

mated by historians, perhaps because they consider them to be sources already known and exploited. This is not so, as has been demonstrated by the meticulous reading of these texts, many of which are only apparently known, others totally engulfed by the oblivion created by alterations in the theory of the discipline. As a whole, these sources delineate different knowledge, form cognitive frameworks of the past and are of considerable use in understanding the descriptions themselves of the phenomena that also appear in other sources.

#### 4.1. *Earthquake catalogues of the erudite and positivist tradition*

The beginning of the nineteenth century, as we have mentioned, saw the formation of the true genre of «catalogue of earthquakes», seen as a scientific instrument and not as a plain list of seismic events for historians and erudites. Indeed, the historical series of earthquakes was necessary for the interpretative model of vulcanism to demonstrate the continuity and stability of the «seismic centres» (the volcanoes), to highlight correlations between earthquakes and volcanic activity, and to confirm the «regularity» of the seismic activity. It is therefore right in the middle of positivism that the historical series of earthquakes began to take on the value of actual empirical data; they thus emerged from the literary and naturalistic curiosity that generally characterised the formation of previous catalogues to become a full member of the new science of seismology. At this stage, the earlier naturalistic tradition concerning earthquakes was rediscovered, in a certain sense absorbed into the studies that were gradually developing, so much so that today we are tempted to consider it a single tradition. Historically, however, earthquake catalogues have had very different epistemological origins. To avoid giving a purpose-based evaluation of this type of text, two different classifications have been used in the bibliography to this catalogue: for catalogues of the erudite literary tradition, generally up to and including the eighteenth century, the term *repertory* has been used; for the recent scientific tradition, the term *catalogue*.

Just before the middle of the nineteenth century, systematic research began in Germany with the work of Karl Ernest Adolf von Hoff, who in 1840-1841 compiled an extensive catalogue of earthquakes and volcanic eruptions starting from the earliest Mediterranean world. Baratta knew of and much appreciated the catalogue of von Hoff, which was used in his work of cataloguing earthquakes in Italy much more than the catalogue of Robert Mallet (1852-1854). The Frenchman Alexis Perrey (1848), in search of seismic-meteorological and lunar correlation, collected with great zeal (but often with little accuracy) a new set of data for France and Belgium, also concerning Italy, to which he dedicated a much-quoted monographic work.

These collections of data sometimes also accompanied innovative seismological research. Giuseppe Mercalli (1883, 1897), for example, dedicated many years of his work to the organisation of historic seismic and volcanic data, to a large extent also used by Baratta and thus channelled into the current catalogues. The most mature and modern result of the whole seismological erudition was certainly, however, Baratta's (1901) great catalogue.

In the early decades of the twentieth century, research into historical seismic data was still attracting followers and many contributions appeared. Of these, the catalogue of Cavasino (1935) is particularly worthy of mention, continuing the descriptive cataloguing of Baratta for seismic events from 1899 to 1933. To provide an idea of the importance of the tradition of studies of earthquakes catalogues occurring in Italy, we have collected together the main works dealing with them, from the beginning of the modern age up to today (see Appendix 1). Because of the special nature of the documentary heritage, Italian earthquakes have been the focal point of interest of a number of Italian as well as European scholars. This has favoured the structuring and consolidation of the disciplinary field.

#### 4.2. *Scientific reports and field survey*

Italian seismology has produced sources of extraordinary interest for the knowledge of seis-

mic events. From the end of the eighteenth century and up to the early twentieth century, field survey after a major earthquake had the value of scientific testimony encouraged even by the governments. Fairly often, on the basis of this survey, theories and interpretations were discussed, administrative decisions were made and criteria of seismic classification were drawn up, or regulations for choosing new sites on which to start reconstruction were devised.

The scientific and social sensitivity of the various authors gave rise to new reflection on the features of construction, on the relation between surface geology and seismic effects and on the social conditions of the populations hit. A famous survey was made by the academic of Naples after the earthquakes in Calabria in 1783, the first survey organised by a scientific institute in Italy. The reports were accompanied by drawings of the damage, which bear the mark of the Neapolitan landscape culture. From direct the survey of the effects on buildings and on the environment, 60 plates were drawn up, collected in the iconographic Atlas of Schiantarelli and Stile (1784), which accompanied the work of Michele Sarconi. The Atlas also included the great summary chart of the damage drawn by Padre Eliseo della Concezione, an illustrious cartographer of his time, who classified the effects with a rudimentary but effective three-level scale.

Behind the development of a new and more scientific observation, based on the systematic nature of the phenomenal evidence (the effects of earthquakes on the human body, constructions and the environment) there was Antonio Maria Vassalli-Eandi for the earthquake of Pinerolo (Northwestern Italy) in 1808. Later, Leopoldo Pilla for the earthquake of Central Italy in 1837 and Tuscany in 1846, Luigi Palmieri and Arcangelo Scacchi for that of Basilicata in 1851 left behind accurate descriptions of directly observed seismic effects.

Interest in field observations and the empirical findings of the effects was led by Mallet, sent to Italy by the Royal Society of London to study the great earthquake that hit Basilicata in December 1857. Mallet surveyed these seismic effects with great care and with remarkable iconographic and photographic set. His study was

followed by many others, consolidating a sector of research destined in time to become a source in itself. Of fundamental importance are the reports by Giulio Pirona and Torquato Taramelli for the earthquake in the Belluno area in 1873. Giuseppe Mercalli, the abbot Domenico Scinà, Annibale Riccò, Gaetano Platania and Venturino Sabatini have made us aware of important elements in the seismic response of major earthquakes in Sicily and Calabria occurring between 1818 and the beginning of the twentieth century. Subsequently, Mario Baratta himself, Giuseppe Martinelli, Emilio Oddone, Guido Alfani, Giovanni Agamennone and Alfonso Cavasino were among the leading authors of this sector of sources and it was our intention to make the best possible use of these in the CFTI3.

The information offered by these scientific reports is different from and in many aspects complementary to the traditional historiographic sources, in themselves irreplaceable. Structured as excursions to the site, almost always enriched with drawings, sketches, maps and photographs, these reports organise material which today is of great value. Scientific survey usually developed two aspects: on the one hand, observations of the seismic effects on the buildings, the natural environment and people; on the other, a series of interpretative reflections in which the author related empirical data and theory. The relation between the two frameworks (observations and theory) was obviously not «ingenuous», in the sense that the empirical data was collected within a framework which was already orientated. Epistemology teaches that the limit of every observation is that it is already an interpretation; however, this has rarely detracted from the informative value of these works. Perhaps the most striking informative limit of these reports lies instead in the fact that the area observed was only partially the area of the damage, much of which remained undescribed either because not all the villages could be reached due to logistic problems, or because the scientists only tended to examine the hardest-hit towns.

The authors' attraction to particular aspects of the effects (rotation of vertical structures, splits in the ground, reaction of buildings, etc.) has meant that a case history of effects of considera-



ble relevance has been preserved in time. Another element is often added: that of the social aspect of the earthquake and the demand for a policy of prevention to mitigate the damage.

The insistence with which the majority of Italian seismologists took action to urge the government to take specific responsibility by approving specific legislation to control the reconstruction represents a noble page in the history of Seismology, also because of the conflicts that were sometimes sparked off as a result. Baratta, for example, was so committed and used such harsh tones in his denouncement of the lack of legislation in building reconstruction after the earthquakes of 1905 and 1907 in Calabria that resentment was generated in the government. When a commission was to be appointed to evaluate the damage of the disastrous earthquake in Messina of 1908, Baratta was excluded. It is only due to his obstinacy and his personal commitment that today we are able to consult an emblematic work like *«La catastrofe sismica calabro messinese»* (Baratta, 1910), written after a long and tiring mission to the field, a work which was neither desired nor commissioned by the Italian State of the time.

#### 4.3. *Macroseismic cards and questionnaires: the sources of the national seismic services in the recent Italian history*

«Macroseismic cards» constitute an unusual source of information on seismic effects. Their history is connected to that of the State seismic services and is the expression of an attempt to discover the effects which is comparable with those of the first instrumental networks.

Shortly after the earthquake on the island of Ischia on 4 March 1881, the Geological Committee was authorised by the Ministry of Agriculture, Industry and Commerce to take provisional responsibility for contributing to the financing of the geodynamic service set up by M.S. de Rossi back in 1873 (Ferrari, 1992). Since 1883, under the pressure of the effects of a new disastrous earthquake again on the Island of Ischia, the Central Geodynamic Observatory and Archive was officially established at the Regio Comitato Geologico (Royal Geological

Committee), directed by its promoter M.S. de Rossi (de Rossi, 1882, 1883; Mariotti, 1991). Subsequently, following a proposal by the Ministry of Agriculture Industry and Commerce, a commission was appointed to plan the institution of a geodynamic service for the whole national territory. On the basis of the works of the commission, disbanded in 1887, the decision was made to set up three geodynamic observatories in that same year (in Catania, Casamicciola and Rocca di Papa) and to charge the existing *Regio Ufficio Centrale di Meteorologia* (Royal Central Meteorology Office) also with the responsibilities of Geodynamics. As from June 1887, the authority became known as the *Regio Ufficio Centrale di Meteorologia e Geodinamica* (Royal Central Meteorology and Geodynamics Office) (UCMG) and the collection of meteorological data was joined by that of seismic data. As the *Regio Ufficio Centrale di Meteorologia*, the institution had been founded by a law decree of 26 November 1876, but only came into operation in May 1879, under the direction of Pietro Tacchini. The collection of meteorological data was made using pre-printed questionnaires in a postcard format, known as «thermo-udometric», «storms cards», etc. For the earthquakes of 1873 in the Belluno area and of 1875 in the Rimini area Alessandro Serpieri had made systematic use of questionnaires for collecting information on the local seismic effects.

A little more than a decade later, Taramelli and Mercalli tried out one of their questionnaires on the occasion of the earthquake in Liguria in 1887 (see in the CD-ROM). The huge success obtained by these scholars and the positive experience with the cards of the meteorological service encouraged the UCMG to organise the collection of information on the seismic effects of earthquakes with the aid of «macro-seismic cards». These questionnaires were compiled at observatories, meteorological stations, municipality, telegraph offices and sent free of charge to the Office, where the scientific staff then compiled the relative seismic bulletins. These were published for the years 1887 and 1889-1894 as supplements to the weather bulletin of the same Office; for the years 1895-1913 in the *«News of earthquakes observed in Italy*

during the year», a specific section of the Bulletin of the Italian Seismological Society. The news for the years 1914-1916 was instead never published.

The bulletins contained the transcription of the descriptive contents of the macroseismic cards, with added information taken from newspapers and other sources (letters, reports). For the years 1917-1936 the seismic bulletin was published directly by the UCMG and it lost its descriptive nature; in fact information on the macroseismic effects was published already interpreted into degrees of intensity. From 1936 to 1947 the seismic news was reported in an extremely summarised form within the Bulletin of the Italian Seismological Society in the «Seismic news» column.

The publication of data continued, occupying less and less space in the bulletins and increasingly in a form subordinate to the instrumental data, according to a hierarchy that unfortunately has gradually been consolidated in the seismological community alongside the technological evolution of instrumental seismology.

With the foundation of the Istituto Nazionale di Geofisica (ING) in 1936, the geophysical

responsibilities of the UCMG were taken over by the new authority. The UCMG, which after a number of changes in name and responsibilities is now known as the *Ufficio Centrale di Ecologia Agraria*, carried out the collection and compilation of the relative summarised outlines on behalf of the ING, from 1936 to 1975, when the service was suspended. In 1983 this service was resumed without interruptions. In just over a hundred years of use, the macroseismic cards have been modified into several versions to be adapted to the subsequent reformulations of the Mercalli macroseismic scale and the changed interpretative models of seismology.

As a support to the collection of the UCMG, various local observatories organised their own service with their own pre-printed cards, which are today often preserved in the original centres. This material is a direct source of great documentary scientific value for the role of the compilers, the eyewitness quality and the timeliness of the testimonies, the statistical value, the standardisation into a list of specific questions. The latter however is not entirely an advantage, since indeed the limitation of the information to the questions of the questionnaire may have over-

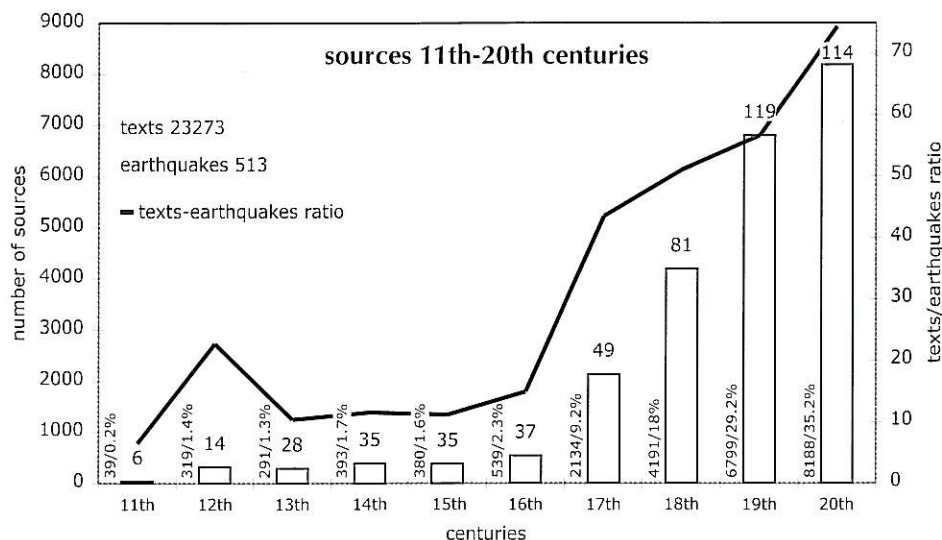
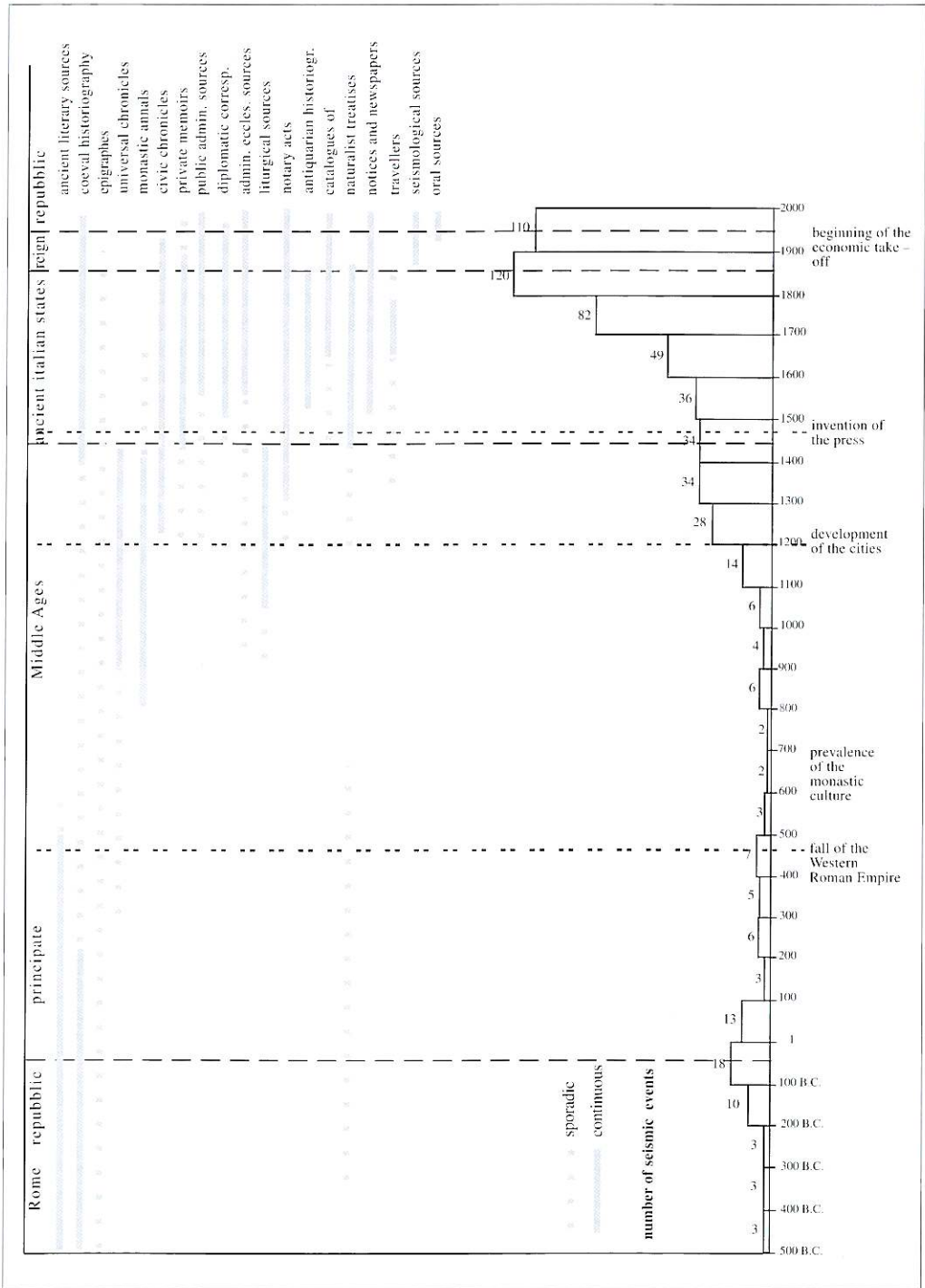


Fig. 7. Number and distribution of sources (as defined by CFTI) for groups of earthquakes divided by century; the percentage indicates the ratio of sources per century in relation to the overall texts of this category in the database. The numbers above the columns of the histogram indicate the earthquakes of the CFTI3 for each century.



**Fig. 8.** Indicative availability of the historical written sources in Italy by kind and period from the 5th century B.C. up to the 20th century. The graph shows the density of different types of sources available in Italy from the 12th century and the increase in new sources from the modern age (16th century).



shadowed some aspects of the phenomenon. However, also according to an explicit recommendation of the UCMG, more complete descriptive outlines could be given either in the footnotes to the postcards themselves or in enclosures.

It is calculated that until 1900 more than 35 000 macroseismic cards were compiled: directly since 1887, and from 1871 to 1886 by taking the information from thermo-udometric and storms cards or from other sources. It is calculated that there are more than 100 000 macroseismic cards available for the twentieth century. The use of macroseismic cards is of considerable importance particularly after 1913, due to the loss of the descriptive nature of the contents of macroseismic bulletins. The mass of data and their descriptive quality make this material a historical and scientific heritage which is as unusual as it is unknown. Unfortunately, access to and consultation of this extraordinary wealth of information, currently preserved in various local and national centres, is often difficult (see overall the use of historical and scientific sources in the CFTI3) (for a general assessment of the number and distribution of the sources used see fig. 7; for an overview of the potential of Italian sources, see fig. 8).

## 5. A brief orientative guide to the historical contexts for the user of this catalogue

As we have said, the chronological extent investigated in the CFTI3 spans more than two thousand four hundred years of history. The extreme diversity of the historical and cultural contexts and the variety of the sources require some explanation about the interpretation and use of the data, obtained through such different instruments of research. We have presented here some elements which are intended to operate as a sort of «warning light» for particularly remote contexts or for problematic and peculiar aspects of the sources.

These guiding elements are the closest approximation to a true interpretative guide, which would have been a fairly ambitious objective given the nature of the text, but obviously they

cannot replace the reading of the historical outlines. Only a huge historiographic production may in fact delineate all the elements concerning both the general features of the territory, and the specific and detailed aspects of the economic life and organisation of urban and rural society through time. The aim of these notes is to establish only a few chronological stages of the catalogue: in this way we may underline some features of the context which may be related to the seismic scenarios in order to improve our knowledge of them.

The multiple political and administrative divisions of the current Italian territory have been summarised in small charts (see historical maps at the end of this volume), to highlight certain chronological scans: these feature the seismic events contained in the catalogue. This graphic support is intended to facilitate an overall view in consistent chronological bands, and aims at lowering the threshold of abstraction in which the data of historical seismology fluctuate when they approach different specialist fields. These simple mentions of the historical contexts are thus intended to encourage a sort of «setting» of the data emerging in relation to the territorial histories.

### 5.1. 5th century B.C.-5th century A.D.: *the ancient and early Christian world*

A considerable research effort has been made over the last few years to shed light on an important but rather confused tradition regarding data on the seismicity of the ancient world. Due to the value and uniqueness of these data, a special critical approach has been required. Below we have outlined some lines of interpretation which may assist the reader in making use of the results concerning this period. Some topics have already been dealt with extensively in recent works, particularly the elements of the residential context and the way of thinking (Guidoboni, 1989; Guidoboni *et al.*, 1994).

There is a considerable, though certainly not limitless, number of sources produced in ancient times which are still available today. As is well-known, all the texts of the past have been subjected to a complex procedure of selection, which

features both voluntary and involuntary elements. As regards earthquakes, we may observe at least two «filters» which have been imposed over the one formed by the losses spread over time, concerning all the documentation, and which have influenced the transmission of testimonies to date. The first filter, of a very general nature, dates back to the same time as the testimonies themselves and is influenced by the contemporary way of thinking, in other words the objective limits in the reception of natural phenomena. Indeed, the selection of the data was affected by all the knowledge and opinions making up the general cognitive and cultural framework of an age in relation to the phenomenal reality observed. Not all earthquakes were always recognised as such, for example, and in any case it was not considered necessary to take into account all seismic phenomena.

The second filter is a consequence of the prevailing role of Rome as a point of observation. Rome, as we know, may experience the effects of a number of seismogenetic sources of the Central Apennines, and this is certainly a feature of considerable interest for the level of seismic risk affecting the city. However, the mention of a tremor in Rome in the early and medieval period is the local perception of an earthquake whose precise localisation is very rarely known.

The filter to which we refer above, concerning all the historical sources in general, applied by the combination of the contingent episodes through the destruction of the sources, dispersion throughout the world or careless preservation, is particularly important. From this point of view, actual seismicity and narrated seismicity represent the two points of a compass which gradually move further apart as we go back in time. The further we go back, therefore, the more likely we are to find an increase in the number of omissions and gaps due to chance. The foundering of a great majority of literary documentation is a serious problem for classical antiquity. This in fact has reduced the level of information even for those sectors of documentation that in some way had remained relatively untouched since they concerned civilisations with a high literary development, such as the Greek or Roman civilisations, unlike other ancient cultures.

As mentioned, the advent of Christian culture did not bring about a serious break with the ancient world in the context of natural phenomena. Instead contents and expectations were transformed.

The results of the survey, however extensive and reinforced by the analysis of contextual elements, come from information which remains very remote from the current image of seismic activity. The «isles of memory» which emerge from this past, besides being chance recollections, obviously also no longer have those meanings and inferences that they probably had for the people who wrote the texts and their readers. The earthquake data is also influenced by the dominance of the large towns with respect to the countryside and smaller urban centres. So on the whole these are testimonies which are poor in quantity and of inconsistent quality, though still endowed with a value of their own, which does not allow us to disregard them. It is very likely that in the future these data will become more significant and go beyond current interpretations, also with the aid of other disciplines (particularly archaeology and palaeoseismology) or thanks to new epigraphical discoveries. The research performed for the Istituto Nazionale di Geofisica from 1987 to 1994 has enabled a full revision to be made of the previous earthquakes catalogues, indicating those events which do not seem to be confirmed by the sources (see Boschi *et al.*, 1995a, pages 135-136, for the list of the ancient earthquakes eliminated).

## 5.2. 6th-10th century: the great territorial transformations of the early Middle Ages

From a typological point of view, there is a great variety of different early medieval Latin sources: monastery annals and chronicles, papal acts, registers, books of notes and *notulae* written in the margins of codices. Hagiographic sources have sometimes also provided information about the seismic effects occurring, although the lives of saints and acts of martyrs have been used here only in the rare cases in which the narration contained some precise historic element (Guidoboni and Marmo, 1989). Altogether there was found to be a higher objective availability of



sources for Northern Italy than for Southern and Insular Italy. This seems to be due to a greater concentration of monasteries with important *scriptoria*, leaving annalist memories which have been preserved through time. These testimonies do not necessarily refer to local events alone. Sometimes traces are found in the annals of a European monastery of an earthquake occurring in Italy. This news had been transmitted orally several times before being included in written culture. In addition, a manuscript could travel and could be used by its later possessors for making notes of all types of facts that were in some way considered worthy of interest.

In the early Latin Middle ages, religious vision distinctly prevailed over the naturalistic vision. The importance of the supernatural dimension of human destinies with respect to earthly happenings placed emphasis on moral duties towards divinity to the detriment of duties of solidarity between men. For this reason perhaps, in early Latin medieval sources ordinary people, with their fears or reactions, are almost never remembered as victims of earthquakes, and sometimes only the reactions of the monks are recorded.

What is more, the actual economic extent of the natural calamities is not always clear. There is no doubt that a situation of discontinuity and a more striking division existed between town and countryside, but the diversification of the two situations which was later to take place in the centuries following the early Middle Ages forms the *vexata quaestio* of whether or not the ancient cities fell into decline (Ward-Perkins, 1984; Giardina, 1986). Cities of ancient foundation took on new roles. Ravenna, for example, was the capital of the Western Roman Empire from the start of the 5th century A.D., and became the symbol of a changing urban society, entrusting the role of the new city to lagoons and marshes (as Venice was to do later). The new urban situation focussed on trade and military control, developing in a world which was absorbing the cultural innovations brought by the new Christian culture but also by the «barbarians» themselves, who were settling in the countryside and taking part in military and political life. It is no coincidence that some earthquakes of the 5th century are recorded in Ra-

venna. These would have been very unlikely to appear in a source if Ravenna had not been the new cultural and political centre (see the seismic events of 429, 443, 467 and 492 in the CD-ROM).

The transformations that took place between the fifth and tenth centuries led to the ruralisation of many cities of the north. Decline in the population and the widespread dominance of the countryside over the urban models of life perhaps indirectly created conditions «attenuating» the factors that determined the destructiveness of an earthquake (Fumagalli and Guidoboni, 1989). Monasteries, besides being new groupings of economic forms, were also places of culture, where ancient literature and historiography was collected, copied and preserved.

Towards the middle of the ninth century, Venice acquired independence from the Byzantine empire and became an independent duchy, together with the hinterland of the Veneto region.

Despite the difficulty of analysing the seismic events of the early medieval period, due to the relative scarcity of available sources, two seismic events of the ninth and tenth centuries have been brought to light which are very important for assessing the return-periods of major earthquakes and the local seismic risk. These are the earthquakes of the year 848 in the Sannio region (Southern Italy) and that of the year 989/990 in Irpinia (Southern Italy). Although the total number of sources is small, they have enabled a framework of effects to be outlined which may be used scientifically (see in the CD-ROM). With regard to some problems of evaluation and use of the sources in relation to the particular historical and inhabited contexts, see the analysis presented in Fumagalli and Guidoboni (1989).

### 5.3. *Eleventh-twelfth centuries: accentuation of the territorial differences in Medieval Italy*

The human context of the earthquakes taking place in these centuries is characterised by such marked territorial differences, between the north and south of present-day Italy, that a brief note is necessary to clarify the reading of the data.



In the north, the territory was on the whole very different from now, due to the age-old changes of investments in land, deforestation and water control. Vast marshy areas and forests were situated in lower Lombardy, Veneto and Emilia; along the course of the Po (which was radically modified in the 12th century, diverting the main stretch towards the north, after the breach of Ficarolo, near Ferrara) vast wooded and marshy areas extended as far as the shore line. The coasts were almost completely uninhabited. Dwellings were very thinly scattered and forest still covered much of the land, around which peasant villages and feudal farms grew, belonging to great monasteries or feudal families. Thousands of hectares of the Po valley were covered in dense woodland, parts of which belonged to farms. Between the 11th and the 12th centuries an intense process of deforestation was begun in order to create new land for crop growing. Many towns of Northern Italy were mainly rural in appearance: not only were they surrounded by uncultivated areas, but even within the town walls there were wide open spaces where trees grew naturally and there were meadows for pasture.

In the south, the economic and political context was very different. According to the most authoritative historiography, one of the most important peculiarities of the history of the Southern Peninsular Italy and Sicily is that it had been characterised not as a group of regional areas, but as a State (Galasso, 1965). This element was supposedly not so much due to geographical or natural factors – nonetheless important for human territorial features – but instead to the particular type of economic development and political and military history which could already be found in these areas after the year 1000.

While in Central Northern Italy the driving forces of the long historic cycle were the towns and economic and social forces of local extraction, in Southern Italy and Sicily, instead, it was a foreign military power that prevailed over the political and administrative organisation of the towns and the countryside. This element is of considerable importance in understanding particular institutional, economic and social frameworks, which directly influenced both the nature and the quality of the building heritage, as

well as the stages of reconstruction after a destructive earthquake.

Relations with Byzantium and the Arab world, the particular trade development of the ports of Campania and Apulia and the intensity of cultural and economic exchanges, meant that the southern towns of the early medieval period not only retained their typically «urban» character, but actually grew in number to a remarkable extent. In the north of Italy, instead, a widespread ruralisation of the towns prevailed, together with a decentralisation towards the countryside of the traditional urban «baricentres» (administrative and economic centres). In Central Southern Italy, even in the inland areas, which had been presided over by Lombard stewards, centres with a mainly urban nature developed in a stable way (Galasso, 1965, p. 129).

The sources that most frequently offer news of seismic events for the north and the south are annals and chronicles. Though between the 10th and 12th century these texts underwent a profound development both in form and content, they retained constant attention for exceptional events, and particularly towards disastrous episodes. Monastic historiography recorded these events from a deeply spiritual viewpoint, while the subsequent chronicles of the age of the communes in general and the memorialist tradition of certain southern monastic centres (like Montecassino) appeared on the whole more intent on gathering details of the concrete and contemporary events which affected the life of the town or abbey (Cilento, 1961).

Over these centuries the great monasteries developed their cultural function also as regards the transmission of the memory of destructive events. The production of these sources is very rich indeed, also regarding a number of Benedictine and Cistercian monasteries of the Germanic area for the earthquakes of the CFTI3 (see in the CD-ROM the earthquakes of 1117, 1169 and 1222). A critical examination of the chronicles and annals has shown that not all earthquakes are events recorded with chronological and geographical precision. The news preserved in these types of sources may be approximate and lacking in detail, but however poor or inaccurate, they were still passed on from one work to another. They were then handed down in time and became tra-

dition, depositing a historic memory which was often confused or overlapping different events.

When the level of detail permitted, the research has also taken into account the documentary sources. For the medieval period, monastic and ecclesiastical documentation is the most extensive: donations, deeds of procedures, sales, requests for exemption or concessions of tithes are the documents most used in this research. From these, elements emerged which allow us to establish the area of a major seismic event, or the traces left indirectly on a farming society, in which the earthquake could become a chronological element of reference for other facts and events (see for example the deeds of Sant'Antonino of Piacenza for the earthquake of 1117 in the CD-ROM).

Until the thirteenth century, the documentation of the southern area was drawn up mainly in Greek. The documentary materials in Greek published until now form the great majority of the surviving material. The same problem also concerns those collections of documents in Latin, where in addition certain linguistic details lead us to suppose that these were later copies of Greek documents (Garufi, 1899). This element can only be demonstrated on a philological basis, and a lexicon of medieval Graecism of Southern Italy and Sicily has only recently been published. Specific studies thus lack a critical overview of the topic.

The decline of the Basilian monasteries after the Swabian era (late 13th century) led to the gradual abandonment of Greek as the administrative language, and this resulted in the need to copy documents and claims. Scholars have been able to highlight a number of falsifications, dating back to the medieval age itself, relative to the possessions of the monasteries, such as for example the claims of Henry VI (1190-1197) (bibliography in Trasselli, 1949). While the situation of public and private administrative documents (donations, testaments, claims) has not always provided data corresponding to expectations, research has made it possible to evaluate the possibilities and at the same time the limitations, for the study of earthquakes, of other documents, such as the colophon of manuscripts and the lives of saints (see in the CD-ROM the earthquakes of the years 853 and 951-1004).

Byzantine historiography of the time dedicated very few annotations to Sicily and relatively few to Southern Italy, perhaps due to the poor consideration that Byzantium had for those lands which had become Norman or easy prey for «Saracen» pirates. Monastic documentation, both in the documents and in the lives of saints, dedicates much space to the problems arising from this devastation, but it appears evident that, especially in the lives of saints, the blame, however unjustly, was put on the Arabs. There was therefore a tendency to consider as destroyed by the «Agarenes» or the «Ishmaelites» even those monasteries or religious dependencies which had collapsed due to neglect or for other reasons, or had even been destroyed by the Norman raids themselves.

Various documents show how the destruction was part of a «consolidated» reality. The Cusa collection (1894), for example, presents a document dated 1109, a *molybdo-bullo* issued by Ruggero II in favour of the monastery of San Barbaro (at San Marco di Demenna). The sigil-lion of the monastery was not available, since the monastery, it is said, had been destroyed by the «Agarenes». In another case instead – a Latin Calabrian document of 1184 – the seal was not available because of an earthquake (see in the CD-ROM the earthquake of the Crati valley of 1184). These cases show that in such documentation, destruction by the hand of nature or man was considered a «normal» event, one of the many variations of the general situation. This explains in part why the surviving papers tend not to indicate seismic events, while more space is given to long-lasting calamities such as famine. Indeed, while violence seemed to be an everyday occurrence, what most preoccupied the monks or Norman rulers was economic prosperity.

A major problem in documenting the seismic effects shared by the documentation of both North and Southern Italy is therefore the difficulty in understanding whether the destruction was due to violent, natural or human phenomena, or to a long-drawn out deterioration, due to neglect, abandonment or economic decline.

In the documents from the south, the problem of reconstruction occupied both governors and abbots. The prefaces to these documents



often indicate the material and spiritual utility of the reconstruction but rarely their main motivation. From the documents examined, a tendency to «conceal» testimonies about natural events may be noted, with the prevailing idea being that the various destructions or abandonments of monasteries should be attributed to the Arabs. The implication was that they had caused the damage as dominators in Sicily and as marauding pirates in Calabria.

#### 5.4. *Thirteenth-fifteenth century: new scenarios of the seismic effects*

From the thirteenth century the explosion of the urban phenomenon was already so extensive and widespread that the whole country took on different characteristics. For the purposes of establishing the seismic effects, it is interesting to note the radical changes in the housing context: the rise in population and in the value of buildings led to a considerable increase in the residential density of the towns. These new spaces were the result of elevations or additions of new floors or new buildings where there had previously been orchards and pastures or abandoned areas. The vertical projection of the medieval town in Italy is well-represented in many paintings of the time, in which towers stand out against a backdrop of fields or hills, houses leaning one against the other, squeezed within the town walls.

The spread of an urban culture, based on the commercial and mercantile trade and on crafts' activities, favoured a production of sources which were very different in quality and in great quantities, the majority of which are still preserved today, produced by public and ecclesiastic authorities. In this period the robust local traditions of citizen memoirs appeared and took root: an authoritative set of chronicles that was later to form the basis for the subsequent urban historiography. A historiography also emerged which was attentive to important events, happening not only on a local level, the narration of which was based on the direct testimonies of merchants, travellers and correspondents. The cornerstone of this tradition may be considered the fourteenth-century chronicles of Giovanni

Villani, whose tale extends from very ancient times, elaborating other chronicles, up to the year 1348, and Matteo Villani, whose narrations (1346-1364) form the basis for a number of traditions on earthquakes of the time taking place on Italian territory (see for example in this catalogue the events of 1348, 1349 and 1352).

In the sector of public sources, continuous and widely found series like the *Riformagioni*, the *Delibere comunali*, the *Consigli*, the Town Senates formed an important filter for gaining information on seismic effects. There have been a number of archive paths which began with these initial selections. The presence of noble authorities along the road to centralisation of municipal autonomies also provided important documentation, particularly for the aspects linked to diplomatic activity and communication: letters, dispatches, notes, information, left the Italian courts of the fifteenth century for other Italian and foreign courts. In this web of exchange, often creating a true tradition in the real sense of the word, a variety of information was exchanged about local seismic effects. In addition, the presence of strong ecclesiastic and monastic organisations, which produced documentation with a view to defending their building heritage, has provided a huge number of other direct testimonies.

For the study of seismic effects, the development of the towns may rightly be considered a significant milestone in history, because it radically altered both the way of perceiving, and therefore of transmitting information on, the earthquake and its destruction, as well as the previous housing situation. From the fifteenth century the process of centralisation of the political and administrative powers accelerated, producing a new type of documentation in relation to the new offices, magistracies and authorities which were gradually being formed. The process of centralisation of powers, on the one hand, and the attempts to control these powers bureaucratically, on the other, often generated complex and overlapping documentary situations as regards the sources. In these, the responsibilities of the offices could often interfere with other governing bodies. In relation to seismic scenarios, we may see that the public authorities began to use the revenue offices as an instru-

ment for verifying damage for the purpose of granting exemptions or extensions of payment. Financial documentation was thus on the way to becoming, as it was to be for a long time, a specific if not the only documentation for «filtering» seismic disasters from an institutional point of view.

A substantial boost to the circulation of information on seismic disasters came from the invention of printing (1449) which in a few decades managed to have a radical influence on urban culture.

### 5.5. *Sources of medium and the late Middle Ages*

The central and late Middle Ages in Italy is recorded in documentation which is found mainly in particular areas of the north and centre. For southern and insular Italy (particularly for Calabria, Basilicata and Sicily) the documentary situation has extensive and not always reparable omissions.

For this period an objective increase in contribution of contemporary sources may be noted. This situation is due mainly to the study of two major seismic events in Northern Italy, on 3rd January 1117 and 25th December 1222. There has been wide and detailed historical investigation due to the exceptional importance of these two earthquakes, which before this research represented the two largest events in Northern Italy. This investigation has allowed us to analyse a huge number of documentary and chronicle sources. If we analyse the type of sources used for these two events, the following elements may be noted: for the earthquake of 1117, 26 archivist sources were used (parchments, deeds, unpublished documents) plus 197 annalist sources. For the earthquake of 1222, 14 archive documents were used, compared with 125 annalist and chronicle sources.

If we analyse the bibliography of a major event in twelfth-century Sicily, a very different situation emerges: evaluations of the 1169 earthquake, one of the strongest in Eastern Sicily, are based on 40 sources (26%), of which only 3 are administrative documents (see in the CD-ROM). The considerable difference is due to the documentary situation of Sicily itself relative to the

twelfth century, which contains many omissions, while the archives of Northern Italy are certainly better preserved, already from this century. This different «documentary potential» is due to various complex historic elements which strongly influence the general evaluations of seismic activity in Sicily during the centuries of the central Middle Ages.

First of all there is a basic difference: Northern Italy was culturally and geographically connected to Germanic and Frankish Europe, an element which encouraged the circulation of information over a fairly wide area, besides allowing direct contact with the affected areas from a potentially large number of witnesses. Sicily, instead, not only enclosing a much smaller territory but also surrounded by the sea, belonged to a system of exchange which was only in part extended also to Central Italy (as shown by the Pisan sources), and with strong links with Arab culture. Those Arab authors who concerned themselves with Sicily, as has been explained by Johns (1989), were much less interested in earthquakes than they were in volcanoes.

These elements highlight the need to make a historical analysis of the territorial contexts of the earthquakes to motivate the actual level of availability of the sources of information. The problem is even more evident for areas like Calabria, regarding which a certain quantity of available documentation only appears from the beginning of the seventeenth century, despite the work of document editing which is still occupying Byzantinists. While for Northern Italy the great step forward in the quality of information took place in the twelfth century, for Central Italy instead it improved with the great earthquake of September 1349. The evaluations of the effects in this case are based on 100 sources, of which 38 are archive sources and 62 memorialist sources.

For the fifteenth century, research was dominated by the great event of the Central-Southern Apennines of December 1456, for the knowledge of which a total of 162 sources have been used. Twenty-three of these (14%) were archive documents and 139 (85%) memorialist sources (also see Figliuolo, 1988-1989, who collaborated on this research in the first stage of the work 1983-1986).