The 12 May 1802 earthquake (N Italy) in its historical and seismological context

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Abstract The Mw 5.7 earthquake that occurred on 12 May 1802 is the only one with Mw ≥ 5.5 located west of Lake Garda in the central-northern part of the Po Plain, Northern Italy, and the strongest event located in the seismic zone 907 of the ZS9 seismogenic zonation of Italy. Current parametric earthquake catalogs locate the event not far from important cities (e.g., Milan) and to sites where nuclear power plants were to be built in the 1980s or could be built in a near future. Although the earthquake parameters seemed sufficiently well constrained, a detailed investigation of documentary sources was performed, in repositories storing the documents of the Napoleonic departments to which the area affected by the earthquake belonged at that time. In the surviving archival series, we found the officers’ correspondence on all the administrative aspects raised by the earthquake. The newly collected records allowed the authors to significantly increase the number of macroseismic intensity data, including new observations in the most damaged area. The results have been then interpreted in terms of both Mercalli–Cancani–Sieberg and EMS98 macroseismic scales. The earthquake parameters were derived applying two different methods in order to get two independent estimates. Earthquake location is confirmed, although the still scarce data available in the area to the east of the epicenter do not permit to reduce the uncertainty to a minimum. According to the Boxer method, the magnitude is now slightly higher, and the source model shows a good agreement with the tectonic setting of the area.

Keywords 1802 earthquake · Northern Italy · Historical seismology · Macroseismic intensity · Earthquake parameters

1 Introduction

On 12 May 1802, at 10.30 a.m., an earthquake caused serious damage in some ten places in Northern Italy, today in the provinces of Brescia, Bergamo, Lodi, and Cremona, among the most densely populated and productive of the country and just some 50 km away from Milan (Fig. 1). The earthquake was felt as far as Savona, Genoa, Turin, Geneva, Bern, Zürich, Chur, Rovereto, and Venice.

On 11 May 1802, around 2 p.m., a light fore- shock was felt in Soncino, Orzinuovi, Bergamo (ASBg 1802c), and Cremona. Some aftershocks are described in the letters addressed to his sister by Giovanni Battista Della Volta living at...
Soncino at the time of the earthquake (letters read and summarized by Galantino 1869): light ones on 13 May, then a few stronger on 14 through 20 May. A strong one reported by Della Volta is also described by a local officer (ASBg 1802l) as felt at Soncino on 2 June.

In the year 1802, the territory affected by the earthquake belonged to three departments of the Repubblica Italiana (under French control, gained by Napoleon Bonaparte in 1797): Mella (capital Brescia), Serio (Bergamo), and Alto Po (Cremona). The intervention of the government, based in Milan, was relatively fast; on 3 June 1802, the Ministry of Internal Affairs informed the prefects of the three mentioned departments that the engineer Girolamo Brioschi had been appointed to carry on damage surveys (ASBs 1802o). Some eyewitnesses wrote that there was no remembrance of such a strong earthquake in the area. Perhaps, this was the reason why Caparrotti (1802) and Balis (1802) published two leaflets with the explicit intention to leave a memory of this earthquake.

The earthquake, known to the Italian seismological tradition (Mercalli 1883, 1897; Baratta 1895–1897, 1901), was among the first events to be studied according to modern criteria in the frame of “Progetto Finalizzato Geodinamica (PFG)”; on the basis of this investigation, included in the “Atlas of isoseismal maps of Italian earthquakes” (Brega et al. 1985), the PFG catalog (Postpischl 1985) provided an epicentral location, an Io = 8, and a macroseismic magnitude 5.8. It was later investigated in the framework of the Catalogo dei Forti Terremoti in Italia—CFTI by Boschi et al. (1997); based on it, the Catalogo Parametrico dei Terremoti Italiani—CPTI04 (CPTI04 Working Group 2004) assessed Mw 5.67 ± 0.09. The subsequent versions of the CFTI (Boschi et al. 2000; Guidoboni et al. 2007) did not change the intensity distribution by Boschi et al. (1997).

This earthquake is important for a number of reasons: (a) it is responsible for the maximum ever observed intensities in more than 20 localities; (b) as a consequence, since 1984, these localities were among the few in the Po Plain inserted in the list of the communes, where buildings had to be designed according to seismic forces of the second category of the code (in 2003, the official seismic map of Italy changed dramatically); (c) the event is located not so far from important cities (Milan, Lodi, Crema, Cremona, Brescia, and Bergamo) and from sites where nuclear power plants (NPPs) were to be built in the 1980s or could be built in a near future (Fig. 1); (d) it represents a singularity in the seismicity of Northern Italy, being the only one with Mw ≥ 5.5 located west of Lake Garda in the central-northern part of the Po Plain (Fig. 2);