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# WAITING FOR THE END OF THE WORLD?

New Perspectives on Natural  
Disasters in Medieval Europe

Edited by  
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*and Peter J. Brown*

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## CONTRIBUTORS

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**Lee John Whittington** is a researcher who completed his PhD and postdoctoral fellowship in philosophy at the University of Edinburgh, UK. His research is on the philosophy of luck, risk and chance. He argues for different methods of thinking about and measuring risk and luck that focus on possibility rather than probability, and is co-editor of the first curated volume on the philosophy of luck.

## PREFACE

Back in 2011 I (Chris Gerrard) shared an office at Durham University with David Petley, a physical geographer who at that time held the Wilson Chair in Hazard and Risk and was director of the International Landslide Centre. We were both serving for a spell in more administrative university roles in the Faculty of Social Sciences and Health. Every morning, whatever time I arrived at work, Dave was already there writing his blog on landslides which he continues to maintain to this day (<https://blogs.agu.org/landslideblog/>).

To my shame, I knew very little about landslide mechanics but as we began to talk about our research, we learned more about our respective academic disciplines and saw ways in which our worlds had unknowingly collided. Dave gave me a copy of his co-edited textbook *Environmental hazards: Assessing risk and reducing disaster* as a guide. Then we began to wonder if there was scope for a review article on the ‘archaeology of disasters’, something which might draw our ideas together and provide a platform for something more. I went away and wrote (lots) about the Middle Ages and Dave gently encouraged me to think about themes such as hazard, risk and resilience with which I was less familiar. How did hazards become disasters, how did societies perceive these events and how did they react and evolve to reduce their vulnerability? The result of this ‘research conversation’ was a jointly written article in 2013 for the journal *Natural Hazards* (volume 69.1) entitled ‘A risk society? Environmental hazards, risk and resilience in the later Middle Ages in Europe’. As we discovered, not only did medieval communities respond continually to environmental hazards, their effects were also felt sometimes across the whole of Europe in a way that has not been observed in modern times.

That article sparked a lot of interest and ideas for more projects. Peter Brown, then a Durham MA student, now one of the editors of this volume, began to talk to me about a possible PhD (now successfully completed) specifically to look in detail at severe weather and flooding in north-west Europe in the later medieval period. His research was supported by the Arts and Humanities Research Council through the Northern Bridge Doctoral Training Partnership (Award Number 1617774). By chance I then met Paolo Forlin, the third editor of this volume, at a conference for postgraduate and doctoral researchers in Flaran in southern France and we began to discuss a possible Marie Curie Intra-European Fellowship to bring him to Durham to study medieval earthquakes. When that application was successful, Dave again brought his expertise to the project and helped to co-supervise (ARMEDEA project: Archaeology of



## PREFACE

medieval earthquakes in Europe; reference no. 626659). We are now working together once again on a three-year project funded by the Leverhulme Trust (RPG-2017-103) which brings together a wealth of European data drawn from scientific, historical, linguistic and geographic resources to assess medieval and post-medieval responses to earthquakes. While there are some excellent case studies of seismic events and how societies reacted in the past, these have not always been analysed with an archaeological eye, as we shall see.

In 2015 we approached the Society for Medieval Archaeology to ask whether they might consider making ‘natural disasters’ the theme for their annual conference. Fortunately for us, the Council of the Society were enthusiastic. We felt that this would be a good opportunity to bring together a relatively small community of European researchers for two days to discuss the impacts of a range of so-called ‘rapid-onset disasters’ such as severe weather, storm surges and flooding, drought, seismicity and its secondary effects such as tsunamis and volcanic eruptions in the Middle Ages. That conference, entitled ‘Waiting for the End of the World: Perceptions of Disaster and Risk in Medieval Europe’, took place on 2–4 December 2016 at Rewley House in Oxford, UK, and was attended by about 70 delegates. Although the content was productive and motivating, we were not altogether successful in encouraging the mix of geographers, seismologists, climatologists, archaeologists and historians we had hoped would participate, so afterwards we agreed to test the water for an edited volume, but not simply a printed set of conference papers, one that aimed for wider coverage and provided a resource for further research. To that aim we sought to supplement the original line-up of speakers to fill gaps and broaden our coverage and the three editors then compiled the catalogue of medieval disasters which has been included here.

It was a great pleasure to work with David Griffiths and Alison MacDonald and their colleagues on the organization of the Oxford conference and the editors would especially like to thank the Society for Medieval Archaeology, the anonymous referee for their time and Taylor and Francis for their efficiency, especially Matt Gibbons. Alejandra Gutiérrez provided figures for Chapter 6 and translated Chapter 8. Above all, we would like to thank all our contributors for working with us on this volume.

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# RESEARCHING NATURAL DISASTERS IN THE LATER MIDDLE AGES

*Peter J. Brown, Paolo Forlin and Christopher M. Gerrard*

In a world of global social media, we are all too familiar with modern images of destruction caused by natural disasters and vulnerable human populations struggling to cope with the aftermath (eg Figures 1.1 and 1.2). The Haiti earthquake in 2010, the Tohoku earthquake and tsunami in 2011, the Yunnan earthquake in 2014, the 2014–16 Ebola outbreak, the Kathmandu earthquake of 2015, the 2017 Sierra Leone mudslide, the Sulawesi earthquake and tsunami in 2018; few will have escaped news of these events over the past decade wherever they might live. The raw energy unleashed by natural hazards can sweep away settlements, destroy housing and infrastructure, cause large numbers of fatalities, transform entire landscapes and lay waste to agricultural produce and livestock. National governments and international aid organisations respond to rescue survivors, establish temporary housing for those displaced and bring in emergency aid, equipment and expertise. As a consequence, terms such as ‘risk management’, ‘vulnerability’ and ‘resilience’ have well and truly entered the public lexicon, and awareness of environmental hazards has perhaps never been higher.

We think of these as wholly modern responses, but they are not. No human being, no society, has ever inhabited a totally risk-free environment. Nor are our modern reactions to disasters as coldly informed by technological or scientific practicalities as we might like to believe; religious beliefs continue to shape perceptions of the natural world in many societies around the globe—just as they did in the past (eg Hanska 2002). The extraordinary accusation in 2014 by an English local government councillor that the storms and floods of the preceding winter were ‘divine retribution for the government’s decision to legalise gay marriage’ (*The Guardian* 18 January 2014) may not reflect the views of the rest of the nation, but it reveals just how shallowly some notions can lie buried. Natural hazards link us to history and archaeology in unexpected ways; the ‘memory’ of the risks they carry may condition the responses of the community for decades or longer. For researchers, an understanding of the frequency and magnitude of past earthquakes will be crucial to any assessment of average return periods and occurrence probabilities, particularly for seismic events (Wisner *et al* 2011). However we look at it, the study of natural disasters links us intimately with our history.

This book is specifically about natural disasters in the later Middle Ages in Europe. It provides an overview of the many environmental hazards which threatened people in the

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*Figure 1.1* The devastating impact of the 2004 Indian Ocean tsunami at Meulaboh (Indonesia) (US Navy, public domain)



*Figure 1.2* Cows killed by rinderpest in South Africa, 1869 (Wikimedia, public domain)

past, such as earthquakes, severe weather, floods and disease, and shows how medieval societies responded to these threats. This topic was selected as the theme of the Society for Medieval Archaeology's annual conference in December 2016, held in Oxford, UK. While the focus of the volume is archaeological, the topic will be approached holistically; the study of disasters is (and should always be) an interdisciplinary endeavour. A number of contributions, therefore, seamlessly meld documentary and material evidence (see Standley, Chapter 13) while others approach the topic from either an historical perspective (see Curtis, Chapter 15) or through the lens of another discipline such as philosophy (see Ware and Whittington, Chapter 8). To highlight the range and impact of individual events, the editors have compiled a catalogue of 20 significant natural disasters which affected medieval Europe. Although this part of the world has been one of the less dangerous places to inhabit, it was this period which arguably hosted the greatest volcanic event of the past 2,000 years in 1257–58, some of the most destructive earthquakes and tsunamis, the most serious famine in recorded history between 1315 and 1321 and the worst crisis in public health during the Black Death of 1346–53.

Thanks to a generation of research by earth scientists, geographers, historians, sociologists, anthropologists and climatologists, a growing number of specialists are becoming committed to mobilising evidence from archaeological excavation, standing buildings, place-names, and socio-economic history in order to recuperate the voices of those who experienced these catastrophic events. These scholars are motivated in different ways. For some, this is a topic which has resonance and relevance for today's world because there may be direct applications to modern disaster-management strategies which could help to anticipate future disasters and perhaps even to prevent them. This is particularly so in the case of tectonic hazards where large sets of 'big data' are available at a continental scale through catalogues such as AHEAD (Archive of Earthquake Data) and SHEEC (European Earthquake Catalogue 1000–1899). For other contributors, reconstructing what transpired when historical populations were hit by natural disasters is not only a fascinating exercise—opening a window on a community at one of its most vulnerable moments, sometimes a window of only a few minutes—it also holds the potential to understand how people coped and recovered, or why they did not. The study of natural disasters is ultimately about people. As one author has put it, 'we cannot be just students of disaster. We must first be students of society and culture' (Oliver-Smith 1986, 25).

## BACKGROUND

Highly destructive events have long been the catalyst for research into the occurrence and impact of specific types of hazard—the 1703 storm in the British Isles (Defoe 1704) and the 1755 Lisbon earthquake (Araújo 2006) being early and well known examples. The study of disasters is certainly not new. At first, interest was generally limited to a specific type of hazard, often in the form of catalogues, rather than natural disasters as a discrete category. Research into the social impacts of natural disasters then accelerated during the post-war years, stimulated by American social scientists who saw these events as proxies through which they might model the social responses provoked by military emergencies, such as a foreign nuclear strike (Quarantelli 1987). Seen in this context, the causes of disaster were sought externally and human communities portrayed as victims forced to react to threats.

Since the 1980s, natural disasters have been recast as events which are best understood as the result of, on the one hand, naturally occurring processes (such as precipitation, seismic activity or cyclonic conditions) and, on the other, cultural decisions (such as the location of human settlement, clustering of high population densities and/or economic interests in areas vulnerable to hazards, etc). These interactions between human society and the natural environment can be conceptualised through a word equation (Figure 1.3) which posits that, in any given situation, risk (meaning the probability of a hazard occurring) is the product of the natural hazard (or threat to humans and their welfare) and the vulnerability of the local population (something which may be affected by a multitude of considerations, including proximity to the source of the hazard, the cultural understanding of the danger posed by the hazard, and the levels of inequality and access to resources within the society). This rephrasing of the conceptual framework applied to natural disasters has been accompanied by a steady growth in interest, both popular and scholarly, in the subject. Research priorities have been galvanised by initiatives such as the United Nations Decade for Disaster Risk Reduction (between 1990 and 1999) as well as the growing realisation that an interdisciplinary approach to disasters is fundamental to addressing the risk that natural hazards will pose in the future as a result of accelerating development and population expansion (Ismail-Zadeh *et al* 2017). Two points might be underlined

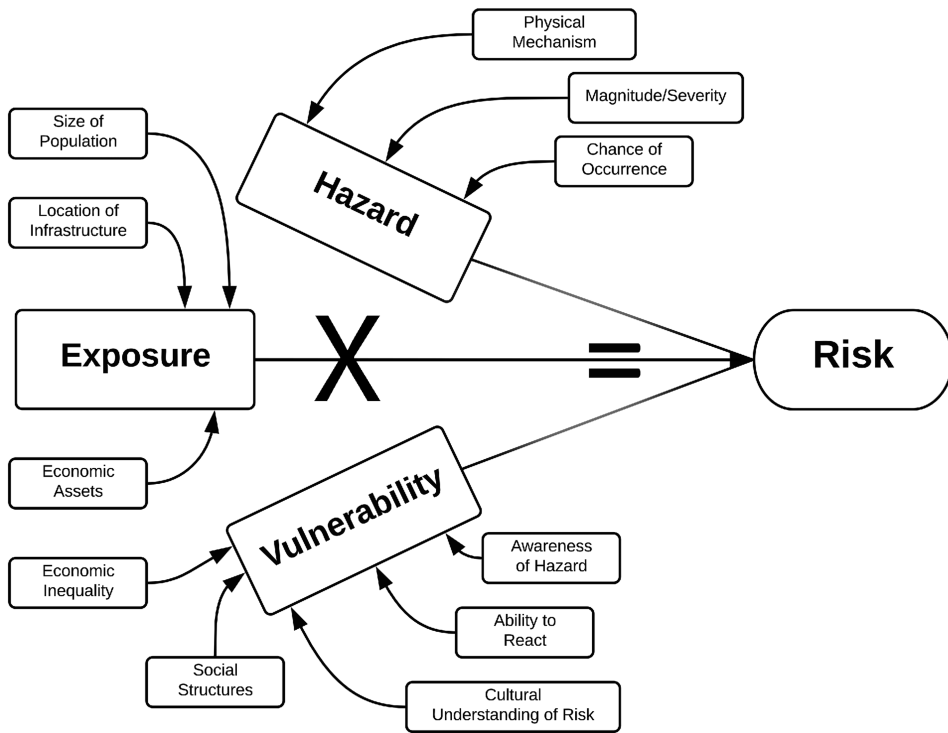


Figure 1.3 A word equation which conceptualises the risk of any given natural disaster as a product of both the hazard (or hazards) and the vulnerability of the local population (© Peter J. Brown)

here. Firstly, as a number of scholars have repeatedly pointed out (Oliver-Smith 1999; Juneja and Mauelshagen 2007; Krüger *et al* 2015), natural events are no longer seen as the sole causes of but rather as precipitants or triggers for crisis and, as a result, it may be questioned whether disasters are really ‘natural’ at all, given that disasters emerge as an expression of social vulnerabilities. Secondly, greater stress (although arguably still not enough) is now placed on analysis of the political, social and economic context of a disaster, what is sometimes referred to as ‘cultural framing’ or (less comfortably) ‘cultural profile’, before interpreting the reactions of the community and the role of local agency in the unfolding of events (Janku *et al* 2012). In simplistic terms, it is this shift in conceptual approach which opens the door for archaeologists and social historians to make a more significant contribution (eg Bankoff 2003).

Social scientists have proposed a number of theoretical models which offer useful frameworks through which to approach the impact of disasters on human populations. In this book, we make use of three of these. The first is the ‘disaster cycle’ (Figure 1.4),

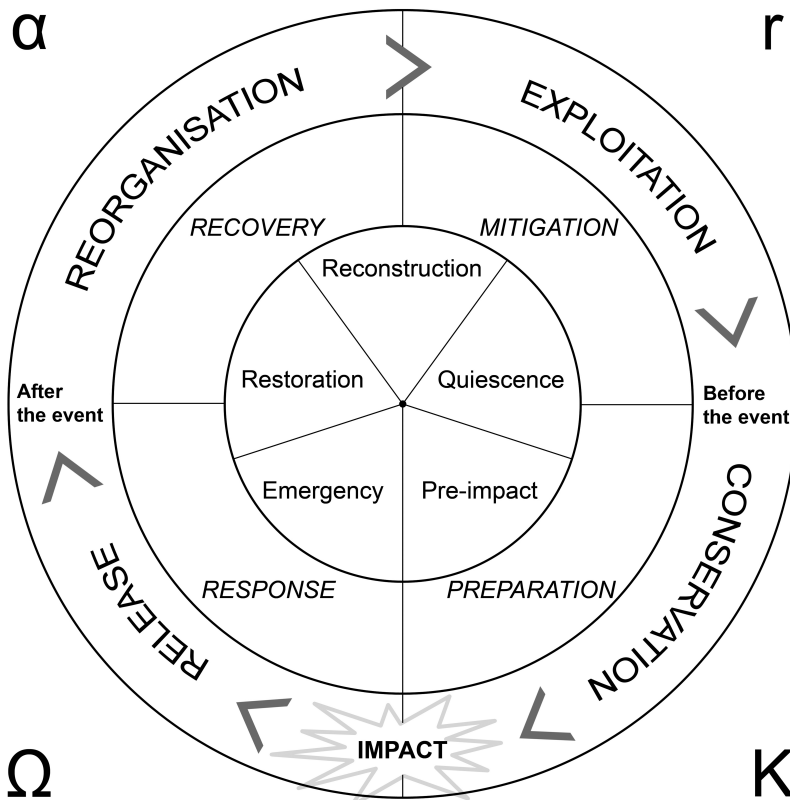


Figure 1.4 Theoretical frameworks of disaster combining the disaster cycle (central and inner rings), which breaks down the responses of human populations to disasters into a number of successive stages, and the concept of adaptive cycles (outer ring), which models how complex systems respond and reorganize themselves in the aftermath of disturbances. Created by Peter J. Brown drawing together concepts from Alexander (2002, 6) and Holling and Gunderson (2002, 34)

which can be applied to any natural disaster and encapsulates the responses of an affected human population through different stages as a continuously repeating cycle, operating at multiple levels (Alexander 2002, 6). Another is the concept of adaptive cycles (Figure 1.4; Holling and Gunderson 2002, 34), which provides a framework to model how complex systems, such as human societies, reorganise themselves in the aftermath of, often recurring, disturbances—such as natural hazards. This is achieved by breaking down the impact of a disturbance into four key stages:  $\Omega$  phase—release (the occurrence of a disturbance),  $\alpha$  phase—reorganisation (the system reacts to the new situation),  $r$  phase—exploitation (advantage is taken of new possibilities created by the disturbance) and  $k$  phase—conservation (the establishment of a new equilibrium). The flexibility of this model, which can be applied to many different settings and scenarios, is both a strength and a weakness. Finally, therefore, we refer to the ‘risk management flowchart’ (Figure 1.5) developed by Smith and Petley (2009, 65), which, while largely compatible with the concept of adaptive cycles, is more closely tailored to the reality of situations generated as a result of the interplay of natural hazards and human societies. Importantly, this model shows how societies can improve their coping strategies over time as a result of repeated exposure to disasters, something we consider to be important with respect to our medieval case studies.

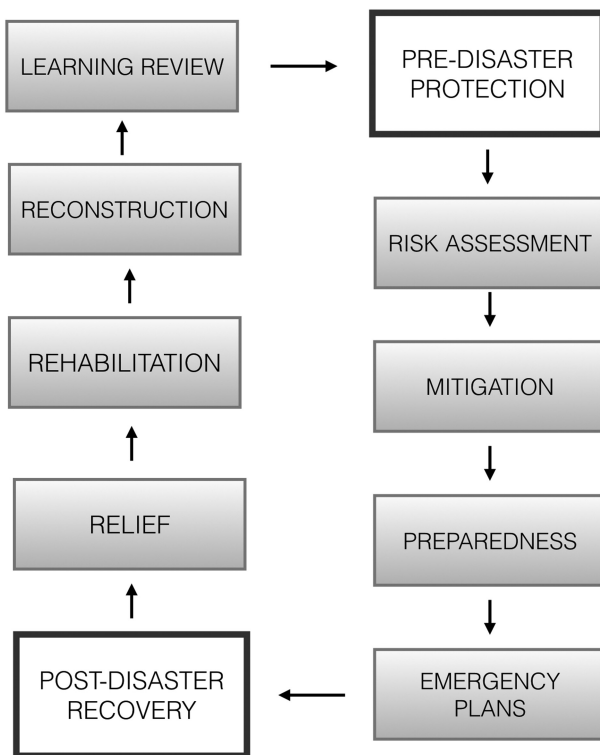


Figure 1.5 The ‘Risk management flowchart’ (redrawn by Paolo Forlin after Smith and Petley 2009, 65)



This flowchart has two main steps—post-disaster recovery and pre-disaster protection—with four phases in each. The post-disaster recovery steps comprise relief (eg the rescue of survivors and items of value), rehabilitation (eg temporary shelter, clearing of debris), reconstruction (commonly including the restoration of defences in the Middle Ages) and learning review (writing accounts, public memorials), while pre-disaster protection includes risk assessment, mitigation (such as the implementation of new urban layouts and anti-seismic architectural adaptations thought to enhance resilience), preparedness and the formulation of emergency plans. While this detailed deconstruction may seem overcomplicated at first, the flowchart does provide a useful set of terminologies and an operational sequence for activities which take place either side of a natural disaster (Forlin and Gerrard 2017). Needless to say, few well understood medieval case studies follow this model slavishly, but this is hardly surprising. The model was first developed for application to modern hazards and risks, and the diverse nature of medieval societies across Europe are unlikely to conform precisely to the way in which we understand these events in the present. If nothing else, however, the flowchart serves to highlight gaps in our understanding.

### MEDIEVAL DISASTERS AND ARCHAEOLOGY

Given that this is a topic with global ‘reach’, with implications for cultural adaptation, risk, resilience, managing change and much else besides, why has the study of natural disasters not been more of a mainstream topic for medieval archaeologists until now? Prehistorians have long been involved in debates surrounding particular events such as the Thera eruption (Knappett *et al* 2011), evaluating risk associated with food supply (eg Halstead and O’Shea 1989) and assessing the possible archaeological signatures of risk. Among these, for example, are the burials of children’s skulls found around the bounds of Bronze Age settlements in the Circum-Alpine region (located in modern-day southern Germany, Austria and Switzerland), which have been interpreted as ritualised deposits to protect against flooding from rising lake-water levels (Menotti *et al* 2014). Archaeologists are well placed to assess human responses to natural disasters like this as well as to resolve the dating, scale and frequency of events, at least on a long timeline. Roman and early medieval floods, droughts, famines and plagues have attracted interest too, particularly ‘landmark’ events such as the eruption of Vesuvius in AD 79 and its impacts at Herculaneum and Pompeii (eg Grattan and Torrence 2008).

For the Middle Ages, however, much of the existing scholarship, at least from a social science perspective, has tended to focus primarily on documentary evidence (see Guidoboni and Ebel 2009 for an important introduction). The main reason for this is the chronological resolution provided by documentary evidence which can be capable of precision to days, even hours, immediately before, during and after the occurrence of a rapid-onset hazard. In the absence of well dated artefacts, such as coins, it is rare that individual archaeological contexts can be resolved to a higher chronological resolution than around 50 years. The refinement of scientific dating methods, such as dendrochronology and thermoluminescence dating, has and will continue to improve matters in this regard, but currently—even in ideal conditions where large timbers with sufficient growth rings survive—chronological resolution often remains too coarse to firmly relate material remains to events documented in written sources. Mike Baillie, in

a discussion of issues around dating accuracy, identified the dangers of what he called ‘suck-in’ and ‘smear’, the former referring to imprecisely dated events with wide error margins which are then incorrectly associated with precisely dated events (Baillie 1991).

There might be another reason too for the lack of archaeological contribution to the study of natural disasters. The uncritical linkage of purported environmental change with developments in the archaeological record has been met with firm rebuttals in the past. One well known controversy is an interpretation advanced in the 1970s which linked the onset of wetter weather conditions with the appearance of drainage ditches on medieval archaeological sites and the decline and eventual abandonment of some villages in medieval England (Beresford 1975, 51–52; Beresford and Hurst 1971, 21; Wright 1976). The deep stigma attached to environmental determinism within the historical and archaeological disciplines has, to some degree, discouraged research into the impact of environmental hazards, and it is only relatively recently that this reticence has begun to be addressed (eg Campbell 2010, 282–284; Hoffman 2014, 342–351). Most historians, from whom medieval archaeologists have to some extent developed their research agendas in the past, do not regard natural disasters as ‘historical prime movers to be analysed and understood in their own right’ (Campbell 2010, 283). Rather they are seen as manifestations of a ‘calamity-sensitive condition’ caused by socio-economic conditions such as population growth.

Although there are some notable exceptions (see Gerrard and Petley 2013 for examples, especially Fäh *et al* 2009), material evidence has most frequently been invoked by physical scientists when it informs modern estimations of risk in vulnerable regions. The focus here is strongly on the identification and reconstruction of events rather than the social context in which the hazards have occurred or their significance for historic communities (McGlade 1995). Perception, experience and the symbolic are rarely considered because researchers are tightly focused on reconstructing the physical parameters of the event. Although this work is important and extremely useful, it is intended for an entirely different disciplinary readership. Archaeoseismology or ‘earthquake archaeology’ (Figure 1.6), for example, aims to reconstruct the intensity, chronology, magnitude and other physical attributes of past seismic events and measure their impact on archaeological sites (eg Galadini *et al* 2006; Rodríguez-Pascua *et al* 2011). We believe that a more ambitious, integrated, form of interpretation can be provided which is more in keeping with current archaeological thinking and best archaeological practice (see Forlin, Chapter 2).

## DISASTERS IN THE MIDDLE AGES

Of the 19 authors who contribute chapters here, 10 spoke at the Oxford conference in December 2016, while the others were commissioned to provide greater geographical breadth. Some of the chapters centre on evidence from the British Isles (see Dyer, Chapter 12), but Europe is our focus. Although seismic events and pandemics know no political boundaries, chapters on the Low Countries (see Curtis, Chapter 15), Lanzarote (Spain) (see de León Hernández, Chapter 7), Italy (see Figliuolo, Chapter 3), Cyprus (see O’Neill, Chapter 4) and Germany and Austria (see Rohr, Chapter 11), all pursue regional narratives in different European contexts. Risk does have an intriguing spatial quality which can vary between regions (Müller-Mahn 2013). Likewise, our essays



Figure 1.6 Excavation in 2018 at El Castillejo, Granada (Spain), an Islamic village destroyed by earthquake in the 13th century (© Paolo Forlin)

range widely in chronology, largely focusing on the later medieval period (1000–1600 here), but also embracing earlier material.

The three sections of this volume each cover a different set of environmental hazards. The categories are those set out in the classic textbook *Environmental hazards: Assessing risk and reducing disaster* by Keith Smith and David Petley (first published in 1991). All are what might be described as ‘extreme, rapid-onset events that directly threaten human life and property ... on a scale sufficient to cause a “disaster”’ (Smith and Petley 2009, 9), but we should recognise that hazards are often interrelated in some way; for example, when a landslide blocks a river course, it may cause flooding. In addition, many hazards will relate to mechanisms operating at a much larger scale such as global environmental change or tectonic forces. Strict categories are probably unhelpful. Man-made, self-inflicted risks such as arson and warfare, however, have been excluded, although we do recognise that there is a degree of human involvement in all environmental hazards which might be brought about by poverty, ill-health and the inappropriate use of resources, among other contributing factors.

Part I, on geotectonic hazards, comprises four chapters about earthquakes (Chapters 2–5). Their impacts can be widespread and involve considerable loss of life. The 1456 earthquake in central Italy, for example, is estimated to have cost 70,000 lives (Guidoboni and Ferrari 2000). This is an extensive area of research; catalogues of major European earthquakes are constantly being refined by earth scientists, not least for those regions with a long history of seismicity such as Italy, Greece and the Balkans. The contribution of historical evidence is paramount here too, and all catalogues have

to contend with multiple reporting and embellishment, as well as pronounced regional and chronological bias (eg Piccardi and Masse 2007).

In some well documented cases, such as the 1504–05 earthquake in Bologna, it has proved possible to ‘map’ the distribution of damage building by building, revealing, in effect, a ‘seismic history’ of the event (Guidoboni and Ferrari 2000), including in that case a detailed seismic assessment of the 12th-century Asinelli tower, a brick-and-masonry structure standing 97.2 m high, which lost its spire and is now inclined by 1.7 degrees (Riva *et al* 1998). There are several compelling case studies available of rebuilding or replacement, and the results of two further investigations are described in this volume from Cypriot and Italian contexts (O’Neill, Chapter 4; and Ganz and Arrighetti, Chapter 5).

Much of the damage caused by earthquakes is due to ground shaking and strong vertical and horizontal accelerations which cause displacements in the ground surface and lead to the collapse of buildings. Secondary earthquake hazards include soil liquefaction, in which water-saturated sediments are shaken into a fluid state and lose their strength, causing buildings to tilt and fall. An earthquake centred on Carmona, Seville, in southern Spain in 1504 caused few fatalities but is notable for contemporary testimony of ground cracks, liquefaction, flooding and turbidity in wells as well as landslides and rock falls which are still visible today (Silva *et al* 2013). ‘Mass movements’ such as landslides and avalanches are also included under the heading of secondary ‘co-seismic’ hazards. Examples of these are discussed in our Catalogue (Chapter 19), among them the catastrophic 1522 landslide which took place at Vila Franca do Campo on the mid-Atlantic island of São Miguel in the Azores, Portugal. A separate chapter is reserved for medieval seismic sea-waves or tsunamis, which tend to be closely (but not exclusively) associated with seismicity (see Gerrard, Chapter 6). Tsunamis affected all the Mediterranean coastlines during the Middle Ages, and there have been many case studies of tsunami-generated sediments which may now provide a point of departure for further archaeological investigations. By contrast, the medieval landscapes and settlements of the Canary Islands, Spain, which lie beneath later outfalls of tephra and lava flows from active volcanoes, have already been subjected to archaeological fieldwork (see de León Hernández, Chapter 7, for Lanzarote). This complements recent work elsewhere in the world, for example studies of the AD 1600 eruptions of the Huaynaputina volcano in Peru, the largest eruption in South America in historic times, which blanketed large areas in ash and pumice. As on Lanzarote, lost settlements buried beneath several metres of flow deposits remain traceable on the ground today (de Silva *et al* 2000).

Some of the most compelling chapters in this volume evaluate the reactions of populations to earthquakes (see Figliuolo, Chapter 3) and provide insights into how communities coped emotionally and technically with risk (Figure 1.5). Medieval people, it seems, had a surprisingly broad conception of risk, embracing not only uncertainty and fear of harm but also containment and control. Few attempts have been made to elaborate on our understanding of fear, risk and emotion in the face of catastrophe from a philosophical perspective, explaining how short-sighted and irrational strategies might be accounted for (see Ware and Whittington, Chapter 8). We should not, however, ignore the psychological trauma associated with disasters; both ‘self-preserving behaviour’ and ‘dissociative behaviour’ have been identified among survivors of plague, for example. When the able-bodied remove themselves from the scene, families can disintegrate and there is less tolerance of dependency (Ariely 2009).

This is not always the case, however. Factors such as cultural insularity and mutual support networks can contribute towards an enhanced sense of group identity which may have encouraged different notions of hazard and risk (Walsh 2005).

‘Rapid-onset’ weather conditions such as floods, storms at sea and lightning are among the better recorded natural disasters of the period. They are the subject of Part II of this volume (Chapters 9–13). Many case studies are available, from regional accounts of sea-storms to floods along major rivers to gales (eg Brázdil *et al* 1999). Generally speaking, local but disastrous impacts are often caused by torrential downpours (a feature typical of Mediterranean weather), whereas larger areas may be affected by melting snow or continuous rainfall. Where the scale and geographical coverage of these events was significant, impacts could be dramatic (see Brown, Chapter 10). All of Europe’s largest buildings, particularly its great churches and cathedrals, were vulnerable to lightning, and many of those which survive in the present bear tell-tale signs of the damage and reconstruction caused by these conflagrations (Figure 1.7).



Figure 1.7 Fire in Delft, the Netherlands, in 1536. In the foreground St Lazarus’s House with praying monks and plague victims (Wellcome Images, CC BY 4.0)

At Chartres, France, most of the Carolingian cathedral was destroyed by fire in 1020, but there was further damage from fires in 1134 and, most seriously, in 1194; successive wooden steeples had burnt down before 1507 (Miller 1996). Other impacts were more enduring. Medieval Old Winchelsea (UK), a prosperous port with extensive fisheries, royal dockyards and overseas trade, suffered two great storms in 1250 and 1252 which permanently breached the shingle barrier on which the port had been built so that by the late 1280s, preparations had begun to transfer the town to its present hilltop location (Martin and Martin 2004).

Subtle warnings of the perils of nature, particularly hydrological hazards, have been found embedded in field- and place-names (see Jones and Kilby, Chapter 9). Elsewhere, stratigraphical layers associated with particular flood events are sometimes identified by archaeologists (Baker 2008). Alluvial sediments with a typically layered structure and homogenous texture from the centre of Florence (Italy), close to the River Arno and dating to the 12th century, have been linked to documentary evidence for a catastrophic flood on 4 November 1177 (Fedi *et al* 2007). Similarly, deposits between 1 and 10 cm thick were probably left between 1421 and 1424 by medieval flooding in the western Rhine delta (the Netherlands), south of Dordrecht, when the North Sea broke through a dyke and inundated 300 km<sup>2</sup> of embanked land (Kleinhans *et al* 2010). Medieval communities were well aware of such dangers and examining economic and social adaptations to the risks posed by flooding reveals pragmatic approaches to flood management in some parts of Europe (see Rohr, Chapter 11).

What was the impact of a natural disaster on medieval populations? If crops failed, there was pressure on food supply, offset to some extent by storage and exchange through markets when impacts were localised and not prolonged. Prices of livestock and grain could rise. A failure in harvests for two years or more, such as that caused by the longer runs of bad weather and wetness between 1313 and 1321, was far more serious. Not only did it delay harvests, reduce yields and available seed corn and encourage unwelcome disease, such as liver fluke in sheep, it also inflated prices further and caused famine. In Ypres in Flanders, for example, 2,794 people, a tenth of the population, died between May and October 1316 (Kershaw 1973). It is instructive to compare different kinds of disaster and assess changes over the long term as well as in the immediate aftermath (see Dyer, Chapter 12; Forlin *et al*, Chapter 18). While extreme-weather events such as river floods and droughts did have a localised effect on medieval communities, for the most part response mechanisms such as storage were robust enough to reduce their impacts. But when stress on resources became severe, crossing thresholds, and where several events followed each other and redistribution efforts were insufficient, this might trigger ‘political solutions’, such as the importation of grain from abroad.

The interpretation of disaster in the Middle Ages might be literal and moral, but it could also be allegorical and mystical. Objects were imbued with the power to protect and overcome the fear of disaster (see Standley, Chapter 13). There are many examples. In medieval England, coin-folding is evidenced widely in the archaeological record, representing around 1% of medieval coin finds reported to the Portable Antiquities Scheme in England (Kelleher 2011, 1499). This practice features in contemporary saint’s hagiographies in which the act of folding a coin was accompanied by a prayer through which a supplicant would call upon a saint for intercession in a time of dire

need, such as the occurrence of a natural disaster (Finucane 1995, 94). In the Christian world of pre-industrial Europe, perceptions of nature were forged largely through readings of the Bible and devotional texts. Passages from the books of Genesis and Revelation were especially formative to any interpretation of environmental hazard and understood through wall paintings, sculpture, stained glass, plays and biblical pageants, among other representations (Spinks and Zika 2016).

Part III (Chapters 14–18) discusses biophysical hazards such as human pandemics and animal disease. The Black Death epidemic in the middle of the 14th century is estimated to have killed 50 million people in Europe with subsequent outbreaks (eg in England in 1361, 1369, 1375). Detailed regional studies indicate the loss of population at between 30% and 50%, events that continue to generate a vast and ongoing literature (eg Benedictow 2004). The immediate impact of so many deaths was the issue of how to dispose of the dead, and for this there is archaeological evidence in the form of plague cemeteries (see Kacki, Chapter 14) as well as new historical evidence for local responses. While disasters were widely interpreted as ‘acts of God’, a divine supernatural punishment for the sins of mankind for which medieval communities periodically sought their scapegoats, usually among lepers, Jews and other minority groups, not all social responses were so extreme; some people preferred to preserve their social customs in defiance of local authority (see Curtis, Chapter 15).

Evidence of the direct impact of the Black Death or later plague outbreaks on settlement, however, has always been rather less visible (Plate 1). Although some villages in England were abandoned forever after 1350, such as Tilgarsley in Oxfordshire, and their sites may be visible today as earthworks, tax collectors listed relatively few abandoned places where no contribution at all could be collected as a result of plague (Baggs *et al* 1990), and some of these, such as Quob in Hampshire, UK, were deserted for only 3 years (Beaumont James 1999). This is a pattern seen for other disasters. Unless the landscape was dramatically and irretrievably altered, as might be the case after a volcanic eruption or a major landslide, subsistence agriculture could usually resume even when people were made homeless and industries reduced to rubble. A large-scale project in the UK has recently been gathering new archaeological evidence which identifies signs of contraction and abandonment of dwellings and plots in villages and hamlets in much greater detail (see Lewis, Chapter 16). Plague in livestock too could be equally calamitous when epidemics were serious (see Gidney, Chapter 17). Not only were animals lost and the reproductive capacity of beef and dairy herds reduced, but also the plough teams needed to cultivate the fields were decimated, and the loss of sheep had a critical impact on the continued fertility of arable fields.

## CONCLUSIONS

Accepting that all environmental hazards are influenced by a range of social, environmental, cultural, political, economic, physical and technological constraints, the archaeology and history of disaster is unquestionably a valid and stimulating line of inquiry for medievalists. The chapters in this volume amply demonstrate that point and underline the importance of breaking down barriers between social science, science and the humanities. Many different aspects of disaster events come under scrutiny here, including the nature of disaster events themselves and their causes, memories of

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previous comparable events as well as coping responses, cultural context and social organisation. Contributors draw principally on archaeology, history, architecture and geoarchaeology/geology for their evidence and ask: What form does the archaeological evidence for disaster events take, and how can it best be evaluated? How and why did different communities across Europe develop their perceptions and responses to disaster over time? Do different disasters provoke specific kinds of reaction and adaptation or are there recurrent choices? What were the factors that influenced the perception and assessment of risk? To what extent did peer behaviour, belief and religion play their part? With these questions in mind, we ask how archaeology can make its voice heard and what new narratives can be developed from buildings, sites and their material culture.



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