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► To cite this version:

Pietro Corsi. The Italian Geological Survey: the Early History of a Divided Community: dans G.B. Vai et W.Cavazza, ed, Four centuries of the word 'Geology', Ulisse Aldrovandi 1603 in Bologna, Minerva Edizioni, Bologna, septembre 2003, p.255-279.. 2003. halshs-00002891v2

HAL Id: halshs-00002891

<https://shs.hal.science/halshs-00002891v2>

Preprint submitted on 29 May 2006

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The Italian Geological Survey: the Early History of a Divided Community

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E.H.E.S.S.

[“The Italian Geological Survey: the Early History of a Divided Community”, in G.B. Vai et W.Cavazza, ed, *Four centuries of the word ‘Geology’*, Ulisse Aldrovandi 1603 in Bologna, Minerva Edizioni, Bologna, septembre 2003, p.255-279.]

The historiography of science, and particularly of geology as well as the historiography concerned with the early formation of the Italian State, have paid scant if any attention to the complex history of the Italian geological survey. Indeed, great uncertainty still prevails as to the origin and source of the project to provide the new Italian State, formally constituted as “Regno d’Italia” on January 1st, 1861, with a geological map. There is an excellent, ground-breaking biography of Quintino Sella (1827-1884), the wealthy Piedmontese scientist turned politician who was one of the major actors in the early history of the survey. However, it mentions only in passing Sella’s involvement in the rapid succession of events, starting in July 1861, that led to the Royal decree on December 12th of the same year, officially launching the enterprise of the geological map of the country (Quazza 1992, p. 356). An outstanding authority on geological matters, David Oldroyd, gives 1877 as the date for the beginning of operations (Oldroyd 1996). Conversely, the official website of the Servizio Geologico, the successor of nineteenth-century State surveying agencies, indicates 1867 (Carusone 1996; Topley 1885). As I shall argue below, this is only partially correct. Documents have recently emerged after decades of neglect; some photocopies made during the 1990s at the historic building of the Geological Survey in Rome (now under renovation) have proven crucial after the apparent disappearance of their originals in the early

2000s. These throw a more dramatic and fascinating light on the history of one of the least studied episodes in the troubled relationship between the modern Italian State and scientific, specifically geological, practices (MAIC 4194, 1, 2, 3; Jacobacci 1973 makes no mention of these events; Eramo 1996).

Constantly under attack, under funded and understaffed, during the last decades of the nineteenth century and the first two of the twentieth, senior officials in charge of the Geological Service produced historical accounts of the difficulties they experienced. They had to justify the extremely slow pace of publication, the poor quality of the maps produced, and the lack of uniformity both in the scale and in the criteria followed (Millosevich 1931). In order to do so, they wrote and re-wrote the history, or perhaps more accurately, the chronicle of their institution. They listed the founding decrees, successive legislative interventions meant to remedy faults and vices, and the three or four new starts each repeatedly announced as, at last, the good one (Zezi 1876; Pellati 1895 and 1904; Cermenati 1891; Millosevich 1931). On the whole, the listing of decrees poses few problems in terms of accuracy, being based on acts of Parliament and on widely accessible printed material. Yet, for reasons that will be reconstructed below, these early chronicles, and the historians who have taken them at their face value, make no reference to the fact that the Geological Survey of Italy had been set up in the early weeks of 1862. A director had been appointed, permanent staff selected and recruiting procedures outlined. Moreover, operational plans had been agreed, including the crucial political choice concerning the location of the headquarters and of the attached museum for collections to be assembled as a complement to field surveying.

It is important to recognise that the “official” histories were based on the archival material available to their authors. This material, it should be added, was carefully catalogued and repeatedly summarised in detailed chronologies of events that were designed for submission to various ministers or politicians likely to take action on behalf of the Geological Service, or to answer increasingly vociferous critics. Thus, when contemporary and later official

commentators wrote that the financial difficulties of the country prevented the December 12th decree from being put into effect, they were deliberately omitting to tell their readers that the Service had indeed been established. In order to understand fully the reasons for this omission, the series of events leading to the Royal Decree of December 1861 and its immediate aftermath must be narrated in full. This will constitute the first step towards a history of the Geological Survey of Italy.

Local traditions and national hopes

It is outside the scope of this study to detail the mapping enterprises conducted by Italian geologists active in the early decades of the nineteenth century. It is sufficient to recall that Italian geology had a very distinguished past and still enjoyed a prestigious reputation in 1830. Charles Lyell, in the historical introduction to volume one of his *Principles of Geology*, refers to the crucial importance of Italian geologists in the development of the discipline. It could hardly be claimed that this was still the case in 1840, or later in the century. Practitioners of geology had not disappeared from the peninsula (still divided in several independent States, submitted to extremely different political, economic and administrative regimes): far from it. The heirs to Anton Lazzaro Moro (1768-174) and Lazzaro Spallanzani (1729-1799), Scipione Breislack (1748-1826), Giovanni Battista Brocchi (1772-1826), and Giuseppe Marzari Pencati (1779-1836) were still active on the national and the international scene. They were often members of the Société géologique de France, established in 1830, and published in its prestigious *Bulletin*. Yet, they travelled less extensively than in the last decades of the eighteenth century, kept more limited correspondence with their European colleagues, and suffered the backlash of the Restoration, in 1815, of pre-Revolutionary and pre-Napoleonic regimes. These crushed or diminished to near insignificance the scientific and technological modernisation of local and national administrations, timidly but efficiently put in action during the French led administration (Corsi 1998; Pasta 1989; Barsanti 1996).

The meetings of Italian scientists started in 1839 gave local geologists ample opportunity of interacting personally with the European luminaries of the discipline. Leopold von Buch (1774-1853), Elie de Beaumont (1798-1874), or Jean-Baptiste Julien d'Omalus d'Halloy (1783-1785), at the time more famous than historians now care to admit, were shown around the classic localities of the peninsula, from the Alps to the Vesuve, the Venetian hills and the marble Alps of Tuscany (Pancaldi 1983; Garin 1991). As I have argued elsewhere, lack of collections, books, and means to travel forced the great majority of Italian geologists to exercise their skills almost within walking distance of their hometown or university. Some turned this necessity into a virtue, and theorised that in fact, geology could only be local. Foreign travellers and amateurs passing by could never gain adequate understanding of the structure of regions that several years of repeated study by local naturalists and geologists had failed to unravel (Corsi 1998). Moreover, the often repeated myth that our current centre - periphery dichotomy already prevailed in the first half of the nineteenth century, does not take into account the all important social validation procedures at the local level, and the complex dialectic and rhetoric of keeping in touch with foreign colleagues. Thus, with few exceptions, Italian geologists did not suffer from any perceptible inferiority complex with respect to their more privileged and better-funded French, German, and British colleagues.

Cartographic efforts conducted elsewhere in Europe, and beyond the old continent, were well known to Italian geologists, and occasionally imitated. However, lack of topographic maps for several regions (the entire south in particular) often limited the effort to sketchy overviews at very small scales. Wealthier states like the Kingdom of Sardinia, or Lombardy and the Venetian regions under Austrian administration (or occupation, as the Risorgimento rhetoric would prefer) had started their own geological mapping enterprises, stemming from a variety of initiatives and responding to a variety of economic, theoretical and symbolic needs. The pioneering geological mapping of Sardinia (published in 1857) by General Alberto della Marmora (1789-1863) was,

however, the result of his determination and personal wealth rather than of governmental choice. Similarly, the project of a geological map of the “Stati di Terraferma”, that is of continental Piedmont, under the leadership of Angelo Sismonda (1807-1878), decreed in October 1846, was more a reflection of the combination of personal ambition and networking on the part of the geologist, than an indication of the government’s conversion to large-scale, state financed surveys. Pace and means were thus at the individual level (Cocchi 1871). No provision for collections, museums, or specialised libraries entered the horizon of these and similar enterprises. For Lombardy and the Venetian regions, the Imperial administration in Vienna took care of topographical and geological mapping, the latter under the direction of Franz Ritter von Hauer (1822-1899) for Lombardy, and Frantisek Foetterle (1823-1876) for the Venetian regions. Indeed in 1867, when the “Comitato Geologico”, led by Iginio Cocchi (1827-1913), started its operations, it was to the hated Austrians that they had to turn for the only reasonable, and often very good, topographic maps available for Lombardy, the Venetian regions, Tuscany, the Pope’s possessions in the Po plains (Bologna, Ferrara) and small States like Modena and Parma (Corsi 2001).

A long rhetorical tradition had extolled, in Italy as elsewhere, the benefits to be expected from the pursuit of geological studies. The creation of the chair of geology in Pisa, conferred to the Neapolitan Leopoldo Pilla (1805-1848) in 1841, had been decided by the Grand Duke himself, Leopold II. The Grand Duke desperately hoped that Tuscany could become the Saxony of the South, rich as it was - he often repeated - in all sorts of minerals; and, more excitingly, providentially endowed with a thick layer of coal seams on which to ground the future prosperity of the state. No coalfield however, was to be found underneath the Tuscan hills. Pilla had undertaken an unsuccessful search for minerals in the Neapolitan regions, attracted the attention of the Queen (the Grand Duke’s sister), who opened the way to the prestigious appointment. Tuscan and Northern geologists often acted as counsellors to local mining

ventures, although the practice of systematic excursions was rare and, as previously mentioned, it often concerned a very limited geographical range. Even the enthusiasm which surrounded the early proposal to work collectively on a geological map of the Italian peninsula, formulated during the first meeting of Italian scientists held in Pisa in 1839, produced little effect (Atti I, pp. 74, 110). Agreement was reached to adopt the chromatic scale used by de Beaumont and Armand-Pierre Dufrenoy (1792-1857) for their general map of France, with the self-serving backing of von Buch, who had inspired the French choice. A central collection of minerals, fossils, and maps was to be set up in Florence, under the benevolent aegis of the Grand Duke, at the end of the Congress held in the Tuscan capital in 1841. It was announced that the collection would represent the first step towards the realisation of the geological map of the peninsula. The project did not outlive the proclamation. Indeed, the chorally reiterated assent acknowledging the need for a collaborative effort did not prevent rivalries and individual attempts to beat the competition. At the 1844 Congress of Italian scientists held in Milan, Giacinto Ottavio Collegno di Provana (1794-1856), who had emigrated to France, where he was teaching botany, geology and mineralogy in Bordeaux, produced his own map at the scale of 1/2.000.000, printed in Paris, without consulting his colleagues. This prompted raised eyebrows and some irritation. (Atti III, p. 165; Atti IV, 1843, p. 397; Atti V, 1844, p. 277; Atti VI, 1845, pp. 536, 584.).

Priority disputes

The manuscript correspondences of Italian geologists to which I have so far gained access do not appear to contain evidence of determined efforts to engage in the project. During the 1870s and the 1880s, Igino Cocchi and Felice Giordano (1825-1892) claimed or were said to have been the new initiators of the project of a national geological survey in the late 1850s and in 1860-1861. However, they could not produce more than scanty evidence of the advice they had provided to, or the promises they had obtained from, their governments. In

short, they offered nothing more than suggestions.

Thus, Igino Cocchi, a chief protagonist in the early history of the geological survey of Italy, boasted that in 1857 he had proposed the creation in Florence of a private association of naturalists, geologists, mining interests and venture capitalists to proceed with a geological survey of Tuscany to enhance mining and general industry (Cocchi 1871; Baldacci 1911). His correspondence with geological colleagues in Pisa, and especially with Giuseppe Meneghini (1811-1889), his teacher and at times reluctant mentor, neither substantiates, nor denies his claim. However, it is at least strange that no mention of so ambitious an undertaking is to be found in letters to his Pisan senior colleagues who would have provided scientific and social caution to the plans of the then young man. Cocchi also resumed the 1841 project of gathering a central collection in the natural history museum of Florence, and on March 9th, 1860, obtained approval from the government of Tuscany, which was in charge of affairs before the full integration of the old Grand Duchy into the new Kingdom. The proposal aimed to improve the credibility and visibility of the young man, then fighting for a full chair in the new higher education institutions evolving in Florence. As in 1841, the 1860 decision had no practical outcome. The state of collections at the Florentine natural history museum was far from satisfactory and, aside from the debates of 1861 related below, no concrete or systematic action was taken even when Cocchi took charge of the museum and the Geological Survey in 1867.

As it is often and uncritically repeated, the recommendation that the Piedmontese government undertake a national survey, a comprehensive study of the huge, new territories gained during the military campaigns of 1859-1860, put forward in October 1860 by Felice Giordano was the one which was followed up by the Minister of Agriculture, Filippo Cordova (1811-1868). I am not convinced, as I shall argue below, that the sequence of events was as linear and unproblematic as contemporary commentators from within the Reale Corpo degli Ingegneri delle Miniere (Royal Corps of Mining Engineers), to which

Giordano belonged, wish us to believe.

Giordano had spent three years (1847-1851) of postdoctoral training at the École des Mines of Paris. He and his lifelong friend, Quintino Sella, were the first two graduates from the school of engineers and architects at Turin to be sent abroad to learn their trade and perfect their skills. After several months of journeying through European mining districts, Giordano returned home and was commissioned to Sardinia, as mining engineer in charge of the entire island. Here, he favoured foreign capital investments, provided advice to local mining ventures, and even directed private prospecting and exploitation activities (not without some anxiety concerning the propriety of being at the same time the inspector and the inspected). In France, Giordano and Sella had learned the theoretical basis of a lithostratigraphical geology based on mineralogy, inspired by the dominant figure at the École, Elie de Beaumont. They were suspicious of paleontology and opposed to, or even spiteful towards, geological theories, which they looked down on as cosmologies or, at worst, mere fantasies. Mining engineers were the only professionals capable of carrying on geological surveys with “geometrical precision”. This was the exact opposite of geologists who came from natural history disciplines and faculties, and were prone to the well-known flights of imagination that had so far retarded the progress of the discipline. In France, Giordano and Sella also learned the meaning of the “esprit de corps” among personnel coming out of the “grandes écoles”. Once he was Finance Minister, Sella systematically employed younger colleagues from the Corps of Mining Engineers to carry on strategic reforms at the Mint, the fiscal offices, the Post Office, and the system of concessions to exploit water resources. In Giordano’s eyes, academic geologists lacked discipline, could never agree on anything, and were ready to pick fights at every opportunity, instead of finding a rational way out of disagreements.

In the interested reconstruction provided by officers of the Ufficio Geologico, a report Giordano sent to the Minister of Agriculture, Industry and Commerce

(thereafter MAIC) on October 19th, 1860 sparked off the project of the geological survey of Italy. In December 1865, the Minister's staff asked Axerio, who was then at the Inspection of Mines and Sella's right hand, to write a memo on the state of affairs concerning the geological map of Italy project, and to collect all documents relating to it. On December 28th, Axerio wrote back to the Minister and provided the earliest authoritative "evidence" of Giordano's "priority" in the matter. After extolling the virtue, necessity and prospect of a geological map, he pointed out:

"that already in 1860 Inspector Giordano proposed: 1. To put the Corps of Mining Engineers in charge of the compilation of the Geological Map of Sicily [sic] on a large scale; 2. To entrust the high direction of the enterprise to a section of the Council of Mines, composed of well-established geologists; 3. To collect in the meantime what already existed, and to reproduce the results of such works on a map of Italy on a small scale" (MAIC 4194, 3, f. 254r, Axerio to Minister MAIC, December 28th, 1865)

This summary of Giordano's proposal is substantially correct. However, the listing and partial collection of documents on which Axerio's report was based (later extended to include items up to 1869) also contains an undated report, advising the Minister to follow a completely different strategy.

The anonymous author of the report, who had been asked to produce an annotated bibliography of state and administrative papers concerning the geological map of Piedmont, proposed ways to adapt the old project to the new political and geographical situation. Provinces of the Kingdom such as Savoy and Nice had been handed over to France, who wished to ensure safer borders with the newly created territorial power and had pretended compensation for the heavy losses incurred during the 1859 campaign. Almost the entire peninsula was in the process of being unified, thus demanding new cartographic work, and a deep rethinking of the project for a geological map of Piedmont entrusted to Sismonda. The task was huge, but the situation was not that desperate. Geologists active in several pre-unity States, now "new provinces", the Piedmontese author proudly pointed out, had produced some

good work. Partial surveys had indeed been undertaken by Sismonda in Piedmont, Lorenzo Pareto (1800-1865) in Liguria, della Marmora in Sardinia, Giulio Curioni (1796-1878) in Lombardy, Giuseppe Scarabelli (1820-1905) and Santagata in the Pope's northern provinces, and Paolo Savi (1798-1871) and Meneghini in Tuscany. It was to them that it was essential to turn in order to undertake the national survey. As a preliminary step, the author concluded, a meeting of expert geologists from all the provinces of the new state would have to be convened. The Commission would have to determine the chromatic scale, the nomenclature of strata, the signs to indicate mines, factories and quarries, and the nature of the explanatory memoirs to accompany the maps, which would include reference to the state of agriculture (MAIC 4194, 3, ff. 262 r, 262v, 263r). The finances of the state were far from flourishing, so it was suggested that the sum of 17.500 lire granted on July 17th, 1858, to complete Sismonda's work, could be used to finance "the preparatory studies for the geological map of the States of our happy kingdom, after having asked the approval of the National Parliament" (MAIC 4194, 3, f. 263r).

Reference to the 1858 budget, the "happy kingdom", and the "new provinces" strongly imply that this memorandum was written sometime in 1860. It could well have been the suggestion that Cordova followed a few months later, when he decided to proceed with the convocation of a Giunta to discuss the project of a geological map of Italy. Indeed, a letter from the MAIC Minister, Tommaso Corsi (1814-1891, Cordova's predecessor), to his colleague the Finance Minister, dated September 12th, 1860, already referred to a "Commission" to be created in order to determine the procedures for carrying on the geological survey of the Kingdom (MAIC 4194, 1, f. 1r). The present state of research does not allow precise dating of the anonymous report suggesting the creation of a special geological commission. It is, however, significant that Giordano's memorandum contains a revealing paragraph *against* the approach outlined in the anonymous report and referred to in the MAIC Minister's letter of September 12th.

After mentioning that eminent geologists had indeed contributed to the geological understanding of several regions of the new Kingdom, Giordano points out that there is still much disagreement among them on the age, structure and composition of various key formations. These were points of exquisite “philosophical” import (in Giordano’s empiricist epistemology, this was not meant to be a compliment), having little bearing on the task at hand, which was essentially descriptive and directed to practical applications:

“What is said above leads us to the conclusion that it would be very difficult to produce quickly a geological map of Italy, from the spontaneous contribution of geologists who have already applied their efforts to the study of various provinces; even if they were asked by the Government to constitute a Commission and were incited to the task, the divergence of opinion we referred to, and above all the great gaps still existing” would certainly doom the enterprise (MAIC 4194, 1, ff. 7r - 7v).

Two solutions were proposed: a National Geological Institute on the Austrian or German model, or the constitution of a special section of the Corps of Mining Engineers in charge of the Survey, on the French model. In 1860, the Austrian model was unlikely to attract much sympathy and, Giordano hastened to add, Parliament would not like to increase the burden on the shaky finances of the State by creating a new agency. Moreover, the new territories and huge tasks facing the new Ministry would in any case require an increase in the size of the corps of mining engineers, the only well trained technical staff of whom the MAIC could dispose. It was easy to foresee that the need for new roads, bridges, railways, water supplies and general infrastructure would inevitably increase the demand for technical expertise, a chance the MAIC should not miss. So, better to be ready, and accomplish a great enterprise in the meantime (MAIC 4194, 1, ff. 7v, 8r, 8v).

It is interesting to note that Giordano’s correspondence with Quintino Sella for 1860 does not mention his proposal of October 19th to put the Corps of Mining Engineers in charge of the geological map. Sella, who by that year had become Giordano’s political patron, was heavily involved in the debates on the reform

of the mining legislation of the newly acquired territories and on the organisation of the MAIC - a technical ministry involved in a wide range of scientific, statistical and financial issues - to which the Corps of Mining Engineers was attached. It is, however, difficult to believe that a strategic proposal of that significance to the Corps could have been undertaken without previous consultation with Sella. Once again, the total lack of secondary literature on this key episode in the history of the formation of the Italian State, and the consequent fragmentary exploration of primary sources, caution against reaching a firm conclusion. It is, nevertheless, of some interest to note that on December 3rd, 1860, Sella, still attached to the Corps of Mining Engineers, sent a letter to the MAIC Minister Corsi, extolling the work he himself and a fellow engineer, F. Grabau, had carried out during the summer, on Elba Island. Fired with patriotic zeal, Grabau had accepted Sella's proposal to continue the survey of the Island, Italy's main provider of iron ores, and had taken up residence there. A first sketch of a section of the geological map of Elba was already on its way to Turin (MAIC 4194, 1, ff. 12r - 12v, December 3rd, 1860, Sella to Minister MAIC). In other words, mining engineers could be very efficient, when the geological survey of a key industrial region was at stake.

Commentators referring to Giordano's October 19th letter as the symbolic starting point of the project often hasten to add that no action ensued. Giordano himself, probably out of that modesty for which Sella always reproached him, never mentioned it. Thus, no one ever quoted the October 19th letter in detail, the undated report considered above, or the letters here quoted, although all were available to Axerio and to the "historians" of the Geological Service writing from within the ranks of the Corps. In view of what follows, it is legitimate to put forward the hypothesis that Giordano's early proposal might have been a move to counteract the plan outlined in the undated report, which would have given free reign to academic and amateur geologists who had already studied different regions of the new Kingdom. This was the option Sella fought against in the events leading to the December 1861

Royal Decree instituting the Geological Survey. Giordano vehemently opposed it from his appointment to the head of the national survey in 1876 until his death in 1892. In other words, the letter was referred to in order to show that it was from within the MAIC and specifically from within the Corps of Mines that the proposal originated. Cocchi's rival project, and the one for the constitution of a National Geological Institute put forward by Antonio Stoppani (1824-1891) in the late 1870s, both insist on the crucial role academic geologists had to play in the enterprise. These were at best a curious coincidence, but most likely the envious imitation of plans the mining engineers had been first to suggest and put into action. Yet, in spite of Giordano's, Sella's and Grabau's zeal, it was the proposal of a commission made up of academic geologists that the new Minister, Cordova, implemented in 1861, rather than Giordano's proposal to put the Corps of Mining Engineers in charge of the national Geological Survey. The eventual implementation of Giordano's (and probably Sella's) plan took some hard work and complex negotiation. Geologists and others were not all convinced that the industrial and mineral future of the country should be left in the hands of the Corps of Mining Engineers.

Action from above

"Italian science and the Italian fatherland do not lack precious studies on the geognosy of our provinces. Yet, it is sufficient to peruse them the one after the other, to see the deep traces of the abandon and the anarchy that lowered all the products of contemporary Italian civilisation. This was due to the will or the lamentable state of the Governments that have just fallen, or to the very fact that these [pre-unity] States were too numerous, isolated, very different the one from the other. Maps on different scales and proportions [were produced], inspired by conflicting scientific faiths, of more or less authoritative origin, dispersed in big and small monographs, forgotten in thick proceedings of scientific societies, conceived and executed without any order or agreement on the typographical criteria and systems to be followed, compiled with different

aims in view, drawn with varying degrees of accuracy, and all, by the way, insufficient for public service, because of the inadequate proportions adopted, and the almost constant omission of all reference to subterranean features like springs, mines, quarries, fossil depots” (MAIC 4194, 1, ff. 17r - 17v, printed version, f. 23v).

This is what Filippo Cordova, in charge of the MAIC from June 1861 to March 1862, and again from June 1866 to April 1867, said to the King during the public audience held on July 28th, 1861. It was also included in the preamble to the Decree signed on the same day establishing the “Giunta Consultiva”, an assembly of experts mandated to “discuss the methods and establish the criteria for the formation of the Geological Map of the Kingdom of Italy.” The meetings were scheduled to last a maximum of fifteen days, and were to be held in Florence, in September 1861. They would coincide with the Industrial Exhibition and the concomitant Congress convened by the Accademia dei Georgofili, Europe’s most ancient learned society devoted to agricultural studies. In his typically flourishing style, Cordova extolled the virtues of geology and of geological maps for building the “expert awareness of the agriculturist, the administrator, the leader of the army, the statesman”. Italy is far from the situation already prevailing in the United Kingdom, France, and Germany, he continued, “where any landowner can acquire for a modest sum, together with the topographic map taken from the cadastre or the decuman tables, the geological map of his property, and, with this map, the knowledge of the land that belongs to him and the measure of its natural richness, luminous elements guiding the determination of its value and of the manpower to be applied to its exploitation” (MAIC 4194, 1, f. 23v).

The “Giunta” set up by the decree, was composed of Giovanni Capellini (1833-1922), Igino Cocchi, Giulio Curioni, Alberto della Marmora, Pietro Doderlein (1810-1895), Bartolomeo Gastaldi (1818-1879), Carlo (1787-1866) and Gaetano Gemmellaro (1832-1904), Giuseppe Meneghini, Giovanni Omboni (1829-1910), Antonio Orsini (1788-1870), Lorenzo Pareto (1800-1865), Giuseppe Francesco Ricci, Paolo Savi, Arcangelo Scacchi (1810-1893), Giuseppe Scarabelli (1820-

1905), Quintino Sella, Alessandro Spada (1798-1878), Angelo Sismonda, Antonio Stoppani, Carlo Strozzi, and Ezio De Vecchi (1826-1897). Cocchi, Spada, and Strozzi were asked to form a local organising Committee.

Cordova's text does not sound like anything Giordano (who was not even invited) had written or would write on the subject of the geological map. The rhetoric is too flamboyant to belong to Sella; and, even though in 1871 Cocchi wrote a similar denunciation of pre-1860 Italian geological studies, he clearly had nothing to do with this decree. Cordova, a Sicilian politician and powerful freemason of mixed reputation, emigrated to Piedmont for his involvement in the 1848 anti-Borbonic revolution. He enjoyed reading widely in subjects such as political economy and geology. He had nursed and helped the German geologist Hermann Wilhelm Abich (1806-1886), who had been a victim of bandits when travelling through Sicily. Subsequently, he had become his closest Italian friend and geological correspondent. Moreover, the fact that the Italian community of geologists suddenly took an active, determined, and passionate interest in the question of the geological map of the country substantiates the hypothesis that it was Cordova and his decree that gave many geologists the idea that the project presented several material advantages and provided a rhetorical strategy to enhance the discipline and the visibility of its practitioners. Whatever the reason, the fact is that the question of the geological map of the kingdom appears to have entered Cocchi's correspondence and life only after the decree of July 28th, 1861. Still on August 5th, in his letter of thanks to Cordova, Cocchi extolled the virtues of a geological map "nowadays indispensable primarily to administer to the needs of the railway industry". He then moved on to tell Cordova of his national geological and paleontological collection, approved by the transitional government of Tuscany, and in need of adequate funding. "I thereby recommend to the wisdom of Your Excellency and of his illustrious colleagues this national Collection of which I am in charge"(MAIC 4194, 1, f. 48v, Cocchi to Cordova, August 5th, 1861).

Bartolomeo Gastaldi, a close friend of Sella and of Giordano, was more in tune (as far as content and style were concerned) with the ambitions of the Minister. He writes:

“It is for many years that I have entertained the burning desire to see the execution of a geological map of the various States into which our peninsula was previously divided, on a scale at least equal to the one chosen for the Sardinian States. Now that circumstances so felicitous have reunited the entire Italy, my desire burns even more hotly, since I can finally hope to see the geological constitution of the Italian Kingdom represented on a map drawn at a large scale. I can also see in the realisation of the wish I have conceived, a powerful means to develop our industries, and especially agriculture, which will always be our prime industry. Moreover, now that Great Britain, France, and even Switzerland possess very accurate geological maps of their territories, it is necessary for Italy, which must make every effort to become a dignified member, under every respect, of the family of the great European powers, to start its own geological map, adequate to its needs, and up to the level to which geological doctrines have arisen” (MAIC 4194, 1, f. 36r - 36v, Gastaldi to Cordova, August 2nd, 1861).

Alberto della Marmora, veteran Piedemontese patriot and geologist, struck several warning notes and gave good advice. He reminded the Minister that he had himself calculated and drawn the topographic map of Sardinia, published in 1845, on which his 1857 geological map was based. The Giunta, and the project, were going to face great difficulties, due to the lack of a topographic map for most of the South of Italy, and the presence of a variety of maps at inconsistent scales and qualities covering some pre-unity states. His advice was to seek early cooperation with Major General Giuseppe Francesco Ricci, of the Army General Staff, and Lieutenant Colonel Ezio de Vecchi, in charge of the new topographic map of Italy. This map, realised by the High Command of the Piedemontese army, was then starting operations from Sicily and the South. Della Marmora believed other duties and ill health would prevent him from

attending the meetings in Florence (MAIC 4194, 1, ff. 40r - 41v, Alberto della Marmora to Cordova, August 3rd, 1861).

Ricci and De Vecchi were duly invited to join the Giunta, though De Vecchi declined, because of his mission to solve border problems with Switzerland. Other geologists excluded from the original list, such as Pietro Doderlain from Modena, demanded to be inserted while others, like Antonio Orsini from Ascoli Piceno, asked their local authorities to plead their case. All received their decree of nomination by the end of August 1861. Others still followed Cocchi's lead and asked for money to carry on surveying work in their own regions. Thus, Oronzo Gaetano Costa (1787-1867), an early Neapolitan acquaintance of Charles Lyell, supported the "Società degli Aspiranti Naturalisti di Napoli", who volunteered to survey the entire South of the Peninsula for the give away sum of 12.000 ducats (MAIC 4194, 1, f. 53r).

Towards the "Giunta Geologica" (1861)

During the early days of September, preparations started in haste. Strozzi and Spada, were long-term friends very near to the Pisa School represented by Paolo Savi and Giuseppe Meneghini. Their junior colleague, Igino Cocchi, a geological graduate of Pisa University, was left to do the work and the worrying. This was not the first time. During his long stay in Paris in the mid-1850s, and a shorter visit to England, Cocchi had purchased specimens and instruments for Spada, Strozzi, Meneghini and Savi, and had promoted the work of his senior colleagues within the geological and natural history community of both countries (Meneghini papers, Correspondence, I. Cocchi). Never a genius in judging characters and situations, Cocchi felt confident that the "good School" was going to come out victorious from the Giunta meetings, and that the great work could be undertaken from the still virtual national collection he had initiated at the natural history Museum in Florence. He was well aware that the Piedmontese School, in spite of its own internal divisions, was far from sympathetic to the Tuscan geological tradition and ultra-agrarian politics. If Elie de Beaumont and Lepold von Buch were the acknowledged reference

points for the Piedmontese School, then Pisa saw Constant Prévost and Charles Lyell as luminaries (Corsi 2001, pp. 894, 921, 925-926; Corsi 1985). As I shall argue below, the two schools were also divided on the key political issue of whether the state had the right to interfere with land ownership when important mineral resources were not exploited. The Piedmontese argued in favour, and acted accordingly, whereas Tuscan agrarian interests, and leading geologists with them, vehemently opposed any form of intervention limiting the sacred right to dispose of one's property at one's will.

In Cocchi's view, at the meeting of the Giunta in Florence, the Pisa School could take advantage of the fact that it was playing on home ground, and that the divisions within the Piedmontese field could entice at least Lorenzo Pareto to the Tuscan side. Moreover, the young, over ambitious Giovanni Capellini, Piedmontese by citizenship, but a disgruntled geological graduate of Pisa (where Paolo Savi had prevented him from publishing his views on the gulf of La Spezia, which contrasted with those defended by the Pisa professor), could be kept in check by Giuseppe Meneghini, Capellini's mentor and teacher. Curioni had written to the Minister proposing to follow Cocchi's plans for a national collection; Scarabelli was a close friend of Meneghini, and had studied at Pisa under Leopoldo Pilla, who died heroically on the battlefield of Curtatone in May 1848, fighting for Italy's independence; and Stoppani was depending on Meneghini for his Paleontology of Lombardy, even though he constantly complained of his older colleague's snail's pace in identifying fossils (Meneghini correspondence, Stoppani). Taking into account those who could not attend, the Giunta would likely be composed of less than 23 members, 9 of whom would probably form a unified group (Cocchi, Curioni, Spada, Strozzi, Savi, Meneghini, Pareto, Stoppani, Scarabelli). Capellini, newly elected professor of Geology at Bologna, would not have dared to oppose his teachers publicly. The 29 years old Gaetano Giorgio Gemmellaro, a protégé of Charles Lyell and just one year older than Capellini, had been appointed to the chair of Paleontology at Palermo thanks to the military-political events of 1860 and the fact that his brother had fought with Garibaldi (Corsi 1999b). Ricci was a

military man, and the absence of De Vecchi, who was a well-trained geologist, but not on excellent terms with the Pisa professors, was welcome news. De Vecchi had fought with Pilla at the battle of Curtatone and had applied for the chair of his teacher, who used to address him as “amico dolcissimo”. The fierce opposition from Savi and Tuscan agrarian interests to Pilla barred De Vecchi, who signed into the Piedmontese army, where he reached the rank of General, in charge of topographic work (Università di Pisa, Biblioteca, Pilla Correspondence). Of the Piedmontese contingent, Sella was already a rising star of politics in Piedmont and in united Italy, but a mineralogist, indeed a crystallographer, little versed in geology, as far as Cocchi could judge. Gastaldi could have created problems, but numbers were on the side of the Tuscan contingent.

With increasing anxiety, Cocchi realised that his plans looked good on paper, but were far from realistic. On August 27th, 1861, he reacted to dilatory measures announced by his Pisa friends. Meneghini had apparently no intention of interrupting his summer holidays in his hometown of Padua where he was getting married, and Savi was engaged on his estate, attending to family business. Savi demanded a postponement of the sessions. Not to appear disrespectful towards the new rulers, he had written to the Minister on August 4th that he was glad to accept the invitation to join the Giunta, but his health was not such as to guarantee his constant attendance. Cocchi was left wondering if the unthinkable would happen: that he might be left alone to fight his courteous but treacherous colleagues from Piedmont. Meneghini’s announcement that he did not foresee coming back to Pisa before the beginning of October sparked off a litany of hurried and worried comments:

“You will then find that everything is over. For the map we are positively meeting on the 15th, and not later. Your absence will be a tragedy and I shiver at the thought. Sandro [Spada] writes that he will not come, neither will Ponzi; little confidence can one place on Strozzi’s health; Paolo [Savi] will make day trips, and the good school will thus leave free hand to those you know. God be

witness, I will not stay a minute longer, if this is going to happen. I do not have colleagues with whom to draw plans, in spite of the fact that, together with Sandro and Strozzi, I form the Provisional Bureau. All the same, I am collecting information and insight from everywhere. I will tell you all, and if you come a few days earlier, we will think over what I have gathered: in short, all comes to this: *ayez votre* Geological Survey [in French and English]. But you must be ready to make this sacrifice for the good of the country: leave [Padua] before the usual time and come a few days before the opening, so that we can prepare ourselves and start [the meetings] after having discussed together and having made some decisions. For God's sake do come [...] We will see what your Capellini will do: for now I say that he is a genius, though *sui generis*; it could be applied to him what someone was saying to me concerning Deville: = *il vous enfoncera tous*. Of my views on the map little I can say for now, we will talk face to face about it, though for the moment they can be expressed as I said above: if someone dreams of doing it all, or almost all, alone, either he is a fanatic or someone who is led astray by his ignorance. Such attempts never had happy outcomes, even when several people were involved; let alone in our present circumstances" (Charles Saint-Clare Deville, 1814-1876; Meneghini Correspondence, Cocchi to Meneghini, August 27th, 1861).

Fascinating for its directness, though perhaps less so for the uncertain grammar and syntax, this letter by Cocchi contains the first hint at Cappellini's unsuccessful campaign to be put in charge of the Geological Survey of Italy. If people had been less envious and would have helped him, he wrote in later years, he could have done the job all by himself, in a few years (Fondazione Sella, Sella Correspondence, Capellini to Sella, December 29th, 1863; Servizio geologico, Capellini to Finali, Minister MAIC, March 20th, 1874).

September 15th was approaching fast, members of the Giunta were already arriving in Florence, and negotiations could start. For a few days, Cocchi appeared less worried. Gemmellaro was a nice young man, Sella was kind and collaborative, and things were looking rather promising. Cocchi wrote to

Meneghini:

“For your information, here are the bases of the full agreement I myself, Gemellaro [sic], Strozzi, Scacchi, Sella and others have entered.

I°. The Government must start by giving a good topographic Map on a large scale (4-6 inches per mile), without which it is impossible to make really accurate geological maps, especially in mountain regions, but only approximate ones, and more or less amateurish.

II°. A Central Commission and a general central Collection; at the moment, the prevailing idea is to constitute it here in Florence. I am proposing Lamarmora for President, Savi and Meneghini for Vice Presidents, us your pupils, as many as possible, as workers; Gemellaro for Sicily and Sismonda for Piedmont, etc.

III°. The publication of several partial maps, illustrated, and not of a single map.

IV°. Training of the personnel for the field surveying [in English], to be achieved through the training of good geological engineers: in short, as our friends are writing us from France = *ayez votre Geological Survey* [in French and English].

Murchison recommends sending there [to London] a good geologist among those who will cooperate in the making of the map, so that he can learn the method they are following, their rules, etc. I do not know whether the Commission will deem it appropriate to propose this. For your information, the Neapolitan and the Sicilian members of the Commission are already here and will leave after the completion of our work. Gemellaro is a dear and nice young man. This is a further reason why we cannot prolong the session, as Paolo was asking me to do yesterday, in a letter; apart from the fact that I do not see how the Provisional Bureau could ask for a new decree modifying the first one without strong reasons, I fear it might not be entitled to do so”(Meneghini Correspondence, Cocchi to Meneghini, September 10th, 1861).

The realities of scientific politics

Five days later came the official opening of the Giunta, and Cocchi's defeat. Alberto della Mamora did not come. Neither did Meneghini. Even Savi was absent, although at Cocchi's insistence, he started attending from the third session, but missed some later ones. Oronzo Costa, the oldest member of the Giunta, was appointed temporary President in charge of the elections of the bureau. Pareto was returned President, Savi Vice-President, Gemmellaro and Stoppani secretaries, and Capellini (who during his stay in Genoa in 1859-1860 had formed a strong friendship with Pareto) was asked to draw up the final report to the Minister. Cocchi had no official position in the day to day running of the congress (MAIC 4194, 2, ff. 90r - 90v). The detailed minutes of the eleven regular sessions and of the additional four public sessions, show that Sella had been extremely efficient during the days preceding the opening of the Giunta (MAIC 4194, 2, ff. 89-120). He emerged as the dominant, and at times domineering, figure. It was he who directly or indirectly set the agenda for each discussion, and fenced off dilatory manœuvres or tenor digressions. Gastaldi and Sella clearly formed a team. Capellini, who took advantage of the work of the Giunta to form a lasting and fruitful friendship with Sella, joined forces with them on several occasions, even though the final Report he drafted did not please his Piedmontese colleagues at all.

In the early sessions, on the first and second day in particular, Cocchi made pathetic attempts at delaying the starting of the meetings, by proposing, for instance, that the Giunta should begin with one of the scheduled public sessions, or that the second session should be postponed for two days. He was rebuked with the obvious argument that there was nothing yet to talk about in front of the public, and that the Royal decree stipulated that all the work had to be done within fifteen days, including the four public sessions. (MAIC 4194, 2, f. 21r, calendar of sessions: I, 16th September; II, 17th September; III, 18th September; IV, 19th September, First public session; V, 20th September; VI, 21st September; VII, 22nd September, Second public session; VIII, 23rd September; IX, 24th September, Third public session; X, 25th September; XI, 26th September, Fourth public session; XII, 28th September) Cocchi's third attempt to remedy

the absence of his authoritative Pisa friends was to argue that people attending the four public sessions had a right to vote. A few distinguished naturalists, amateur geologists, geographers and topographers had in fact asked to be heard; others could be invited by the Giunta itself to express their opinion. It would be fair to give them the right to vote, otherwise why invite them? Sella, who had himself raised the issue of the right to vote, after Cocchi's repeated insistence on the importance of the public sessions, was in favour of a non binding vote. Cocchi, meanwhile, favoured a full vote, clearly hoping to garner support from Florentine and Tuscan colleagues who could be mobilised to attend the public sessions (MAIC 4194, 2, ff. 92r - 93v). Yet, the Giunta voted 4 to 8 against taking into consideration the opinion expressed during the public sessions, on the reasonable grounds that, should they have a vote, the members of the public would become *de facto* members of the deliberative commission itself (MAIC 4194, 2, f. 94r).

As in the agreement Cocchi had described to Meneghini, preliminary discussion concerned the lack of a topographic map for most of the national territory. A unanimous wish was expressed that the Government should produce and publish such a tool, indispensable for conducting geological surveys (MAIC 4194, 2, ff. 94r - 94v). It was also decided that an initial geological map should be published, based on previously printed local essays and unpublished memoirs. The scale of 1/500.000 was proposed and a sub-commission, composed of Cocchi, Costa, Curioni, Gastaldi and Scarabelli, was asked to draw up a list of available topographical and geological maps. As far as the great geological map of the Kingdom was concerned, the scale of 1/50.000 was adopted (MAIC 4194, 2, f. 97v).

High politics started with the third session, when the President, Pareto, established the agenda of the day: "To whom should the Government allocate the execution of the great geological map?" (MAIC 4194, 2, f. 98r). Savi, finally taking his chair as Vice-President, asked for various commissions to be established, composed of geologists, paleontologists, and chemists, each

dealing with one aspect of the complex collection of “facts”, in preparation for the real work of the map. Pareto and Sella counter-argued that the issues raised by Savi concerned the actual organisation of activities; the real question was still, “the organisation of that office, which, under whatever name, will be in charge of the studies and the activities required for the great geological map of Italy (MAIC 4194, 2, ff. 98r - 98v).

The fourth session, on September 19th, was the first one open to the public. Ignazio Porro (1801-1875), inventor of optical instruments and surveyor, argued for a single map to be drawn, topographical, and at the same time geological, geographical, and industrial. He calculated the time required, the costs, and the personnel to be employed. He warned that the choice of producing several successive maps would in fact mean that only a basic topographic one was realistically going to be completed, which would in the final analysis prove to be inapplicable to needs as specific as the ones posed by a geological map. The typographic signs, the lines indicating altitudes, the notation for rivers and towns, were different in different maps, and it was better to do the work only once, by appropriate and successive modification of the same printing stones, instead of hoping that parliament would finance new surveying activities for any new social or industrial demand that might arise. He was thanked, and forgotten (MAIC 4194, 2, ff. 99v - 100r).

The fifth session, on September 20th, demonstrated clearly that Sella’s rhetoric and tactics could not be matched by his colleagues, especially when he was efficiently seconded by Gastaldi. At the end of a long and logically stringent intervention by Sella, punctuated by open rhetorical questions -Should the execution of the map be entrusted to individuals or to a well-organised body? Should this body be tightly organised, and composed of “directors and directed”? Which would be the tasks of the “directed” and which would be the “directors’s”? Should the “directed” be free agents or State employees? - it was Gastaldi who produced all the answers, duly written down and articulated under several headings. “The key proposal is that the personnel in charge of the execution of the geological map should be attached to the Corps of Mining

Engineers” (MAIC 4194, 2, f. 102r -102v). “Should they be employees or free agents?” Pareto asked. The commission, unanimously, decided their status as employees.

It was at this point that Sella laid down the law (or at least he tried), as Cocchi was to say a few days later. The open questions became well argued answers, and Gastaldi stepped back into his supporting role:

“Mr. Sella seconds Gastaldi’s proposal. The attachment to the Corps of Mining Engineers of the geologists employed could be sustained at first on technical grounds. The current organisation of the Mining Corps, as it exists in Piedmont, Lombardy, and parts of Emilia, already contemplates scientific tasks not only similar, but indeed identical to the ones performed by geologists. It is this category [of employees] that conducts all the studies on the nature and structure of mines. Once the map is executed, it will require maintenance in order to keep it abreast of new discoveries and of the constant advances in the science, and this requires a permanent commission. The Mining Corps is therefore the natural agent for the execution and maintenance of the map. Geologists dedicated to the collection [of data] could not take care of its technical, industrial, and agricultural features, the very ones the Government takes particular care in. We are therefore looking for geological engineers who are at the same time mining engineers, that is, geologists, as well as mathematicians, chemists, and, mineralogists. He [Sella] then moves on to consider the administrative reasons [to defend the proposal]. The geologists employed must inevitably enjoy future perspectives, career advancements, etc. The operator today apt to geological work may tomorrow become unfit, and we must provide some form of employment. A corps organised as the corps of mining engineers, to which geologists will be integrated, is one that can offer the greatest variety of advancement and of possibilities of changing activity. He then concludes by mentioning the political reasons, namely that the government does not like new bureaucratic structures impinging upon the State budget. The Minister would perhaps hesitate before proposing to Parliament the reasons in favour of the constitution of a new body of

employees, whereas the expansion of the Council of Mines is a measure already agreed upon. Lastly, in the event that a financial crisis should impose a reduction of expenses to the powers of the state, Mr. Sella [...] recalls the experience proving that purely scientific establishments are the first to be targeted” (MAIC 4194, 2, ff. 102v-103v).

For different reasons, Costa, Capellini and Curioni each opposed the proposal which, it should be pointed out, closely resembled Giordano’s October 19th, 1860, report to the MAIC Minister. Capellini, as hinted above, hoped to be the geologist in charge of the survey, an ambition he could not, for obvious reasons, reveal. He thus stressed that the need for a permanent commission to update and improve the map already provided stable career prospects for the geologists there employed. He also added that mining engineers were indeed quite capable of taking care of practicalities, but they were perhaps less sensitive to scientific issues. Curioni agreed with Capellini. He, too, defended the superiority of the geologist over the engineer, whereas Costa found that the political reasons put forward by Sella were the only ones he found convincing. Omboni hesitated. No sufficient attention had been paid to the long-term consequences of this decision. Stoppani asked whether a secret ballot was not appropriate in view of the sharp divisions that had emerged. This was denied and an open vote carried Sella’s proposal 8 to 5 (MAIC 4194, 2, f. 104r).

There is no record of any intervention by Cocchi, who, after all, was not in sharp disagreement with the idea put forward by Sella of a strong body of surveying staff centrally organised. Furthermore, his animosity towards Capellini meant he would have delighted in seeing the arrogant young colleague’s ambition curbed. Savi was away that day, and the following one. His dislike for mining engineers would probably have erupted, had he been present.

The decision made on September 20th, though substantially watered down by Capellini and the geologists as described below in the final recommendations to

the Minister, would weigh heavily on the entire history of the geological survey of Italy. Mining engineers systematically boycotted academic geologists when the latter took over the survey from December 1867 to June 1873, whereas the geologists waged a sparse but bitter war against their rivals, when the Corps of Mining Engineers was finally put in charge of the survey from 1873 through the first two decades of the twentieth century.

Geologists and engineers

The key battle won Sella must have thought the time was ripe for concessions and compromise. The Council of Mines, supervising and directing the section of the Corps of Mining Engineers in charge of the actual survey, would be split into two sections: one for Industry, the other for Geology. The latter would be composed of ministerial appointees as well as “extraordinary members” taken from the constituency of provincial academic or amateur geologists. The end of the fifth session and the whole of the sixth, on September 21st, were devoted to discussing the responsibilities of the Geological section within the Council of Mines. Geologists as a group or as individuals successfully worked to regain the lost ground. They negotiated that the Geological section would make the scientific and strategic decisions that would be implemented by the mining engineers. This, in spite of Gastaldi who argued that the survey should first start, under the responsibility of the Corps of Mining Engineers, and only afterwards would the Geological section of the Council of Mines intervene to evaluate and sanction norms and choices already tested on the field. Geologists also stipulated that “free operators”, that is, professional or academic geologists, should be asked to perform surveying activities, and be paid for them. Cocchi secured the establishment of a paleontological journal to accompany and publicise the progress of the survey, and his often-repeated proposal for a central collection was unanimously upheld. Gastaldi, himself, argued in favour of a central library of national and international publications, maps and manuscripts to be attached to the central collection (MAIC 4194, 2,

ff. 107-114). Cocchi was delighted, wrongly assuming that these treasures would most probably fall into his own hands.

Little skirmishes broke out again when Savi intervened to suggest points of detail, some of which were adopted, and others opposed, mainly by Capellini. Further discussion arose concerning the recruitment of the operators to be employed by the Corps of Mining Engineers in the surveying campaigns. This was a point of great contention throughout the 1920s, since the Corps successfully prevented geologists graduating in natural science faculties from joining the survey, whereas the eighth session of the Giunta, on September 23rd, stipulated that graduates from both mathematical and natural history faculties (in this order) were eligible (MAIC 4194, 2, f. 111r). On the same day, geologists also established that field operators could be directly supervised by an ordinary (that is, Ministerial staff) or by an extraordinary member of the Geological Section of the Council of Mines, whenever a region presenting particular difficulties of interpretation from a scientific point of view was going to be surveyed. In other words, the surveying personnel was indeed attached to the Corps of Mining Engineers, but priorities, scientific orientation, norms and rules, as well as actual field supervision were the responsibility of the members of the council, including its academic and amateur geologists. It was at this point that Pareto put to the vote the apparently non-contentious proposal concerning the creation of the position of “Administrative Director General”, answering to the Council, and executing its orders. This was unanimously approved, though it was clear from the formulation of the proposal that the Director General had no autonomous role to play at all (MAIC 4194, 2, f. 111r).

The Giunta met again on September 24th for the third public session, where Sella painted a grim picture of the general situation. Mining engineers were in great demand, mines were abandoned for chronic scarcity of fuel, and no chief mining workers or foundrymen were to be found. He argued for continuing the practice of sending young engineers abroad for training, and for industrial schools to be immediately instituted to prepare foremen to act as intermediaries between the engineers and the workforce (MAIC 4194, 2, ff.

113r - 113v).

The final sessions were devoted to points of detail and self-congratulatory speeches, while the Giunta waited for Capellini to write his final report. Duly approved on September 28th, the day of the twelfth and final session, the report was printed in 1.400 copies, and distributed in November among members of the Upper and Lower Houses (MAIC 4194, 2, f. 168r - 168v). The minutes very laconically state that “a few corrections were introduced”. However, the printed report sharply contradicts the minutes, or at least the first part of them, in the sense that the greatest emphasis is placed on the role of the Geological Section of the Council of Mines discussed during the last sessions. Whereas Sella and Gastaldi had placed the burden and the honour of the survey on the Corps of Mining Engineers, the final report devoted 15 articles to outlining the powers of the Geological Section, accorded the impressive title of “High Council Geologico-Mineralogical”. In other words, the decisions made during the last sessions concerning the role and powers of the geologists attached as extraordinary members to the Geological Section informed the entire document and the concrete proposals that were put forward. The 15th article, described the role of the Director general as: “subject to the High Council, whose orders he will execute” (MAIC 1494, 2, ff. 156-158).

A very short, final section of the report, consisted of two articles devoted to the “geologist-operators”. The first article specifies that geologist-operators would have to be graduates from natural history faculties or mathematics. The order in which this requirement was spelled out is in itself evidence of the geologists’ come back. The second article explained that geologist-operators would be attached to the Corps of Mining Engineers, where they would be devoted exclusively to geological work. In other words, they could not be applied to core mining, industrial, or administrative duties, as Giordano had suggested in 1860, and Sella had argued during the Giunta’s sessions (MAIC, 4194, 2, f. 158v; f.166r - 167r, Cocchi to Minister MAIC, October 17th, 1861 ; f.

172 r - 172v, Capellini to Minister MAIC, October 31st, 1861). The minutes bear no trace of the reactions of Sella and Gastaldi. It is legitimate to assume that they were initially satisfied that the central role of the Corps of Mining Engineers in the geological survey of the Kingdom had been inscribed in the recommendations. Furthermore, as events showed, Sella and the Minister had already decided on the path to follow. The shrewd Piedmontese mineralogist knew how to win the ear of the ambitious Sicilian politician.

The politics of natural resources

As early as September 24th, Cocchi had drawn his own conclusions. In a letter to Meneghini, who still proposed to arrive with his bride at the beginning of October, he writes:

“[I am waiting for you], though you will find the commission done with and dissolved after its sessions close next week. You did not come, Savi was often absent, and Spada came only today. The good School was thus in a minority position, let’s say it, and had the law laid down. She defended herself, though, and at times she won the day. All in all, things turned out better than it was feared. It should also be said that the project was so easy to formulate that it could have been drawn up by sitting for half an hour at a table, putting into practice the: *ne faites pas ce que nous avons fait, ayez votre* Geological Survey. The agreements I was telling you about could not be implemented. Capellini and Pareto run the game: the majority was made minority by the absences. I do not understand how you are still thinking of doing something in October, in spite of what I told you. The need to comply with the decree, and the economic interest of all [the members of the Giunta] mean they have to go home. That’s enough. You will see for yourself how far you have deluded yourself” (Meneghini Correspondence, Cocchi to Meneghini, September 24th, 1861).

Cocchi could not understand why his teachers had chosen to keep such a low profile in the affair. The historian can and must advance some explanation. It is possible that Savi and Meneghini considered the Giunta a rhetorical exercise,

in view of the lack of topographic maps on which to draw strata and rocks. It is, however, more likely that they did not wish to be associated with a State, that is, Piedmontese, undertaking while the reform of the legislation concerning mines was still pending. Were the Piedmontese to impose their legislation on the newly annexed territories? Tuscan moderate politicians and agrarian interests (the two categories often coincided) were determined to oppose the Piedmontese rule that allowed the State to grant concessions of exploitation to third parties in cases where the landowner could not or would not undertake the work by himself. Pilla, Meneghini's predecessor, had been isolated and victimised for upholding the principle of intervention in mining affairs when the superior interests of the State were at stake (Corsi 2001, pp. 906-908; Mori 1976). Meneghini probably decided to take full advantage of his marriage in Padua to repeat to his naive pupil that he would come "when things were over." Savi attended some of the sessions, though his proposals were vague and unconvincing, if not positively dilatory. Moreover, he limited his presence strictly to the sessions, going back to Pisa when the meetings were over. He did not stay or socialise with his Piedmontese and Italian colleagues (Sella in particular). He did not even greet the Minister, when he visited the Exhibition in Florence, and the Giunta in session. Savi made it clear to Felice Giordano, who was in charge of preparatory diplomatic work with a view to the harmonisation of mining legislation, that Tuscan interests would not bend. In the end, Piedmontese politicians thought the price of an open conflict too high. They gave in to the Tuscan demand that national legislation accorded the full right of property to the landowner, *usque ad infera*, down to hell, as the landed aristocracy pretended (Savi and Meneghini, 1861, pp. 137-186, 120-133). Cocchi, a lover of modernisation and of French and British mines, was in favour of a mild form of the Piedmontese right of interference, which might provide further explanation for the lukewarm reception his proposals received from his Pisa mentors. A geological map on a large scale - that is, not as a local test of geological theories, but as systematic survey of mineral potentials - could have opened the door, and the floor of Parliament, to talks of attracting foreign

investments, increasing the industrial output of the country, and acknowledging the growth of the industrial interests and classes. The well organised, rural world of agrarian Tuscany was in great danger. Finally, it is worth recalling that Meneghini and Savi did not support Cocchi to the best of their abilities when the latter was fighting for a chair in Florence, although personal relations remained excellent. Like Pilla before him, Cocchi was the object of criticism and suspicion about his political and social loyalties because of his mining heresies (Corsi 2001).

Cocchi did not understand his Piedmontese colleagues either. He could not know, and the historian with him, how far Sella, who was joining the ranks of the top guns of the Piedmontese political elites, was speaking for himself, or on behalf of the Minister. Documents found and examined to date do not support the hypothesis that Sella's manoeuvring intended from the beginning of the sessions the finalities it achieved. The composition of the Giunta was not, on paper, in favour of Piedmontese interests, which did not fully achieve their goals anyway. As I have demonstrated, some preliminary agreement was sought from both sides. Though a determined opposition from the Tuscan school might not have gained the day, it would have advised the postponement of divisive decisions. This was a time when the new Kingdom had to show unity and unanimous willingness to work together for Italy, rather than for a Savoy king, as was perhaps the case.

Yet, Sella's active and determined participation in the fifteen-day long Giunta, indeed his arrival in Florence several days ahead of the first meeting, as well as his preliminary negotiations with Cocchi and the geologists already in town, should hardly be reduced to a chronological or tactical detail. Twenty days or more were - and are - a long time in the life of a rising star of politics. It would be fascinating to speculate that Sella was given the mission of taking the helm of the project of the geological map of Italy by the Minister himself. And, that it should be entrusted to the Corps of Mining Engineers, for the reasons he declared during the public session in which he talked about the poor state of

mining and related industries: lack of fuel and personnel. It was important to pursue geological investigations in order to find new energy and mineral resources and to train new mining engineers capable of taking care of a huge country, almost unknown, and in need of everything: roads and railways, energy resources and industrial infrastructures.

Redressing the balance: Sella's geological politics

It is no speculation to acknowledge that Sella quickly took over the entire project, as he had attempted to take over the sessions of the Giunta. One day before the closing of the sessions he was put in charge of dispensing the money to reimburse participants for their travel expenses. The fact was announced by Cordova personally on September 27th (MAIC 4194, 2, f. 152r ; MAIC 4194, Accounting, September 27th, 1861), clearly an indication that an agreement had been struck with the Minister. Capellini, a rising star of inflated expense accounts and multiple reimbursements, complained that he received only the equivalent of a return ticket from Bologna, whereas he had come on purpose from a much greater distance, though he kept writing to Sella that he was used to working for the glory of the country at his own expense (Fondazione Sella, Sella Correspondence, Capellini to Sella, November 12th, 1861). As previously discussed, there is no evidence of Sella's involvement in the events leading to the July 28th decree instituting the Giunta. His letter of acceptance is courteous but formal, and does not indicate any intelligence between the Minister and the newly elected Member of Parliament (MAIC 4194, 1, ff. 39r-39v). His involvement in MAIC affairs, however, had grown dramatically during the summer. On August 27th a Royal Decree appointed Sella a member of the Council of Mines, and his cooperation with Cordova intensified, including matters concerning the reform of agricultural agencies in Naples, the exploitation of sulphur mines in Sicily, and the evaluation of the mineral potential of the new Kingdom (Fondazione Sella, Sella Correspondence, folder "Ministero di Agricoltura, Industria e Commercio" and folder "Cordova Filippo"). More importantly, on November 1st, Sella was asked to undertake an

exploratory mission to the major European capitals and report on the best systems adopted to carry out national geological surveys (MAIC 4194, 2, ff. 176r-177r). On November 2nd, with a letter of introduction from Cordova to the Italian ambassadors posted in several European capitals in his pocket, Sella was already on his way to Paris. He returned to Turin at the end of the month, after having visited London, Brussels, Liège, Bonn, Berlin, Prague, and Vienna. The one day interval between the Ministerial letter and the actual departure clearly indicates that the project had been decided upon some time in advance. Indeed, an October 18th decree authorizing the reimbursement of the considerable sum of 3.720 liras to Sella, “for the mission confided to him, to acquire documents for the new Geological Map of the State” might indicate that he was being advanced the money for the trip, and the maps and books he acquired in the various capitals he visited (MAIC 4194, Accounting, Decree December 18th, 1861). By December 8th he had already written a long and detailed report (wrongly dated “October 8th”) addressed to Cordova on the geological surveys of France, the United Kingdom, Austria, Belgium, Prussia, and Switzerland, which included letters from Thomas Sterry Hunt (1826-1892) on the Canadian survey, and from James D. Dana (1813-1895) on the American one. The fact that Hunt’s letter was dated September 5th, and the one from Dana September 16th (Dana kindly informs us that Sella’s request of information on the US Survey was dated August 14th), reinforce the hypothesis that Sella had gone to Florence intending to take over the project. However, it should be mentioned that Cocchi too, had taken authoritative advice, and read to the meeting (not without some opposition) a letter from R.I. Murchison. Moreover, as we have seen, Cocchi kept quoting unspecified French colleagues advising the Giunta to follow the British model.

The December 8th report was Sella at his best. He drew tables listing salaries of directors and janitors, the cost of the survey per square mile, the profits to be expected from the sale of maps, and the cost of museums and laboratories down to the penny. He could have done better, he wrote modestly to Cordova,

but Parliamentary discussion of the 1862 State budget was pending, and he did not want to prevent MAIC from calculating and subsequently demanding, what was necessary in order to start the great national geological survey. It is worth pointing out that his final recommendations to the Minister constituted a detailed and explicit criticism of the official, printed report of the Giunta (Esposizione, pp. 14-43; Sella 1887).

Sella acknowledged that the expense to be incurred was heavy. He calculated 40 lire per square kilometre, for a total of 12 million to cover the 315.000 square kilometres of the new Kingdom. Contrary to decisions he would make a few months later, as Minister of Finances, he argued that budgetary considerations should not take precedence. “The map has to be done” (Esposizione, p. 36). A good geological map was indeed the pre-condition for economic growth and the infrastructure investments the country so desperately needed. Moreover, the bulk of the expense was not to be incurred immediately. Indeed, a decision to act promptly was required, in order to train the surveying personnel and a good chemist for mineral analysis; and to begin to lay out the relevant collections. It would have taken a few years to be ready to start with the actual surveying.

Sella presented the deliberations of the Giunta in the order of the minutes, rather than in the order of the final report. The first point he emphasised was the decision to recruit geological personnel exclusively devoted to surveying activities and attached to the Corps of Mining Engineers. The wording of the Giunta report was adapted to support the view that recently recruited mining engineers were already well trained to do geological work, and could afterwards be employed in mining districts or in other activities within the range of competencies of the MAIC, such as irrigation, agriculture, mechanical, and chemical industries. This point had also loomed large in Giordano’s 1860 memo to Minister Corsi. The last proviso openly contradicted the report, which stipulated that surveying engineers could never be applied to activities others than geology. The majority of members of the Giunta had probably thought that there was a danger of the survey personnel being diverted to other duties.

This did in fact happen, on a large and embarrassing scale, when the Corps of Mining Engineers took over the survey in 1873. The young engineers (they had to be young to do surveying work, Sella wisely specified) should be sent for training to the École des Mines in Paris and then to the Geological Survey of the United Kingdom. Sella was happy to report that senior staff at the Survey assured him that the Italian engineers would be treated as ordinary staff, so that they could come back fully trained, and ready for action (Esposizione, p. 37).

Sella diplomatically but firmly criticised the Giunta proposal to put a section of the Council of Mines in charge of operations. He had occasion to discuss this form of organisation with Elie de Beaumont, Lyell, Murchison, Andrew Crombie Ramsay (1814-1891), and Foetterle. These and other luminaries of that calibre all suggested that the survey should be under the directorship of a single person, who would be directly responsible to the Minister. Yet, always a good politician, Sella insisted that the proposal of the Giunta could be put to good use, thus introducing a novelty with respect to the systems followed in other countries. The Minister could convene a meeting of the Council of Mines once a year, to which eminent geologists from all over Italy could be invited, as extraordinary members of the Council. The work of the year could be presented and discussed, the Council could express its advice, and the Minister could even ask the Council to undertake specific tasks. Ever a perfect administrator, Sella suggested an “adequate reimbursement” for the geologists attending the yearly session of the Council, though he hastened to add that a limit to the duration of such meetings should be established, in order to avoid excessive expenses (Esposizione, pp. 37-38).

The Giunta report had insisted that surveying activities, paleontological studies or general geological work undertaken in the plurality of Italian scientific centres (a diplomatic way of referring to the scientific activities carried on in the capitals and university towns of pre-unity States) or by single individuals should be integrated into the project of a national geological map, and that

such contributions should be duly paid. Once again, members of the Giunta thought it wise to make provisions for their own futures, and worried that a national survey would dry up even the scarce local resources many of them had counted on for their work. The idea was excellent, Sella remarked, on condition that such studies were commissioned by the Minister himself and followed strictly the criteria established for the national survey. More aptly, the principle could be applied to the determination of fossils. Paleontology had specialised to such an extent, that staff of the survey would do best to send fossils to the various specialists, instead of trying to undertake the work themselves. It is revealing that Sella, the mineralogist, worried that the survey should have a full time chemist, but not a full time palaeontologist on its staff (Esposizione, pp. 38-39).

Sella further proposed that the working topographic tablets used by Army General Staff cartographers, at the scale of 1/10.000, should be photographed and handed over to surveying staff for their field work. These would serve as the basis for the geological map the scale of which, Sella concurred with the Giunta, should not be smaller than 1/50.000. He also argued that the conservation of lithographic stones, the need for collections, books and working spaces implied the creation of a central office, to which a chemical laboratory should be added (Esposizione, p. 39). Writing in the optics of a Piedemontese scientist and politician, Sella naturally considered Turin the capital of the new Kingdom (which indeed it still was) and took for granted that the central office for the national geological survey should be constituted there. In a footnote to the detailed budget he produced at the end of his report to the Minister, Sella suggested that rooms available at the School of Engineers at the Valentino Castle, in Turin, could be adapted to the needs of the central geological office with little expense (Esposizione, p. 42).

Sella's report provides further confirmation of the hypothesis regarding Cordova's personal, and indeed determined, interest in geology and in geological maps in particular. "Your Excellency has repeatedly expressed the wish that a geological map of Italy at the scale of 1/500.000 should be

immediately published” (Esposizione, p. 39). Collegno’s map was universally considered outdated, and no one would deny the utility of a new summary and overview of scientific advances achieved during the preceding twenty years. Yet, Sella warned, such a map should be understood not as the result of the activities of the national geological survey, but as the work of private and academic geologists. It should be clearly and unambiguously stated that the general map was simply presenting the results of previous geological studies, for which the central geological office could take no responsibility, or endorse in any way. “If the Ufficio expressed itself with a map on a small scale, given as its own, containing an immense assemblage of facts still to be duly examined, it would be easy to impair the progress of Italian geology for some decades”. Not that such a map should not be undertaken, but it should be published, “as a map of mere compilation based on the work of MM. A., B., C., etc.” (Esposizione, pp. 39-40). Sella was not simply expressing the traditional dislike of the mineralogist for academic geology. He was afraid that the publication of a map on a small scale would open the door to the introduction of the French system, based on the general map published by Elie de Beaumont and Dufrenoy. Produced on a relatively small scale, this system left to the individual Departments the task of publishing the detailed map of their territory. This choice proved disastrous, Sella argued in his conclusions, since it gave birth to a chaotic series of local maps that followed different criteria, standards and aims. Before long, he predicted, French colleagues would have to start again, from scraps (Esposizione, p. 36). Sella was probably worried that once a general geological overview of the peninsula was published, there might be a strong temptation to postpone further expenditure at national level. This would give a new lease of life to local geological traditions and actors for whom he had neither sympathy nor respect.

Sella’s report ended with the draft of a Royal decree, which summed up his proposals and his biased re-writing of the conclusions of the Giunta report. Article 1 establishes the principle of publishing a geological map of the

Kingdom at the scale of 1/50.000, whereas a map summing up recent work on a scale of 1/500.000 would soon to be made available, as the Minister wished. Article 2 sanctions the central role of the Corps of Mining Engineers in the project, under the “high direction” of the Council of Mines. Articles 3 and 4 specify the advisory functions attributed to the Council and the geologists coming from all the provinces of the Kingdom as extraordinary members for a maximum of six years each. Article 5, not surprisingly the longest of all (in the official published version, it would be split into two separate articles), institutes the position of Director general, reserved for an Inspector of Mines. The Director would answer to the Minister, though he would also comply with the suggestions of the Council. He would be responsible for a central office for the colouring and publication of maps, a chemical laboratory, a collection of fossils, minerals and rocks, and a library. Articles 7 and 8 are devoted to the composition of the surveying staff. In all, the corps of Mining Engineers would recruit 13 new officers, that is, it would almost double its ranks. In a footnote, Sella explained that he was not proposing to hire the lot immediately, but indicating only the basic structural needs. For the moment, it would be wiser to send young aspiring engineers abroad, in order to be in a position to choose the best in the coming years (Esposizione, pp. 40-41).

The total annual expense would be 97.000 lire. 15.000 had already been allocated for the geological map of the central and northern regions of Italy, and 17.500 for the southern ones. Sella argued that Parliament should vote to increase the funds by only 65.000 lire, an “insignificant” amount “when compared to the enterprise at hand” (Esposizione, p. 42).

Sella’s Geological Survey: national science in Piedmontese style

Cordova’s staff had only proof edited Sella’s drafted decree, leaving out budgetary calculations and footnotes, when the Minister presented it to the King for his signature on December 12th, 1861 (MAIC 4194, 2, 196r-197r). The national geological survey of the Kingdom of Italy was thus officially created, and work could start to implement the decree. In a letter from Turin, dated

January 1st, 1862, Cordova offered Sella the position of Director General of the geological survey of Italy (MAIC 4194, 3, f. 198r). Sella accepted on January 5th, on condition that no salary should be attributed to him (as a member of Parliament, he could not accept any remuneration) and that he could choose with whom to work. “In truth, while Your Excellency is at the head of the Ministry of Agriculture, Industry and Commerce [...] I would not need to ask to be allowed to make proposals, since I well know that you have always accepted with great amiability my advice, but more particularly since you know by experience how a geological map is executed. But when the Ministry which you now direct, falls into other hands, I would be comforted in the difficult task you are asking me to take upon myself, if it were established that on all matters relating to the personnel of the geological map the Minister will hear the advice of the director, who will naturally leave to the Minister’s political wisdom to decide as he will deem it appropriate” (MAIC 4194, 3, ff. 201r - 202v, 205r, January 5th, 1862).

A first request concerned Bartolomeo Gastaldi, at the time Secretary to the School of Engineers in Turin. Sella explained that Gastaldi enjoyed his full confidence, was a very able geologist, and could be attached to the Corps of Mining Engineers at the same salary level. Furthermore, he well knew the Castle of the Valentino, where Sella proposed to create the central office of the geological survey of Italy. Gastaldi lived there, and indeed such privilege should be continued for the good of the service. On January 10th Cordova accepted Sella’s conditions, and solicited the latter’s proposals for the “Ufficio Centrale per la formazione della Carta Geologica del Regno”, which he received in the form of a long letter dated January 15th (MAIC 4194, 3, f. 203r, January 10th, 1862).

The newly appointed director detailed the personnel he wished to engage and his plan of action for the following two to three years. Sella’s love of precision and his care for the smallest detail offer a fascinating view of how he believed the geological survey of Italy should (and could) be organised. In hierarchical

fashion, the composition of the Council of Mines was the first point to be dealt with. The Council, then composed of della Marmora, Sismonda and Curioni, should be reinforced with a number of extraordinary members. Sella proposed: Pareto, Eugenio Sismonda (brother of Angelo), Scarabelli, Spada, Orsini, Savi, Meneghini, Scacchi, Costa, Guiscard, and Gemmellaro, who with the exception of the last two, were all “mature men”, and, representative of all the major geographical and former political divisions of the peninsula. It should not escape the attention of the reader that whereas the ordinary Council of Mines was composed of just three members, the advisory board envisaged by Sella counted fourteen members of different geological allegiances, who would have wasted more time in fighting each other than in providing unanimous, and therefore binding, instructions to the Director of the survey.

As far as the personnel attached to the survey were concerned, Sella reduced the staff originally foreseen from thirteen to eight, though, understandably, he insisted on the key role Gastaldi had to play in the project. Sella proposed that he should be promoted to Chief Engineer of the 2nd class, and assigned the role of deputy to the Director. “In my view, he should go immediately to London, so as to study as long as he will deem it appropriate the material structure of the central office at the Geological Survey, and take active part in all its operations, in order to be able to do the same over here. Upon his return, we could immediately undertake the execution of the small geological map on a scale of approximately 1/500.000”. A second post, mining engineer of the 1st class, was reserved for Antonio Stoppani, who had been appointed extraordinary professor of geology in Pavia, at a salary of 2450 lire per year only a few months earlier. Sella recommended that he too, despite his geological proficiency, should be sent to London in order to learn the language, and to take part in the surveying activities of the spring and summer campaigns. Once back in Italy, he could be put in charge of a section of the map. In view of Stoppani’s strenuous and fierce opposition to the “Ufficio Geologico” of mining engineers during the late 1870s and early 1880s, this choice might in retrospect seem surprising. Yet, Stoppani always kept very

good relations with Sella, and it will be argued elsewhere that towards the end of his life the senior politician tended to agree with the controversial “abbé” that the Corps of Mining Engineers had not performed particularly well on the geological front.

Two posts of mining engineers of the second class were also anticipated, but not assigned. A cryptic passage in the letter, referring to university professors as too expensive and too busy with their lectures to be able to concentrate on the survey, ends with the suggestion that they could be asked to perform special tasks. Thus, before appointing engineers of the second class, university professors could do some circumscribed but useful work. (Capellini, Galileo Guiscardi (1821-1885) and Gemmellaro were mentioned, but there is no word of Cocchi, either in this letter, or elsewhere in the correspondence of this year.) Of the two positions of engineers of the third class, one could be immediately filled by Camillo Ferrua, a young graduate of the Faculty of engineers in Turin, and the best chemist of his class at the École des mines of Paris (“Rivot told me that last November”). Ferrua should be sent to work for some time with Robert Wilhelm Bunsen (1811-1899), a friend of Sella (MAIC 4194, 3, ff. 204r - 210v, Sella to Cordova, January 15th, 1862; Quazza 1984, pp. 486-487; Louis-Edouard Rivot, 1820-1869).

Of the two positions of engineer in training, one should be allotted to Giacinto Berruti (1837-1904), a pupil of Sella and in later years his close collaborator, who should be sent immediately to London. The second position should be awarded to Alasia, now at the École des Mines in Paris, from where, after completing his second year, he would move to London. Three posts were thus free, two engineers of the second class, and one engineer of the third class. For these, national examinations should be held in Palermo, Naples, Pisa and Bologna, in order to guarantee a fair “representation” of the provinces of the Kingdom. Sella had no doubt that the enterprise should be firmly in Piedmontese hands, allowing only token concessions to the personnel active in the former, pre-unity States.

Finally, Sella suggested a complicated system of promotions and decorations, in order to avoid jealousies within the ranks of the Corps of Mining Engineers. For instance, he proposed that Giordano, then chief engineer of the first class, should be promoted to Inspector of Mines of the second class. Costantino Perazzi (a close collaborator of Sella) well known for his extreme interventionist views in mining matters, would not have liked to have Gastaldi above himself, so Sella suggested the prestigious decoration of the Order of SS. Maurizio and Lazzaro as an honourable compensation. Pellati, the future director of the Ufficio Geologico after the death of Giordano in 1892, could be promoted to engineer of the third class, to be on the same level as his contemporary, Alasia.

A letter from Sella dated January 19th, makes evident that Cordova accepted all the proposals, and agreed to ask the Minister of Public Education permission to occupy several rooms at the Valentino Castle, in Turin. This, too, was granted, and on January 21st 1862, “Professor Q. Sella [...], following today’s letter N. 1549 bureau 3d, is charged with the general Direction of the activities needed to realise the Geological Map of the Kingdom” (MAIC 4194, 3, f. 213r, Cordova to the Minister of Education). Some delay occurred before the final approval from the Ministry of Public Education allowed Gastaldi and Stoppani, as well as Sella himself (who was still, formally at least, Engineer of the Mining Corps and Professor of Mineralogy at the School of Engineers of Turin), to work at the survey. On February 14th, Sella was confidently anticipating the official decrees of nomination for all the staff, so as to start working on “this grandiose enterprise” (MAIC 4194, 3, f. 221r).

A few days later, Sella became Minister of Finances, despite rumours that he would get the MAIC, as Giordano had hoped. On March 4th, he unsuccessfully proposed that his colleague the MAIC Minister appoint Gastaldi at the head of the survey (MAIC 4194, 3, f. 222r).

This is the last letter in the archives covering the early history of the survey in which Sella appears to take an interest in the survey. Several documents

covering the years 1862 and 1863 apologetically accompany the transmission of notes of expenditures incurred in the refurbishment of the Valentino rooms allocated to the survey, the acquisition of books and bookshelves, collections, and office material. There had not even been time even to inform some of the younger prospective staff of the changes that had occurred in the “grandiose enterprise”. Writing from London on February 18th, 1863, Berruti asked for instructions. One year earlier, he related, he had been put at the disposal of F. Grabau, the engineer in charge of mineralogical and industrial exhibits at the London Exhibition of 1862 who had already worked with Sella on Elba Island. Berruti had been told to be ready to join the British Geological Survey and to learn their way of working. No further instruction had followed, not even a word. He had now met a British colleague, who had provided him with an introduction to senior staff at the Geological Survey, where he could work for eight months. On February 24th the Ministry gave its assent, and praised the young engineer for his spirit and initiative. In the MAIC archive, this is the last document relating to the totally neglected first of several attempts to get the geological survey of Italy started (MAIC 4194, 3, ff. 231r-232v, 234r).

Conclusions

In later years, official historians and chroniclers of the geological survey of Italy **refer** only to the December 12th founding decree, and the decision by Sella who, as Minister of Finances, postponed its implementation until better financial years. It was a noble act, some commented. Sella was asking for sacrifices from all the departments of the State, and he felt compelled to provide a good example. Giordano disagreed when he was under fire from Stoppani and academic geologists in the late 1870s. The time lost had weakened the position of the mining engineers, who were by then accused of having done too little in so much time. Sella’s sacrifice was a mean self-interested move, from someone who wanted to keep the job warm as insurance against the hazards of life at the top of the political ladder, Cocchi bitterly insisted in 1867 (Meneghini Correspondence, Cocchi to Meneghini, March 23rd,

1867). On the subject of Sella's behaviour, opinions may of course vary, and intentions are easy to impute, though difficult to prove. Further research will no doubt help to clarify Sella's actions. Thus, for instance, it may help to establish why Sella signed the notes of expenses of 1863 as "Director" of the geological survey, a point in favour of Cocchi's interpretation of his rival's behaviour. In the light of what is so far clear, Sella mistrusted academic geologists and their localism. He also suspected their lack of administrative skills, which would make a great deal of difference in an enterprise of that scale. In this, he was certainly right. None of the geologists or engineers who aspired to the direction of the Geological Survey ever bothered to understand the reasons why things were progressing more efficiently and accurately in England, Germany, Austria, the United States, and even France, after the reforms of the late 1860s. Capellini, who kept extensive international contacts and aspired to be in charge of the project, did not see why young geologists or engineers should be sent abroad for training. He could not understand this unpatriotic veneration for foreign geological agencies. The only exception that comes to mind is Luigi Baldacci (1850-1927), who had been trained at the Geological Survey. Yet, when he became Director of the Ufficio Geologico, much later in life, he kept a very low profile, did as he was told (not to bother authorities with geological maps) and never travelled outside the strictly defined missions to survey the new Italian colonies. He was well paid, indeed, but neither by the MAIC nor the Ufficio Geologico. Instead, he was paid either by the Ministry of Colonies or directly by the colonial administration.

Several features of the very early history of the geological survey of Italy must retain our attention, especially those which could characterise future developments. Already noted are the plurality of local traditions and local centres of scientific activities and pride. Until the 1930s, academic and amateur geologists temporarily appointed to take part in surveying activities, or to become members of the Comitato Geologico (the scientific, supervisory body instituted in 1867 and active until very recently) invariably privileged

local scientific or industrial interests, their universities, towns, or pupils. Local economic, symbolic or career priorities appear to characterise the action of pillars of the establishment as well as of vociferous reformers. The conflict between mining engineers and academic geologists has also been evoked. It characterises the slow and contentious progress of the Italian geological survey well into the 1930s, and it will be reconstructed in detail in later studies. A final element has emerged, for which a long-term perspective is required. This concerns the role and personal interest of politicians in the history of the Italian geological survey. When a politician personally concerned with geology, mining, the quest for natural resources or scientific agriculture, took an interest in the geological map, things moved fast: at times, as in the combined action by Cordova and Sella here reconstructed, extremely fast. When Cordova was back in power in June 1866 and during the early months of 1867, he eagerly followed Cocchi's suggestion to resume the "grandiose enterprise", and established the Comitato Geologico, despite Sella's warnings and lack of confidence in Cocchi. It was again Sella, acting in concert with Gastaldi and Axerio, who precipitated Cocchi's fall and the transfer of the entire operation from Florence to Rome, in 1873, where the geological survey of Italy barely survived until Giordano took over the operations, in 1876. Sella again supported the Ufficio Geologico at the Second international geological congress held in summer of 1881 in Bologna, when the honour of the service (and of the country, and perhaps even of Sella himself) was at stake. With Sella's death in 1884, the geological survey lost its domineering protector. Funds decreased year after year, and the MAIC, and other ministries who took over the administrative and scientific responsibility of the enterprise, lost interest in, or paid very little attention to, the geological map of Italy. This continued until new political figures took a personal interest in the matter, during the 1900s, the 1920s, and after the Second World War, during the 1960s. Yet, in the bitter words of one of the last Presidents of the Comitato Geologico (Martinis 1985), in spite of luminous exceptions (like the map of the Apuane Alps executed by Domenico Zaccagna at the end of the nineteenth-century) results are, and have

been mixed, slow to come, uneven, and often the product of individual or institutional pride, rather than of any sustained financial support from succeeding governments and Parliaments, right or left of the political spectrum. Scientific and technological developments have rarely concerned either Italy's mainly agrarian and provincial nineteenth-century leadership, scarcely capable of drawing plans for the whole of the country and its future, or the State-financed industrial groups and scientifically illiterate politicians of the twentieth century. Geology was not and is not an exception.

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Atti III: *Atti della terza riunione degli scienziati italiani tenuta in Firenze nel settembre del 1841*, Firenze, Coi Tipi della Galileiana, 1841.

Atti IV: *Atti della quarta riunione degli scienziati italiani tenuta in Padova nel settembre del 1842*, Padova, co' tipi del Seminario, 1843.

Atti V: *Atti della quinta riunione degli scienziati italiani, tenuta in Lucca nel settembre del 1843*, Lucca, Tipografia Giusti, 1844.

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