

*ELECTRIC SOLDANI*

*FASHIONABLE EARTHQUAKE THEORIES IN LATE EIGHTEENTH CENTURY TUSCANY*

Viviana Castelli

INGV, Istituto Nazionale di Geofisica e Vulcanologia

**Abstract.** Ambrogio Soldani wrote on earthquakes only once, after Siena was struck by one in May 1798. Unlike Soldani's earlier works, the *Relazione del terremoto accaduto in Siena il dì 26 Maggio 1798* is not original either for what concerns the seismogenic theory underlying it or the treatment of data. However, it gives the first systematic overview ever made of historical seismicity in the Sienese district. Thus, even in the field of descriptive seismology, Soldani managed to become a groundbreaker, after all.

**FIRE VS. ELECTRICITY**

In the second half of the eighteenth century, earthquakes had become a very controversial subject. An ongoing debate about what exactly it was that caused earthquakes to happen had split the international scientific community into the two warring factions of the *Firists* and the *Electricists*.

The former – whose ranks numbered luminaries such as Immanuel Kant and Sir William Hamilton – subscribed to the ancient seismogenic theory set forth by Aristotles, according to which earthquakes are a product of the dynamic processes at work within the insides of the Earth. *Pneuma* (Greek for 'breath'), a kind of underground wind heated by the unquenchable fires burning at the very core of the Earth, is the ultimate earthquake-generating force. Until *Pneuma* remains free to blow around within the vast cavities existing underground, nothing untoward happens on the outside surface of the Earth. If, however, *Pneuma* does get trapped within some fissure or tunnel in the layer of rock enveloping the planet, then it is forced to rise up- and outwards through these narrow channels, causing the earth surface to quake and shake as it blows out and disperses in the atmosphere. It is interesting to note that faint but unmistakable traces of this venerable theory do still survive nowadays in the popular belief that earthquakes are more likely to occur in hot weather or that localities whose underground is hollow are less prone to earthquake damage (unfortunately an opinion which experience does not bear out).

If *Firists* took an ultra-conservative stand, on the other side *Electricists* went as progressive as they could be. In the mid 1700's electricity was a byword for progress. The scientific studies of electricity and magnetism started in the seventeenth century had produced a considerable amount of empirical known-how and machinery for demonstrating electrical phenomena and

electricity had become popular, finding expression in fashionable drawing room entertainments, therapies, quack treatments, and a few new ideas for pornographers. On a more serious plan, speculations on the still mysterious "electric fluid" had given rise to a new seismogenic theory, according to which the cause of earthquakes was to be looked for over the ground rather than under it, in the state of unbalance between terrestrial and atmospheric electricity. As long as both earth and air were neither too dry nor too damp their electric fluids would be well balanced and nothing untoward would happen. However an unbalance between fluids (such as could ensue from a prolonged drought or an excessive rainfall) would generate a friction between the atmosphere and the earth's surfaces and therefore set off an earthquake. Impending earthquake could be forecasted by a close observation of atmospherical phenomena (vapours, fogs, oddly-shaped clouds, lightnings, fireballs and so on) and sudden climatic or temperature changes. For this reason, electricist literature took special care to recording the occurrence of these phenomena.

**ITALIAN ELECTRICISTS AT WORK**

Obviously enough, the electric earthquake theory had to be proved. During the second half of eighteenth century, Italian electricists had many opportunities to set down to this task, as a great many earthquakes occurred in Italy in these years. Among them there are one of the top seismic disasters on record in Italy (the 1783 Calabrian earthquakes), the strong earthquakes which caused heavy damage in extended areas or important towns (1751, Gualdo Tadino; 1781, Faentino-Forlivese and Cagliese; 1786, Riminese), low-intensity seismic sequences which went on for several months generating great panic if not much damage (1779, Bologna:

---

Correspondence to:

Viviana Castelli

Scientist INGV, Istituto Nazionale di Geofisica e Vulcanologia, Section of Bologna, Italy.

e-mail: castelli@bo.ingv.it

1785, Umbro-Marchesan Apennines; 1785-1786, Piediluco) and comparatively minor earthquakes that caused moderate damage in circumscribed areas (1781 and 1787 in the Sienese district). Each of these events gave to supporters of the electric earthquake theory the occasion to make detailed observations and publish them, as pamphlets, books or magazine essays (Fig. 1). By and large, all these literary efforts are planned on the same lines, starting with a meticulous relation of the context in which the earthquake took place and proceeding to record the exact date, time and circumstances in which earthquake shocks manifested themselves; the effects they wreaked on buildings, people and the environment; the extent of the area within which they were observed and, last but not least, the weather conditions, temperature and atmospheric phenomena (if any) that preceded or accompanied them, the latter - as it will be remembered - being intended to give a confirmation of the theory espoused by the author.

The remarkable similarity existing between so many distinct works should not be wondered at. After all, their authors were part of the same intellectual network, which spread all over Italy and abroad. Often they were personally acquainted or at least had common friends; they read the same magazines, correspon-

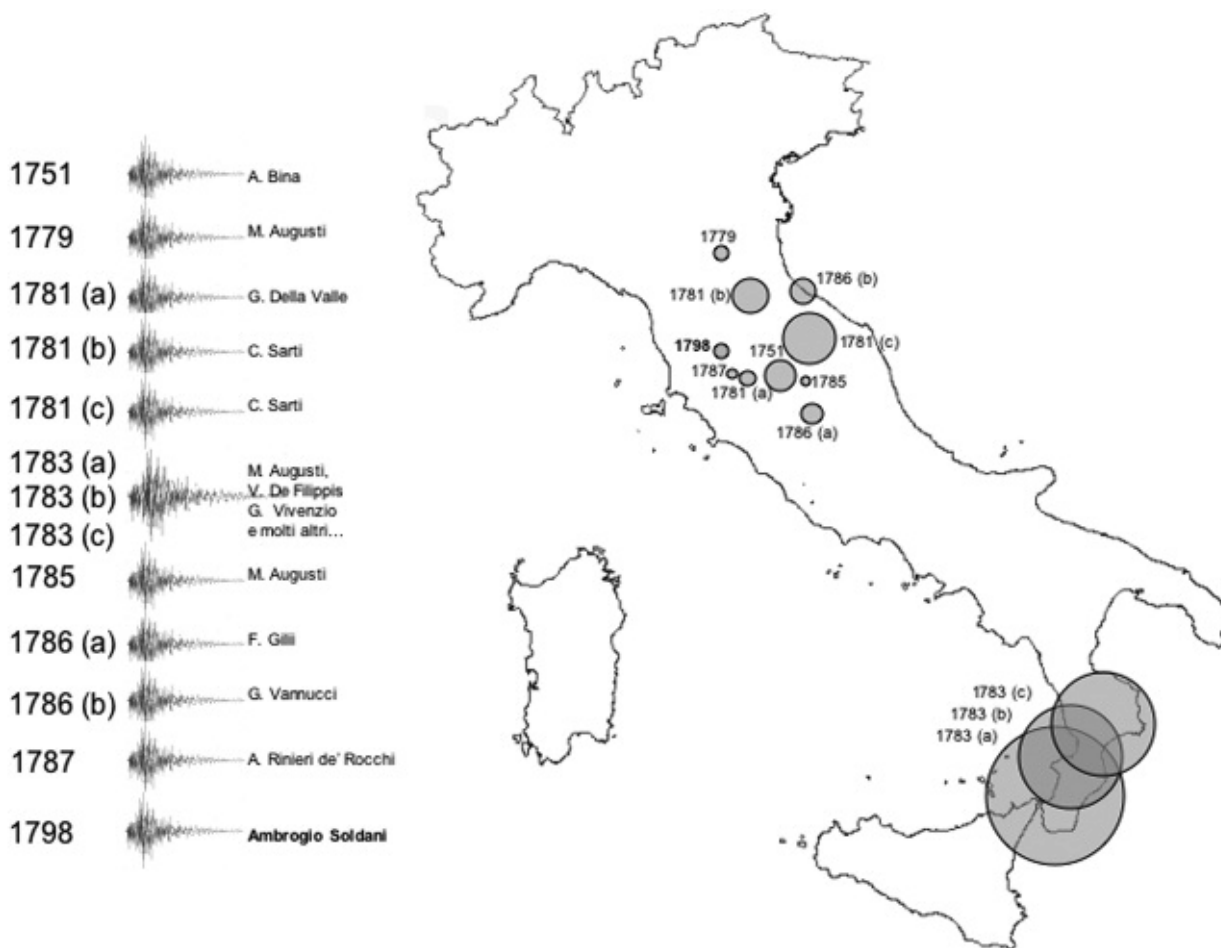
ded and sent each other copies of one's own works. Ambrogio Soldani was a full-title member of this erudite milieu, together with other ecclesiastics such as the Olivetan monks Michele Augusti and Piermaria Rosini, the Franciscan friar Guglielmo Della Valle and the *arciprete* Giuseppe Vannucci, university professors such as Cristofano Sarti and mere *dilettanti* like the Sienese nobleman Antonio Rinieri de'Rocchi, who in 1788 suggested to the Fisiocritic Academy that seismic risk in the Sienese Crete could be reduced by planting in the ground iron "earthquake rods" through which earth's electric fluid would be harmlessly discharged in the air.

Thus, when a biggish earthquake struck Siena, on 26 May, 1798, and Ambrogio Soldani was finally in the position to make his contribution to the electrical debate, he had only to follow in the footsteps of many friends and associates, to produce a work written according to a well-established pattern.

**SOLDANI'S CONTRIBUTION TO SEISMOLOGY**

The *Relazione del terremoto accaduto in Siena il dì 26 Maggio 1798* was printed by the Sienese typographer Giuseppe Pazzini Carli a few months after the earthquake it described. Divided into six "letters", dated between 9

Figure 1. Electricists at work. Fifty years of earthquakes in Italy and the people who wrote about them (1751-1798).



June and 17 July 1798, the *Relazione* includes a detailed chronicle of the recent earthquake (based on Soldani's own impressions and on the evidence of several reliable eyewitnesses), a précis of the distribution of damage in the urban area, meteorological and geological observations, and a lists of the «earthquakes that at various times have previously struck Siena» together with short descriptions of their effects, as derived by an assortment of printed and manuscript historical sources dating back as far as the thirteenth century.

It is with the compilation of this list of historical Siennese earthquakes that Ambrogio Soldani managed to make a unique contribution to Italian seismology. In process of time the electric earthquake theory would be discarded and become no more than a quirky episode in the history of science. Soldani's chronological list of historical earthquakes, on the contrary, did live on.

Descriptive seismology (the collection of evidence of the macroseismic effects of earthquake past and present) is an avocation that attracted many followers in Italy, the earliest of whom seems to have been humanist Giannozzo Manetti that inserted a list of historical earthquakes in his *De Terraemotu* treatise, written in 1457. Thus, along the centuries, a large corpus of descriptive earthquake compilations was accumulated in Italy. When seismologist Mario Baratta started putting together his monumental history of *I terremoti d'Italia* (1901), he relied to a large extent on this considerable national tradition of historical earthquake studies and Ambrogio Soldani's chronological list became its main source of information for Siena and the Siennese territory for the pre-1800 period. Later still, in the 1970's, Baratta's opus did become, in its turn, the main source of raw data for the compilation of the first generation of Italian parametric earthquake catalogues, an indispensable tool for setting in train the complex procedures necessary to assess the seismic hazard of the country, locate its seismic zones and effect a correct seismic classification of the national territory. Thus, even in a field such as seismology, in which he was not a forerunner – as he was in micropaleontology and in meteorite studies- the outstanding personality of Ambrogio Soldani managed to express itself with a lasting contribution to general knowledge.

## REFERENCES

- 1) Augusti, M. [pseud. Cimaste Hulugeo], (1779). *Osservazioni memorie e riflessioni su li terremoti sentiti in Bologna nel mese di giugno 1779, lettere tre, Firenze 1779*
- 2) Augusti, M., (1780). *Dei terremoti di Bologna, ivi.*
- 3) Augusti M., (1783), *Dei terremoti di Messina e di Calabria del 1783. Memorie e riflessioni. Bologna 1783.*
- 4) Augusti M., (1785), *Lettera [...] sopra i terremoti ed aeromoti di Camerino e di Serravalle, Antologia Romana, 11, 193-198, 201-206.*
- 5) Baratta, M., (1901). *I terremoti d'Italia; saggio di storia geografia e bibliografia sismica italiana, Torino.*
- 6) Bertucci, P. (2007) *Viaggio nel paese delle meraviglie. Scienza e curiosità nell'Italia del Settecento, Torino, Bollati Boringhieri.*
- 7) Della Valle G., (1781). *Osservazioni sul tremuoto sentitosi in Siena nel Gennajo 1781. In: Antologia Romana, 1781.08, n. 8, 60-62.*
- 8) Gili, F.L., (1786). *Dissertazione fisico storica su i terremoti di Piediluco accaduti nell'ottobre del 1785, Roma.*
- 9) Gruppo di Lavoro CPTI (2004). *Catalogo Parametrico dei Terremoti italiani (CPTI04, maggio 2004), Milano. <http://emidius.mi.ingv.it/CPTI04/>*
- 10) Rinieri de' Rocchi, A.F., (1788). *Dissertazione sopra i Terremoti, che furono sentiti nelle vicinanze di Siena il Mese di Ottobre dell'anno scorso 1787 Letta nella Sala dei Sig.ri Fisiocritici il dì 6 Maggio 1788, Archivio dell'Accademia dei Fisiocritici di Siena, Memorie, IV, c.n.n.*
- 11) Rosini P., (1781). *Terremoto (Lettera a Cristofano Sarti). Antologia romana, 1781.12, n. 22, 169-174.*
- 12) Sarti, C., (1783). *Saggio di congetture su i terremoti, Lucca.*
- 13) Scaffer, S., (1983). *Natural philosophy and public spectacle in the eighteenth century, History of Science, 21, 1-43.*
- 14) Soldani, A., (1798). *Relazione del terremoto accaduto in Siena il dì 26 Maggio 1798, Siena Pazzini Carli.*
- 15) Syson, L., (2008). *Doctor of Love: Dr James Graham and His Celestial Bed, London: Alma Books.*
- 16) Vannucci, G., (1787). *Discorso storico filosofico sopra il tremuoto che nella notte del dì 24 venendo il 25 dicembre dell'anno 1786 scosse orribilmente la città di Rimini, e vari paesi vicini, 3a ed. Corredata di note, d'un'appendice e di risposta ad una critica anonima e ad un estratto del "Giornale Enciclopedico di Bologna, Cesena.*