

«Unknown» earthquakes: a growing contribution to the Catalogue of Strong Italian Earthquakes

Dante Mariotti, Alberto Comastri and Emanuela Guidoboni
SGA, Storia Geofisica Ambiente, Bologna, Italy

Abstract

The particular structure of the research into historical seismology found in this catalogue has allowed a lot of information about unknown seismic events to be traced. This new contribution to seismologic knowledge mainly consists in: i) the retrieval and organisation within a coherent framework of documentary evidence of earthquakes that took place between the Middle Ages and the sixteenth century; ii) the improved knowledge of seismic events, even destructive events, which in the past had been «obscured» by large earthquakes; iii) the identification of earthquakes in «silent» seismic areas. The complex elements to be taken into account when dealing with unknown seismic events have been outlined; much «new» information often falls into one of the following categories: simple chronological errors relative to other well-known events; descriptions of other natural phenomena, though defined in texts as «earthquakes» (landslides, hurricanes, tornadoes, etc.); unknown tremors belonging to known seismic periods; tremors that may be connected with events which have been catalogued under incorrect dates and with very approximate estimates of location and intensity. This proves that this was not a real seismic «silence» but a research vacuum.

Key words *unknown earthquakes – completeness of seismic catalogues*

1. Introduction

The seismic history of an area, summarised in historical earthquake catalogues, constitutes an attempt to «reconstruct» true seismicity starting from historical evidence. Therefore, the so-called extent of «completeness» of the seismic catalogue of an area defines the degree of approximation of the data in the catalogue compared with the actual seismicity. The «completeness» of the data may generally only be

evaluated for classes of high intensity. The more complete a catalogue, the better our knowledge of the true frequency of events that caused damage in different intervals of time. The completeness of the basic historical data is, therefore, of considerable importance in order to give a correct estimate of the seismic hazard of particular sites and territories – regardless of the different approaches adopted by seismologists (see Albarello, 1994) – and strategies aimed at reducing the seismic risk of an area.

The catalogue of historic earthquakes in Italy covered in the past four centuries can be considered «complete» as regards earthquakes of IX degree on the Mercalli-Cancani-Sieberg (MCS) macroseismic scale. For various historical and cultural reasons, all information regarding high-impact seismic events which took place *after* the seventeenth century can be considered more or less complete. Nevertheless, during his-

Mailing address: Dante Mariotti, SGA, Storia Geofisica Ambiente, Via Bellombra 24/2, 40136 Bologna, Italy; e-mail: mariotti@sga-storiageo.it

torical seismic research it is often possible to uncover new destructive events which took place after the seventeenth century.

A considerable amount of information regarding unknown seismic events was collected during the research over almost twenty years for the *Catalogo dei Forti Terremoti in Italia*. The new data was uncovered by systematically cataloguing *corpora* of sources such as chronicles, registers, inscriptions, etc. This new information has not yet been incorporated into the catalogue and makes up a *corpus* on its own. A few examples are given below.

The problem of «unknown» earthquakes was initially tackled only in 1993, when the specific territorial analysis of certain areas that appeared to be seismically «silent», was included in the research programs of the Istituto Nazionale di Geofisica (Valensise and Guidoboni, 1995 and the introduction in this catalogue). Looking for «unknown» earthquakes requires research strategies and procedures which are, in some aspects, more exacting. In any case, the organisation of the research regarding the re-examination of well-known events also allowed data, traces and informative leads regarding unknown seismic events to be uncovered. Even if this information has not yet been used systematically, it has highlighted some destructive earthquakes and numerous tremors. On the other hand, new research regarding areas considered free of historical seismic activity has brought to light some data whose originality makes it perhaps of even greater scientific interest.

2. Casual traces of earthquakes from the Middle Ages to the 16th century

The earthquakes known to have occurred between the eleventh and sixteenth century are far fewer than those which have taken place during the past five centuries. This «vacuum» is essentially due to missing basic information. Indeed, the production and preservation of a large quantity of written evidence strongly influences the state of this knowledge, as does the lack of detailed research.

During research for the CFTI3, information was gathered on formerly unknown numerous

seismic events which occurred in this period. New data have emerged from the scrutiny of documents or from a systematic reading of sources: however, this information must be used with particular caution, because a more careful study of «new» events often shows them to be:

- i) simple chronological errors relative to other well-known events;
- ii) descriptions of other phenomena of natural origin, though defined in the texts as «earthquakes» (landslides, hurricanes, tornadoes, etc.);
- iii) unknown *tremors* belonging to well-known seismic sequences;
- iv) tremors that can be traced back to events included in the previous PFG Catalogue (Postpischl, 1985) with erroneous dates and with very approximate estimates of location and intensity.

In the latter case, which has a certain importance as regards seismic hazard, we may give the following example: Baratta (1901, p. 40) mentions a destructive earthquake in Naples in 1282 based on Perrey (1848, p. 13), expressing grave doubts about the veracity of this event. Nevertheless, in the PFG Catalogue (1985), this tremor has been classified as degree VIII of the MCS scale with epicentral intensity in Naples. During the research, reliable evidence emerged which allowed us to believe that an earthquake which caused some damage took place in Naples not in 1282, but in 1280. The evidence comes from a notarial document, written by the notary Dionisio De Sarno in 1429, a copy of which is preserved in a 1696 memorial in the monastery of San Marcellino (Archivio di Stato di Napoli). The notary mentions a marble slab of ancient writing which fell due to the earthquake of 1280 (*huna marmora de littere antiche that casscho per le terremuoto in anno domini nostri Jesu Christi 1280*). This inscription referred to the foundation of the monastery. An earthquake indeed occurred, but the Naples trace remains very faint: no effects on the city are recorded and an important question remains: where was the epicentre of this event? Was it the after-effect of an earthquake in the Apennines or a local earthquake?

Much information contained in medieval annals and chronicles, which deal with the local effects of effectively unknown earthquakes, are traces to be followed up by documentary research. In some cases this information can be of

great evidential value and considerably change the picture of seismological knowledge and hazard estimates.

During the research a sort of small archive of «enigmatic» cases was compiled, made up of reliable information regarding religious buildings and castles which were either destroyed or in ruins. In the absence of indisputable proof to relate this kind of data to the occurrence of earthquakes, it cannot be used. Nonetheless, this type of information supplies important elements regarding evidence of inhabitation. Sometimes this destruction can be included in a framework of precise explanations. Raids, wars and abandonment were, in fact, common phenomena during the Middle Ages in many parts of Italy. For example, the causes of the ruin and decline of the Calabrian church of San Filippo di Terrati (near Lago, Cosenza) when Roberto il Guiscardo decided to rebuild it in 1070 (deed of donation, doc. 21 in Ménager, 1980) remain unknown. What is more, there is still doubt that a seismic event destroyed the ancient church (no longer standing) of Santa Maria di Picciano (Aquila area): in a 1497 Papal bull, when Alexander VI had to decide on the unification of no less than twenty monasteries, he described this building as being in ruins due to damage caused by age, wars and other undefined sinister events: «... *causantibus vetustate illius ac guerrarum turbinibus et aliis sinistris eventibus*». We may presume that the latter expression refers to earthquakes, but in this case it is doubtful whether these were the 1461 earthquakes (see in the CD-ROM) or other unknown earthquakes. It is interesting to note here that this new data emerged from the systematic scrutiny of monastic archives which took place throughout the research; in this case, from the archives of the abbey of Picciano (Clementi, 1982).

From the mid-fifteenth century, extensive information is available regarding unknown seismic events: personal and family diaries and town chronicles record local tremors or tremors relative to territories belonging to the main cities of ancient Italian States. Even in areas which have already been studied and well-documented, evidence of unknown destructive tremors has emerged, such as the one that occurred on 20 February 1455 in the Bolognese Apennines and recorded in direct and reliable sources.

Sometimes, even though the traces are reliable, they are often so limited that they require a follow-up by in-depth research, above all when traces of ancient earthquakes regard areas with little or no documentation. Data regarding earthquakes in Calabria during the sixteenth century, for example, are known to be lacking, not only because of the scarcity of documentary sources, but also due to the lack of research. For this reason, information about an earthquake in the sixteenth century should motivate thorough and specific development. A trace we came across consists in moving the convent of Santa Veneranda in Maida (now in the province of Catanzaro) due, as explicitly stated, to an earthquake which caused a lot of damage. This information emerged while researching Calabrian earthquakes, in particular during detailed historiographic research into the history of the Basilian monasteries, from the early Middle Ages to the beginning of modern times.

3. Major known earthquakes that have «observed» minor events

In their time, great seismic disasters have often caused contemporaries to «focus exclusively» on the important seismic event, so that other minor seismic events which occurred during the same period have either been overlooked or underestimated. There are many such cases, but we have indicated just a few that can exemplify this situation in different periods. The cases presented regard the following unknown events:

- 1303, mid Adriatic;
- Just before 13 September 1348, Subiaco;
- 14 September 1780, Patti, Milazzo (North-Eastern Sicily).

Though the data regarding the first two events is reliable and convincing, it only represents an initial degree of knowledge, whereas in the last case which took place in 1780, the research has been completed with satisfactory results.

3.1. 1303, Fano and Senigallia

An earthquake of exceptional force shook the island of Crete at dawn on 8 August 1303,

spreading southwards through the Mediterranean until it violently hit the coast of Egypt and Syria (Guidoboni and Comastri, 1997). Since Crete was governed by the Venetians, the news of the destruction of more than 12 cities and castles on the island spread quickly through the entire Latin area. Arab countries assimilated and preserved information regarding this disaster particularly as regards the Arab countries involved: Egypt, Syria and Palestine. Byzantine historians, however, left more general records, because the tremor in Constantinople was just felt and not by everybody; above all, Greek economic interests were not directly affected.

Venetian ships obviously sailed through the Adriatic Sea on their way to or from Crete and the news spread through the cities along the Adriatic coast. Records of the event were thus also left in many chronicles in the Venetian and Latin areas, in both Latin and the Vulgar tongue. This earthquake had a very great effect on the imagination of those generations because it also caused a very violent tsunami, which hit the Egyptian coast. There are also some reliable traces from Italian sources which can be placed within this complex informative context regarding the earthquake in Crete on 8 August 1303, regarding a completely different earthquake of a much smaller entity which hit Fano and Senigallia (Marches). One source is an authoritative fourteenth-century Venetian manuscript, the *Zibaldone da Canal*: the original text is preserved in the University of Yale and was edited by A. Stussi (1967). This text mentions the 1303 earthquake in Crete and associates its effects with other seismic damage which took place in the «Marcha», but which are clearly due to an independent event. The text records serious damage to Fano, where the earthquake *sfesse lo so pallaço nuovo* (destroyed its new building). Another Italian source mentions this event on the Adriatic coast: the *Chronicon parmense*, a text compiled in the sixteenth century from two former ancient chronicles. During the events that took place between October and December 1303, there is the indication of various earthquakes which occurred in many areas, also including Venetian dominions (Crete, 8 August 1303) and one regarding «Sinigallia and Fano». The doubt that this grouping includes the well-

known event which took place in Romagna and the Marches in 1279 (see in the CD-ROM and in Appendix A) seems to be dispelled by the fact that the sites hit by this last event concern a completely different area: in fact, Camerino, Nocera Umbra, Cagli, etc. were damaged in the 1279 earthquake. At this point the indications from the two Venetian and Parmesan independent sources confirm each other.

3.2. *Just before 13 September 1348, Subiaco*

In our opinion, the second case regarding Subiaco in 1348 well illustrates the relation between famous seismic events and forgotten minor events. In that year, an epidemic of the plague hit much of Europe and Italy. In the north, on the border between Carinthia and Friuli, on 25 January 1348, a highly destructive earthquake damaged many German, Friulian and Venetian cities (see in the CD-ROM). In September of the following year, Central Italy was devastated by a seismic disaster of exceptional proportions: two or three seismogenetic sources were probably activated, hitting a vast area (see in the CD-ROM). The huge area affected by the 1349 earthquake also included Rome, where in 1350, Clement VI celebrated the Holy Year in a city full of pilgrims dumbfounded by the «old and new ruins». Even Petrarca was present and he left an important recollection. The 1350 jubilee was a great religious and cultural event, which indirectly contributed to giving an aura of legend to the earthquake of the previous year. The 1349 earthquake was talked about everywhere and this contributed to its fame.

When this event was studied, that particular cultural context was taken into consideration and so as not to lose the realistic framework of the seismic scenario, the research group concentrated on sources that had not assimilated a «voluntary» recollection of the event (and which, therefore, could have been more easily influenced). Particular research was also made into public and private institutional documentation. During this work phase a new parchment emerged, preserved in the library of the Abbey of Subiaco, regarding a donation by Giacomo di Santo Vito in favour of his nephew Giovanni,

drawn up on 13 September 1348. The notary Paolo di Cervara recorded the date and location with great precision, as is required by this kind of document: *Actum in orto Sancti Francisci de Sublaco de ordine minorum ubi prefatus dominus abbas personaliter residebat propter terremotus maximum, ex quo dirupta erat rocca Sublaci* (drawn up in the garden of the order of the Friars Minor, where the aforementioned abbot personally resides due to the great earthquake which destroyed the stronghold of Subiaco). The hypothesis that the notary could have mistaken the year appears remote, because of the decisive importance that this chronological element held for notarial documents. The date of the document is intended as an *ante quem* term. The seismic event referred to by the notary therefore took place before 13 September 1348.

3.3. 14 September 1780, Patti and Milazzo (Sicily)

The third case concerns the earthquake of 14 September 1780, which damaged Patti and Milazzo. The more detailed research into this earthquake has already proceeded beyond the initial traces, «to reach» the archival sources (Mariotti, 1995).

We should perhaps point out that the recollection of a seismic event is «constructed culturally» over the subsequent years. In fact, an earthquake becomes famous not only due to the ruin it causes, but also for the impact of its reconstruction on the societies and culture of the time. If only the scholarly and educated traces leaving «voluntary» evidence are followed up, it can be seen that certain events emerge in the collective memory, while others become blurred. Only research into institutional sources can balance this relation between different types of traces. Why was the destructive earthquake of 14 September 1780 which caused considerable damage in North-Eastern Sicily forgotten? It seems reasonable to believe that this event was considered «negligible» by scholarly and naturalistic recollection after the devastating seismic events occurring in Calabria some years later in 1783. Neither should we underestimate

the fact that the catalogue of earthquakes compiled by Mongitore (1743), which includes the historiographic knowledge of earthquakes in Sicily subsequently used by Baratta (1901), terminates a few decades before this earthquake. For various reasons, therefore, an «area of shadow» was created which has had repercussions on seismological knowledge.

During the research into earthquakes in Sicily, carried out as part of ING programs (1990-1993), a printed source was found relative to the destructive earthquake that took place in Patti in 1780, which was ignored by regional and national seismic catalogues (Carrozzo *et al.*, 1975; Postpischl, 1985; NT4.1, 1997).

The source is a four-page booklet (*Distinto ragguaglio... 1780*) printed in Palermo, which is also mentioned, independently of our research, by Ligresti and Gallo (1991). A copy of this publication is preserved within a volume of miscellaneous manuscripts in the Biblioteca Centrale della Regione Siciliana di Palermo (1780). The description of the effects on Patti is detailed: Thursday 14 September 1780, at 21.30 hours Italian time (corresponding to about 15.05 GMT) a strong earth tremor was felt which frightened the population, causing people to leave their homes and take refuge in the open; a little more than two hours later, at 23.45 (about 17.20 GMT) a second tremor violently hit the city.

The second earthquake – defined as «much stronger, and longer than the first» – caused serious damage to the town.

Similar or more serious damage is recorded by the same source in the towns of Raccuja, Montalbano Elicona, San Piero Patti, Milazzo and in other nearby towns, unnamed, where the damage also claimed some victims («finding a number of people under the fallen walls who had pitifully died»).

The informative value of this account is common to the vast series of *Avvisi, Racconti, Ragguagli e Relazioni* (Accounts, Reports and Relations) – almost always anonymous – which circulated in Italy and in much of Europe from the mid-sixteenth century until almost the end of the eighteenth century, bearing news of natural disastrous events (earthquakes, eruptions, landslides, floods) or facts which were consid-

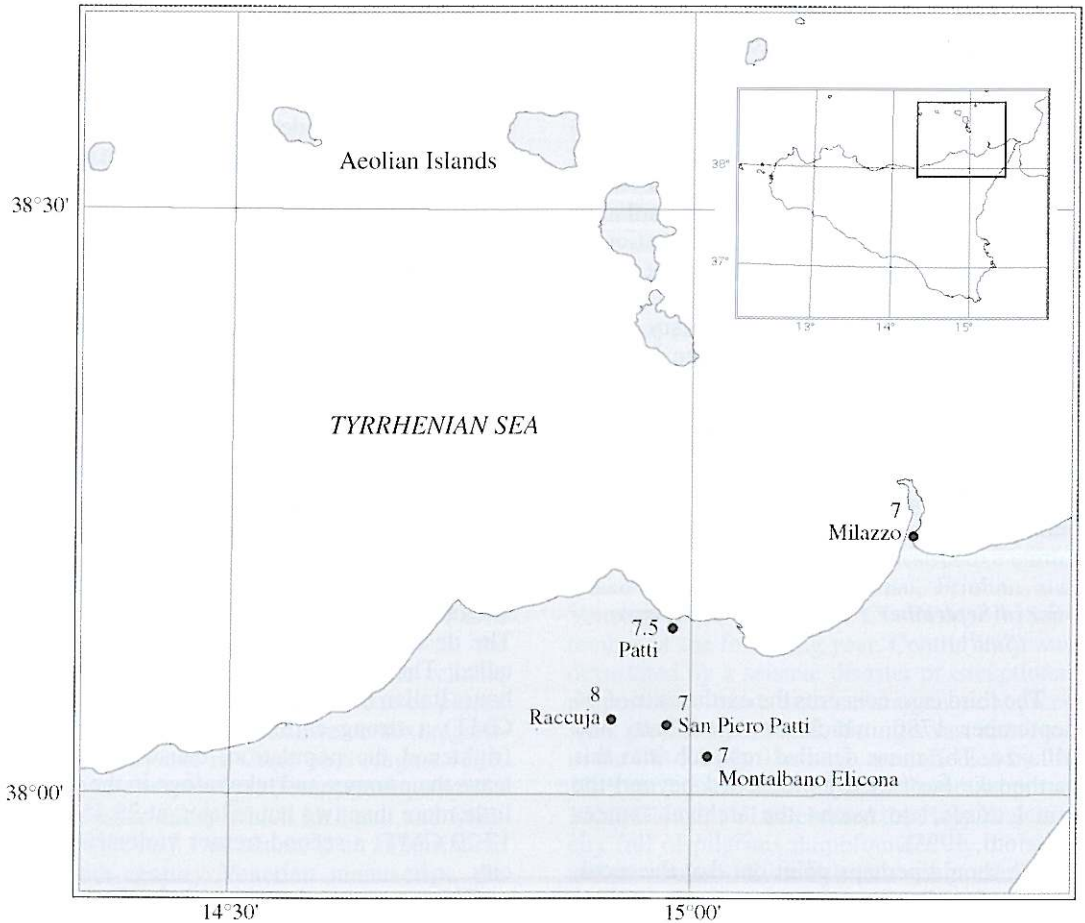


Fig. 1. Map of the intensities (MCS degree) of the 14 September 1780 earthquake, previously unknown to the Italian seismic catalogues.

ered exceptional in general. These «proto-news-papers» represent widespread testimony of many seismic events, but, in common with the developed press of the subsequent period, they often suffer from a degree of approximation or rhetorical emphasis in reporting the facts. Their informative content, therefore, must be compared with that of other types of source, particularly with administrative documents. The investigation carried out at the State Archives in Palermo (Archivio di Stato di Palermo, 1780) in the *Real Segreteria* archive, containing the documenta-

tion relative to the secretary of the viceroy's office (whose role was to connect the other administrative structures of the kingdom), had a positive outcome. The *Incartamenti* series includes a letter, dated 21 September 1780, sent to the viceroy by the administrator of the Sicilian estates belonging to the prince of Butera, Michele M. Perremuto, who reported the serious damage caused by the earthquake on the Raccuja estate. According to the report referred to the administrator by the civil and religious authorities of the town, the tremor «ruined and destroyed from

Table I. Previously unknown earthquakes in the Pollino region. The table gives the date, places most damaged maximum intensity and summary of effects.

19 August 1596, between eight and nine o'clock during the day: Castrovillari

A tremor was felt in Castrovillari which did not cause any damage (Biblioteca Civica di Castrovillari, G. De Rubeis, *Vita del Beato Pietro da Santo Andrea della Marca*, 1754).

8 January 1693, 4 o'clock at night: Castrovillari, Morano, Mormanno, Oriolo

The documentation gathered shows a macroseismic picture of great interest. This event occurred just before the great Sicilian earthquake of the 9 and 11 January 1693 («blurring» phenomenon mentioned above). The chronicler of Oriolo, G. Toscano (ed. 1985), an eye-witness to this seismic event, noted the first strong tremor at 4 o'clock at night on 8 January 1693, which led to the flight of the inhabitants.

8 January 1693 is mentioned as the starting date of the seismic period in a register of the parish of Saracena in which, on 9 January 1693, a very strong earth tremor is recorded which was felt «in the middle of the night». In the parish Archive of Mormanno the deed of a donation of sacred decorations was discovered, giving 8 January 1693 as the date of the miraculous intercession of the Virgin who saved the town from the destructive effects of the earthquake (Archivio Arcipretale di S. Maria del Colle di Mormanno, *Registro delli Beni Stabili*, 1742). G. Toscano records three tremors during the night of 8 January 1693: at 4, 6 and 12 o'clock at night; only the last two tremors caused damage. The same author records a strong tremor that woke the entire population of Oriolo at 8 o'clock at night on 22 January 1693 and, concluding his narration of the events, declares that all the earthquakes felt did not cause any serious damage to his town, whereas buildings had collapsed in the neighbouring towns of Castrovillari, Morano and Mormanno and in other unidentified towns. Associating these tremors with the great earthquake in Sicily during the same period, Toscano records that a tremor on 11 January 1693 caused very serious damage in both Sicily and Malta.

An initial research into the archive has uncovered the «Platea» of the Convent of San Francesco in Castrovillari: this document affirms that an earthquake in the year 1693 caused the collapse of some buildings in the districts of San Francesco and the Bishopric (Archivio di Stato di Cosenza, Sezione di Castrovillari, *Platea Universalis...*, 1704-1706). Indirect confirmation of damage to Castrovillari has been found in the travel diary of the abbot, Pacichelli, who abandoned a visit to the city because – he wrote – it had been extensively damaged by the earthquake (ed. Valente, 1980).

A different picture of events emerges from the documentation found in Mormanno: the various deeds of devotion after «liberation» from the 1693 earthquake record that, unlike the surrounding towns, unnamed, the city suffered little damage.

1707: Mormanno

A contemporary document, copied in 1742, states that the citizens of Mormanno donated a silver lamp to the Virgin in thanks for liberation from the earthquake (Archivio Arcipretale di S. Maria del Colle di Mormanno, *Registro delli Beni Stabili*, 1742).

1708 January 26: Laino Castello

A tremor seriously damaged the altars and the interior of the mother church of Santo Spirito in Laino Castello (Caterini, 1977).

1708 Viggianello

A tremor was recorded (the date is not specified) which seriously damaged the village of Viggianello (Pedio, 1965).

1825 April 10, evening: Laino Castello

A strong tremor damaged the Convent of Santo Domenico in Laino Castello which was already in bad static condition (Caterini, 1977).

1843 March 31: Castrovillari

Three tremors were felt in Castrovillari which did not cause any damage (*Gazzetta di Genova*, 1843, no. 32).

1845 May 31 and June 1: Castrovillari

Two tremors were felt in Castrovillari which frightened the population but did not cause any damage (De Rossi, 1889).

1856 March 14: Castrovillari

A contemporary source records a strong tremor which did not cause any damage (Rubini 1859). This information has been taken up by contemporary historians (Russo, 1956).

1859: Mormanno

A strong earth tremor caused some damage. The frightened population slept in the open (Minervini, 1940).

1892: Mormanno

Many tremors were felt which led the population to abandon their houses and sleep in the open. The mayor informed the sub-prefect by telegram, who then sent a Public Safety Official (Minervini, 1940).

just about the foundations» the Mother church, the other parish churches and daughter-churches, the two monasteries of the town, the baronial palace and many private houses; the Castle was also greatly damaged. Just two victims had been ascertained up to that moment, but a more detailed report was announced regarding the number of dead and wounded and the total entity of the damage. Unfortunately the latter document was not found among the papers of the Archivio di Stato di Palermo.

For extrinsic reasons, close examination of the *relationes ad limina* of the bishops of Patti, kept in the Secret Vatican Archive, had a negative outcome. In fact, the report that was chronologically nearest to the event was drawn up by bishop Salvatore Pisani: no damage to ecclesiastic buildings was recorded therein and the document is not dated but it is known that it was certainly drawn up after 17 March 1779, and perhaps before September 1780. A subsequent second report, written by bishop Raimondo Moncada, may be dated between March 1786 and July 1787. This text reports the need to repair the floor of the church of San Domenico di Patti, but no seismic damage is mentioned (Archivio Segreto Vaticano, Sacra Congregatio Concilii, b. 611 B).

There are other elements that must be taken into account to explain why this event seems to have been forgotten even by the local administrations of the time: since from an administrative point of view the area was covered by Messina, no administrative document was uncovered in the past (nor perhaps will be in the future) because this important archive, which had already been damaged many times by the 1783 and 1908 earthquakes, was for the most part destroyed in 1943 due to war-time manoeuvres.

On the basis of the data located, the earthquake on 14 September 1780 hit the Tyrrhenian coast in the province of Messina facing the archipelago of the Aeolian Islands, causing maximum effects of the VIII degree of the MCS. This earthquake, like other known seismic events in the area, caused damage to a fairly limited area. The data acquired so far, which could be detailed further by local research, is already of considerable interest since it can be used to

improve seismic hazard estimates and the forecasting of return times in a densely populated area at high environmental risk due to the presence, in Milazzo, of the second largest chemical-industrial centre in Sicily (fig. 1 for a summary of the effects).

4. Unknown earthquakes in «silent» seismic areas

A third category of «findings» of earthquakes not known to the catalogues comprises the so-called silent seismic areas. In recent years, this area of research has made an interesting novel contribution to the field: a good example being the findings in the area of the Pollino massif (Northern Calabria, Southern Italy) whose seismological features and historical problems are addressed in the paper by Valensise and Guidoboni (2000, this volume).

It is also noteworthy that research in this field (SGA, 1994) has disclosed eleven earthquakes previously unknown to the catalogues: ten of these new events are local quakes and fall into the category of earthquakes not known due to a lack of target research in this area. The most destructive of these events, that of 8 January 1693, occurred in the «shadow cone» of the strong earthquake in Eastern Sicily on 9-11 January of the same year. Although this was a strong earthquake, it was plainly «forgotten» in favour of the major Sicilian seismic event. Table I summarises the data on new earthquakes in the Pollino region.

5. Conclusions

Unknown earthquakes are opening up a new field of enquiry which may lead to changes in our current knowledge of active faults. Retrieval of these new data depends on the quality of primary historical research and the possibility of carrying out in-depth studies and checks, *i.e.* following up clues and gradually extending the possibility of recovering new findings. This field further confirms that Italian sources hold much potential information and that the earthquakes catalogue is an ongoing work.

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