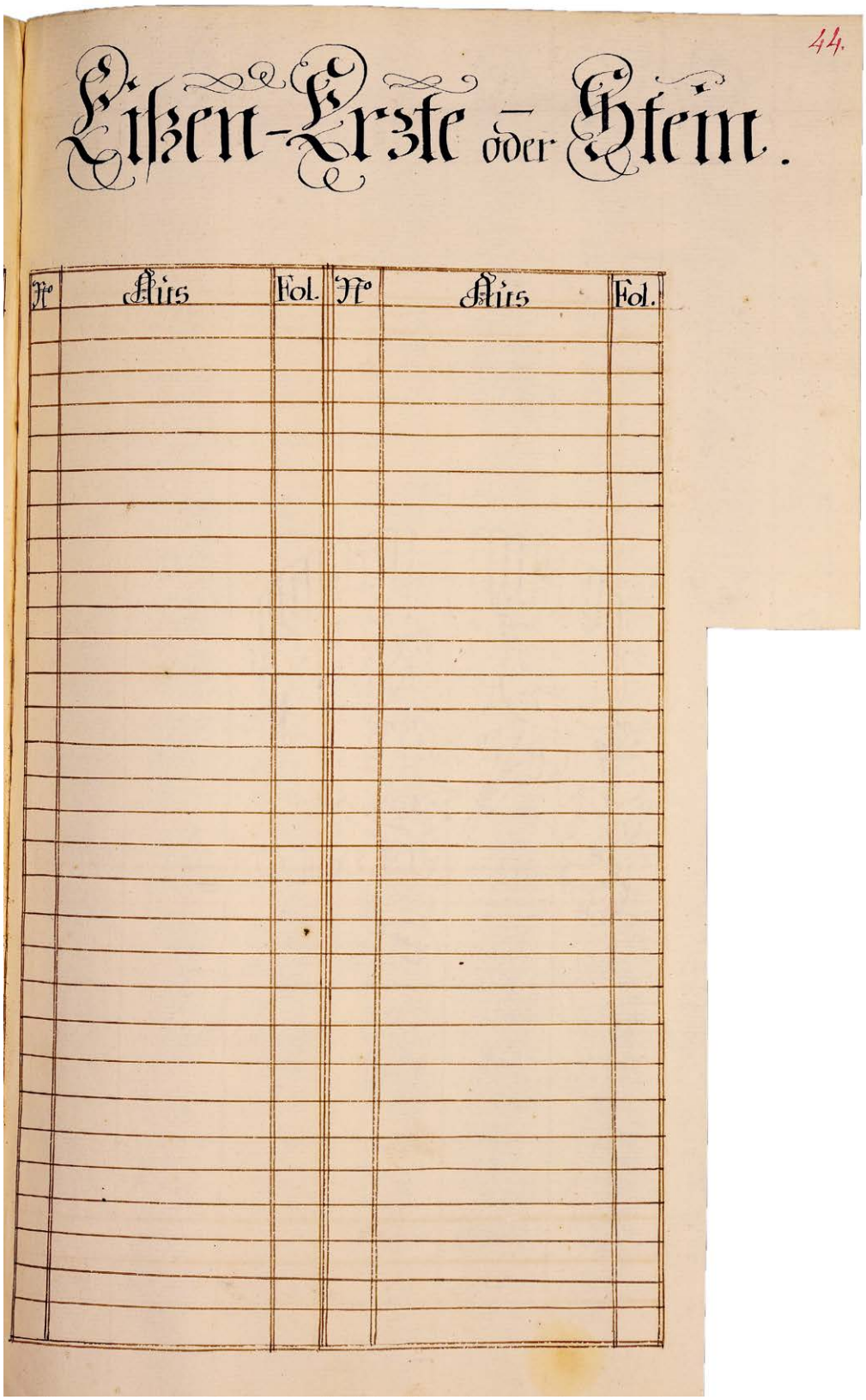
Eißen Erzte oder Stein

No	Aus	Fol.	No	Aus	Fol.
48.	Steÿermark	15.			
53.	Dto.	23.			
140.	Unter Hungarn	33.			
141.	Dto.	33.			
142.	Dto.	33.			
143.	Dto.	34.			
144.	Dto.	34.			
145.	Dto.	34.			



Eisen-Erze oder Stein.

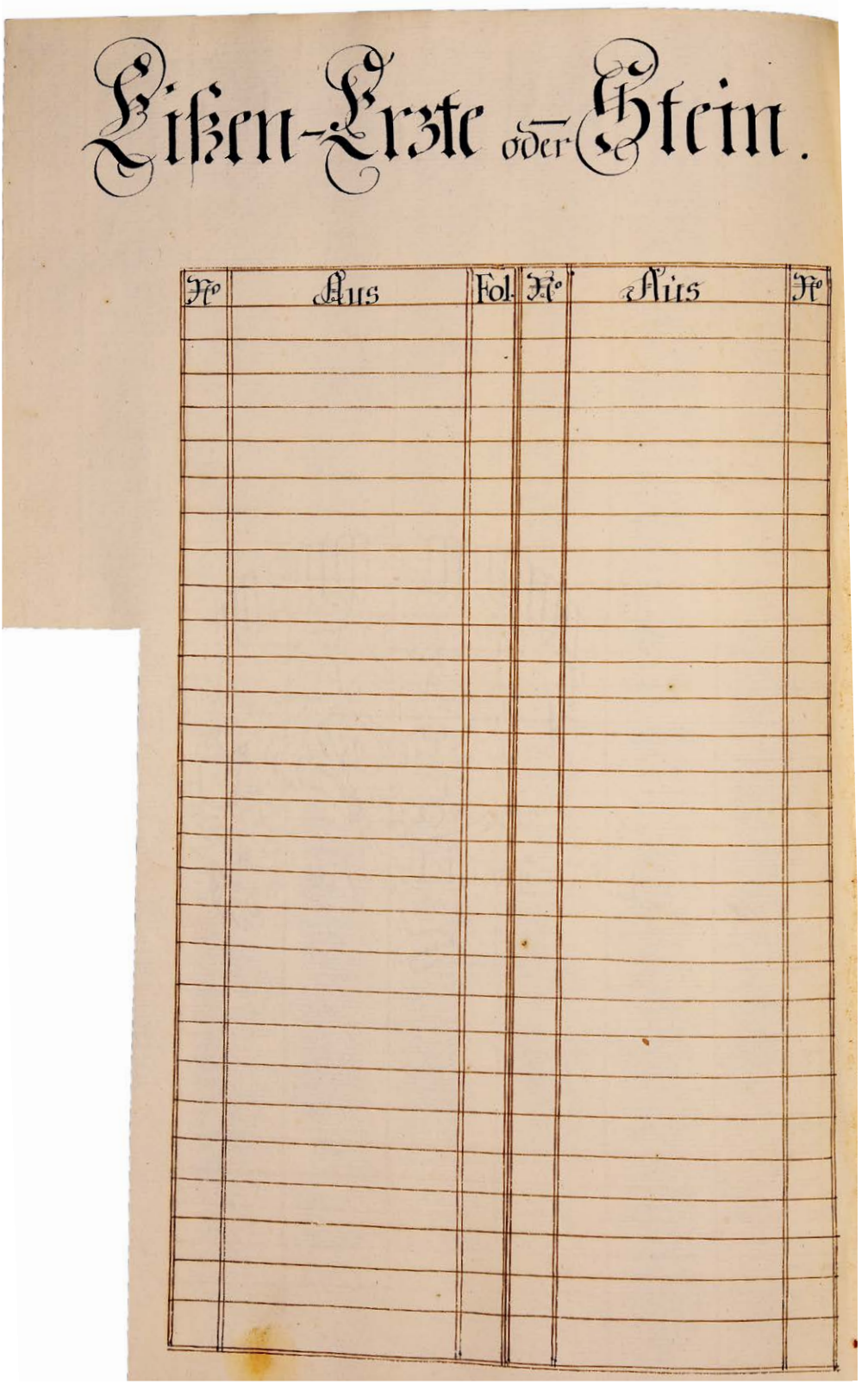
Nr	Nus	Fol	Nr	Nus	Fol



44.

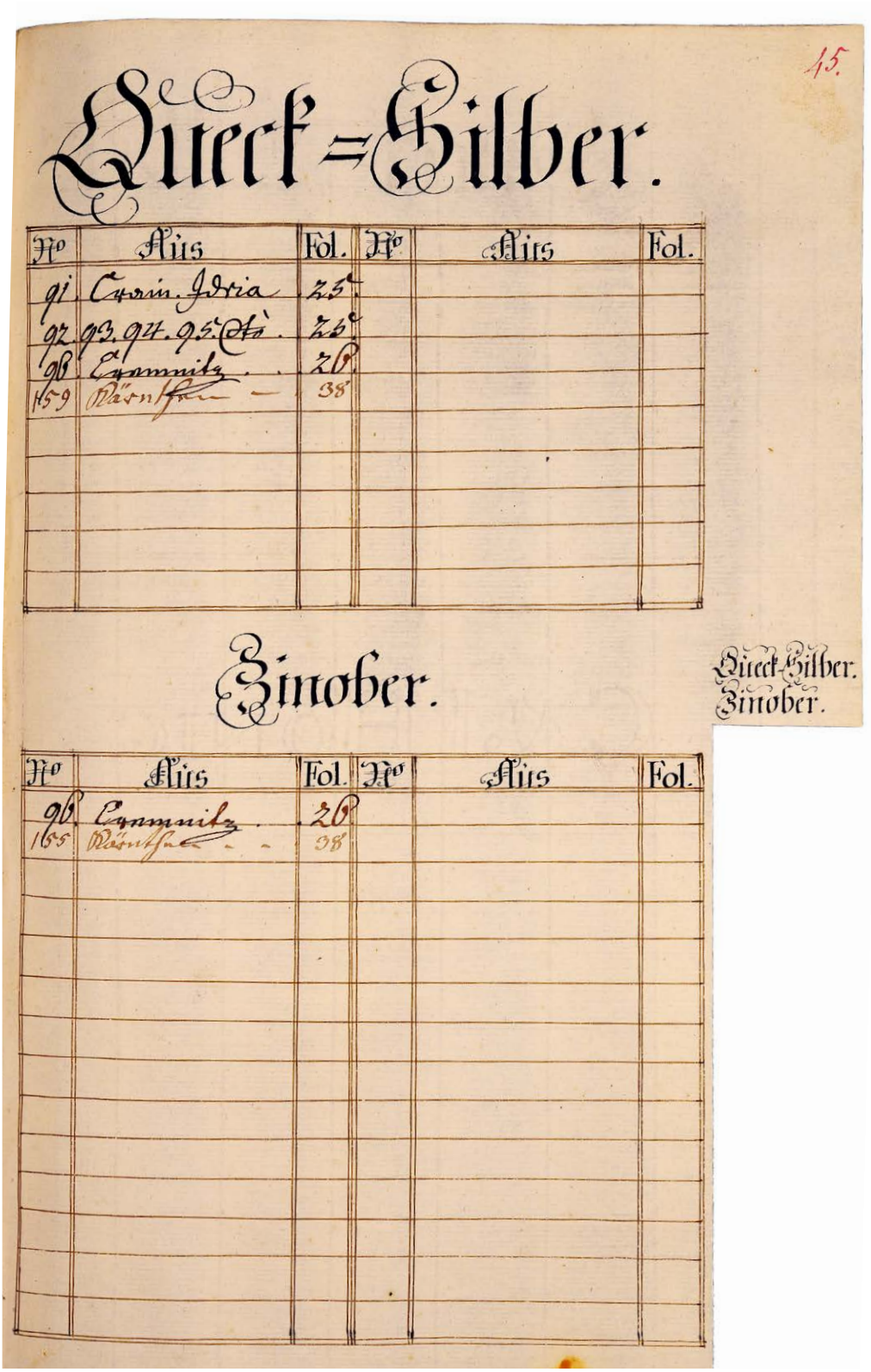
Eisen-Erze oder Stein.

№	Ans	Fol.	№	Ans	Fol.



Eisen-Erze oder Stein.

№	Aus	Fol.	№	Aus	№



15.

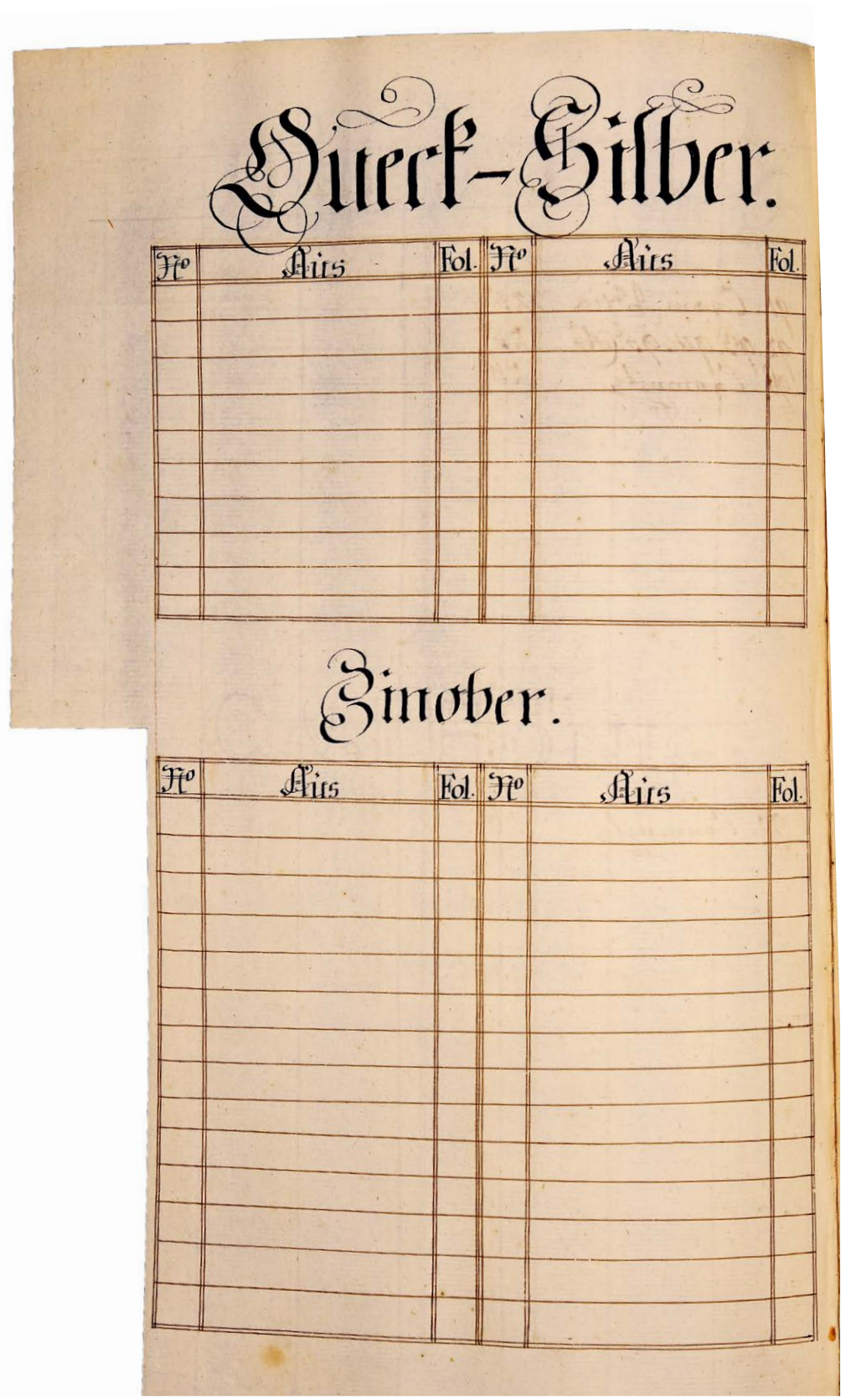
Queck=Silber.

No	Nits	Fol.	No	Nits	Fol.
91.	Carin. Idria	25.			
92. 93. 94. 95.	Ste	26.			
98.	Cammitz	28.			
159	Wärnstein	38.			

Zinober.

No	Nits	Fol.	No	Nits	Fol.
98.	Cammitz	28.			
165	Wärnstein	38.			

Queck-Silber.
Zinober.

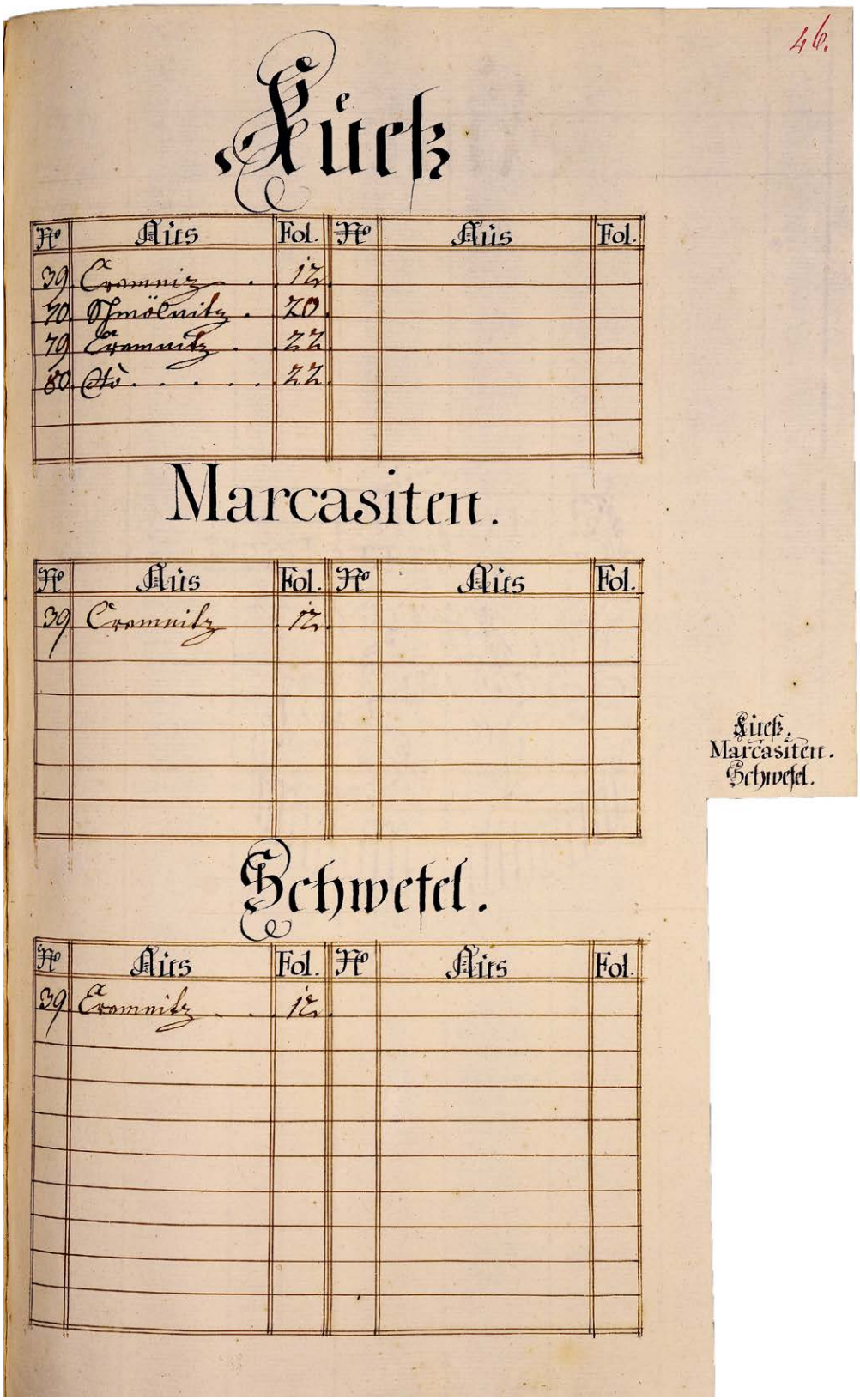


Quick-Silber.

No	Nits	Fol.	No	Nits	Fol.

Zinober.

No	Nits	Fol.	No	Nits	Fol.



46.

Kieß

№	Nits	Fol.	№	Nits	Fol.
69	Cremnitz	12.			
70	Schmölnitz	70.			
79	Cremnitz	22.			
80	Ebendo	22.			

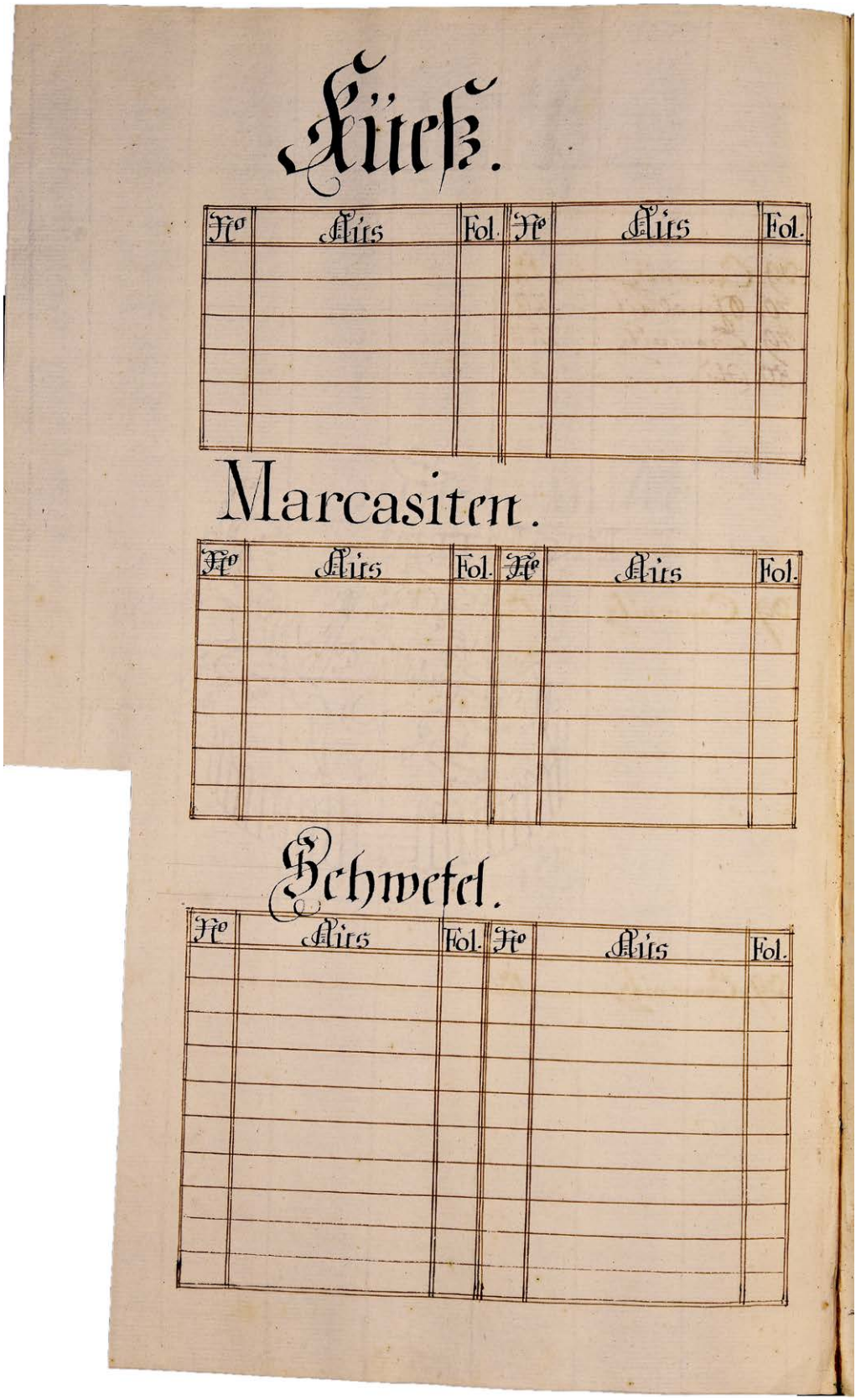
Marcasiten.

№	Nits	Fol.	№	Nits	Fol.
69	Cremnitz	12.			

Schwefel.

№	Nits	Fol.	№	Nits	Fol.
69	Cremnitz	12.			

Kieß.
Marcasiten.
Schwefel.



Kies.

No	Nits	Fol.	No	Nits	Fol.

Marcasiten.

No	Nits	Fol.	No	Nits	Fol.

Schwefel.

No	Nits	Fol.	No	Nits	Fol.

47.

Antimonium.

Nº	Nits	Fol.	Nº	Nits	Fol.
44	Siebenbürgen	13.			
138	Hungarn Magurka	32.			
139	Gemnitz	33			

Wißmuth.

Nº	Nits	Fol.	Nº	Nits	Fol.

Zink oder Spiauter.

Nº	Nits	Fol.	Nº	Nits	Fol.

Antimonium.
Wismuth.
Zink oder Spiauter.

Antimonium.

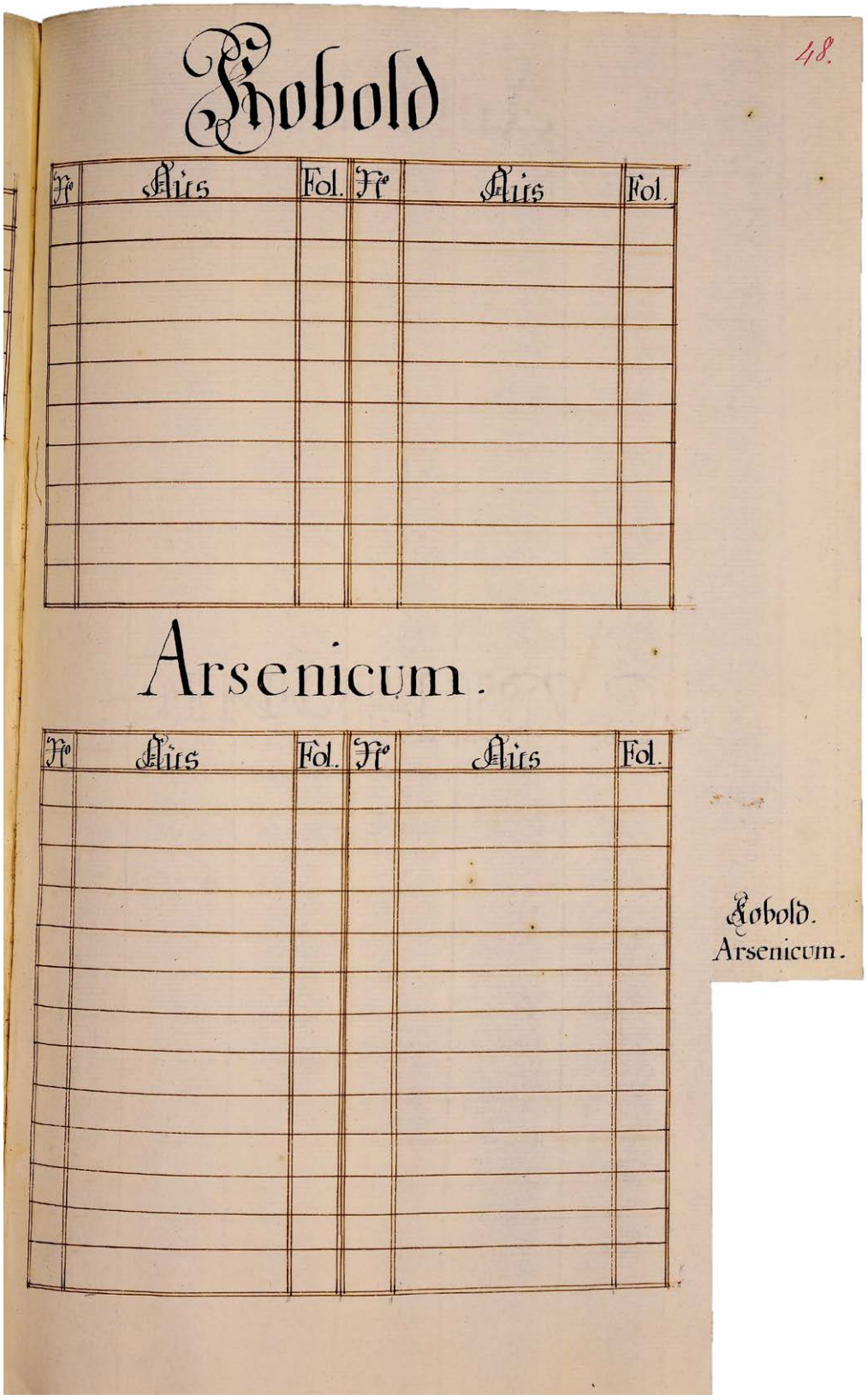
Nº	Nits	Fol.	Nº	Nits	Fol.

Wißmuth.

Nº	Nits	Fol.	Nº	Nits	Fol.

Zink oder Spiauter.

Nº	Nits	Fol.	Nº	Nits	Fol.



48.

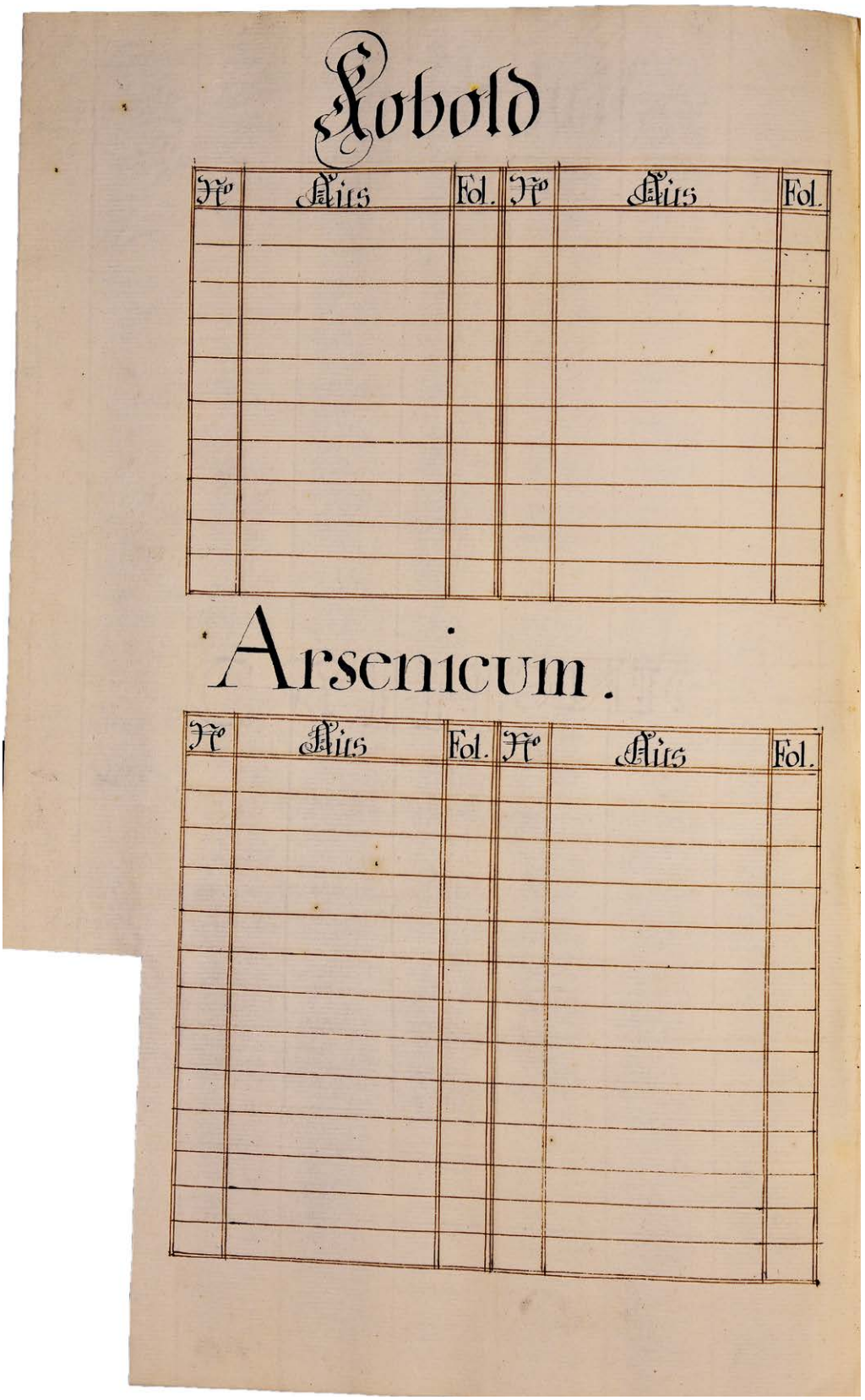
Kobold

Fo	Aus	Fol.	Fo	Aus	Fol.

Arsenicum.

Fo	Aus	Fol.	Fo	Aus	Fol.

Kobold.
Arsenicum.



Kobold

№	Nus	Fol.	№	Nus	Fol.

Arsenicum.

№	Nus	Fol.	№	Nus	Fol.

49.

Saltz.

No	Aus	Fol.	No	Aus	Fol.
119.	Ober Österreich	28.			
120.	Dto.	28.			
121.	Dto.	28.			
122.	Dto.	28.			

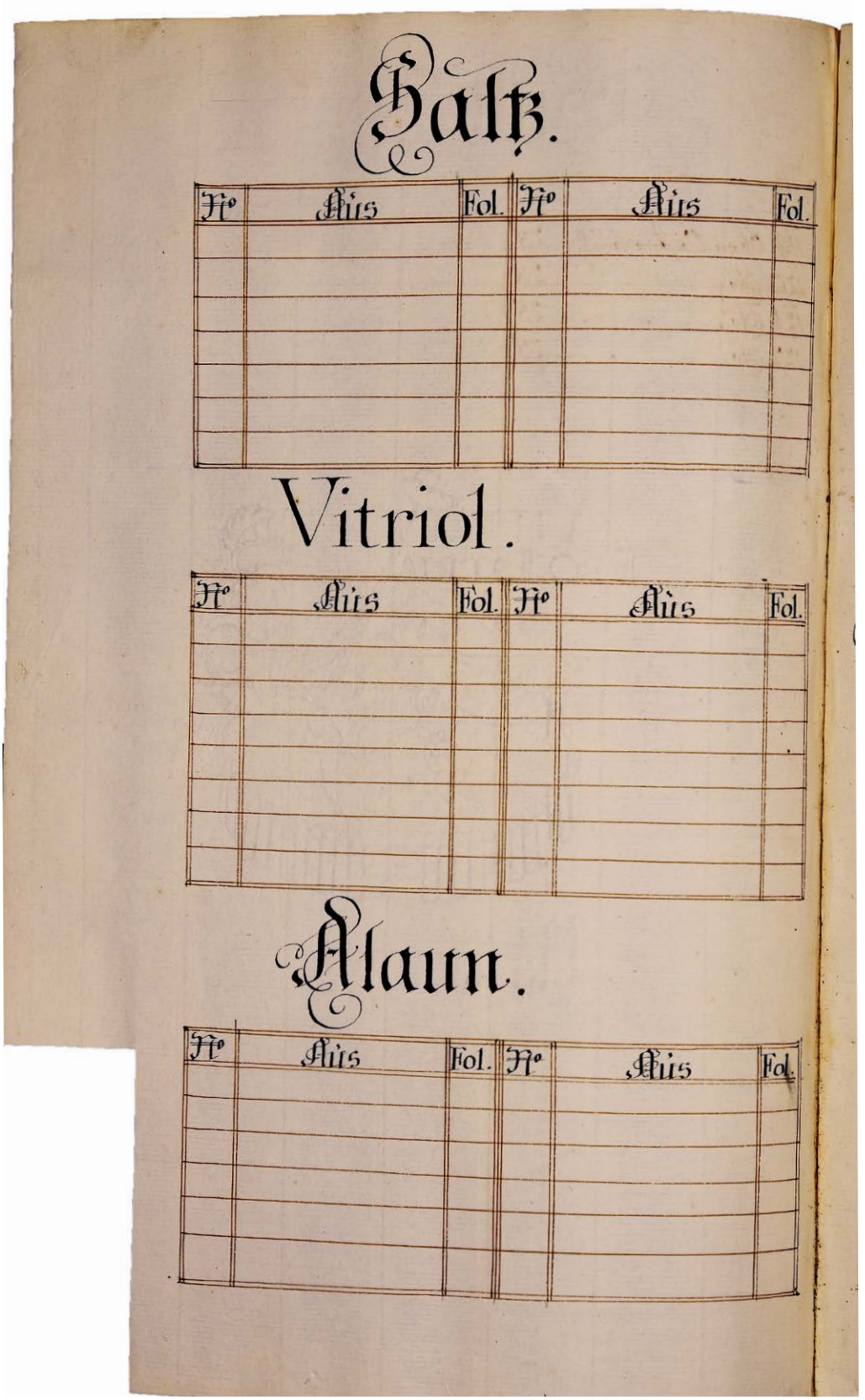
Vitriol.

No	Aus	Fol.	No	Aus	Fol.

Alaun.

No	Aus.	Fol.	No	Aus	Fol.

Saltz.
Vitriol.
Alaun.



Salz.

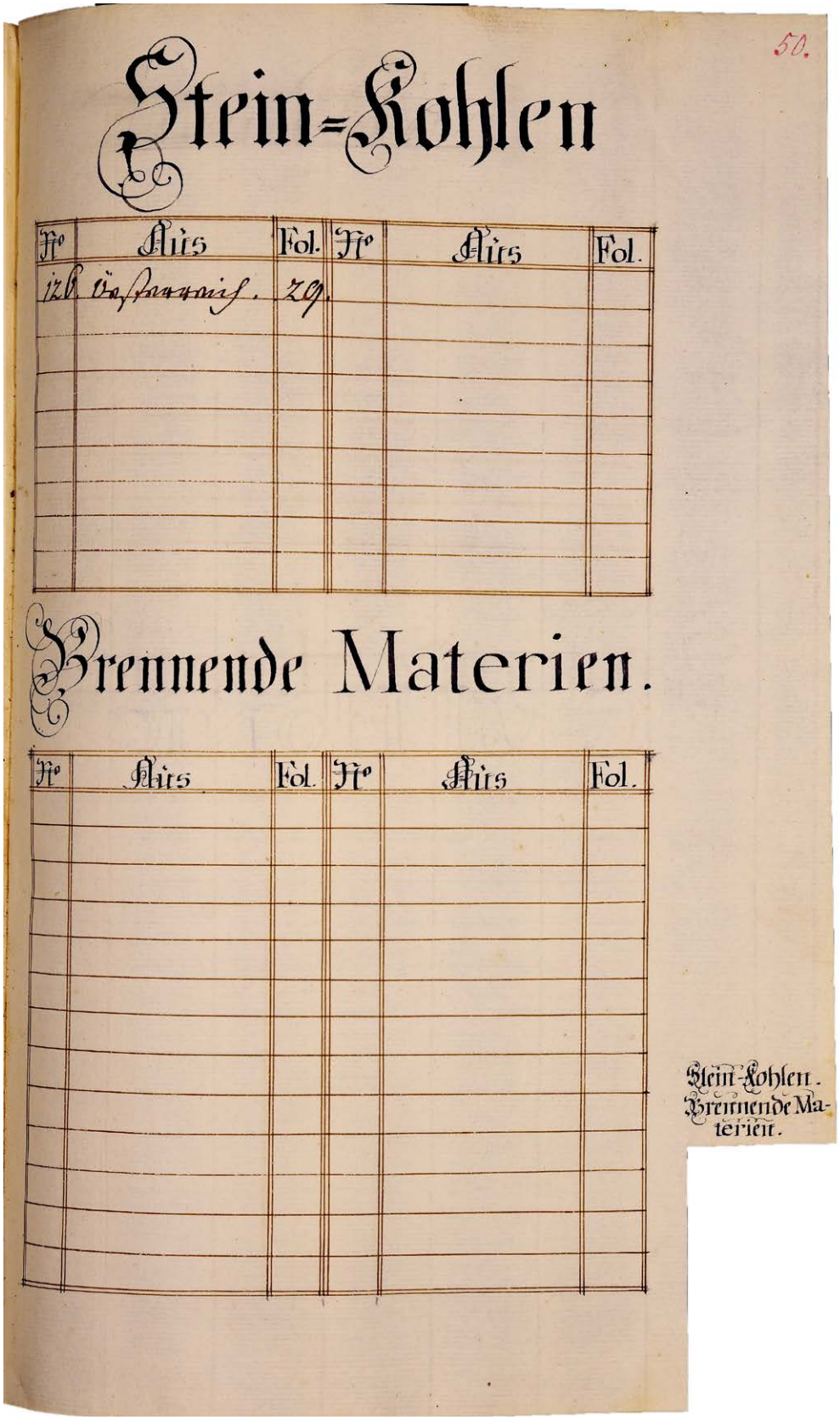
Nº	Nus	Fol.	Nº	Nus	Fol.

Vitriol.

Nº	Nus	Fol.	Nº	Nus	Fol.

Alaun.

Nº	Nus	Fol.	Nº	Nus	Fol.



50.

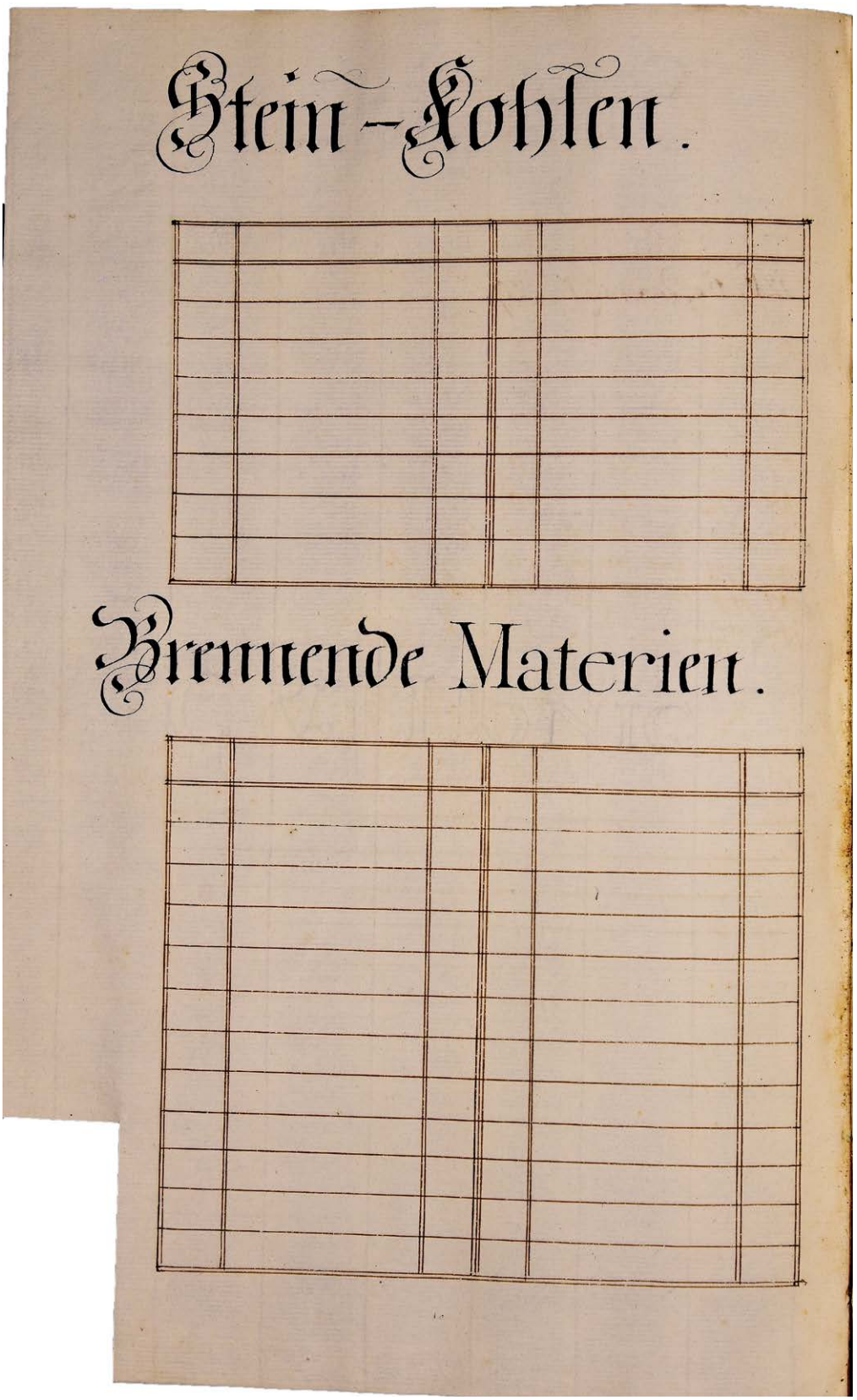
Stein-Kohlen

Nro	Nits	Fol.	Nro	Nits	Fol.
126	Bestimmung.	29.			

Brennende Materien.

Nro	Nits	Fol.	Nro	Nits	Fol.

Stein-Kohlen.
Brennende Materien.


Stein-Kohlen.
Brennende Materien.

51.

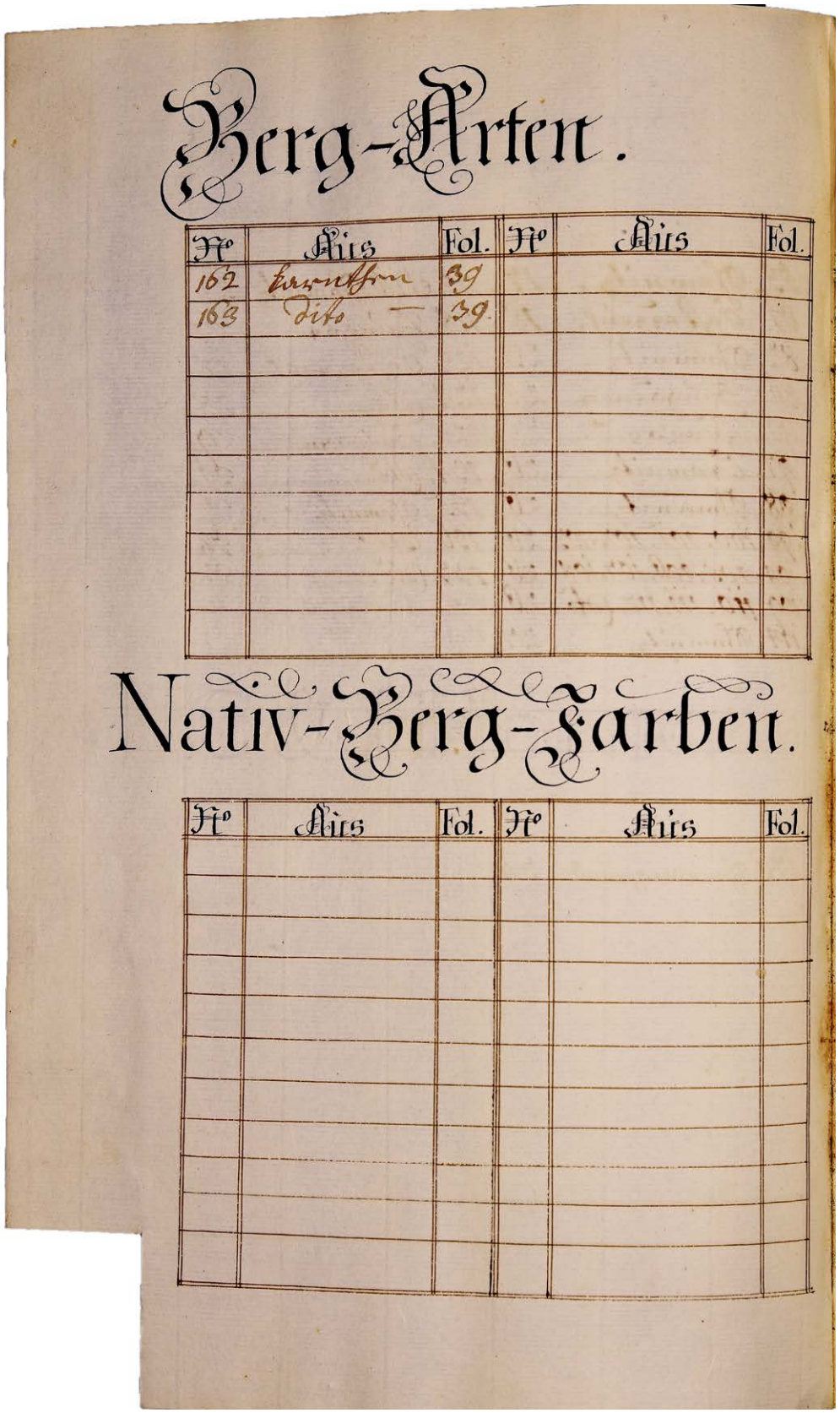
Berg-Arten.

No	Nus	Fol.	No	Nus	Fol.
53.	Schmitz	17	115.	ebl. Schmitz	27
81.	Eisenrauf	18	118.	Zinnzaun	27
82.	Schmitz	23	123.	Eisenrauf	28
88.	Zinnzaun	24	124.	Dto	28
90.	Zinnzaun	25	125.	Zinnzaun	29
97.	Cammitz	26	134.	Dto	31
98.	Schmitz	26	135.	Schmitz	32
99.	100. 101. 102. 103.	26	136.	Dto	32
104.	105. 106. 107. 108.	26	137.	Dto	32
109.	110. 111. 112. Dto	26	160.	Bäumlisen	39
114.	Schmitz	27	161.	dito	39

Nativ-Berg-Farben.

No	Nus	Fol.	No	Nus	Fol.
148.	Zinnzaun	34			

Berg-Arten.
Nativ-Berg-Farben.

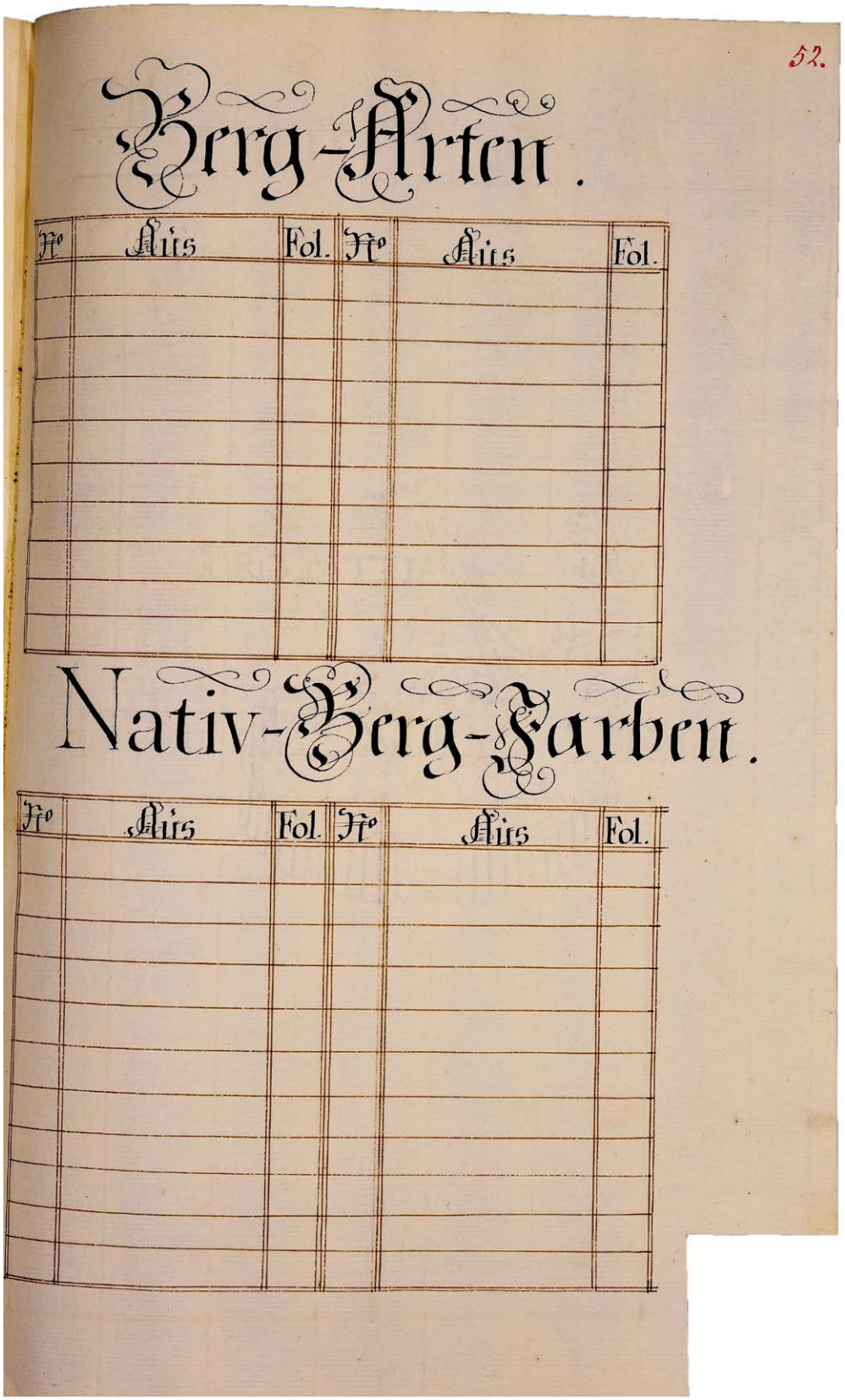


Berg-Arten.

Nº	Nus	Fol.	Nº	Nus	Fol.
162	Bergart	39			
163	Dito —	39			

Nativ-Berg-Farben.

Nº	Nus	Fol.	Nº	Nus	Fol.



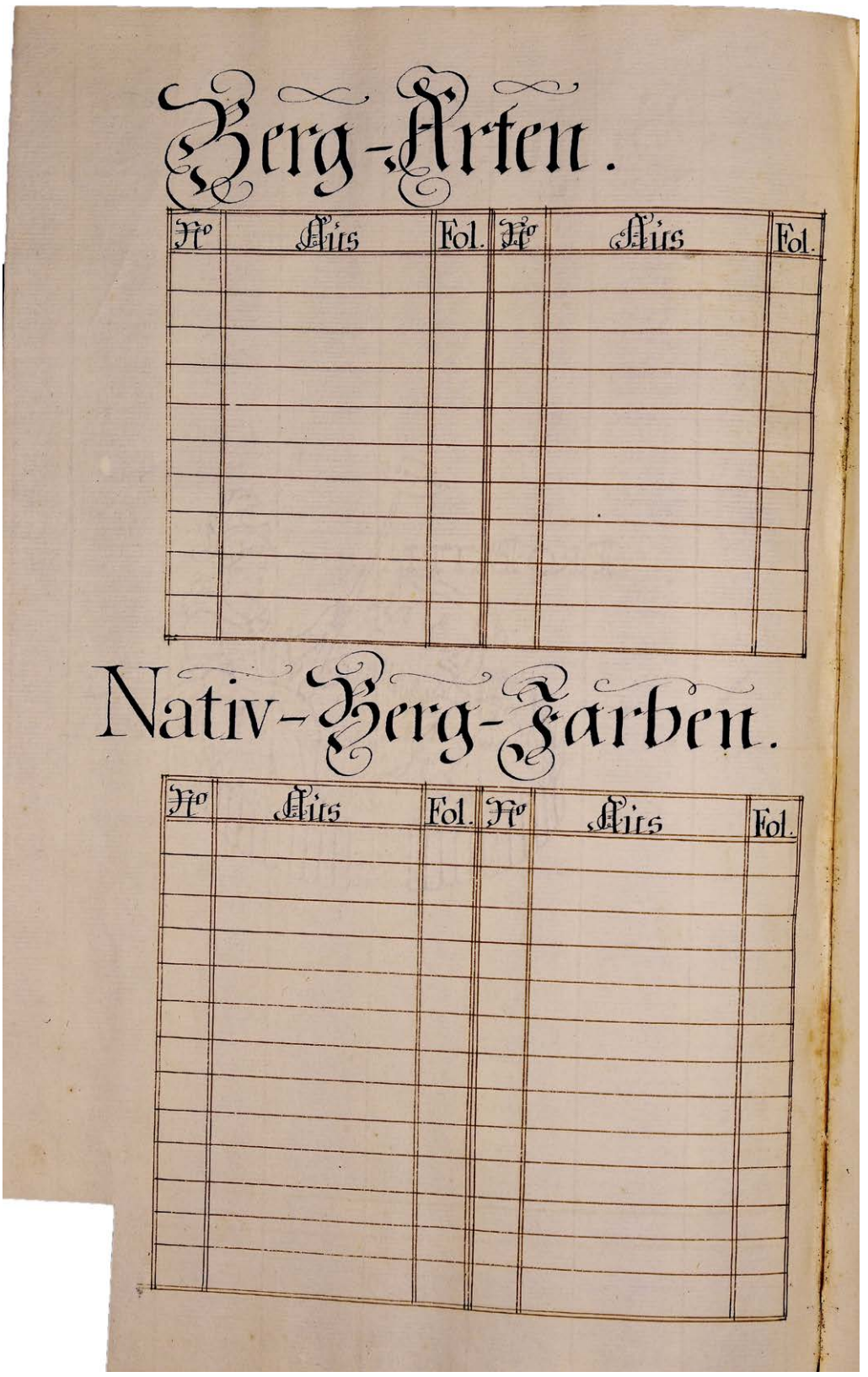
52.

Berg-Arten.

Nº	Nits	Fol.	Nº	Nits	Fol.

Nativ-Berg-Farben.

Nº	Nits	Fol.	Nº	Nits	Fol.



Berg-Arten.

No	Nis	Fol.	No	Nis	Fol.

Nativ-Berg-Farben.

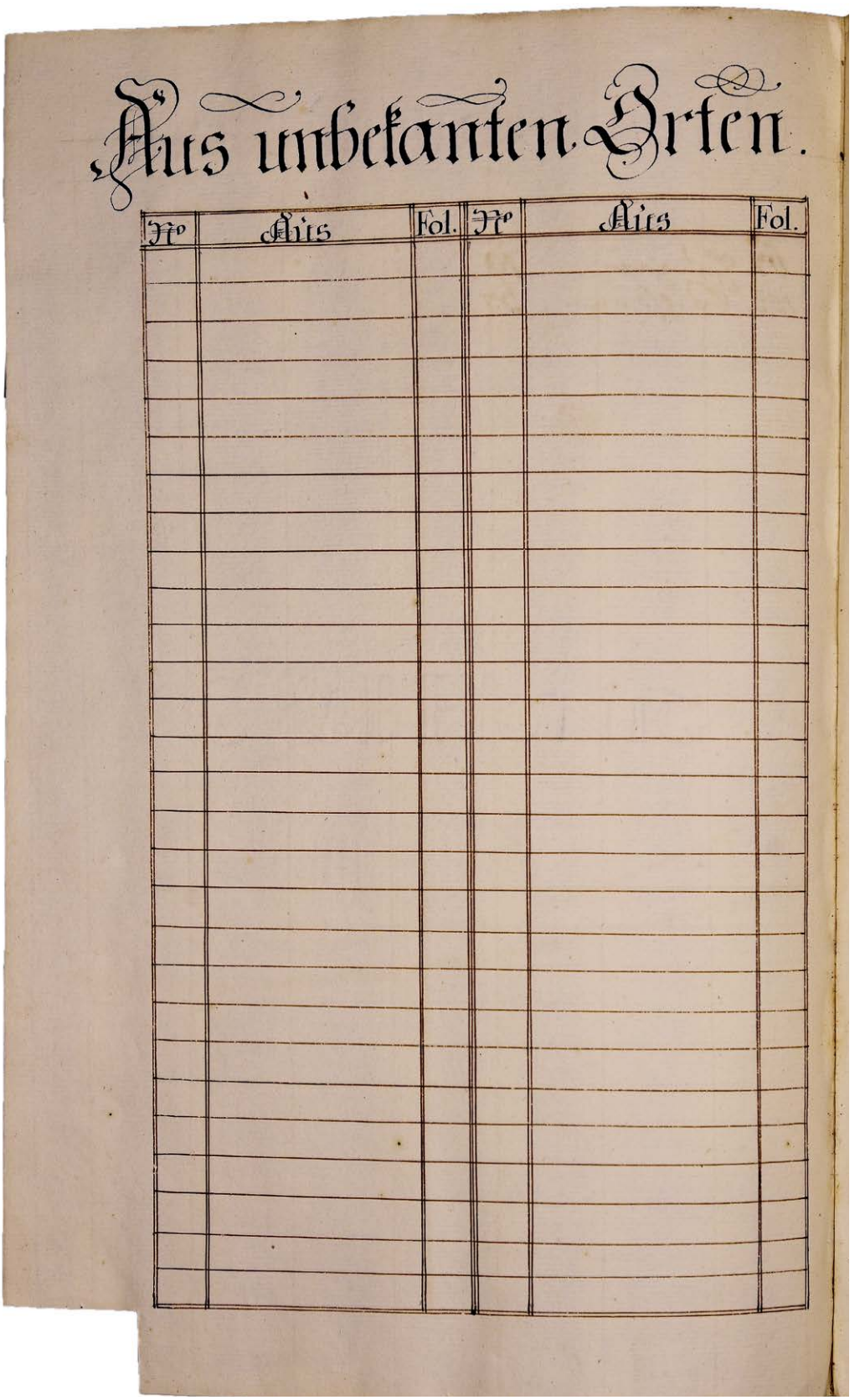
No	Nis	Fol.	No	Nis	Fol.

53.

Aus unbekanten Orten.

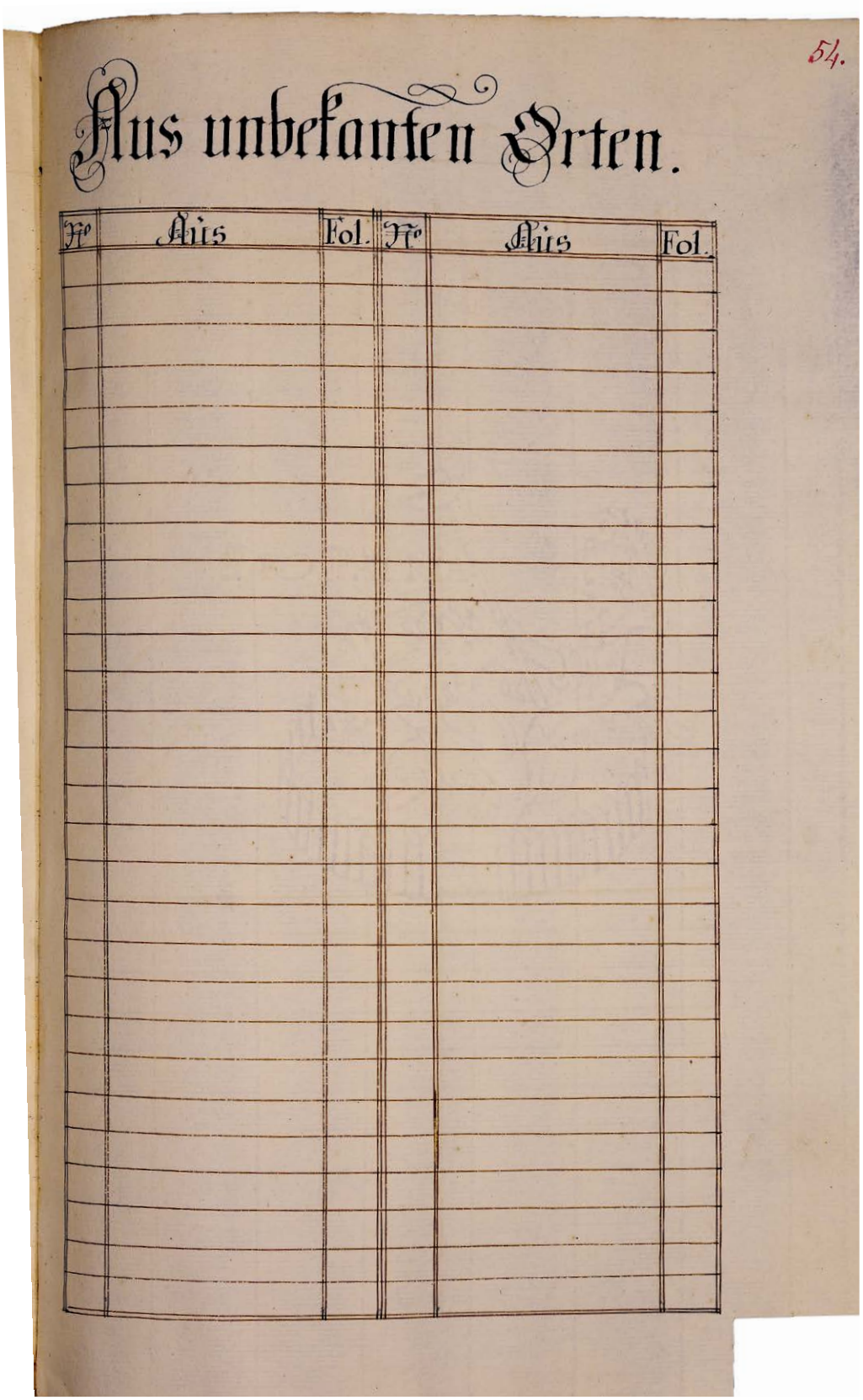
No	Aus	Fol.	No	Aus	Fol.
67	Hungarn . .	19.			
173	Reußen .	37.			

Aus unbekann-
ten Orten.



Aus unbekanten Orten.

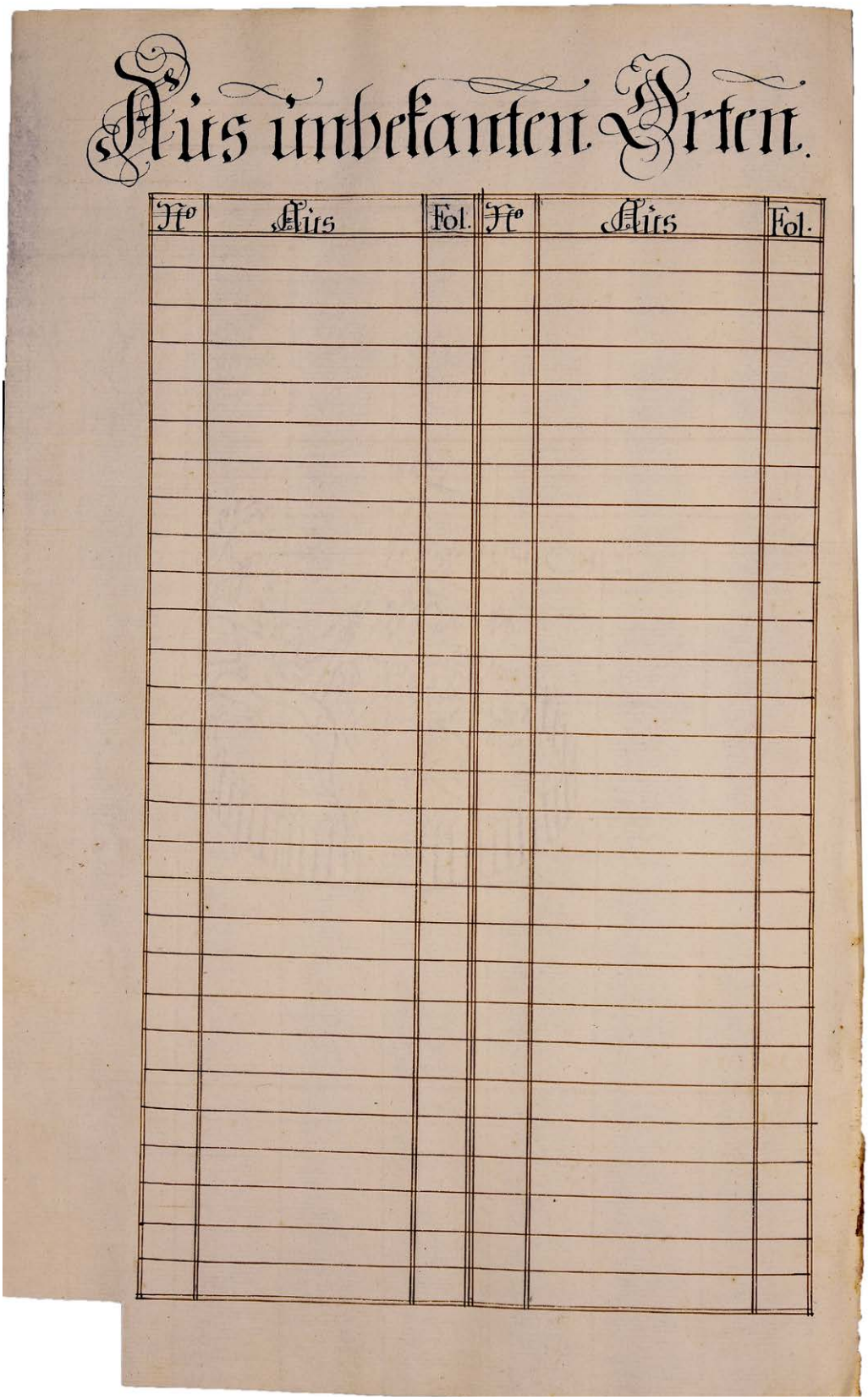
Nr	Aus	Fol.	Nr	Aus	Fol.



54.

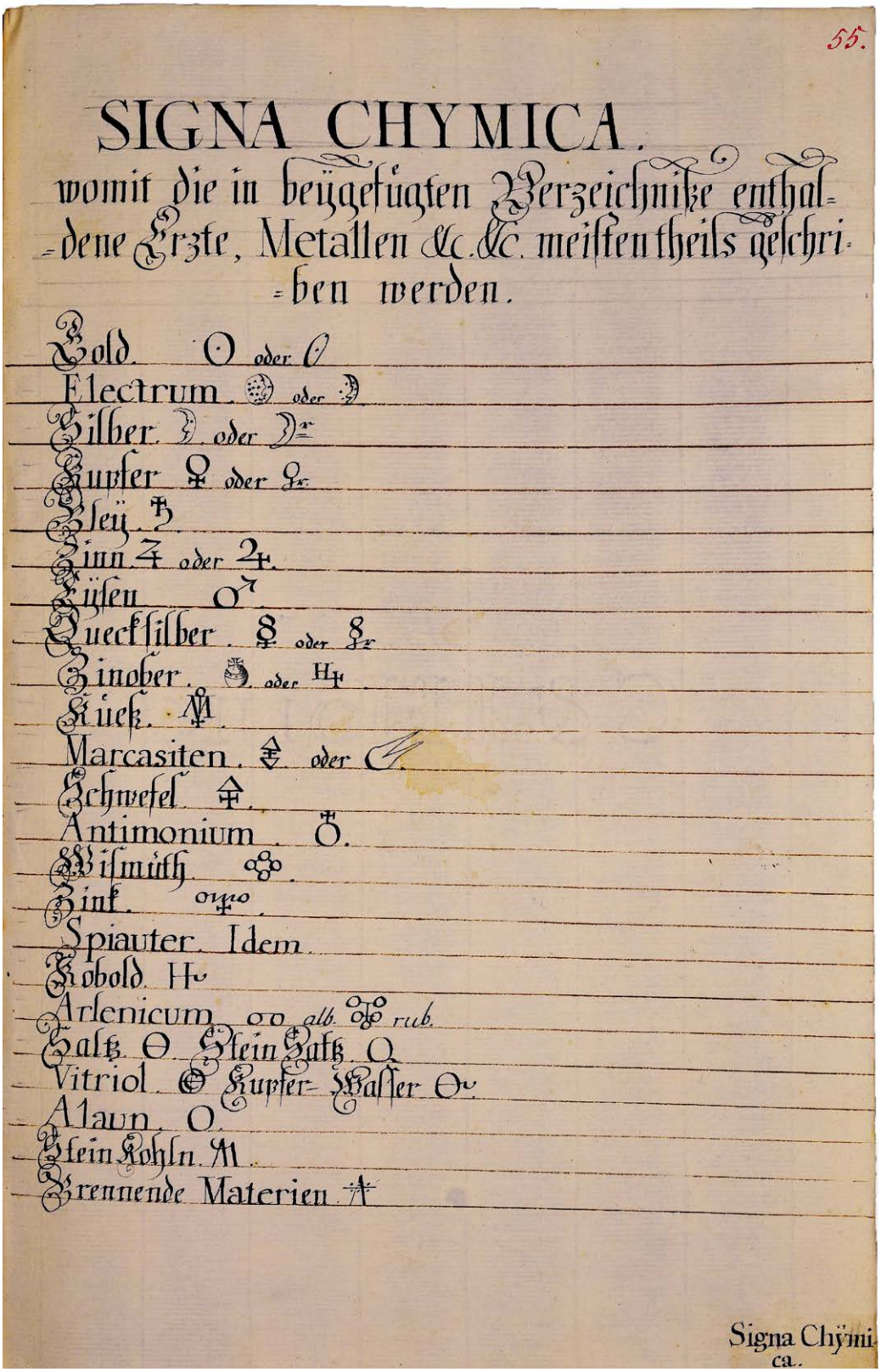
Aus unbekanten Orten.

Nr	Als	Fol.	Nr	Als	Fol.



Aus unbekanten Orten.

No	Aus	Fol.	No	Aus	Fol.



55.

SIGNA CHYMICA.

womit die in beygefügten Verzeichnisse enthal-
-dene Erzte, Metallen &c. &c. meistentheils gelchri-
-ben werden.

Gold. ☉ oder ☉
Electrum. ☉☽ oder ☽☉
Silber. ☽ oder ☽ʳ
Kupfer ♀ oder ♀ʳ
Bley. ♄
Zinn 4 oder 2♃
Eisen ♂
Quecksilber. ☿ oder ☿ʳ
Zinober. ☿S oder H♄
Kieß. ♍
Marcasiten. ♎ oder ♎
Schwefel ♎
Antimonium. ♁.
Wismuth ✿.
Zink. ♃♄
Spiauter. Idem.
Kobold H♄
Arsenicum ♁♁ alb. ♁♁ rub.
Salz ☉ Stein Salz ☉
Vitriol ☉ Kupfer-Wasser ☉♄
Alaun ☉.
Stein Kohln ♍.
Brennende Materien ♐

Signa Chymi-
ca.

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This work is the critical edition of the catalog of Holy Roman Emperor Leopold's II mineralogical collection. The volume, unpublished and preserved at the Historical Archives of the University of Firenze Museum System, dates to 1765 and describes 242 mineralogical specimens coming primarily from the current Slovak-Hungarian mining district. This edition gives the transcription of the German manuscript and its translation into English together with an organized system of notation to illustrate the complex history of the text, the characterization of the mineralogical species, and the geographical location of the mineral extraction sites. This work represents to date the only published catalog of a mineralogical collection belonging to a member of the Habsburg-Lorraine family.

Annarita Franza is a Postdoctoral Fellow at the University of Firenze. Her research is focused on the history of European naturalistic collecting, scientific museology, and museum cataloging.

Johannes Mattes is a PhD and an historian based at the Austrian Academy of Sciences. He has conducted research and/or taught at universities in Paris, Stanford, Toronto, Vienna, and the Leopoldina (Halle) where he specialized in eighteenth to twentieth history of natural sciences in Central and Eastern Europe.

Giovanni Pratesi is a PhD and Professor of scientific and naturalistic museology and planetary geology at the University of Firenze. He is also the Italian representative at the Museum Commission of the International Mineralogical Association. He has published numerous scholarly books and research articles, and has been recognized for excellence in research, teaching, and outreach.

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