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## First historical evidence of a significant Mt. Etna eruption in 1224

Emanuela Guidoboni\*, Cecilia Ciuccarelli

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

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## ABSTRACT

The 1224 Mt. Etna eruption is a significant event both in terms of the mass of erupted materials and because it involved the lower eastern slope of the volcano, reaching down to the sea. Nevertheless, it is unknown to current historical catalogues. According to the historical sources, only two other lava flows actually reached as far as the sea: in 396 BC, just north of the present-day inhabited area of Acireale, according to the geological data alone, and in 1669, when the lava covered the south-eastern flank of Mt. Etna and damaged Catania. We present and discuss the two medieval sources that attest to the eruption of 1224 and make available the original texts. Furthermore, through the close analysis of the historical and topographic context of the Etna area, taking account of the roads and ports in the early 13th century, we have tried to single out the possible area of the lava's outlet into the sea in 1224 on historical grounds. A repeat of an eruption similar to that of 1224 would have a serious impact today as the coast is densely populated.

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## 1. Introduction

Etna has been an active volcano ever since ancient times and the history of its activity has been reconstructed by scholars and subsequently by volcanologists, starting from the end of the 18th century (Ferrara, 1793 and 1818; Maravigna, 1811; Recupero, 1815; Alessi, 1829–1835; Sartorius, 1880; Mercalli, 1883) up to the present day (Romano et al., 1979; Tanguy, 1981; Romano and Sturiale, 1982; Mulargia et al., 1985; Siebert and Simkin, 2002; Speranza et al., 2006; Tanguy et al., 2007). Although more than a hundred eruptions from the 7th century BC to the 19th century have been reported in current catalogues, only about a dozen eruptions are dated prior to 1284 AD. Catalogue data currently combine: 1) historical evidence, that is, evidence based on written texts; and 2) evidence based on archeomagnetic and paleomagnetic dating. Often, however, the latter dates are not entirely independent of the historical data.

Although Mt. Etna's historical activity has been the subject of recent studies (Tanguy, 1981; Chester et al., 1985; Chester et al., 2000; Branca and Del Carlo, 2004; Tanguy et al., 2007), which have contributed to improving the geological data on the volcano, many issues still remain open. The medieval eruption described here, based on 13th century sources, is unknown to the catalogues currently in use. We present this medieval eruption as information that has its own intrinsic stability, having been identified within the framework of a specific disciplinary methodology (Guidoboni, in press). In contrast, geological, paleomagnetic and/or archeomagnetic data are necessarily subject to changes, having been "driven" by scientific and technological advancements.

\* Corresponding author.

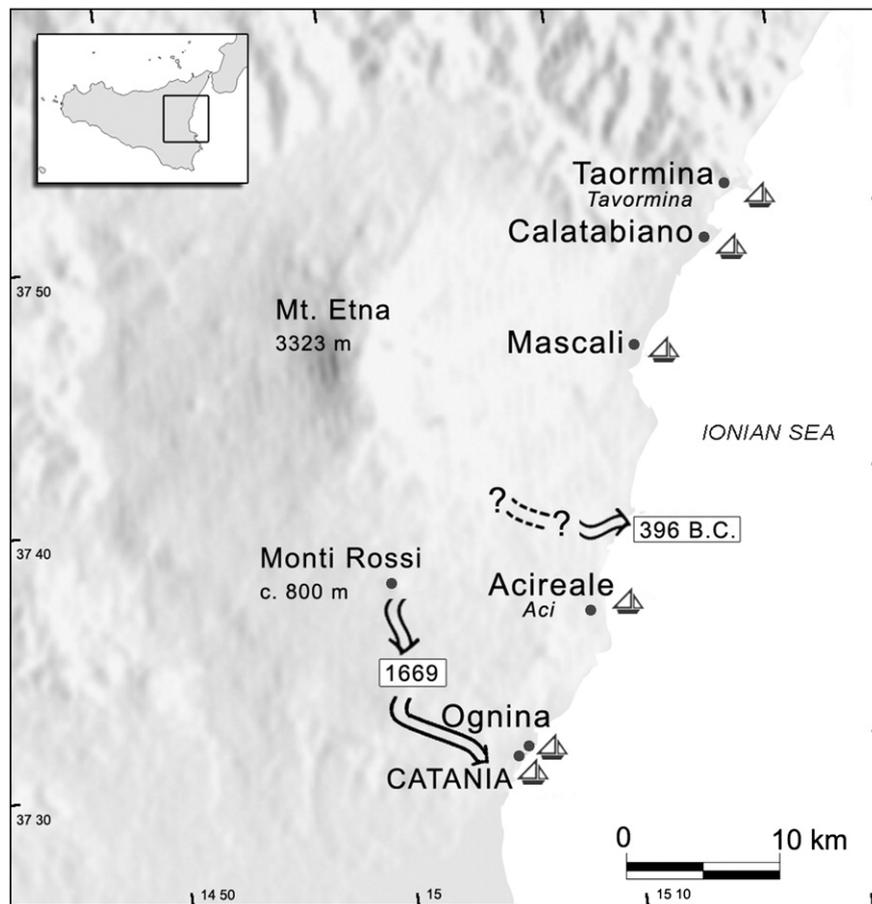
E-mail address: [guidoboni@bo.ingv.it](mailto:guidoboni@bo.ingv.it) (E. Guidoboni).

During our research for the new Etna catalogue (Guidoboni and Boschi, in preparation) we have highlighted that over 30% of the data for the period from Antiquity to the end of the 16th century are the result of mistaken historical indications, which have then given rise to incorrect geological interpretations. The 1224 eruption is the third among those reported by historical written sources that had affected the lower-eastern side of Mt. Etna, and whose lavas reached the sea. The oldest of these occurred in 396 BC, as recalled by the Greek historian Diodorus Siculus (14.59.3; 1st century BC, ed. 1933–1957), who probably either drew upon more ancient lost sources or upon oral traditions. Tanguy et al. (2003, 2007) have confuted their previous location of such a lava flow near Stazzo and hypothesised that it could have reached the sea simply "north of Acireale". The second lava flow that reached the sea occurred in 1669 as the final outcome of a long, exceptional and historically very well documented eruption (Ciuccarelli, 2001, 2004) from Monti Rossi, at an altitude of around 800 m (see Fig. 1).

Even the eruptions in the years 1329 and 1381 affected the eastern flank of Mt. Etna: their lavas are indicated as going as far as the sea in the geological map of Romano and Sturiale (1981), but have been correctly modified in the latest works (Branca and Del Carlo, 2004). The medieval eruption of 1224 is, therefore, the third one to have explicitly reached as far as the sea, according to the contemporary texts.

## 2. The methods used

For the study of this eruption (as for all of those of the new historical Etna catalogue) we have applied a philological-semantic historical method. It is not easy to explain what this consists of in just a few lines, but it might be enough to summarise it in the three key points that



**Fig. 1.** Simplified map of the two known historical eruptions, in 396 B.C. and in 1669, mentioned by written sources, which reaching the sea from lower eastern side of Mt. Etna. A further two medieval eruptions, attested to by written sources, involved this side of the volcano, in 1329 and in 1381, but did not reach the sea. The map also highlights, with the symbol of a boat, the ports operating in the 13th century in this area.

characterise it: i) philological approach to the contemporary texts; ii) awareness of the meanings and the cognitive context of the author of a text; iii) historical knowledge (that is, extra-textual) of the territory where the recalled events took place.

As regards point i), in brief we can say that the philological approach is a system of rules, which allows us to ascertain whether a text is true or false and, in the former case, whether it is independent (that is, it autonomously attests to its contents) or whether it relies on previous texts, either known or lost. These criteria are crucial in attributing “value” to the contents of an historical text and in considering it to be a reliable *source* of information for the facts recalled in it. Moreover, it is important to know whether or not the event described is chronologically and geographically close to the writer. From these elements we can thus establish whether the author of a text is a direct and trustworthy witness, or whether he merely transfers information received from others, passed on by means of oral sources (with possible misinformation), or accrued from other texts, not known of today. In short, we can hypothesise how an event narrated in a text has reached us today.

Ideally, we should always have several historical sources at our disposal that describe the same event, and this is what research constantly strives for: indeed, this generally tends to consolidate and specify the information level and is a good benchmark of “philological security.” However, it is not always possible to dispose of a set of sources for the same event, in particular for centuries further back in time. But whatever the philological situation we can dispose of, our method requires that the textual criticism (or text exegesis) be nonetheless made *explicit*, since the transparent assessment of the information stems from that. In this light, an indispensable element is

that of assuring the reader (or user of the data) the complete availability of the original source texts: this allows one to shed light on the whole process of analysis and decision-making which took place in regard to the sources considered. That decision-making process generally marks the watershed between textual criticism understood in a specialist sense and the collecting of information that was made by the scholarly people of centuries past (generally valid only for the historical period they lived in). The information collected then helped to form the basis of the modern catalogues of the historical eruptions, most of which are still in use. That accounts for the many mistakes, misunderstandings or, as in this case, information gaps, still present in current catalogues, often unbeknown to the volcanologists.

As regards the medieval texts, as in this case, we should also bear in mind the fact that the scarce dissemination of the writing, associated with the relative rarity of text production, brought about an enormous selection between the real and the narrated events. Apart from that, for many centuries, in the annals and the chronicles there was only room for events that were deemed important not only for the writer as ‘author’, but also for the culture and the value system of the community, which that text belonged to (above all monasteries).

Point ii) concerns the semantic analysis of the text. We feel that such an analysis is indispensable in order to know about the *point of view* of the author of the source, his motivations, the qualitative instruments used in the narration, such as his own personal use of language and the system of chronology and measurement he refers to. This approach also allows us to highlight any meanings that the narrated event was connected to. Indeed, the medieval account of an event, such as an eruption is, in respect to the real event, a selection of elements enacted within the world of the author’s linguistic and

cognitive references. Furthermore, the narration that we use concerns an event that for the people of the day was laden with mystery, symbols and analogies, most of which incomprehensible or impossible to assess for us today.

As regards point iii), that is, the historical knowledge of the territorial context of the narrated events, we can say that this is complementary to the philological and semantic approach, as it contains potential information capable of casting light on other elements. The transformations and the use of the territory over the centuries can undergo changes that make it necessary to outline the “scene,” so to speak, within which the natural events narrated took place.

The medieval sources, which preserve the memory of an unknown eruption, obviously have some limits in regard to the need for accuracy, which the scientific use of the data demands: however, unlike the ancient sources (Chester et al. 2000), they are valid and intrinsically precious.

As example of mistaken attribution of eruption we mention the false event of 1222, that has not been connected to the eruption presented here. The catalogues in use (Tanguy, 1981; Siebert and Simkin, 2002; Tanguy et al., 2007) list an eruption in the year 1222 without actually locating it. However, this was a false event, already listed as such by Agnello (1992), for whom the 1224 event, highlighted here, is not known. The analysis of the false event in 1222 has been undertaken in the new historical Etna catalogue currently undergoing completion (Guidoboni and Boschi, in preparation). The year 1222 was attributed by the scholar Alessi (1829–1835), who arbitrarily interpreted a collection of miracles and *memorabilia* written by Cesarius, a Cistercian monk from the abbey of Heisterbach (near Bonn), who lived between 1180 and 1240. From two prodigies of this work, set within a fairy-tale like context and relating to the description of Etna as a mythical hell-like place, Alessi dated three eruptions with no descriptive detail, including that of 1222. That date was only inferred from the year in which the monk Cesarius was believed to have written his account. The inconsistency of Alessi dating from both the historical and the philological standpoints makes any reference to 1222 wholly spurious.

### 3. The medieval sources on the 1224 eruption

The 1224 eruption is attested to by two authoritative 13th century sources: 1) the *Continuatio Funiacensis* (ed. Waitz, 1872; Alexandre, 1990), a short monastic chronicle in verses, written in Latin; and 2) the treatise of Restoro d'Arezzo, *La composizione del mondo con le sue cascioni*, written in vulgar Italian in 1282.

The first text is one of the continuations of the *Pantheon* (see the introduction of Waitz in the 1872 edition) by Goffredo da Viterbo (c. 1133–c. 1191 AD) for the years 1224–1226. Goffredo was an ecclesiastical intellectual belonging to the entourage of the Emperor of Germany Konrad III (1138–1152) and his notary. He was then at the service of Frederick I and Henry VI as an ambassador and diplomatic envoy. His chronicle comprises the events from the Great Flood up to the year 1186. That chronicle enjoyed great fame and popularity in the Middle Ages. In some monastic *scriptoria* (that is, in the libraries of the monasteries where the ancient texts were copied into new codices) over the course of time the text of the *Pantheon* was copied and integrated with annotations on events contemporary to the copyists, and deemed of importance by them. A membranaceous codex, the *Codex Oxoniensis Bodlei.* no. 1296 (*Laud.* no. 721), copied in 1454 at the monastery of Eberbach (near Wiesbaden, present-day Germany), contains the text of two such ‘continuations’ (*Continuationes*) of the 13th century. The first one attesting to the eruption is the *Continuatio Funiacensis*, almost completely written in verse, quite frequent in those times (Fig. 2). Based on references found within the text, the anonymous author has been identified by the first editor, Waitz (1872), as a monk from the Cistercian abbey of Foigny (dioceses of Laon, France). The *Continuatio Funiacensis* starts with the description

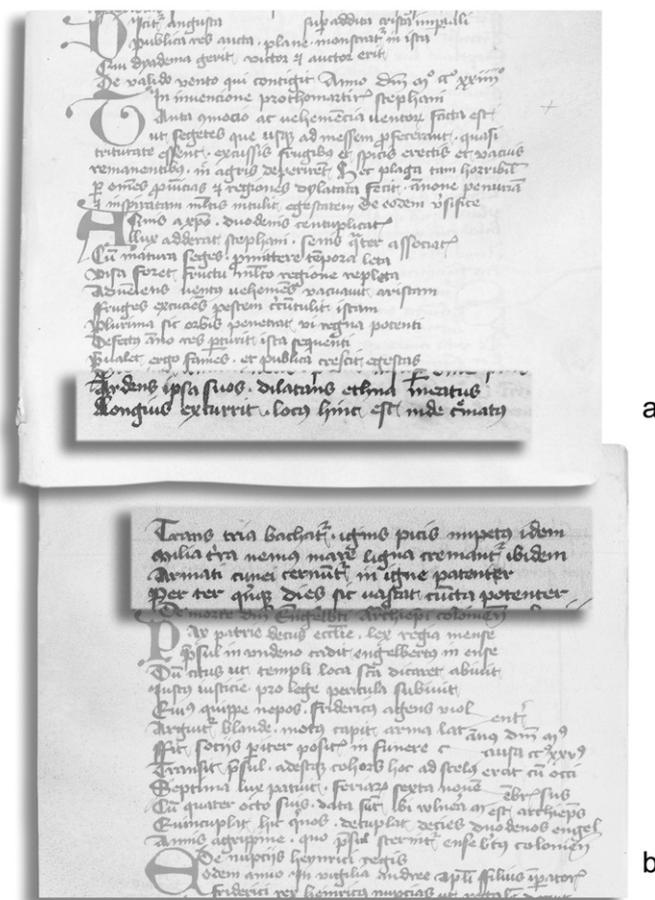


Fig. 2. Codex of the *Annales Funiacenses* (13th century) preserved in the manuscript *Laud Misc. 721* (copy of 1454) of the Bodleian Library, University of Oxford, in which the Etna 1224 eruption is described: the text starts at the end of folio 331r (a) and continues in the subsequent folio 331v (b).

of a strong wind that swept France in the year 1224 (the date is indicated as a typical medieval arithmetic riddle), on the day when the body of St. Stephen was found, i.e. 3rd August (this finding occurred in the year 415). The wind destroyed the harvest and the following year there was a serious famine (for these events, also based on other sources, see Alexandre, 1987). After this event an important eruption of Mt. Etna is mentioned in *Continuatio Funiacensis*. It is not completely clear from the text whether that eruption actually occurred in August 1224 at the same time as the windstorm, or in 1225 during the famine. However, as the following chapter of the *Continuatio* speaks of the events of 1225, we have considered the year 1224 to be the most likely. Moreover, we can exclude the possibility that it may have occurred earlier: a detailed analysis of the whole short text *Continuatio Funiacensis* shows that the events narrated in this text all occurred in the years 1224–1226, even if they concern areas far from Foigny, and are confirmed in other contemporary sources (the recalled windstorm in 1224, the famine in 1225, the murder of the Bishop Engelbertus of Cologne and the wedding of Henry VII, son of the Emperor Frederick II, in November 1225; another storm at Foigny in 1226). This is the text of *Continuatio* in translation (for the Latin text see Appendix A):

In the years when twelve was centupled [1200] (since the birth) of Christ, / plus four times six [1224], on the day when Stephen was found, / when the ripe corn crops seemed to promise happy times and the region was full of diverse fruits, / A violent wind came and emptied the ears of corn, / destroying the crops; and the disaster spread, / bursting into many earthly realms. The following

year, that event was the cause of a famine:/ a lack of food indeed holds sway, and public poverty increases./A bitter cattle plague spreads, so great that there is no possible remedy.Etna, too, burns and opens wide its mouths,/ flowing fast and long, and burning places all around;/it rages with three fires of pitch, all equally violent,/ burning woods, sea and boats over a distance of three miles in that place./Ranks of armed men could clearly be seen in the fire./ And so for fifteen days it violently devastates everything.

The second source that attests to this Etna eruption is the renowned treatise written in 1282 by Restoro d'Arezzo (c. 1220–post 1282), the first “scientific” text on natural phenomena written in vulgar Italian. The eruption is described within the context of a theoretical discussion on the origins of fire inside the Earth. We have taken into account the two different codices and compared them. The oldest manuscript, dated to the end of 13th century, preserved in the Biblioteca Riccardiana of Florence, codex 2164, fol.43v (Fig. 3), is written in language of Arezzo (ed. Morino, 1997). The second codex, dating to the 14th century, is the Barberiniano Lat. 411, of the Biblioteca Apostolica Vaticana and is written in Florentine (ed. Narducci, 1859). The two codices do not show differences in the passage relating to the eruption.

Restoro refers to Etna with the medieval term of Arab origin “Mongibello.” The eruption is not explicitly dated and we only have the term *ante quem* to the writing of the treatise, that is the year 1282. Mottana (1999), who commented on the treatise by Restoro, tried to pinpoint the date of this eruption, but failed to do so as he was unaware of a direct source reporting it. From the words of Restoro, who uses the impersonal form “was seen” (*fo veduto*) we can infer that he did not witness the eruption directly. However, it is reasonable to hypothesise that he drew his information from a previously written source, lost or today unknown, or most likely from someone who had seen Etna after the eruption, as well as the great *sciara* (a word meaning “solidified lava path” in Sicilian).

This is the text of Restoro in translation (for the vulgar Italian text see Appendix A):

And we find fire burning below ground, and fire and smoke issuing from the earth; and the reason for this is that the heat of the sun penetrates the body of the earth and that of the other stars as well, and encounters a mine of sulphur which acts as tinder for the fire and is able to absorb it. Because of the warmth of the sun, it heats up over a long period and the fire is set alight; and when

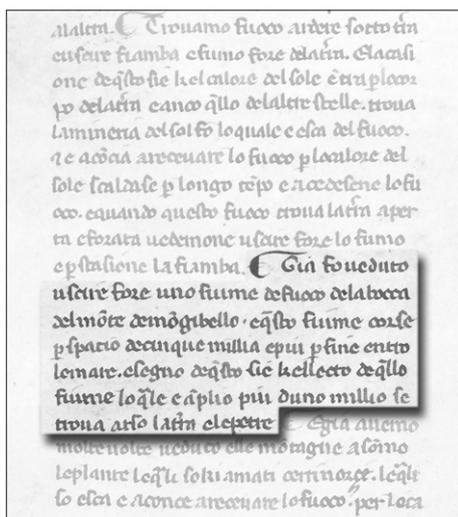


Fig. 3. Detail of the ms Treatise by Restoro d'Arezzo (1282) preserved in the Biblioteca Riccardiana of Florence, codex 2164, fol.43v: highlighted is the passage recalling the eruption.

this fire finds the earth opened and cracked, we see fire burning and sometimes flames. And a river of fire was seen to issue from the mouth of the mountain of Mongibello (Etna), and this river flowed for a distance of 5 miles [c.7.5 km] and more until it entered the sea, and evidence of this lies in the river bed, which is more than a mile wide, where the earth and stones in it are found to have been burned.

We have been able to deduce that the same eruption is being dealt with by applying the philological method of lexical comparison between the passage by Restoro and that of *Continuatio Funiacensis*. The two sources agree in regard to these elements:

- i) the lava went as far as the sea, a very rare event for Etna, as has been pointed out above;
- ii) measures of length are mentioned, a circumstance that is quite rare in the medieval sources;
- iii) a “vast territory” is indicated as having been destroyed.

There are some differences between the two sources that lead us to believe that the two texts are independent (in other words, they do not stem from a single lost text). Indeed, they both contain an element that is missing from the other: the eruption’s duration of at least 15 days is only contained in the *Continuatio*; the breadth of the lava flow, more than 1.5 km (*more than a mile*), is only in Restoro.

Instead, the following aspects differ between the two texts:

- a) the number of mouths that opened in the volcano during the eruption and therefore the number of lava flows: three in the *Continuatio*, one in Restoro;
- b) the length of the path of the lava flow that reached the sea: *three miles* in the *Continuatio* and *five miles* in Restoro.

### 3.1. The measurement problem

In medieval times quantitative data did not belong to the mental universe of precision – of the kind what we commonly refer to today. The historians who use the measurements reported in the medieval sources know with how much care and approximation they must be used. Specifically for measurements of length we need to take account of a sort of metric relativism, due to the points of view adopted by the authors. Instruments were hardly ever used to measure distances: everything was related to man, his work and his way of travelling across geographical space.

The most widespread unit of measurement was the “mile”, inherited from the Roman era to indicate 1000 double paces of about 0.75 m each, and equivalent to about 1480 m. The mile was adopted across the whole of medieval Europe, but does not lend itself to any exact definition of current metrics. Indeed, the vast diffusion of the mile did not correspond to any one identical measurement. Depending on the different geographical areas, the mile could indicate between 1.5 km (such as the original Roman one) up to 7 km (Borst, 1990). In the Italian area the mile in the various eras and locations measured between 1500 m and 2500 m. In Sicily its value wavered between 1487 m (in Catania and Palermo) and the 1845 m of other cities (Martini, 1883).

Furthermore, the distance would have indicated: i) the optical perception of the distance between two points, and ii) the road actually travelled on foot or on horseback, if it existed and was known. In the first case, whoever knows Etna well also knows how the evaluations the flow lengths can be skewed even today, for anyone observing them from the coast.

As regards the two sources taken into consideration here, in our opinion it can be concluded that the indications concerning the length of the 1224 flow can be used as a scale factor, that is to indicate that it was an eruption considered to be important by the contemporaries.

The equivalent modern unit of measurement, which we also report, is therefore an approximate measure.

Perhaps a more general question on the sources remains to be clarified: if this eruption in 1224 had been small and of little importance, would these texts have preserved any memory of it? From the historical standpoint, we can say that a text written in the 13th century in itself had a preciousness and an authoritativeness (which today we have difficulty perceiving), due to the fact that in that day and age few people could write or read.

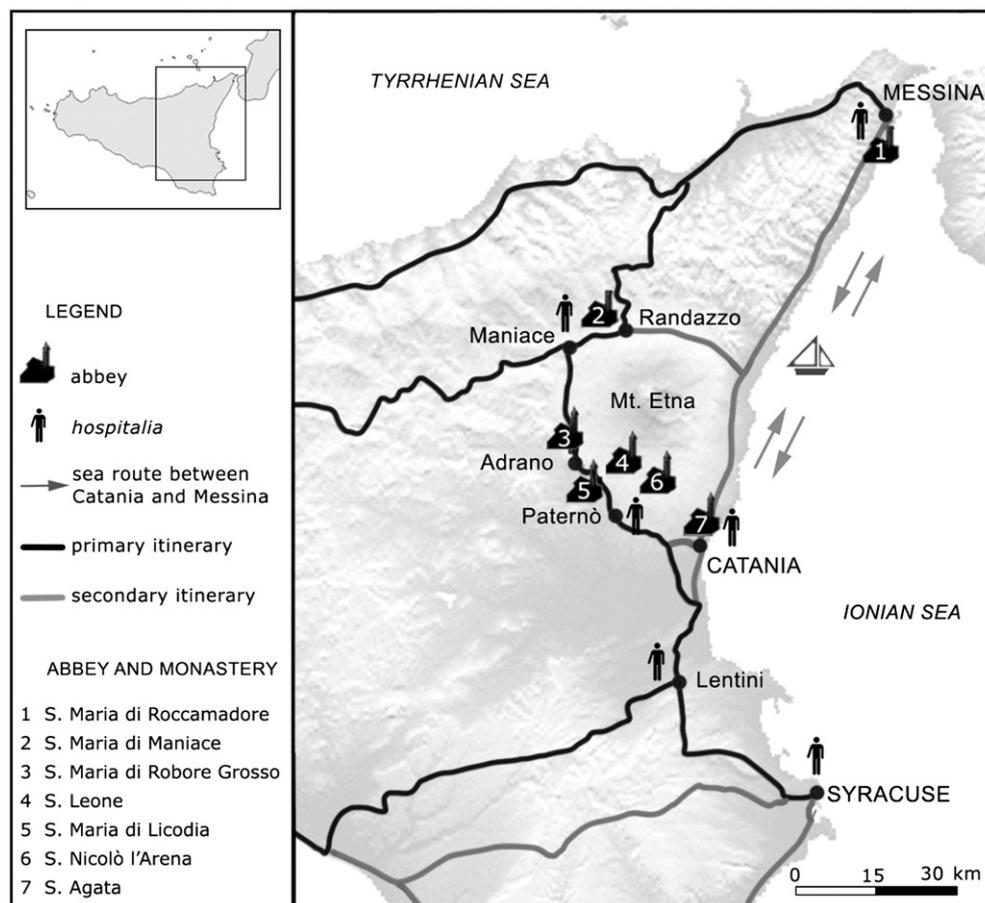
The preservation of the memory of an event, such as the 1224 eruption, in a monastic text and in a famous treaty, testifies to an event that was felt and transmitted as being important. Although the language, in which such texts were written may seem distant, inaccurate and almost fairy-tale like, it was nonetheless a real, precise event clear-cut (localised at a specific time and in a geographical space) that was to be set in the collective memory.

#### 4. Description of the eruption

The eruption occurred in the year 1224, very likely in the month of August. New craters opened on Mt. Etna, from which a great amount of lava was emitted, flowing rapidly in different directions. Three lava flows burned the woods and the vegetation for a length of 4.5 km approximately (according to the *Continuatio*) or 7.5 km (according to Restoro). The new vents opened up at an elevation that may have ranged between 600 m and 800 m, if we take account of the degree of approximation of the measures reported by the sources. Indeed, the lava flow, reached the sea, where it set fire to some boats. The boats could have been destroyed more by the lava directly (it had advanced

slowly and could allow for a possible salvaging of the vessels), rather than by the high temperature of the sea water close to the lava, which could have damaged the wood and melted the pitch. A similar circumstance is historically attested to by the Etna eruption in 1669, when the lava reached the city of Catania and as far as the sea: the boats could not be moored or come close to the port of Catania precisely because the waters there had become too hot, to the extent that the waters actually “boiled” (Archivio di Stato di Venezia, *Senato*, Dispacci, Ambasciatori, 82, 28 May 1669, in Guidoboni and Boschi, in preparation).

There are no textual elements to know exactly *where* the lava reached the sea. However, the passing mention to the burnt vessels allows us to hypothesise the presence of a harbour or moorings. In the 13th century, according to Peri (1990) the eastern coast of Sicily had moorings in Acireale, Mascali (Fondello), Calatabiano and Taormina (see again Fig. 1). In the period being examined here, the port of Catania, called *Saracen port*, was a moderately-sized mooring in terms of size and importance, situated on the natural wharf external to the fortification of the episcopal citadel (the so-called *Civita*), more or less in the area currently occupied by via Porticello-Piazza Borsellino (Arcifa, 2001). This port's position is such that the lava would have reached it only after causing serious damage and destruction in the urban area: in our opinion, this destruction would be long remembered in the sources of the time and subsequently, instead, there is no trace of it. As a confirmation of this hypothesis we should remember that the coeval historical sources have well preserved the memory of two events that had destructive consequences in the urban area of Catania between the 12th and 13th centuries: the disastrous earthquake in 1169 (Guidoboni, 2001) and the destruction which occurred



**Fig. 4.** The roads of transit, the monasteries and the pilgrims' hostelries existing in eastern Sicily including the Etna area, in the 12th and 13th centuries. The main land route went from the western side of Etna, opposite to that of the 1224 eruption. From Catania one could reach Messina by sea, the main port for Rome and the Mediterranean: from this short but much frequented route the eruption could be seen on the eastern flank.

in 1232 during the repression of the anti-Swabian uprising by Frederick II (Pispisa, 1993).

According to what was reported by Restoro, the lava flow reaching the sea was *more than* 1.5 km wide, so it had a significant size, easily visible as a *sciara* several years later (as Restoro wrote the Treatise in 1282), formed of burnt earth and stones (“*se trova arso la terra e le pietre*”). The area covered by the lava flow was scarcely inhabited in the 13th century, both due to the reduced demographic scale of the times and the different use of the coast.

The eruption lasted around 15 days. A verse of the *Continuatio* compares this eruption to armed phalanxes, probably alluding to the dense smoke caused by the fire of the woods overrun by the lava, along the flank of the volcano, or by other volcanic material that had erupted. That mutating mass of moving material may have given the impression, to whoever was observing it from below, of a slowly advancing army.

### 5. Reconstruction of the medieval Etna context: roads and ports

We have wondered why an eruption such as the one of 1224, which had a substantial impact and was highly visible, reaching as far as the sea, left so few written traces in its wake. In particular, we have wondered why its most precise memory is preserved in a monastic text of the European area. In our opinion, some characteristics of the territory on the eastern side of Etna can shed some light on these questions. Unlike today:

1) the area was very sparsely inhabited: the sources do not recall the destruction of inhabited areas and the worst damage concern the loss of vegetation (burnt woods) and some boats (see later);

2) the area was far from the main routes of transport, which in those days ran along the western slope of Etna (Fig. 4). From this path no eruption could have been seen on the opposite eastern side of the volcano.

Eastern Sicily's south–north road connecting road came from Lentini, passed through the suburban western area of Catania, and continued towards the villages of Paternò, Adrano, Maniace, Randazzo (all on the western side of the volcano). The buildings providing hospitality were situated in these villages (*hospitalia*, a sort of hostel of the day) and were for the pilgrims who then reached Messina, without then passing along the eastern coast (Fig. 4). The port of Messina connected Sicily to the rest of the Mediterranean: the pilgrims used it to take the ship towards Rome, Jerusalem and the sanctuary of Santiago di Compostella (Arlotta, 2005).

Furthermore, on the eastern flank of Etna – therefore the opposite part to the 1224 eruption – there were, starting from the mid-12th century, some Benedictine monasteries. As is well-known, in medieval Europe the monasteries formed a real network for the spreading of news on the events that had taken place, and that were deemed important. This occurred thanks to the movements of the monks between the various local and transalpine monasteries (see Alexandre, 1990, and the case of the 1117 earthquake in Guidoboni et al., 2005). Within this European Benedictine network there were also some seats on the Mt. Etna: these were the Benedictine abbey of Sant'Agata in Catania (founded in the last decade of the 11th century), which the *priories* depended on (that is, affiliated abbeys) of Santa Maria di Robore Grosso in Adernò (now Adrano) and San Leone on the Panacchio hill (Pispisa, 1993) and the cenobies of Santa Maria di Licodia, near present-day Licodia, and San Nicolò l'Arena, in present-day Nicolosi (Gaudio, 1929). Another Benedictine monastery had existed

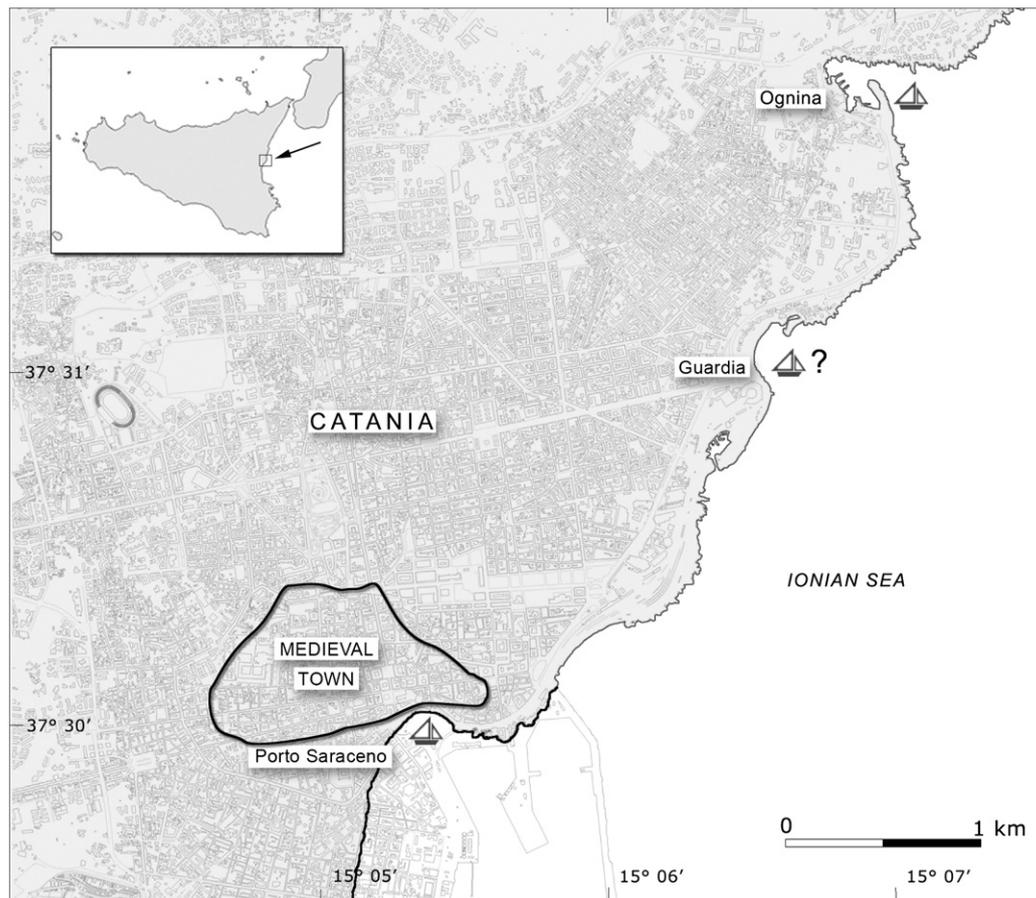


Fig. 5. Map of the present-day city of Catania, indicating: – the borders of the medieval town (i.e. *Civita*), corresponding to a small part of the present metropolitan surface; – the small ports of the Etna area, whose existence in the 13th century is historically attested to, that is the Saracen port of Catania and the small harbour of Ognina; that of Guardia is not attested to and remains an uncertain fact; – the 12th–13th century coastline, shown in bold type: the southern part was much further back than at present, as an effect of the 1669 lavas.

since 1174 in Santa Maria di Maniace, near Randazzo. The Cistercians were present starting from 1193 at the abbey of Santa Maria di Roccamadore, near Tremestieri, a locality on the coast a little further to the south of Messina. By means of this itinerary, then, the monks and the pilgrims could head northwards and reach Messina from the western slope of Etna, or head southwards, to Catania or in the other southern cities of Sicily. As an alternative to the land route, to reach (or to set off from) Messina the sea route along the coast was used. In Catania, the opportunities for mooring were two: the previously mentioned *Saracen port* and the mooring at Ognina.

Ognina was located to the north-east of Catania and today is a populous neighbourhood of the town, on the sea. Ognina had had a famous ancient port, the so-called “*port of Ulysses*”, but that had no longer been used for centuries previously. However, at Ognina in the 13th century there was also a small port which offered another mooring to the city of Catania (Arcifa, 2001). Ognina was connected to Catania by a secondary road, that had existed from at least the first half of the 12th century, used for the short, local transfers. Catania’s tendency to be connected with Ognina is also testified to, precisely because of its possibility to have an alternative mooring to the small *Saracen port*, which did not have the chance to expand (Arcifa, 2001). Hence, it is likely that the small medieval port of Ognina was frequented more than the other docks situated to the north of Catania. Instead, there are no written records concerning the existence of moorings in the inlet of Guardia (or S. Giovanni Li Cudi), between Catania and Ognina (Fig. 5).

The land routes along the eastern coast of Sicily were therefore secondary and used almost exclusively for the local transfers (Arlotta, 2005). The context of the Mt. Etna area can thus explain why, in spite of the importance of this eruption, so few written traces were left about it. The inhabited landscape, the roads and the scale of importance of the inhabited centres were profoundly different from the current ones. Considering where the Etna roads were located in the 13th century, the Benedictine headquarters and the hostels for pilgrims, we can reasonably speculate that the observation point of whoever described this eruption in 1224 was indeed *from the sea*. So it is quite likely that the European monks were the ones who, passing from Catania and in transit towards Messina, made the news of this eruption in the transalpine area gain currency.

## 6. Discussion and conclusions

Once the authoritativeness of the sources of information, the date and the importance of the event have been established, it remains to be decided at what point of the coast the lava of the 1224 eruption reached the sea. On this point the sources, as we have seen, are not explicit, but the analysis of the territorial context makes it possible to venture some hypotheses on an historical basis.

Before formulating these hypotheses it is worth taking a look at what the standpoints of paleomagnetic, archeomagnetic and geological investigations are. It is interesting to remark that the historical data we present cannot be correlated directly and unequivocally with available volcanological data, also because of disagreements in the volcanological literature.

The first lava flow that reached the sea quoted in Speranza et al. (2006) is that of Cavolo (Etna 01), located in the vicinity of Ognina, which is dated differently depending on the method used: “122 BC?” (Table 1, p.4, stratigraphic method); in the time range “953–1229 AD” (Table 3, p.10; REN-DATE method) and “1066–1200 AD” (Table 4 p.12).

Tanguy et al. (2003, 2007) used archeomagnetic dating, primarily based on a reference curve from archaeological materials and independent of stratigraphic data. They take into consideration the so-called “1381” Ognina lava flow and date it “around 1160”.

It is worth recalling that the historical source attesting to the 1381 eruption, Simone da Lentini (14th century, ed. R. Gregorio, 1792) does not specify that the flow reached the sea, but mentions only the destruction of olive groves around Catania. The Ognina lavas had been

dated to 1381 by historiography starting from Amico (1740–1746), who attributed the destruction of the Ognina ancient port, so-called “*port of Ulysses*”, to that 1381 eruption: but that ancient port, as has been said above, had not been used for centuries previously. Subsequently Amico’s opinion was uncritically referenced by the volcanologists of the 19th and 20th century, up to Romano and Sturiale (1979).

Could the lavas from the 1224 eruption be those of Ognina? From the historical standpoint, on the basis of the local contemporary context, which we have outlined, and that has had a major influence on the description of the eruption and in the preservation of the news, it is reasonable to suppose that the 1224 lava reached the sea in the vicinity of Ognina. The chance that these lavas may have reached the sea in the area of Aci, further north, should not be discarded, but at the current state of our knowledge we think this is much harder to support with the historical data.

To conclude, this study has highlighted that for the medieval eruptions of Etna there is little concordance between the historical and the geological data. One may have the impression that the volcanologists, perhaps not knowing the exact nature of the historical dating tend to “extend” them to the ground data, beyond what the historical criticism can allow. For the specific case presented here, we can argue that:

- i) the Mt. Etna eruption of August 1224 is authoritatively attested by the historical sources and must be regarded as a solid piece of information;
- ii) we think the hypothesis that this eruption can be linked to the Ognina lavas is well supported on historical grounds;
- iii) the absolute dating – 1224 – being explicitly written in an authoritative contemporary text, can now be used to calibrate other dating methods.

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## Appendix A. The two medieval sources in original language

*Continuatio Funiacensis* [1224–1226], ed. G. Waitz, in *Continuationes et addimenta ad Gotifredi Pantheon*, “*Monumenta Germaniae Historica*”, SS, 22, Hannover 1872, pp. 342–45, p. 343.

*Annis a Christo duodenis centuplicatis, / Lux adderat Stephani, senis quater associatis, / Cum matura seges promittere tempora leta / Visa foret, fructu multo regione repleta, / Adveniens ventus vehemens vacavit aristam, / Fruges excuciens, pestem circumtulit istam / Plurima sic orbis penetrat vi regna pudenti, / Defectus anno res parturit ista sequenti, / Prevalet ergo fames, et publica crescit egestas, / Sternit amara necis pecus insuper omnes potestas, / Ardens ipsa suos dilatans Ethna meatus, / Longius excurrit, locus hinc est inde crematus, / Trans tria bachatur ignis picis impetus idem, / Milia tria nemus, mare, ligna cremantur ibidem, / Armati cunei cernuntur in igne patenter, / Per ter quinque dies sic vastat cuncta potenter.*

Restoro d’Arezzo, *La composizione del mondo*, ed. A. Morino, Parma 1997, p. 268.

*E trovamo fuoco ardere sotto terra, e uscire fiamba e fumo fore della terra; e la casione de questo si è, che l calore del sole entra per lo corpo*

de la terra, e anco quello de l'altre stelle; trova la mineria del solfo, la quale è esca del fuoco e è aconcia a ricévere lo fuoco; per lo calore del sole scaldase per longo tempo e acendesene lo fuoco; e quando questo fuoco trova la terra aperta e forata, vedemone uscire fore lo fumo, e per stagione la fiamba. E già fo veduto uscire fore uno fiume di fuoco del a bocca del monte de Mongibello [Etna] e questo fiume corse per spazio di cinque millia [ca. 7,5 km] e più, per fine entro lo mare; e segno de questo si è che'l letto de quello fiume, lo quale è ampio più d'uno millio, se trova arso la terra e le pietre.

## References

- Agnello, G.M., 1992. Terremoti ed eruzioni vulcaniche nella Sicilia medievale. *Quaderni Medievali* 34, 73–111.
- Alessi, G., 1829–1835. Storia critica delle eruzioni dell'Etna, discorsi I-VIII: Atti dell'Accademia Gioenia di Scienze Naturali di Catania, v. 3 (1829), p. 17–75; v. 4 (1830), p. 23–74, v. 5 (1831), p. 43–72, v. 6 (1832), p. 85–114, v. 7 (1833), p. 21–63, v. 8 (1834), p. 99–148, v. 9 (1835), p. 121–162, p. 163–206.
- Alexandre, P., 1987. *Le Climat en Europe au Moyen Age*. Paris.
- Alexandre, P., 1990. Les séismes en Europe occidentale de 394 à 1259. *Nouveau catalogue critique*. Brussels.
- Amico, V.M., 1740–1746. *Catana illustrata, sive sacra, et civilis urbis Catanæ historia a prima ejusdem origine in præsens usque deducta, ac per annales digesta*, 4 vols. Catania.
- Arcifa, L., 2001. La città medievale. In: Boschi, E., Guidoboni, E. (Eds.), *Catania terremoti e lave dal mondo antico alla fine del Novecento*. Bologna, pp. 36–54.
- Arlotta, G., 2005. Vie Francigene, *Hospitalia* e toponimi carolingi nella Sicilia medievale. In: Oldoni, M. (Ed.), *Tra Roma e Gerusalemme nel Medioevo. Paesaggi umani ed ambientali del pellegrinaggio meridionale*. Salerno, vol. 3, pp. 815–886.
- Branca, S., Del Carlo, P., 2004. Eruptions of Mt. Etna during the past 3200 years: a revised compilation integrating the historical and stratigraphic records. In: Bonaccorso, A., Calvari, S., Coltelli, M., Del Negro, C., Falsaperla, S. (Eds.), *Mt. Etna: Volcano Laboratory*. Geophysical Monograph Series, vol. 143, pp. 1–27.
- Borst, A., 1990. *Forme di vita nel Medioevo*. Naples.
- Ciuccarelli, C., 2001. L'eruzione del 1669 e le modificazioni urbane di Catania. In: Boschi, E., Guidoboni, E. (Eds.), *Catania terremoti e lave dal mondo antico alla fine del Novecento*. Bologna, pp. 94–104.
- Ciuccarelli, C., 2004. In margine all'attività dei vulcani italiani: storie di grandi disastri e pericolosi eventi minori: *Giornale di Storia Contemporanea*. In: Guidoboni, E. (Ed.), *Storia ed Eventi Naturali Estremi in Italia: Strategie e Risultati di Ricerche Interdisciplinari*, vol. 2, pp. 51–68.
- Chester, D.K., Duncan, A.M., Guest, J.E., Kilburn, C., 1985. *Mount Etna: Anatomy of a Volcano*. Cambridge.
- Chester, D.K., Duncan, A.M., Guest, J.E., Johnston, P.A., Smolenaars, J.J.L., 2000. *Geological Society, London, Special Publication* 171, 179–188.
- Continuatio Funiacensis, 1872. *Continuationes et addimenta ad Gotifredi Pantheon*, (13th century). In: Waitz, G. (Ed.), *Monumenta Germaniae Historica*, SS, vol. 22, pp. 342–345. Hannover, (reprint, Berlin, 1976).
- Diodorus Siculus, 1933–1957. (1st century BC) In: Vogel, F., Fisher, C.T. (Eds.), *Bibliotheca Historica*. London, Cambridge (Mass.). trans. C.H. Oldfather et al.
- Ferrara, F., 1793. *Storia generale dell'Etna*. Che comprende la Descrizione di questa Montagna: la Storia delle sue Eruzioni, e dei suoi Fenomeni: la Descrizione ragionata dei suoi Prodotti; e la Conoscenza di tutto ciò, che può servire alla Storia dei Vulcani. Catania.
- Ferrara, F., 1818. *Descrizione dell'Etna con la storia delle eruzioni e il catalogo dei prodotti*. Palermo.
- Gaudio, M., 1929. L'abbazia di S.Nicolò l'Arena di Catania. *Archivio Storico per la Sicilia Orientale*, II 5, 199–243.
- Guidoboni, E., 2001. Catania medievale e il terremoto del 1169. In: Boschi, E., Guidoboni, E. (Eds.), *Catania terremoti e lave dal mondo antico alla fine del Novecento*, 35, pp. 55–64. Bologna.
- Guidoboni, E., in press. Vesuvius: An Historical Approach To The 1631 Eruption - "Cold Data" From The Analysis Of Three Contemporary Treatises: *Journal of Volcanology and Geothermal Research*, monographic number on Exploris project, edited by A. Neri and P.Baxter, in August.
- Guidoboni, E. and Boschi, E., in preparation. Mt. Etna historical eruptions: a new historical catalogue from 13th BC up to the 17th century, with the collaboration of C. Ciuccarelli, A. Comastri and D. Mariotti: INGV.
- Guidoboni, E., Comastri, A., Boschi, E., 2005. The "exceptional" earthquake of 3 January 1117 in the Verona area (northern Italy): a critical time review and detection of two lost earthquakes (lower Germany and Tuscany). *Journal of Geophysical Research* 110 (B12309). doi:10.1029/2005JB003683.
- Maravigna, C., 1811. *Tavole sinottiche dell'Etna che comprendono la Topografia, la Storia delle eruzioni, la descrizione delle materie eruttate, e di alquanti fenomeni di questo vulcano dietro le recenti fisico-chimiche scoperte*. Catania.
- Martini, A., 1883. *Manuale di metrologia, ossia misure, pesi e monete in uso attualmente e anticamente presso tutti i popoli*. Turin.
- Mercalli, G., 1883. *Vulcani e fenomeni vulcanici in Italia*. Milan (reprint, Sala Bolognese, Italy, 1981).
- Mottana, A., 1999. Oggetti e concetti inerenti le scienze mineralogiche ne "La composizione del mondo con le sue casconi" di Restoro d'Arezzo (anno 1282): Atti della Accademia Nazionale dei Lincei. *Rendiconti Lincei. Scienze Fisiche e Naturali*, s. IX, vol. 10, pp. 133–229.
- Mulargia, F., Tinti, S., Boschi, E., 1985. A statistical analysis of flank eruptions on Etna volcano. *Journal of Volcanology and Geothermal Research* vol. 23, 263–272.
- Pispisa, E., 1993. Messina, Catania. In: Musca, G. (Ed.), *Itinerari e centri urbani nel Mezzogiorno normanno-svevo*, Atti delle decime giornate normanno sveve (Bari 1991): Bari, pp. 147–194.
- Peri, I., 1990. *Uomini, città e campagne in Sicilia dall'XI al XIII secolo*. Roma-Bari.
- Recupero, G., 1815. *Storia naturale e generale dell'Etna, arricchita di moltissime interessanti annotazioni del suo nipote tesoriere Agatino Recupero*. 2 vols.: Catania.
- Restoro d'Arezzo, 1859. (ms 1282) In: Narducci, E. (Ed.), *La composizione del mondo, testo italiano del 1282*. Rome.
- Restoro d'Arezzo, 1997. (ms 1282) In: Morino, A. (Ed.), *La composizione del mondo*, Parma, Fondazione Pietro Bembo, Ugo Guanda Editore.
- Romano, R., Sturiale, C., 1982. The historical eruptions of Mt. Etna (volcanological data). In: Romano, R. (Ed.), *Mount Etna Volcano. A Review of the Recent Earth Sciences Studies: Memorie della Società Geologica Italiana*, vol. 23, pp. 75–97.
- Romano, R., Sturiale, C., Lentini, F., et al., 1979. *Carta Geologica del Monte Etna, scala 1:50.000*. C.N.R., Istituto Internazionale di Vulcanologia, Catania, Progetto Finalizzato Geodinamica.
- Sartorius von Waltershausen, W., 1880. *Der Aetna*. 2 vols., Leipzig.
- Siebert, L., Simkin, T., 2002. *Volcanoes of the World: an Illustrated Catalog of Holocene Volcanoes and their Eruptions*; Smithsonian Institution, Global Volcanism Program Digital Information Series. GVP 3 (<http://www.volcano.si.edu/gvp/world>).
- Simone da Lentini, 1792. (14th century) In: Gregorio, R. (Ed.), *Chronicon nunquam antea editum, ab anonymo inde continuatum ad annum usque 1434, e manuscritto Codice Catanensi, in Bibliotheca Scriptorum qui res in Sicilia gestas sub Aragonum imperio retulere, eam uti accessionem ad historicam Bibliothecam Carusii*. Palermo, vol. 2, pp. 303–323.
- Speranza, F., Branca, S., Coltelli, M., D'Ajello Caracciolo, F., Vigliotti, L., 2006. How accurate is "paleomagnetic dating"? New evidence from historical lavas from Mount Etna. *Journal of Geophysical Research* vol. 111 (B12533). doi:10.1029/2006JB004496.
- Tanguy, J.-C., 1981. Les éruptions historiques de l'Etna: chronologie et localisation. *Bulletin Volcanologique* vol. 44, 585–640.
- Tanguy, J.-C., Le Goff, M., Principe, C., Arrighi, S., Chillemi, V., Paiotti, A., La Delfa, S., Patanè, G., 2003. Archeomagnetic dating of Mediterranean volcanics of the last 2,100 years: validity and limits. *Earth and Planet Science Letters* vol. 211, 111–124.
- Tanguy, J.-C., Condomines, M., Le Goff, M., Chillemi, V., La Delfa, S., Patanè, G., 2007. Mount Etna eruptions of the last 2,750 years: revised chronology and location through archeomagnetic and 226Ra-230Th dating. *Bulletin of Volcanology*. doi:10.1007/s00445-007-0121-x.