The 1762 October 6 earthquake in the Middle Aterno Valley (L'Aquila, Central Italy): new constraints and new insights

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Introduction

The effort for reducing the uncertainties in the location and size of historical earthquakes, even moderate-size ones, is not a peripheral issue, as it plays a major role in the distribution of earthquake recurrence times that can affect the maps of seismic hazard of a territory. The L'Aquila area (Abruzzo, Central Italy) struck by the April 6, 2009 Mw 6.3 seismic event is a typical example of an earthquake-prone region the location of whose historical seismicity needs to be better located. Thanks to a large body of geological, seismological and geodetic evidence the deep source of the 2009 mainshock has been imaged as a ~15 km-long, NW-trending, SW-dipping, almost pure normal fault coinciding with the Paganica Fault

System at the surface (Fig. 1). Conversely, very few papers have addressed so far the issue of reconstructing the seismic history of the Paganica Fault, charting the relationships between this fault and the adjacent ones, and finding out the causative source for each of the earthquakes listed in the Italian earthquake Catalog (CPTI Working Group, 2004; Rovida et al., 2011).

In particular, the 1461 M 6.4 and the 1762 M 6.0 earthquakes (Fig. 1) took place in the same general area as and display a comparable magnitude to the 2009 earthquake. According to recently provided paleoseismological data (Cinti et al., 2011) the shock of 1461 was the penultimate event that ruptured the Paganica Fault. The case of the 1762 earthquake was more open to debate: Tertulliani et al. (2009) suggested that it could have had the same fault source as the 2009 shock (west of the Catalogue epicenter), on account of some similarities in the distribution of the maximum intensities and in the temporal evolution of the 1762 and 2009 sequences. At the same time, however, Tertulliani et al. (2009) were aware of, and cautioned against, the very short recurrence interval implied by their hypothesis. The issue of the too short recurrence interval, along with some observations on the too low throw rate measured across the Paganica Fault, induced Roberts et al. (2010) to invoke the role of other neighbouring sources and to propose for the 1762 shock an alternative location some 10 km ESE of the epicenter adopted by the Catalog.

Such a variance of opinions concerning the epicentral location of the 1762 earthquake is explained by the scantiness of the data set on which investigations must rely, and which consists of the shaking intensities at three localities only. As Di Bucci et al. (2011) pointed out, such a data set made it impossible to associate the 1762 event to any fault “beyond mere speculation”. We are left from this stark and somewhat frustrating consideration to systematically gather all potential primary sources of information available for the 1762 earthquake in the area, in order to attempt to improve its intensity map and to compare it with the 2009 one.

In the following we will 1) set out the evidence newly collected from archives in L’Aquila and Naples and from other repositories of contemporary sources; 2) explain the rationale that allowed us to turn demographic and historical information into data sensitive to macroseismic analyses; 3) show the new intensity map for the 1762 earthquake and discuss its main differences from the previous intensity datasets (Boschi et al., 2000 and the most recent versions of the Italian Macroseismic Data Base, i.e. Stucchi et al., 2007; Locati and DBMI Working Group, 2009; Locati et al., 2011); 4) provide a more accurate location and propose new source parameters for the event; 5) discuss the constraints on its epicenter location and source parameters with the possible seismotectonic implications.

Improving the historical data set

In the last thirty years the 1762 earthquake has been studied several times (Spadea et al., 1985; Monachesi and Castelli, 1992; Boschi et al., 1997; Guidoboni et al., 2007). All studies were based on a scanty data set that included very few contemporary sources (official records, newspapers); none seems to have attempted a thorough search for contemporary information. In the latest catalogs (Stucchi et al., 2007; Locati and Working Group DBMI, 2009; Locati et al., 2011) the 1762 earthquake parameters are derived from Guidoboni et al. (2007). This study is based on the perusal of a single folder of archive file ASAQ (1762-1779) which was put together in October-November 1762 by officials charged with assessing earthquake damage in the villages of Castelnuovo and Poggio Picenze, whose inhabitants had, on account of the earthquake, pleaded for a temporary exemption from taxes. On the basis of this information Guidoboni et al. (2007) concluded that the 1762 earthquake reached its highest effects in Castelnuovo (I IX-X MCS) and Poggio Picenze (I IX MCS), while it was only felt in two nearby villages (Barisciano and San Demetrio ne' Vestini). According to Guidoboni et al. (2007) L'Aquila also was damaged, evidence for this being derived from non-local newspapers (Bologna, 1762; Diario Ordinario, 1762). As a look at the terrain will show (Fig. 1), this picture of the 1762 earthquake effects seems quite unsatisfactory because of the closeness between the few highly damaged sites and the undamaged ones and also because of the presence in the area of many other localities about which there is no evidence of any earthquake effect at all.

Seeking to improve the 1762 earthquake historical data set, we carried out a systematic, cost-effective search for contemporary written records of this event. We defined the potential field of investigation and located the main repositories of documentary and narrative sources to be searched. For original narratives, i.e. writings produced for preserving and/or disseminating the remembrance of events, we extensively sampled contemporary diaries and newspapers (Table 1). For archive documents, produced for administrative purposes by public and private bodies, we decided to consider only public records (i.e. those produced by the main lay and ecclesiastic bodies entrusted with the administration of the territory, see Table 1), because extending the investigation to private records would be too costly in terms of time and effort without guaranteeing adequate results in the short period. We then located the main archives to be investigated by taking into account the history and administrative structure of the affected territory. In 1762, the Abruzzo provinces belonged to the kingdom of Naples, an absolute monarchy within which the provincial administrators had very little freedom in the decision-making processes concerning local affairs, all of which had to be submitted to the central government. For this reason, public documents concerning the 1762 earthquake were sought not only in local archives but also in the central archives of the kingdom, preserved in Naples. Accordingly, we carried out our search not only in the public archives of L'Aquila (Archivio di Stato for State records and Archivio diocesano for Church records) but also in Naples (Archivio di Stato). Our search took into account the records of all the provincial and central offices that, by reason of their allotted tasks and prerogatives (financial, managerial and so on), were likely to have been involved with handling the consequences of the 1762 earthquake. The results of this investigation far surpassed our expectations, bringing to light information on earthquake effects in ten localities, seven of which had never been considered by any of the previous studies.

Turning historical evidence into macroseismic evidence

Having completed an exploration of the repositories most likely to have preserved contemporary evidence of the 1762 earthquake and retrieved a remarkable amount of previously unknown historical information, it remained to translate the information acquired into macroseismic data in order to assess intensity values for all the earthquake-affected sites. To this end we needed to know with a good approximation: 1) how many buildings there were in each site at the time of the earthquake; 2) how many buildings in each site were damaged by the earthquake; 3) the damage levels for as many as possible of the damaged buildings.

The new 1762 historical data set includes detailed damage surveys made for official purposes by experts of building techniques in three localities (Barisciano, Castelnuovo and Poggio Picenze); only part of the data concerning Castelnuovo and Poggio Picenze had been considered in previous studies (Boschi et al., 1995; Guidoboni et al., 2007).

In order to assess macroseismic intensities from historical documents such as the ones used in this study, it is necessary to find a correct translation of the technical or vernacular terms employed to describe earthquake effects into the standard word pictures proposed by the EMS98 scale (Grünthal, 1998). The 1762 accounts of damage in Barisciano (Fig. 2), Castelnuovo and Poggio Picenze include both sworn depositions made by houseowners whose structures had sustained damage and who were asking for financial relief, and surveys made by skilled master masons charged with checking those depositions on behalf of the public authorities (ASAQ, 1762-1779). Owing to the cultural divide then existing between the ruling class, whose language was a formal, convoluted Italian language with Neapolitan overtones, and the common people, who spoke the local vernacular (i.e. Carrer and Federici, 1827; Fanfani, 1865), the descriptions of the type, amount and severity of damage employ quaint nouns and adjectives best intelligible within a regional or even local context and are often quite difficult to interpret by modern Italian speakers.

In order to use in the best possible way the considerable amount of information available, we decided to cross-check the depositions made by damaged houseowners with those made by assessors so as to construct a pattern according to which to translate and organize the original descriptions of damage into "modern" damage categories (Tab. 2). At the same time we took care to distinguish between the cases in which damage accounts were related to whole buildings and those related to parts (rooms) of a building, as the sources mention both cases (e.g. *"Pietro Sidonio's four-roomed house […], one [room] is fallen to the ground, the others are quite extensively damaged*" or "*Francesco Gasbarro's house is completely fallen down and ruined.").*

The next step in the translation of damage information into EMS98 intensity values was to find out how many buildings there were in each of the damaged localities at the time of the earthquake, in order to obtain reliable percentages of damage. By crossing the contemporary data provided by standard demographic studies (De Matteis, 1973; Giannangeli, 1989) on the number of taxable dwellings (called 'fuochi' or hearths) existing in the L'Aquila countryside with those provided by a mid-eighteenth century census of the Kingdom of Naples (De Matteis, 1973), we were able to infer the approximate number of buildings in Castelnuovo (120), Poggio Picenze (170) and Barisciano (450). In some cases, direct information on the building stock benefited from the discovery of a contemporary, detailed image of a village (see Fig. 3). The building typologies most likely to be found in these villages can all be referred to the A class of vulnerability as defined in the EMS98 (Grünthal, 1998). Local traditional buildings, as it has been pointed out both by literature (Carocci e Lagomarsino, 2009; Ortolani, 1961) and by direct observation of historical buildings in situ, tended to be constructed out of simple stone cemented with poor quality mortar, with barns or stables on the ground floor and living quarters above, roof coverings of wood or rushes and very large masonry spans at the ground floor. The results of the reevaluation of the data and the assessment of the macroseismic intensities are summarized in Table 3.

Detailed reports of damage are available only for the three localities mentioned above (ASNA, 18th century; ASNA, 1763a-b-c-e; ASNA 1763-1773). For another ten localities (five of which completely unknown to previous studies), summary descriptions of earthquake damage are available; for seven more localities (all of them unknown to previous studies) only indirect evidence of earthquake effects has been found (Figure 4). One interesting discovery was that Barisciano, Castelnuovo and Poggio Picenze were not the only communities that applied for a tax exemption on account of earthquake damage. Similar pleas were made by the communities of Pescomaggiore, Picenza and Sant'Eusanio Forconese (ASNA, 1763d; ASNA, 1764), but we have found no evidence of damage surveys carried out in these localities to check the soundness of these claims. It is impossible to tell whether this means that these pleas were not taken into consideration or that they were considered but the surveys made in these localities are missing. In these cases we supposed that the localities in question were damaged but to a lesser degree than Barisciano, Castelnuovo and Poggio Picenze. Table 4 shows examples of the main information related to these localities and the intensity values we assessed to them.

The general picture of effects is completed by a number of reports found in the Visite pastorali (i.e. the accounts of the periodical inspections carried out by the Bishop of L'Aquila on Church properties) from 1762 to 1769 and in other archival records of the L'Aquila diocese (ADAQ, 1762). These accounts mention the state of disrepair of many inspected buildings, without linking it explicitly with the 1762 earthquake. Nevertheless it is interesting to note that these references are very close, both in time (1762-1766) and in space, to the 1762 event. Although those accounts could not be used to assess intensities, we think that a real correlation between them and the earthquake is highly possible and can contribute to shaping the general scenario of damage. We accordingly treated such accounts as '*indirect*' sources (Fig. 4).

There are also '*silent*' sources, i.e. records that, though produced within the earthquake time-frame and dealing with localities likely placed within the earthquake-affected area, do not mention the earthquake at all, which implies a likelihood that the earthquake in those localities was either not felt or inconspicuously felt.

The intensity map produced after the revision of all the available sources (Fig. 5) confirms that the epicentral area of the 1762 earthquake is placed 15-20 kilometers southeast of L'Aquila. The major damage area is well constrained to a limited sector of the Middle Aterno Valley. The city of L'Aquila suffered much less damage from the 1762 earthquake than from the 1461, 1703 and 2009 earthquakes. The high level of damage undergone by Castelnuovo in 1762 appears to be due to local large amplifications of ground motion (as occurred following the 2009 earthquake, see Tertulliani et al., 2009; Lanzo et al., 2011), showing its proclivity to be extensively damaged. Conversely, the village of Monticchio appears to have been preserved from heavy damage in 1762, just as it was also in 1703 (Morelli, 1962) and in 2009 (Galli et al., 2009).

Previously, no information was found on the duration of the whole 1762 seismic sequence (Amato and Ciaccio, 2012), apart from some generic evidence describing a period of twenty-four days of continuous shocks. New information retrieved from this study (ASNA 1762; ASNA 1763b) show that the sequence was active up to the end of December 1762 (approximately for three months) and included frequent aftershocks that alarmed the population at L'Aquila and Castelnuovo.

Fig. 5 shows all the macroseismic information available at the end of this study. The intensity data set has been more than doubled by our investigation (rising from six to thirteen intensity data points) and it is now possible to attempt a more reliable estimation of the epicentral parameters. To allow for a robust and objective comparison with the source parameters estimated by previous studies we decided to use the Boxer 3.3 code (Gasperini et al., 1999) adopted by the latest Italian Earthquake Catalog (Rovida et al., 2011). The Boxer 3.3 code correlates the magnitude to the available isoseismal areas defined as those of circles with radii equal to the average epicentral distance of sites with a given intensity (Gasperini and Ferrari, 2000). Clearly we are aware that an algorithm using intensity observations provides an estimation of the centre of strong shaking rather than the location where the quake starts (Bakun et al., 2011). Table 5 shows a comparison between the parameters calculated by Rovida et al. (2011) and by this study.

The newly calculated magnitude in this study has dropped to 5.3 from the earlier value of 6.0 (Rovida et al., 2011), due to the decrease of the maximum intensity; the epicentral location has not changed (as was to be expected, the epicenter in both cases having been calculated with the same code and using an almost unchanged distribution of highest intensity points). However, location and magnitude are now considerably more robust than before, because they are based on a larger set of data than previously used in analyses of this event.

Discussion

After carrying out a painstaking historical study of the 1762 earthquake we confirm the epicentral coordinates that had been previously determined. At first glance, this might be considered having taken much pain for little gain, were it not for the obvious fact that, far from missing a chance to improve the general knowledge on this historical event, we were in fact able to put new and better constraints on the epicenter position, which provides a better insight on seismic hazard assessment in the study area.

Constraints on the location of the epicenter

The CPTI (Rovida et al., 2011) epicenter of the 1762 earthquake was calculated on the basis of a very sparse and uneven data set; out of eight localities reporting news from the event only three could be used for calculating the epicenter, a fourth one was judged to be well outside (~90 kilometers) the epicentral area, and in the last four localities the earthquake was barely felt. The distribution of these points was also quite puzzling, with the two highest intensity sites immediately juxtaposed by another two sites where intensity seems to have been at its lowest. The 1762 epicenter calculated by our study relies on a data set that includes thirteen intensity points, eleven of which are useable for calculating the epicenter. The highest intensities cluster in a 5-7 kilometers-wide area that includes the villages of Poggio Picenze, Barisciano, Castelnuovo and San Demetrio ne' Vestini; intensities outside this area tend to decrease as one gets progressively farther from the highest intensity area. Mapping the distribution of '*indirect*' and '*silent*' sources delimits the above mentioned area of maximum damage and limits the possibility of shifting the epicenter any farther NW or SE. A SE shift seems particularly unlikely as an extensive perusal of contemporary sources shows that the life in most villages located southeast of Castelnuovo simply was not affected at all by the occurrence of the earthquake.

The new data set suggests that the epicentral location of the 1762 earthquake cannot have been the same as that of the 2009 earthquake, as the respective macroseismic epicenters are 5-6 kilometers apart, a distance higher than the errors associated with the output of Boxer 3.3 code (see Figure 5 and Table 5). To further compare the 1762 and 2009 epicenters, we run the Boxer 3.3 code of localization using the intensities of the 2009 earthquake only on the localities affected by the 1762 event. The result is again a location (named 2009b in Fig. 5) adjacent to the 2009 instrumental epicenter (2009a in Fig. 5).

Negative and positive evidence on the earthquake source

The most important result of this study is the marked decrease of the 1762 earthquake magnitude from 6.0 to 5.3 relative to earlier estimates of the size of this event. Merging this information with the above described constraints on the earthquake location, some of the source locations proposed in the past for this event should be no longer considered accurate, as they were based on the old dataset and on the quest for a M=6, ~15 km-long source.

First, it can be reasonably ruled out that the 1762 earthquake source was the Paganica Fault as it ruptured in 2009 (compare the 2009 source in Figure 6), the two earthquakes being markedly unlike in terms of fault dimensions and damage scenarios. This assumption is confirmed by the lack of paleoseismological signatures of the 1762 earthquake in the trenches so far dug along the Paganica Fault (Cinti et al., 2011; Galli et al., 2011), although the M=5.3 proposed in this study sets the 1762 earthquake at the lower limit for paleoseismological identification.

Second, similar considerations lead us to rule out the S. Pio Fault as a possible source for the 1762 earthquake (Fig. 6). Apart from the questionable activity of this structure (Messina et al., 2011), neither the magnitude proposed for a potential earthquake originated by this source (Mw 6.2, Di Bucci et al., 2011) nor the hypothetical intensity map associated with it would fit with the historical evidence recently retrieved for the 1762 earthquake.

A third possibility, suggested by Tertulliani et al. (2009), was that the 1762 earthquake originated on the Fossa Fault (Fig. 6), a NE-dipping structure antithetical to the Paganica Fault and showing evidence of Holocene activity (Emergeo Working Group, 2009). The seismic potential of the Fossa Fault could be comparable to the magnitude of the 1762 earthquake; we think, however, that the damage scenario produced by this structure would be totally different.

Placing the 1762 epicentral location in the context of the active faults of the area (Fig. 6), we note that the epicenter is situated at the southern end of the Paganica Fault system, in a zone of extremely distributed deformation that coincides with the southern boundary of the 2009 earthquake source and with the limits of most of its aftershocks sequence. This is the area where the Paganica complex fault system (composed of several 2 to 5 km-long segments) has a zone of overlap and stepover with the Middle Aterno fault system (Cinti et al., 2011; Galli et al., 2011). Therefore, from all the previously described evidence and constraints, a possibility is that the 1762 earthquake was located on the southernmost segment of the Paganica Fault system, between San Demetrio ne’ Vestini and Poggio Picenze.

Conclusions

When we started this work our aim was to improve the characterization of the 1762 earthquake in terms of epicentral location and source dimensions. After a systematic search for contemporary evidence which retrieved a great amount of new data the main findings of our study can be summarized as follows:

- a noticeable improvement of the macroseismic database (from six to thirteen localities) and a wider distribution of the intensities;
- new information on the duration of the sequence, that lasted approximately three months instead of about twenty-five days;
- a marked decrease of the estimated magnitude of the event, from ~6.0 to ~5.3;
- a reduction of the uncertainties associated with the position and the size of the earthquake source. This allowed us to rule out some of the hypotheses about the 1762 event (e.g., twin of the 2009, NE-dipping source etc.) proposed before this study;
- the constraints on the epicentral location and on the earthquake source dimensions suggest that the 1762 earthquake ruptured only the southernmost segment of the Paganica Fault.

This study demonstrates that improving the macroseismic dataset even of a single historical earthquake can influence the definition of damage scenarios and can also affect the knowledge of the seismic hazard of an area. We believe that historical investigation can vigorously contribute to the knowledge of past seismic events, and that there is still much to be gained from the in-depth study of any single historical earthquake.

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Figure captions

Figure 1 – Map of the study area (see inset for location of the area in the Italian Peninsula). Black symbols indicate the epicenters of the most important historical earthquakes in this region (CPTI Working Group, 2004). We also show the locations and intensities (in brackets) of the five localities in Abruzzo quoted in the Italian Macroseismic Database (Locati et al., 2011) for the 1762 event that were known before this study (a sixth locality is Rome, ~90 southwest of L'Aquila). A white star marks the location of the instrumental epicenter of the 2009 mainshock, and a dashed rectangle represents the surface projection of the seismogenic source of the 2009 earthquake according to the model of Atzori et al. (2009).

Figure 2 – Example of an historical document retrieved by this study: it is a detailed survey of the damage produced by the 1762 earthquake in the village of Barisciano, for which 297 cases of damage are described. Such documents allowed us to cross-check the datum on the population of the village with the information on its building stock. Following the retrieval of this document we could assess a new EMS intensity of 7.5 for Barisciano (it was classified 'Felt' in the CPTI).

Figure 3 - The picture shows a faithful reproduction of the village of Villa S. Angelo as it was in 1694 (ADAQ, 17th-18th century). This reproduction allowed us to establish a relation between taxable housing units (hearths) deduced from the census and an effective number of buildings, and to estimate the average number of inhabitants *per* building.

Figure 4 – Map of the sources available for the 1762 earthquake following this study.

Figure 5 – New map of the intensities associated with the 1762 earthquake. There are now ten points in the epicentral area with an assigned intensity; the old intensity from CPTI is shown in parenthesis. Black symbols indicate the location of the epicenters (and associated errors indicated by black bars) calculated by the code Boxer 3.3 for the 2009 event (2009a, whole dataset; 2009b, intensities of the 2009 event only from the localities with intensities for the 1762 event) and for the 1762 event (1762). The inset shows the complete map of intensities for the 1762 earthquake, including three points located outside the epicentral area. Legend: F, Felt; ss, silent source (see main text); is, indirect source (see main text).

Figure 6 – Instrumental seismicity and tectonic structures in the L'Aquila 2009 epicentral area. White star indicates the mainshock

and white dots indicate the M≥2.0 aftershock distribution (April-December 2009) of the 2009 seismic sequence from the Italian Instrumental Database (ISIDe Working Group, 2010). The surface projection of the seismogenic source (dashed rectangle) is from Atzori et al. (2009). We also show the epicenter of the 1762 earthquake. Active (late Quaternary) normal faults are modified from Civico et al. (2010) and Vezzani and Ghisetti (1998). The inset shows the geometry of the seismogenic sources quoted in the text: a) Paganica Fault; b) S. Pio Fault; c) Middle Aterno Fault; d) Fossa Fault.

Diaries		**Newspapers**	
Carnili	XVIII Century	Amsterdam	1762
Pelli Bencivenni	XVIII Century	Annual Register	1762
Bassanelli	XVIII-XIX Centuries	Bologna	1762
Bedetti	XVIII-XIX Centuries	Diario ordinario	1762
Campanelli	XVIII-XIX Centuries	Gazette de France	1762
Archives		La storia dell'anno	1762-1763
ADAQ – Archivio Diocesano dell'Aquila	XVI-XVIII Centuries	Mercurio historico y politico	1762
ASAQ – Archivio di Stato dell'Aquila	XVIII Century	Wienerische Diarium	1762
ASNA – Archivio di Stato di Napoli	XVIII Century	Mercure de France	1763

Table 1. Contemporary sources (diaries and newspapers) and public records (archives) investigated in this study.

Damage degree EMS98	**Original terms**	**English translation**	**Original terms**	**English translation**
	Building		Room	
D5 Total or near total collapse	*caduta,* *caduta a terra,* *rovinata/ ruinata*	fallen down fallen to the ground ruined		
D4 partial failure, substantial to heavy damage	*fracassata* *cadente*	smashed/shattered about to fall/ tumbledown	*caduta,* *caduta a terra, rovinata, ruinata*	fallen down fallen to the ground ruined
D3 substantial to heavy damage	*lesionata*	damaged	*fracassata, lesionata, cadente*	smashed/shattered about to fall/ tumbledown

Table 2. Statements of assignment of the lexical items retrieved in contemporary documents.

Locality	Building stock	Buildings with D3 damage	Buildings with D4 damage	Buildings with D5 damage	***I EMS*** *before*	***I EMS*** *after*
Castelnuovo	**120**	**30**	**38**	**41**	***9-10***	***9***
Poggio Picenze	**170**	**29**	**35**	**10**	***9***	***8***
Barisciano	**450**	**195**	**82**	**7**	***Felt***	***7-8***

Table 3. A summary of damage inferred from contemporary reports (ASAQ, 1762-1779) and related translation into modern macroseismic items. Last two columns on the right show the intensity degree assessed for each locality before this study and after this study, respectively.

Locality	**Source**	**Account**	**I EMS** before	**I EMS** after
Ariccia	Bassanelli (1829)	*"in that year only one real earth shaking, felt in this neighbourhood in October [..] that damaged Aquila."*	F	F
Arischia	ASAQ (1743-1792)	*"[..] felt a very strong earthquake [..]"*	NA	5-6
L'Aquila	(ASNA, 1762-1763a; ASNA, 1763f; ASNA, 1764)	Damage to public buildings (Castle, Gaol etc.); thanksgiving rites	7	6-7
Mogliano	Carnili (18th century)	*"On the 6th of October at a quarter past 19 hours, there was an earthquake…"*	F	F
Monticchio	(contemporary epigraph in Morelli,1962)	*"The Monticchio people remained safe thanks to the protection of their patron, St. Nicholas." [contemporary epigraph]*	NA	5-6
Pescomaggiore	ASNA (1763d)	Plea for tax exemption on account of the damage caused by the earthquake of 6 October 1762.	NA	7
Picenza	ASNA (1764)	Plea for tax exemption on account of the damage caused by the earthquake of 6 October 1762.	NA	7
Roma	Bologna (1762)	*"The 6th of this month a very feeble earthquake was felt in several part of this Metropolis..."*.	3	3
San Demetrio ne' Vestini	ADAQ (1586-1768); ASAQ (1762-1779; ASNA (1764)	Plea for tax exemption on account of the damage caused by the earthquake of 6 October 1762. *"On the 6th of October at a quarter past 19 h, a horrible earthquake[…], in our village of S. Demetrio many houses fell, and all the others are damaged and almost uninhabitable".*	F	7-8
Sant'Eusanio Forconese	(ASNA, 1764)	Plea for tax exemption due to the damage caused by the earthquake of 6 October 1762.	NA	7

Table 4. Examples of sources, relative accounts and intensity, of the less or not damaged localities. Last two columns on the right show the intensity degree assessed for each locality before this study (when available) and after this study, respectively. Legend: F, Felt; NA, not available.

	Lat	Long	Mw	Np	Fault dimensions LxW (km)
Rovida et al. (2011)	42.308±2.1	13.585±1.5	6.0	8 (3)	12.4x8.1
This study	42.308±1.4	13.585±3.6	5.3	13 (11)	5.0 x 4.9

Table 5. Comparison between the parameters of the 1762 earthquake in the latest Catalogue and in this study.

Legend: Np, number of points in the dataset (in brackets the number of intensity points used in the calculation).

Figure 1

Figure 1

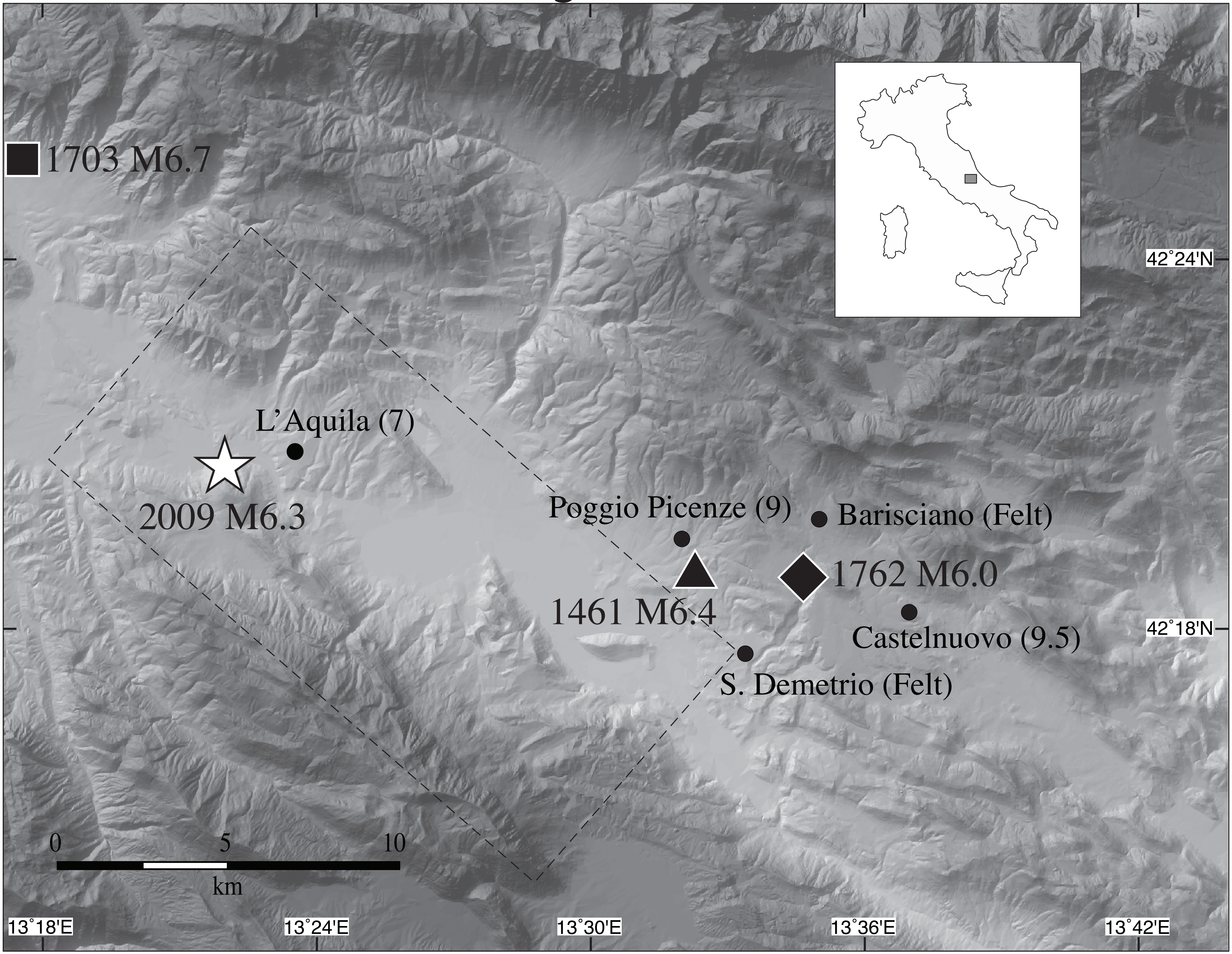


Figure 2

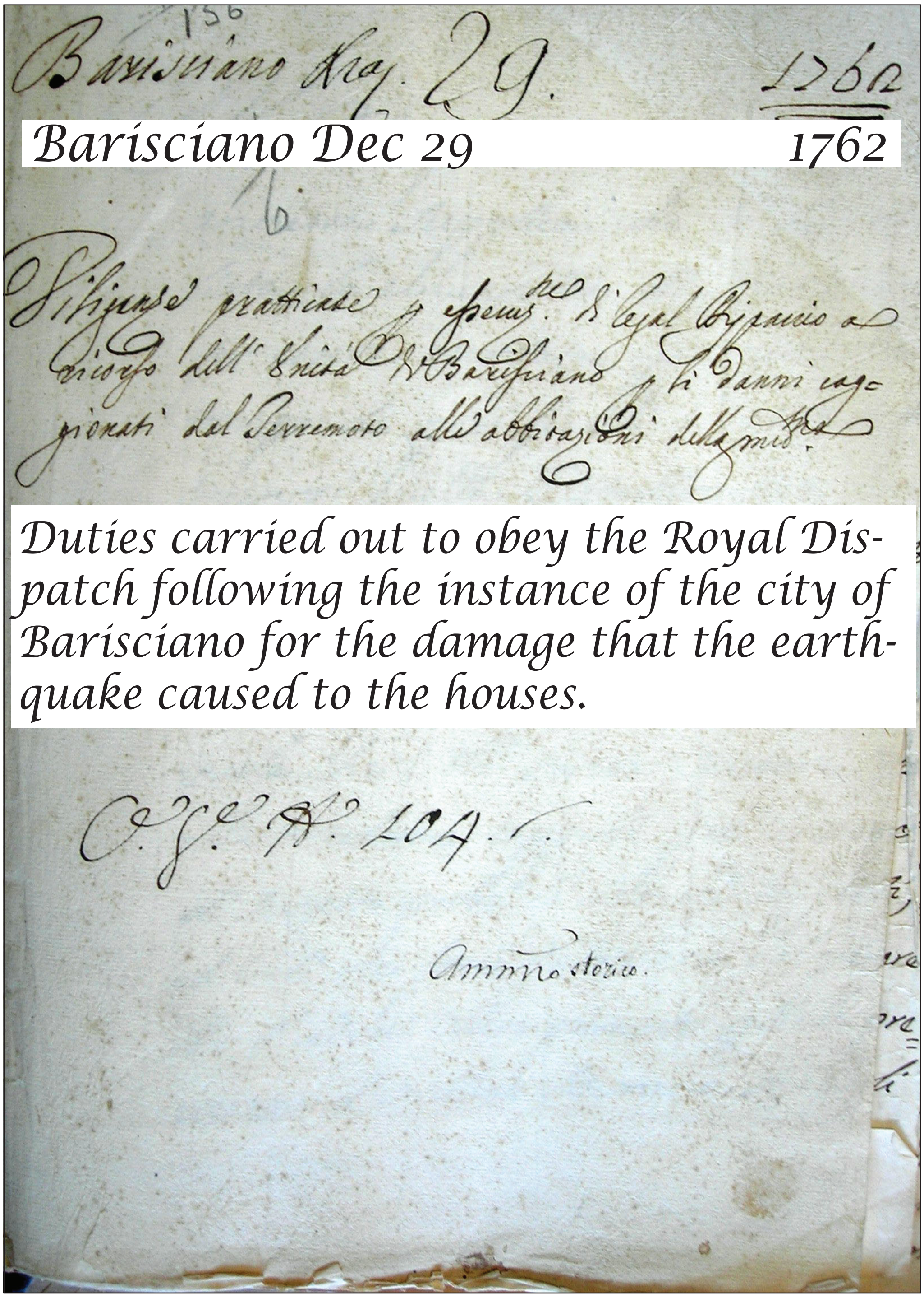

Bariscano Dec 29
1762
Duties carried out to obey the Royal Dispatch following the instance of the city of Barisciano for the damage that the earthquake caused to the houses.

Figure 3

Figure 3

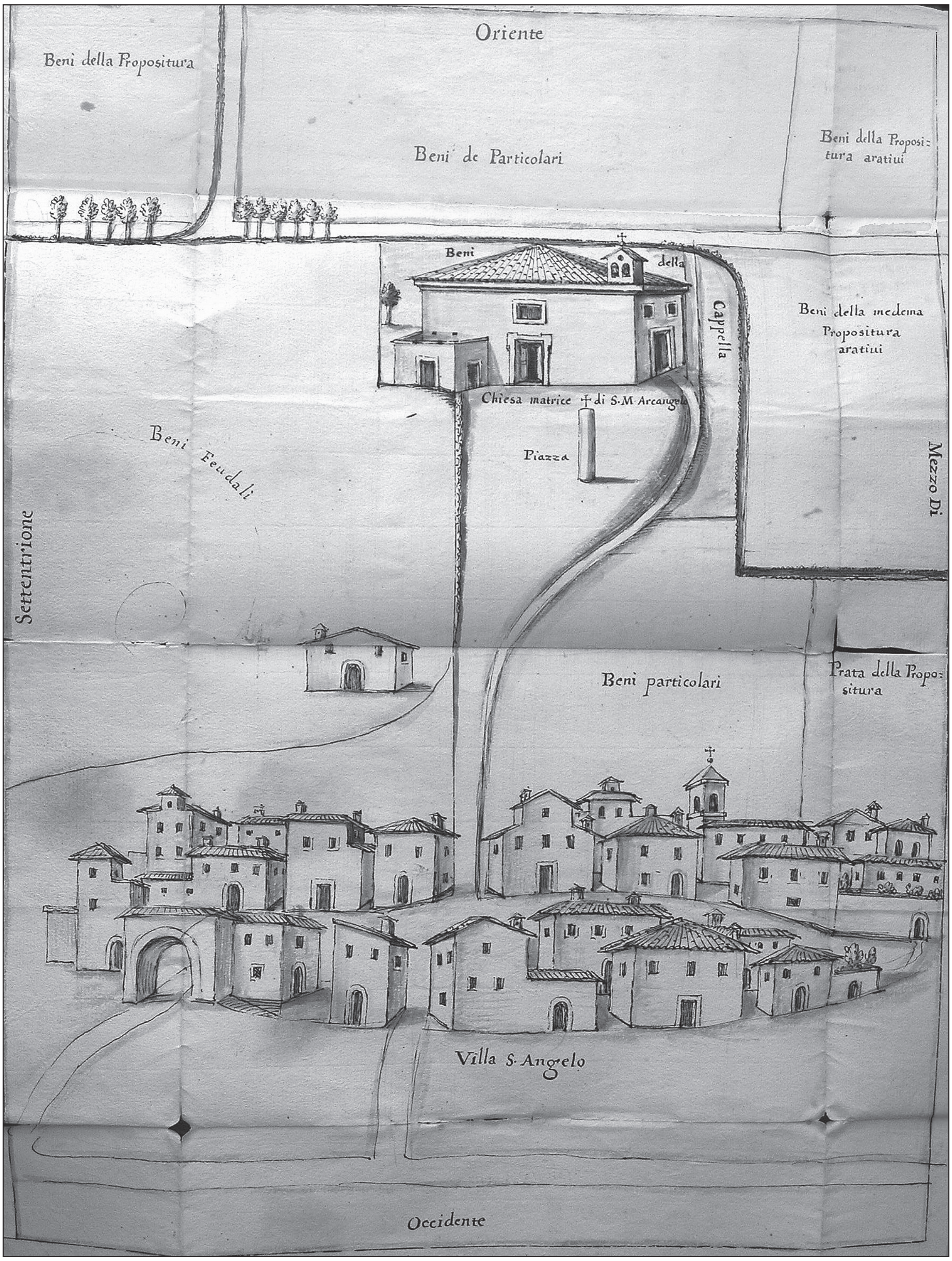


Figure 4

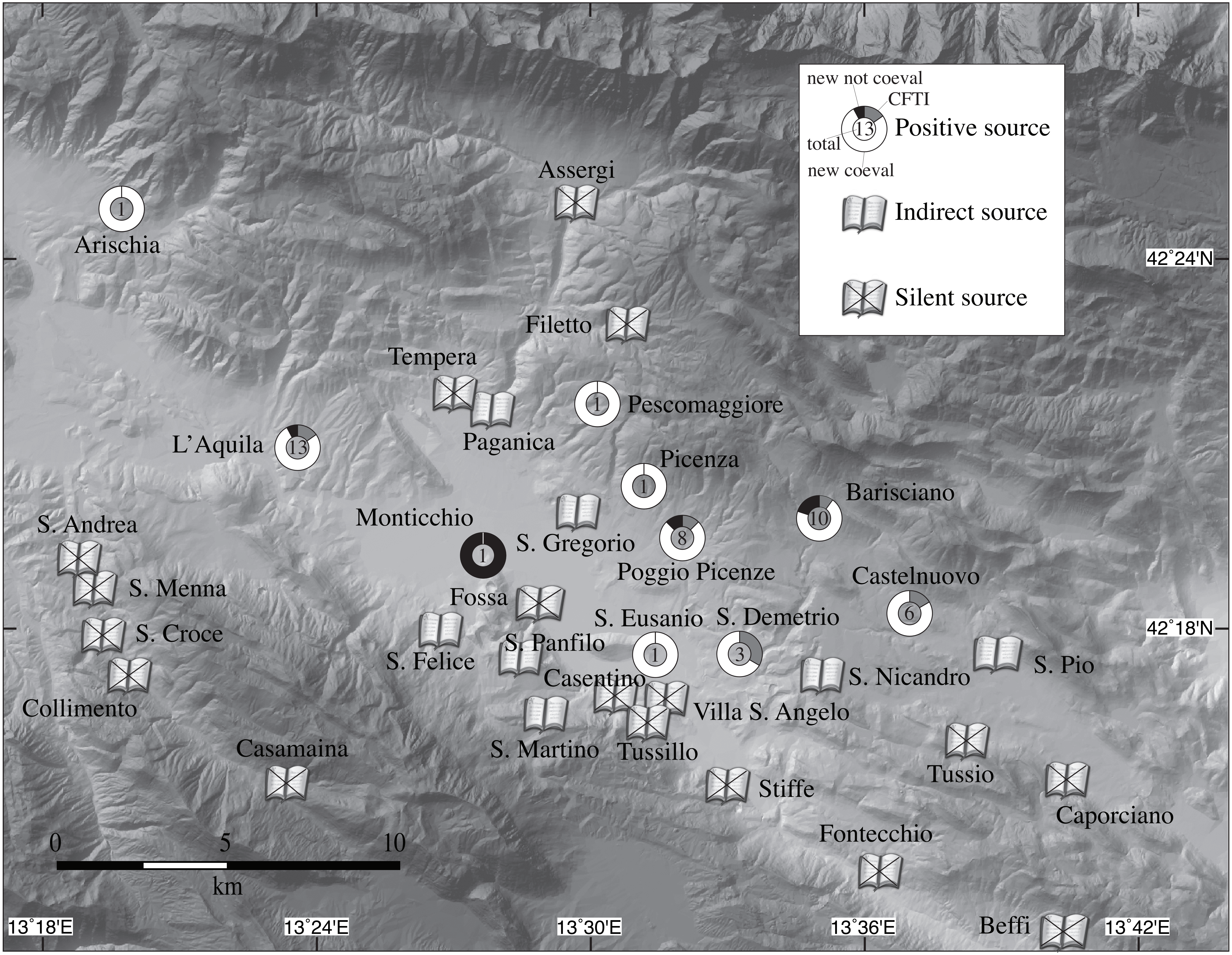


Figure 4

Figure 5

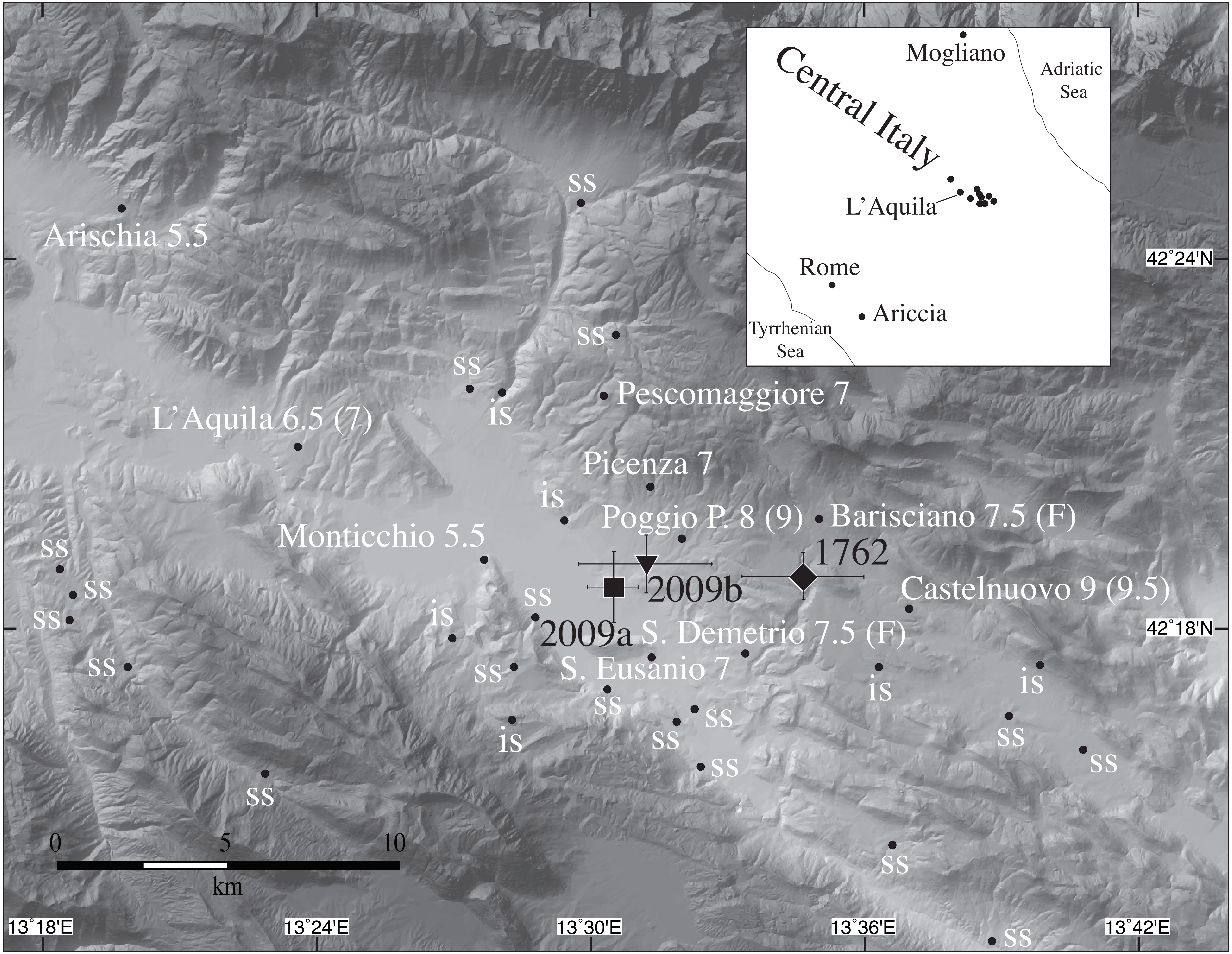
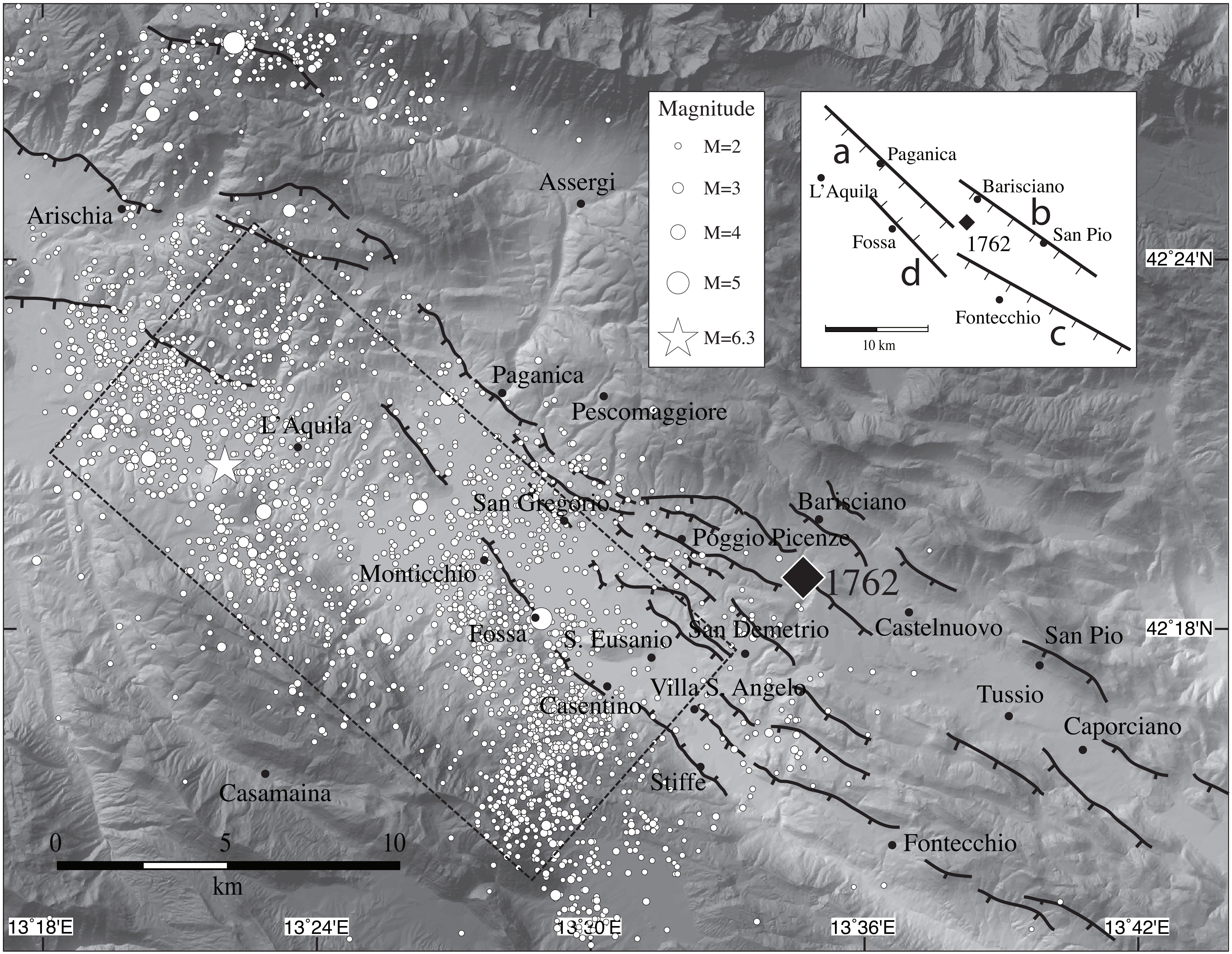


Figure 5



Magnitude
M=2
M=3
M=4
M=5
M=6.3
a
Paganica
L'Aquila
Barisciano
b
San Pio
Fossa
1762
d
Fontecchio
c
10 km
Assergi
Arischia
42˚24'N
Paganica
Pescomaggiore
L'Aquila
San Gregorio
Barisciano
Poggio Picenze
1762
Monticchio
Fossa
S. Eusanio
San Demetrio
Castelnuovo
San Pio
42˚18'N
Villa S. Angelo
Tussio
Casentino
Caporciano
Stiffe
Casamaina
Fontecchio
0
5
10
km
13˚18'E
13˚24'E
13˚30'E
13˚36'E
13˚42'E

Figure 6