

# Method of investigation, typology and taxonomy of the basic data: navigating between seismic effects and historical contexts

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## Abstract

This contribution presents the methods of research and filing of the historical data which are at the basis of the *Catalogue of Strong Italian Earthquakes* (CFTI3). Seen from the point of view of historical research, this is the first research carried out in Italy with continuous methods and objectives exceeding 15 years. Here the basic, historical and scientific sources that were used are presented, considering the peculiarity of these sources in relation to the testimonies of the seismic effects. In total, there are 25 780 recorded and analysed bibliographical entries, which have disclosed and located 33 150 seismic effects from the ancient world till 1997. The basic work has not only consisted of a meticulous indexing of the sources and texts, but also of a new outlining of the particular historical and cultural contexts, in which 605 analysed strong earthquakes occurred. Moreover, a small historical guide is presented to help orientate the user of the CFTI3. The complex history of the present-day Italian territory (which has passed for centuries under very different dominations and institutional structures) has demanded a non-superficial analysis of these contexts in order to better trace and interpret the testimonies of the seismic effects on buildings as well as on the natural environment. The work, carried out with groups of specialised researchers, has also led to the compiling of a database capable of dynamically managing the interpreted information. The open structure of this work allows for the continuous data updating and expansion.

**Key words** *historical earthquakes – method of research – seismic database*

## 1. Introduction

The data in this catalogue are the results of review and research studies carried out over more than eighteen years, regarding different projects and in part having different aims. The catalogue initially required complex organisation since it was necessary to guarantee as much

overall homogeneity to the results as possible. Italian historical catalogues are based on the complex and illustrious tradition of historical and seismological studies, which now date back for more than two centuries. The sum of this knowledge forms a corpus of remarkable historiographic and scientific value, representing a case unique in the world. In order to be able to make use of this wealth of data using modern critical criteria, however, it has been necessary to carry out systematic basic research.

Unlike other much less complete historical catalogues, the Italian catalogue of historical earthquakes may be used with statistic criteria. This is another reason why it is universally recognised today as being irreplaceable in the evaluation of seismic risk and the level of seismic

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hazard. The *Catalogue of Strong Italian Earthquakes* (CFTI3) stored in the enclosed CD-ROM, is the result of various stages of research, conducted between 1983 and 2000. Until 1986 the research had been carried out within the projects of ENEL in order to evaluate the seismic parameters of the six planned (but not built) nuclear power plants (ENEL, 1985, 1986). Between 1987 and 2000 the research was carried out by the Istituto Nazionale di Geofisica, in order to provide new data on seismic risk and increase knowledge of the active faults. Both commissioning bodies shared the ambitious aim of checking, expanding and improving the data from the great Italian seismological tradition.

Hence, it was necessary to review the parameters of seismic events that were already being consistently used among seismic risk experts, according to categories of intensity. A specific historical research project was thus planned, both in order to apply grounded variations to known parameters, and to further examine damage scenarios which had usually only been outlined. The research which today provides the basis of the CFTI3 from the historiographic point of view has acquired almost unexpected scientific value. It is in fact the only theme-based historical research project in progress for more than a decade in Italy and carried out by a stable working group using a homogeneous method. By continuously applying the same research method and gradually conferring a marked specificity to this approach, a new field of studies has been structured over the past fifteen years, known as *Historical Seismology*, furthered in this process by the commitment and activities of other working groups.

## 2. Structure and organisation of this research

Although the research cannot be considered complete strictly speaking, it does however encompass the majority of the seismic events which are considered in estimations of evaluation of seismic risk in Italy. The data concerning 605 earthquakes occurring between the fifth century B.C. and the twentieth century have been made available, whose previous estimation was not below the VIII-IX degree on the

MCS. In order to handle some very real problems, such as the time available for completing the work, as well as the resources available, some study priorities have been drawn up. The earthquakes have thus been studied on three levels as shown in-table I.

The extension of the area examined, concerning the whole national territory and the length of the chronological period investigated (almost two thousand five hundred years) required demanding teamwork, featuring a well-defined and fixed methodology and a rigorous organisation of the computer resources.

The research was organised by a single co-ordinating body, planning specific research projects on the territory. This enabled parallel analysis of a considerable number of seismic events, even of great territorial impact, to be dealt with by different groups of researchers in a relatively short time. This was made possible in the first place by the analyses carried out by the co-ordinating body prior to the research itself in order to highlight the availability of the sources and to select working strategies which would make the best use of skills and time. The results of the systematic reading of particular documentary and memorial *corpora* were then added to these initial general analyses, without following chronological indicators. This led to the recovery and analysis of a database of considerable descriptive value, later expanded by the results of selections from other specific sources, according to the periods and areas being studied. As early as 1983, computerised filing was prepared of the material to be included in the database (Guidoboni and Ferrari, 1989).

The methodological approach applied, covering a large part of the Italian historical and documentary heritage, has enabled a great deal of valuable historical data to be recovered, thus maximising the research work, which in itself required considerable resources both in terms of skills and time. Before this centralised approach was adopted, researchers who had to review historical earthquakes arranged their own personal research into single events. With this new organisation of work, researchers participated in different stages according to their specialisations and research experience. Many of them were only involved in archives research, for

**Table I.** Distribution by centuries of the three levels of analysis adopted.

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### First level

The first level of revision of the known parameters of the events involved a time-consuming critical work concerning all the events, even those for which new research was to be developed subsequently. This level involved three stages:

1. recovery of the works already quoted in the bibliography of the catalogue and the remote sources of Baratta's catalogue (1901);
2. critical reading of the texts located;
3. attribution of a code of value to each work and in relation to each earthquake.

Through these three stages the original bibliography of the revised catalogue was reconstructed, with two additional elements: direct checking of the previously used sources (almost all referring to the catalogue of Baratta, 1910), even of those quoted indirectly, and classification of the quality of the basic information available for each specific earthquake. The quality of the data used by Baratta (1910) not only reflects the historiographic sensitivity of the author and his numerous collaborators, but also the critical level of historiography of his time, the end of the nineteenth century. It was already possible to correct a number of errors of location and chronology even at this stage of the revision, as well as eliminating earthquakes resulting from chronological errors or misunderstandings in the sources. Bibliographical revision also included scientific literature of the decade from 1985-1995.

### Second level

In order to acquire new basic data, research was done on new memorial sources or archive research aimed at particular aspects (*i.e.* conducted either by sites which had priority or by types of sources). For earthquakes occurring since the fifteenth century, the memorial sources of manuscript tradition and selections from the press were often integrated. This has enabled us to make use of previously unknown texts of considerable descriptive value.

### Third level

This is the most advanced level of the research and concerns the territorial approach to the seismic effects, making use of different types of independent sources. The most qualifying aspect of this level is formed by detailed research into administrative and institutional sources. This archive research has led to a considerable improvement in the state of knowledge. Indeed, both the number of classified sites and the detail of the effects has been increased for almost every event. Much attention was also paid during the research to analyses of particular aspects of the territorial, economic and social history of the areas affected, thus improving estimation of the effects. For ancient earthquakes and those of the early Middle Ages (fifth century B.C. – tenth century) the third level consisted of systematic research into the memorial and epigraphic sources available.

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particular periods and areas, while others analysed and filed memorial sources (published and manuscript), or scientific sources (bulletins, macroseismic questionnaires, seismological reports), and others still developed the study of particular demographic, economic or building contexts.

As can well be imagined, all these general pictures of the effects of earthquakes were not reordered automatically. Most of these summaries, structured according to database logic (see table II), were compiled within the co-ordinating structure, making use of the complex skills

and experience of historical seismology, through stages of evaluation and writing made all the more arduous by the huge mass of work and the enormous range of periods and areas analysed, also in relation to the resources used and the limited time available for the work.

All the memorial sources gathered during the research, as well as other special types of sources (epigraphic inventories, treatises, registers of documents etc.) were fully filed through a systematic interpretation, going beyond the single seismic event under examination. As the selections were completed, allow-

**Table II.** Synthesis of historical-critical comments including the results of research on each earthquake in the CFTI3.

■ **Information available in previous catalogues**

A concise comment containing a comparison between the parameters supplied for the same earthquake by the *Catalogue of Strong Italian Earthquakes* with those of the previous catalogues (ING, 1981; PFG, 1985 and NT, 1997) in order to facilitate the recognition of the revised events and compare any variations made. This information area allows a synoptic view of the catalogues available, within which users may orientate their evaluations or from which they may deduce a sort of «history» of the interpretation of each event.

■ **State of earthquake review**

Level of the revision made and main types of basic data used, bibliographic and archive; the general viewpoint of the revision is described, stating the selections made, even those with negative outcome; the main scientific works available are also indicated.

**Development of earthquake review**

Particular problems of the research, positive and negative archive selections made and types of data; highlighting of the critical elements emerging with respect to the datings or the tradition of the texts; problems of toponymy.

■ **Major earthquake effects**

Main tremors, most damaged sites, extent of the area struck, typology of the most serious damage, extent of the felt area. It is indicated whether the data available allows the effects of the tremors to be differentiated or whether the overall view of the effects is cumulative.

**Effects by individual locality**

Descriptive summary of the effects on each location identified, with the relative specific bibliographical references. For the events revised only at first and second level, when direct macroseismic information has not been available, estimates of intensity by quoted authors have been used. Every site is located through its geographical co-ordinates and refers back to the list of locations evaluated with the degree of intensity.

■ **The earthquake's social context**

Main social and economic elements of the seismic disaster: number of dead and wounded, particular impact on the local economies, elements of the historical building heritage in relation to the seismic effects, brief picture of the institutional responses, which have interacted at the stage of emergency or reconstruction, favouring or halting it; the economic costs, both in monetary terms (when available from the sources) and in a more general sense such as the impact on the local economy. This area of information, with the relative sub-areas, is intended to favour a qualitative evaluation of the effects in relation to the particular historical contexts involved.

**Elements of local demography**

Data on the population of the areas hit to evaluate both the incidence of deaths caused by the earthquake, and the social impact of the event in relation to the residential density.

**Concurrent natural and man-induced destructive events**

Indication is given of the concurrence of the earthquake with other destructive events (extreme events of natural origins or human destruction) which can considerably alter the contemporary descriptions of the seismic effects and the evaluation of the impact on the human environment.

**Characteristics of the local buildings**

The main elements of the building heritage in relation to the materials used, the techniques and the state of preservation.

**Administrative/historical affiliations and boundaries**

The main elements of the administrative hierarchies, which may clarify the strategy of research adopted, motivate possible different institutional interventions during evaluation of the damage and in reconstruction, as well as providing elements for more detailed research at a later date.

**Social responses**

Summary of the social responses: from the immediate aspects to those with greatest effect on the economic context: halting of the production activities, types of requests to the public administrations, migratory flows, prolonged desertion of the area; forms of regulation, etc.

**Table II** (continued).

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**Institutional and administrative response**

Main institutional and administrative dynamics which characterised the post-earthquake stage, both for evaluating the damage and for planning the reconstruction; projects or intentions of moving sites, territorial or urban planning, tax exemptions.

**Reconstructions, relocations**

The main elements emerging during the stage of reconstruction; towns reconstructed from new with change of site; times of reconstruction, quality of the building interventions, since these elements had a considerable influence on the effects of later earthquakes.

**Technical/scientific observations and surveys**

Indication of expert reports, technical evaluations of damage in iconography or description; on-site seismological survey, specific descriptions regarding the technical, naturalistic and scientific context.

**Scientific observations and theories**

Interpretations of the earthquake expressed by natural philosophers, naturalists and seismologists according to the various historical periods. There are two main fields of interest in this information area: the composition of the cognitive framework, to which the historical descriptions of the seismic phenomena refer and, more generally, the history of Seismology.

**Associated natural phenomena**

Indications are given of phenomena which contemporary testimonies associate with the earthquake: strange animal behaviour, light phenomena, electromagnetic variations, etc.

■ **Effects on the environment**

Brief description of the effects on the natural environment: fractures in the ground, chasms, landslides, falling rocks, variations of the water capacity of rivers and springs, tsunami effects, overflowing of lakes, etc.

**Location and nature of the observed effects on the environment**

The sites and geographical elements (mountains, rivers, etc..) are located through their geographical co-ordinates with the environmental effects found.

■ **Sequence of the main tremors**

Chronological parameters of the most significant tremors reported.

**Main features of the earthquake sequence**

Chronological parameters of the tremors of which memory is preserved, place of measurement when this was clearly expressed by the sources, brief typology of effects. The aim of this section is to explain all the possible information about the seismic period, with a view to subsequent parameterisation of the tremors.

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ing us to recuperate important details regarding local seismic effects, even when generated by earthquakes whose epicentral areas were very remote. By means of what we may call a «mosaic» procedure, the territorial outlines of the propagation have been reconstructed. In some special cases, this element also enabled us to use *ex silentio* sources and, when considered significant in the information context analysed, to indicate in the bibliography the negative response of a text with relation to a certain event.

Archive research was instead conducted with specific aims on the basis of chronological indicators. In this case breadth and completeness

was provided by the links explored between the individual offices and territorial responsibilities, in the network of procedures and matching produced by official figures, for requests, checks and decisions made at different administrative levels. The systematic nature of the research work has enabled broad frameworks of reference to be constructed. These were both of a textual (sources, historiography) and extra-textual nature, in other words regarding key elements of the territory affected (particularly demographic scales, building features, handling of the reconstruction).

An indirect result of the research was also the acquisition of data on the numerous destruc-

tive earthquakes previously unknown to seismological tradition (see the relative work in this volume, Mariotti *et al.*, 2000). Sometimes these are just clues, requiring specific research in order to be completed. These «new» earthquakes may even alter the estimation of local seismic hazards in different areas.

### 3. The basic data: typology of historical and seismological records

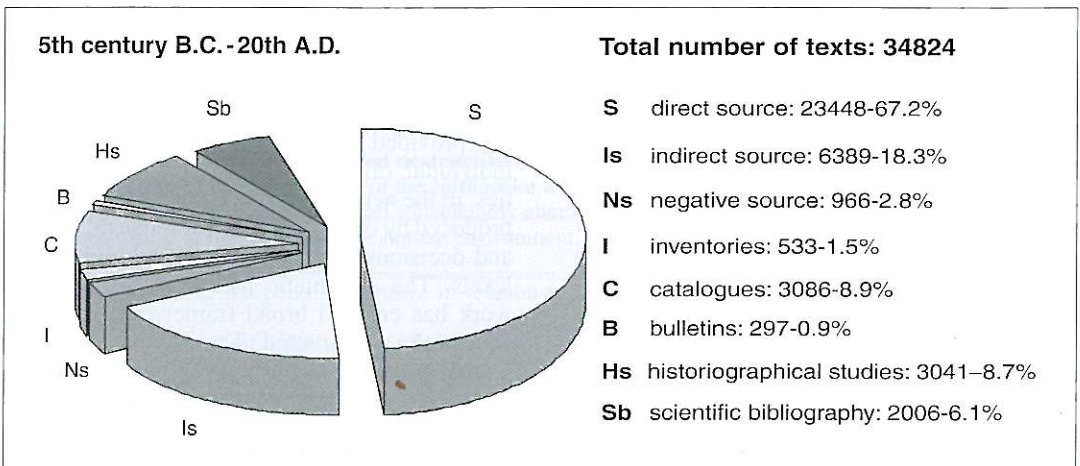
#### 3.1. Historical records

The special nature of the catalogue of historical earthquakes in Italy derives from a unique and valuable documentary and historical heritage: one of the most important in the world as regards the quantity, territorial diffusion, extent of the chronological span and the quality of the information.

The historical research was systematic and the method applied stable, thus guaranteeing considerable data quality. However, the various scientific programs developed have often followed different strategies, according to priority-driven objectives. Therefore, it was the seismological choices which guided the stages of

development of the new catalogue rather than the historiographic choices, thereby conditioning the strategies of the research work. Though this «capitulation» of the basic historical research to scientific requirements presented a number of problems, it also brought on a number of positive results. The ability to adopt «points of view» other than those traditionally taken when interpreting historical records was enhanced, for example. Problems concerning the territorial, institutional and inhabited structures within which the earthquakes occurred had been made more explicit to potential users traditionally outside historical research. In addition, there had been an improvement in the interpretation of words apparently similar to contemporary Italian but actually belonging to cognitive universes which are conceptually remote.

The aim of working constantly with a method guaranteeing clarity of data and results, as well as the qualitative and quantitative aspects of the basic data used to define seismic scenarios, has helped to reveal the state of initial knowledge, the research paths and the results obtained, including unresolved problems. These aspects are all highlighted in specific «entries» in the information system provided on the accompanying CD-ROM. Indeed, it was considered that



**Fig. 1.** Classification of the general bibliography of CFTI3 on the basis of information given in the text, for the earthquakes from 5th B.C. up to the 20th century.

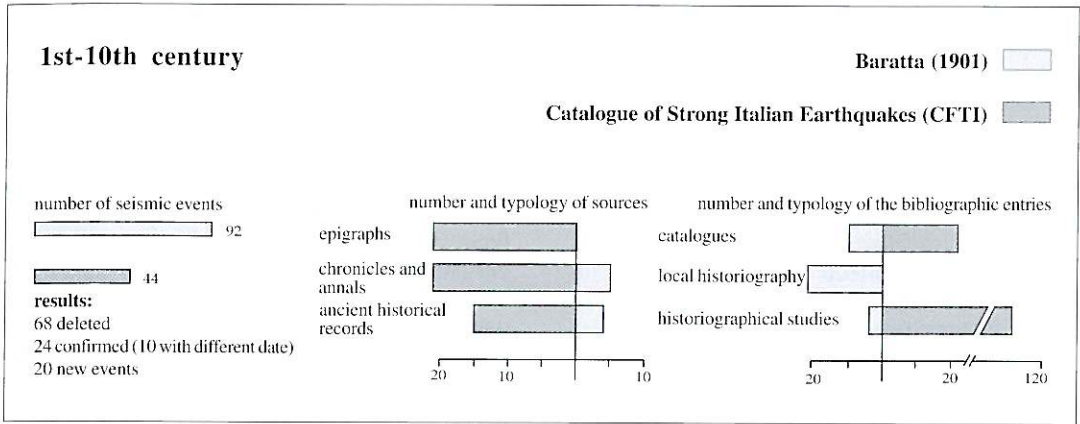


Fig. 2. Comparison between number of earthquakes, typology and quantity of database in Baratta (1901) and CFTI over 1st-10th century.

further developments would be favoured if the user was able to evaluate the quality of the results and the types of interpretations made.

If we consider the common subjectivism of traditional macroseismic processing, the effort to highlight the decisional processes used in this catalogue may also be considered an innovative contribution. The sources used to delineate the various scenarios of effects may be grouped into two large families: the records of traditional historiographic research, and the records produced within a seismological scientific context (the latter as from the late nineteenth century). To facilitate an overall view of the basic data used in this catalogue, the various types of text have been described briefly below, beginning with the ancient world, as well as some general problems connected with their use in the study of seismic effects (fig. 1).

### 3.2. Ancient earthquakes: nature of the historical sources

Ancient earthquakes and those of the early Middle Ages, up to and including the tenth century, have been analysed systematically and have already been the subject of monographic publications (Guidoboni, 1989; Guidoboni *et al.*, 1994). The sources used for the earthquakes of

antiquity are of a literary nature (including testimonies of various genres: historiographic, naturalistic and literary in the strict sense) as well as epigraphic (for a more extensive description and for the relative historiographic bibliography, see Guidoboni *et al.*, 1994).

This work of revision has been made necessary because in the Italian seismological tradition over the last three centuries there has been a gradual loss of antiquity, if it may be described thus. Indeed, the data of the historic series have gradually been limited in the various catalogues, failing to give due attention to the analysis of data whose authoritativeness is not in many ways inferior to that of the following centuries. The catalogue preceding this one – the catalogue by Postpischl (1985) – begins the historic series from the eleventh century. Baratta (1901) had previously started his catalogue from year 1 of the current era, eliminating without explanation the historical work of Bonito (1691), who as a true erudite had begun his enormous inventory of earthquakes from year 1765 after the creation, *i.e.* from about the year 1202 B.C. (obviously later demonstrated to be unacceptable to historical analysis) (fig. 2).

The critical and systematic revision of this complex and confused tradition has also taken into consideration the state of knowledge consolidated in an unpublished parametric cata-

logue of the Istituto Nazionale di Geofisica (Gasparini *et al.*, 1983) which listed 218 seismic events located in Italy from 1450 B.C. to the tenth century. This catalogue, in spite of its valuable compilation effort, had not been based on specialist studies and instead formed a summary of a confused tradition of data, with numerous interpretative errors. Thus, a lot of parameters concerning chronology, location and estimation of the effects were incorrect.

The systematic research carried out between 1987-1992 on ancient sources permitted the historical series to begin from 5th century B.C., thus notably reducing the previous chronological span of the catalogue, though to the benefit of philological and historiographic accuracy. What gives quality to a catalogue is not in fact the length of the chronological period (the Chinese catalogue, for example, begins in 1177 B.C. but cannot be used for statistical purposes or for evaluations of seismic hazard), but the continuity of authoritative information over a defined area.

The user of the CFTI3 may perhaps be surprised also to find texts which were in fact written centuries after the event, given as fundamental testimonies for ancient earthquakes. For Italy this is less common as from the Middle Ages, a period in which this information was contained in sources which have often been preserved in their original manuscript form, while for antiquity this is almost the norm. For such ancient texts we applied the philological rule valid for analyses of the codes: *recentiores non deteriores* (the most recent texts are not the most corrupt). In other words, a piece of information is no less authoritative if testified by sources produced even several centuries later. This element, which is not valid for the later periods and in relation to much richer documentary contexts, is motivated by the particular value of the written text in the ancient world and also by the particular way of transmitting the texts themselves.

As regards ancient historians, it is important to take into account each author's working method. The historian Cassio Dione, for example, writing at the beginning of the third century A.D., drew on first-hand documents, such as the archives of Rome and the *municipia*. Cassio Dione has therefore left testimonies of great value for

earthquakes occurring in currently Italian territory under the Republic and the Principate, *i.e.* dating back many centuries. Late testimonies like these are sometimes the only sources enabling an earthquake to be dated and localised. In other cases, earlier authors or even those contemporary to the event have left little mention, while later historians have picked up and perpetrated traditions of great value, often preserving details important for the knowledge of an earthquake.

Something else which may help to add to the value of the relatively little information on ancient earthquakes is the almost sacred worth of the written text in the ancient world. Errors may have occurred during the copying of the manuscripts, but this is a problem common to the whole of ancient literature since, with very few exceptions, original texts dating back to the early Middle Ages are no longer in existence.

Substantial changes in the cultural and cognitive contexts mean that certain elements are now considered important in the description of an earthquake that were not at all so in the ancient world. The culture of early authors was essentially urbane and the city represented a privileged point of observation. For this reason, minor seismic effects were remembered more easily than the disastrous effects hitting remote towns and villages only because they were felt in a large city, such as Rome. Nevertheless, for the period of the Republic various items of news of earthquakes occurring in different sites are known, coming from the lists of the «freak events» of the various *municipia*. These «freak events» concerned earthquakes, portentous births and generally whatever could be interpreted as an element unexplained by an idea of normality of nature (Traina, 1989).

The lists preserved in the *municipia* did not, however, record all earthquakes systematically, because the earthquake in itself was perceived as an inevitable natural phenomenon. So historical memory has recorded only those events which were considered in some way to interfere directly with human activity or could be charged with some particular significance, perhaps because the earthquake had occurred at the same time as an important social or political event.

The unification of Italy at the start of the first century B.C. made these lists of portents less



important, and as a consequence the documentation regarding earthquakes appears less frequent from this very date. Authors were more interested in the areas of Greek language, where the success of naturalistic literature had preserved the memory of even the most remote events.

Narrations of a historiographic nature are generally available for the whole of classical antiquity, allowing fairly accurate dating of the seismic events. With the advent of Christianity, a certain mutation can be noted in the language of the sources. The new code of values in fact influenced the interpretation of natural calamities, which were seen as divine punishment. Moreover, Christian Humanism did not initially impose the need to take into account new descriptive data, not yet considered very relevant, such as the number of victims. Between the fourth and fifth centuries A.D., a new historiographic genre developed. This was universal history, based on a Christian division of the great eras begun with the *Chronicon* of Eusebius (263-339). In these works, some of which were then copied, used and continued throughout the early Middle Ages, earthquakes are mentioned as important events. The value of «freak event» generally prevails in them with respect to the impact of the social event.

### 3.3. Epigraphs

Epigraphs have not been used until recently in the study of historical earthquakes. Exceptions are the contribution of Lanciani (1918) for the earthquake of Rome in 443 and that of Burmand (1984), who collected epigraphic fonts in Latin for the earthquakes of the Italian area, publishing a collection of 11 epigraphs. This contribution provided the foundations for the *Catalogue of Latin Epigraphs* (Guidoboni, 1989, with bibliography), which extended the collection to 20 epigraphs.

The inscriptions known until now, testifying restoration and reconstruction due to earthquakes in Italy, refer to the period between the first century A.D. and the early sixth century A.D. The epigraphs used refer explicitly to earthquakes. When we have taken into account epi-

graphs which do not directly mention the earthquake as the cause of the damage, but which have been linked by epigraphists to a seismic event, this has been noted in the text of the file (see in the CD-ROM the case of the earthquake of 346 A.D. for example).

Taken as a whole, these sources form an unusual inventory for the localisation of the seismic effects. They always refer to public buildings or monuments: in no case is a minor civil construction mentioned.

Several other epigraphs have been identified which allude to damage and reconstructions without specifying their cause, and no author has linked them explicitly to earthquakes. These form a secondary documentation of potential and considerable interest. However, these epigraphs have not been used at this stage, since their use at the current state of knowledge would have involved an excessive margin of uncertainty and arbitrariness.

It may be claimed that the epigraphic language rarely referred to the earthquake itself. What actually interested the ancients was first of all the extent of the damage and the cost of rebuilding. If a public building collapsed due to an earthquake and not because it was already crumbling, the cause of the destruction might be mentioned both to emphasise the gravity of the damage, and in memory of a special contribution from the authorities. In general, however, the cause of the damage was not considered important enough to deserve a mention on a public inscription, which was more likely to give the name of the sponsor. In epigraphs, as in all works of reconstruction or restoration of public buildings, this figure was usually a public authority (administrative or political) or a figure with a public role, but often operating on his own behalf. Occasionally, the epigraph might also mention a private figure, who accepted the financial burden – and the honour – of the restoration.

Although not impartial, epigraphs provide information on seismic damage which may be located on the territory and in this regard they represent reliable data about the territory. By nature, the sector of epigraphic studies is always open to new discoveries and could in future reveal new and important data.

### 3.4. *Testimonies of individual memory*

Memorial sources form an extremely varied and large group of testimonies, already appreciated by the nineteenth-century seismological tradition in Italy. This type of source, whose original manuscript texts have often had more than one critical edition, required a huge amount of textual checking during the revision.

This group includes, with a criterion of simplification, all those testimonies *not* produced by specific institutional bodies and which are based either directly on perception of the seismic effects by a writer or indirectly on a communicative context produced by more than one witness (religious communities, town communities, etc.). This sector includes texts from a wide period of time: *notulae* written in the margins of medieval codices, liturgical notes, family diaries, memorials, personal diaries, letters and papers. It also includes memorial sources of a more official nature or with different objectives, though still based on the memory and perception of individuals. These include the annals of the monasteries, town chronicles, histories written by contemporary witnesses, in which the facts were permeated by a specific and personal vision of the world.

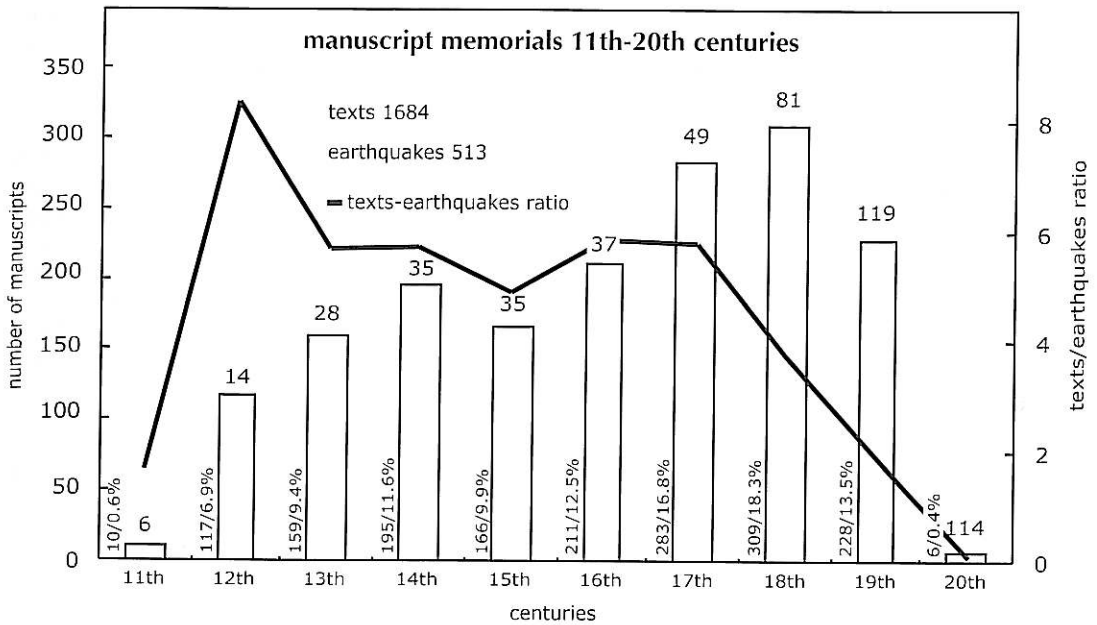
In many cases, only some parts of these works represent a direct source for us, when the writer became the witness of a seismic event, of which he captured a few local effects, even very far from the area of destruction. «The lamps in the churches swung», observed the monks of Montecassino in January 1117. This was a seismic effect occurring hundreds of kilometres away from the epicentre (in the Verona area). Francesco Petrarca, the great poet of Renaissance Italy, wrote a letter in 1368 telling how on 25 January 1348 the books suddenly fell over on his library bookshelves at home in Verona, describing a scene of family panic. These were the local effects of the violent tremor that devastated a vast area between Carinthia and Friuli. Leopold II of Lorraine, grand duke of Tuscany, moved by the news that reached him about the earthquake in the Pisan Maremma on 14 August 1846, visited the place in person and left a very human description of that seismic disaster in his book of memories.

The instances are numerous: these precious titbits of personal memory and perceptiveness do not only concern famous figures, but also a crowd of scribes, notaries, annalists, chroniclers, with varying degrees of fame, and correspondents of every kind. These sources could be divided into sets and subsets which would certainly be numerous in type, purpose and nature. We considered that such a detailed case history would have seemed rather abstract in this catalogue so it was decided to include some critical aspects of these sources in the individual comment sections in the catalogue for the individual earthquakes.

#### *Manuscript memorials: eleventh-twentieth centuries*

Research into manuscript memorial sources was found to be necessary to expand the depth of knowledge already offered by published memorial sources. When critical editions were available, we chose to use these; however, research was strongly encouraged in the manuscripts sector since the heritage of hand-written memorial sources in Italy is almost unlimited. Indeed, even small remote villages have a civic, parish or private library containing valuable local memorials as yet unpublished.

It became clear that there was a great opportunity to detail a number of features of local seismic effects with the contribution of memorial sources: research in this direction has thus been ample and detailed. We have often mentioned the value and the pitfalls of this type of source; here it is enough to recall that the research carried out on the property of national, civic and ecclesiastic libraries unveiled a wealth of data of considerable quality and quantity. Research in this field has been carried out with systematic criteria (according to centuries) working first on historiographic bibliography, then on the inventories (these too almost always still hand-written), and finally on the texts, selecting the most authoritative sources for memorialist value and tradition. Besides this selection, a number of manuscripts have been analysed in order to perform specific autoptic checks, particularly for old or rather careless



**Fig. 3.** Number and distribution of manuscript memorials (as defined by CFTI) for groups of earthquakes divided by century; the percentage indicates the ratio of manuscript memorials per century in relation to the overall texts of this category in the database. The numbers above the columns of the histogram indicate the earthquakes of the CFTI3 for each century.

editions. Hand-written works are distributed in relation to seismic events as from 11th to 20th century shown in fig. 3. Altogether 1684 hand-written memorials have been used to analyse the effects of 513 seismic events (in the CFTI3). There was a great contribution of this type of source even in the centuries following the advent of printing (from the sixteenth century).

The contribution that the memory and sensitivity of so many people has given to the knowledge of seismic events over the years may be defined as extraordinary. These are individual universes, very much part of their own time and permeated with their culture, creating therefore very strong filters between the phenomena which took place and the possibility of our knowing them now. Moreover, descriptions have been taken from these testimonies which would not otherwise have been available. What is more, it was not uncommon for a new critical reading of

texts already known to seismological tradition to reveal the need for a new interpretation, often also supported by elements emerging from the analysis of the residential context (see in the CD-ROM, the case of the false earthquake of Issime – Val d’Aosta region, in Northern Italy – in September 1600).

The chance to compare various independent testimonies for the same event also encouraged observation of stable elements and variable elements of the individual memory, in relation, for example, to the qualitative perception of the same tremors of a seismic sequence. These were not literary exercises but attempts, often positive (as in the case of the long seismic period in Ferrara of 1570-1574) to use human memory as a very special seismograph (the «felt» tremors). At other times, the sources of individual memory have been correlated with public administrative sources to gain complementarity or corroboration, like in a painstakingly slow game of dominoes.

### 3.5. Testimonies of institutional memory: archive sources

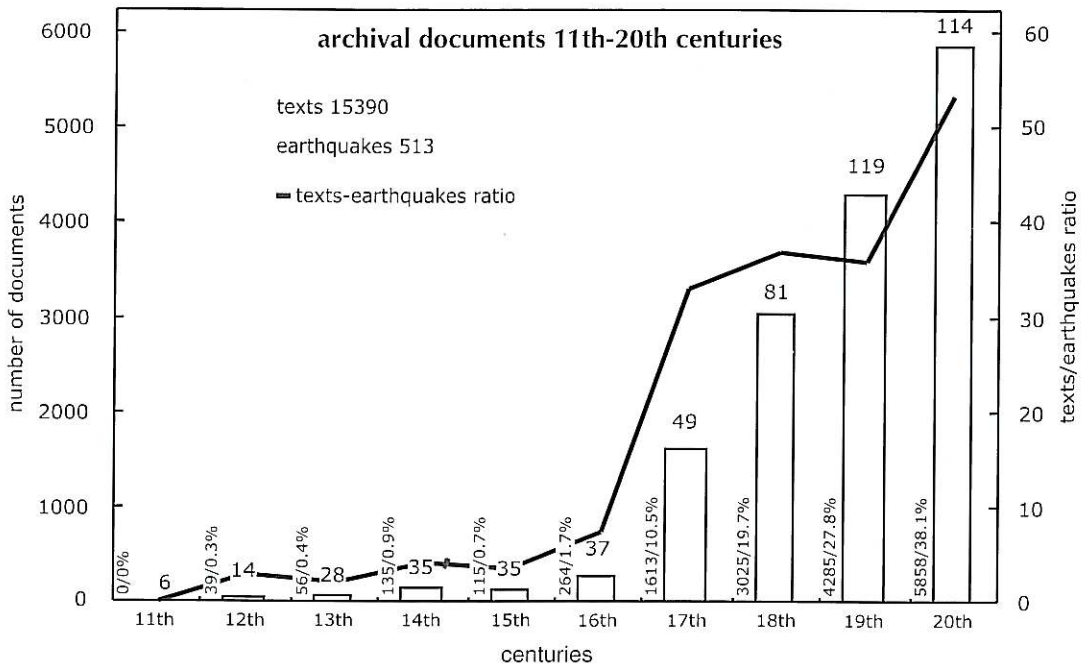
Historical archives are very complex structures of historical memory, which only in part reflect the authorities that produced them. The term «archive network» was aptly used to indicate the set of archives and property making up a historical archive and the countless potential directions that the research could take. As regards the specific field of research on historical earthquakes, it should be made clear that the quality of the archive work for the study of earthquakes came from two key stages:

- 1) Translating the seismological queries into historiographic queries;
- 2) Translating the historiographic queries into archive pathways.

In every archive situation, the logic guiding the work was obviously not the research for subjects or themes directly connected with the

earthquakes, but the institutional and administrative procedures produced in relation to the post-earthquake stage and thus an expression of the administrative, financial, jurisdictional and ecclesiastical management of the areas affected.

The creation of the archives in their current form began shortly after the unification of Italy (1860). As from the eighteenth century, the structure of the archives (or their re-ordering, when this was done) is the result of a voluntary action with the purpose of directing the use of the historical memory and the use of the past in historiography. The archives had previously acted only as a memorial/self-documentation for the use of those who had produced them. Later, this univocal line between production and usage gave way to a conscious re-evaluation of the «memory function», as the main though not exclusive result of the process of production. The past was thus made to emerge as an *object of survey and study*, as the development of a



**Fig. 4.** Number and distribution of archival documents (as defined by CFTI) for groups of earthquakes divided by century; the percentage indicates the ratio of archival documents per century in relation to the overall texts of this category in the database. The numbers above the columns of the histogram indicate the earthquakes of the CFTI3 for each century.

tradition, alternative or at least parallel to erudite elaboration.

Today it is normal to consider that each archive source may not only be queried in a new way, but may also become a stage along multiple directions, identified and structured on the basis of specific seismological queries. For this reason archive research on the effects of earthquakes cannot be borrowed from other research with a different orientation (territorial history, economic history, history of culture, etc.). A reading of the archive sources limited to the descriptive contents alone would, however, have been insufficient – or even misleading – if separated from the complexity of the historical contexts which were both the expression and origin of this information. We have therefore attempted to make it possible for the user of the CFTI3 to catch a glimpse of at least some elements of the residential and institutional backgrounds against which the earthquakes analysed here actually took place (fig. 4).

#### *Archive sources: public institutions*

The archive sources mainly used are those of the public institutions, relative to administrative and financial activity, and correspondence: diplomatic, between different hierarchies and figures from the same offices or ministries, between central and peripheral administrations, between central headquarters of political power and local branches, etc.

A characteristic of archive sources is to refer directly to the structure of the authority producing the document. However, as is known, no procedure is inseparable from its bureaucratic context (this is true even for very recent archives). Indeed, the current state of archives, from the medieval to the most recent ones, results from selections and losses of material occurring both directly, through rejecting and re-ordering, and indirectly through destruction or loss in time. These elements, external to the documentary production, are joined by elements of and variations to the bureaucratic practices, due to contingent factors particularly in administrations prior to the unification of Italy (reports between individual people in power, variations or overlapping of offices and responsibil-

ities, extensions, proxies, arrogation of procedures, etc.): all aspects linked to specific situations of the authorities producing the material. This means that the archive context, seen as the image of the authority producing the documentation, may never be reconstructed in its entirety, not only because of the material losses, but also due to the variations in the conditions of production.

Knowledge of extra-textual elements, historical features in the broad sense, is therefore of particular importance. These do not only concern the way in which the individual institutions operated (*i.e.* administrative history), but also the different types of relations: on the one hand, those between the institutions and the territory affected, in the relations formed between central powers and peripheral powers, and, on the other hand, those between different institutional powers or figures (public, ecclesiastic or private). The archive approach to public sources, developed in an organised fashion over the long-term, has been handled according to periods and areas, taking into account the complexity of the various institutes which sometimes differ for the same territory affected because they refer to different political and administrative areas. The different administrative layouts and authorities producing a documentation of the current Italian territory have obviously required specific and differentiated projects as regards areas and periods of research.

#### *Archive sources: large-scale private administration*

Private administration is a feature of the not too distant past, and depending on the periods and different areas of Italy has created a very special administrative geography. The presence of feuds, portioned out from lands belonging to the State, brings with it a specific problem within the general problem of the research for two reasons. First of all, the situations and documentation vary considerably in type and according to administrative models and the importance and seniority of the feudatory families. Secondly, the relations formed between feudal lords and the State in the case of calamity often

superimposed requests and petitions from the local communities.

A huge number of State archives contain family archives (Filangeri, 1956; Saladino, 1970) whose inventories are often found to be incomplete. Cataloguing was in fact often hasty, and what is more, on consignment, the property was often separated from other papers preserved by the same families, making it difficult or even impossible to consult today (see in the CD-ROM the case of the archives of the Torlonia family for the 1915 earthquake in Avezzano).

There are also notable exceptions to this which have given a positive contribution to research on seismic effects. One of these is the Archivio Doria-Pamphilj in Rome, for the wealth of documentation preserved in a practically intact state, and for the ease with which it may be consulted. Scholars have had access to it for years: see, for example, in the CD-ROM, the correspondence used for the earthquakes of 1688 in Romagna and of 1694 in Irpinia. Another exception is the Archive of the Barons Compagna of Corigliano (Cosenza, Calabria), where the correspondence between the members of the family has provided a huge number of details about the damages caused by the 1836 earthquake. It is, however, still impossible to gain access to an inestimable private documentary heritage, mainly concerning extensive seismic areas of Southern Italy, and this documentation could bring to light new data.

#### *Archive sources: notaries*

Much could be said about the documentation collected in the resources of notarial archives, present in vast quantities in all the State archives with generally systematic property organisation since the fourteenth century (see Petrucci, 1958; Berengo, 1976; Liva, 1979).

Many notarial testimonies (sales, testaments, concessions etc.) have given us valuable information about the seismic damage caused to the private and monastery building heritage. The data relative to single buildings forms a sort of seismic micro-scenario of constructions in the long-term. The importance of these sources is due to their reliability, since they are direct testimonies

of damage or restoration, and their extraordinary diffusion across the territory. However, it was not possible to make systematic recourse to these sources because of their practically limitless quantity and the need for very long systematic selection, due to the presence of various notaries, even in small towns, covering the same sites.

Notarial archives have been used only when other types of sources have been found to be missing due to destruction or lacking due to particular administrative situations, such as feuds and lack of relative archives or specific documentation. The selection has thus been made mainly with specific aims in mind and always with results of considerable interest (see, for example, in the CD-ROM, the cases of the 1349 earthquakes in Central Italy and 1743 in Nardò, Puglia).

#### *Archive sources: the territorial organisation of the Church*

Besides its own political and administrative structure as a State (see below), the territorial organisation of the Church in Italy was based from the start, throughout the territory of the Catholic ecumene, on that network of territorial structures still formed today by the dioceses and parishes. It was, however, after the application of the counter-reformation dictated by the Council of Trento (1563) that the territorial structure of the Church was established in more specific administrative and bureaucratic forms. The production of documents became systematic and widespread towards the end of the sixteenth century.

Our research has made a thorough exploration of the sources produced by the Church on the territory, both because of their documentary homogeneity, and for their extraordinary territorial diffusion. Parish and bishop archives contain registers, visits and papers produced by parish priests and bishops in their official roles as administrators of a considerable building heritage, the survival of which was a necessary condition for the very duties to be exercised there. The Secret Archive of the Vatican contains the documents and correspondence between bishops and the secretariat of the Papal

State. The highly centralised historical structure of the organisation of the Church, as a religious institution, today enables the collection in a single location of very different aspects of ecclesiastic territorial management, ranging from aspects of information and control to administrative features.

This type of source has provided a precious contribution, of great testimonial worth, from which we may deduce the state of the Church heritage after major earthquakes, from different viewpoints. Systematic selection of the documentation has also enabled important elements to emerge regarding the state of preservation of church buildings. The reports on the state of the dioceses that bishops were obliged to draw up for the Pope, at intervals of some years (*Sacra*

*Congregatio Concilii, Visitae ad limina*), for example, not infrequently also testify the conditions of the buildings before a major earthquake. An important contribution to our research was also given by parish and bishop archives.

Different for archive and historical reasons are the great archives of the religious bodies suppressed during the Napoleonic period from 1797 to 1810, currently stored in the State Archives. This is property belonging to monasteries, convents, chapters, religious societies and boarding schools. This type of documentation has given much specific information on the seismic effects on the building heritage belonging to the Church. In these archives a large historical memory is preserved concerning the history of monument complexes and building heritages (the majority of which still exist) in a detailed and continuous manner as from the seventeenth century. Following destructive earthquakes, interventions were made for restoration, sales of goods, works of renovation which were counted and described in minute detail. The quality of the information in this documentation is considerable and the data is interesting also for other aspects, such as the history of building construction and techniques of restoration (fig. 5).

*Problems with archive sources: early and recent destruction, rejection and disorder*

Besides early and recent damage and devastation, problems in themselves are formed by i) re-ordering during the eighteenth and nineteenth centuries, and ii) the practice of rejections. As regards the re-ordering of the archives, a direct consequence was obviously to alter the original ordering, through which it would today have been easier to reconstruct the administrative papers. A further consequence of the re-ordering is that it is now impossible to locate documents cited in earlier seismological tradition. Certain documents mentioned by Bonito (1691) for example, or by ancient historians, concerning administrative provisions or exemptions of the Kingdom of Naples after destructive earthquakes, can no longer be identified today.

The practice of rejections, which now concerns only the most recent documentation, re-

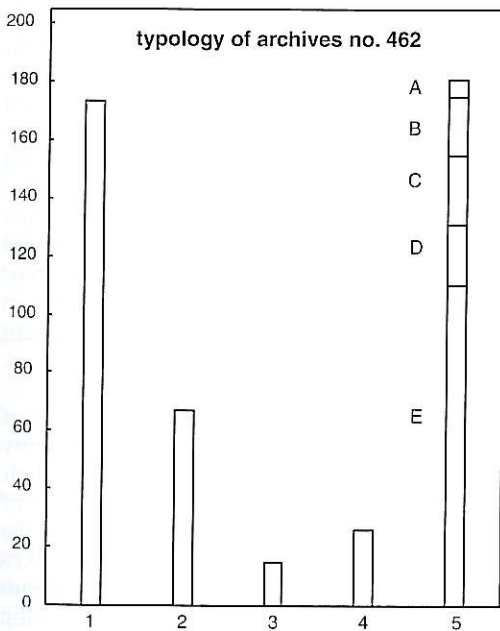


Fig. 5. Typology and number of archives in which the research has been carried out. 1 = no. 173 municipal-historical and current; 2 = no. 67 of the state and its divisions; 3 = no. 15 observatories; 4 = no. 26 private citizens, newspapers, hospitals; E = no. 110 parish and archpriest; 5 = no. 181 ecclesiastic and monastic; A = no. 6 conventual; B = no. 20 capitular; C = no. 24 episcopal and archiepiscopal; D = no. 21 diocesan.

veals new problems which are not easy to solve (Plessi, 1972; Carucci, 1975; Zanni Rosiello, 1983). Archive research is also complicated by the various local situations of inventory-making, particularly for municipal historical archives or for parts of recent archives, such as those for the Civil Engineers, concerning the Ministry of Public Works, consigned to the current State archives but not always in usable condition. Since the documentation of the Civil Engineers includes material of primary importance for knowledge of seismic damage, it is clear that the research into historical seismology relating to earthquakes over the last 50 years may lack, wholly or in part, an often irreplaceable documentary support.

Other archive material of great informative value and which for organisational reasons is almost impossible to consult, are parts of the historic archives of certain ministries, not registered with the Central State Archives and currently preserved at different sites or deposits (Carucci, 1978). In particular, for the interest that they represent for our research, this material includes documentation relative to the Ministry of Public Works, the Ministry of Agriculture, Industry and Commerce and the Ministry of Public Education. From the period following the unification of Italy up to recent times, these Ministries were in charge of the commissions and sub-commissions of enquiry for the inspection of seismic effects; only a part of this material was then used in the reports published by the parliamentary commissions.

### 3.6. *Sources of literary and naturalistic erudition*

The conservation of this particular historical memory, whose distant roots lie in Greek treatise tradition, began again in the Renaissance, in imitation of the ancient texts. The first known catalogue of earthquakes of the modern age is by the Florentine Giannozzo Manetti, written immediately after the great earthquake of Central Italy in 1456. The code was first indicated by Magri and Molin (1983) (ENEA has edited a translation, by Scopelliti in 1983). Preserved in various hand-written codes in different libraries

(including the Biblioteca Apostolica Vaticana and the Krauss Library of New York, see Figliuolo, 1988-1989), the catalogue reports 70 seismic events from ancient times to the fifteenth century. Despite the great value of the work, which appears as a summary of theory and empirical data of remarkable historical and epistemological interest, this code did not circulate at all in the Europe of its day, perhaps because its author fell foul of the Inquisition.

From the sixteenth century, alongside a revival of interest in «freak events» and in phenomena considered «portentous» in general, the trend was for scholars to compile lists of earthquakes of the past. In this context, and obviously beyond any applicative aspect, various earthquake catalogues were produced. Important examples include those by Pirro Ligorio (1574) still preserved in the manuscript version at the State Archives of Turin, by Filippo da Secinara (1652) and by Marcello Bonito (1691). Bonito's work, the famous *Terra tremante*, is the historical forebear of European earthquake catalogues, based on antiquarian erudition, in which late historiographic works often occupy a more important place than the sources. But besides these limitations, which were due to the era itself, Bonito's catalogue is an unusual product of literary and historical erudition, based on countless geographic interests (it even lists earthquakes in Japan and Latin America). Indeed, even modern compilers of catalogues in other countries have long considered this a model.

In the eighteenth century, the attention of natural philosophers and erudites turned mainly to the study of single major events and their theoretical interpretation: the earthquakes of Lisbon in 1755 and Calabria in 1783 shifted the focus on compilation of catalogues of earthquakes over vast areas. As early as the early eighteenth century a certain interest had begun to develop for limited regional areas, as shown by Mongitore (1743), a historian and erudite from Palermo, who compiled a list of earthquakes of Sicily much appreciated by Baratta. Subsequently, Vivenzio (1783) laid the foundations for historical catalogues of Calabria. This meticulous work of cataloguing and research was in part discouraged by the theory of electricity as the cause of earthquakes, which prevailed at the time. This in



a certain sense «released» the seismic phenomenon from geology and the history of the territory (we can almost say from the actual landscape), to interpret it as a totally chance, stochastic event, motivated by complex atmospheric and electric equilibrium. It was only when the new theory of vulcanism began to spread in the early nineteenth century and Seismology began to take shape as a science that studies of earthquakes of the past began again with renewed vigour. The historical catalogues then became a special product of true seismological science, which absorbed the previous naturalistic erudite tradition (see below in the section on the specific sources of seismology).

### 3.7. *The press: from popular press sheets to gazettes (16th-20th centuries)*

This section encompasses the large group of testimonies that over time have gradually taken shape as «newspapers». Italy has a well-known tradition of popular press, gazettes and newspapers which is characterised by a dense network for circulating news, fostered by a widespread urban culture. These sources have been taken into account as far as possible, starting from the first news sheets (popular printed sheets) up to the most recent national newspapers. As a whole, these sources have given a significant contribution both in outlining the social contexts of the immediate post-seismic emergency, and in highlighting aspects of popular thought about earthquakes.

Publications consisting of notices, reports (often preceded by terms such as «*veridical*», «*faithful*», «*authentic*» etc.) between the sixteenth and eighteenth centuries, were intended for an uneducated public, whose main requirement was information rather than literary or scientific study. Even so, as has already been noted by some cultural historians (Petrucci, 1992), these texts do not feature any particular literary excess or rigid descriptive schematisms: instead they appear in the form of summaries or letters. They therefore drew their interest and success from the very fact of being a direct form of communication, thus responding mainly to a new need for information. These texts were also

the sign of increasing literacy, spreading at low and middle level, between the seventeenth and eighteenth centuries, and of the influence of natural sciences in the choices of the printers, previously more orientated towards less naturalistic genres, such as visions, portents and religious literature.

Taken as a whole, the notices and reports form a valuable set of descriptive material, which during the research have often been compared with the information contents of institutional sources. It may be said that, in general, the notices present pictures which were approximately true and almost always incomplete. Some of these popular sheets are sometimes embellished by stereotyped drawings of the disaster (houses uprooted, whirlpools in the sea) or more rarely, by maps of the effects (such as the report of De Poardi for the earthquake and the tsunami in Puglia of 30 July 1627). Widely used and appreciated by the seismological tradition of the nineteenth century, these notices are not always easily traceable today in public libraries.

More pitfalls, as regards the structure itself and the organisation of the information, are found instead in the informative use of newspapers starting from the marvellous gazettes of the seventeenth century (the «*Gazzetta di Mantova*», «*Bologna*», «*Avvisi stampati di Foligno*», etc.). During the eighteenth century some of these newspapers virtually became primary sources of information (see the gazettes of Mantua, Milan; for Venice, Berengo, 1962). Smaller newspapers took their news from these, often re-elaborating it slightly for no clear reason and thus creating apparent confirmation. This type of source has provided an important contribution to the knowledge of local seismic effects; however the risks of an uncritical use of these texts are numerous (for a general historical outline of the history of the press, see Castronovo and Tranfaglia, 1976-1980). The limits lie in two main aspects: one concerns the way these sources are consulted, the other the contents of the information itself. As regards the former aspect, the research carried out has made it possible to show that selection should always be made systematically and extended chronologically. Indeed, it was not uncommon to find that an error, later absorbed into the seismological

tradition, was based on a false or badly inaccurate piece of news from a gazette, sometimes subsequently retracted or corrected in later publications (a good example in the CFTI3 is the case of the false earthquake of Syracuse in 1757; see in the CD-ROM).

A seismologist such as Perrey, for example, who was highly esteemed in the Italian scientific world for his interest in earthquakes in Italy, often committed errors which were then absorbed into the various Italian catalogues. These errors are in part due to the rather rash use of eighteenth and nineteenth-century newspaper reports.

As regards the latter aspect, *i.e.* the actual contents of the news, the limits lie both in the times of broadcasting the information and in the dependence between the various newspapers, which led to the custom, as we have mentioned above, of reprinting the same news even with considerable alterations. During the research we have tried to identify a sort of information «matrix» of the news and its circulation, in other words, the original piece of news and its ensuing variations.

The role of the press in the first decades of the twentieth century was fundamental in creating a public opinion and a new awareness *vis-à-vis* seismic disasters. Perhaps it is no exaggeration to say that when the first legislation containing regulations for anti-seismic defence was approved after the Messina earthquake in 1908, this was mainly due to the role of the means of information of that time, which was able to keep the attention of the national community focussed on this problem.

Even in its moments of great professional quality, the press, due to its very nature, is always closely linked to social and political events. The Stefani Agency of Information, founded in Turin in 1853 by the journalist Guglielmo Stefani, operated along the lines of similar firms created abroad. With time this became a semi-official government agency and in 1920 was changed into a limited company with the aim of gathering news from all over the world. In 1931 regulations were approved which delegated to the Stefani agency the handling of public information on behalf of the government, according to the criteria that the government itself undertook to refer each time to the prefects and other

governmental offices. The consultation of newspapers from the periods of direct governmental control was therefore accompanied by the consultation of restricted telegrams preserved at the Ministry of War and the Interior (Central State Archives, at Rome), sent from the affected areas by mayors and prefects.

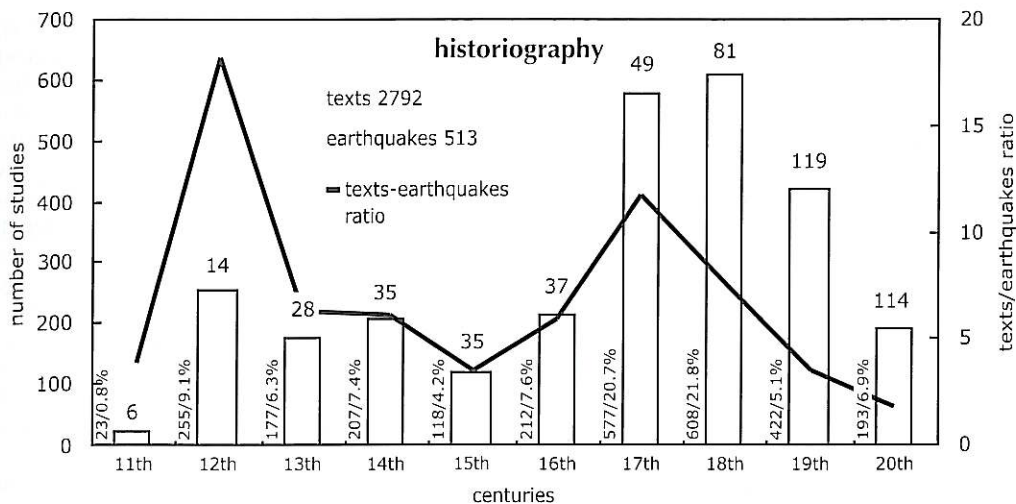
The more recent press reporting shows, we believe, some characteristics with regard to the effects of the earthquakes which seem to concentrate less on the descriptive aspects in favour of a greater attention on the social and emotional aspects. The language sometimes highlights even the distance between journalism and research. Above all, the obsolescence of the linguistic terms used and the casual and often fantasy references to other earthquakes occurring in the past show how little depth there was in the scientific attention to the phenomena described.

### 3.8. *The contribution of historiography*

Historiography as a genre produced over the long term encompasses a vast range of works: from those of the erudite and antiquarian historians to the specialist studies of contemporary conception. If we consider historiography as a genre, the sector of contributions examined obviously contains a strong generalisation, but at the same time identifies a production that may have a common denominator. This denominator, in the different interpretational approaches developed in time, is basically the elaboration of an individual or institutional memory, remote from the seismic event.

Historiographic studies have been used because they contain information on earthquakes as well as elements used to delineate the historical and economic contexts. The distribution of these data in relation to various seismic events throughout the centuries obviously varies a great deal and for the whole period analysed reflects not only the historiographic interests for certain periods, but also the «fortune» of some seismic events.

For the period between the eleventh and twentieth centuries, 2792 studies were used, relative to 513 earthquakes (see fig. 6). Two significant peaks may be noted, relative to the twelfth and seventeenth centuries. There are different rea-



**Fig. 6.** Number and distribution of historiographic studies (as defined by CFTI) for groups of earthquakes divided by century; the percentage indicates the ratio of historiographic studies per century in relation to the overall texts of this category in the database. The numbers above the columns of the histogram indicate the earthquakes of the CFTI3 for each century.

sons for these. In the twelfth century there were two major earthquakes: that of 1117 in Northern Italy and that of 1169 in Eastern Sicily which has also been mentioned, relative to which the contribution of historiography, both antiquarian and recent, has been considerable and analysed in depth. Historiographic works and contributions relative to the earthquakes of the seventeenth century (mainly produced in the eighteenth and nineteenth centuries) were probably stimulated by a new sensitivity to seismic disasters, seen as factors of social and territorial change, particularly in minor and local historiography.

### 3.9. Oral sources

Some recent destructive earthquakes have occurred in special periods: immediately before or straight after another destructive event, natural or anthropic. Where the information was absent or only a small amount was available, an attempt has been made to recuperate or integrate the descriptive elements through direct interviews of reliable witnesses of the event. Oral sources have proved to have particular informational content: they have been collected and filed accord-

ing to the methodology of examination proper to this sector of sources (recorded interview and transcription, Gualca and Carretta, 1984). One of these cases, the earthquake of Varzi (Piedmont) of 29 June 1945, was also accompanied by photographic evidence of the effects highlighted directly, thus revealing a seismic scenario which had previously been superimposed (also for evaluations of economic convenience of the citizens) by a scenario of war damage.

Various oral sources have also been collected for highly documented earthquakes, such as those of 1908 in Messina and 1915 in Avezzano, in an attempt not to lose direct information from witnesses, who provided elements of personal history. Recent seismological literature has also shown itself aware of the possibility of using oral testimonies in relation to the effects of recent major earthquakes on the environment (Serva *et al.*, 1986).

## 4. Seismological records

A wide range of sources belong to the historical heritage of seismology studies: the importance of these contributions is often underesti-