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# A "forgotten" earthquake rediscovered: the 1948-1949 Monti Reatini (central Apennines) seismic sequence

F. Bernardini, V. Castelli, R. Camassi, C.H. Caracciolo and E. Ercolani

*Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Italy*

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***ABSTRACT*** Contemporary newspapers and seismological literature describe in detail an earthquake occurred on December 31, 1948 in the Monti Reatini area (central Apennines, Italy). The seismic sequence that had this event as its main shock started in December 1948, went on for most of 1949 and was recorded in full by an unpublished regional earthquake catalogue compiled in 1980. However, none of the Italian parametric earthquake catalogues printed from the 1980s onwards records either the December 31, 1948 earthquake or the earliest part of the 1948 - 1949 sequence. This paper describes how the "forgotten" event of December 31, 1948 was rediscovered and reinstated as one of the main quakes on record in the Monti Reatini area.

**Key words:** historical seismology, earthquake catalogue, local seismicity.

## 1. Introduction

It is a truth universally acknowledged that "past seismicity is one of the keys for predicting future seismicity; […] the more reliable picture of the past we have, the more successful prediction of the future we expect to perform" (Stucchi *et al.*, 2004). For this reason, over the last thirty years, in Italy and other European countries, many large-scale historical investigations have been carried out with the aim of improving the picture of past seismicity embodied in the national parametric earthquake catalogues; for a list see the reference page of the recent AHEAD database (AHEAD Working Group, 2013).

As a general rule, historical investigations of past earthquakes start from information summed up in a catalogue record, and/or in a description provided by some earthquake descriptive compilation, and proceed to sift through vast amounts of assorted historical records in order to find out whether that information is correct or not and to increase/improve it as thoroughly as possible. While browsing historical records, it does often happen - as a sort of bonus - that one stumbles upon traces of other earthquakes (even significant, damaging ones) whose existence is unknown to historical seismology because no parametric earthquake catalogue or descriptive earthquake compilation has ever recorded them (Vogt, 1984). Impressed by the dimensions of this phenomenon, several researchers over the years did launch ad hoc searches for past earthquakes "unknown" to seismology (Alexandre, 1990; Albini and Rodriguez de la Torre, 1993; Camassi and Caracciolo, 1994; Mariotti *et al.*, 2000; Camassi and Castelli, 2004; Castelli and Camassi, 2005; Castelli and Bernardini, 2006; Mariotti and Guidoboni,

 

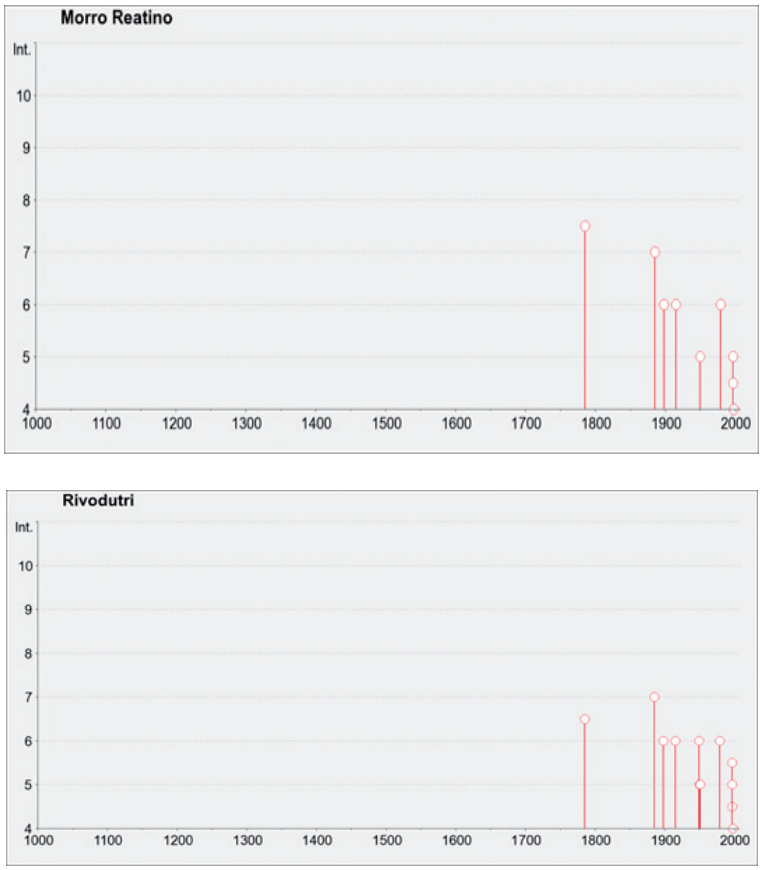


Fig. 1 - Seismic histories of Morro Reatino (a) and Rivodutri (b), two of the main sites of the area (Locati *et al.*, 2011).

2006; Guidoboni *et al.*, 2007; Tertulliani *et al.*, 2008). In Italy, the success of these studies was recently acknowledged by the inclusion in the latest Italian parametric earthquake catalogue (Rovida *et al.*, 2011) of 138 new records related to as many damaging earthquakes that had never previously figured in any parametric earthquake catalogue; 103 of these new records are derived from Guidoboni *et al.* (2007) and 35 from other studies.

The most recent large-scale Italian venture in this field of research is Camassi *et al.* (2011), a study that deals both with "forgotten" earthquakes and with "neglected" ones, i.e., earthquakes that had been included in the earliest Italian parametric earthquake catalogue (Postpischl, 1985) but were discarded by the catalogues compiled, for purposes of seismic hazard assessment, from the mid-1990s onwards, because at the time there was no evidence of any damage caused by them. Further research having retrieved the required evidence, a significant re-evaluation of the epicentral parameters of these earthquake is now possible and their reinstatement in the next issue of the Italian catalogue can be proposed.

This paper describes the case of a comparatively recent and regionally relevant seismic sequence, whose actual importance for the assessment of seismic hazard in some urban sites of a small area of central Italy has failed to be remarked so far because its main shock has not been recorded by any of the Italian catalogues in the public domain.

## 2. Geographical and seismological setting of the studied area

The earthquake described in this paper occurred in an area that takes its name from the Monti Reatini (Rieti Mountains), a minor branch of the central Apennines on the border between the Lazio and Umbria regions, about 100 km NE of Rome. This is a marginal and comparatively underpopulated area dotted with minor urban settlements (Labro, Colli sul Velino, Morro Reatino, Rivodutri, Poggio Bustone, Cantalice, Polino, Arrone and Piediluco), with a population that ranges from a few hundreds to a couple of thousands in each site and which dwells partly in the namesake towns and partly in the hamlets (or *frazioni*) scattered throughout the surrounding territories. Some of the mentioned towns have a historical seismic record (Fig. 1) that in most cases covers little more than a couple of centuries, with comparatively moderate intensities.

Local seismicity is moderate also with respect to the number and magnitudes of the recorded earthquakes (Table 1). The largest local earthquake on record (1885, $M_w$ = 4.9) reached maximum intensity VII MCS in Morro Reatino and Rivodutri (Locati *et al*., 2011).

Table 1 - Seismic history of the studied area (Rovida *et al*., 2011).

| Date | Lat. (°N) | Lon. (°E) | Imax | I0 | Mw | Epicentral area |
|---|---|---|---|---|---|---|
| 1298 12 01 | 42.575 | 12.902 | X | IX - X | 6.2 | Reatino |
| 1785 10 09 | 42.536 | 12.788 | VIII - IX | VIII - IX | 5.7 | Umbria meridionale |
| 1885 06 17 | 42.521 | 12.844 | VII | VII | 4.9 | Poggio Bustone |
| 1949 06 03 | 42.517 | 12.850 | | V - VI | 4.5 | Poggio Bustone |
| 1949 10 27 | 42.532 | 12.805 | VI - VII | VI - VII | 5.0 | Labro |

Owing to the proximity of the main seismogenic belt of the central Apennines, the highest macroseismic intensities on record in the area were caused by non-local earthquakes (Fig. 2). The 1298 Reatino earthquake ($M_w$ = 6.2), whose epicentre is currently located some kilometers north of the Monti Reatini area, reached $I$ = IX-X MCS in Poggio Bustone, a few kilometers east of Rivodutri (Guidoboni *et al*., 2007). The destructive Norcia - L'Aquila sequence of 1703 (two $M_w$ = 6.7 main shocks on January 14 and February 2) reached $I$ = VII-VIII MCS in Apoleggia, Borgo San Pietro and Cantalice. Damage assessed as $I$ = VI MCS was caused by the non-local 1915 (Marsica, $M_w$ = 7.0) and 1979 (Valnerina, $M_w$ = 5.9) earthquakes and by the June 27, 1898 earthquake ($M_w$ = 5.5), located close to the studied area in the surroundings of the provincial capital, Rieti.

Local seismicity seems to tend to arrange itself in seismic sequences of variable length and formed by mostly low-energy events. Two such sequences occurred in the Rivodutri area in 1924 and 1949, and have been studied by Molin *et al*. (2008). The 1924 sequence (main shock on September 15) affected a very circumscribed area around Rivodutri; its stronger shocks were barely felt in Poggio Bustone and Morro Reatino (only 3 km far from Rivodutri) and not felt at all in Labro, Cantalice and Piediluco, at a distance of 5 - 7 km. The 1949 sequence will be examined more closely in the next chapter.

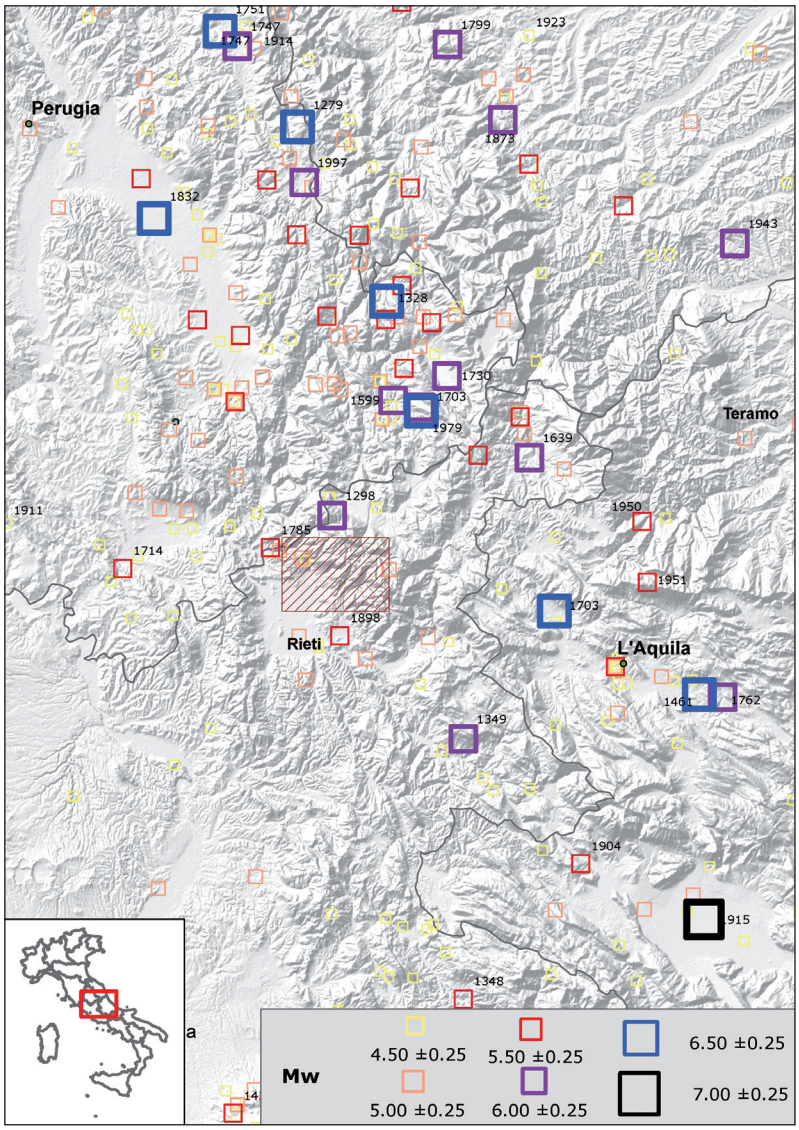


Fig. 2 - The studied area (red-shaded rectangle) in the context of the historical seismicity of the central Apennines (Rovida *et al.*, 2011).

## 3. Rediscovering the 1948 - 1949 sequence

Postpischl (1985) records about 70 low-intensity events located in the neighbourhood of Poggio Bustone from mid-February to mid-December 1949. All data are derived from an earlier unpublished regional catalogue (Dell'Olio e Molin, 1980) that does not indicate its own sources. The two most significant events, dated on June 3 (Poggio Bustone, $I_0$ = V-VI MCS) and October 27, 1949 (Labro, $I_0$ = VI-VII MCS) are recorded in the Rovida *et al.* (2011) catalogue. The epicentral location and intensity of the October 27 event are based on an intensity table provided by Dell'Olio and Molin (1980).

In the frame of a large-scale study of minor damaging Italian earthquakes (Molin *et al.*,

2008) a systematic examination of 20th century newspapers led to the discovery that the area affected in 1949 by the seismic sequence recorded in Postpischl (1985) had been subjected to earthquake shocks from as early as December 1948. The 1948 - 1949 sequence was studied in its entirety, for the first time ever, by Camassi *et al*. (2011), with special reference to a previously "unknown" damaging earthquake occurred on December 31, 1948. The earliest newspaper article describing this earthquake is dated on January 1, 1949 and sketches a picture of severe damage, with 50 buildings left uninhabitable in Rivodutri, and collapses and casualties elsewhere (L'Unità, 1949.01.01, 1949.01.02). Other newspapers picked up the story in the next few days, stressing the severity of earthquake effects in Rivodutri and its *frazioni* (Il Popolo, 1949.01.01; Il Tempo, 1949.01.01), as well as in the neighbouring province of Terni, Umbria (La Nazione Italiana, 1949.01.01, 1949.01.02). Additional information useful for calibrating macroseismic intensities at the sites is provided by a first-hand news report from the affected area that was published around mid-January 1949 [Il Giornale d'Italia, 1949.01.14 (Lazio issue)]. Besides pointing out that the buildings of Poggio Bustone were already in a state of disrepair before the earthquake on account of heavy war damage undergone in 1944, this report does also mention the poor architectural quality of the buildings in Rivodutri and other heavily affected localities.

"[Le abitazioni, ndr] *sono costruite in maniera così poco solida che, anche se riparate, non possono essere più abitate con sicurezza e la cosa va anche a svantaggio della pubblica incolumità. Si rende quindi necessario costruire solide casette a valle, cioè nella pianura sottostante (…). Per le cosiddette riparazioni, del resto, la spesa è abbastanza elevata in quanto si rende necessaria la demolizione delle pareti o delle case sinistrate, per poi ricostruirle. Ed ora, se tutti hanno rilevato che i danni sono stati sensibili dove non esistono fondamenta, perché insistere per ricostruire sulle stesse?*" [Il Giornale d'Italia, 1949.01.14 (Lazio issue)].

[trans. "(The residential buildings) are so poorly constructed that, even after being repaired, to dwell in them would be dangerous and detrimental to public safety. Instead sturdy new cottages should be built on more level ground, i.e., at the foot (of the hill on which Rivodutri is built). Moreover, the so-called repair work would be very expensive, because it would require pulling down and rebuilding anew the damaged walls or houses. Now, as everyone agrees that the worst damage affected just those buildings that had no foundations, why should we persist in rebuilding them as they were?"].

The historical investigation developed from this input pointed out that both the December 31, 1948 event and the aftershocks occurred in January - February 1949 were recorded by the monthly seismic bulletins of the Istituto Nazionale di Geofisica (ING, 1938 - 1984) and by dozens of "macroseismic cards" compiled by local correspondents of the Ufficio Centrale di Meteorologia ed Ecologia Agraria (UCMEA) of Rome. According to the ING bulletin for December 1948, the main shock (December 31, 1948 at 3:32 GMT) was recorded by all the main observatories then operating in Italy. The cards provide observations of macroseismic effects for about 30 sites, with intensity values ranging from III to VII MCS.

About another 70 macroseismic observations are included in the UCMEA unpublished Register of Macroseismic Cards (UCMEA, 1948 - 1975). From February 15, 1949 to the end of the same year many macroseismic cards were dispatched from Rivodutri to UCMEA with details on the occurrence of later aftershocks, most of them with $I$ = IV MCS. The State Archives of Rieti hold some official files (Fig. 3 - left) recording damage caused by the

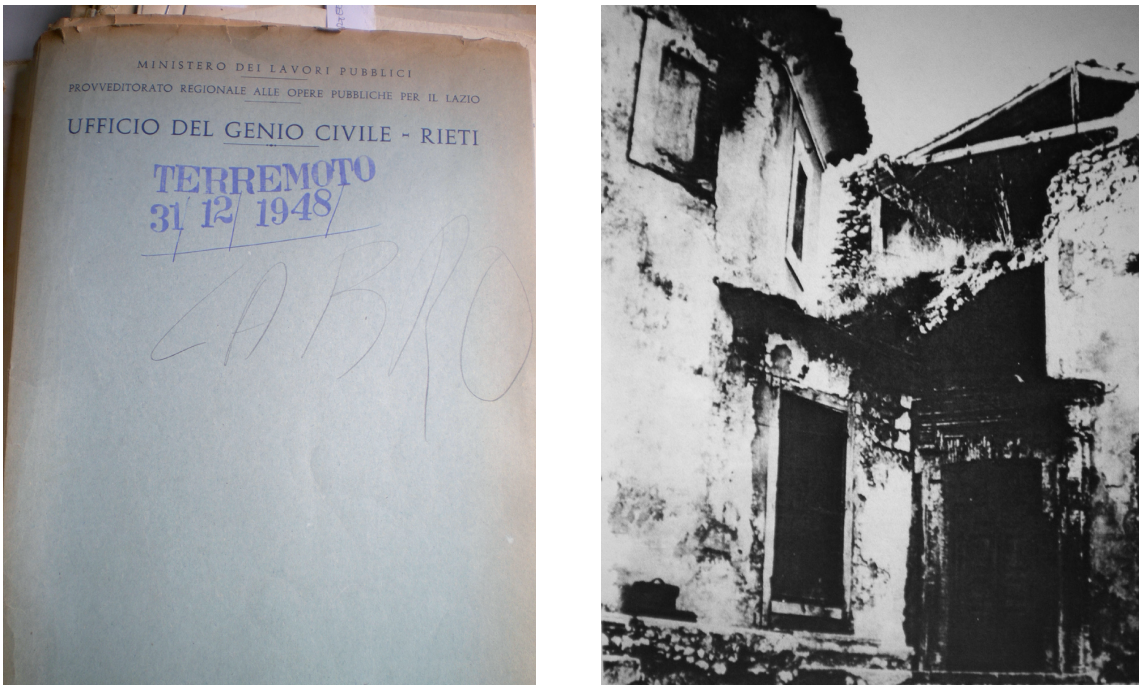


Fig. 3 - Left: One of the files on the December 31, 1948 earthquake preserved at the State Archives in Rieti (ASRI, 1948). Records in the files include: correspondence between owners of damaged buildings and public authorities, damage surveys and financial records of repair work. Right: Contemporary pictures of damaged buildings in Rivodutri (Vannozzi, 1988).

earthquakes in the Labro municipality (ASRI, 1948); a few snapshots of earthquake-shattered buildings in Rivodutri (Fig. 3 - right) are also available (Vannozzi, 1988).

## 4. The December 31, 1948 earthquake in the context of the 1948 - 1949 sequence

The event of December 31, 1948 at 4.32 local time (03:32 GMT) was the main shock of the 1948 - 1949 sequence, as evidenced by the severity of its macroseismic effects and the extension of the area over which it was felt. The most severe effects occurred in a few municipalities at the northern end of the Rieti basin, some 12 km north of the provincial capital. The most heavily affected sites were Rivodutri and Apoleggia (a *frazione* of Rivodutri) where several collapses occurred and some people were hurt. Severe damage also occurred in Morro Reatino, Poggio Bustone and Piedicolle; in Rieti itself there was panic but little damage; the shock was felt in Rome, L'Aquila and in the eastern central Italy (Fig. 4 and Table 2).

As for Rivodutri, in particular, some press news report that: at least fifty houses were heavily damaged and left uninhabitable (L'Unità, 1949.01.02); a few of them suffered either partial or total collapses, including the main church, the municipal hall, the school and the "mill-building" (L'Avvenire d'Italia, 1949.01.06); "many buildings collapsed" (Il Tempo, 1949.01.06); around 70% of dwellings turned out to be "uninhabitable" [Il Giornale d'Italia, 1949.01.02: (Lazio issue)], and many of them "are going to be either shored up or partially demolished by the

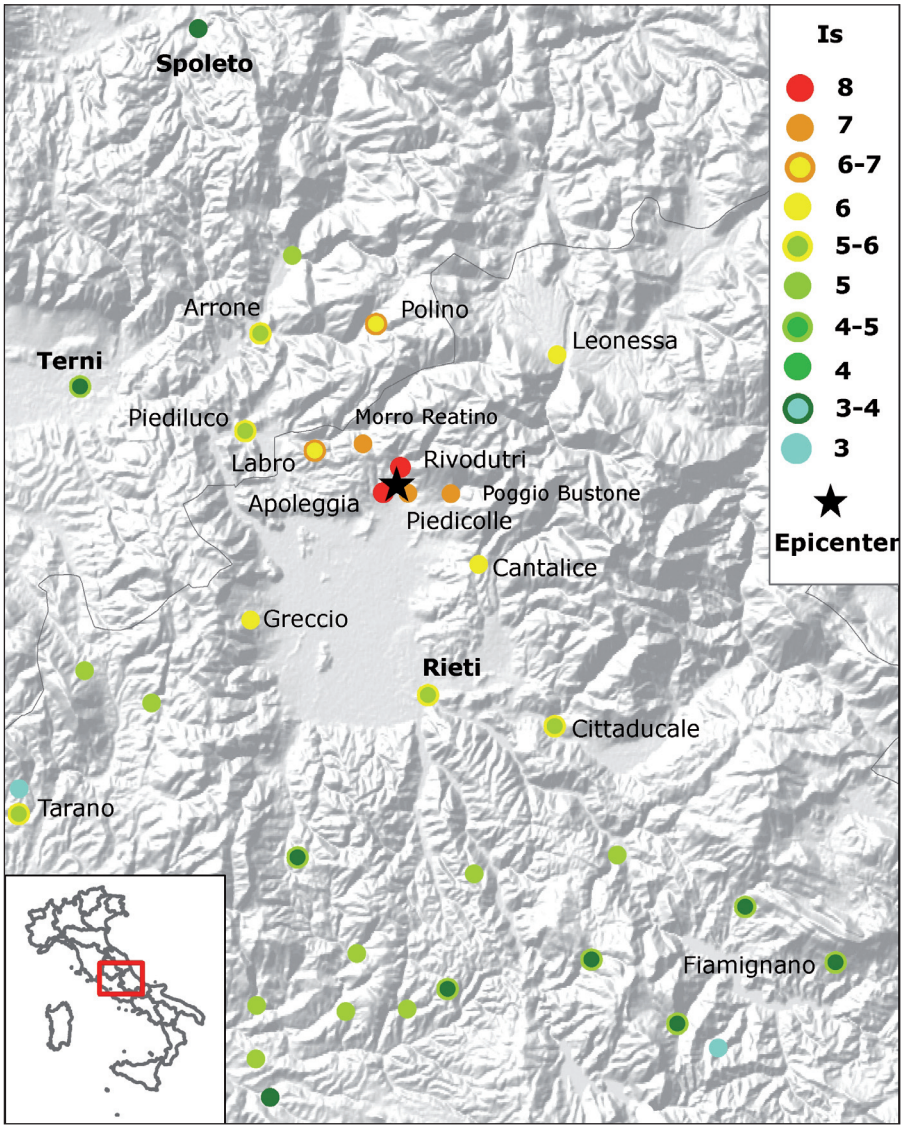


Fig. 4 - Macroseismic field of the December 31, 1948 earthquake. The black star corresponds to the macroseismic epicentre (see Table 3).

Engineers corps of the Public Works Office" (Il Popolo, 1949.01.01).

All these pieces of information bear convincing testimony to the high level of damage that the December 31, 1948 earthquake caused in Rivodutri and its *frazioni*. At the end of the 1940s Rivodutri was a mountain settlement composed of about a hundred of buildings of low architectural quality (vulnerability class A), as it appears from its panoramic views depicted in contemporary postcards (Vannozzi, 1988). Although no precise estimate of earthquake damage percentages is available, we believe, from the available information, that at least 50% of the buildings in Rivodutri and Apoleggia suffered damage level 3, of which around 20 - 25% suffered a higher damage level (4 and, in a few cases, even 5). Therefore a maximum intensity value as high as VIII MCS was assigned to Rivodutri and Apoleggia localities.

Table 2 - Macroseismic effects of the December 31, 1948 earthquake expressed according to the MCS macroseismic intensity scale (PR: province; Lat.: latitude; Lon: longitude; *I*: intensity, F = felt, NF = not felt).

| Locality | PR | Lat. (°N) | Lon. (°E) | I (MCS) |
|---|---|---|---|---|
| Apoleggia | RI | 42.503 | 12.844 | VIII |
| Rivodutri | RI | 42.515 | 12.856 | VIII |
| Morro Reatino | RI | 42.527 | 12.832 | VII |
| Piedicolle | RI | 42.502 | 12.860 | VII |
| Poggio Bustone | RI | 42.501 | 12.888 | VII |
| Labro | RI | 42.525 | 12.800 | VI - VII |
| Polino | TR | 42.585 | 12.844 | VI - VII |
| Cantalice | RI | 42.466 | 12.904 | VI |
| Greccio | RI | 42.444 | 12.753 | VI |
| Leonessa | RI | 42.566 | 12.962 | VI |
| Arrone | TR | 42.583 | 12.768 | V - VI |
| Cittaducale | RI | 42.386 | 12.949 | V - VI |
| Piediluco | TR | 42.536 | 12.755 | V - VI |
| Rieti | RI | 42.404 | 12.867 | V - VI |
| Tarano | RI | 42.355 | 12.596 | V - VI |
| Belmonte in Sabina | RI | 42.316 | 12.892 | V |
| Borbona | RI | 42.512 | 13.137 | V |
| Casaprota | RI | 42.252 | 12.804 | V |
| Castelnuovo di Farfa | RI | 42.231 | 12.744 | V |
| Collevecchio | RI | 42.334 | 12.553 | V |
| Concerviano | RI | 42.322 | 12.986 | V |
| Configni | RI | 42.423 | 12.643 | V |
| Cottanello | RI | 42.406 | 12.686 | V |
| Ferentillo | TR | 42.620 | 12.791 | V |
| Forano | RI | 42.297 | 12.595 | V |
| Montenero Sabino | RI | 42.280 | 12.813 | V |
| Poggio San Lorenzo | RI | 42.252 | 12.844 | V |
| Salisano | RI | 42.257 | 12.746 | V |
| Stimigliano | RI | 42.299 | 12.565 | V |
| Turania | RI | 42.137 | 13.009 | V |
| Collalto Sabino | RI | 42.135 | 13.048 | IV - V |
| Fiamignano | RI | 42.265 | 13.125 | IV - V |
| Longone Sabino | RI | 42.272 | 12.966 | IV - V |
| Monte San Giovanni in Sabina | RI | 42.328 | 12.777 | IV - V |
| Narni | TR | 42.517 | 12.521 | IV - V |
| Nera Montoro | TR | 42.499 | 12.474 | IV - V |
| Nespolo | RI | 42.155 | 13.071 | IV - V |
| Petrella Salto | RI | 42.294 | 13.068 | IV - V |
| San Gemini | TR | 42.613 | 12.547 | IV - V |
| Terni | TR | 42.561 | 12.648 | IV - V |
| Torricella in Sabina | RI | 42.261 | 12.871 | IV - V |
| Varco Sabino | RI | 42.239 | 13.020 | IV - V |
| Vasanello | VT | 42.416 | 12.346 | IV - V |
| Accumoli | RI | 42.694 | 13.248 | IV |
| Amatrice | RI | 42.628 | 13.290 | IV |
| Capranica Prenestina | RM | 41.862 | 12.952 | IV |

Table 2 - continued.

| | | | | |
|---|---|---|---|---|
| Cerreto Laziale | RM | 41.944 | 12.982 | IV |
| Orvinio | RI | 42.131 | 12.939 | IV |
| Pozzaglia Sabina | RI | 42.158 | 12.964 | IV |
| Spoleto | PG | 42.732 | 12.736 | IV |
| Toffia | RI | 42.212 | 12.752 | IV |
| Macerata | MC | 43.299 | 13.452 | III - IV |
| Matelica | MC | 43.256 | 13.009 | III - IV |
| Poggio Catino | RI | 42.295 | 12.692 | III - IV |
| Arsoli | RM | 42.040 | 13.019 | III |
| Bellegra | RM | 41.884 | 13.027 | III |
| Borgorose | RI | 42.193 | 13.234 | III |
| Castelnuovo di Porto | RM | 42.128 | 12.497 | III |
| Cave | RM | 41.818 | 12.931 | III |
| Foligno | PG | 42.955 | 12.704 | III |
| L'Aquila | AQ | 42.356 | 13.396 | III |
| Marcetelli | RI | 42.226 | 13.046 | III |
| Montebuono | RI | 42.367 | 12.597 | III |
| Perugia | PG | 43.106 | 12.386 | III |
| Roma | RM | 41.895 | 12.482 | III |
| Carpineto Romano | RM | 41.605 | 13.084 | II |
| Cerveteri | RM | 41.997 | 12.099 | II |
| Rocca di Papa | RM | 41.760 | 12.710 | II |
| Subiaco | RM | 41.925 | 13.095 | II |
| Fiano Romano | RM | 42.170 | 12.590 | F |
| Frascati | RM | 41.808 | 12.681 | F |
| Genzano di Roma | RM | 41.707 | 12.688 | F |
| Treia | MC | 43.311 | 13.312 | F |
| Agosta | RM | 41.981 | 13.033 | NF |
| Altino | CH | 42.102 | 14.331 | NF |
| Anzio | RM | 41.451 | 12.628 | NF |
| Ascrea | RI | 42.196 | 12.996 | NF |
| Atessa | CH | 42.066 | 14.446 | NF |
| Bomba | CH | 42.035 | 14.366 | NF |
| Camerata Nuova | RM | 42.018 | 13.108 | NF |
| Campodimele | LT | 41.390 | 13.530 | NF |
| Canosa Sannita | CH | 42.294 | 14.304 | NF |
| Carpineto Sinello | CH | 42.009 | 14.504 | NF |
| Casalanguida | CH | 42.036 | 14.498 | NF |
| Casalbordino | CH | 42.150 | 14.584 | NF |
| Casoli | CH | 42.117 | 14.291 | NF |
| Castelguidone | CH | 41.823 | 14.524 | NF |
| Chieti | CH | 42.351 | 14.169 | NF |
| Civitaluparella | CH | 41.944 | 14.303 | NF |
| Civitavecchia | RM | 42.090 | 11.799 | NF |
| Crecchio | CH | 42.297 | 14.327 | NF |
| Foggia | FG | 41.460 | 15.553 | NF |
| Todi | PG | 42.781 | 12.407 | NF |
| Torgiano | PG | 43.025 | 12.436 | NF |
| Valfabbrica | PG | 43.158 | 12.602 | NF |

The event had $M_w$ = 5.3, calculated with the Boxer 3.3 code (Gasperini *et al.*, 1999) on the basis of the macroseismic datapoints listed in Table 2; the macroseismic epicentre corresponds to the point of coordinates Lat. 42.507° N, Lon. 12.853° E (Table 3).

Table 3 - Epicentral parameters of the December 31, 1948 earthquake calculated with the Boxer 3.3 code (Gasperini *et al.*, 1999).

| Date | Time (UTC) | Lat. (°N) | Lon. (°E) | $I_X$ | $I_0$ | $M_w$ |
|---|---|---|---|---|---|---|
| 1948 12 31 | 3:32 | 42.507 | 12.853 | VIII | VIII | 5.3 |

The event of December 31, 1948 was preceded, a couple of weeks earlier, by a lesser foreshock and followed by a great number of aftershocks up to December 1949. The strongest aftershocks occurred on January 4 and 14, 1949 (Tables 4 and 5). The earthquake of October 27, 1949 [already known and included in the Rovida *et al.* (2011) catalogue; see Table 1] too is likely to have been a late aftershock of the Rivodutri sequence, though shifted a handful of kilometers westwards, close to the border between the Rieti e Terni provinces.

Table 4 - Macroseismic effects of the January 4, 1949 aftershock expressed according to the MCS macroseismic intensity scale (PR: province; Lat.: latitude; Lon.: longitude; *I*: intensity).

| Locality | PR | Lat. (°N) | Lon. (°E) | *I* (MCS) |
|---|---|---|---|---|
| Piedicolle | RI | 42.502 | 12.860 | VI |
| Rivodutri | RI | 42.515 | 12.856 | VI |
| Apoleggia | RI | 42.503 | 12.844 | V - VI |
| Morro Reatino | RI | 42.527 | 12.832 | V - VI |
| Labro | RI | 42.525 | 12.800 | V |
| Poggio Bustone | RI | 42.501 | 12.888 | V |
| Rieti | RI | 42.404 | 12.867 | IV – V |

Table 5 - Macroseismic effects of the January 14, 1949 aftershock expressed according to the MCS macroseismic intensity scale (PR: province; Lat.: latitude; Lon.: longitude; *I*: intensity).

| Locality | PR | Lat. (°N) | Lon. (°E) | *I* (MCS) |
|---|---|---|---|---|
| Morro Reatino | RI | 42.527 | 12.832 | VI |
| Rivodutri | RI | 42.515 | 12.856 | IV – V |
| Poggio Bustone | RI | 42.501 | 12.888 | IV – V |

## 5. Why did the December 31, 1948 earthquake disappear?

Thank to the accidental discovery of some essential pieces of information it has been possible to identify the previously unknown main shock of a seismic sequence occurred in the Monti Reatini (central Apennines, Italy) in 1948 - 1949 and to piece together a full picture of the chronology and effects of the sequence (Fig. 5 and Table 6).

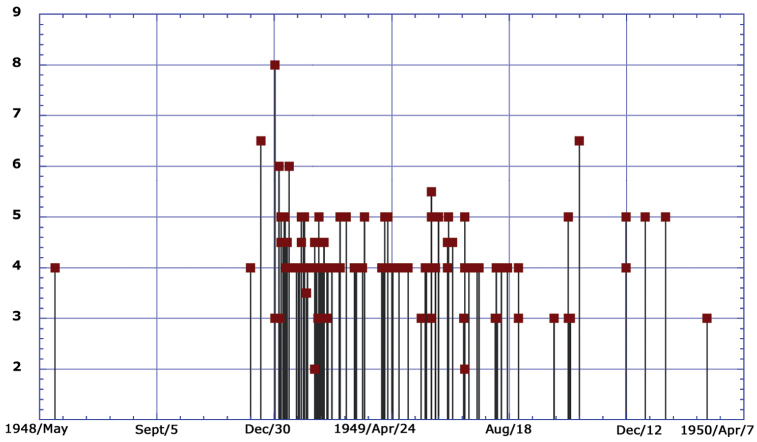


Fig. 5 - The 1948 - 1950 seismic sequence [from Dell'Olio and Molin (1980), updated after this study].

Table 6 - Chronology of the 1948-1950 seismic sequence. All records are from Dell'Olio and Molin (1980) catalogue, except the ones marked with a code number (see Ref. column), whose parameters were revised and modified by: (1) Molin *et al*. (2008); (2) this study; (3) CPTI11 catalogue (Rovida *et al*., 2011). In bold the main shock.

| Date | Time | Epicentral area | Lat (°N) | Lon (°E) | Is (MCS) | REF. |
|---|---|---|---|---|---|---|
| 1948 05 28 | 11 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1948 12 07 | 20 23 | Terni | 42.567 | 12.650 | IV | |
| 1948 12 17 | 21 18 | Ternano | 42.585 | 12.844 | VI - VII | (1) |
| **1948 12 31** | **03 32** | **Rivodutri** | **42.507** | **12.853** | **VIII** | **(2)** |
| 1949 01 04 | 20 55 | Rivodutri | 42.517 | 12.816 | VI | (2) |
| 1949 01 06 | 00 50 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 06 | 04 35 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 01 08 | 05 55 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 09 | 08 05 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 01 10 | 02 25 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 10 | 22 50 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 01 11 | 03 45 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 11 | 17 30 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 12 | 00 50 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 14 | 16 ?? | Morro Reatino | 42.527 | 12.832 | VI | (2) |
| 1949 01 14 | 18 21 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 14 | 19 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 21 | 20 18 | Poggio Bustone | 42.500 | 12.883 | IV | |
| 1949 01 23 | 07 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 23 | 10 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 24 | 03 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 26 | 02 ?? | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 01 26 | 16 59 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 01 26 | 17 12 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 26 | 23 05 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 01 28 | 22 15 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 01 29 | 01 30 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 02 01 | 01 00 | Rivodutri | 42.517 | 12.850 | IV | |

Table 6 - continued.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1949 02 01 | 04 00 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 08 | 11 ?? | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 02 08 | 11 10 | Rivodutri | 42.517 | 12.850 | II | |
| 1949 02 08 | 18 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 09 | 03 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 09 | 06 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 10 | 08 47 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 10 | 09 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 10 | 15 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 11 | 03 30 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 02 12 | 04 50 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 12 | 04 55 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 02 13 | 20 12 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 14 | 01 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 14 | 02 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 14 | 03 30 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 14 | 06 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 15 | 04 25 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 15 | 06 40 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 15 | 22 15 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 16 | 05 15 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 17 | 01 50 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 02 17 | 02 ?? | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 02 17 | 08 55 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 17 | 09 ?? | Rivodutri | 42.517 | 12.850 | III | |
| 1949 02 17 | 12 20 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 02 20 | 19 40 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 20 | 19 45 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 02 21 | 10 25 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 02 25 | 14 30 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 04 | 13 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 04 | 16 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 04 | 17 10 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 05 | 10 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 05 | 16 ?? | Rivodutri | 42.517 | 12.850 | V | |
| 1949 03 11 | 05 05 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 03 19 | 05 20 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 19 | 17 27 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 20 | 04 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 20 | 19 21 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 21 | 10 20 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 27 | 11 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 03 29 | 21 45 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 04 15 | 09 15 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 04 16 | 13 36 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 04 17 | 11 36 | Rivodutri | 42.517 | 12.850 | IV | |

Table 6 - continued.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1949 04 17 | 20 30 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 04 18 | 00 32 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 04 21 | 00 24 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 04 25 | 05 ?? | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 04 26 | 10 24 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 05 02 | 18 20 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 05 11 | 06 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 05 24 | 21 27 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 05 28 | 11 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 05 29 | 05 07 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 06 03 | 07 11 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 06 03 | 08 08 | Rivodutri | 42.515 | 12.856 | V | (1) |
| 1949 06 03 | 08 26 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 06 03 | 16 16 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 06 03 | 20 27 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 06 07 | 03 05 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 06 10 | 14 12 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 06 19 | 14 23 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 06 19 | 20 05 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 06 20 | 00 27 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 06 20 | 19 40 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 06 24 | 21 45 | Rivodutri | 42.517 | 12.850 | IV - V | |
| 1949 07 05 | 22 07 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 07 06 | 00 21 | Rivodutri | 42.517 | 12.850 | II | |
| 1949 07 06 | 17 45 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 07 06 | 17 57 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 07 06 | 21 23 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 07 10 | 02 54 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 07 18 | 02 21 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 07 18 | 16 32 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 07 20 | 15 50 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 08 05 | 23 55 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 08 06 | 00 08 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 08 07 | 14 02 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 08 11 | 05 53 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 08 17 | 02 28 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 08 28 | 02 15 | Rivodutri | 42.517 | 12.850 | IV | |
| 1949 08 28 | 03 49 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 10 02 | 18 12 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 10 16 | 05 43 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 10 16 | 15 00 | Rivodutri | 42.517 | 12.850 | V | |
| 1949 10 17 | 00 13 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 10 18 | 15 45 | Rivodutri | 42.517 | 12.850 | III | |
| 1949 10 27 | 19 08 | Labro | 42.532 | 12.805 | VI - VII | (3) |
| 1949 12 12 | 02 ?? | Morro Reatino | 42.533 | 12.833 | V | |
| 1949 12 12 | 07 04 | Rivodutri | 42.517 | 12.850 | IV | |

The main shock and earliest portion of the 1948 - 1949 sequence are not recorded by any of the Italian parametric earthquake catalogues in the public domain, from the earliest (Postpischl, 1985) to the latest one (Rovida *et al.*, 2011). Postpischl (1985) records only the later portion of the sequence, quoting as its source an unpublished regional catalogue (Dell'Olio and Molin, 1980). A comparison between the two show that a block of 53 records included in Dell'Olio and Molin (1980) are missing from Postpischl (1985). The missing records represent the first two months of the Rivodutri sequence, from late December 1948 to mid-February 1949, including both the main shock and the strong aftershock of January 4, 1949. It seems likely that these records must were discarded by mistake in the course of an automatic transfer of data from the unpublished regional catalogue (Dell'Olio and Molin, 1980) to the first Italian catalogue in the public domain (Postpischl, 1985).

This commonplace error led to the lapse from consciousness of a significant local earthquake that was responsible for the most severe damage recorded so far in Rivodutri and Morro Reatino (Locati *et al.*, 2011: Fig. 1). The December 31, 1948 earthquake is very important for the purposes of hazard assessment at the sites of Rivodutri and Morro Reatino and as such needs to be reinstated in the catalogue. Besides allowing an undoubted improvement of knowledge on seismicity at a regional level, this episode of historical seismological research does also remind us that even the most recent time-window of historical earthquake catalogues can be less complete than they are ordinarily thought to be.

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*Corresponding author:* Filippo Bernardini
Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna
Via Donato Creti 12, 40128 Bologna (Italy)
Phone: +39 051 4151430; fax: +39 051 4151498; e-mail: filippo.bernardini@bo.ingv.it