

**Austro-Italian Scientific Relationships in the field of the Earth Sciences.
The Geologische Reichsanstalt and the geologists
of the Lombardo-Venetian Kingdom (1850–1866)**

EZIO VACCARI*)

17 text-figures

Austria (Monarchy)
Italy (Lombardo-Venetian Kingdom)
Geologische Reichsanstalt
History of Geology
History of Paleontology
History of Mineralogy

Contents

Abstract	95
Zusammenfassung	95
Riassunto	96
1. Introduction: The historical background	96
2. Towards the establishment of the Geologische Reichsanstalt: Wilhelm Karl Ritter von Haidinger and Italian geology	98
3. The early years of the Geologische Reichsanstalt: Franz von Hauer's travels in northern Italy and the Lombardo-Venetian geological community	100
3.1 Establishing Scientific Co-operation	100
3.2 The 1856 Field Survey	102
3.3 The Geological Debate on Lombardy	104
4. The end of the Lombardo-Venetian Kingdom and the change in Austrian geological perspectives on the Italian regions	108
5. Conclusions	109
Acknowledgements	110
References	110

Abstract

Since the time of its establishment in 1849, the Austrian Imperial Geological Survey directly organized geo-paleontological and mineralogical researches in the northern Italian regions which had become part of the Austro-Hungarian Monarchy in 1815 and formed the Lombardo-Venetian Kingdom. The aim of this paper is to reconstruct the Austro-Italian scientific relationships in the field of the Earth Sciences through a survey of primary sources such as the first 16 volumes of the *Jahrbuch der k. k. Geologischen Reichsanstalt* (from 1850 to 1866), as well as other printed and manuscript material from the Library and the Archive of the Geological Survey of Austria.

The beginnings of these relationships date back to the second half of the 18th century and were later resumed thanks to the scientific activities promoted by W. Haidinger. During the 1850s, increasing fieldwork determined by mapping purposes was undertaken by members of the staff of the Geologische Reichsanstalt in the Alpine and pre-Alpine areas of Lombardy, Veneto and Friuli. Their studies, in particular those by F. von Hauer, caused a debate among the Italian geologists from the Lombardo-Venetian Kingdom and prompted the new researches in the field by A. Stoppani, G. Omboni, G. Curioni and others.

Österreichisch-italienische Beziehungen auf dem Gebiet der Erdwissenschaften – Die Geologische Reichsanstalt und die Geologen des Lombardo-Venezianischen Königreiches (1850–1866)

Zusammenfassung

Die k. k. Geologische Reichsanstalt begann unmittelbar nach ihrer Gründung im November 1849 mit erdwissenschaftlichen Forschungsarbeiten in jenen Teilen Oberitaliens, die im Jahre 1815 unter dem Namen Lombardo-Venezianisches Königreich Teil der Öster-

*) Address of the author: Centro di Studio sulla Storia della Tecnica (CNR), via Balbi 6, 16126 Genova (Italy). Tel : +39 010 2099838
Fax: +39 010 2099826 Email: vaccari@linux.lettere.unige.it

reichisch-ungarischen Monarchie wurden. Die Zielsetzung dieser Arbeit ist eine Rekonstruktion der geowissenschaftlichen Beziehungen auf der Basis offizieller Quellen, wie den ersten 16 Bänden des Jahrbuchs der k. k. Geologischen Reichsanstalt (erschienen 1850–1866) sowie anhand anderer Druckwerke und von Archivmaterial, das in der Bibliothek bzw. im Amtssarchiv der Geologischen Bundesanstalt in Wien verwahrt wird.

Schon in der zweiten Hälfte des 18. Jahrhunderts waren entsprechende Kontakte vorhanden, die dann später dank der wissenschaftlichen Aktivitäten im Umkreis von Wilhelm HAIDINGER wiederaufgenommen und gefördert wurden. Während der Fünfzigerjahre des letzten Jahrhunderts führte die Reichsanstalt umfangreiche Kartierungstätigkeiten in den alpinen und voralpinen Gebieten der Lombardei, Veneziens und des Friaul durch. Diese Untersuchungen, insbesondere jene von Franz von HAUER, bewirkten Debatten unter den italienischen Geologen des Lombardo-Venezianischen Königsreiches und hatten schließlich neue Feldforschungen zur Folge, wobei in diesem Zusammenhang u. a. Antonio STOPPANI, Giovanni OMBONI und Giulio CURIONI zu nennen sind.

Contributo allo studio dei rapporti scientifici tra Italia ed Austria nelle scienze della Terra. Il Servizio Geologico Austriaco e i geologi del Regno Lombardo-Veneto (1850–1866)

Riassunto

A partire dall'anno della sua fondazione nel 1849, il Servizio Geologico Austriaco (inizialmente denominato "Geologische Reichsanstalt", Imperiale Ufficio Geologico) ha organizzato ricerche geologiche, paleontologiche e mineralogiche nelle regioni dell'Italia settentrionale che erano state annesse all'Impero Austro-Ungarico nel 1815 e formavano il Regno Lombardo-Veneto. Questo lavoro si propone di ricostruire le relazioni scientifiche italo-austriache nel campo delle scienze della Terra attraverso l'esame dei primi 16 volumi degli *Jahrbuch der k. k. Geologischen Reichsanstalt* (dal 1850 al 1866) e di altro materiale a stampa e manoscritto conservato presso la biblioteca e l'archivio del Servizio Geologico Austriaco a Vienna.

Gli inizi di questi rapporti risalgono alla seconda metà del Settecento e furono quindi ripresi verso la metà del secolo seguente, grazie alle attività scientifiche promosse da W. HAIDINGER. Nel corso degli anni Cinquanta dell'Ottocento i geologi appartenenti al Geologische Reichsanstalt realizzarono un crescente lavoro sul terreno, al fine di compilare carte geologiche delle zone alpine e pre-alpine di Lombardia, Veneto e Friuli. I loro studi, in particolare quelli di F. von HAUER, accesero un dibattito tra i geologi italiani del Regno Lombardo-Veneto e stimolarono la realizzazione di ulteriori ricerche sul campo da parte di A. STOPPANI, G. OMBONI, G. CURIONI e altri.

1. Introduction: The historical background

During the 18th century, traces of Austrian-Italian relationships in the field of geology and mining may be found mainly in the Italian territories controlled by the Habsburg Monarchy, but also in other ancient Italian states, such as the Republic of Venice and the Kingdom of Naples.

Since 1714 the former Duchy of Milan (south-western Lombardy) had been incorporated within the Austrian Empire. Later, cultural and scientific links between Vienna and Lombardy (Milan and Pavia in particular) were established within the program of reforms promoted by MARIA THERESA and JOSEPH II (DE MADDALENA, ROTELLI & BARBARISI, 1982; MONTI, 1996; BRAMBILLA, 1996; VISCONTI, 1997), and these reforms also influenced the policy of science in the Granduchy of Tuscany governed by PETER LEOPOLD von HABSURG-LORENA (PASTA, 1996). Some distinguished Italian naturalists of the late 18th century, who worked in Lombardy and were involved in geo-mineralogical studies, had several contacts with Austrian personalities and institutions, as in the case of Lazzaro SPALLANZANI (1729–1799), professor of natural history at the University of Pavia (FERRARESI, 1999), and Ermengildo PINI (1739–1825) professor of natural history at the Arcimboldo Schools in Milan (ROVIDA, 1832; ARRIGONI, 1995). Moreover, the south Tyrol naturalist Giovanni Antonio SCOPOLI (1723–1788) – formerly physician in the mining town of Idria in Carniola and later professor of chemistry, mineralogy and metallurgy at the Mining Academy of Schemnitz (1769–1776) – also taught chemistry and botany at the University of Pavia from 1777 to 1788 (Voss, 1881).

During the Austrian domination in the Kingdom of Naples, from 1707 to 1734, some attempts were made by the government of Vienna for increasing the mining exploitations in Calabria and Sicily under the direction of Austrian and German mining experts (DI VITTORIO, 1973: 26–29, 59–60, 175–192; BALDANZA & TRISCARI, 1987: 31–36). Later, at the end of the 18th century, the reference to the German/Aus-

trian mining tradition was highly considered in the Kingdom of Naples also by the Bourbon government, which sent six young scholars first to Vienna to learn the German language and the mining dialects spoken in the various territories of the Austro-Hungarian Monarchy, and later to study at the Mining



Italy in 1815

Fig. 1. Italy in 1815. From FORD, F. L. 1970: Europe 1780–1830. – London & New York, Longman, p. 307.

Academy of Schemnitz in the early 1790s. The aim of this operation was mainly to create a new specialized staff of mining experts in southern Italy, but after their extensive travel from 1792 to 1797 through Hungary, Saxony (they studied at the Mining Academy of Freiberg) and England, the Neapolitan scholars also introduced Wernerian views on mineralogy and lithology in the Kingdom of Naples, where some of them held important positions for the development of mineralogical science (VACCARI, 1998a: 119–124).

In the Republic of Venice individual scientific relationships, based on common geological interests, were established between Venetian and Austrian scholars particularly in the second half of the 18th century, as in the case of the geologist Giovanni ARDUINO (1714–1795) with the Austrian mineralogists Ignaz von BORN (1742–1791) and Benedikt Franz Johann HERMANN (1755–1815) in Vienna (VACCARI, 1993: 245–47, 294–95). The naturalist and polymath Francesco GRISELINI (1717–1783), editor of several scientific-economic journals in Venice, had instead both cultural and political connections with Vienna (TORCELLAN, 1965). He was a Freemason like von BORN and benefited from the patronage of some Habsburg authorities: for this reason GRISELINI undertook an extensive naturalistic travel, with several geological observations, in the Imperial territories of Bannat of Temeswar (southern Hungary) together with his patron count Giuseppe BRIGIDO, who was also the designated governor of that region. At the end of this travel GRISELINI stayed in Vienna for some months and finally moved to Milan, where the Austrian government had appointed him as the first secretary of the "Società Patriottica" (MOLLA LOSITO, 1982: 1044–45). The report of the travel to Bannat of Temeswar was translated into German by Ignaz von Born and published in Vienna in two volumes, while the Italian edition was partially printed in Milan (GRISELINI, 1780).

From the last years of the 18th century, the links with Vienna and the Austro-Hungarian Monarchy rapidly decreased in the northern Italian regions which became part of the Cisalpine Republic (1797) and later of Napoleon's Kingdom of Italy (1806). During the first decade of the 19th century substantial political, economical and institutional changes were introduced by the French in Lombardy and Veneto (FONTANA & LAZZARINI, 1992), although it must be noted that the former Republic of Venice had previously been annexed to the Austrian Empire in 1797 (after the Campoformio treaty) and became part of Napoleon's Kingdom of Italy in 1806.

After the Congress of Vienna (1815) most of northern Italy (Lombardy, Veneto and Friuli) was included within the territories controlled by the Austro-Hungarian Monarchy and formed the Regno Lombardo-Veneto (Fig. 1) (CANTÙ, 1857–1861; GIUSTI, 1979; MERIGGI, 1987; PONTIGGIA & RUMI, 1988; DACREMA, 1996; MICELLI, DI DONATO, CARGNELUTTI & TAMBURLINI, 1998). Although the Habsburg government did not really dismantle most of the administrative structures established during the previous Napoleonic Kingdom of Italy (MERIGGI, 1983; MAZOHL-WALLNIG, 1993), according to Agnese VISCONTI (1998) the return of the Austrians in Lombardy determined an «immediate and fast decline» in relation to the development of the natural sciences in that Italian region, which continued at least until 1838. The "Consiglio delle Miniere" (Mining Council), founded in 1808 for promoting mining researches and assembling a new centralized geo-mineralogical museum in Milan, had employed several valid geologists such as Ermenegildo PINI, Giambattista BROCCHI (1772–1826) and Giuseppe MARZARI PENCATI (1779–1836), but was immediately closed by the Austrian government in 1814 and not replaced with a similar institution. However, while several historical studies have analyzed the attempts of reorganizing and

revitalizing the mining industry especially in Lombardy from 1796 to 1814 under the French (FRUMENTO, 1985, 1991; TREZZI, 1992, 1996), much less data are available on the following Restoration period, although mining and metallurgy of the newly established Lombardo-Venetian Kingdom had been considered important industrial activities – especially in the provinces of Brescia and Bergamo – but in progressive decline due to the competition with the iron production from Carinthia (GREENFIELD, 1940: 135).

Within this context, the evaluation of the role of the Italian geologists in mining exploitation and the development of their geoscientific research in possible relation with Austrian scientists in the first half of the 19th century still need further detailed investigations. VISCONTI (1998) has provided a good overview of the institutional situation in Milan, while some traces of contacts between local geologists and Austrian authorities have been documented in Veneto, as in the case of the 1817 visit to Vicentino by the Viceroy of the Lombardo-Venetian Kingdom, Archduke RAINER: he was interested in mineralogy and in fact received a gift of a collection of rocks, fossils and minerals from the territory around Vicenza assembled by two local scholars, the collector Luigi CASTELLINI (1770–1824) and the geologist Pietro MARASCHINI (1774–1825) (VACCARI, 1998c: 120–122; LAZZARI, 1999b: 74). Further historical data may come from the study of the geological works published, for example, in periodicals such as the *Biblioteca Italiana* (Milan), *Il Politecnico* (Milan) and *Il Poligrafo* (Verona) or undertaken within scientific societies such as the "Imperiale Regio Istituto del Regno Lombardo Veneto" in Milan – later divided into the "I. R. Istituto Lombardo di Scienze, Lettere ed Arti" in Milan and "I. R. Istituto Veneto di Scienze, Lettere ed Arti" in Venice (GULLINO, 1996) –, the "Accademia di Agricoltura, Scienze e Lettere" of Verona (VANZETTI, 1990), the "Accademia di Udine" (TONUTTO, 1997) and other similar local institutions.

At this stage of the research and in consideration of the several aspects which still need to be analyzed in detail, the aim of this paper is to provide a starting point for a wider study on the scientific relationships between Austria and Italy in the field of the Earth Sciences during the 19th century. The selected case study concerns the early years of the Geologische Reichsanstalt and the fieldwork undertaken by its geological staff and external collaborators in the territories of the Lombardo-Venetian Kingdom, as well as the links of cooperation established with Italian geologists and scientific institutions from about 1850 to 1866.

It is important to remember that during this time span, the Austro-Hungarian Monarchy lost control of the northern Italian regions which constituted the Lombardo-Venetian Kingdom. Lombardy was annexed by the Piedmontese in 1859, while Veneto and part of Friuli remained under Austria until 1866, when they became part of the Kingdom of Italy established in 1861. Consequently, the development of the attitude of the Italian geologists toward the Austrian authorities and state institutions, such as the Geologische Reichsanstalt itself, should be also carefully evaluated: for example, in the case of Veneto, PRETO (1998) has noted the difference between the nationalist Italian geologists («geologi patrioti»), such as Giuseppe MENEGHINI (1811–1889) or Lodovico PASINI (1804–1870), and those who instead supported the Austrian government, such as Achille DE ZIGNO (1813–1892) or Alberto PAROLINI (1788–1867). The problem is very delicate and not easy to define, because it generally seems that the scientific collaboration between Austrian and Italian geologists was not affected by political and nationalistic vindications, as for example in the case of Franz von HAUER's travels of 1850 and 1856 in the Lombardo-Venetian

Kingdom, two episodes which will be analyzed in the following pages.

2. Towards the establishment of the Geologische Reichsanstalt: Wilhelm Karl Ritter von Haidinger and Italian geology

During the second part of the 19th century, increasing fieldwork, often determined by mapping purposes, was undertaken by Austrian geologists and paleontologists in the northern Italian regions, particularly in the Alps and pre-Alps. Within this context, the activities promoted by the Geologische Reichsanstalt were particularly significant and drastically changed the Austrian attitude toward the geology of the Italian territories of the Monarchy (VISCONTI, 1998: 147). In fact, since the time of its establishment at the end of 1849, the Geologische Reichsanstalt directly organized and coordinated new geo-paleontological and mineralogical researches in Lombardy, Friuli and Veneto. In some cases, these researches were linked to the early fieldwork undertaken since the 18th century by Italian geologists especially in Veneto (VACCARI, 1993; CIANCIO, 1995; PRETO, 1995) and continued in the same region during the first decades of the following century (VACCARI, 1998b; LAZZARI, 1999a). Instead, in other cases, the geological features of some northern Italian areas were mapped for the first time by geologists employed in Vienna. As in the case of the first Geological Surveys established in Europe and in North America between the 1830s and the 1850s for compiling inventories of local geological and mineral resources (GUNTAU, 1991), the activities of the Geologische Reichsanstalt significantly improved the quality and the diffusion of geological cartography concerning the territories of the Austro-Hungarian monarchy (CERNAJSEK, 1984; CERNAJSEK, 1996a; CERNAJSEK & POŠMOURNY, 1993; BREZSNYÁNŠKY, 1996).

A few years before the foundation of the Geologische Reichsanstalt, an occasional interest in the geological and paleontological features of northern Italy may be found in the works of the Viennese Society of the "Freunde der Naturwissenschaften" (Friends of Natural Sciences) founded in November 1845 by Wilhelm Karl Ritter von Haidinger (1795–1871), who later became the first Director of the Austrian Geological Survey (CERNAJSEK, 1996b). In connection with his course of mineralogical lectures at the "Montanistisches Museum" in Vienna, Haidinger arranged weekly informal meetings for his most advanced students, which prompted the establishment of the Society and the publication from 1847 to 1851 of seven volumes of the *Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien*, as well as four large volumes of the *Naturwissenschaftliche Abhandlungen*, both edited by Haidinger himself. However, among the approximately one hundred scientists (mostly Austrians) who contributed to the content of these periodical publications, there were no Italians at least until 1851, although the *Berichte* and the *Abhandlungen* were sent to editorial offices of scientific periodicals and scientific institutions in Bologna, Catania, Milan, Naples, Padua, Palermo, Rovigo, Trieste, Turin, Udine and Venice.

Within the works of the Viennese Society, the first sign of interest in the geology of Italy occurred in January 1847, when the report of a mineralogical travel throughout the northern Apennines between Piedmont, Piacenza and Modena – mostly in the Duchy of Parma-Piacenza, governed by MARIA LOUISA of Habsburg – sent by Adolf Senoner (1806–1895), was presented at two meetings of the "Freunde der Naturwissenschaften" (HAMMERSCHMIDT, 1847). SENONER, (Fig. 2)



Fig. 2. Adolf SENONER (1806-1895). Courtesy of Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-07121-B.

a physician at Hadersdorf in Niederösterreich, had studied medicine in Italy at the universities of Pavia and Padua and later had served as surgeon in the Imperial Army (STACHE, 1895). His familiarity with the Italian geological literature of the late 18th and early 19th century (writings by FORTIS, ARDUINO, SPALLANZANI, PINI, BROCCHI, MARZARI PENCATI and others) is clearly shown by the report of this Apenninic travel, as well as his knowledge of the most significant geo-mineralogical collections of northern Italy – in particular those assembled by Giuseppe CORTESI in Piacenza, Vitaliano BORROMEO (1792–1894), Giuseppe DE CRISTOFORIS (1803–1837) and the brothers Antonio († 1885) and Giovanni Battista VILLA († 1887) in Milan (DE MICHELE, 1978; VISCONTI, 1998), NICOLÒ DA RIO (1765–1845) in Padua (COLOMBARA, PIGNATARO & PETTENELLA, 1995: 39–42), Giuseppe INNOCENTE (1770–1839) in Venice (BASSANI, A., 1995) and Alberto PAROLINI in Bassano (PRETO, 1998: 73–74).

In the same year 1847, the young assistant of the "Montanistisches Museum" Franz von Hauer (1822–1899) (Fig. 3) took part in the 9th congress of Italian scientists which was held in Venice in the second half of September: on that occasion HAUER had the opportunity to meet several Italian geologists, particularly from Veneto, such as PASINI, DE ZIGNO, PAROLINI, MENEGHINI and Tommaso Antonio CATULLO (1782–1869), as well as Lorenzo PARETO (1800–1865) from Genoa, Giacinto Provana di COLLEGNO (1793–1856) from Turin, the famed Leopold von BUCH (1774–1853), Roderick I. MURCHISON (1792–1871) and Philippe E. Poulletier de VERNEUIL (1805–1873). HAUER sent to Haidinger an outline of the debates which took place within the geological section of the Venetian congress, where he also witnessed an argument between DE ZIGNO and CATULLO on the stratigraphic series of the Venetian



Fig. 3.
Franz von HAUER (1822–1899). From TIETZE, 1899.

sedimentary terrains (HAIDINGER, 1848a; HAUER, F., 1848a). These discussions had started in 1841, during the third congress of the Italian scientists in Florence, and concerned particularly the question of the placement of the nummulitic limestones of the Venetian region within the stratigraphic scale. According to CATULLO, supported by PASINI, the nummulitic limestone was a clear indicator of the Tertiary terrain and could not be found in the Cretaceous, but this interpretation was not accepted by COLLEGNO and above all not by DE ZIGNO (MORELLO, 1983: 73–76; OMBONI, 1897: 119–123).

At the end of the Venetian meeting, HAUER joined the trip to Padua (for visiting some geological collections, such as the private one of DE ZIGNO and those kept in the University) and later took part in the excursion to the Berici Hills near Vicenza, where the geologists observed the basaltic intrusions in the nummulitic formations. While in Venice, HAUER was joined by the Swiss geologist Adolf von MORLOT (1820–1867) – officer of the "geognostisch-montanistische Verein" of Central Austria and responsible for mapping a part of the north-eastern Alps – who presented the first volumes of the *Berichte* and the *Abhandlungen* of the "Freunde der Naturwissenschaften" at the Italian Congress (HAIDINGER, 1848a:

299–300). At that time MORLOT (1848a, 1848b) was also doing fieldwork in the area of Trieste, Karst and Istria, sometimes together with another young contributor of HAIDINGER'S *Berichte*, Friedrich KAISER († 1850), who worked particularly on the surroundings of Trieste also in the following years, until his sudden and premature death (HAIDINGER, 1848b; KAISER, 1849, 1850; HAUER, F., 1851a). Moreover, also the paleontologist Johann Jakob HECKEL (1790–1857), "diurnist – präparator" and later assistant curator at the "Hof-Naturalienkabinet" in Vienna, stayed in Venice at the time of the 9th congress of the Italian scientists (HAIDINGER, 1848a: 301).

The presence of Austrian geologists at this meeting is certainly significant. The congresses of the Italian scientists had been held annually since 1839 (PANCALDI, 1983) and on three occasions they were hosted in the Lombardo-Venetian Kingdom (Padua in 1842, Milan in 1844 and Venice in 1847). On the other hand, the Austrian government was certainly aware that these meetings could also reinforce a sense of belonging to an Italian unity which, even if it did not yet exist politically, was however perceived within the various scientific disciplines and particularly in the field of geology (PRETO, 1998: 67–69). In fact, after the revolutionary events of 1848–1849 (which also involved Venice and Milan), the congresses were not resumed: consequently the Venetian meeting of 1847 (Fig. 4) was the last one which took place before the Italian unification and its proceedings remained mostly unpublished (VISCONTI, 1983).

However, the idea of compiling a general geological map of Italy – assembling the already existing regional maps together with other completely new ones – had been put forward since the congress of 1839 (COLLEGNO, 1847: vii), although only at the congress of Milan in 1844 did the Italian geologists finally decide to adopt a common colouring system, which followed that established by the German speaking scientists at the congress of the "Gesellschaft Deutscher Naturforscher und Ärzte" of 1832 in Vienna (MORELLO, 1983: 71). It is interesting to note that, within the context of this early project of the Italian geological map, the intentional involvement of some Austrian institutions seems to be rather evident. In 1844 the suggestion to standardize a common colouring system came from Camillo VACANI, general of the Corps of Engineers of the Habsburg Army, while later, at the congress of the Italian scientists in Venice, the "Militärgeographisches Institut" of Vienna directed by Joseph SCHEDA proposed the project of a geognostic map of Italy (VISCONTI, 1983: 216). HAIDINGER himself sent to the president of the geological-mineralogical section of the Venetian congress, Lorenzo PARETO, a copy of his preliminary geological map of the Austrian Empire ("Geognostische Übersichtskarte der Österreichischen Monarchie"), which had just been published and was presented to the Italian colleagues by Adolf von MORLOT (HAIDINGER, 1848a: 301; VISCONTI, 1983: 217).

HAIDINGER stated that he had used the recent works by COLLEGNO (1846) and PASINI – a draft of a geological map brought to Vienna by the french geologist Ami BOUÉ (1794–1881) – for collecting data on Lombardy and Veneto, as well as the monograph on the Venetian Alps (1844) written and illustrated with several nice coloured plates by the mineralogist and mining geologist Wilhelm FUCHS (1802–1853), "Bergverwalter" in Agordo near Belluno (HAIDINGER, 1847a: 32; 1847b: 18–20). COLLEGNO, who had worked for many years in France, also published in 1847 his *Elementi di geologia pratica e teorica*, probably one of the first handbooks on the geology of Italy (RATTI & SILVESTRI, 1982), while PASINI had written extensively on the geology of Veneto (RUMOR, 1907: 500–503) and according to COLLEGNO (1847: vii) was compiling at that time a geological map of the Lombardo-Venetian

Kingdom, which had been already partially presented at the congress of the Italian scientists in Pisa and Turin, but was never completed and published (PRETO, 1998: 74–76).

3. The early years of the Geologische Reichsanstalt. Franz von HAUER's travels in northern Italy and the Lombardo-Venetian geological community

3.1. Establishing Scientific Co-operation

When the Geologische Reichsanstalt was founded in November 1849, its director Wilhelm von HAIDINGER and one of its two first geologists, Franz von HAUER (TIETZE, 1899), were already quite familiar with Italian geology and Italian geologists, especially from Lombardy and Veneto. After his stay in Venice in 1847, HAUER travelled throughout other parts of Europe during the following year (HAUER, F., 1985), but also remained interested in paleontological questions which concerned the Venetian region (HAUER, F., 1848b, 1850d).

In 1850, although the Lombardo-Venetian territories had not been included in the five sections of summer field-work planned by the Geologische Reichsanstalt, HAUER was sent to northern Italy in spring for studying the main geological features of Lombardy and Veneto, as well as to collect information on the available geological literature on those regions and establish scientific co-operation with local geologists (SENONER, 1854a: 11–13; HAIDINGER, 1859b: 145; HAIDINGER, 1864a: 19). The travel took place from mid April to mid May starting from Vienna then on to Graz, Ljubljana, Trieste, Venice, Padua and Milan (HAUER, F., 1850a, 1850b). In Veneto HAUER met PASINI, CATULLO, DE ZIGNO and the Veronese botanist and paleontologist Abramo MASSALONGO (1824–1860), who was working in that year on the description of a collection of fossil bear bones found in some grottos of the Veronese district of Tregnago (DE VISIANI, 1861: 249). In Lombardy, HAUER visited the Civic Museum of Natural History ("Museo Civico di Storia Naturale", founded in 1838) and met its director Giorgio JAN (1791–1866), an Hungarian naturalist born and educated in Vienna, who had taught at the University of Parma from 1816 to 1845 (CONCI, 1967). HAUER was introduced to JAN's Milanese collaborators involved in geological studies, such as Giuseppe BALSAMO CRIVELLI (1800–1874), Giulio CURIONI (1796–1878) and Emilio CORNALIA (1824–1882), three significant figures – together with Antonio STOPPANI – of the history of earth sciences in Lombardy during the central decades of the 19th century (VISCONTI, 1998). In 1850 BALSAMO CRIVELLI was a high-school teacher of natural history in Milan with a particular interest in geology who, two years later, was appointed professor of mineralogy and zoology at the University of Pavia



CONGRESSO DEGLI SCIENZIATI A VENEZIA

SETTEMBRE 1847.

Fig. 4. The 9th congress of the Italian Scientists in Venice (September 1847). Author's private collection.

(GLIOZZI, 1963). He had just published for his students a collection of geological sketches on the Italian regions, particularly on Lombardy, and was preparing an elementary course of geology with several illustrations (BALSAMO CRIVELLI, 1850, 1851). One of his pupils was CORNALIA (Fig. 5), who also became a teacher of natural history in 1849 and was nominated assistant director ("direttore aggiunto") of the Museum of Natural History of Milan from 1851 to 1866 (CONCI, 1967: 61–62; DI TROCCHIO, 1983). BALSAMO CRIVELLI and CURIONI worked as curators at the same Museum but during different periods (CONCI, 1967: 36, 42), although the latter was much more involved in the promotion of mining and applied geology. He became a great expert in the Lombard Alps through about forty years of field-work in that area (CURIONI, 1857, 1877; ACCORDI, 1985).

While in Milan, HAUER had several meetings with local geologists and collectors (such as the VILLA brothers) and undertook some interesting excursions, for example to the mountains around the lakes of Como and Lecco (6 May 1850), together with BALSAMO CRIVELLI, CURIONI and CORNALIA. Moreover, HAUER proposed to the Italian colleagues to establish in Milan and in Veneto two geological societies based on the model of the "geognostisch-montanistischer Verein" of Graz and Innsbruck. The aim was clearly to create in the Lombar-



Fig. 5.
Emilio CORNALIA (1824–1882). From CONCI, 1967:
plate xix.



Fig. 6.
Achille DE ZIGNO (1813–1892). From ACCORDI,
1984: 76.

do-Venetian Kingdom an institutional network linked to the newly established Geologische Reichsanstalt: but although both DE ZIGNO and JAN promised to pursue this project, in 1854 nothing had yet been done, while four new "geognostical" societies had instead been established in Austria, Hungary and Bohemia (SENONER, 1854a: 13, 34–35).

However, the immediate results of HAUER's first travel to the Lombardo-Venetian Kingdom were altogether positive: PASINI, DE ZIGNO, CURIONI and BALSAMO CRIVELLI sent to Vienna several geological publications and small collections of minerals, rocks and fossils from Veneto and Lombardy, which were included in the library and in the museum of the Geologische Reichsanstalt (SENONER, 1854a: 13, 21–22, 37). For example, DE ZIGNO sent a selection of fossil fishes from the famous locality of Bolca, near Verona, which was visited on behalf of the Geologische Reichsanstalt by the ichthyologist Johann Jakob HECKEL (1850).

Another result of the established relationships between the Geological Institute of Vienna and the scientific community of the Lombardo-Venetian Kingdom was the exchange of papers for publication. DE ZIGNO and MASSALONGO submitted to HAUER their recent studies, respectively on the stratified terrains of the Venetian Alps and on the fossil bear bones of the Veronese province. The paper by DE ZIGNO was presented by Franz von HAUER (1850c) at the meeting of the Geologische Reichsanstalt on the 16th of April 1850 and was published in German in the first volume of the *Jahrbuch* and in French in the last volume of the *Naturwissenschaftliche Abhandlungen* edited by HAIDINGER (DE ZIGNO, 1850, 1851). Its content was widely diffused among the European geological community, as two short summaries had already been published in the *Bulletin de la Société Géologique de France* (vol. 4, pt. 2, Paris, 1847) and in the *Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefaktenkunde* (Stuttgart, Jahrgang 1848), while an English edition was printed in 1850 in the 6th volume of the *Quarterly Journal of the Geological Society of London* (OMBONI, 1897: 141). This work represented the final result of many years of research on the Tertiary terrains of Veneto, which were considered by DE ZIGNO as having been very badly studied by other geologists up to that time, and in fact contained critical remarks to the previous writings of CATULLO and PASINI. At the end of his text DE ZIGNO stated that these terrains could be divided, according to their distinctive fossils, into Eocene and Miocene formations. Baron Achille DE ZIGNO (Fig. 6) was a non-academic and self-

taught geologist who openly supported the Austrian government of the Lombardo-Venetian Kingdom (CORSI, 1991). He was "Podestà" (Mayor) of Padua from 1846 to 1856 and later, from 1860 to 1866, represented the Venetian provinces at the "k. k. verstärkten Reichsrathe" (Imperial Council) in Vienna: his political position is also confirmed by his official correspondence with the Geologische Reichsanstalt, especially in the early 1850s (letters in *Bibliothek der Geologischen Bundesanstalt, Amtsarchiv, 1850–1856*).

The long and detailed paper of MASSALONGO on the fossil bear bones of the Veronese area, presented at the Geologische Reichsanstalt on the 7th of January 1851 (HAUER, F., 1851b), was instead published only in Italian in the *Naturwissenschaftliche Abhandlungen* (MASSALONGO, 1851). It was one of the first significant papers of this young Veronese naturalist who was mainly interested in geology, paleontology and botany and had been a former student of Tommaso Antonio CATULLO at the University of Padua. In 1851 MASSALONGO had just been nominated teacher of natural history in the Lyceum of Verona and his correspondence relating to the following years, housed in the Public Library of Verona, shows the significant extent of his relationships with several Austrian scientists, such as HAIDINGER, HAUER, SENONER, HECKEL, FOETTERLE, FITZINGER, KOLLAR, HEUFLENER, SUESS, WOLF and others (GUIDOTTI, 1985).

Also Tommaso Antonio CATULLO, a stratigrapher and paleontologist who was professor of natural history at the University of Padua from 1829 to 1851 (ALIPPI CAPPELLETTI, 1979; CASELLATO & PIGATTO, 1996: 342–346), sent some abstracts of his works to Vienna, which were promptly translated and published in the *Jahrbuch* of the Geologische Reichsanstalt (CATULLO, 1852, 1853). Because of the long argument with DE ZIGNO, CATULLO's role in the Italian stratigraphical debate of the first half of the 19th century – with particular reference to the complexity of the use of fossil records in the terrains of Veneto (MORELLO, 1998, 1999) – was certainly not ignored by the geologists of the Reichsanstalt. Like DE ZIGNO, CATULLO himself corresponded with the Austrian Survey during the early 1850s (letters in *Bibliothek der Geologischen Bundesanstalt, Amtsarchiv*) and some of his writings were mentioned or reviewed in the periodicals of the Geologische Reichsanstalt (FOETTERLE, 1853, 1854; HAUER, F., 1858a), as well as in the case of the works by DE ZIGNO (FOETTERLE, 1852; HAIDINGER, 1859a; HAUER, F., 1866), MASSALONGO (FOETTERLE, 1855), CURIONI (HAUER, F., 1855a,

1858b, 1862, 1865a) and other geologists of the Lombardo-Venetian Kingdom.

Within the staff of the Geologische Reichsanstalt, the figure of Adolf SENONER was particularly significant for his role as an effective link between the Austrian and the Lombardo-Venetian geological communities since the early 1850s. His excellent knowledge of the Italian language allowed him to study most of the printed material concerning the geology and the physical geography of northern Italy, in order to compile a series of altimetric studies on Lombardy, Veneto and Istria (SENONER, 1851b, 1852). He also described the geo-mineralogical collection of the Bolognese naturalist Giovanni Giuseppe BIANCONI (1809–1878) and that owned by the VILLA brothers in Milan (SENONER, 1851a, 1856a). On the other hand, SENONER also published several papers in Italian, for example a report of the first four years of the scientific activities of the Geologische Reichsanstalt (1854a), studies on some geo-mineralogical features of Veneto and Friuli (1854b, 1856b, 1863) and a work on museological subjects (1861). Although he probably started rather early as an external collaborator of the newly established Geologische Reichsanstalt, his position within this institution seems to be clearly defined in 1854, when his name appears in the official published list of the staff (HAIDINGER, 1854: iii) as "Diurnist" and "Bibliothekbesorger" (in charge of the library) together with the archivist August Friedrich von MARSHALL (1805–1877).

In the same year, the director HAIDINGER (1854: iv–viii) also published a list of the first "Correspondenten" of the Geologische Reichsanstalt. Apart from CATULLO and DE ZIGNO – who had contributed their works to the first five issues of the *Jahrbuch* – other Italian scholars who sent books and specimens to Vienna between 1850 and 1853 became correspondents of the geological Institute: among them there were of course Giuseppe BALSAMO CRIVELLI, Giulio CURIONI and the VILLA brothers from Milan; Giovanni Giuseppe BIANCONI from Bologna (sent a fossil collection from the Bolognese Apennines); Giuseppe SCARABELLI (1820–1905) from Imola (sent a similar collection from the surroundings of Imola); Pietro DODERLEIN (1810–1893) from Modena (sent a precious collection of sub-apenninic fossils); Giuseppe MENEGHINI from Pisa (sent a collection of Tuscan fossils); Eugenio SIMONDA (1815–1871) from Turin (sent a rich collection of Tertiary fossils from Turin, Tortona and Asti); Antonio ORSINI (1788–1870), Lodovico PASINI and others (SENONER, 1854a: 43). During the following years, more distinguished Italian scientists joined the category of the "Correspondenten": in 1855 the list included naturalists such as Oronzo Gabriele COSTA (1787–1867) from Naples and Giulio Andrea PIRONA (1822–1895) from Udine, as well as the geologist Paolo SAVI (1798–1871) from Pisa; in 1856 the naturalist Giovanni OMBONI (1829–1910) from Milan – former student of BALSAMO CRIVELLI –, Alberto PAROLINI from Bassano and the pharmacist Giuseppe RAGAZZONI († 1898) from Brescia.

3.2. The 1856 Field Survey

After 1850, in spite of the above mentioned augmenting contacts with local geologists, the regions of the Lombardo-Venetian Kingdom were not included within the plans of annual fieldwork of the Geologische Reichsanstalt for some years until 1856, when Friuli, Veneto and Lombardy were selected for surveying that summer (HAIDINGER, 1859b: 146–148). Thus, Franz von HAUER returned to Lombardy in spring 1856 and a few months later he was joined by one of the assistant geologists of the Institute, Viktor Leopold von ZEPHAROVICH (1830–1890) (ZAPFE, 1971: 135). Their re-

search was included within the 4th section of the summer fieldwork of the Geologische Reichsanstalt and took place from May to November 1856: its details are well documented in one of HAUER'S field-notebooks (1856c) as well as by various official reports – "Reisebericht" and "Reise und Geschäfts Journal" – which were regularly sent to Vienna by HAUER and later by ZEPHAROVICH (Bibliothek der Geologischen Bundesanstalt, Amtssarchiv: 1856, prot. 470, 506, 539, 587, 642, 762, 1052; Ministerial-Erlässe 1856).

At the beginning of his travel HAUER spent about a week in Milan, where he met Giorgio JAN, Emilio CORNALIA, Giovanni OMBONI, General Camillo VACANI, Ambrogio ROBIATI – engineer, director of a private scientific high-school and founder of a geological society in Milan a few months earlier – and Antonio STOPPANI (1824–1891) (Fig. 7), a cleric and self-taught geologist who had assembled a remarkable geo-paleontological collection as a result of his extensive fieldwork undertaken mostly in Lombardy (DACCÒ, 1991). HAUER also examined the collections owned by Giulio CURIONI and by Antonio and Giambattista VILLA. Significantly, at the end of April, the two VILLA brothers had sent to the Geologische Reichsanstalt a selection of fossils and rock-specimens from the Lombard territory of Brianza, together with a short description of their private geological museum (Bibliothek der Geologischen Bundesanstalt, Amtssarchiv: 1856, prot. 397).

On the 20th of May 1856 HAUER started his fieldwork from Milan to northern Lombardy, up to the border with Switzerland, in the Calcareous Alps ("Kalkalpen") around Varenna, Como, Lecco, Bellagio, Esino, Menaggio, Chiasso, Lugano and



Fig. 7. Antonio STOPPANI (1824–1891). From DACCÒ, 1991: 120.

Locarno. Later, in June and early July, he explored the province of Bergamo, in particular the Brembana valley and the surroundings of lake Iseo and Lovere, as well as the Trompia, Camonica and Scalve valleys and the area of Bovegno in the territory of Brescia (Fig. 8). Around mid-July, he arrived to the north-western coast of lake Garda and to lake Ledro. Then, after a stop in Brescia for visiting the geological collection of Giuseppe RAGAZZONI, HAUER returned to Milan, for the last meetings with CURIONI, OMBONI and STOPPANI, before to leave to Vienna, via Sondrio and Tyrol, at the beginning of August.

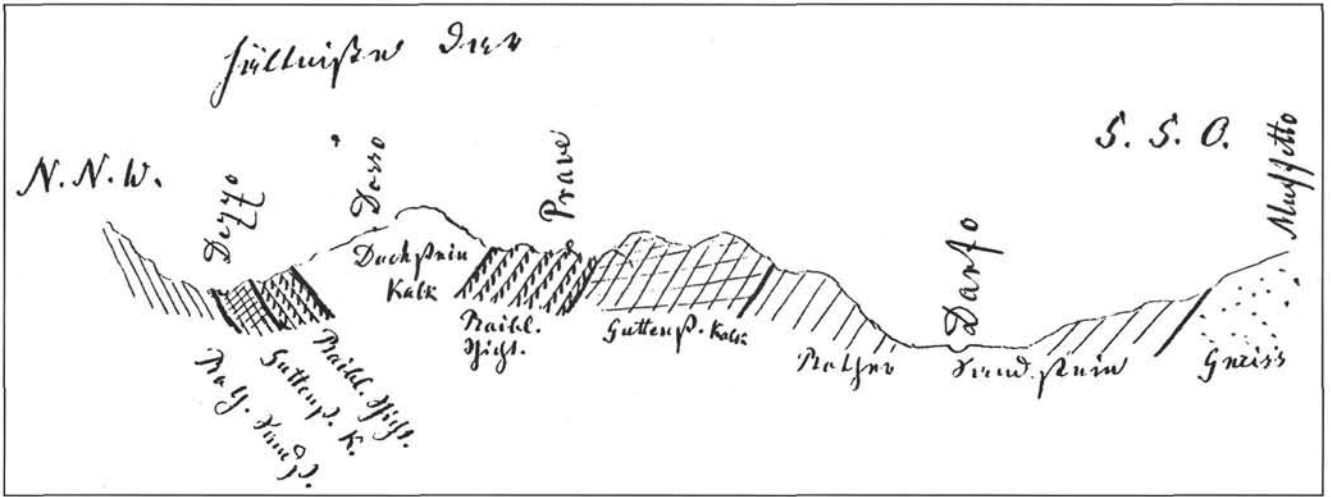


Fig. 8. Section of the rock formations in the Scalve valley, between Bergamo and Brescia (Lombardy), drawn by F. von HAUER during the fieldwork of July 1856. Courtesy of Bibliothek der Geologischen Bundesanstalt, Amtssarchiv, 1856, Prot. 587 (4.7.1856).

In Riva del Garda HAUER had been joined by ZEPHAROVICH, who then completed the last part of the fieldwork in the valleys of the provinces of Brescia and Bergamo, including the surroundings of Lake Maggiore, from September to November 1856. While in Riva, HAUER also met his colleague from the Geologische Reichsanstalt, Franz FOETTERLE (1823–1876), who was surveying during the same period some areas of Veneto and Friuli. During the previous years FOETTERLE (ZAPFE, 1971: 32) (Fig. 9) had collected several pieces of information on the geology of Veneto by studying the writings by DE ZIGNO, CATULLO, MAIMERI and MASSALONGO (FOETTERLE,

1852, 1853, 1854, 1855). The fieldwork in the eastern part of the Lombardo-Venetian Kingdom had started around mid-June 1856 in the mountain areas of Friuli, where FOETTERLE was accompanied and guided by Giulio Andrea PIRONA (1856), a naturalist and geologist from Udine who was in personal contact with HAUER on mineralogical matters since the previous year (HAUER, F., 1855b; SIMONETTO, 1997: 101). FOETTERLE'S fieldwork in this area integrated that done by another geologists from the Reichsanstalt, such as Dionys STUR (1827–1893), in Carnia and Comelico during the summer of 1855 (STUR, 1856a, 1856b). At the end of July, while



Fig. 9. Franz FOETTERLE (1823–1876). Courtesy of Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-07304-B.



Fig. 10. Heinrich WOLF (1825–1882). Courtesy of Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-07139-B.

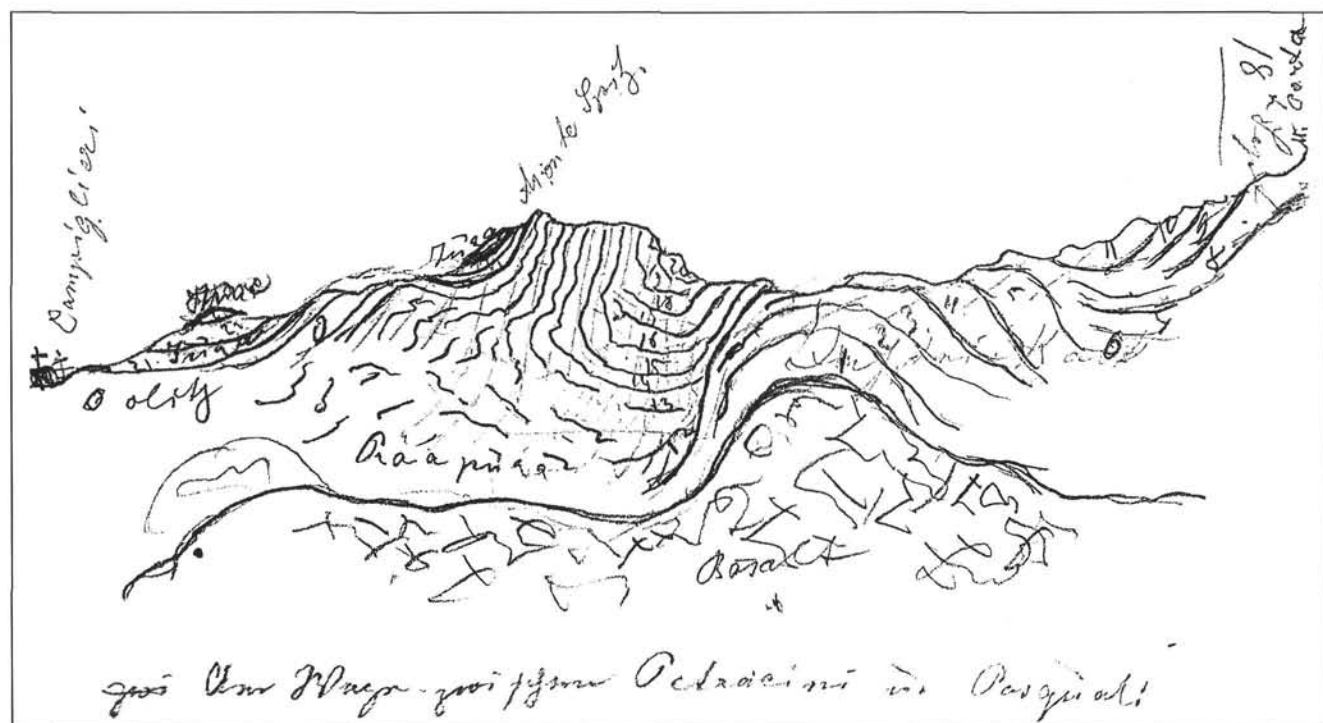


Fig. 11. Field sketch of Mount Spitz, near Bolca (between the provinces of Verona and Vicenza), drawn by H. WOLF in September 1856. Courtesy of Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-00092-TB, "Südalpen 1854–1856".

FOETTERLE was sending his report from Riva del Garda to Vienna on the observations made in Carnia, Cadore, Zoldo valley and other parts of the province of Belluno in northern Veneto, his assistant geologist Heinrich WOLF (1825–1882) (ZAPFE, 1987: 206–207) (Fig. 10), was starting another program of fieldwork in the provinces of Belluno, Vicenza, Verona and Padua, which continued until mid-November (Bibliothek der Geologischen Bundesanstalt, Amtsarchiv: 1856, prot. 654; Ministerial-Erlässe 1856). During his numerous excursions in Veneto, WOLF (1856) visited and studied some of the classic localities featured in the geological research of the 18th and early 19th century, such as the Agno valley, the mountain area around Bolca (Fig. 11), and the Euganean Hills.

The results of this first fieldwork and general survey («geologische Uebersichts-Aufnahme») in the Lombardo-Venetian Kingdom, undertaken by four geologists of the Geologische Reichsanstalt over six months during the summer and autumn of 1856, were positively mentioned by the Director HAUER (1859b: 148; 1864a: 169) a few years later. A general geological map of the Lombardo-Venetian Kingdom was produced by the Geologische Reichsanstalt in four sheets 1:288,000 (two on Veneto/Friuli and two on Lombardy). Although it was available only in one original copy, which could be reproduced upon request (SELLA, 1863: 160–165), this map was known and positively regarded by the Italian geologists at the end of the century, as in the case of Mario CERMENATI (1891: 4). The base map sheets which were probably used for compiling the final version of the above map, which was completed at the end of 1856, have recently been traced in the Wissenschaftliches Archiv of the Austrian Geological Survey, thanks to the precious help of Dr Albert Schedl. However, among 47 sheets representing a full set of the topographical map of the Lombardo-Venetian Kingdom published in 1833 in Milan by the "Militärgeographisches Institute" of the Austrian Army ("Carta Topografica del regno Lombardo-Veneto costruita sopra misure astronomico-trigo-

nometriche ed incisa a Milano nell'Istituto Geografico Militare dell'I.R. Stato Maggiore Generale Austriaco") (Fig. 12), only 18 are fully or partially coloured, or contain signs indicating geo-mineralogical features.

Another consequence of the Austrian fieldwork of 1856 in Lombardy, Veneto and Friuli was the reinforcement of the scientific links with local Italian geologists and naturalists such as CURIONI, OMBONI, VILLA, STOPPANI, in Lombardy, CATTULLO, PASINI, DE ZIGNO, PAROLINI, MASSALONGO, MANGANOTTI, DE VISIANI in Veneto, and PIRONA in Friuli, as well as the establishment of useful contacts with local mining officers (FAVRETTI in Valdagno, HUBERT in Agordo) and active collectors such as RAGAZZONI and FEDREGHINI in Lombardy, DE MARCO and PELLEGRINI in Veneto, count MANIAGO and count POLCENIGO in Friuli (HAUER, F., 1856a; FOETTERLE, 1856). FOETTERLE (1856: 850) also refers to contacts with a certain "Forstmeister SENONER in Feltre", who perhaps could be the same Adolf SENONER mentioned above, temporarily working near Belluno as a forest inspector around 1856.

3.3. The Geological Debate on Lombardy

Finally, the third and more important result was the significant growth of the Austrian-Italian geological debate during the late 1850s, particularly with regard to Lombardy. HAUER (1856a), FOETTERLE (1856, 1857) and WOLF (1857) gave short reports of their Italian travels. The former mainly took into consideration the works by CURIONI and STOPPANI on the geology of Lombardy (HAUER, F., 1855a, 1858b, 1859, 1862, 1865a, 1865b) and emphasized the role of the Civic Museum of Natural History of Milan as the main reference for local geologists and naturalists (HAUER, F., 1857). He also mentioned the first attempts of compiling a geological map of Piedmont (HAUER, F., 1863) and MENEGHINI's paleontological studies in Tuscany (HAUER, F., 1854). In the same year as the fieldwork

Prospetto dei Fogli della Carta topografica del Regno Lombardo-Veneto
componente il Governo di Venezia.

Übersicht jener Blätter der topographischen Karte des Lombardisch-Venetianischen Königreiches,
welche das Gouvernement von Venedig bilden.



Fig. 12.
 General plan of the topographical map of the Lombardo-Venetian Kingdom, Government of Venice (Milan, 1833), which was used in 1856 for preparing the geological map of the same region. Courtesy of Bibliothek der Geologischen Bundesanstalt, Kartensammlung, 693.

in the Lombardo-Venetian regions, it is significant to note that HAIDINGER (1856) presented the study by Theobald ZOLLIKOFER *Beiträge zur Geologie der Lombardei* (1856). The Director of the Geologische Reichsanstalt had also supported the establishment of a new "Società Geologica residente in Milano", which was officially founded in February 1856 by engineer Ambrogio ROBIATI, together with a group of geologists (mainly Lombard) which included among others CURIONI, CORNALIA, BALSAMO CRIVELLI, OMBONI, the VILLA brothers, PAROLINI, PIRONA and STOPPANI (VISCONTI, 1998: 147-149).

Therefore, the old project to create a "geognostical" society linked to the Geological Institute of Vienna within the Lombardo-Venetian Kingdom had been successfully resumed after five years. In fact, at the beginning of February ROBIATI had written to HAIDINGER asking about the possibility to establish a geological society in Milan, based on the model of those Austrian institutions called "geognostisch-montanistischer Verein". HAIDINGER strongly encouraged this project in a letter to Robiati dated 25 February 1855 (OMBONI, 1859a: 5-6), which stated that the new Milanese Society could pursue the same scientific aims of the Geologische Reichsanstalt and could operate independently, in «continuous relationship» and «friendly correspondence». In the same year 1855, ROBIATI became correspondent of the Geologische Reichsanstalt, went personally to Vienna for obtaining the necessary authorizations and widely publicized his project by sending a

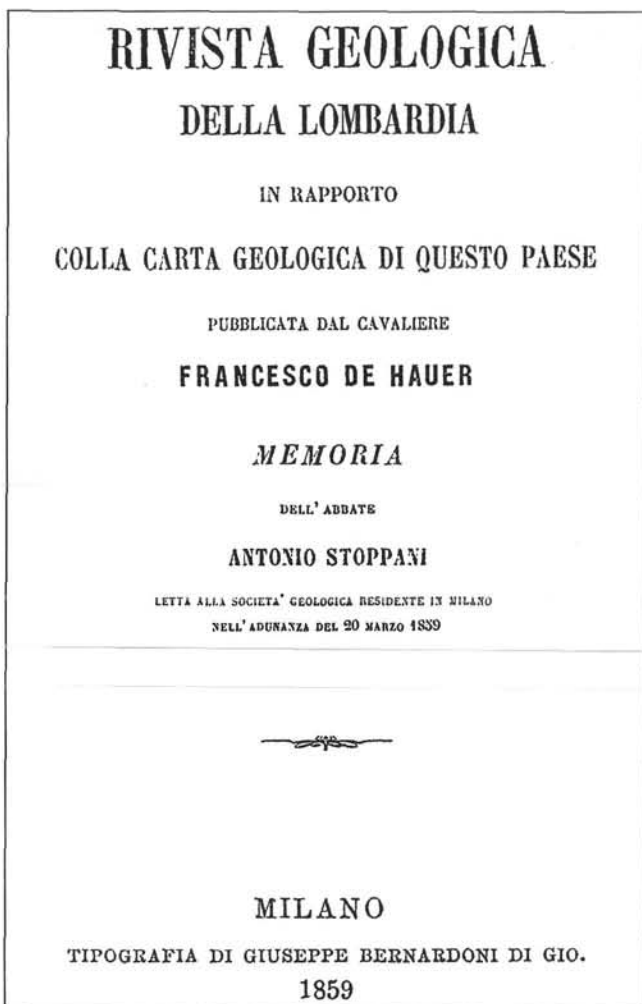


Fig. 13.
Title page of STOPPANI, 1859.

La seguente tabella mette in confronto la classificazione dei terreni ammessa dal cav. di Hauer e quella adottata da me e dallo Stoppani.

TERRENI SEDIMENTARI DI LOMBARDIA.

Secondo il cav. di HAUER:	Secondo STOPPANI e OMBONI.	
<i>Diluvium e aluvium</i>		
Terreno subapennino di Gandino.	1. Terreni superficiali e plio-stoeceni.	
Terreno subapennino della Folla, ec.	2. Terreno subapennino di s. Colombano, della Folla, di Nese, di Castenedola, ec.	
Eocene. — Rocce nummulitifere.	3. Miocene. — Arenarie sup. della Brianza. 4. Eocene. — Rocce nummulitifere.	
Greta superiore. — Puddinga di Sirone, calcare a catilli.	Terreno cretaceo { 5. Calcare a catilli. 6. Puddinga di Sirone. 7. Arenarie psammitiche, ec. 8. Scisto calcareo-marnoso a vari colori, ec.	
Neocomiano. — Arenarie con fucoidi e parte della maiolica.		
Giura. — Calcarei diversi e parte della maiolica.	Terreno giurose { 8. Maiolica. 9. Calcare rosso con aptichi. 10. Calcare rosso ammonitifero. 11. Gruppo di Arzo, Saltrio, Viggiù, ec. 12. Dolomia superiore. 13. Banco madreporico. 14. Deposito dell'Azarola (veri Kössener Schichten).	
Lias { Superiore. — Calcareo diverse con ammoniti. Inferiore. (<i>Dachsteinkalk e Kössener Schichten</i>).		
Trias { Sup. { <i>Raitler Schichten</i> . Calcareo d'Esino. Strati di s. Cassiano (<i>Cassaner Schichten</i>).	Trias { 14 c, 15 a e 15 c. Gruppo di Esino e dolomia media. 14 b e 15 b. Rocce variegate di Dossena, Gorno, ec. (<i>Raitler Schichten</i>) e rocce fossilifere delle stesse località. 16 e 17. Gruppo di Perledo, Varenna, ec. 18. Dolomia inferiore (<i>Muschelkalk</i>).	
		Inf. { <i>Muschelkalk</i> . Verrucano e scisti di Werfen.
		Carbonifero. — Schisti neri, argillosi, talcosi, ec.

Fig. 14.
Comparison of the stratigraphic series of Lombardy according to HAUER (left) and to STOPPANI/OMBONI (right). From OMBONI, 1859b: 108.

circular to all the "Licei" (high schools) of the Kingdom and to numerous Italian geologists. Finally, on the 8th of February 1856, the first 56 members of the "Società Geologica" gathered at the Istituto Robiati, the scientific high school owned and directed by ROBIATI himself and who also taught mathematics and physics there.

The beginnings of the geological society were rather slow and only at the end of 1858 were its structures and charters definitively approved (ATTI, 1859: 3-68). The Society was open to scholars resident in the Lombardo-Venetian Kingdom: however, the admission of foreign members required the previous approval of the "Luogotenenza" of the Austrian Government in Milan. A commissar from the latter institution also had to participate in all the meetings of the Society thus demonstrating the level of control officially exercised by Vienna within the Monarchy. One of the main aims of the "Società Geologica" was to promote the formation of «geognostical provincial collections» particularly through the systematic organization of fieldwork and the compilation of geological maps and memoirs which would be published in the annual proceedings. The first president was CURIONI, but he soon resigned and was replaced by CORNALIA, while OMBONI was nominated secretary and later was joined by STOPPANI as second secretary. The meetings were held monthly from

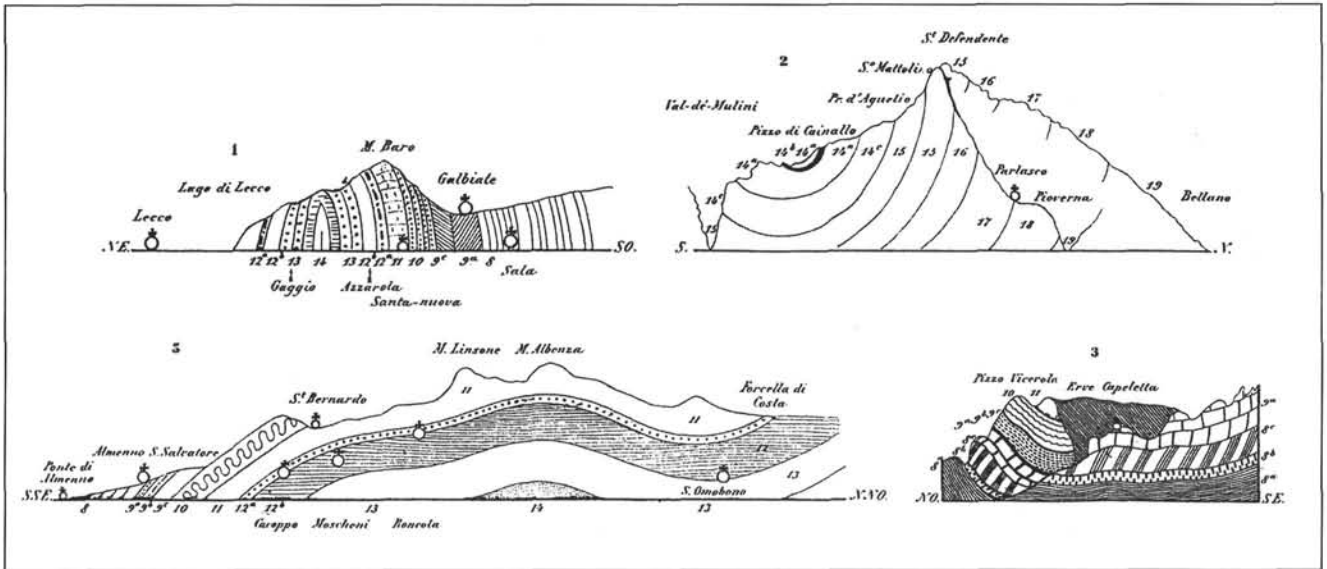


Fig. 15. Samples of geological sections of the Lombard Alps. From STOPPANI, 1859: plate 1.

December 1858 to April 1859, then were interrupted for the period of the war between Austria and the Franco-Piedmontese alliance, and resumed in August: consequently, the first volume of *Atti della Società Geologica residente in Milano* (which included the reports of the activities since 1856) was published at the end of 1859, when Lombardy was already no longer part of the Austrian Monarchy (ATTI, 1859).

Although no Austrian contribution is shown in the content of this volume, the most interesting papers concerned the discussion which arose among the Lombard geologists after the publication of the general geological map of northern Lombardy by Franz von HAUER (1858c). This work by HAUER represented the final synthesis of the fieldwork undertaken by him in the summer of 1856. It contained an impressive bibliography on the geo-paleontological features of Lombardy (which showed a deep knowledge of Italian literature), followed by the analysis of the formations illustrated on the map, ranging from the Carboniferous to the Alluvium: HAUER had subdivided them in "Steinkohlenformation", "Untere Triasformation", "Obere Triasformation", "Unterer Lias", "Oberer Lias", "Juraformation", "Neocomienformation", "Obere Kreide", "Eocenformation", "Subappenninen-Formation", "Diluvium und Alluvium". At the beginning of his paper, HAUER acknowledged the help from his Italian colleagues CURIONI, OMBONI, STOPPANI, VILLA, RAGAZZONI and FEDREGHINI. According to some biographers (NOSOTTI, 1991), STOPPANI was particularly stimulated by the meeting with HAUER: it was not by chance that the volume *Studii geologici e paleontologici sulla Lombardia* (STOPPANI, 1857) originated from the annotated catalogue of STOPPANI's geo-paleontological collection which had been written for the benefit of HAUER. STOPPANI's work, which provided a detailed stratigraphical series of the terrains of Lombardy and supported the homogeneous upheaval of the Lombard Alps («unità del sollevamento lombardo») according to ELIE DE BEAUMONT'S (1798–1874) orogenic theory, was highly praised by the Milanese geological community (VILLA, 1858). In February 1858, a few months before the publication of HAUER's map of Lombardy, a paper on the Trias formation of the same region, sent by STOPPANI to HAUER himself, was translated into German and published in the 9th volume of the *Jahrbuch der k.k. Geologischen Reichsanstalt* (STOPPANI, 1858). This volume also included,

within the part issued for the same month, the review of the *Studii geologici e paleontologici sulla Lombardia* (HAUER, F., 1858b) and STOPPANI's admission as correspondent of the Reichsanstalt.

At the meeting of the "Società Geologica" of Milan, held on the 27th of February 1859, the discussion on HAUER's map of Lombardy was opened by the secretary OMBONI (ATTI, 1859: 82), who provided a critical analysis of the stratigraphic series presented by the Austrian geologist (OMBONI, 1859b). In fact, since the time of HAUER's travel in summer 1856, the research on the northern Lombard rock formations had been significantly enlarged by the Italian geologists, who had undertaken several excursions in the field. The results of this new fieldwork allowed OMBONI (1859b, 1861) and especially STOPPANI (1859) to propose some corrections to HAUER's classification of the terrains of Lombardy (Fig. 13). Although the map published in 1858 was not rejected, on the contrary it was substantially accepted as a general overview, even though OMBONI and STOPPANI disagreed with HAUER about many internal stratigraphical subdivisions. Moreover, the table which compared their corrections with HAUER's classification of the «sedimentary terrains of Lombardy» also showed the problems caused by the difference in stratigraphical nomenclature (Fig. 14). In particular, the *Rivista geologica* by STOPPANI (1859) was entirely dedicated to explaining the differences of classification between his divisions and those by HAUER concerning the oldest terrains of Lombardy (Paleozoic, Triassic and Jurassic) (Fig. 15).

In spite of the different arguments, this episode did not constitute a real controversy. STOPPANI regretted that his *Studii geologici e paleontologici sulla Lombardia* had been published after HAUER's travel of 1856 because the book could have been useful to the Austrian geologist in the field. On the other hand, HAUER encouraged STOPPANI to publish the corrections to the map of 1858, stating that when he had acquired a copy of the *Studii* (HAUER, F., 1858b) it was too late for introducing substantial changes to his paper and map of 1858, which were already in press (STOPPANI, 1859: 192). In fact, at the meeting of the Geologische Reichsanstalt of the 13th of December 1859, HAUER himself positively presented the *Rivista geologica* of STOPPANI, pointing out the important amount of new data collected by the Italian geologist. HAUER

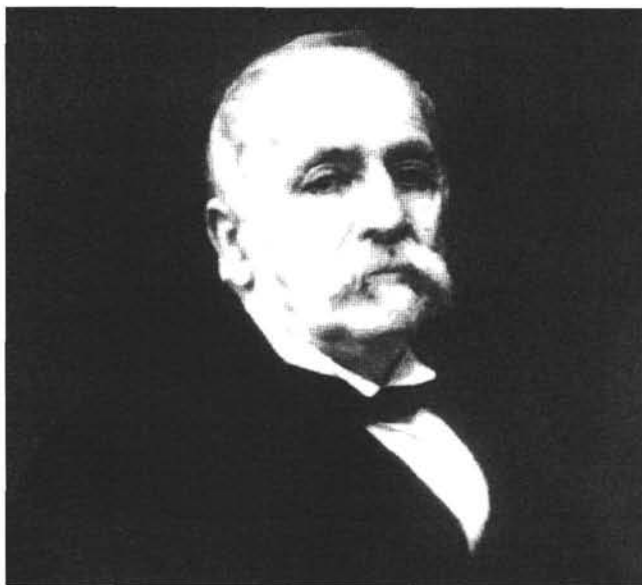


Fig. 16.
Giovanni OMBONI (1829–1910). From CASELLATO & PIGATTO, 1996: 228.

also discussed some of STOPPANI'S critical remarks («die beste und fruchtbarste Kritik») to the general geological map of 1858, with regard to a future perspective of detailed survey («geologische Detail-Aufnahme») in the same areas of Lombardy (HAUER, F., 1859). Unfortunately, HAUER'S correspondence with the Milanese geologists around the end of the 1850s is not documented by the collection of his letters kept in the Library of the Geological Survey of Austria (Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-00209-B).

In 1859 OMBONI (Fig. 16) – who at that time was a thirty-year old geologist at the beginning of a bright career which would be mainly spent at the University of Padua (CASELLATO & PIGATTO, 1996: 229–233) – had already published a small book on the geology of Italy with some observations on the stratigraphy of Lombardy (OMBONI, 1856: 7–40, 156–159). Later, he would summarize his research in a paper (OMBONI, 1861) illustrated by a sketch of a geological map of the northern Lombard Alps (Fig. 17).

It seems therefore evident that HAUER'S general geological survey in Lombardy, together with HAIDINGER'S strong support to the establishment of the "Società Geologica" in Milan, had stimulated a new phase of geological studies in the western part of the Lombardo-Venetian Kingdom. Instead, in Veneto and Friuli the initiative was left to the local scientists, who had already formed an enthusiastic geological community which was active in the field. This is shown by the writings of CATULLO, DE ZIGNO, PASINI, MASSALONGO and PIRONA, which often had a wide international diffusion. Most of these scientists regularly corresponded with the Geologische Reichsanstalt and sent small collec-

tions of specimens for its museum, as in the case of PASINI and MASSALONGO in 1859 (Jahrbuch der k.k. Geologischen Reichsanstalt, 10, Verh., p. 91. Wien). However, the idea of establishing a Venetian geological society, in spite of the promised interest since 1850 of a powerful scientist and politician such as DE ZIGNO, did not have any response in Venice or Padua.

4. The end of the Lombardo-Venetian Kingdom and the change in Austrian geological perspectives on the Italian regions

At the beginning of July 1859, after the war between Austria and the alliance Franco-Piedmontise, Lombardy was assigned to the Kingdom of Sardinia which was leading the process of Italian unification, and thus sanctioned the end of the Lombardo-Venetian Kingdom. During the meeting of the Geologische Reichsanstalt held on the 31st of the same month the Director HAIDINGER (1859c) mentioned the recent loss of Lombardy and briefly recalled the general fieldwork done in 1850 and 1856 by HAUER and ZEPHAROVICH, which was not going to be developed with further detailed survey due to the new political situation. In spite of the statements of friendships with the community of Lombard geologists and the promises to continue the scientific cooperation established during the 1850s, in order to produce more geological studies, the interest shown by the Geologische Reichsanstalt toward Lombardy and in general toward northern Italy gradually decreased in the following decade.

The "Società Geologica" of Milan resumed its meetings in August 1859 under the Piedmontise government and in January 1860 the members decided to change its denomination to "Società Italiana di Scienze Naturali", «as a conse-

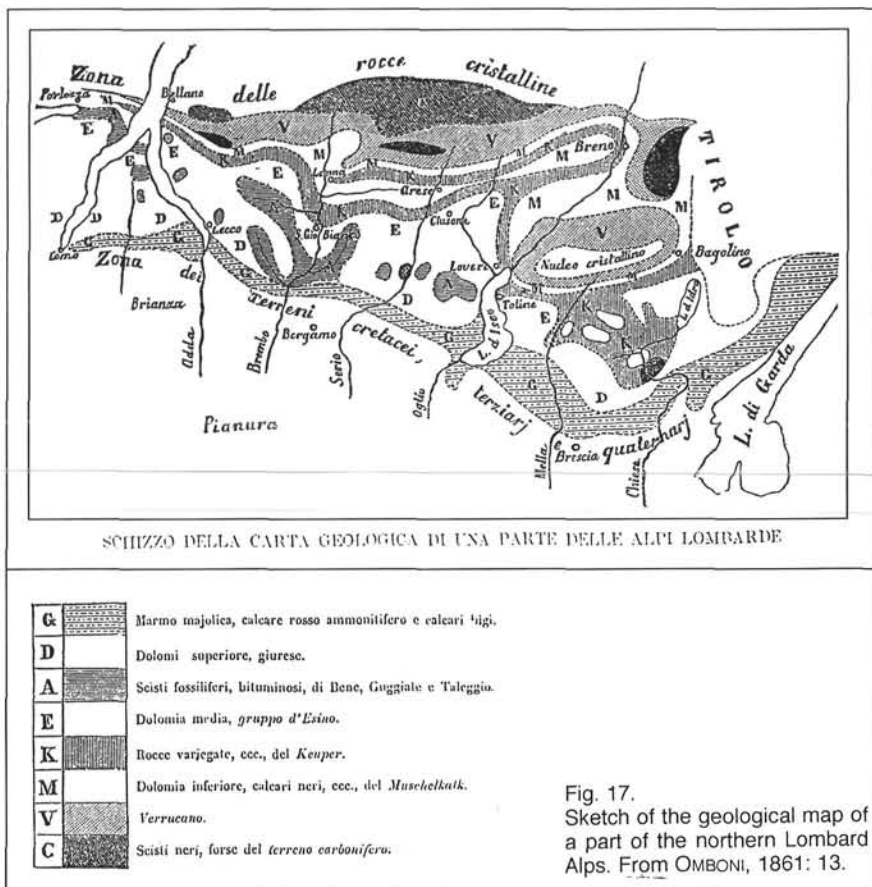


Fig. 17.
Sketch of the geological map of a part of the northern Lombard Alps. From OMBONI, 1861: 13.

quence of the new political situation and due to the variety of studies being pursued» which now must concern all the Italian territory (ATTI, 1860: 26, 36). Thus, the institutional project planned and encouraged by HAIDINGER had a very short life in Lombardy, as the regional geological society supported by Vienna was soon transformed into an Italian national society of natural sciences, which still exists today. Nevertheless, the relationships between the "Società Italiana" and the Geologische Reichsanstalt were not interrupted at the end of 1859 particularly because, as secretary OMBONI mentioned (ATTI, 1860: 25), most of the precious links and exchanges of publications with other scientific institutions had been established and maintained until then by Adolf SENONER, the librarian of the Viennese Geological Institute. And in the early 1860s SENONER not only continued to take care of the correspondence between the Reichsanstalt and Italian individuals or institutions, but also published an interesting outline of the geological community in the former Lombardo-Venetian Kingdom (SENONER, 1860) and a systematic list of minerals from the Venetian provinces (SENONER, 1863). Although these works showed SENONER'S personal interest and involvement in Italian geology, it is important to point out that both writings were not printed in the periodicals of the Geologische Reichsanstalt.

Instead, up to 1860 the Italian regions of the Austrian Monarchy had often been considered within the pages of the *Jahrbuch*, also from particular aspects such as the state of thermal and mineral waters, mainly studied by Karl von HAUER (1819–1880) at the Chemical Laboratory of the Geologische Reichsanstalt (HAUER, K., 1858a, 1858b, 1858c, 1858d), the state of the mining exploitation (Suess, 1858; TRINKER, 1858a, 1858b) or some specific paleontological topics (Suess, 1859, TRINKER, 1860). Although not included in the subject of this paper, it can be useful to mention briefly that also various geological features of the area around Trento/Triest, in south Tyrol, were analyzed by the German geologist Hermann Friedrich EMMRICH (1815–1879) – then reviewed by Franz von HAUER (HAUER, F., 1856b; EMMRICH, 1857) –, but above all by another German born scientist, Ferdinand von RICHTHOFEN (1833–1905). From 1856 he travelled extensively in south Tyrol on behalf of the Geologische Reichsanstalt and published in 1860 an important monograph on the geology of the area around Predazzo, which was reviewed by Haidinger in the same year (RICHTHOFEN, 1856, 1857, 1858, 1860; HAIDINGER, 1860b; BIZZARINI, 1999).

Finally, also the geology of the south-eastern area including Istria and the surroundings of Trieste had been investigated in the first half of the 1850s (KNER, 1853; HEYDEN, 1853; HAIDINGER, 1853; HAUER, F., 1855b; STUR, 1856a, 1856b) and later described more in detail by the monographic studies of Guido STACHE (1833–1921) on the Eocene terrains of Istria (STACHE, 1859a, 1859b, 1859c, 1864; HAIDINGER, 1860a). Some detailed geological maps of the area between Trieste, Gorizia/Görz and Istria were produced from these studies (HAIDINGER, 1864a: 171, 181).

During the early 1860s the correspondent geologists from Milan, such as STOPPANI and CURIONI, occasionally sent to the Geologische Reichsanstalt copies of their new publications as well as short pieces of information concerning interesting stratigraphical features of Lombardy (Suess, 1860; HAUER, F., 1862, 1865a). Moreover, the relationships with the "Società Italiana di Scienze Naturali" continued to be very friendly. In 1864 HAIDINGER sent to Milan a short report of the main activities of the Geologische Reichsanstalt during the previous two years, which was warmly welcomed at a special meeting of the Society in Biella. It was translated in Italian and promptly published in the *Atti* (HAIDINGER, 1864b,

1865), as was another similar report sent the following year (HAIDINGER, 1866). A few years before HAIDINGER himself (1862: iv-v) had positively referred to the visit by the mineralogist and politician Quintino SELLA (1827–1884) to the Geologische Reichsanstalt, whose structure and organization was later described in the report of the European travel undertaken by SELLA in order to collect information on the best way to realize a national geological map of the Kingdom of Italy (SELLA, 1863: 160–168; CORSI, 1998: 40–44).

Concerning Veneto and Friuli, which were still under the Monarchy in the first half of the 1860s, there was not a real Austrian policy of geological fieldwork such as that undertaken for Lombardy in the previous decade. It may be significant to note that a bibliographical survey on Veneto compiled by OMBONI (1863) listed a majority of Italian publications and mentioned the 1850s studies by FOETTERLE, HAUER, HECKEL and SENONER, as well as the older work by W. FUCHS (1844). FOETTERLE (1862a, 1862b, 1866) occasionally referred again to geo-mineralogical and paleontological subjects concerning the Venetian territories, while a few other studies on the area of the Lake of Garda and the Lessini hills (north of Verona) were also presented (WOLF, 1865; STAUDIGL, 1866). However the contribution from Venetian geologists to the *Jahrbuch* of the Viennese Geological Institute appears altogether reduced in the 1860s and in fact the new Italian correspondents of the Geologische Reichsanstalt registered in these years were only partially from Veneto, being mainly from the central and southern region of Italy (Naples, Rome Florence, Sicily).

With the annexation of Veneto and Friuli to the Kingdom of Italy in October 1866, as a result of the war started in Spring between Austria and Italy (allied with Prussia), also the last part of the former Lombardo-Venetian Kingdom disappeared. In the same year HAIDINGER left the directorship of the Geologische Reichsanstalt to Franz von HAUER.

5. Conclusions

After 1866 the scientific relationships between the Geologische Reichsanstalt and Italy continued and even increased in the following decades up to the end of the 19th century. Until his retirement in 1886 the librarian and archivist Adolf SENONER took care personally of the correspondence with Italian geologists and scientific institutions from which he received many books, off-prints and periodicals, presently indexed in the "Alte Kataloge" of the Library of Geologische Bundesanstalt in Vienna. SENONER also established links with new Italian scientific societies, as in the case of the "Società dei Naturalisti di Modena", founded in 1866 (BERTACCHINI, 1996: 138).

The evaluation of the 19th century Austro-Italian scientific relationships in the field of the earth sciences is of course still far from complete: however, the case study of the early years of the Geologische Reichsanstalt, which has been reconstructed in this paper, has provided some interesting elements, also for orientating further historical researches. The travels of the Austrian geologists in Lombardy during the 1850s certainly contributed to revitalizing the research activities in the field of the local geological community. Franz von HAUER'S attitude, particularly during the debate which followed the publication of his geological map of Lombardy in 1858, shows that the strategy of the Geologische Reichsanstalt was to stimulate the work of the Lombard geologists in a collaborative and non controversial way. The aim was clearly to obtain more detailed data on local geological features which could be utilized and compared later, during the planned second stage of the fieldwork (the "Detail-Aufnahme"), in order

to produce the sheets of the detailed geological map of the area. Within this context the establishment and the beginnings, although slow and troubled, of the Geological Society in Milan were positively regarded in Vienna, but the possible developments were suddenly interrupted by the political events of 1859. Probably, according to the hopes of HAIDINGER and HAUER, the role of this new institution patronized by the Geologische Reichsanstalt was to gather and organize all the potential research energies represented by the Lombard geologists, who were often non-academic scholars and collectors, sometimes rather isolated (as in the case of STOPPANI), and who until then had been only partially coordinated within the activities of the Museum of Natural History of Milan.

A similar attempt to establish a controlled institution did not take place in the Venetian provinces, although the geologists of Veneto and Friuli continued to offer their collaboration when requested by the colleagues from Vienna, for example in the case of DE ZIGNO, PIRONA and PASINI. But it is possible that the political changes of 1859-1861, which determined the Austrian loss of Lombardy and the declaration of the Kingdom of Italy, encouraged the nationalism already embraced by some Venetian scientists. On the other hand it must be remembered that the distinguished geologist and paleontologist Giuseppe MENEGHINI had to leave Padua for political reasons, after the patriotic uprising of 1848, although his involvement in those events «was probably circumstantial» (CORSI, 1995: v). In fact he then became professor at the University of Pisa in Tuscany, but maintained good relationships with Austrian authorities and in particular with the Geologische Reichsanstalt (CANAVARI, 1889).

Emilio CORNALIA, Antonio STOPPANI and Giulio CURIONI, before to collaborate with HAUER in the 1850s had all participated in the five days of uprising in Milan in 1848, while Giuseppe BALSAMO CRIVELLI, politically more favourable than his colleagues to the Austrian government, was nominated vice-president of the "Istituto Lombardo" in 1850-1851 directly by RADEZKY. However, these possible patriotic sentiments among the Lombard geologists did not negatively influence their scientific co-operation with HAUER and the Geologische Reichsanstalt during the 1850s. Only in 1860, in the pages of the *Atti* of the "Società Italiana di Scienze Naturali" just established under the Piedmontese government, did CORNALIA (1860: 201-202) conclude his obituary of the Veronese paleontologist Abramo MASSALONGO with anti-Austrian overtones.

Among the various aspects of this historical reconstruction which still need further investigations, may be mentioned the question of the possible widespread diffusion of the *Jahrbuch* and other publications of the Geologische Reichsanstalt within the territory of the Lombardo-Venetian Kingdom. In fact, most of the Italian correspondents of the Geologische Reichsanstalt were little known teachers and directors of high schools ("Licei"), as well as secretaries of scientific societies, episcopal seminaries and other provincial institutions.

In the last part of the 19th century, although the Geologische Reichsanstalt did not directly promote official fieldwork in northern Italy, the Austrian geological knowledge of these regions improved thanks to the works by Edmund MOJSISOVICS von MOJSVÁR (1839-1907), Eduard SUSS (1831-1914), Alexander BITTNER (1850-1902), Michael VACEK (1848-1925), Cornelio DOELTER (1850-1930) and others. Italian scientists were free to come to Vienna to study the geo-paleontological collections housed in the Museum of Natural History and in the Geologische Reichsanstalt, as in the case of a former student of OMBONI, the paleontologist Francesco BASSANI (1858-1916), who also published in Italian an outline of the structure and activities of the Geologische Reichs-

anstalt (BASSANI, F., 1879a, 1879b). On the other hand, some Italian geologists involved in the early project of making the geological map of Italy soon started to realize that the better organization of the Austrian colleagues and of their institutions, such as the Geologische Reichsanstalt, was allowing them to produce very authoritative geological researches also on the Italian Alps and pre-Alps (TARAMELLI, 1880).

The new autonomous series of the *Verhandlungen der k.k. geologischen Reichsanstalt* (from 1867), together with the volumes of the *Jahrbuch*, also show a renewed interest in Italian geology especially in the 1880s and 1890s. However, for further research towards a paper on late 19th century Austrian literature concerning northern Italy, it will be necessary to carefully check several bibliographical repertoires (PORTIS, 1881; BLAAS, 1900; RUMOR & LIOY, 1901; TRENER, COGOLI & CADROBBI, 1927; TRENER, 1928; DESIO, 1943; GORTANI, 1906; HERITSCH, 1914; SRBIK, 1935-1937), which may be integrated with the content of the volumes on northern Italy published by the CNR (Consiglio Nazionale delle Ricerche) within the series *Bibliografia Geologica d'Italia*. Finally, a systematic survey of the manuscript material presently housed in the Amtsarchiv and Wissenschaftliche Archiv of the Geologische Bundesanstalt, will certainly provide useful data on the late 19th century geologists linked to the Geologische Reichsanstalt who carried out researches in the Italian regions.

Acknowledgements

The research for this paper was made possible by a four-month fellowship (October 1997 - February 1998) spent at the Geologische Bundesanstalt in Vienna and awarded by the Bundesministerium für Wissenschaft und Forschung (BMFW) of the Republic of Austria within the exchange program between Italy and Austria. I would like to thank the Director of the Geologische Bundesanstalt, HR Prof. Dr. Hans Peter SCHÖNLAUB, and the Director of the Library of the same institution, Dr. Tillfried CERNAJSEK, for their great support to my research in the Library and in the Archives of the Austrian Geological Survey; Dr. Harald LOBITZER and Dr. Albert SCHEDL for their suggestions on several topics relating to the history of Austrian geology; Frau Johanna Findl for the precious help in tracing very old and dusty books; and finally Kathleen for revising the English version of the manuscript and for her invaluable moral support throughout all the stages of my research.

References

- ACCORDI, B. (1984): Storia della geologia. - 114 p., Bologna, Zanichelli.
 ACCORDI, B. (1985): Curioni, Giulio. - In: Dizionario Biografico degli Italiani. - vol. 31, 453-455, Roma, Istituto dell'Enciclopedia.
 ALIPPI CAPPELLETTI, M. (1979): Catullo, Tommaso Antonio. - In: Dizionario Biografico degli Italiani. - vol. 22, 531-533, Roma, Istituto dell'Enciclopedia.
 ARRIGONI, T. (1995): Alla ricerca di minerali nell'Italia del Settecento. Ermenegildo Pini. - Bollettino della Società Storica Maremmana, 66-67, 41-58. Grosseto.
 ATTI (1859): Atti della Società Geologica residente in Milano. - vol. 1, Anni 1855 a 1859. Milano, Bernardoni.
 ATTI (1860): Atti della Società Italiana di Scienze Naturali. - vol. 2, Anno 1859-1860. Milano, Bernardoni.
 BALDANZA, B. & TRISCARI, M. (1987): Le miniere dei Monti Peloritani. - 283 p., Messina, Società Messinese di Storia Patria.
 BALSAMO CRIVELLI, G. (1850): Schizzi geologici dell'Italia eseguiti ad uso della scuola di geologia dell'Istituto Matematico e Filosofico in Milano. - ill. + 6 maps, Milano, A. Robiati.
 BALSAMO CRIVELLI, G. (1851): Sunto delle lezioni di geologia ad uso degli studenti dell'Istituto di Istruzione Superiore Scientifica diretto dall'Ingegnere Ambrogio Robiati, per cura di Giovanni Omboni. - 216 p., Milano, In Contrada S. Paolo N° 937.
 BARSANTI, G., BECAGLI, V. & PASTA, R. eds. (1996): La politica della scienza. Toscana e Stati Italiani nel tardo Settecento. - 587 p., Firenze, Olschki.

- BASSANI, A. (1995): Le attività scientifiche di un collezionista veneto: Giuseppe Innocente. – In: LAZZARI, C. & BIZZARINI, F. eds.: *Giovanni Arduino e i geologi veneti del Settecento*. – 83–91, Venezia, Società Veneziana di Scienze Naturali.
- BASSANI, F. (1879a): Vorläufige Mittheilungen über die Fischfauna der Insel Lesina. – *Verhandlungen der k. k. geologischen Reichsanstalt*, Nr. 8, 162–171. Wien.
- BASSANI, F. (1879b): Cenni sull'organizzazione dell'I.R. Istituto Geologico di Vienna. – 11 p., Padova, Tip. Prosperini [also published in *Bollettino della Società Veneto-Trentina di Scienze Naturali*, 2, Padova].
- BERTACCHINI, M. (1996): La ricerca geologica a Modena dal 1866 ad oggi. – *Atti della Società dei Naturalisti e Matematici di Modena*, 127, 113–138. Modena.
- BIZZARINI, F. (1999): Da Leopold von Buch a Ferdinand von Richthofen: breve sintesi dei primi studi geopaleontologici nelle valli Ladine del Sud-Tirolo. – In: LAZZARI, 1999a, 119–137.
- BLAAS, I. (1900): Die geologische Erforschung Tirols und Vorarlbergs in der zweiten Hälfte des 19. Jahrhunderts. – 322 p., Innsbruck, Wagner'sche Universitäts-Buchhandlung.
- BRAMBILLA, E. (1996): Libertà filosofica e giuseppinismo. Il tramonto delle corporazioni e l'ascesa degli studi scientifici in Lombardia, 1780–1796. – In: BARSANTI, BECAGLI & PASTA, 1996, 393–433.
- BREZSNYÁNSZKY, K. (1996): Austro-Hungarian geological mapping before 1869. – In: DUDICH, E. & LOBITZER, H. eds.: *Advances in Austrian-Hungarian Geological Research*. – 25–32, Budapest, Máfi.
- CANAVARI, M. (1889): Meneghini Giuseppe. Nachruf. – *Verhandlungen der k. k. Geologischen Reichsanstalt*, Nr. 3, 62–64. Wien.
- CANTÚ, C. ed. (1857–1861): Grande illustrazione del Lombardo-Veneto, ossia, Storia delle città, dei borghi, comuni, castelli, ecc. fino ai tempi moderni. – 5 vol., Milano, Corona & Caimi.
- CASELLATO, S. & PIGATTO, L. eds. (1996): Professori di materie scientifiche all'Università di Padova nell'Ottocento. – 390 p., Trieste, Lint.
- CATULLO, T. A. (1852): Priorität der in der "Zoologia Fossile delle Provincie Venete" angegebenen Beobachtungen in Hinsicht der Stelle, welche der rothe Ammoniten-Kalk in der geologischen Reihe der Sedimentformation einnimmt. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 3, 126–129. Wien.
- CATULLO, T. A. (1853): Fortsetzung und Schluss der Abhandlung über die Priorität in der "Zoologia Fossile delle Provincie Venete" aufgestellten Beobachtungen und Bemerkungen über das Werk des Herrn Prof. Dr. Massalongo "Sulle Filliti del Vicentino". – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 4, 113–119. Wien.
- CERENATI, M. (1891): Il R. Comitato Geologico d'Italia. Brevi cenni di cronaca. – 16 p., Roma, Tip. Società Laziale [published in *Rassegna delle Scienze Geologiche in Italia*, 1 (3–4). Roma].
- CERNAJSEK, T. (1984): Historical review of geological mapping in Austria. – In: DUDICH, E. ed.: *Contributions to the history of geological mapping. Proceedings of the Xth INHIGEO Symposium. Budapest 16-22 August 1982*. – 99–101, Budapest, Akadémiai Kiadó.
- CERNAJSEK, T. (1996a): Die Bedeutung der bibliothekarischen Behandlung von besonderen Dokumenten für die Geschichte der Entwicklung der geologischen Karten und Kartierung in Österreich bis 1918 am Beispiel der Kartensammlung der Bibliothek der Geologischen Bundesanstalt. – In: CERNAJSEK, T., JONTES, L. & SCHMIDT, P. eds.: *Cultural Heritage Collected in Libraries of Geoscience, Mining and Metallurgy. International Symposium, Freiberg (Saxony) Germany*. – 57–60, Wien, Verlag der Geologischen Bundesanstalt [Berichte der Geologischen Bundesanstalt, Bd. 35].
- CERNAJSEK, T. (1996b): Wilhelm Karl Ritter von Haidinger – der erste geowissenschaftliche Manager Österreichs. – *Abhandlungen der Geologischen Bundesanstalt*, 53, 5–13. Wien.
- CERNAJSEK, T. & POŠMOURNY, K. (1993): Historische geologische Karten vom Gebiet der Tschechischen Republik (Böhmen, Mähren und Österreichisch-Schlesien) bis zum Jahre 1918 als Quellen bedeutender wissenschaftlicher Informationen. – In: LOBITZER, H. & DAURER, A. eds.: *Gedenkbund zum 100. Todestag von Dionys Stur*. – 701–706, Wien, Verlag der Geologischen Bundesanstalt [Jahrbuch der Geologischen Bundesanstalt, Bd. 136].
- CIANCIO, L. (1995): Autopsie della Terra. Illuminismo e geologia in Alberto Fortis (1741–1803). – 388 p., Firenze, Olschki.
- COLLEGNO, G. O. PROVANA di (1846): Esquisse d'une carte géologique d'Italie. – 2nd ed., Paris.
- COLLEGNO, G. O. PROVANA di (1847): Elementi di geologia pratica e teorica destinati principalmente ad agevolare lo studio del suolo dell'Italia. – 446 p., Torino, G. Pomba.
- COLOMBARA, F., PIGNATARO, A. & PETTENELLA, A. (1995): Una giornata a Cava Bomba e Monte Cinto. Storia naturale, analisi del paesaggio, archeologia industriale. Tre sguardi su un versante dei Colli Euganei. – 110 p., Verona, Cierre Edizioni.
- CONCI, C. (1967): Il centenario di Giorgio Jan (1791–1866) e la fondazione ed il primo sviluppo del Museo Civico di Storia Naturale di Milano. – *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano*, 106 (1), 5–94. Milano.
- CORNALIA, E. (1860): Sulla vita e sulle opere di Abramo Massalongo. – *Atti della Società Italiana di Scienze Naturali*, Anno 1859–1860, 2, 188–206. Milano.
- CORSI, P. (1991): De Zigno, Achille. – In: *Dizionario Biografico degli Italiani*. – vol. 39, 627–630, Roma, Istituto dell'Enciclopedia.
- CORSI, P. (1995): The «Pisa School of Geology» of the 19th century: an exercise in interpretation. – *Palaeontographia Italica*, 82, iii–viii. Pisa.
- CORSI, P. (1998): Le scienze naturali in Italia prima e dopo l'Unità. – In: SIMILI, R. ed.: *Ricerca e istituzioni scientifiche in Italia*. – 32–46, Roma-Bari, Laterza.
- CURIONI, G. (1857): Come la geologia possa concorrere più direttamente ai progressi delle industrie. – *Giornale dell'I.R. Istituto Lombardo di Scienze, Lettere ed Arti*, 9 (51), 176–184. Milano.
- CURIONI, G. (1877): *Geologia applicata delle Province Lombarde*. – 2 vol., Milano, Hoepli.
- DACCÒ, G. L. ed. (1991): Antonio Stoppani tra scienza e letteratura. Atti del Convegno Nazionale di Studi. Lecco 29-30 novembre 1991. – 206 p., Lecco, Musei Civici di Lecco [Materiali. Monografie periodiche dei Musei Civici di Lecco, 6 (1)].
- DACREMA, N. ed. (1996): Il Lombardo-Veneto (1814–1859). Storia e cultura. – 444 p., Pasian di Prato (UD), Campanotto/Università di Pavia.
- DE MADDALENA, A., ROTELLI, E. & BARBARISI, G. eds. (1982): *Economia, istituzioni, cultura in Lombardia nell'età di Maria Teresa*. – 3 vol., Bologna, Il Mulino.
- DE MICHELE, V. (1978): Le collezioni mineralogiche del Museo Civico di Storia Naturale di Milano attraverso 140 anni di storia. – *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano*, 119 (1), 3–58. Milano.
- DESIO, A. (1943): *Bibliografia geologica lombarda, vol. 1: Autori*. – 317 p., Lecco, Comune di Lecco.
- DE VISIANI, R. (1861): Relazione della vita scientifica del dott. Abramo Bartolommeo Massalongo. – *Atti dell'I.R. Istituto Veneto di Scienze, Lettere ed Arti*, ser. III, 6, 241–305. Venezia.
- DE ZIGNO, A. (1850): Uebersicht der geschichteten Gebilde der Venetianischen Alpen. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 1, 181–196, 1 plate. Wien.
- DE ZIGNO, A. (1851): Coup d'oeil sur les terrains stratifiés des Alpes Venetiennes. – *Naturwissenschaftliche Abhandlungen*, 4 (I. Abth.), 1–16, 1 plate. Wien.
- DI TROCCHIO, F. (1983): Cornalia, Emilio. – In: *Dizionario Biografico degli Italiani*. – vol. 29, 114–115, Roma, Istituto dell'Enciclopedia.
- DI VITTORIO, A. (1973): Gli austriaci e il Regno di Napoli, 1707–1734: ideologia e politica di sviluppo. – 535 p., Napoli, Giannini.
- EMMICH, H. (1857): Geognostische Notizen aus der Gegend von Trient. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 8, 295–307. Wien.
- FERRARESI, A. (1999): Spallanzani docente di storia naturale all'Università di Pavia. Gli esordi. – In: BERNARDI, W. & MANZINI, P. eds.: *Il cerchio della vita. Materiali di ricerca del Centro Studi Lazzaro Spallanzani di Scandiano sulla storia della scienza del Settecento*. – 263–299, Firenze, Olschki.
- FOETTERLE, F. (1852): A. de Zigno. Notizen über die venetianischen Alpen. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 3, p. 171. Wien.
- FOETTERLE, F. (1853): [...] Dr. Catullo. Tertiäre Ablagerungen im Vicentinischen. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 4, p. 180. Wien.
- FOETTERLE, F. (1854): Dr. T. A. Catullo. Ueber fossile Crustaceen des Grobkalkes von Verona und Vicenza. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 5, p. 886. Wien.
- FOETTERLE, F. (1855): A. Maimeri's Mittheilung über die Petraja bei Bassano – Neue Funde von fossilen Pflanzen im Venetianischen durch Dr. A. Massalongo. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 6, 886–887. Wien.
- FOETTERLE, F. (1856): Geologische Verhältnisse des Venetianischen. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 7, 850–851. Wien.
- FOETTERLE, F. (1857): Steinkohlen von Cosina, Vrem und Skoffle bei Triest [...]. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 8, Verh., p. 814. Wien.
- FOETTERLE, F. (1862a): [...] über den Avanza-Graben im Venetianischen. – *Jahrbuch der k.k. Geologischen Reichsanstalt*, 12, Verh., 78–79. Wien.

- FOETTERLE, F. (1862b): Braunkohlenvorkommen von Valdagno. – Jahrbuch der k.k. Geologischen Reichsanstalt, **12**, Verh., 154–155. Wien.
- FOETTERLE, F. (1866): Petrefacten aus der Umgegend von Belluno. – Jahrbuch der k.k. Geologischen Reichsanstalt, **16**, Verh., p. 121. Wien.
- FONTANA, G. L. & LAZZARINI, A. eds. (1992): Veneto e Lombardia tra rivoluzione giacobina ed età napoleonica. Economia, territorio, istituzioni. – 685 p., Milano-Roma-Bari, Cariplo-Laterza.
- FRUMENTO, A. (1985): Le Repubbliche Cisalpina e Italiana, con particolare riguardo a siderurgia, armamenti, economia ed agli antichi luoghi lombardi del ferro 1796–1805. – 608 p., Milano, Banca Commerciale Italiana.
- FRUMENTO, A. (1991): Il Regno d'Italia napoleonico. Siderurgia, combustibili, armamenti ed economia 1805–1814. – 971 p., Milano, Banca Commerciale Italiana.
- FUCHS, W. (1844): Die Venetianer Alpen. Ein Beitrag zur Kenntniss der Hochgebirge. – 60 p. [1 map, 18 plates], Solothurn, Jent & Gassmann; Wien, Rohrmann.
- GIUSTI, R. ed. (1977): Il Lombardo-Veneto (1815–1866) sotto il profilo politico, culturale, economico-sociale. – 442 p., Firenze, Olschki.
- GLOZZI, M. (1963): Balsamo Crivelli, Giuseppe. – In: Dizionario Biografico degli Italiani. – vol. 5, 622–623, Roma, Istituto dell'Enciclopedia.
- GORTANI, M. (1906): Bibliografia geologica ragionata del Friuli (1737–1905). – Bollettino della Società Geologica Italiana, **25** (2), 377–410. Roma.
- GREENFIELD, K. R. (1940): Economia e liberalismo nel Risorgimento. Il movimento nazionale in Lombardia dal 1814 al 1848. – 459 p., Bari-Roma, Laterza. [First edition: Economics and Liberalism in the Risorgiment. A Study of the nationalism in Lombardy 1815–1848. – Baltimore, Baltimore University Press, 1934]
- GRISELINI, F. (1780): Versuch einer politischen und natürlichen Geschichte des Temeswarer Banats in Briefen an Standespersonen und Gelehrte. – 2 vol., Wien, J. P. Krauss. [Italian edition: Lettere Odeporiche. – 1 vol., Milano, Motta, 1780]
- GUIDOTTI, G. (1985): La vita e l'attività scientifica di Abramo Massalongo. – La Lessinia. Ieri Oggi Domani. Quaderno Culturale, **1-2**, 103–110. Verona.
- GULLINO, G. (1996): L'Istituto Veneto di Scienze, Lettere ed Arti. Dalla rifondazione alla Seconda Guerra Mondiale (1838–1946). – 580 p., Venezia, Istituto Veneto di Scienze, Lettere ed Arti.
- GUNTAU, M. (1991): Geologische Institutionen und staatliche Initiativen in der Geschichte. – In: BUTTNER, M. & KOHLER, E. eds.: Geosciences/Geowissenschaften. Proceedings of the Symposium of the XVIIIth International Congress of History of Science. III. Teil. – 229–239, Bochum, Universitätsverlag.
- HAIDINGER, W. von (1847a): Geognostische Übersichtskarte der Österreichischen Monarchie. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **2** (Nr. 7. November 1846), 29–35. Wien.
- HAIDINGER, W. von (1847b): Bericht über die Geognostische Übersichtskarte der Österreichischen Monarchie. – 43 p., Wien, k.k. Hof- und Staats-Druckerei.
- HAIDINGER, W. von (1848a): Briefe von den Herren v. Hauer und v. Morlot aus Venedig. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **3** (Nr. 4. October 1847), 299–301. Wien.
- HAIDINGER, W. von (1848b): Fr. Kaiser, Nummulitenkalk und Sandstein bei Triest. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **4** (Nr. 2. Februar 1848), 158–163. Wien.
- HAIDINGER, W. von (1853): Das Schallphänomen des Monte Tomatico bei Feltre. – Jahrbuch der k.k. Geologischen Reichsanstalt, **4**, 559–567. Wien.
- HAIDINGER, W. von (1854): Vorwort zum fünften Bande. – Jahrbuch der k.k. Geologischen Reichsanstalt, **5**, i–xviii. Wien.
- HAIDINGER, W. von (1856): Zollikofer's Beiträge zur Geologie der Lombardie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, p. 830. Wien.
- HAIDINGER, W. von (1859a): Des Freiherrn Achill de Zigno, *Flora fossilis formationis oolithicae* [...]. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., p. 1. Wien.
- HAIDINGER, W. von (1859b): Ansprache gehalten am Schlusse des Ersten Decenniums der kaiserlich-königlichen Geologischen Reichsanstalt in Wien am 22. November 1859. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., 137–174. Wien.
- HAIDINGER, W. von (1859c): Die Lombardie abgetrennt. Bisher gute Landsmannschaft, künftig gute Nachbarschaft. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., 94–95. Wien.
- HAIDINGER, W. von (1860a): [...] Dr. G. Stache's, Gebirgsbau in Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **11**, Verh., p. 38. Wien.
- HAIDINGER, W. von (1860b): [...] Freiherr von R[ichthofen] Geognostische Beschreibung der Umgegend von Predazzo u.s.w. – Jahrbuch der k.k. Geologischen Reichsanstalt, **11**, Verh., p. 62. Wien.
- HAIDINGER, W. von (1862): Vorwort zum zwölften Bande. – Jahrbuch der k.k. Geologischen Reichsanstalt, **12** (1861–1862), iii–viii. Wien.
- HAIDINGER, W. von (1864a): Ansprache des Directors. – Jahrbuch der k.k. Geologischen Reichsanstalt, **14**, Verh., 147–198. Wien.
- HAIDINGER, W. von (1864b): Sui recenti lavori dell'Istituto Geologico di Vienna. – Atti della Società Italiana di Scienze Naturali, **7**, 203–207. Milano.
- HAIDINGER, W. (1865): *Società italiana di scienze naturali*, VII Band. Ausserordentliche Sitzung in Biella. – Jahrbuch der k.k. Geologischen Reichsanstalt, **15**, Verh., 95–96. Wien.
- HAIDINGER, W. von (1866): Lavori dell'I. R. Istituto Geologico di Vienna nell'anno 1865. – Atti della Società Italiana di Scienze Naturali, **8**, 365–370. Milano.
- HAMMERSCHMIDT, K. E. (1847): A. Senoner. Mineralogische Excursion in den Appenninen von Piacenza. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **2** (Nr. 9. Jänner 1847), 72–75, 102–104. Wien.
- HAUER, F. von (1848a): Arbeiten der mineralogisch-geognostischen Section des Italienischen Gelehrten-Congresses zu Venedig. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **3** (Nr. 4. October 1847), 311–319. Wien.
- HAUER, F. von (1848b): Dr. Ewald und Prof. Catullo über Nummuliten. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **4** (Nr. 3. März 1848), p. 253. Wien.
- HAUER, F. von (1850a): [Tagebuch] Gratz, Laibach, Triest, Venedig, Mailand. – Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-00077-TB.
- HAUER, F. von (1850b): Ergebnisse der Bereisung der Kronländer Venedig und Lombardie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **1**, 377–378. Wien.
- HAUER, F. von (1850c): A. de Zigno. Ueber die geschichteten Gebilde der Venetianer Alpen. – Jahrbuch der k.k. Geologischen Reichsanstalt, **1**, p. 367. Wien.
- HAUER, F. von (1850d): Ueber die vom Herrn Bergrath W. Fuchs in den Venetianer Alpen gesammelten Fossilien. – Denkschriften der mathematisch-naturwissenschaftlichen Classe der kaiserlichen Akademie der Wissenschaften, **2**, 109–127, 4 plates. Wien.
- HAUER, F. von (1851a): Erinnerung an Friedrich Kaiser. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **7** (Nr. 2. Februar 1850), p. 42. Wien.
- HAUER, F. von (1851b): Dr. A. Massalongo. Die fossilen Bärenknochen aus der Gegend von Verona. – Jahrbuch der k.k. Geologischen Reichsanstalt, **2**, p. 137. Wien.
- HAUER, F. von (1854): Dr. G. Meneghini's Auffindung von Kreide-Petrefacten in der "Pietra Forte". – Jahrbuch der k.k. Geologischen Reichsanstalt, **5**, 228–229. Wien.
- HAUER, F. von (1855a): G. Curioni's Gliederung der Triasgebilde in der Lombardie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **6**, 887–896. Wien.
- HAUER, F. von (1855b): Das Quecksilber-Vorkommen von Gagliano bei Cividale in der Provinz Udine. – Jahrbuch der k.k. Geologischen Reichsanstalt, **6**, 810–814. Wien.
- HAUER, F. von (1856a): Geologische Untersuchungen in der Lombardie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, 843–844. Wien.
- HAUER, F. von (1856b): Mittheilung von Dr. H. Emmrich über die geologische Beschaffenheit der Gegend östlich von Trient. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, p. 836. Wien.
- HAUER, F. von (1856c): [Tagebuch] Reisen nach der Lombardie. – Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-00077-TB.
- HAUER, F. von (1857): G. Jan. *Cenni sul Museo Civico di Milano*. – Jahrbuch der k.k. Geologischen Reichsanstalt, **8**, Verh., 172–173. Wien.
- HAUER, F. von (1858a): [...] Catullo. *Prospetto degli scritti pubblicati*. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., 4–5. Wien.
- HAUER, F. von (1858b): Stoppani. *Studi Geologici* – Curioni. *Geologische Notizen* [...]. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., 31–33. Wien.
- HAUER, F. von (1858c): Erläuterungen zu einer geologischen Uebersichtskarte der Schichtgebirge der Lombardie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, 445–496. Wien.

- HAUER, F. von (1859): [...] Abb. Stoppani, *Rivista Geologica della Lombardia*. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., 191–193. Wien
- HAUER, F. von (1862): Curioni *Sulla Industria del Ferro*. – Jahrbuch der k.k. Geologischen Reichsanstalt, **12** (1861–1862), Verh., 47–48. Wien.
- HAUER, F. von (1863): Angelo Sismonda's geolog. Karte von Piemont u.s.w. – Jahrbuch der k.k. Geologischen Reichsanstalt, **13**, Verh., p. 4. Wien.
- HAUER, F. von (1865a): Ueber die Stellung der Esinokalke in der Lombardie, von Giulio Curioni. – Jahrbuch der k.k. Geologischen Reichsanstalt, **15**, Verh., 109–111. Wien.
- HAUER, F. von (1865b): Über die Gliederung der oberen Trias der lombardischen Alpen. – Sitzungsberichte der k. Akademie der Wissenschaften, **51** (Abth. 2), 33–48. Wien.
- HAUER, F. von (1866): Ach. Bar. De Zigno, Aufzählung der fossilen Farne der Oolithformation. – Jahrbuch der k.k. Geologischen Reichsanstalt, **16**, Verh., 28–29. Wien.
- HAUER, F. von (1885): Reiseberichte über eine mit Moritz Hörnes im Sommer 1848 unternommene Reise nach Deutschland, Frankreich, England, und der Schweiz mit einer Subvention d. Akad. D. Wissenschaften zwecks Studien über geologische Landesaufnahmen. Ed. PETRASCHKEK, W. E. & HAMANN, G. – 87 p., Wien, Verlag der Österreichischen Akademie der Wissenschaften.
- HAUER, K. von (1858a): Die Mineralquellen von Monfalcone – Die Mineralquellen von S. Stefano. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., 99–100. Wien.
- HAUER, K. von (1858b): Die Anlysen des Mineralwassers von Monfalcone und San Stefano. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., p. 121. Wien.
- HAUER, K. von (1858c): Chemische Untersuchung der warmen Quellen von Monfalcone bei Triest. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, 497–502. Wien.
- HAUER, K. von (1858d): Die Schwefeltherme von S. Stefano in Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, 689–695. Wien.
- HECKEL, J. (1850): Bericht über das Vorkommen fossiler Fische zu Seefeld in Tirol und am Monte Bolca im Venetianischen. – Jahrbuch der k.k. Geologischen Reichsanstalt, **1**, 696–700, 747. Wien.
- HEYDEN, A. von (1853): Ueber die geologischen Verhältnisse von Carpano in Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **4**, 546–550. Wien.
- HERITSCH, F. (1914): Verzeichnis der geologischen Literatur der Österreichischen Alpenländer. – 69 p., Leoben, Verlag L. Nüssler.
- KAISER, F. (1849): Geologie der Umgegend von Triest. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **5** (Nr. 3. März 1849), 267–281. Wien.
- KAISER, F. (1850): *Macigno* bei Gargaro nördlich von Görz. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **6** (Nr. 1. April 1849), 17–20. Wien.
- KNER, R. (1853): Geologische Verhältnisse von Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **4**, p. 192. Wien.
- LAZZARI, C. ed. (1999a): Le Scienze della Terra nel Veneto dalla caduta della Serenissima all'Unità d'Italia. – 137 p., Venezia, Società Veneziana di Scienze Naturali.
- LAZZARI, C. (1999b): Tommaso Antonio Catullo e la collezione Castellini. – In: LAZZARI, 1999a, 73–97.
- MASSALONGO, A. (1851): Osteologia degli Orsi fossili del Veronese con un Saggio sopra le principali Caverne del Distretto di Tregnago. – Naturwissenschaftliche Abhandlungen, **4** (III. Abth.), 31–85, 4 plates. Wien.
- MAZOHL-WALLNIG, B. von (1993): Österreichischer Verwaltungsstaat und administrative Eliten im Königreich Lombardo-Venetien 1815–1859. – 458 p., Mainz, P. Von Zabern.
- MERIGGI, M. (1983): Amministrazione e classi sociali nel Lombardo-Veneto (1814–1859). – 361 p., Bologna, il Mulino.
- MERIGGI, M. (1987): Il Regno Lombardo-Veneto. – 400 p., Torino, UTET.
- MICELLI, F., DI DONATO, M., CARGNELUTTI, L. & TAMBURLINI, F. (1998): Il Friuli provincia del Lombardo-Veneto. Territorio, istituzioni, società (1814–1848). – 331 p., Udine, Comune di Udine/Biblioteca Civica "V. Joppi".
- MOLLA LOSITO, V. (1982): La Società Patriottica di Milano (1776–1796). – In: De MADDALENA, ROTELLI & BARBARIS, 1982, vol. 3, 1039–1055.
- MONTI, M.T. (1996): Promozione del sapere e riforma delle istituzioni scientifiche nella Lombardia austriaca. – In: BARSANTI, BECAGLI & PASTA 1996, 367–392.
- MORELLO, N. (1983): La geologia nei congressi degli scienziati italiani (1839–1875). – In: PANCALDI 1983, 69–81.
- MORELLO, N. (1989): La geologia in Italia dal Cinquecento al Novecento. – In: MACCAGNI, C. & FREGUGLIA, P. eds.: Storia sociale e culturale d'Italia. vol. 5/II. La storia delle scienze. – 587–632, Busto Arsizio, Bramante.
- MORELLO, N. (1998): Problemi paleontologici nella geologia veneta dei primi decenni dell'Ottocento. – In: VACCARI 1998b, 11–22.
- MORELLO, N. (1999): La "fiaccola dei petrefatti", il Saggio di Zoologia Fossile di Tommaso Antonio Catullo. – In: LAZZARI, 1999a, 43–72.
- MORLOT, A. von (1848a): Über die Trebichgrotte im Karst unweit Triest. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **3** (Nr. 5. November 1847), 380–382. Wien.
- MORLOT, A. von (1848b): Über die geologischen Verhältnisse von Istrien. Mit einer Karte und zwei lithographirten Tafeln. – Naturwissenschaftliche Abhandlungen, **2** (I. Abtheilung), 257–318. Wien.
- NOSOTTI, S. (1991): Un ricordo di Antonio Stoppani. – Paleocronache, **1**, 87–91. Milano.
- OMBONI, G. (1856): Sullo stato geologico dell'Italia. Cenni [...] in appendice al Corso di Geologia di Beudant. – 163 p., 80 fig., 1 map, Milano, Vallardi.
- OMBONI, G. (1859a): Cenno storico. – Atti della Società Geologica residente in Milano, **1**, 3–14. Milano.
- OMBONI, G. (1859b): Intorno alla Carta geologica della Lombardia ed alla relativa Memoria del cavaliere Francesco di Hauer, pubblicata nel nono volume degli Annali dell'I.R. Istituto Geologico di Vienna. Cenni. – Atti della Società Geologica residente in Milano, **1**, 97–108. Milano.
- OMBONI, G. (1861): Cenni sulla carta geologica della Lombardia. – 13 p., Milano, Vallardi.
- OMBONI, G. (1863): Bibliografia delle principali opere finora pubblicate sulla geologia del Veneto. – Atti della Società Italiana di Scienze Naturali, **5**, 353–398. Milano.
- OMBONI, G. (1897): *Commemorazione del Barone Achille de Zigno*. – Atti del R. Istituto Veneto di scienze, lettere ed arti, ser. VII, **8**, 1896–1897, 111–150. Venezia.
- PANCALDI, G. ed. (1983): I congressi degli scienziati italiani nell'età del Positivismo. – 227 p., Bologna, CLUEB.
- PASTA, R. (1996): Scienza e istituzioni nell'età leopoldina. Riflessioni e comparazioni. – In: BARSANTI, BECAGLI & PASTA, 1996, 1–35.
- PIRONA, G. A. (1856): Lettere geologiche sul Friuli. – 32 p., Udine, Tip. Trombetti-Murero [published in *Annotatore Friulano*, 29, 30, 32, 33, 37, 38. Udine]
- PONTIGGIA, G. & RUMI, G. eds. (1988): Il tramonto di un regno. Il Lombardo-Veneto dalla Restaurazione al Risorgimento (1814–1859). – 399 p., Milano, CARIPLO.
- PORTIS, A. ed. (1881): *Bibliographie Géologique et Paleontologique de l'Italie*. – 630 p., Bologna, Zanichelli.
- PRETO, P. (1995): Girolamo Festari. Medicina, "Lumi" e geologia nella Valdagno del '700. – 188 p., Valdagno, Comune di Valdagno.
- PRETO, P. (1998): I geologi vicentini dell'800: dall'amore della terra all'amore della patria. – In: VACCARI 1998b, 51–80.
- RATTI, G. & SILVESTRI, D. (1982): Collegno, Giacinto Ottavio Provana di. – In: Dizionario Biografico degli Italiani. – vol. 26, 802–807, Roma, Istituto dell'Enciclopedia.
- RICHTHOFEN, F. von (1856): Ergebnisse einer geognostischen Studienreise in Süd-Tirol. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, p. 841. Wien.
- RICHTHOFEN, F. von (1857): Contactwirkungen des Syenits in Süd-Tirol. – Jahrbuch der k.k. Geologischen Reichsanstalt, **8**, 164–165. Wien.
- RICHTHOFEN, F. von (1858): Ueber den Quarzporphyr von Süd-Tirol. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., 7–8. Wien.
- RICHTHOFEN, F. von (1860): Geognostische Beschreibung der Umgegend von Predazzo, Sanct Cassian, und der Seisseralpen in Süd-tirol. – 327 p., Gotha, Perthes.
- ROVIDA, C. (1832): Elogio di Ermenegildo Pini. – 141 p., Milano, G. Truffi & Comp.
- RUMOR, S. (1907): Gli scrittori vicentini dei secoli decimottavo e decimonono. – vol. 2, Venezia, Tip. Emiliana.
- RUMOR, S. & LIOY, P. (1901): Bibliografia geologica della Provincia di Vicenza. – 110 p., Vicenza, Club Alpino Italiano.
- SELLA, Q. (1863): Sul modo di fare la carta geologica del Regno d'Italia. – Atti della Società Italiana di Scienze Naturali, **4** (1862–1863), 145–187. Milano.
- SENONER, A. (1851a): Prof. Bianconi's in Bologna Sammlungen von Felsarten. – Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien, **7** (Nr. 8. August 1850), 158–161. Wien.
- SENONER, A. (1851b): Zusammenstellung der bisher gemachten

- Höhenmessung im lombardisch-venetianischen Königreiche. – Jahrbuch der k.k. Geologischen Reichsanstalt, **2**, 78–90. Wien.
- SENONER, A. (1852): Zusammenstellung der bisher gemachten Höhenmessungen in den Kronländern Krain, Görz und Gradisca, Istrien, Dalmatien und der reichsunmittelbaren Stadt Triest. – Jahrbuch der k.k. Geologischen Reichsanstalt, **3**, 41–61. Wien.
- SENONER, A. (1854a): L'Imperial Regio Istituto Geologico dell'Impero d'Austria e rivista degli studj di mineralogia, geologia e paleontologia nella Monarchia Austriaca 1850–1853. – 52 p., Bologna, Tip. All' Ancora [also published in *Nuovi Annali di Scienze Naturali*, 1854, Bologna].
- SENONER, A. (1854b): Relazione sul fenomeno di detonazione del Monte Tomatico di Feltre. – 14 p., Verona, Tip. Antonelli [also published in *Il Collettore dell'Adige*, 1854, Verona].
- SENONER, A. (1856a): Das naturhistorische Museum der Herren Anton und Johann Baptist Villa in Mailand. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, 763–765. Wien.
- SENONER, A. (1856b): Cenni geologici sulla Carnia. – Bollettino dell'Associazione Agraria Friulana, **10**. Udine.
- SENONER, A. (1860): Reiseskizzen aus der Lombardei und Venetien. – 71 p., Moskau, In der Buchdruckerei der Kaiserlichen Universität.
- SENONER, A. (1861): Catalogo delle meteoriti esistenti nell'I.R. Gabinetto Mineralogico di Vienna. – Atti della Società Italiana di Scienze Naturali, **3**, 444–453. Milano.
- SENONER, A. (1863): Enumerazione sistematica dei minerali delle Provincie Venete. – 94 p., Venezia, Tip. Antonelli [also published in *Atti dell'Istituto Veneto di scienze, lettere ed arti*, ser. III, 8, Venezia].
- SIMONETTO, L. (1997): Giulio Andrea Pirona geologo e paleontologo. – In: VECCHIET, R. ed.: Giulio Andrea Pirona 1822–1895. – 99–112, Udine, Graphis/Biblioteca "V. Joppi".
- SRBIK, R. von (1935–1937): Geologische Bibliographie der Ostalpen von Graubünden bis Kärnten. – 2 vol. [1935] + Fortsetzung [1937], München & Berlin, R. Oldenbourg.
- STACHE, G. (1859a): Die Eocengebiete in Inner-Krain und Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, 272–331. Wien.
- STACHE, G. (1859b): Carpano in Istrien. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., 117–119. Wien.
- STACHE, G. (1859c): Geologische Karte des istrischen Festlandes und der Quarnerischen Inseln. – Jahrbuch der k.k. geologischen Reichsanstalt, **10**, Verh., 193–194. Wien.
- STACHE, G. (1864): Die Eocengebiete in Inner-Krain und Istrien (Zweite Folge). – Jahrbuch der k.k. geologischen Reichsanstalt, **14**, 11–115. Wien.
- STACHE, G. (1895): Todesanzeige: Adolf Senoner. – Verhandlungen der k.k. geologischen Reichsanstalt, **11**, p. 294. Wien.
- STAUDIGL, E. (1866): Die Wahrzeichen der Eiszeit am Südrande des Garda-See's. – Jahrbuch der k.k. Geologischen Reichsanstalt, **16**, 479–500. Wien.
- STOPPANI, A. (1857): Studii geologici e paleontologici sulla Lombardia. – 461 p., Milano, Turati.
- STOPPANI, A. (1858): Notizen über die oberen Triasgebilde der lombardischen Alpen. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, 137–143. Wien.
- STOPPANI, A. (1859): Rivista geologica della Lombardia in rapporto colla Carta geologica di questo paese pubblicata dal Cavaliere Francesco de Hauer. Memoria. – Atti della Società Geologica residente in Milano, **1**, 190–316. Milano.
- STUR, D. (1856a): Geologische Aufnahme im Comelico und in der Carnia. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, 178–179. Wien.
- STUR, D. (1856b): Die geologischen Verhältnisse der Thäler der Drau, Isel, Möll und Gail in der Umgegend von Lienz, ferner der Carnia im venetianischen Gebiete. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, 429–459. Wien.
- STUR, D. & KEIL, F. (1856): Barometrische Höhenmessungen aus dem Gebiete der obersten Drau in der Umgegend von Lienz und aus dem oberen Gebiete der Piave und des Tagliamento. – Jahrbuch der k.k. Geologischen Reichsanstalt, **7**, 459–465. Wien.
- Suess, E. (1858): Säugethierreste aus der Braunkohle von Granco in den Vicentinischen. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., p. 121. Wien.
- Suess, E. (1859): Gastaldi, *Fossili invertebrati del Piemonte* [...]. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., p. 18. Wien.
- Suess, E. (1860): Abb. Stoppani *Deposito d'Azzerola*. – Jahrbuch der k.k. Geologischen Reichsanstalt, Verh., **11**, 142–143. Wien.
- TARAMELLI, T. (1880): Della necessità in Italia di un Istituto geologico indipendente dal R. Corpo degli Ingegneri delle miniere. – Rendiconti del R. Istituto Lombardo, serie **2**, **13** (10–11), 14 p., Milano.
- TIETZE, E. (1899): Franz v. Hauer. Sein Lebensgang und seine wissenschaftliche Thätigkeit. Ein Beitrag zur Geschichte der österreichischen Geologie. – Jahrbuch der k.k. Geologischen Reichsanstalt, **49**, 679–827. Wien.
- TONUCCO, A. (1997): L'Accademia di Udine dalla caduta della Repubblica di Venezia all'unione del Friuli al Regno d'Italia (1797–1866). – 147 p., Udine, Accademia Udinese di Scienze, Lettere e Arti.
- TORCELLAN, G. F. (1965): Francesco Grisellini. – In: GIARRIZZO, G., TORCELLAN, G. F. & VENTURI, F. eds.: Illuministi italiani. VII. Riformatori delle Antiche Repubbliche, dei Ducati, dello Stato Pontificio e delle isole. – 91–120, Milano-Napoli, Ricciardi.
- TRENER, G. B. (1928): Bibliografia Mineraria della Venezia Tridentina. – 18 p., Gleno, Archivio per l'Alto Adige.
- TRENER, G. B., COGOLI, M. & CADROBBI, M. (1927): Bibliografia geologica della Venezia Tridentina. – 118 p., Gleno, Archivio per l'Alto Adige.
- TREZZI, L. (1992): Attività minerarie e metallurgiche in Valcamonica durante il Regno d'Italia. – In: FONTANA & LAZZARINI 1992, 344–367.
- TREZZI, L. (1996): Miniera e metallurgia della montagna lombarda fra '700 e '800: fonti e problemi di fonti. – In: PIOLA CASELLI, F. & PIANA AGOSTINETTI, P. eds.: La miniera, l'uomo e l'ambiente. Foti e metodi a confronto per la storia dell'attività minerarie e metallurgiche in Italia. – 121–140, Firenze, All'Insegna del Giglio.
- TRINKER, J. (1858a): Die Bergbau-Unternehmung in Vallalta. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, Verh., p. 122. Wien.
- TRINKER, J. (1858b): Die Entstehung und der erste Aufschwung der Quecksilber-Grube Vallalta bei Agordo. – Jahrbuch der k.k. Geologischen Reichsanstalt, **9**, 442–444. Wien.
- TRINKER, J. (1860): *Anthracotherium* von Zovencedo. – Jahrbuch der k.k. Geologischen Reichsanstalt, **10**, Verh., p. 95. Wien.
- VACCARI, E. (1993): Giovanni Arduino (1714–1795). Il contributo di uno scienziato veneto al dibattito settecentesco sulle scienze della Terra. – 408 p., Firenze, Olschki.
- VACCARI, E. (1998a): Mineralogy and mining in Italy between the 18th and 19th centuries: the extent of Wernerian influences from Turin to Naples. – In: FRITSCHER, B. & HENDERSON, F. eds.: Toward an History of Mineralogy, Petrology and Geochemistry, Proceedings of the Symposium: München, 8-9 March 1996. – 107–130, München, Institut für Geschichte der Naturwissenschaften.
- VACCARI, E. ed. (1998b): Le scienze della Terra nel Veneto dell'Ottocento. – 368 p., Venezia, Istituto Veneto di Scienze Lettere ed Arti.
- VACCARI, E. (1998c): Geologia e collezionismo nel primo Ottocento veneto: il rapporto tra Luigi Castellini e Pietro Maraschini. – In: VACCARI 1998b, 109–134.
- VANZETTI, C. (1990): La Accademia di Agricoltura, Scienze e Lettere di Verona (1768–1989). – 348 p., Verona, Accademia di Agricoltura, Scienze e Lettere.
- VILLA, A. (1858): Intorno agli Studj geologici e paleontologici sulla Lombardia del sacerdote professore Antonio Stoppani. – 12 p., Milano, Società Tipografica de' Classici Italiani.
- VISCONTI, A. (1983): Gli Atti del nono congresso degli scienziati italiani riuniti in Venezia nel 1847. – In: PANCALDI 1983, 203–218.
- VISCONTI, A. (1997): Il ruolo dell'assolutismo asburgico per l'avvio della natura in Lombardia. – In: BETRI, M. L. & PASTORE, A. eds.: Avvocati, medici, ingegneri. Alle origini delle professioni moderne (secoli XVI-XIX). – 349–366, Bologna, CLUEB.
- VISCONTI, A. (1998): Geologia, istituzioni naturalistiche e descrizione del territorio nella Milano asburgica della Restaurazione. – In: VACCARI 1998b, 135–149.
- VOSS, W. (1881): Johannes Antonius Scopoli. Lebensbild eines österreichischen Naturforschers und dessen Kenntnisse der Pilze von Krain. – Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, **31**, I Halbjahr [Italian translation: Voss, G. (1884): Della vita e degli scritti di Giovanni Antonio Scopoli. – 22 p., Rovereto, Tip. Roveretana].
- WOLF, H. (1856): [Tagebuch] Südalpen 1854–1856. – Bibliothek der Geologischen Bundesanstalt, Wiss. Archiv, A-00092-TB.
- WOLF, H. (1857): Diluvium am Gardasee. – Jahrbuch der k.k. Geologischen Reichsanstalt, **8**, 161–162. Wien.
- WOLF, H. (1865): Ein geologischer Durchschnitt vom Lago di Garda bis zur Höhe der Monti Lessini. – Jahrbuch der k.k. Geologischen Reichsanstalt, **15**, Verh., 47–48. Wien.
- ZAPPE, H. (1971): Index Palaeontologicorum Austriae. – Catalogus Fossilium Austriae, **15**, 1–140. Wien.
- ZAPPE, H. (1987): Index Palaeontologicorum Austriae – Supplementum. Materialen zu einer Geschichte der Paläontologie in Österreich. – Catalogus Fossilium Austriae, **15a**, 143–242. Wien.
- ZOLLIKOFER, T. (1856): Beiträge zur Geologie der Lombardei mit besonderer Berücksichtigung der quaternären Bildungen im Po-Thale. – Berichte über Naturforscher Versammlung in Wien im Jahr 1856, 10–54. Wien.