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The gradual separation process from naturalistic knowledge: travel instructions for geologists and mineralogists in the eighteenth century

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Abstract

Between 16th and early 19th Centuries collecting data with economic and scientific purposes have been deeply articulated through writing travel instructions oriented to define actions at the distance. This association took place in different geographical and institutional settings within Europe, the Americas, Asia. Instructions were a key textual devices used since 16th-Century in order to surveying territories and collecting data. These documents concentrated and spread a set of concepts and practices related to making knowledge process which was in debt with data and agencies located on territories beyond the original locus where instructions had been wrote.

According to this framework the article aims to discuss the intimate relationship between travel, writing instruction and the gradual separation process from naturalistic knowledge focusing on travel instructions for geologists and mineralogists.

Keywords: Travel Instructions; Earth Sciences History; 18th Century

Riassunto

Tra il XVI e l'inizio del XIX secolo, la raccolta di dati a fini economici e scientifici si articolò profondamente attraverso la redazione di istruzioni di viaggio volte a definire azioni a distanza. Questa associazione ha avuto luogo in diversi contesti geografici e istituzionali in Europa, nelle Americhe e in Asia. Le istruzioni erano un importante strumento testuale utilizzato fin dal XVI secolo per esaminare i territori e raccogliere dati. Questi documenti concentravano e diffondevano un insieme di concetti e pratiche legate al processo di creazione della conoscenza, che era in debito con dati e agenzie situate in territori diversi da quello in cui erano state scritte le istruzioni.

Secondo questo schema, l'articolo si propone di discutere la relazione intima tra viaggio, istruzione sulla scrittura e il graduale processo di distacco dalla conoscenza naturalistica, concentrandosi sulle istruzioni di viaggio per geologi e mineralogisti.

Parole chiave: Istruzioni di viaggio; Storia delle scienze della Terra; XVIII secolo

A new way to talk about travelling

The drafting of instructions, carried out more frequently all over Europe throughout the second half of the eighteenth century, was meant to provide the travelling scientists with specific principles for mastering the techniques of observation and analysis of natural phenomena (Bossi & Greppi 1988; Kury 1988). In so doing, scientific mission was to become instrumental for the government, which could enjoy the benefits of technical-scientific advances to strengthen its economic and political power over the nations (Chappey & Donato 2016).

During the eighteenth century, the progressive research into the structure of the earth's surface and its components was closely linked to the experience of travel. The "oryctologists" and "mineralogists", as the Earth's scholars used to call themselves at that time, moved around the territory not only to collect rock, mineral or fossil samples for specialised museums, but also to gather crucial data for the interpretation of certain geological phenomena. If it was true that planning was crucial to the eighteenth-century geological investigation, the development of itinerant research into the inorganic natural world relied on different variables (Guntau 1984; Ellenberger 1994; Stafford 1984; Leed 1992). The simplest form of travelling was in fact, the short hike, namely a short-distance route covered by a single individual and referred to as a scientific practice linked to herborisation

for pharmaceutical purposes during the sixteenth and seventeenth centuries. Later, in the second half of the eighteenth century, the most popular way of travelling matched the definition of the county or regional trip, which would include at the most, two or three scholars or, more rarely, a small group of people. This medium-distance journey, also consisting in crossing some regions, or even some mountain ranges like the Apennines (Vaccari 2000a), required special training and the support of local guides. Finally, geological research found significant reflection in European journeys, in the Grand Tour itself and in the great non-European expeditions, which became popular thanks to the scientific work of Alexander von Humboldt and Charles Darwin (Bertrand 2008).

In the early eighteenth century, the "oryctological" and botanical trip was probably the most widespread journey over limited distances. It was particularly popular with the German naturalists and the Italian scholars among which Giuseppe Monti, Jacopo Bartolomeo Beccari and Jacopo Biancani (Cooper 1998; Cavazza 1990) working at first at the Accademia degli Inquieti and later on at the Institute of Sciences in Bologna. It was in fact, in this academic context, that the Apennine trips from Bologna to Mount Cimone organised by Luigi Ferdinando Marsili and Domenico Gusmano Galeazzi in 1721, and by Ferdinando Bassi up to the surrounding mountains in Porretta in 1754, took place. Institutional support was however, not always requested, since, between 1704 and 1711, the doctor and naturalist Antonio Vallisneri, on his own initiative, had, on several occasions, passed through the Modenese-Reggiano Apennines and more precisely from Scandiano to Garfagnana, to the Gulf of La Spezia and the Apuan Alps (Luzzini 2013). From the middle of the eighteenth century onwards, trips on a county and regional level intensified, especially as a way to observe more closely the geological characteristics of valleys, mountain chains and hills. In France,

for example, Jean-Étienne Guettard managed to publish in the *Mémoires of the Académie Royale des Sciences* numerous papers on his mineralogical and lithological journeys between 1746 and 1764. Likewise, in Italy between the 1950s and 1990s, geological field researches increased considerably, including: Veneto, Tuscany, Emilia-Romagna, Lombardy, Piedmont regions and other central and southern areas of the peninsula (Ciancio 1995; Vaccari 1993). Through this prism, the observation of mountains became a key element for the development of an Earth sciences' branch known today as historical geology or stratigraphy.

Between the final decades of the eighteenth century and the beginning of the nineteenth century, the growing need to compare a wide range of data and observations - encompassing the study of extinct volcanism, endogenous phenomena and the origin of rocks like basalt and granite - led to organize extended and articulated journeys. In Italy, a major example is the well-known *Viaggio alle Due Sicilie e in alcune parti dell'Appennino* (*Journey to the Two Sicilies and in some parts of the Apennines*) by Lazzaro Spallanzani, not by chance referred to as a "volcanic journey" by its author (Spallanzani 1792-1797; Vaccari 1998).

However, most of the scientific journeys of the eighteenth century were, in the broadest sense of the term, still committed to the naturalistic model: geological, paleontological and mineralogical research included in fact, numerous botanical, zoological and anthropological observations as shown in the printed version of their reports. However, as early as the end of the seventeenth century, some naturalistic journeys appeared particularly oriented towards more descriptive geological research, as they reflected the individual traveller's major interests. This trend can also be seen in the first scientific travel instructions, and more precisely, the *Brief Instructions for making observations in all*

parts of the world (1696), the *Brief Directions for making Observations and Collections*, and for composing a travelling Register of all Sorts of Fossils (1728) by John Woodward. The English scholar was the author of a successful theory of the Earth, which became quite widespread in Italy during the eighteenth century. In the first text, Woodward seems to focus his attention more on the hydrographic, mineralogical, lithological, geomorphological and paleontological features than on the botanical and zoological ones. In this respect, he urges us to observe the various types of rock visible both on and under the surface including the metal minerals, the mountains rocks, the places where fossils could be found and all the geomorphological changes due to earthquakes, volcanic eruptions and water erosion. The second text, intended for Woodward's collaborators, expanded the contents of the Brief Instructions and focused more on the stratigraphic aspects including instructions on how to compile a traveling logbook containing all geo-paleontological fossils information, basically all the mineral and rocky objects identified on and within the earth's surface (Torrens 1985).

Under the current historiography on Earth sciences, the definition process of geological journeys, including their different styles and specific requirements, warrants further explorations. In this respect, although it is clear that notion of geological mobility came with the emergence of geology as an autonomous discipline during the crucial forty years between 1780 and 1820, early signs of this trend can already be found in previous decades. If, in fact, the textbooks for travelling geologists were issued between the last years of the eighteenth century and the beginning of the nineteenth century, other early writings dedicated to geological, paleontological and mineralogical research already contain specific indications on how to embark on a travel. Nonetheless, in order to be able to draw a more precise historical picture of the

instruction process for travelling geologists, a further systematic investigation of reports dating back to the eighteenth and nineteenth centuries seems essential.

Travel's instructions in Vallisneri e Targioni Tozzetti missions

The journey along the Apennine chain between Emilia-Romagna and Tuscany, which ended in Garfagnana at the foot of the Apuan Alps in 1704, inspired Antonio Vallisneri - then professor of practical medicine at the University of Padua - to draw up a series of indications for another trip in the surrounding areas of Tuscany and Liguria. This text, divided into twenty-six points on geological research, is a veritable "index of observations", which appeared to be instrumental to finally settle the universal question on the origin of springs (Perruchini 1726). In the second paragraph, special emphasis is placed on the description of fossils and the importance of closely observing the outward appearance of the mountains and their colour composition. While indicating how to study animals, insect and plants, Vallisneri also stressed the need of embracing the history of crops, breeding and hydrography, including site climate and topography. He then examined the mineralogical features, along with the economic viability of the metal mines.

According to Vallisneri's instructions, a precise definition of how the paleontological study should be carried out is evident, even though in the scientist's text, there is no reference to any geological or mineralogical instruments for investigation, as opposed to barometers and thermometers for measuring air quality, which are instead mentioned. In his research plan, Vallisneri finally elaborated an extremely precise research method that favoured, alongside the usual description of "natural productions", a structural analysis of mountain reliefs, which should focus on the lithological

content and morphology of their layers, as well as on the different types of fossils and position.

The indications contained in Vallisneri's text, although not strictly conceived by their author as instructions for other scholars, were all the same presented by Giovanbattista Perruchini, editor of the Vallisneri's text. The Venetian "oryctologists" of the second half of the eighteenth century certainly treasured it as a precious vade mecum for their frequent research in the field, while in Tuscany, around the middle of the eighteenth century, Vallisneri's methodological heritage was ideally collected by the Florentine doctor and naturalist Giovanni Targioni Tozzetti. Il *Prodromo della Corografia e della Topografia Fisica della Toscana* (*The harbinger of Chorography and Physical Topography of Tuscany*), published in 1754 immediately after the publication of the first edition (1751-1754) of *Relazioni di alcuni Viaggi in diverse parti della Toscana* (*Reports of a few journeys in different parts of Tuscany*), contains an interesting overview of the physical topography of Tuscany (Targioni Tozzetti 1754).

The Targionian travel style was taken up by Tuscan scientists, among them Giuseppe Baldassarri, Antonio Matani, Ambrogio Soldani. These scholars, while committing themselves to the geological description of some delimited territories like Siena and to the analysis of their paleontological and mineralogical features, often drew on the Florentine naturalist's theoretical conclusions based on the lithological and morphological distinction between primary mountains and secondary hills (Vaccari 2000b). Moreover, the methodological indications developed in the early eighteenth century by Vallisneri and Targioni Tozzetti can be treated as a means of comparison to the *Instructio Peregrinatoris* written and published in 1760 by the well-known Swedish botanist Linnaeus (Linné 1759).

Mountains, mines and natural cavities of the earth's surface, recognised as vital places for geological observation, started to become increasingly popular in the naturalistic instructions of travelling scientists like Alberto Fortis and Peter Simon Pallas in the late eighteenth century, as well as in the geological field investigation methods developed for personal use, as in the case of Lazzaro Spallanzani.

From Piedmont to the heart of mining Europe

In this period, the definition of "mineralogical journey" began to appear more frequently in the titles of volumes and articles published in the scientific journals, with a rather broad meaning, which was not limited to the exclusive study of minerals. In this respect, Targioni Tozzetti's Reports became *Voyages minéralogiques* for the French edition of 1792, while Alberto Fortis's *Lettere geografico-fisiche sopra la Calabria (1784)* (*Physical map Letters about Calabria and Apulia*) had already been translated into German as *Mineralogische Reisen durch Calabrien und Apulien*. Among others, the *Briefe über Mineralogische Gegenstände auf seiner Reise durch das Temeswarer, Bannat, Siebenbürgen, Ober- und Nieder-Ungarn* (1774) by the Austrian mineralist Ignaz von Born, had turned, a few years later, into *Voyage Minéralogique fait in Hongrie et en Transylvanie* as edited by Antoine-Grimoald Monnet.

In reality, a "mineralogical voyage" stood for long mining education tours, such as those undertaken by some Piedmont officers and artillery cadets on the orders of government both in the mid-eighteenth century and from 1787 to 1790.

Furthermore, in the eighteenth century, the Savoy State, within the framework of an intense reforming programme, financed a number of educational trips to the most

popular scientific training centres in Europe involving a new technocratic class of scholars from the *Royal Schools*. This new team of technicians was supposed to take an active role in the army, the management of mines, and in bridges and roads building. Through this prism, in 1749, Nicolis Spirito di Robilant, together with other four young cadets from the Royal Piedmontese schools set off to Saxony, Austria, Bohemia and Hungary by Carlo Emanuele III to carry out a thorough study of local mines' production system. The trip was promoted by the Savoy ambassador to Saxony, Francesco Perrone di San Martino, who strongly advocated for a restructuring of the mining sector the House of Savoy had been supporting since the sixteenth century, thus favouring the arrival of foreign technicians and workers in Piedmont. At the time of Carlo Emanuele III, and thanks to the support of Minister Bogino, the management of private mines was put under state control and entrusted to the artillerymen. Despite little practical results on an economic level, this operation led to the creation of an invaluable technical and scientific reserve, bound to have a positive impact on all business sectors of subalpine territory.

One only has to read the reports of the Royal mining engineers to understand the nature and extent of information the mining system (Ferrone 1984) was able to provide.

Nicolis di Robilant belonged to a team of scientists who, during the second half of the eighteenth century, helped to re-establish and restore the technical-scientific system in Piedmont. Inspired by what was happening abroad, they were in fact identified as the bearers of that innovative movement that would lead, on the one hand, to the creation of companies and academies, privileged places for information sharing, and on the other hand, the adoption of those new skills learned elsewhere in Europe to improve the Piedmontese economic-productive system. At the height of the reformistic season

promoted by the Savoy family was the activity of the Spirito di Robilant who in 1749, embarked on a long educational journey to Saxony, Bohemia, Thuringia, Hungary, Hesse, Styria, Carinthia and Tyrol with his four artillery cadets. This experience was extremely important to Robilant because the visit to both the academies and metallurgical plants in Central Europe enabled him to broaden his field of knowledge in the mining and metallurgical sectors, and to enhance and develop his scientific and technical expertise in his own country.

The first stop on the mineralogical journey of the Piedmontese artillerymen was Saxony. During one-year study in Freiberg, Nicolis di Robilant and his four cadets managed to attend lessons in metallurgical chemistry and mineralogy at Christlieb Ehregott Gellert and Frederick Hoffmann, and also in underground geometry (Johannes Zeibt) and in docismastic i.e. mineral tasting (Johann Andreas Klotsch). In addition to the theoretical lectures, the Piedmontese group also did a practical apprenticeship by visiting the mines and production facilities in Saxony.

After that stay in Saxony, the Piedmontese troops continued their journey towards the Erzgebirge, a region on the border of Saxony and Bohemia, renowned for its rich mineral deposits. The team visited both the mines and the tin and copper processing plants in Zinnwald, Alterbeng, Graslitz and Johanngeorgenstadt. Particular interest was

aroused by the blue cobalt¹ manufacturing plant, whose production process had been one of the main targets of industrial espionage during the eighteenth century.

In this framework, the Oberbergamt's officials, namely the superior collegiate mining management body, were ultimately responsible for allowing foreign visitors to access the Saxon workshops. Robilant and his travelling companions were issued with a pass so that they could become acquainted with the cobalt blue production process. At the Grünthal plant in Olbernhau², the Piedmontese engineers were trained in copper processing and the technique used to separate silver from copper by lead melting. The workshop was a large building, further subdivided into several complexes, in which the different phases of copper processing³ were being carried out.

In 1752, after visiting other mining plants in Saxony and Hungary, Robilant returned to Turin with six thick volumes of new findings⁴. This major collection of data meticulously described each processing stages ranging from metal extraction, metalworking and the operating facilities. Robilant's work could indeed rival Gabriel Jars' *Voyages métallurgiques* in terms of detail accuracy and the amount of information provided.

In the work's preliminary speech, addressed to the Savoy government, the author openly stressed the political and strategic value of the Saxon journey for the economy of the

¹ The production process of the blue colour used in the glass and porcelain factories was carried out in several stages, probably in separate buildings, as can also be seen in the drawings by Robilant during the mineralogical journey. Firstly, the cobalt stone was shredded and passed through roasting furnaces. Afterwards, the roasted mineral was melted in an oven with the addition of quartz and potash to obtain a glassy material. This was grinded and then gradually passed into different water basins to obtain, after several passages, an increasingly fine powder.

² In the Erzgebirge district, Saxony.

³ The copper, containing silver, was refined with lead in a furnace to form a copper-silver-lead alloy. This alloy was then heated in a special furnace until the lead and silver had turned liquid, while the copper continued to be in solid form. The lead-silver alloy was further separated into another furnace. Once the processing processes were completed, silver was sent to Dresden for coinage, while copper kept being processed for the production of copper sheets and other objects.

⁴ Of Robilant's mineralogical journey to Saxony, two manuscript copies of the six volumes are available, generically entitled *Viaggi alle miniere d'Alemagna*. A copy is kept in the Royal Library of Turin, while the other one is in the library of the Academy of Sciences of Turin.

Piedmontese kingdom. Those who know the decisive value *"of a State political economy should not disregard the importance of the mines and metals manufacturing and other products of the Kingdom"* (Ferrone 1984, 462). Robilant's reports, in fact, provided a detailed and comprehensive description of the Saxon and Austrian mines, as well as their organisational structure, machinery, work shifts, the collateral processing facilities, the safety systems, mine access roads, transport, accommodation and formularies.

However, his reports did not strictly focus on the technical-scientific aspects of metalworking, but rather on the careful evaluation of production cycles. In fact, many pages keenly focused on the physical movement of products from mines and forests to foundries and factories, their specific routes and economic costs in particular with regard to the availability of raw materials and their proximity to fuel supplies and factories location. Furthermore, two entire volumes report the costs of each single operation, the balance sheets, the expenses of the porcelain factories and saltpans. Finally, the kilns, mills, metalworking machines and all industry-related aspects were described. Nicolis di Robilant's extraordinary volumes collection was ultimately completed during the 1780 probably because its potential publication could benefit the support of the great aristocrats' reformist programme of the Academy of Sciences (Ferrone 1984, 463).

The outcome of the Piedmontese artillerymen's mineralogical voyage led by Robilant and his technical reports gave rise to important initiatives aimed at developing

the subalpine manufacturing sector. The pride and joy of the projects put forward from 1755 onwards, strongly backed up the knowledge acquired in the mines and mining academies of Central Europe included: the general recasting of coins in the Sospello foundries⁵ under the control of Spirito di Robilant, the creation of the Conflans⁶ and Moûtiers salt pans, the modernisation of the mines in Valsesia through the construction of machinery and the development of new production cycles, the establishment of new arms factories and copper processing plants (Ferrone 1984, 463-466).

Among the different proposals by the group of artillerymen returning from the German States, worthy of mention is the *"hypothetical project of a building bringing together all the operations on iron and the arts in that kingdom and elsewhere, akin to introducing a great trade and industry"* (Ferrone 1984, 464-466)⁷. This was an analytical description, carried out by Robilant in 1764, on the aspects related to the creation and operation of a large iron and steel plant, which summed up the results of the training trips abroad made by the artillerymen a few years earlier.

In addition to introducing the techniques tested in Central Europe, the journey of the Piedmontese team prompted the Savoy sovereign to recognise the need to establish new schools of mineralogy to train new workers, who had been crucial to the economic development of the state in the second half of the eighteenth century. In the preliminary speech of the six volumes on the mineralogical journey, Robilant expressly asked the sovereign to "introduce the schools

⁵ Currently a French municipality located in the department of Alpes-Maritimes in the Provence-Alpes-Côte d'Azur region. In the past, it was part of the Piedmontese possessions.

⁶ The towns of Conflans and l'Hôpital, in the current department of Savoy, were united in 1836 by King Charles Albert of Savoy of Sardinia in the town of Albertville, founded and baptised after the sovereign's name. Conflans in Savoy is not to be confused with Conflans-Sainte-Honorine in the department of Yvelines in Île-de-France.

⁷ Please refer to *"Ragionamento che ha per oggetto il ferro ed i suoi trattamenti con cui si accompagna il gran edificio di cui si unisce li disegni, stato concepito per raccogliere in un sol corpo e presentare con una semplice occhiata tutte l'arti che ne derivano, in Memorie riguardanti la mineralogia, la metallurgia, le scienze naturali e altro"*. The manuscript is kept in the library of the Academy of Sciences of Turin, ms. 0382.

of mineralogy, chemistry, underground architecture and metallurgy". To this end, he brought the publications, translated into Italian by Georg Ernst Stahl, Andreas Sigismund Marggraf, Johann Heinrich Pott and Friedrich Hoffmann to Turin marking the beginning of a cultural information campaign in Piedmont, similar to what was happening at the same time in France thanks to the German mineralogists' manuals translated by Baron d'Holbach.

Robilant's projects soon found practical implementation, confirming the Savoy family's interest in the management and exploitation of mineral deposits. In the fifties of the eighteenth centuries, within the Turin Arsenal, the Mining Magistrate and the Mineralogy School began to operate (Ferrone 1984, 466). Spirito di Robilant, at the turn of his brilliant career, while affirming the importance for European governments to foster scientific research, he also stressed the great educational value of cultural exchange and international relations in the book *De l'utilité et de l'importance des voyages*, published in 1790 (Di Robilant 1790). The outcome of the study period from Robilant to Freiberg, described in the pages of the six volumes of *Viaggi alle Miniere di Alemagna* had opened up "an important gate in Piedmont, which would boost the economic development and create the conditions for the recovery of an intellectual life" (Ferrone 1984, 467).

A few decades after his travels in Europe, Robilant, who in the meantime had become Inspector General of the mines, decided to send other young officers to the countries of the Habsburg Empire. In fact, it was necessary to continue to stimulate the economic activity of the State by focusing on mining and metallurgy in order to give consistency and continuity to Robilant's achievements. In this respect, Robilant, while believing in

the effectiveness of the regional missions to Piedmont and Valle d'Aosta, also assumed that beside the theoretical background in the mineralogical school of Turin, further training abroad was indispensable. In this context, Carlo Antonio Napione was chosen as the person in charge of the new mineralogical journey between 1787 and 1790 at the Saxon mines and academies (Argentieri 2012, Bulferetti 1970). Born in Turin in 1757, he began his military career at the Piedmontese academies where he studied mathematics and artillery. He then moved on to the Robilant's school where he learned mineralogy, metallurgy and chemistry. After completing his theoretical studies in autumn and winter, Napione, similarly to other academic and royal students, used to practice in the Piedmontese mines of the Aosta Valley and Savoy during the summer.

Napione was chosen by Robilant to undertake a seminar trip in the same territories he himself explored in 1749. In March 1787, he drew up the instructions for "those members of the artillery who, while excelling in mathematics, physics and chemistry would be able to go to Germany and Hungary and gain adequate and practical experience in metallurgy to operate for the mines of His Majesty in Sardinia" (Bulferetti 1970, 12). The itinerary included several stops at the Noric Alps⁸, the course of the Danube to the Oder and the Vistula, the mountains that separate Silesia from Bohemia - the Riesengebirge to the Fichtelgebirge - the mining mountains of Saxony.

Before crossing the Alps and heading towards the German states, the officers made a trip to the valleys of Aosta, Andorno, Sesia, Ossola and visited the iron foundries of Giaveno⁹, Canavese and Aosta. The aim was to prepare a report on mineral deposits to compare the data collected with what they would see outside Piedmont.

⁸ They take their name from Noricum, a historical region including the central part of Austria, part of Bavaria, Slovenia and Italy.

⁹ Piedmontese municipality in the province of Turin.

The mission continued towards to the Mineralogical Museum and the mint in Pavia, and ended up in Milan, Bologna and Verona. After crossing the Austrian border, the group decided to head on to Vienna, where the Piedmontese ambassador, Ludovico di Breme, gave Napione the necessary documents to keep on travelling. Following Robilant's indications, the young artillerymen visited the mineral deposits and the foundries of Saxony and Hungary, studied the techniques of mineral processing, cobalt blue, glassworks and saltpetre production processes. At each stop, the cadets compiled accurate reports, which were sent, to the General Finance Office in Turin on a regular basis.

After completing his Styria and Carinthia tour, Napione made a long stay in Schemnitz, travelled to Transylvania before arriving in Saxony and more precisely in Freiberg. In June 1788, he attended Werner's courses at the Bergakademie, considered at the time, *«la meilleure école pour l'exploitation des mines en Allemagne et peut être en Europe»* (Bulferetti 1970, 20). In that period, Napione not only began to prepare a volume on the amalgamation of metals including the notes taken at the Saxon Academy, but he also made sure that Turin received the model of some of the machines he had encountered during his journey.

Going towards the insular Europe, England and Scotland, and then returning to Piedmont in 1792, Carlo Antonio Napione concluded an important new mission. The organisation of mineralogical journeys, in the second half of the eighteenth century, gave a decisive boost to the Piedmontese science and economy of the time, owing to an organic restructuring project for mining and metallurgy, which would *"pilot the transition from the empirical, semi-artisan activity of mine and mineral processing to a more proto-industrial approach"*, in line with the most avant-garde

centres in Central Europe. Thanks to the foundation of the school of mineralogy and a theoretical-practical system inspired by the travelling scientists' transalpine model, the Savoy State was bound to become an effectively autonomous entity in both mining management and metallurgy.

Southern travellers on their way to find mines

In addition to the Piedmontese officers and artillery cadets' trips in the mid-eighteenth century, missions to Freiberg in Saxony and other well-known mining centres in Central and Northern Europe were also financed in Southern Italy, both during the Austrian viceroyalty (1707-1734) and the first Bourbon period (1734-1799). Given the official nature of the expeditions and the complexity of the itineraries both journeys highlight the need to draw up and assign precise travel and mining research instructions.

In June 1753, the Secretary of State Giovanni Brancaccio gave Pietro Conca, an official of the General Direction of Mines of Naples and Sicily, the instructions for an upcoming trip with Augusto Knoblauch, assistant to the director, and Giovanni Heidenreich, administrator of the quarries of Fiumedinisi, *"in the mines of foreign countries in order to acquire the basic knowledge and master the art where it appeared to be more profitable"*¹⁰.

According to the trip and its objectives, travel instructions, which depended on the traveller's cultural and scientific background, became of highest importance. In fact, as in the Neapolitan case, the most relevant missions financed by governments between the second half of the eighteenth century and the French Decade were always accompanied by specific instructions (D'Angelo 2016, 2018)¹¹. Actually, those given to Pietro Conca

¹⁰ Archivio di Stato di Napoli (from now on ASNa), *Ministero delle finanze*, fs. 2633.

¹¹ In addition to the aforementioned example of Pietro Conca, travel instructions were given to the expedition lead-

and his fellow travellers contained a wide range of indications, and suggestions for making the journey more comfortable and worthwhile. Ultimately, this programme provided a comprehensive set of tips and precise information for the mission to become an asset for the country and not to satisfy one's own personal sense of accomplishment¹².

Beside the observance of Catholic religion's rules, the distribution of payments among the members of the group, the appointment of the expedition leader, the instructions enabled Conca to acquire a wide range of knowledge and technical skills¹³.

If the drafting of the travel instructions was completed in June 1753, the actual group only took off at the beginning of 1756¹⁴. On 9th January, the Councillor of the court of Vienna, Ignaz Kempf von Angret issued three permits to the subjects of the Kingdom of Naples to visit the mines and metallurgical plants of Upper and Lower Hungary, Banat, Transylvania and finally Tyrol. They were also authorised to assist quarrymen and miners from Carinthia and Bohemia during the extraction of minerals from the caves. On this occasion, Conca, Knoblauch and Heidenreich could therefore practically train in metallurgical activity, in the techniques of opening and draining the water in the quarries, the construction of metalworking furnaces, in particular those for silver and copper purification. Beyond the

practical and technical aspects, the Neapolitan group was committed to getting information on how account books and registers were produced along with all the documentation relating to the extraction and processing of raw materials, including their implementation in the different branches of industry.

Conca's journey ended, presumably by the spring of 1756, with a visit to Neusohl, now Banská Bystrica, and Kremnitz, both cities in Slovakia¹⁵. Since then, archival traces have been lost. In this respect, it is not possible to know with certainty about the mission outcome, nor is there any available documentary footage that would allow a clear and precise reconstruction of the organisation and the findings during the 1756 trip. It nonetheless marked a new phase, financed by the Crown, which should have been more consistent to ensure its sustained impact over time. If, in fact, in Piedmont, only a few years had elapsed between Robilant and Carlo Napione's mineralogical journeys in Saxony, in Naples, the time gap was of twenty-six years, and more precisely from the study stay in the imperial dominions of Conca to the new trip financed by King Ferdinand IV, in 1782.

In that year, the "Nunziatella" Military School's future commander-in chief, as well as patron of the mineralogical journey of 1789, Giuseppe Parisi, was authorised by the court of Vienna to visit the mines of Lower Hungary

er, Giacomo Dillon and the four hydraulic engineers in charge of a mission to France between 1787 and 1789, as well as to the six naturalists who travelled in Europe between 1789 and 1796.

¹² «Ordina sua Maestà a Don Pietro Conca di regolare i designati viaggi di sorte che si miri a dirittura al prefisso fine del desiderato profitto loro ed interesse reale e non già a fini particolari travianti dal principale». "His Majesty orders Don Pietro Conca to arrange for the designated voyages of fortune to be made at the prefix of the desired profit and real interest for them and not for any particular purpose that would be of benefit to the principal". ASNa, *Ministero delle finanze*, fs. 2633, *Istruzioni del Marchese di Brancaccio a Don Pietro Conca*, Napoli 3rd June 1753.

¹³ «Debbono osserrar bene le diverse armature delle grotte sì di legno che di pietre murate e come cavansi o facciano perder le acque, come si procuri l'aria e necessario respiro e sfogo con far disegno o mostre del più rimarchevole. [...] Pigliino pure le vere idee delle fornaci e focolai pella fondazione e separazione de' metalli, del modo e divario delle fabbriche a fondere e separare, della qualità delle miniere che si uniscono per far meglio riuscire le fondazioni e separazioni». *Ibidem*.

¹⁴ From the documents available it is not possible to establish the reasons for this delay. Diplomatic or financial problems may have arisen.

¹⁵ Slovenský Banský Archív v Banskej Štiavnici (SBA), *Banská komora v Banskej Bytrici*, fs. 603, f. lo 21.

(D'Ayala 1845, 200)¹⁶. Unfortunately, Parisi's expedition ended before it even started, as there is very little information about his mission in the overseas territories and therefore it is impossible to assess its impact on the economy and the metallurgical sector of Southern Italy.

As shown by the instructions prepared for the two Piedmontese and Neapolitan groups and in general, for the Italian and European naturalists who travelled across the continent, the detailed nature of the texts specifically intended to provide a thorough picture on the activities of the travelling scientists. The drafting of instructions process went hand in hand with the definition of geology and mineralogy as autonomous disciplines, whose contributions would reach its peak in the nineteenth century. Thus, the geo-mineralogical journey developed during the eighteenth century, while complying with the main operating procedures, managed not only to acquire its own disciplinary independence during the first decades of the nineteenth century, but also to mark the beginning of a new specialisation process bound to establish a direct and indissoluble link between geologist, mineralogists and the practice of travelling.

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¹⁶ *Ivi*, Baský úrad v Kremnici, fs. 603, f.lo 169. Mariano d'Ayala, biografo di Parisi, ricorda: «[...] Nel 1782 andavano ad ammaestrarsi in Germania Giuseppe Parisi, Macri, del Re, Brune, Gensano, Roccas, Pignatelli Cerchiara, Carnavè, Serrano e qualcun altro quale di artiglieria, chi ingegnere e chi delle fanterie. [...] Onde in Germania il nostro Parisi, aggiungendo a geometrico acume una leggiadra incantevole locuzione, si ebbe fama di altissimo ingegno, e però il volle tra suoi confidenti il generale austriaco Pellegrini dell'arma sapiente degli ingegneri, che lo fece tenere in ugual prezzo al ministro Caunitz, primo a que' di nel concistoro dell'aulico consiglio. E la Maestà di Giuseppe II, al quale era già chiara la valentia del giovane ufficiale napoletano, spesso invitava al suo desinare, facendolo incontrare col poeta chiarissimo degli affetti Pietro Metastasio; e reiterate volte con ogni guisa di ricompensa offrivagli il posto di maggiore fra suoi ingegneri di campagna, che rispettosamente sempremai quei rifiutò, tenero come egli era della sua terra natale e devoto alla bandiera nostra».

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