

Nel nome di Lazzaro

Saggi di storia della scienza e delle istituzioni scientifiche
tra il XVII e il XVIII secolo

a cura di

CENTRO STUDI LAZZARO SPALLANZANI

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AN UNCOMFORTABLE, YET WONDERFUL JOURNEY
ANTONIO VALLISNERI AND HIS EXPLORATION OF THE NORTHERN APENNINES

FRANCESCO LUZZINI

In the cold January of 1705, the great naturalist and former Holy Roman Empire officer Luigi Ferdinando Marsili (1658-1730) received a letter from Antonio Vallisneri (1661-1730), a brilliant physician and proud lecturer at the University of Padua. The message declared a steady admiration for the nobleman's «uncommon knowledge».¹ And indeed Vallisneri's esteem for his correspondent was not a secret: he considered Marsili a mentor in those fields of natural philosophy devoted to the study of rocks, minerals, fossils, mines, and of many other topics related to the Earth sciences.²

But there was something else in the letter, something worth attention. A somehow peculiar, specialized question. And from the zealous tone of the message, the sender was in urgent need of an answer. He asked Marsili for precise information on the water in mines:

[...] in this [subject] I know there is no man who can enlighten me more than Your Lordship [...], in fact you had the opportunity to satisfy your hunger for sure information in the wealthy mines of Hungary [...]. I therefore beg you for the time being to make me know if you have observed in all the mines some streams or springs, and if you believe that all the springs come from rain, or snow, or both from these and from the sea. I don't expect Your Lordship to prove your opinion. Just briefly say *yes* or *no*, and this will be enough for me to support a great argument I am working on.³

Vallisneri's letter was the consequence of an investigation which dated back to 1700, when he became professor at the University of Padua and began to be deeply involved

¹ ANTONIO VALLISNERI, *Epistolario*, vol. I (1679-1710), edited by Dario Generali, Milan, Franco Angeli 1991, p. 282.

² See DARIO GENERALI, *Antonio Vallisneri. Gli anni della formazione e le prime ricerche*, Florence, Olschki 2007, pp. 351-360; FRANCESCO LUZZINI, *Il miracolo inutile. Antonio Vallisneri e le scienze della Terra in Europa tra XVII e XVIII secolo*, Florence, Olschki 2013, pp. 89-90; EZIO VACCARI, *Antonio Vallisneri, Luigi Ferdinando Marsili e la «struttura de' monti»*, in *Antonio Vallisneri. La figura, il contesto, le immagini storiografiche*, edited by Dario Generali, Florence, Olschki 2008, pp. 391-432.

³ «[...] in questo io so che non v'è alcuno che possa darmi lumi maggiori di V.S. Ill.ma [...], avendo ella avuta tutta la commodità di saziare la sua degna fame di sicure notizie nelle miniere ricchissime dell'Ungheria [...]. La supplico dunque per ora a favorirmi di due notizie, se in tutte le miniere ha osservata acqua perenne, o fonti, la seconda, se crede che tutti i fonti vengano dall'acque piovane, o nevi, o parte da queste, parte dal mare. Né pretendo già che V.S. Ill.ma mi provi quanto scrive, ma solo brevemente dica, o il sì o il no, che a me basterà per un grande argomento» (A. VALLISNERI, *Epistolario*, vol. I, cit., p. 282).

in the European debate on the origin of fresh water. The dominant theory in those years, which derived from the Cartesian assumption of *alembics*, considered springs as originating from seawater after a process of filtration through rock strata. Nevertheless Vallisneri disagreed. The data he collected on the field persuaded him that all the fresh water came from rain or from the melting of snow and glaciers on the mountains.⁴ And to prove his theory by experimental means, he performed various journeys in the Apennines: the most important of which was the one he made in the summer of 1704, when he left the first hills south to Reggio Emilia and reached the Tuscan (and his native) region of Garfagnana.

It was exactly this last experience that convinced him to ask for Marsili's advice, hoping that the nobleman's eminent testimony would confirm his theory. Ironically, Marsili's judgement leaned toward the thesis of a compound origin of fresh water, for he was in part a supporter of the *alembics*. But this hitch didn't prevent the Paduan professor from publishing, in 1715, his *Lezione Accademica intorno all'Origine delle Fontane (Academic Lecture on the Origin of Springs)*,⁵ where he confuted the existence of filtering devices to convert salt water into fresh water.

The great relevance of this journey, anyway, did not only reside in springs and creeks. Many other geological phenomena were studied during this adventure, which proved to be a key experience for Vallisneri's research in the field of the Earth sciences. In 1705 he wrote a meticulous report of it in Latin, the *Primi itineris specimen Physico-Medicum*.⁶ And such was his high regard for this document, that he sent a copy of it to

⁴ On this topic, see F. LUZZINI, *Il miracolo inutile...*, cit., pp. 69-159; ID., *La Tana che urla: cenni di speleologia vallisneriana*, in Antonio Vallisneri. *La figura, il contesto, le immagini storiografiche*, cit., pp. 349-369; ID., *Cavità naturali ed artificiali in Garfagnana e Lunigiana. Le esplorazioni di Antonio Vallisneri*, in Antonio Vallisneri *dalla Garfagnana alla Scienza*, Lucca, Maria Pacini Fazzi Editore 2010, pp. 93-124; ID., *Matrices, not seeds. Vallisneri's research on mines: between empiricism and philosophy*, in *History of Research in Mineral Resources*, edited by José Eugenio Ortiz, Octavio Puche, Isabel Rábano and Luis Mazadiego, Madrid, Instituto Geológico y Minero de España, Cuadernos, del Musero Geominero, 13, 2011, pp. 105-112; ID., *Multa curiosa. Vallisneri's early studies on Earth sciences*, «Nuncius», XXVI, n. 2, 2011, pp. 334-354; ID., *Contro i lambicchi. Antonio Vallisneri e l'origine delle sorgenti*, «Acque Sotterranee», Italian Journal of Groundwater, n. 1, June 2012, pp. 81-82.

⁵ A. VALLISNERI, *Lezione Accademica intorno all'Origine delle Fontane, colle Annotazioni per chiarezza maggiore della medesima, di Antonio Vallisneri, Pubblico Primario Professore di Medicina Teorica, e Presidente nell'Università di Padova. A Sua Eccellenza il Sig. Generale Co. Luigi-Ferdinando Marsilli*, Venezia, Appresso Gio. Gabbriello Ertz 1715.

⁶ ID., *Primi itineris per Montes specimen Physico-Medicum...*, manuscript, Archivio di Stato di Reggio Emilia, Archivio Vallisneri, 10, Scritti, minute e appunti scientifici e letterari d'Antonio Vallisneri sr., mazzo IV. See F. LUZZINI, *Il miracolo inutile...*, cit., pp. 90-107. A previous study of Vallisneri's journey was performed by FRANCESCO RODOLICO, *L'esplorazione naturalistica dell'Appennino*, Florence, Le Monnier, 1963, pp. 103-104, 122-123, 141, 373-374, Map A. On the exploration of the Apennines in the Early Modern Age, see ROSA MARIA MANARI, *Viabilità antica nella storia del crinale appenninico. Percorsi e vie nell'alto Secchia con riferimenti a Lunigiana e Garfagnana*, Reggio Emilia, Antiche Porte, 2002; *La regione e l'Europa: viaggi e viaggiatori emiliani e romagnoli nel Settecento*, edited by Elvio Guagnini, Bologna, Il Mulino 1986; *Antonio Vallisneri – Viaggi in Garfagnana*, edited by the Circolo Culturale Garfagnana, Castelnuovo di Garfagnana, Tipografia A. Rosa 2000; F. RODOLICO, *La Toscana descritta dai naturalisti del Settecento: pagine di storia del pensiero scientifico*, Florence, Le Monnier 1945.

the Royal Society, eager that it could find a place in the prestigious pages of the «Philosophical Transactions». Alas, this honor was not granted to the piece, which remained unpublished. Only two decades later a synthesis in Italian was published in two parts, called ‘Extracts’ – *Estratto d’alcune Notizie intorno alla Provincia della Garfagnana* and *Continuazione dell’Estratto*, in 1722 and in 1726 – in the «Supplementi al Giornale de’ Letterati d’Italia».⁷ As to the original manuscript, it was considered lost until 2009, when Dario Generali and I were lucky enough to find it in the State Archive of Reggio Emilia, in an almost perfect – though ferociously reworked – condition (Fig. 1). This precious text, along with the two *Estratti*, provided such a huge amount of information that it was possible to recreate Vallisneri’s itinerary at a level rarely achieved, and hoped, in the history of naturalistic explorations in Early Modern Italy, and it led me to perform the same journey from Scandiano to Garfagnana, in June 2010.⁸ Furthermore, through this experience I was able to detect and analyze a great part of the many geological phenomena described in the *Primi itineris specimen* and in the *Estratti*.

Vallisneri’s path (Figs. 2, 3) runs roughly from north-northeast to south-southwest, stretching for a total distance of about 130 kilometres. It departs from the hills south to Reggio Emilia and goes through the San Pellegrino Pass, reaching at last the western end of Garfagnana, the Apuan Alps («ultimos Alpium fines, quos *Panie* vocant», Fig. 5).⁹ The report is written in the form of a field guidebook: methodical descriptions are provided of the geological features observed from time to time at every stage. It is in Scandiano that we find the first reported observation, which focuses on the gypsum and sulphur veins on the Monte Gesso: a mountain located in the gypsum-sulphur formation that is typical of the northern borders of the Apennines. The sulphur mine can be found «west of it, about one mile» from the city.¹⁰ According to the manuscript, its

⁷ A. VALLISNERI, *Estratto d’alcune Notizie intorno alla Provincia della Garfagnana, cavate dal primo Viaggio Montano del Sig. Antonio Vallisneri... dal Sig. Dottore Giovanbatista Perrucchini, e da lui indirizzato in una Lettera al Sig. Lodovico Da Riva...*, «Supplementi al Giornale de’ Letterati d’Italia», 1722, II, Articolo VII, pp. 270-312; ID., *Continuazione dell’Estratto d’alcune Notizie intorno alla Garfagnana, cavate dal primo Viaggio Montano del Sig. Antonio Vallisneri...*, «Supplementi al Giornale de’ Letterati d’Italia», 1726, III, Articolo VIII, pp. 376-428. Though from the writing style it appears that these texts were composed by Vallisneri himself, the authorship of the *Estratti* was officially attributed to Giambattista Perrucchini, who presumably was one of his pupils, or even a false name. Vallisneri often adopted this strategy, in order to better defend himself against potential criticisms. See D. GENERALI, *Bibliografia delle Opere di Antonio Vallisneri*, Florence, Olschki 2004, pp. 155-156, 176-177; ID., *Antonio Vallisneri. Gli anni della formazione e le prime ricerche*, cit., pp. 383-412; F. LUZZINI, *Il miracolo inutile...*, cit., p. 91.

⁸ See at this regard F. LUZZINI, *Il miracolo inutile...*, cit., pp. 91-101; ID., *Nel gran libro della natura. Antonio Vallisneri e le scienze della Terra: il viaggio montano del 1704*, Catalogue of the exhibition (Reggio Emilia, January-March 2011), Introduction by Dario Generali, Graphics by Stefano Meloni, Reggio Emilia, Centro Studi Lazzaro Spallanzani, 2011. A sincere thanks to Luca Annoni and Nicolò Vegetti, who shared this historical and naturalistic (and gastronomic) adventure with me.

⁹ A. VALLISNERI, *Primi itineris specimen...*, cit.

¹⁰ «Verso occidente, un miglio in circa sopra Scandiano» (ID., *Estratto d’alcune Notizie intorno alla Provincia della Garfagnana...*, cit., p. 279). On this topic, see F. LUZZINI, *Il miracolo inutile...*, cit., pp. 71-

wealth is far from negligible. The single river carries enough sulphur to be used «by poor people» for the production of matches. The ore vein, then, is so abundant to satisfy all the near cities. Nor are the quarries small in size, being wide enough to let the work of two standing men «with their tools to carry out the extracted mineral». There are two pits «made by art»; they are interconnecting, in order to enable the required air passage.¹¹ And

It is worth of notice an observation made [by the author] on the alignment of pure sulphur layers, being them wedged in the mine's clay beyond the clods [with the mineral] that are found hither and yon in various sizes. The first [layers] are like trees with the tops and the branches tending down, and the more water seeps and drips from above, the more they flourish; which [data] more and more confirm that all the water in the mines, and in the springs, comes from rain and from melted snow.¹²

Once passed the sulphur mine, the path heads southwest and descends from the Monte Gesso towards the river Tresinaro.¹³ Vallisneri crosses it and reaches one of its small affluents, the Riazzone, where he notices and describes some specimens of mar-

74, 93-94; ID., *Matrices, not seeds...*, cit., pp. 105-106; ID., *Multa curiosa...*, cit., pp. 336-340. Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is a mineral usually found in evaporitic deposits, in association with sedimentary rocks. The gypsum-sulphur formation of the northern Apennines results from the Messinian salinity crisis occurred in the late Miocene epoch (between 5.95 and 5.33 million years before present). During this epoch a temporary closure of the Strait of Gibraltar made the Mediterranean sea to dessicate almost completely. This event caused the formation of the evaporitic rocks that are now visible along the northern borders of the Apennines from Reggio Emilia to the Marche region. The sulphur (S) veins found in this zone result from the biochemical activity of bacteria. Under anaerobic conditions, sulphate reducing bacteria produce hydrogen sulphide gas (H_2S) from sulphate (SO_4) in gypsum. H_2S is then oxidized to elemental sulphur if exposed to oxygen. See *Scienze della Terra, elementi di geologia generale*, edited by Pompeo Casati, Milan, Città Studi Edizioni 1996, pp. 518-519; ALFONSO BOSELLINI-EMILIANO MUTTI-FRANCO RICCI LUCCHI, *Rocce e successioni sedimentarie*, Turin, UTET 1989, pp. 133-169; *L'area carsica di Borzano (Albinea – Reggio Emilia)*, edited by Mauro Chiesi, Memorie dell'Istituto Italiano di Speleologia, Serie II, vol. XI, Albinea 2001.

¹¹ «[...] seguitando il rivo a portar tanto zolfo, quanto, accattandolo, bastava a povera gente di continuo lavorare zolfanelli da vendere, cadde in pensiero ad alcuni, di cercare di nuovo questa miniera, che facilmente fu ritrovata così ferace, che da sé sola soddisfa, per ogni bisogno, a tutte le vicine città. Due sinora sono le cave fatte dall'arte, che comunicano insieme per lo giuoco necessario dell'aria, capaci di due uomini, che vi lavorino in piedi, e che co' loro ordigni portino fuori la cavata miniera» (A. VALLISNERI, *Primi itineris specimen...*, cit.).

¹² «È degna di riguardo un'osservazione, che fa intorno alla positura di stirie di puro zolfo, incastrate nella creta della miniera oltre le zolle del medesimo, che ora di maggiore, ora di minor mole in qua, e in là si ritrovano. Si veggono le prime a guisa d'alberi con le cime, e co' rami tendenti al basso, e dove dall'alto geme, e gronda più acqua, lussureggiano più copiosi; lo che sempre più conferma, che tutte le acque delle miniere, e de' fonti dalle piogge, e dalle nevi squagliate derivino» (ID., *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., pp. 279-280).

¹³ The river Tresinaro flows in the Province of Reggio Emilia. It is a tributary of the river Secchia. It originates in Felina (Castelnovo ne' Monti, RE) and flows from southwest to northeast, reaching Scandiano.

casite.¹⁴ Along the shores he also finds many fossils like seashells, shark teeth («*glossopetrae*»), sea urchins, and «other things of this sort», and he notes how «none of these objects are petrified»; rather, «since the rains uncovered them, they are mixed with a salty and stony soil, so they now appear as if they just came out from the sea».¹⁵

The journey goes on along the Tresinaro, heads south and passes through the first slopes of the Emilian Apennines, arriving in Regnano. Here are some of the strangest phenomena ever studied by Vallisneri: the enigmatic *salse*.¹⁶ These small, bubbling mud volcanoes (that at the beginning of the eighteenth century were much more active than now) are not new to him. He had studied them already in 1694, when he served as general practitioner in Scandiano. And he devoted much effort in dealing with the problem of their origin, also studying the clinical effects of that oily mud (which resulted to be «very effective to desiccate tumours, mainly those on the legs»), as young and enquiring Vallisneri scribbled down in one of his early field books, the *Quaderni di Osservazioni*.¹⁷

The path is still long, however, and now Vallisneri can't afford to linger here. He leaves Regnano for the Monte Valestra, where he explores the frightful cavern that lies on its slopes: the Buca del Diavolo («Devil's Pit»).¹⁸ Such a sinister name tickles his curiosity, and he climbs up «a strange staircase, roughly carved in the stone», which leads to the entrance. But an accident occurs that instantly persuades him to reconsider his purpose:

Here, he says that as long as he will live, he will remember this mountain; since when he resolved to enter the cavern, and sent ahead a servant, [...] one of the stony steps broke and fell down to his master, who was following him, but it smashed into another stone, diverted its trajectory, and rolled at his feet [...]. Nev-

¹⁴ Marcasite, also known as iron pyrite, is an iron sulfide (FeS₂) with orthorhombic crystal structure. See CHRIS PELLANT, *Rocce e minerali*, Milan, R.C.S. Libri 1995 (Italian edition of the original *Rocks and Minerals*, 1992, London, Dorling & Kindersley 1992), p. 61.

¹⁵ «[...] un torrentello detto Riazzone, le di cui ripe sino a certa altezza sono tutte aperte, e gremite di varie produzioni marine, come pettini, buccinetti, turbini, chiocciole, antali, e dentali, glossopietre, ombilichi di mare, ricci marini (benché questi rari) e cose simili. È osservabile, che niuna di queste materie trovò impietrite, per essere in uno strato di terra salsugginosa, e renosa, le quali dalle piogge scoperte appaiono tali, e quali dal mare allora venissero [...]» (A. VALLISNERI, *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., pp. 280-281).

¹⁶ A *salsa* is a peculiar phenomenon of secondary volcanism. It is a cold, muddy mixture composed of water, clay, carbon dioxide and hydrocarbons (usually methane) which leaks out from the ground. The term 'salsa' means 'salty', as the mixture contains NaCl. Its salinity is equivalent to 1/2-1/3 of seawater. On this topic, see F. LUZZINI, *Il miracolo inutile...*, cit., pp. 74-77; ID., *Multa curiosa...*, cit., pp. 341-343; <http://www.comune.viano.re.it>.

¹⁷ «Quella terra, che vomita fuori è bonissima per essiccare i tumori particolarmente delle gambe» (A. VALLISNERI, *Quaderni di osservazioni*, vol. I, edited by Concetta Pennuto, Introduction by Dario Generali, Scientific Notes by Andrea Castellani, Florence, Olschki 2004, p. 41).

¹⁸ ID., *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., p. 282. On the Monte Valestra, see <http://www.apenninoreggiano.it>

ertheless he intrepidly continued his way to the cavern, [...] but in the end, he wasn't able to reach it.¹⁹

This honorable defeat doesn't detract Vallisneri from his journey. He proceeds southward to Quara, an ancient spa, the origins of which date back to the Roman age, but which is now nothing more than a desolated pile of ruins, «without glory, and without respect»: this is a real pity, as «the medical stories say marvels about it».²⁰ From here he moves east and crosses the valleys of the rivers Dolo and Dragone, where he notices many specimens of marcasite and other «apparent clues of hidden mines».²¹ Then he goes southwest and, at last, approaches the passage that links Emilia to Garfagnana: the San Pellegrino Pass. This place and the alpine tundra above²² are carefully studied by Vallisneri, which by «wandering, and observing all those rough, and rugged deserts», pays special attention to the snows that – still during summer – cover them.²³ According to some shepherds, these «dwell eternally in certain dark, gelid, deep places, melting little by little»:²⁴

¹⁹ «Qui dice, che avrà memoria, finché vive, di questo monte; imperocché volendo in tutti i modi salire per certi gradini rozzamente scolpiti nel sasso, e già logori, e dirupati, per entrare nella famosa grotta, mandando avanti un suo servo, ed egli seguendolo, si staccò un gradino, e precipitò al basso verso il padrone, che lo seguiva, ma urtato da un altro sasso lo sviò dalla linea, che preso avea, e rotolò rasente i suoi piedi con orrore di lui, e di alcuni spettatori [...]. Ciò non ostante intrepido seguitava il suo viaggio [...] per giungere alla bramata grotta, ma non fu possibile l'arrivarvi» (A. VALLISNERI, *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., pp. 282-283).

²⁰ «Le trovò [...] senza gloria, e senza stima alcuna, essendo affatto abbandonate [...], dove che [...] le mediche storie maraviglie ne cantano» (*ivi*, pp. 283-284). On Quara and its renowned springs, see <http://www.appenninoreggiano.it>; <http://www.comune.toano.re.it/turismo/storia.htm>. Quara is also described in A. VALLISNERI, *De nova Methodo Thermarum explorandarum, mineraeque, et viribus Multorum Fontium, quos Baccii complexus non est*, in ANDREA BACCI, *De Thermis Andreae Baccii Elpidiani, Civis Romani, Medici, atque Philosophi, Libri Septem... Editio novissima, quae in singulis libris tractentur, versa pagina indicabit*, Patavii, Sumptibus Jo. Baptistae Conzatti 1711, pp. 287-365 (353-354); A. VALLISNERI, *Raccolta di varie Osservazioni, spettanti all'Istoria Medica, e Naturale dal Signor Antonio Vallisneri, Pubblico Professore Primario dell'Università di Padova... scritte agli eruditi, o dagli eruditi a lui: con varie annotazioni, e giunte, compilata da Gio. Jacopo Danielli, Medico, e Filosofo di Padova, e consacrata all'Illustrissimo Signor Conte Jacopo Riccati*, Venezia, Per Domenico Lovisa 1728, pp. 112-117.

²¹ «Trovò colà molte marcassite, e segni chiari di nascoste miniere» (A. VALLISNERI, *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., p. 286). The Dragone is the first creek which can be found once crossed the Dolo, moving east from the Province of Reggio Emilia to the Province of Modena.

²² This is known as Alpe di San Pellegrino («Alp of Saint Peregrine», 1701 metres above sea level).

²³ «Andò vagando, e osservando tutti que' crudi, ed aspri circonvicini deserti» (*ivi*, p. 287). It must be considered that Vallisneri's exploration took place in the summer of 1704: namely, in the middle of the Little Ice Age, which occurred in the Northern Hemisphere from the sixteenth to the nineteenth century. Nowadays, during summer it is almost impossible to find snow on the Northern Apennines.

²⁴ «Colà trovò [...] i ghiacci, e le nevi, che al dire di que' pastori in certi oscuri, freddissimi fondi, eterne dimorano, dileguandosi a poco a poco» (*ibid.*).

The snows, which were barely melted, came down from those slopes, and some continued their way by originating foaming, and roaring streams that fell down, others hid, and went to ground into pits, and caverns, vanishing. It was in that moment that our author discovered the origin of springs [...], having clearly known how far from truth are those philosophers which assume it is from the sea, or from their dreamed alembics in the bowels of the mountains [...].²⁵

This is a crucial passage. San Pellegrino (Fig. 4) is one of the highest places in the Northern Apennines. It is a privileged viewpoint for Vallisneri's investigation, and here he collects vital information to support his «great argument», making it strong enough to prevail (especially with the publication of the *Lezione Accademica*) on rival ones: the theory that all groundwater comes from rain, snow, or glaciers.

But the journey is not over yet. Having finally passed the «hard yoke of Apennines»,²⁶ the author comes in the valley of Garfagnana, an Este enclave in Tuscan territory. He reaches the city of Castiglione, proceeds along the river Serchio and passes Pieve Fosciana and Castelnuovo. Then he turns northwest and arrives in Camporgiano. Here he is received by his uncle Carlo Davini, who invites him to rest for a while. The exhausted wanderer gladly accepts the offer, lingering for a few days on «every sort of most honest amusement» and «almost forgetting to be a philosopher». ²⁷ On leaving this cosy shelter, he follows the course of the river Serchio, heads southeast and arrives in Galliciano. From here he decides to climb up the southwestern valley of Turrîte, being eager to visit the famous iron mines of Fornovolasco.²⁸ But this new adventure is not to be underestimated, as it involves many risks: the way to the village is in horrible condition, and – what's more – it is infested with robbers. Therefore, Vallisneri hires some men to protect him and proceeds along the dangerous road that leads to the Petrosiana Pass, enjoying the distant sight of his native town, Trassilico. At last, after

²⁵ «Colavano allora (dice) le nevi, che con istento squagliavansi, giù per lo dosso di que' ciglioni, e formando spumanti, e strepitosi rivi al basso piombavano, seguendo oltre il loro corso, altre nascondendosi, e rimpiantandosi dentro buche, e caverne, ne' più veggendosi. Allora fu, che il nostro autore scoperse l'origine delle fontane [...], avendo chiaramente conosciuto quanto male al vero s'accostino que' filosofi, che le riconoscono dal mare, o da' sognati lambicchi dentro le viscere de' monti [...]]» (*ivi*, p. 289).

²⁶ «[...] l'arduo giogo dell'Appennino» (*ivi*, p. 293).

²⁷ «Colà si fecero conviti, allegrezze, cacce, e giuochi, procurando essi di dargli ogni sorta di più onesto divertimento; il che fu da lui talmente aggradito, che [...] vi dimorò molti giorni, e dimenticando quasi d'essere filosofo» (ID., *Continuazione dell'Estratto d'alcune Notizie intorno alla Garfagnana...*, cit., p. 379).

²⁸ During the eighteenth century, the iron mines of Fornovolasco were intensely exploited on behalf of the Dukes of Este, which used the iron for military purposes. For more information about this topic, see MARCO BONINI-CRISTIAN BIAGIONI, *Le miniere medioevali e la lavorazione del ferro a Fornovolasco*, «Notebooks on Medieval Topography», British Archaeological Reports, International Series, Oxford, 2007, pp. 581-620; PIETRO ROCCHI, *Il paese natale di Antonio Vallisneri: Trassilico, una Vicaria Estense in Garfagnana*, in *Antonio Vallisneri dalla Garfagnana alla Scienza...*, cit., pp. 9-36.

having walked through «paths barely accessible even to wild beasts»,²⁹ he arrives in Fornovolasco, where

[...] while he was sitting in a poor, and smoked tavern, to have some food, and to rest his tired limbs, so that the next morning he could visit the mines, a kind youngster came in, [...], who with a cheerful face and with open arms ran to him, hugged him, rejoiced to see him in those remote mountains, and with the kindest and warmest manners invited and begged him to grace his inn, leaving that place.³⁰

The «kind youngster» is Domenico de' Corradi d'Austria (1677-1756), chief superintendent of artillery on behalf of the Duke and a very expert miner. His practical knowledge will play a key role in the success of Vallisneri's investigation, as the next day he will provide his illustrious guest with helpers and equipment, assisting him in the last two adventures of his voyage: the explorations of the iron mines and of the Tana che urla («*Antro ululante*», or «Screaming Cave»), the most famous and mysterious cavern in Garfagnana.³¹ Thanks to these experiences, Vallisneri will be able to collect further, decisive data, supporting his theory on the origin of springs with conclusive empirical information.

We have good reasons to consider the *Primi itineris specimen* and the two *Estratti* as very precious documents for the history of natural sciences in Europe. And not just because we have the rather rare chance to follow in detail the process that leads to the publication of an Early Modern scientific text, from the troubled manuscript to the final editorial product. Above that, these papers allow us to have a close look at the requirements, criteria and purposes to which a naturalistic journey should conform, according to a *philosopher* of the early eighteenth century. Inevitably, Vallisneri's attempt to follow a rigorous experimental method in his observations and descriptions is not exempt from ambiguities, which are typical of an epoch where scientists are still far from achieving univocal procedures and terminologies. Yet, these documents show a clear perception of the importance of these aims.³²

²⁹ «[...] per calli, e sentieri appena concessi alle fiere» (A. VALLISNERI, *Continuazione dell'Estratto d'alcune Notizie intorno alla Garfagnana...*, cit., pp. 387-388).

³⁰ «[...] ritiratosi in una povera, e affumicata osteria, per ivi prender cibo, e riposare le stanche membra, per portarsi la mattina seguente a visitar le miniere, entrò in quella un gentilissimo giovane [...], che con faccia allegra a braccia aperte gli corse incontro, l'abbracciò, si rallegrò di vedere la sua persona fra quelle balze romite, l'invitò, anzi con maniere cortesissime, e calde lo pregò, a volere onorare il suo albergo, da quel luogo levandosi» (*ivi*, pp. 390-391).

³¹ ID., *Primi itineris specimen...*, cit. See also F. LUZZINI, *Il miracolo inutile...*, cit., pp. 100-101, 124-129; ID., *La Tana che urla: cenni di speleologia vallisneriana*, cit.; ID., *Cavità naturali ed artificiali in Garfagnana e Lunigiana...*, cit.; ID., *Contro i lambicchi...*, cit. As to the collaboration between Vallisneri and Corradi, see ID., «*Tutto pien di natura tacito*». *Le scienze della Terra nel «Giornale de' Letterati*», in *Il «Giornale de' Letterati d'Italia» trecento anni dopo. Scienza, storia, arte, identità (1710-2010)*, edited by Enza Del Tedesco, Pisa-Rome, Fabrizio Serra Editore, 2012, pp. 49-60 (54-55, 58).

³² See also F. LUZZINI, *Il miracolo inutile...*, cit., pp. 101-106.

Vallisneri does not limit his study to the geological features of his travel. He also pays a great attention to other disciplines like zoology, botany, history, literature, ethnography, and politics. This tendency is particularly evident in the description of Garfagnana. The region abounds in «valleys, and plains, many hills, mountains, and rocks, and immense stones, and fields, and vineyards, and woods, and forests of various sorts»; it is also rich in «wheat, wine, hems, fruits, and herbs, and delicious fishes», and in «meat, chestnuts, milk products, and particularly in precious cheeses». Nor there is lack of «entertainment for hunting; indeed, bears are now rarely found, but they were once abundant, and now wolves, badgers, and foxes are still present, for the pleasure of the most fierce hunters». Quite intriguing is the description of the inhabitants: they are generally «short, dull colored, with lively eyes, strong, muscular, always ready to fight, easily offended», but – this must be acknowledged, since Vallisneri's mother was from Garfagnana – they are also «acute, clever, friendly to strangers, very fond of hospitality, loyal to their master, predisposed to literature, provided by nature with the most pleasant Tuscan language, merry, ingenious in mechanics, and eager to business».³³ Garfagnana is divided into three «vicarie» ('vicarages'): Castelnuovo, Camporgiano, and Trassilico. Then in the *Estratti* a detailed list follows of «all the lands, and strongholds [...] with both their ancient, and current names»,³⁴ while two maps of the entire region worthily end the manuscript.³⁵

These notes are not to be considered as eccentric exceptions to the main purpose of Vallisneri's journey. Rather, they are essential parts of a well-defined *philosophical* experience, that aims to gain the maximum amount of information from the field. It is not by chance that in the final pages of the *Continuazione dell'Estratto* we find a scrupulous «Indice di osservazioni» ('Index of observations'),³⁶ where Vallisneri tries to define

³³ «Contiene questa provincia alcune valli, e pianure, molti colli, balze, e scogli, e sassi smisurati, e campi coltivabili, e vigne, e boschi, e selve di varie sorti. È ricca di [...] grani, di vino, di canape, di frutti, e d'erbe ortensi, e di esquisiti pesci. È poi abbondantissima di carni, di castagne, di latticini, e particolarmente di preziosi formaggi [...]. Né colà mancano le delizie della caccia d'ogni più delicato salvatico, anzi anticamente abbondavano d'orsi, a' tempi nostri distrutti, o almeno radissime volte trovati, non cessando però d'esservi e lupi, e tassi, e volpi, per divertimento de' più feroci cacciatori. Gli uomini sono per lo più di piccola statura, di colore la maggior parte tirante al fosco, con occhi vivaci, forti, nerboruti, sempre alle armi apparecchiati, facili allo sdegno, avidi di vendetta, ricordevoli delle ingiurie, d'acuto, e versatile ingegno, amici a' forastieri, dell'ospitalità amatissimi, fedeli al suo padrone, atti alle lettere, dotati dalla natura dell'amenissimo parlar toscano, allegri, al salto, ed al canto spiritosissimi, ingegnosi nelle macchaniche, e nella mercatura solleciti» (A. VALLISNERI, *Estratto d'alcune Notizie intorno alla Provincia della Garfagnana...*, cit., pp. 304-305).

³⁴ «Per corollario apporta un lungo catalogo di tutte le terre, e rocche della Garfagnana, co' nomi presenti, ed antichi» (*ivi*, p. 311).

³⁵ ID., *Primi itineris specimen...*, cit. One of these maps can be seen in Fig. 3.

³⁶ ID., *Continuazione dell'Estratto d'alcune Notizie intorno alla Garfagnana...*, cit., pp. 404-417. On this topic, see E. VACCARI, *Le istruzioni per i geologi viaggiatori in Toscana e in Europa tra Settecento e Ottocento*, in *Viaggi e Scienza, le istruzioni scientifiche per i viaggiatori nei secoli XVII-XIX*, edited by Maurizio Bossi and Claudio Greppi, «Gabinetto Scientifico Letterario G.P. Vissieux», n. 13, Florence, Olschki 2005, pp. 3-26 (9-11); ID., *Antonio Vallisneri, Luigi Ferdinando Marsili e la «struttura de'*

an analytical method to explore the mountains. And though the *Index* – which consists of 26 Points – pays great attention to the naturalistic features of the journey, we can also notice a remarkable interest in the history of the territories and their populations.

In the first paragraph, or Point 1, the author recommends to «exactly describe [...] all the plants, and grasses, which can be found on the mountains». Point 2 suggests to define «the figured stones, the crystals [...], and all the hard and stony things that can be observed».³⁷ On the mountains, then, an explorer should study (Point 3) the composition and the arrangement of the rock strata, the area of the vegetation cover (Point 4), the thermal and chemical features of the streams (Point 5), and, if possible, the exact location of the springs (Point 6).³⁸ Four entire paragraphs (Point 7 to 10) focus attention on fossils: on their presence in rock layers, their marine or terrestrial origin, the various substances which form them, and even on their supposed age.³⁹ Furthermore, it should be considered «the structure of every mountain, both in particular and in general» (Point 11); and the own study of insects should not be disregarded (Point 12), since «it could be possible to find rare and new ones, which have never been examined before». A careful *philosopher* should then describe «the life, the food, the habits, the generation, and the variations» of these insects. The same should be done for the «greater animals»: birds, fishes, and quadrupeds, «both domestic and wild ones» (Point 13 to 16). And just like animals, plants deserve to be closely studied, as it could be useful to know their fruits and the uses that people make of them (Point 17). As for the mines (Point 18), they should be surveyed and properly described, also searching for the still undiscovered and unexploited ones («which could greatly benefit the Prince and the subject alike».⁴⁰

Points 19 and 20 highlight the importance of knowing «the different peoples, their habits, their houses [...], their crafts, their clothes», their origin, their history and laws,

monti», cit., pp. 394-396; ID., Travelling with Instruments: Italian Geologists in the Field in the 18th and 19th Centuries, «Centaurus», n. 53, 2011, pp. 102-115.

³⁷ «1. Pensava esattamente descrivere [...] tutte le piante arboree, i frutici, e l'erbe, che si trovano su i monti [...]. 2. Tutte le pietre figurate, i cristalli [...], e tutto ciò, che di duro, e di petroso si trova, notando i siti, dove si veggono, o trovano» (A. VALLISNERI, *Continuazione dell'Estratto d'alcune Notizie intorno alla Garfagnana...*, cit., pp. 404-405).

³⁸ *Ivi*, pp. 405-406

³⁹ *Ivi*, pp. 406-409.

⁴⁰ «11. È d'uopo considerare la struttura, l'indole, o natura d'ogni monte sì in particolare, come in generale [...]. 12. Né merita silenzio l'osservazione del popolo minuto degl'insetti, trovandosene de' rarissimi, non mai descritti [...]. Di tutti [...] si descriva la loro vita, cibi, costumi, sviluppi, incrisalidamenti, e mutazioni [...]. 15. Lo stesso si faccia de' quadrupedi tanto domestici, quanto salvatici, tanto benigni, quanto feroci [...]. 18. Le miniere d'ogni metallo, o minerale, o mezzo minerale debbono de' primi luoghi occupare, per essere utili al Principe, ed al suddito, non solo minutamente osservando le antiche, e le nuove, ma trovandone delle non ancora scoperte [...]. 23. Deve pure portar seco, e barometri, e termometri, per sapere il peso, la leggerezza, il caldo, e il freddo dell'aria, e così altri moderni ordigni, per distinguere l'umido, il secco, ed ogni qualità della medesima [...]» (*ivi*, pp. 409-412).

and even «the illnesses to which they are exposed» and their particular remedies, since «unknown secrets, and drugs from herbs and plants sometimes exist, which the most learned professors never discovered». And of course, explorers should learn the topography of the different territories, their main places and cities (Point 21), the height of their mountains and the own *quality* of the air (Point 22), which should be measured by using barometers and thermometers, and by means of «other modern devices, in order to know humidity, dryness, and any other quality» (Point 23). In those places where shepherds roam, then, it could be helpful (Points 24 and 25) to learn how they keep their herds and which are their products. Finally (Point 26), attention should be paid to the «particular skills, or secrets» of the different peoples, as all countries have «something valuable, whether it be a typical food, or artefact, [...] etc.».⁴¹

This «great and magnificent plan»,⁴² with its detailed explanation, can be considered the *summa* of Vallisneri's endeavor to define goals and procedures that should govern a *philosophical* exploration on the field. But as the author himself acknowledged, putting into practice such an ambitious project would have required many efforts and resources, along with plenty of time for study (surely, much more than the busy Paduan professor could have hoped for, given his enormous academic and medical responsibilities). Still, this confession does not imply a renouncement or a defeat. Rather, in this very consideration lies an emblematic feature of Vallisneri's concept of scientific knowledge, which owes much both to Bacon's natural philosophy and to Galileo's experimentalism: science is a collective and cumulative enterprise, and it needs the joined efforts of many (and many generations) to proceed along its troubled path. Hence came Vallisneri's constant, passionate call for unity among the ranks of the *letterati*; and hence came his efforts to develop a shared and univocal scientific lexicon, that would use the Tuscan language «for debt, for justice, and for the dignity of our Italy».⁴³

Sadly, Vallisneri's voice remained largely unheard – or worse yet, ignored. A long time would pass before a unified Italy became institutionally strong enough to foster its humanistic and scientific culture. But knowing these undeniable facts adds further value to the work of the Paduan professor, who (already in the early decades of the eighteenth century) proved to possess an unmatched awareness of the political and so-

⁴¹ «19. Non è men curioso, ed utile il sapere i costumi de' popoli, le case [...], le arti, i vestiti, le particolari prerogative, i mali, a' quali sono sottoposti, i rimedi, che adoprano [...], né sdegnando di ricercare, e d'imparare da tutti, trovandosi alle volte segreti, e rimedi semplici d'erbe, e di piante, non mai pensati da' più dotti professori [...]. 26. Oltre alla coltivazione delle loro piante, e grani, e orti, e giardini, si cerchi, se hanno qualche arte, o segreto particolare, avendo molte terre, e paesi qualche cosa di distinto, o ne' cibi, o nelle opere manufatte [...], ec.» (*ivi*, pp. 412-417).

⁴² «Questo è il grande e magnifico apparato, che si pone avanti l'autore» (*ivi*, p. 417).

⁴³ ID., *Che ogni Italiano debba scrivere in Lingua purgata Italiana, o Toscana, per debito, per giustizia, e per decoro della nostra Italia. Lettera del Sig. N. N.* *** al Sig. Alessandro Pegolotti Segretario di Belle Lettere del Serenissimo di Guastalla, «Supplementi al Giornale de' Letterati d'Italia», 1722, I, Articolo IX, pp. 252-330. Now edited in ID., *Che ogni Italiano debba scrivere in Lingua purgata Italiana*, edited by Dario Generali, Florence, Olschki 2013.

cial factors that allow science to develop and flourish. It is clear, then, why the flaws in Vallisneri's attempt to define an experimental approach to naturalistic explorations don't reduce the importance of his uncomfortable and wonderful journey. And in spite of – or thanks to – their lexical inconsistencies and their descriptive ambiguities, the *Primi itineris specimen* and the *Estratti* are precious tools for understanding a crucial step in the evolution of the Earth sciences in Europe.

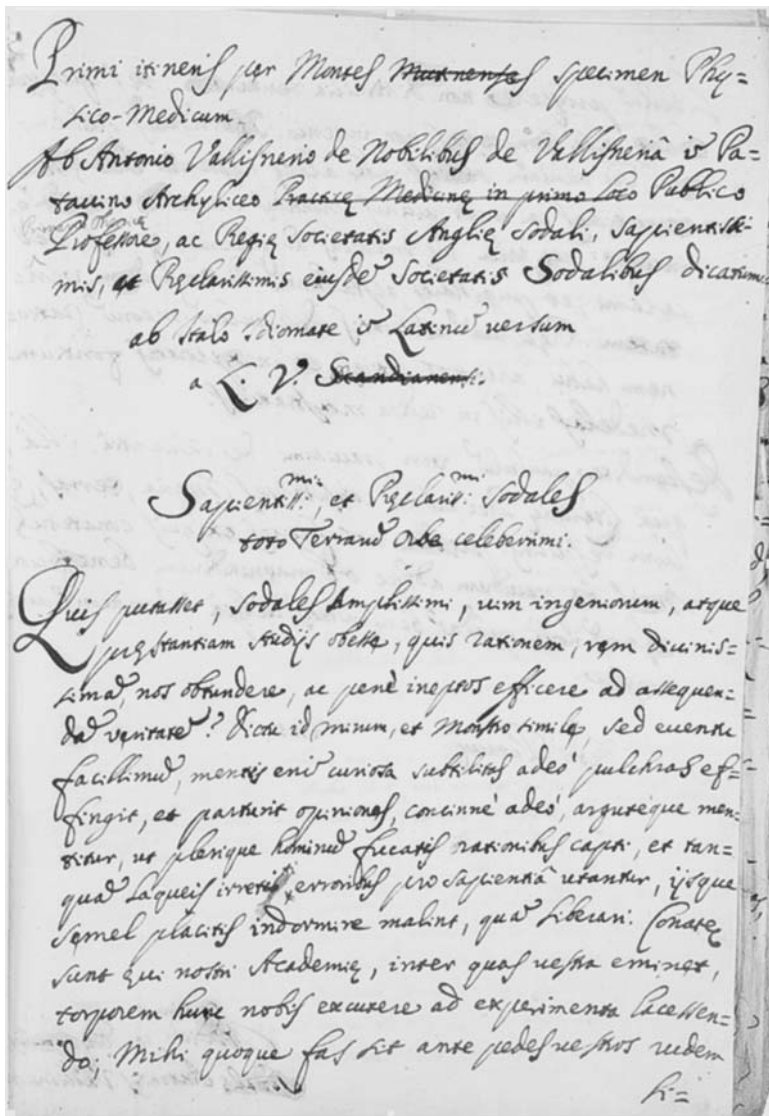


Figure 1 The first page of Vallisneri's manuscript, the *Primi itineris specimen*.



Figure 2 The first part of Vallisneri's journey, from Scandiano to Castelnovo di Garfagnana. Map: *Carte Nouvelle du Duché de Modene, de Regio et de Carpi; avec la Seigneurie de la Ca-fargnana &c. levée par ordre exprès a l'usage des Armées en Italie, où sont exactement marqués les Grand Chemins, les Routes des Imperiaux &c.* Par le S.r Sanson, Géographe du Roy, à Amsterdam, Chez Pierre Mortier 1704.

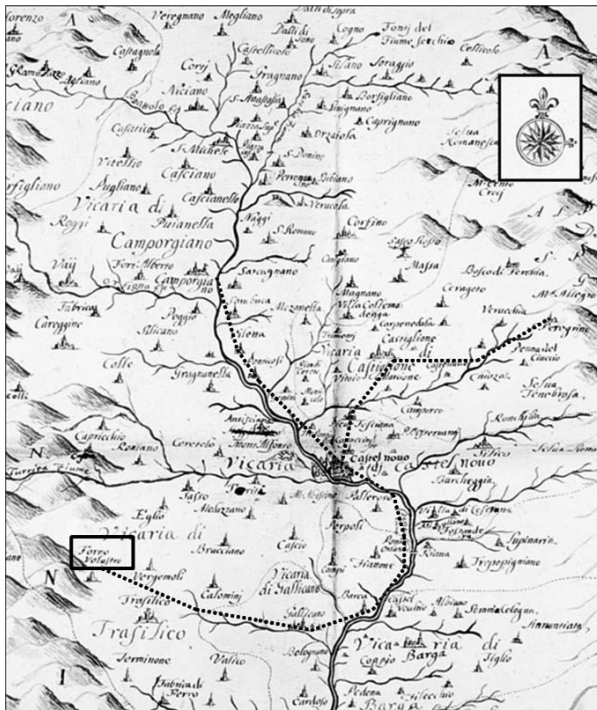


Figure 3 The second part of the journey, from San Pellegrino to Fornovolasco. Map: *Corografia della Garfagnana, in A. VALLISNERI, Primi itineris specimen...*, cit.



Figure 4 Alpe di San Pellegrino («Alp of Saint Peregrine»).



Figure 5 «Ultimos tandem Alpium fines, quos *Panie* vocant» (Mount Pania Secca as seen from Garfagnana, in Northern Tuscany).