Weathering a Medieval Climate: Gauging the impact of natural hazards on northern European society through archaeology and history, AD 1000-1550

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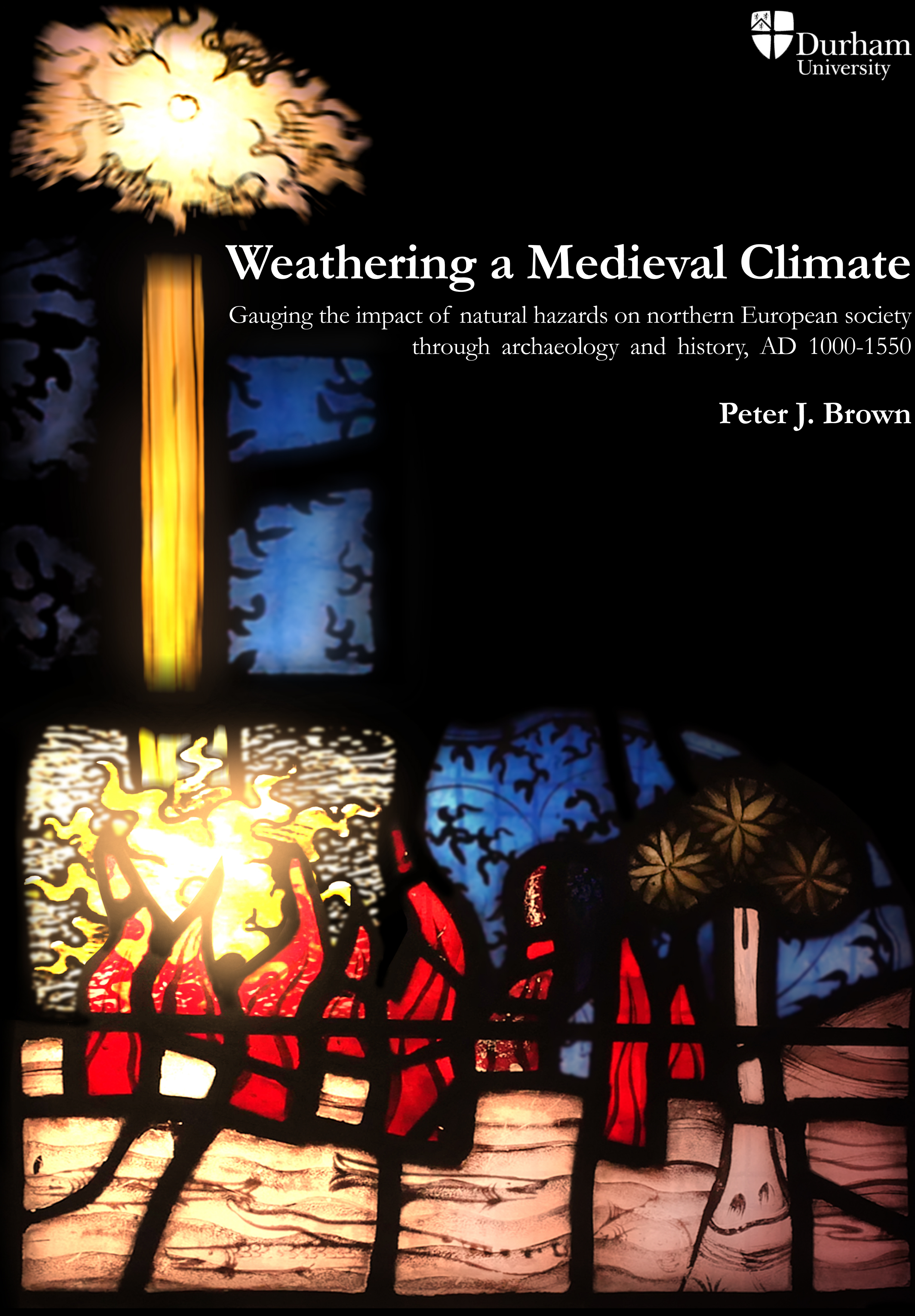

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Abstract

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This thesis investigates the occurrence of meteorological hazards in northern Europe and their impact on society during the medieval period (AD 1000-1550). When high-magnitude meteorological hazards affected vulnerable human populations disasters were the inevitable consequence. These events resulted in highly complex repercussions over the short- and long- terms, touching a wide variety of different spheres of human activity and experience. Additionally, the occurrence of these events was usually sudden and unpredictable in an age when natural processes were poorly understood. As a result, floods, storms and other hazards were widely interpreted through a framework of religious and superstitious beliefs which is widely attested by the historical record. A range of different types of archaeological artefact are also associated with these beliefs and, particularly, in accruing personal protection from a hazardous environment. At the same time, medieval society understood disasters in a practical sense and took steps to minimise risk through constructing flood defences and reinforcing structures damaged by storms. Medieval society, therefore, interpreted disasters through a duality of understanding in which disasters could be the result of spiritual or superstitious causes but could be mitigated through established and well-understood practical solutions. This thesis evaluates this duality in reference to specific case studies and in light of the significant demographic and climatic fluctuations of the medieval period—as a result of the Black Death and the transition to the Little Ice Age.

Cover image: The Pricke of Conscience Window, All Saints' Church, North Street, York.

Photograph and cover design by the author.

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List of Abbreviations

AD *Anno Domini*

aDNA ancient DNA

BP before present

DI Deutsche Inschriften

DMV deserted medieval village

DTM digital terrain model

DUL Durham University Library

HL Huntingdon Library

LBO Landesbibliothek Oldenburg

LIA Little Ice Age

LiDAR light detection and ranging

NHER Norfolk Historic Environment Record

PAS Portable Antiquities Scheme

PPG16 Planning Policy Guidance Note 16: Archaeology and Planning

PTSD post-traumatic stress disorder

OS Ordnance Survey

RCHME Royal Commission on Historical Monuments England

RCHM Royal Commission on Historical Manuscripts

SHARE Seismic Hazard Harmonisation in Europe

TNA The National Archives of the United Kingdom

UCD University College Dublin

UIUC University of Illinois at Urbana-Champaign

WCL Worcester Cathedral Library

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Chapter 1

Introduction

The impacts of natural hazards on human societies can be acute, far reaching and at times surprising. As much as the products of hazards arising entirely by natural means, however, the disastrous circumstances created by such events are socially-created phenomena. Not only are natural hazards themselves the result of a complex web of Earth-system processes, their effect on human society is the result of a constellation of inter-related and unpredictable variables. The impact of any given hazard on a particular human society, therefore, can be estimated but never predicted with absolute certainty. By turning to the 'laboratory' of the past, however, it is possible to investigate the impact of extreme natural events, both at the moment of disaster and across longer timespans. Additionally, the different ways in which human societies have responded to these types of event—and whether the adopted measures ameliorated or exacerbated the situation—may be explored. As such, this thesis examines the relationship between later medieval society (AD 1000-1550) and natural hazards across northern Europe. The aims of this thesis, therefore, are:

- To reconstruct, in detail, a number of case studies to explore the impact of extreme natural events on medieval society
- To characterise how medieval society responded to these types of event (both physically and through religiously motivated and superstitious practices)
- To assess to what extent exposure to recurrent hazards affected the resilience and/or vulnerability of medieval society (either positively or negatively)
- To place the role of disasters as drivers of cultural change within a wider historical and archaeological context.

In order to accomplish these objectives a variety of historical and archaeological sources of evidence are investigated here to explore different aspects of these interactions between nature and culture. Disasters as a subject of academic enquiry are highly interdisciplinary (Juneja & Mauelshagen 2007: 4) combining elements from the physical sciences, such as physical geography and climatology, with the humanities and social sciences. The investigation of disasters in the past, therefore, requires the integration of many disparate fields including studies of historical documents, archaeological sites and standing buildings, which preserve evidence of the occurrence of disasters, as well as material culture related to how contemporaries reacted to these events. The range of different types of hazard, their varying impacts in different locales, and their occurrence within varying historical contexts, necessarily means that there can be no 'one size fits all' approach to analyse the occurrence and impact of historical natural hazards. Rather, the approach adopted must be tailored to the available sources of evidence. These must be analysed creatively in order to tease out as much information as possible relating to the occurrence of the hazard, and its impact on contemporary society. The later medieval period is especially conducive to this type of research due to the significant quantity of extant documentary source material, which in most areas of Europe is orders of magnitude richer than from any preceding period. From an archaeological perspective, some types of natural hazard can be ephemeral, meaning that historical evidence is invaluable as a record of the occurrence and impact of these events. In addition, the documentary record assists in interpreting evidence for the responses these events provoked as well as their less tangible impacts on society.

Geographically, this thesis covers northern Europe, defined here as Scandinavia, the British Isles, Northern Germany, the Low Countries and Northern France. Particular emphasis is placed on evidence from the British Isles, for which the documentary record is among the most complete, but this is considered in wider reference to archaeological and historical research from across the entire zone. Archaeological sites and research from other regions; both elsewhere in Europe and beyond, are also introduced throughout the thesis where these provide a relevant comparison or add further contextualization to data sourced from within northern Europe itself.

The format of this thesis is arranged around the 'disaster cycle' (Alexander 2002: 6; see fig. 1.1), a conceptual framework which describes the 'lifecycle' of a disaster, applicable to any event. This framework encompasses the physical damage caused in the moment(s) of disaster, phases of repair and reconstruction in the immediate aftermath and the periods of quiescence in the, sometimes lengthy, gaps between the occurrence of hazards. Following the Braudelian model of historical time,[1] the effects of natural disasters can be envisaged over multiple overlapping timescales. In his first layer of historical time, Braudel generally viewed environmental systems as gradual and cyclical and judged them to be 'almost imperceptible in nature' (Braudel 1972: 20-21). With respect to rapid-onset natural hazards, however, although it is possible to conceive of many as occurring cyclically over the *longue durée*, the short-term effects unleashed by these events on the individuals and communities they affected were not just extremely noticeable but could be decisive in determining the fates of these communities during and immediately after their occurrence. While Braudel's model is not well suited to the immediate impact of environmental hazards, therefore, as

[1] In which historical time is envisaged over three layers encompassing relatively gradual changes in environmental systems, more rapid changes in political and social systems and the more immediate history of the individuals which populated these overarching systems.

the remainder of this thesis demonstrates, conceiving of the impacts of these events on the different spheres of life encompassed by Braudel's layers—individuals, society more generally and the wider environment in which medieval people lived remains a valuable approach which offers a holistic understanding of the impacts generated by these events over different timescales.

Thus, following an introduction of key concepts and an overview of existing research in the remainder of this chapter, Chapter 2 approaches how medieval populations perceived anomalous natural events during periods of relative quiescence, particularly how their beliefs about disasters were informed by, on the one hand, religious instruction, and on the other, practical experience. Chapter 3 presents a number of detailed case studies to explore what actually happened, both physically and socially, during the occurrence of rapid-onset natural hazards during the medieval period. This includes a variety of types of hazard which affected society in different ways and at different scales. Turning to the aftermath of these events, Chapter 4 analyses the physical responses adopted by society in order to understand what 'real world' steps were taken to mitigate and protect against disastrous events during the period under consideration. Chapter 5 augments this evidence by examining how people sought protection from these events through spiritual means, guided by both the Christian world-view and traditional, sometimes superstitious, beliefs. Next, Chapter 6 considers to what extent disastrous events lived on in the memories of individuals and communities long after their occurrence, as well as whether these memories fed back into reducing vulnerability from recurrent hazards. Chapter 7 draws the evidence presented in the preceding chapters together in order to consider the broader nature of the relationship between human society and disaster during this period. This is followed by chapter 8 which sums up the findings of the thesis.

1.1 What constitutes a disaster?

Natural hazards—the instigators of any 'natural' disaster—encompass a wide gamut of different types of events which are caused by diverse processes. Such phenomena include wildfires, earthquakes, avalanches, tsunamis, volcanic eruptions, hurricanes and meteor impacts as well as many other types of event. Of course, many of these types of event are rare occurrences or restricted to particular geographic zones. As this thesis focuses on northern Europe, the emphasis is on the types of hazard which most commonly afflict this part of the world: meterological hazards. Compared to 'natural hazards', 'meteorological hazards' is a more restricted category; including all those hazards of which the underlying cause relates to weather systems. The main categories of event are, therefore; floods, storm surges, droughts, wind and thunderstorms but not geophysical hazards such as earthquakes or tsunamis. Non-meteorological hazards are considered throughout the remainder of this thesis only to provide parallels or where a causal relationship exists with a meteorological hazard—such as landslides caused by high precipitation.

The occurrence of a natural hazard, however, does not automatically trigger a 'natural' disaster.

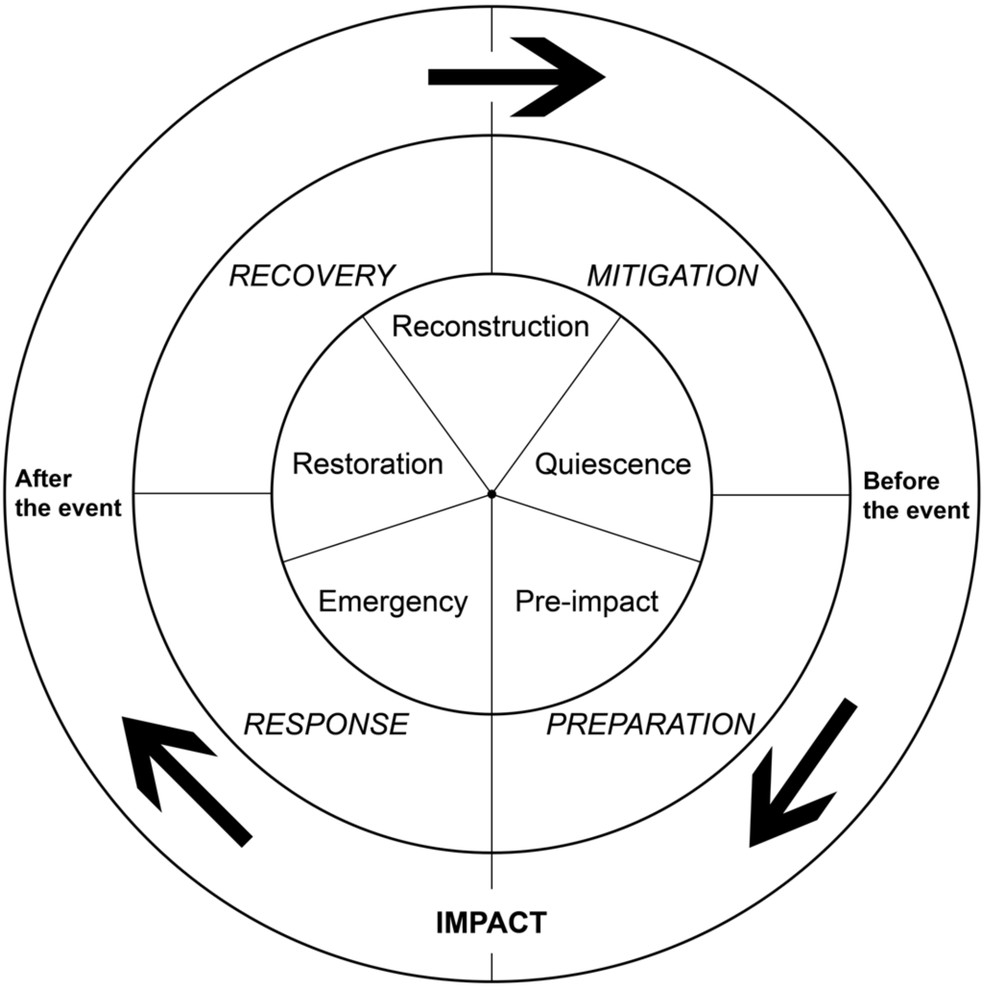

Figure 1.1: The disaster cycle. This model conceptualises the occurrence of disasters as repetitive events. Although each event will play out slightly differently to its predecessors, or any future events, the effects of any given disaster on any given society can be classified into the same fundamental stages. Redrawn by the author after Alexander 2002: 6.

We may imagine that, on another planet, similar to Earth but devoid of life, completely natural fluctuations in sea level, precipitation and weather patterns might lead to the inundation of areas that are usually dry, long droughts, severe rainfall or the occurrence of violent atmospheric storms. To an astronomer watching from afar, these events would, most likely, not register as disasters; only as inevitable natural processes. It is only, therefore, by introducing the presence of human society, and its interests, that such events, and their impacts, come to be considered as disastrous. This simple distinction between presence and absence is what causes the natural action of a hazard to precipitate a 'natural' disaster. A simplistic definition of a 'natural' disaster, therefore, is an unwelcome change from an accepted norm experienced by a human community as a result of the action of a natural hazard. More clinically, the most comprehensive database of modern disasters defines a disaster as an event which either results in over 10 casualties or negatively impacts at least 100 people (Smith & Petley 2009: 24). Importantly then, for a natural hazard to result in a 'natural' disaster, an impact on human life, assets or interests is required.

The term 'natural disaster' can be problematic however. Although, as above, a human component is a prerequisite for any 'natural' disaster, in certain cases human decisions, rather than the inevitable and natural occurrence of a natural hazard, have been held almost entirely responsible. A good example is the Fukushima Daiichi incident in Japan in March 2011 in which a high magnitude earthquake caused a tsunami wave which flooded the nuclear power station at Fukushima leading to reactor meltdown, explosions and the leakage of radioactive material. As a result, over 100,000 people were evacuated and a 20km exclusion zone was enforced around the nuclear power station (Hasegawa 2012). Another oft cited example is the devastating flooding and loss of life which occurred when Hurricane Katrina struck the US Gulf Coast in August 2005. The ensuing disaster was a product of poorly designed flood defences and widespread poverty which increased vulnerability, with many inhabitants unable to escape to safety (Comfort 2006: 503). In such examples, while the conditions themselves arose naturally: the earthquake and tsunami which hit Fukushima and the hurricane conditions of Katrina, the main factors which made these events 'disasters' were economic, social or political issues both internal to the societies they affected and the result of human decisions. While these two examples sit at the extreme end of the scale, and have received copious amounts of both scholarly and popular analysis, all disasters incorporate a human element meaning that, at a semantic level, none can truly be considered 'natural'. Clearly then, the risk created by a 'natural' disaster is composed of multiple elements. The two most fundamental of these are: the natural hazard, which comprises aspects such as the physical mechanism behind its occurrence, its magnitude and area of effect, and the vulnerability of the human society, which is a product of factors such as their awareness and understanding of the hazard, their location in relation to the hazard's area of effect and their resilience when the hazard strikes. This is often conceptualised as an equation, as in fig. 1.2, in which these two factors combined produce the risk from any given disaster (Wisner *et al.* 1994: 49). Accepting that 'natural' disasters are the results

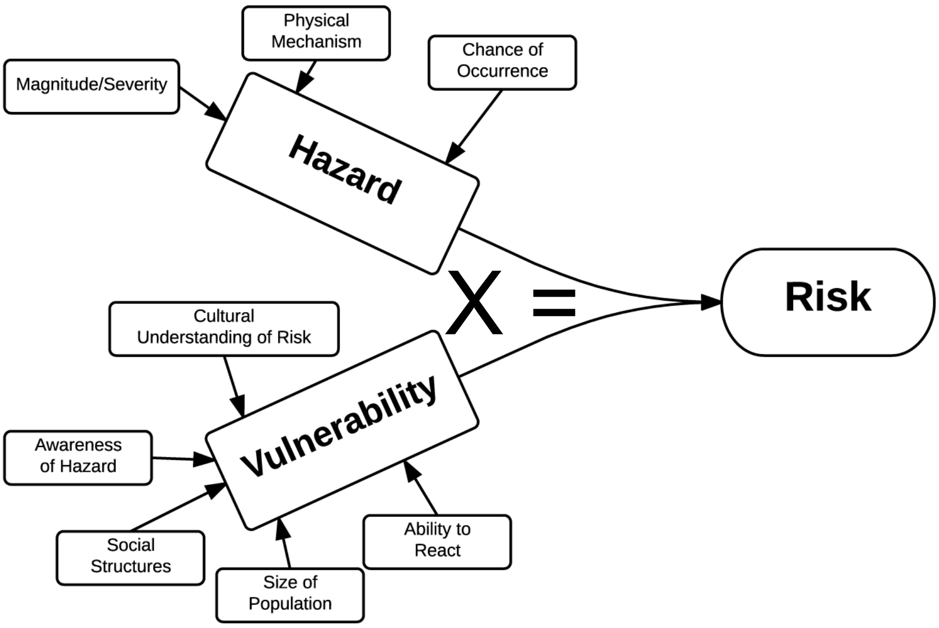

Figure 1.2: A conceptual diagram of the equal roles played by hazard and vulnerability in generating risk. A number of the factors which play into the creation of vulnerability and the attributes of a given hazard are shown. Created by the author.

of the interplay between a natural hazard and human decisions, the term 'natural disaster' is used throughout the remainder of this thesis to refer to these events.

1.2 Natural hazards in northern Europe

Although meteorlogical hazards are the focus of the thesis, it is useful to provide a brief overview of the main natural hazards which pose a risk across northern Europe. The types of natural hazards which typically impact this zone are relatively uniform. The combination of long, exposed, coastlines and the interactions between the Atlantic Ocean and climate systems strongly influence both the weather and many of the hazards experienced across this zone. Extra-tropical cyclones frequently track across northern Europe—indeed, the storm tracks which occupy this zone are among the most active in the northern hemisphere (Lamb & Frydendahl 1991: 3). These events cause high magnitude windstorms and/or precipitation and most commonly occur during the autumn and winter months. At a continental scale, worst affected are westward coastal areas between latitudes of 50°and 70°which are exposed to the full force of cyclonic systems from the Atlantic Ocean (Bartholy *et al.* 2006; see fig. 1.3, B). Strong storm winds can also produce other hazards such as aeolian sand (Clarke & Rendell 2009), when sand deposits become mobilised, and storm surges, during which high wind speeds drive bodies of water against coastlines causing the water to 'pile-up' bringing about a localised rise in sea-level. The low pressures associated with storm systems also precipitate a rise in sea-level amplifying the flood risk posed by storm surge events. The North Sea basin, and adjoining coasts, are particularly vulnerable to this effect (see fig. 1.3, A) due to the basin's relatively shallow bathymetry, funnel-like shape and the 'bottleneck' of the English Channel which slows the escape of water driven from the north. The risk to surrounding coastlines is epitomised by devastating modern events such as the storm surge and resulting flood which struck the UK and the Low Countries on 31st January/1st February 1953 (Baxter 2005; Gerritsen 2005).

Floods caused by other factors routinely occur throughout northern Europe. While there are many different categories of flood, including those caused by ice-jams, the failure of dams, levees or mass movements, the most common, in addition to storm surge flooding, are river floods and flash floods (Barredo 2007: 130). River floods occur when sustained or intense precipitation, over a timespan of days to weeks, swells rivers beyond their normal bounds. These events become particularly severe when flooded soils become waterlogged or frozen as this prevents the floodwaters from draining away into the soil. River floods are common throughout northern Europe (see fig. 1.3, C), especially during the winter months when atmospheric depressions cause warm fronts bearing moisture to pass over the zone from the west. Flash floods are localised extreme precipitation events which occur over a short time frame, usually under six hours. These events most commonly affect mountainous areas, although lowlands can also fall victim, and can also be caused, or exacerbated, by rapid snowmelt. Precipitation supplied by moisture from the Atlantic Ocean means that an excess of precipitation is more common than a deficit. Drought, however, does occur across the region although not to the same extent as in southern and eastern Europe (Lloyd-Hughes & Saunders 2002).

Turning to geo-tectonic hazards, active volcanoes within northern Europe are limited entirely to Iceland[2] which is somewhat anomalous for the zone in geological terms. Risk from earthquakes across the majority of northern Europe is low, with a slightly elevated probability of seismicity in parts of Belgium, northern France, western Norway and Wales, as documented by the 2013 European Seismic Hazard Map produced by the SHARE project (Giardini *et al.* 2013; see fig. 1.3, D). Again the exception is Iceland which sits atop the Mid-Atlantic Ridge, a major fault line between two tectonic plates. In spite of the relatively low seismic risk across northern Europe, damaging earthquakes do occur; modern examples include the magnitude 4.4 17th February 2018 Cwmllynfell earthquake which affected Wales and England (BGS 2018) while medieval cases include the tremors of 21st May 1381, with a reconstructed epicentre in the Straits of Dover, which caused structural damage in south-east England and the low countries (Hoffman 2014: 308).

Another hazard to which the entire zone is exposed are mass movements such as landslides. These can be caused by seismic activity, although, as above, excepting Iceland, there is only a low risk of such an occurrence across northern Europe. High rainfall on the other hand, can also

[2] The only exception is Beerenberg on Jan Mayen Island, Norway, located in the North Atlantic.

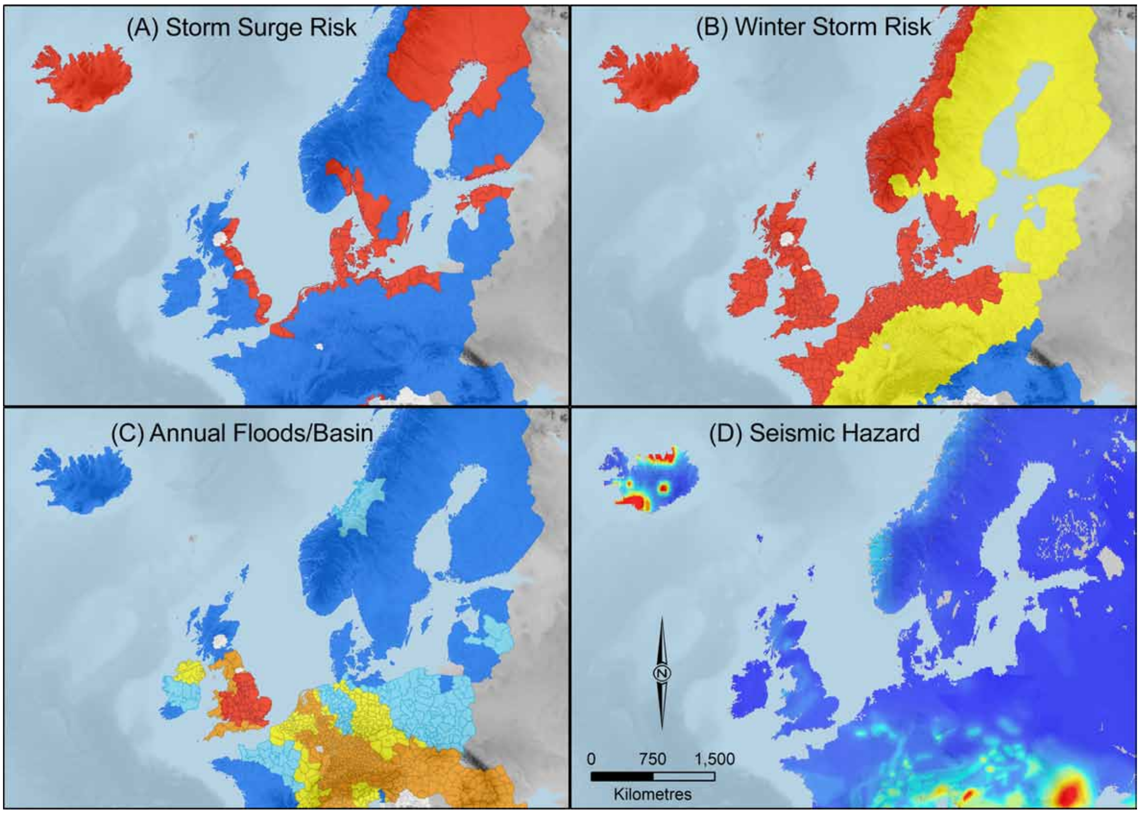

Figure 1.3: Natural hazards in present-day northern Europe. A: Risk from storm surges. red=high, blue=negligible. B: Risk from winter storms. red=very high, yellow=moderate, blue=low. C: Number of floods per basin per year. Red=very high, orange/yellow=high/moderate, blue=low. D: Risk from seismic hazards. Red=high, blue=low. Created by the author using data from European Spatial Planning Network available at: http://rimap.espon.eu [Accessed 27/09/2018]. Seismic hazard map from Giardini *et al.* 2003.

precipitate mass movements and is a common occurrence across the zone. In the majority of areas however, such occurrences only have the potential to be low magnitude events due to the relatively flat topography of much of the zone including most of England, much of Ireland, northern France, the Low Countries, northern Germany and eastern Scandinavia. The exception are mountainous regions including parts of Wales, the English Lake District, the Scottish Highlands and parts of Scandinavia. Jaedicke *et al.* (2014: 333) identify the Scottish Highlands, two distinct areas of eastern Norway and two separate areas on the north and south coasts of Iceland as hotspots for landslides caused by precipitation within northern Europe. Perhaps the zone worst affected by rainfall-induced mass movements is the western coast of Norway where steep mountains and high precipitation as a result of the arrival of humid air transported by Atlantic low pressure systems coalesce (Jaedicke *et al.* 2009).

One of the most severe, although rare, hazards to affect the region are tsunami. These can be caused by either submarine earthquakes, landslides or by meteor impact. The first of these appears to have affected the British Isles in 1755 when tsunami waves were generated by the Lisbon Earthquake (Banerjee *et al.* 2001). The impact of undersea landslides in the region, on the other hand, are revealed by investigations into the 8200 BP Storegga Slide event, in which the land bridge between Britain and the European continent was inundated, undoubtedly with disastrous consequences for those dwelling in between (Weninger *et al.* 2008: 16-17). Outside of such events which are either relatively recent, and thus historically documented, or of extremely high magnitude, and thus identifiable in the geological record, there are difficulties in distinguishing between tsunami and severe storm events. The occurrence of tsunami affecting the British Isles during the medieval period has been suggested but never proved beyond doubt (Haslett & Bryant 2007a; Haslett & Bryant 2007b). Mark Bailey, for example, discusses the possibility, without concluding it to be the case, that increased submarine earthquake occurrence was the cause of the heightened occurrence of coastal flooding during the 14th century in East Anglia (Bailey 1991: 189; Bailey 2007a: fig. 16).

1.3 Approaching the study of disasters in the past

The occurrence of specific disasters, mythical or historical, has always figured prominently in the popular imagination of the past—one need only think of the Atlantis myth, the Biblical flood of Noah or, more recently, the archaeological discovery of Pompeii. Throughout the early modern period, specific disasters spurred research into their underlying causes and in some cases, how they might be mitigated. The 'great' storm of 1703, for example, inspired the writer Daniel Defoe to collate contemporary eyewitness testimony as well as trying to understand, through the literature available at the time, why such an event had occurred (Defoe 1704). Most famously, the 1755 Lisbon earthquake gave rise to early research into the causation of the disaster and what might be done to mitigate damage on the same scale occurring in the future (Araújo 2006). The Verdalen landslide in Norway in 1893 drove research into the mechanics behind landslides which included historical analysis of past events but "as memory of the disaster faded, so did the funding for further . . . investigations" (Rokoengen *et al.* 2001: 58-59). As demonstrated in the latter case, these early studies were affected by an element of 'amnesia' (Schenk 2007a: 10)—although, for a time, the occurrence of a disaster inspired research into why they happened, as well as their impacts, up until the mid 20th century, this was generally a temporary phenomenon which lapsed as memory faded of the event which had originally sparked interest.

Academic research into disasters as a discrete category of event worthy of consideration is a relatively recent phenomenon (Juneja & Mauelshagen 2007; Schenk 2007a). In the United States, social scientists first began to investigate disasters in detail during the post-war years, using natural disasters as proxies to investigate plausible social responses to military emergencies such as a nuclear attack by a foreign power (Quarantelli 1987). During this period, natural disasters were, somewhat fatalistically, treated as unpredictable events which could not be averted. Only from about 1980 has a view emerged which, as outlined above, treats disasters as events created by an interplay of natural processes and cultural decisions (Oliver-Smith 1996: 304). The emergence of the academic study of disasters has been accompanied by a rapid growth in interest, both scholarly and popular, in disasters since the mid-20th century (see fig. 1.4). In this context, from the 1990s, but especially since the early 21st century, this has fed into the development of the sub-discipline of historical disaster studies which seeks to approach the study of disasters, as a combination of naturual and cultural concerns, from the historical perspective. Prominent scholars within this sub discipline include Gerrit Schenk, who, as well as investigating a number of detailed case studies (2007b; 2017), has done much to refine concepts and methodology (2007a) and promote the value of studying disasters from a historical perspective (2015), Christian Rohr, whose research especially focusses on hydrological and seismic disasters in central Europe (2003; 2013) as well as questions of historical methodology (2007), Christian Pfister, who has particularly focussed on reconstructing climate related hazards (*eg.* 2017) as well as looking at risk culture in historical societies more generally (2011), Franz Mauelshagen, who has investigated cultural responses to disaster during the post-medieval period (2012), Tim Soens, whose work on medieval and post-medieval flooding in the Netherlands has explored how social and economic conditions created the risk to which these populations were exposed (*eg.* 2011; 2013) and Greg Bankoff who has studied the cultural component of disaster and risk in both the Philippines (2003) and medieval and post-medieval England (2013).

Beyond this exclusively historical sub-discipline, however, most other disciplines have done little to engage with work on historical disasters. The exception is historical climatology, which finds much common ground in tracing the occurrence of specific events in order to provide data for reconstructions of historical climate (*eg.* Ogilvie & Farmer 1997; Brázdil *et al.* 2005) and in some cases to investigate the impact of climatic changes on society (*eg.* Behringer 1999; Anderson *et al.*

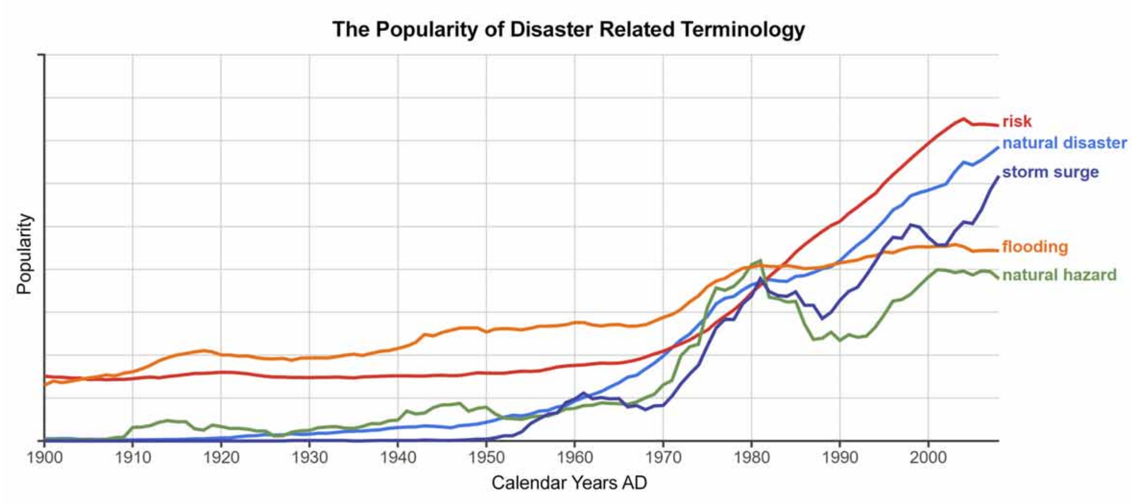

Figure 1.4: The popularity of disaster related terminology over time. The occurrence of various terms related to disasters and disaster research in books since 1900. A multiplier has been applied to the values of the different terms in order to make them more easily comparable. Created by the author using data from Michel *et al.* (2011).

2016). Medieval economic historians, on the other hand, although well placed to contribute toward the study of disasters in the past have generally ignored disasters as a research question. There are a number of reasons for this. Curtis *et al.* (2016) ascribes the general drift of the historical discipline away from the social sciences as one of the main reasons. A prevailing view is that medieval disasters bear no relevance to modern issues due to the fact that medieval culture, particularly religious thinking, was so far removed from modern beliefs that no useful comparisons are possible. Perhaps most pervasively, natural disasters are still regarded by many as entirely natural occurrences. This is problematic as the historical discipline, as Bruce Campbell (2010b: 282-284) has argued, has largely rejected environment as a 'protagonist' emphasising instead the primacy of human actions and decisions in precipitating cultural change (see also Hoffman 2014: 342-351).

Archaeology as a discipline is well placed to investigate the human-environment relations between natural hazards and vulnerable societies. Indeed, this was among the 'grand challenges' identified as priorities that archaeologists should aim to tackle according to a recent international gathering of prominent archaeologists (Kintigh *et al.* 2014: 11, 18). However, as with economic history, archaeology as a discipline has done little to engage with wider debates in disaster studies, a fact highlighted by some national research frameworks (Hall & Price 2012: 31). This is crudely illustrated by a search of the major disaster studies journals (Disasters, Natural Hazards, Journal of Mass Emergencies and Disasters) with the keyword 'archaeology'. Very few of the research papers returned through this method include anything more than a passing reference to archaeological evidence (Brown 2017).

The sparsity of interaction between archaeologists and other disciplines working on disasters is certainly not indicative of archaeologists' avoidance of studying sites and landscapes affected by natural disasters. Indeed, a recent conference of the Society for Medieval Archaeology[3] sought to explore the contribution archaeologists can make to the study of disasters for the medieval period.[4] In most instances where archaeologists have encountered evidence for the occurrence of natural disasters, however, the disaster is not the primary research objective. The relatively rare cases where this has occurred include early work by Sheets (1980) which provided a broad but brief overview of archaeological evidence for the occurrence of natural hazards. Since then, a number of researchers have produced synthetic and comparative work on archaeology and disasters, (*eg.* Guttormsen 2008; Gerrard & Petley 2013) but these have generally been limited in scope and have, necessarily, focussed on either specific periods, geographic regions and/or types of hazard. A number of researchers have examined specific case studies in detail; Fernández *et al.* (2017), for example, have examined archaeological evidence for the impact of a high magnitude flood event on a medieval village in Asturias, NW Spain, while Forlin and Gerrard (2017) have investigated the impact of a devastating landslide in 1522 on the town of Vila Franca do Campo in the Azores, Portugal. Looking at how historic communities responded to the risk posed by hazards, Gardiner and Hartwell (2006) reconstructed the phasing and chronology of medieval and post-medieval flood defences located in English wetland environments. Turning to the longer-term implications of living with the risk of natural hazards, Stephen Rippon has made the flood risk inherent to wetland environments a central part of his research into human occupation of these locales (*eg.* 2000a; 2000b; 2001; 2004) while Menotti *et al.* (2014) interpreted the flood risk experienced by Bronze Age lake shore settlements in the central European Alpine region as a motivation for the development of complex ritual practices. Reide (2014) has examined the impact of prehistoric volcanic eruptions in Europe and called for further integration of archaeology into the study of past disasters. The above examples demonstrate that one of Sheets' (1980: 25-26) key conclusions almost 40 years ago that: "archaeologists are almost completely unaware of the hazard research conducted by social scientists within the past few decades" can no longer be said to represent the *status quo.* His other primary conclusion (Sheets 1980: 26), however, that: "whatever piecemeal knowledge has been generated by archeologists with respect to natural disasters largely has been ignored by hazard researchers" certainly still holds some truth.

The area in which archaeology has contributed most significantly to the study of disasters, beyond the limits of the discipline itiself, is archaeoseismology. Archaeological evidence can be used to estimate the physical characteristics of past seismic hazards which, in turn, can enhance knowledge about the nature of future seismic activity. Conducted overwhelmingly with a natural science rationale, the data obtained from archaeological sites relating to past earthquakes can inform

[3] Waiting for the End of the World: perceptions of disaster and risk in medieval Europe, held from 2nd-4th of December 2016 at Rewley House, Oxford, United Kingdom.

[4] Note that this conference has given rise to a forthcoming volume, of which the author is an editor. Many of the contributions to this forthcoming volume present analogous and complementary evidence to the contents of this thesis and, as such, are referenced throughout the remainder of the text.

models of contemporary and future seismic risk. The value of this data for evaluating modern-day risk has, however, had an unfortunate blinkering effect meaning that archaeoseismological research rarely engages with the relationship between past societies and the seismic events they investigate. This is a short-coming recognized by archaeoseismologists themselves (Sintubin 2011: 8). An ongoing Durham University research project[5] seeks to redress this situation for the medieval period in Europe through investigating a number of key case studies (Forlin & Gerrard 2017).

Compared to seismic hazards, meteorological hazards have not seen the same intensity of research. Archaeologists frequently encounter evidence for the occurrence of these type of events on archaeological sites; floods are attested through layers of alluvium or marine sediments, discrete layers of wind-blown sand attest to past storm activity (Brown 2015) and even rainstorms occassionally leave an archaeological signature (Hinzen *et al.* 2013). Of course, certain hazards, such as windstorms, droughts or lightning strikes are ephemeral and do not always leave lasting impressions in the archaeological record. For those hazards which can be identified in the archaeological record, as with archaeoseismology but more rarely, such data has been interrogated to answer practical scientific questions—for example investigating changes in river flood regimes (Kiss & Laszlovszky 2013). Synthetic and comparative research on the impact of these events on contemporary society, however, has been lacking. In the rare cases where archaeologists have considered such events as a primary research topic, the focus is often on archaeological methods and research is usually published in discipline specific journals, unlikely to be read by other disciplines (*eg.* Griffiths 2015), effectively preventing engagement with other disciplines.

Part of the reason that archaeology has not figured more prominently in interdisciplinary approaches to disaster can be explained by some of the difficulties peculiar to archaeological technique and sources of evidence. By definition, disasters are short-term occurrences which alter conditions from what is considered 'normal' at a given location. In most cases therefore, only a short window of time exists for the deposition and accumulation of an archaeological signature. In the case of some types of hazard, such as volcanic eruptions, landslides, floods and some earthquakes, the deposition of large volumes of ash, sediment or debris in short spaces of time (hours and days) is a common occurrence, providing a recognisable archaeological signature. However, other types of hazard such as windstorms, snowfalls (Schofield 2009), and droughts rarely leave behind any long-term material evidence. Even in the case of those hazards which are more recognisable archaeologically, site clearance and later reworking of material can often truncate and erase evidence for the occurrence of earlier hazards.

It is also difficult, and indeed one of the major challenges of this thesis, to combine archaeological data with data relating to the past from other disciplines (Cooper & Peros 2010: 1226). Climatic data obtained from proxies such as tree rings or ice cores usually operate at interannual time-scales

[5]The Leverhulme Trust funded 'Risk and Resilience: exploring historic responses to earthquakes, 1200-1755'.

while documentary data can, in some instances, be securely dated to a particular calendar date.[6] On the other hand, the chronological resolution applicable to most archaeological data—in the absence of well dated material culture, such as coins, or absolute dating methods, such as tephra- or dendro- chronology—rarely allows individual contexts and artefacts to be precisely dated beyond a date range less than *c.*100 years.[7] This poses a problem when dealing with specific historical events, such as a natural disaster, as it becomes difficult to convincingly demonstrate that archaeological evidence can securely be connected to a specific, documented disaster (Galadini *et al.* 2006: 408). This is exemplified by the documentary evidence which records the burning of the Cistercian Abbey of Strata Florida, Ceredigon, Wales, as the result of a lightning strike in 1284 (Christie 1887: 115-117). Although the archaeological evidence corroborates the written description—the solidified molten lead unearthed during excavation is a detail specifically mentioned in the historical source (Williams 1889: 153-154)—it is impossible to definitively prove that the melted roofing lead recovered was a product of that particular blaze and not another fire, of which there are a number of possible, historically documented, candidates (Williams 1889: 154). These chronological issues may explain to some degree why medieval archaeology has particularly engaged with disasters in Norse Iceland. Here tephra layers from volcanic eruptions provide precisely dated reference points which can be used to anchor archaeological layers in time. This allows analysis of the material changes that took place in the aftermath of a particular eruption, with chronological evidence of their association to the hazard. This research is often conducted by, or in association with, volcanologists with primarily scientific aims but a number of studies have explicitly focussed on the social impacts and consequences of these disasters (Dugmore *et al.* 2007: 7-8).

Another challenge in approaching the study of disaster from an archaeological perspective lies in the controversy that surrounds the impact of exogenous natural forces on human societies. As with the traditional historical viewpoint, discussed above, archaeologists are also wary of straying too far into the realms of environmental determinism. When researchers have proposed a link between environmental factors and cultural change, they invariably attract criticism—a fact which has likely impeded research into human environment relations within the discipline (Rippon *et al.* 2014: 236). The recent periodisation of geological time based, to some extent, on the impact of disasters on human societies,[8] for example, provoked criticism for misinterpreting the evidence and ascribing cultural changes to climatic factors when other plausible explanations are available (Middleton 2018). In an example from medieval archaeology, within which the impact of environmental fluctuations on society has not traditionally been a major research theme, the desertions at the medieval villages of Barton Blount, Derbyshire, and the village identified as Goltho, Lincolnshire, were interpreted as

[6] Although, of course, historical documentary data brings with it its own set of chronological issues relating to calendrical systems and source reliability, as discussed by Brázdil *et al.* (2005).

[7] This is exemplified by the high-energy deposit discussed in Chapter 3.3.1 in relation to the storm of 1362.

[8] Namely the proclamation of the Meghalayan Age based on an extreme drought which occurred *c.*4200 years BP and is interpreted as having significant implications for societies throughout the Near East, the Indian subcontinent and China.

largely a result of the impact of the declining climate brought about by the onset of the Little Ice Age. The excavator, Guy Beresford (1975: 51-52) argued that under the deteriorating climatic conditions the clay soils would have become unworkable for long periods making continued occupation at the sites untenable. Swift rebuttals followed, dismissing Beresford's interpretation as simplistic environmental determinism, pointing to the continuity of settlement at neighbouring village sites as evidence that "raindrops [are not] locally selective" (Beresford & Hurst 1971: 21). In addition, further detractors invoked the post-Black Death economic and demographic situation as a more plausible explanation for abandonment (Wright 1976).

Beresford's original counter argument was that differential abandonment between nearby villages might be explained by minimal differences in local soil composition (Beresford 1981: 36) and indeed soil chemistry and geology are now being recognized as major determining factors in the development of medieval villages (Williamson *et al.* 2013: 79-80; Rippon *et al.* 2014: 200-201). Furthermore, 40 years after the publication of Beresford's interpretation of the deserted medieval village (DMV) sites at Barton Blount and Goltho, similar conclusions were recently suggested regarding the desertion of the medieval settlement at Cedars Park, Stowmarket, Suffolk. At this site it is suggested that increased wetness during the climatic decline of the 14^{th} century provoked the cutting of increasingly large enclosure ditches to drain surface water while cobbled surfaces may also have been a response to the difficulties of traversing wet clay. Such conditions, it is argued, would have made the surrounding clay soils difficult to work. 'Puddling' on clay soils requires time to dry out before the soil can be worked so increased wet weather could have, therefore, reduced the number of days when soils could be worked below a viable threshold making abandonment a favourable option (Woolhouse 2016: 122).

Comparably, Platt (2010; 2012) has made the case that the sudden appearance of homesteads equipped with moats in medieval England, during the early 14^{th} century, relates to the climatic decline known as the 'Dantean Anomaly' (*c.*1315-*c.*1322).[9] This climatic aberration was marked by unprecedented rains throughout 1315 (Jordan 1996: 17-18) leading to a severe famine which was swiftly followed by a cattle panzootic in the 1320s. Platt (2010), therefore, argues that these environmental fluctuations created conditions—dearth and hunger—among the populace that drove those with something to protect to dig moats around their homesteads for security.

Of course, in all of these examples, economic and social considerations are just as paramount as climatic and environmental factors. Although modern scientific climatic reconstructions call into question received wisdom surrounding the role of climate in facilitating and constraining human activity (see for example Campbell 2016b) it remains controversial to equate developments in human affairs with changes in nature and environment. The above examples not excluded, all other potential avenues should be fully explored before climatic and environmental factors can be

[9] So called due to the fact that its abatement more or less coincided with the death of the Italian poet Dante Alighieri.

considered as plausible drivers of cultural change. Where many in the past have entirely eschewed ascribing any impact to these forces, however, the potential impacts of changes in the natural environment on contemporary populations is becoming increasingly clear.

As we will see, there are many cases in which medieval populations chose not to relocate in the aftermath of severe disasters and continued to occupy locations which had been drastically altered by natural hazards. Even when extreme natural forces were unleashed, therefore, many choices remained undetermined allowing human populations considerable leeway in which to choose how to respond. Consciously or unconsciously, no doubt, the cost/benefit calculations which medieval populations entered into in these situations factored in not only economic and social considerations—such as the costs of setting up anew compared to resettling the original place of habitation, dependencies to local lords and the proximity of family members and friends—but also intangible factors encompassing ideas of 'place' and familial ties to the land. The various pathways open to medieval populations in the aftermath of fluctuations in the environment and climate, therefore, were constrained by both the realities of the physical changes in the environment as well as economic and social considerations. From two sides, therefore, these two categories of factors affected what decisions people made and how they chose to react. While environmental forces never 'determined' what people did, abrupt changes, to a greater or lesser extent, did influence decisions and what options were viable.

1.4 The contribution of archaeology to the study of disasters

Despite the difficulties in approaching disasters from an archaeological perspective, archaeologists can make a valuable contribution to the study of disasters. Perhaps the most obvious point is that archaeology can extend our knowledge of disasters far back in time. In most parts of the world, reliable scientific data relating to hazards is rarely available before the 19^{th} century. As a result, hazards with a long return period often sit beyond the period covered by instrumental records. In these cases, information on the causes, magnitude and effects of such hazards must be collected through alternative means—including historical sources and investigations of the archaeological and geological records. A good example are high magnitude earthquakes in the Himalaya. By correlating extant historical records with geological evidence and radiocarbon dates derived from trenching (Stolle *et al.* 2017), together with standing building evidence, in this case medieval temples (Rajendran *et al.* 2013), the impact of seismic activity in the region over longer time periods than instrumental records allow can be investigated. This permits both the identification of undocumented seismic events and the characterization of modern day risk if similar events were to recur in the present day.

Another important area which can benefit from an archaeological contribution is through the provision of precise information concerning the impact of a rapid-onset hazard. While historical sources often provide descriptions of the occurrence of hazards, these sources are usually low in detail and cannot always be taken at face value—often dates and details were misreported or elaborated (Rohr 2003: 136-137; Brázdil *et al.* 2005: 373-374) while the coverage of documentary evidence, at least for medieval Europe, is biased towards the literate and land-owning classes. In rare cases, where high magnitude rapid-onset hazards such as floods, landslides, earthquakes or volcanoes cause the destruction of a settlement or structure, this can promote the long-term preservation of in-situ remains. This, in turn, preserves a record of the final abandonment and destruction of the site by the hazard and, perhaps, the last-minute responses of the affected population. While a number of high profile sites of this category, mostly from the Classical world, are known such as the Roman settlements of Pompeii and Herculaneum and the Minoan town of Akrotiri on the Greek island of Santorini, medieval case studies are also known. One of the most fully investigated is the case of the castle of Saranda Kolones, Paphos, Cyprus, where, during the 1222 earthquake, as the structure collapsed, most of the inhabitants appear to have made a hasty escape leaving behind objects of value as they fled (Rosser 2004: 39-40). Remains of one unfortunate individual who perished after escaping down a latrine shaft only to find his only exit blocked indicate at least one human casualty (Rosser 1986: 47), with faunal remains crushed beneath fallen masonry attesting to further losses (Megaw 1957: 49). In the aftermath of the earthquake the archaeological evidence suggests salvage attempts either to recover the bodies of casualties or to claim and reuse the fallen masonry for the repair of the town of Paphos, which had also suffered severe damage during the earthquake (Rosser 2004: 47-48). Evidence from a nearby cave may indicate the presence of refugees made homeless following the earthquake while newly built structures suggest attempts to remedy this situation by constructing new housing in the earthquake's aftermath (Rosser 1985: 94). Such an example demonstrates the rich level of detail that archaeological data can lend to an event which, although documented to some degree—the earthquake itself was recorded but little mention was made of the castle—would be otherwise unknown.

The demographic and economic impacts of hazards can also be investigated through archaeological evidence. While medieval chroniclers often record the number of fatalities lost to specific natural hazards—50,000,[10] for example, were reported to have been lost in a 13th century flood in the Netherlands (Pertz 1861: 215)—these cannot be trusted at face value. Although as above, archaeological evidence can confirm the presence of fatalities,[11] it is impossible to quantify exact numbers in any given event. Over a longer timespan, however, demographic decline can be inferred through material remains. Systematic test-pitting in eastern England, for example, provides material evidence for the acute decline which followed the Black Death allowing an estimate of the percentage of demographic change in the locales studied (Lewis 2016). This approach could theoretically be

[10] This number is certainly an exaggeration as it seems doubtful the chronicler would have had access to any accurate figures if these were even produced. High figures such as these were merely used by medieval writers to illustrate that a very high number had died (Ziegler 1969: 51-53).

[11] The absence of fatalities from an archaeological site affected by a disaster may not automatically contradict historical sources stating that high casualties occurred as, where possible, bodies might be removed in the aftermath of an event in order to carry out proper burial rites.

applied to landscapes or settlements affected by hazards which impact a wide area, such as tephra falls, landslides or aeolian sand inundations, in order to gauge what, if any, impact these hazards had on demography and economic activity over the medium-long term.

The occurrence of a hazard itself is also only one aspect of the impact of a disaster which may be investigated archaeologically. In the case of extreme events, sites may be entombed and preserved in-situ by the action of the hazard itself. In other cases, the occurrence of a disaster may lead to later site abandonment or a period of reduced activity. In the case of a protracted abandonment at some point after the occurrence of a hazard, it would be difficult to demonstrate the causation behind the abandonment with certainty. However, abandonment in advance of or in the immediate aftermath of the occurrence of a hazard may leave a distinctive archaeological signature. In the case of 'normal' site formation, an assemblage comprising a limited number of old, low-value, damaged or cumbersome objects would be expected with more valuable or useful items being removed during the abandonment phase. When a site is abandoned for 'catastrophic' reasons, however, fewer items are likely to be removed, with a greater incidence of valuable, personal and functional objects. As a result, the nature of the assemblage should be easily distinguishable from a 'normal' site (Young *forthcoming*). An example comes from the medieval farmstead at Eckweek, Somerset, which appears to have been abandoned rapidly in the mid-late 14th century.[12] The factors behind the abandonment of this particular site are unknown although plague (most likely the 1348-52 or the 1361-62 outbreaks), including its indirect effect on the mobility of workers, is considered a possible contender (Young *forthcoming*).

Archaeological evidence can also provide valuable insights into internal processes within societies before, during and after disasters. In some cases, for example, archaeological evidence may allow something of the role of authorities in the post-disaster rebuilding stage to be inferred. Where it is possible to compare the layout of structures before and after the occurrence of a disaster, for example, the alignment of structures may attest to whether rebuilding was planned centrally or if individuals were left to make repairs of their own volition. The latter is demonstrated in the aftermath of conflagrations in medieval Bergen by the permanence of property boundaries, suggesting individual property, and thus the responsibility to repair the damage, were unaffected by the repeated fires which razed the town to the ground (Hansen 2015). Archaeological evidence can also illuminate disasters' positive and negative economic impacts. As an example, archaeological excavations at Vila Franca do Campo, Sao Miguel, Azores, reveal that, following the landslide of 1522 in the relatively newly settled Portuguese Azores, the destruction caused by the landslide, rather than tipping the population into total poverty, invigorated the local economy by forcing the surviving population to produce their own roof tiles, where previously they had relied entirely

[12] In support of a rapid abandonment are the high relative abundance of artefacts, including domestic artefacts, structural metalwork, horse gear, craft-related items and personal belongings, including jewellery and coins. At the time of abandonment the site also appears to have achieved a zenith of prosperity compared to earlier periods (Young *forthcoming*).

on imports from the Portuguese mainland (Forlin & Gerrard 2017: 104). Clearly, the landslide disrupted the established economic order but it may have, in fact, had an economically positive effect.

The archaeological record can also provide evidence for ritual activities which may have been stimulated by the occurrence of natural hazards. Although ritual and belief are notoriously difficult to infer through material remains alone, a number of practices can be connected to beliefs surrounding disasters. For example, one interpretation of burnt marks in churches and vernacular architecture, which seem to have been deliberately created, is that they were believed to bestow protection on the structure from lightning (Lloyd *et al.* 2001). Similarly, the distribution of *ampullae*, vessels obtained through pilgrimage containing dust, holy water or oil blessed at the shrine of a saint, in agricultural fields across medieval England has been interpreted as evidence for belief in saintly protection against extreme natural events such as hail and drought (Anderson 2010). This type of evidence can be profitably combined with the historical record which, for medieval Europe, is rife with descriptions of processions, prayers and ritual acts which were believed to provide communal or personal protection against natural hazards (Hanska 2002).

As this section has outlined, archaeology has much to 'bring to the table' but a holistic understanding of disasters is only possible through the integration of strands of evidence from a wide variety of disciplines. The remainder of this thesis, therefore, while attempting to capitalise on the opportunities provided by the archaeological record, integrates research from other disciplines in order to investigate how disaster affected medieval northern Europeans in as much detail as possible.

Chapter 2

Disaster and society in medieval Europe

Before any disaster befalls a community, much of its potential to cause damage is 'pre-set' by conditions already present within the society itself. Vulnerability to specific hazards, is created by physical factors, such as the proximity and relative level of a home to a source of flooding, but also less-tangible cultural considerations such as socio-economic status, the availability of charitable relief to the poor and religious beliefs. To understand the impact of specific disasters on medieval society, it is first necessary to consider how risk as a concept was conceived by populations during the Middle Ages—what mitigative measures were available and the extent to which the medieval mindset regarded natural disasters as avoidable or inevitable events against which efficacious measures could be taken. A key stage in the 'disaster cycle' (see fig. 1.1), therefore, is to what extent medieval society was prepared for the occurrence of a disaster prior to its occurrence. While in modern terms, this might constitute 'battening down the hatches' in response to the forecast of a violent storm, such reliable weather predictions were totally unavailable to medieval populations.[1] This meant that short-term preparations against unforeseen events were rarely possible—and where high magnitude natural hazards struck in this way the results were likely to be devastating. This being the case, medieval people practised a wide array of longer-term strategies in order to guard against risk posed by natural hazards and future uncertainty more generally. This chapter, therefore, explores the extent to which medieval populations were prepared for disaster and what factors peculiar to the medieval period made people more or less vulnerable to the occurrence of natural hazards. As we shall see, while archaeology can make an important contribution to this debate, much of the evidence, at present, comes from the documentary record.

Of course, medieval Europe was not homogeneous and important distinctions existed across the region, both spatially and temporally; ranging from the mode of landholding and roles of institutions to religious beliefs. It is impossible to cover how all these considerations varied across

[1] Medieval weather predictions were based either on traditional knowledge based on observed weather patterns and temperatures, which offered a certain degree of reliability, or popular folk beliefs which ranged from observing the behaviour of animals to the practice of prognostication, which claimed to be able to predict the weather based on such unlikely events as the day of the week on which Christmas or New Year fell, which month brought the first thunder clap of the year or on which days of the 12 days of Christmas the sun shone brightly (Jones 2013: 39-40).

medieval northern Europe, geographically and over time, in a single chapter. Necessarily, therefore, this chapter adopts a broad brush approach which is refined in respect to more detailed case studies in chapter 3.

2.1 Living with risk

Horden and Purcell (2000: 175-230), in their influential *longue durée* history of human-environment interactions in the Mediterranean, emphasised the importance of cultural practices to deal with the risk posed by natural hazards such as the sudden storms, flash floods and droughts to which the Mediterranean climate is particularly prone. Of course, such practices are not, and have never been, exclusive to the Mediterranean world and comparable, equivalent practices have been relied upon by northern European populations throughout history. For the medieval period, one of the most well-known is the practice of fragmented land-holding associated with the open field system, common across much of midland and central southern England, in which peasants living in a nucleated settlement farmed small strips of land scattered throughout the lands of the parish, usually in 2 or 3 large and unenclosed 'open' fields (Williamson 2003: 1-5). As an adaptation against risk, scattered holdings have been most consistently championed by McCloskey (see for example 1989: 34-46; 1991) who argued that the practice reduced the likelihood that any single land-holder would suffer the total loss of their crops as a result of unfortunate circumstances, such as flooding, hail or pests—which would be unlikely to affect more than a small portion of their diverse holdings.[2] Despite the inherent inefficiencies of scattered holdings, mainly the increased time spent travelling between parcels of land, McCloskey (1989: 46) calculated that the practice was an economical method of insuring against risk to agrarian produce, especially when compared to alternatives such as grain storage which, in tying up potential earnings, could result in a reduction in earnings by as much as a third (McCloskey 1989: 46-48).

McCloskey's interpretation of medieval peasants' practices to guard against risk has proved divisive and many scholars have proposed variations or entirely alternate explanations for how risk was managed by medieval society. According to Cosgel (1990), for example, scattered holdings were attractive because they enabled lords and peasants to deliberately distribute risk—rather than simply trying to minimise its consequences. For Fenoaltea (1976: 141-144), diversified land holdings were important not for their geographical distribution of risk but for the fact that they increased efficiency by facilitating the distribution of labour—allowing each peasant the opportunity to work on the portion of their holdings most suited to the present conditions at any given time. Bekar and Reed (2003), meanwhile, have argued that the insurance provided by scattered holdings, rather

[2] "The land and weather of England are notoriously variable, even over the two square miles or so of the typical village. A place with sandy soil on a rise would shed some year's excessive rain, yet one with clay soil in a valley would hold another's insufficient rain. An exposed place would have wheat likely to become tangled by rain and high winds at harvest but free of mold in a generally wet year. A sheltered place would be relatively immune from windy disasters but less dry and more moldy on account" (McCloskey 1989: 34).

than spreading risk across different locations, soils and terrain types, related to the fact that land could serve as an attractive savings instrument—with scattered holdings allowing small portions of land to be bought and sold as and when budgets required. On the other hand, scattered holdings have been interpreted as a pragmatic method of ensuring resources were divided equitably amongst tenants (Williamson 2003: 181). Such models are of interest and highlight the different priorities that coloured medieval calculations of risk, consciously or not, when organising their agricultural affairs. Although they probably arose primarily as a bi-product of the open field system,[3] scattered holdings likely did contribute to reducing vulnerability or were, at least, inherently risk averse—if open field farming had been vulnerable to commonly occurring and predictable natural hazards it would seem strange that, as a practice, it enjoyed such longevity.[4] Open field farming, and the scattering of holdings within these fields, however, saw significant variation in different areas, for example in south west England (Rippon *et al.* 2006: 59-63), and was not the only agriculture model practised during the medieval period. In some areas, for instance, cohesive parcels of land around isolated farmsteads were held by single tenants (Rippon *et al.* 2006: 58-59). There were clearly, therefore, systems other than the open field model which worked meaning that any advantage offered by scattered holdings was either relatively minor or limited to specific landscape settings.

Additionally, the model of scattered holdings within the open field system was almost certainly motivated by other considerations rather than being simply a practice to minimise risk. For example, by dividing up the productive landscape into different parcels of land, which were then allocated to different members of the village community, scattered holdings ensured that the areas worked by each person were relatively equitable—each member of the community had a more or less equal share of the most agriculturally productive areas as well as those areas which might have been undesirable due to their poor fertility, unfavourable situation or distance from the village. This can be seen clearly in the annual allocation of strips of common meadow which, in most villages in medieval England, were shared between every member of the community who held rights to the hay crop (Brian 1999). As Brian (1999) has explored, this was often accomplished through the casting of lots[5] which ensured, over the long term, a random, and therefore, relatively fair distribution of the resources of the village. By the later Middle Ages, outside areas of common meadow and pasture, land holdings had generally become crystallised and were passed down through family lineages or privately transferred between peasants rather than being re-distributed *en masse* amongst the village community on a regular basis (Dyer 1998: 118-127). However, when the system was established, ensuring that members of the village community received a relatively equitable share

[3] The factors behind which are numerous and debated (Rippon *et al.* 2006: 66-67).

[4] Adopted from about the 8^{th} century (Williamson 2003: 6; Rippon *et al.* 2006: 67-68) until its dismantling during the post medieval enclosure movement.

[5] The system used for casting lots was based on symbols associated with either different individuals/families/estates or different parcels of land. The symbols were then drawn at random—either at the parcel of land, in which case the symbol indicated who would harvest the crop from that particular parcel, or, alternatively, the symbol stood for a specific parcel of land in which case the crop from a particular parcel of land associated with that symbol was allocated to the individual/family or estate.

of the resources within a particular parish provides an alternate explanation for the development and spread of scattered holdings rather than simply as a practice which reduced an individual's exposure to risk.

Beyond scattered holdings, other scholars have advanced entirely different explanations for how medieval peasants coped with risk. Cull *et al.* (1992), for instance, has argued that crop diversification provided significantly greater insurance against uncertainty than that offered by the scattering of holdings. Certainly, the evidence for crop diversification throughout both the documentary and archaeological records (see for example Campbell & Overton 1993: 62-66; Fyfe *et al.* 2004: 1711-1712; Davies 2007: 2057) leaves no doubt that crop rotation and the tailoring of planting strategies, including the selection of crop varieties and the percentages sown, to suit specific soils and situations, formed an important part of medieval agricultural regimes. In south west England, for example, the regional practice of 'convertible husbandry'—which involved the alternation and rotation of grain and grass crops—can be traced in the pollen record from nearby peat bogs (Rippon *et al.* 2006: 55-58). On a larger scale, the stark variations in medieval crop and animal husbandry between different surface geologies, revealed by analysis of archaeobotanical and zooarchaeological evidence in aggregate from a swathe across southern England, attest to medieval farmers' deliberate selection of appropriate crops and livestock, in part based on their environmental setting (Rippon *et al.* 2014).[6] Additionally, medieval communities dealing with crises seem to have been acutely aware of the need to carefully select crops and organise agricultural regimes to suit local conditions (Rippon 2001: 27-31).[7] Relatively simple decisions relating to arable and pastoral farming, therefore, such as what crops to grow, which animals to rear and where best to carry out these tasks, were fundamental to the economic prosperity of the individual and/or community and, as such, were also key to minimising potential risks.

Land was central to McCloskey's view of medieval insurance—it provided the means to support oneself, both for subsistence and through the production of a surplus that could be saved and sold. Sufficient land-holdings to provide for these requirements, therefore, afforded tenants a significant buffer against slipping into poverty. According to Braid (2010: 362), the sale of accumulated land holdings was instrumental in the survival of many during the Great Famine. When land-holdings were insufficient to raise sufficient capital, however, tenants became very vulnerable. The occurrence of such problems rose starkly from *c.*1290, when population in England reached its medieval zenith. Growing morcellation of land-holdings as more people sought to own the same amount of land meant that tenants, especially at the lower end of the scale, were forced to eke out a living from ever smaller parcels of land (Campbell 2016b: 182-191). Between 1279-1332, 50% of the rural peasantry

[6] It should be noted, however, that more detailed comparisons at the macro scale are hindered by the small size of the majority of existing archaeobotanical datasets as well as the limited number which contain weed seeds—as the ecology of different weed species are key to investigating different agricultural strategies (Van Der Veen *et al.* 2013: 171-172).

[7] This is discussed in greater detail in Chapter 4.3.

occupied holdings of a size which was unable to sufficiently provide for a family (Dyer 2012: 43). As a result of such pressure, it is unsurprising that when environmental and social shocks occurred during the early 14th century spikes occurred in both the rate of land transactions, as those unable to support themselves were forced to sell, and crime, as those pushed to a tipping point were left with no where else to turn (Campbell 2016b: 192-196; fig. 3.18). Although land did provide security, there were certainly those who were unable to take advantage of, or forced to give up, its benefits.

Although holding land provided security and insurance, even those who did hold land could ill afford to be complacent about their ability to ride out a crisis. There were many other ways in which medieval communities could provision themselves against future risks. An important aspect to any such strategy was the storage and stockpiling of resources during times of plenty to see out times of need. While McCloskey argued that grain storage was a rare and prohibitively expensive practice (McCloskey & Nash 1984), a growing body of evidence demonstrates that grain storage was, in fact, common (Claridge & Langdon 2011). Although the underground silos common in the Mediterranean world and prehistoric Britain are unknown in the medieval period (Gardiner 2013: 34), evidence from both the historical and archaeological records attests to the different types of structures which provided storage space for agricultural produce. Simple stacks, for example, provided a method of drying and storing hay, corn and sometimes cereals—although these were usually used only for short periods rather than for long-term storage (Gardiner 2013: 24-25). Barns provided an indoor space where produce could be dried and stored. The form of these structures is relatively well known. Some have survived as standing structures into the present—as is the case with the four monastic barns of Glastonbury Abbey which remain standing in Somerset considered by Bond and Weller (1991). Within these structures, which in some cases exceeded 40x9m, produce would typically have been stacked from ground level to the eaves—with the space above providing additional capacity when required (Bond & Weller 1991: 83-85). In some cases barns were reserved for the storage of specific crops—as was the case at the preceptory of the Knights Templar at Cressing Temple, Essex, which had separate barns for wheat and barley (Brady 1997: 80-81). There are difficulties in estimating the precise capacity of such barns (Bond & Weller 1991: 85), however, and, in any case, the size and magnificence of some barns was related to the social status of their owners, constructed as shows of conspicuous consumption, rather than to meet storage requirements (Brady 2018: 266-268). The main function of barns was to provide a space where crops could be dried and threshed after which, produce was typically moved either to a specific area of the barn or to a separate granary (Brady 1997: 81). These structures, which were often supported by wooden posts to keep the contents off the ground and free from damp, are known through the historical record (Claridge & Langdon 2011: 1251-1252) and, although relatively rarely encountered, also through the archaeological record (Claridge & Langdon 2011: 1244-1245; Gardiner 2013: 32-34). Gardiner (2013: 32) suggests that the relative scarcity of granary structures on medieval sites in England may be explained by the fact that on many smaller farms storage was probably achieved in chests or large jars rather than dedicated granary buildings.

Distinguishing between barns and granaries and other functional structures archaeologically is not an easy task. In rare cases this is facilitated when archaeologists have happened on barns or granaries that had burned down with their contents preserved *in situ* (*eg.* Ruas *et al.* 2005). This, however, hints at one of the risks associated with stockpiling—that large quantities could be lost in one-off incidents.[8] Without the *in situ* preservation of the contents, distinguishing barns or granaries from other types of structure based on archaeological evidence poses a challenge (Gardiner 2013: 29). This point is reinforced by a trawl of developer-funded grey literature for medieval rural settlement in a specific English county, in this case Suffolk,[9] through which very few structures actively interpreted as barns or granaries are definitively revealed—with those that can be identified with certainty all standing buildings (*eg.* Alston 2013). However, many archaeological interventions in the county did encounter evidence interpreted as possible evidence for grain storage. At a site in Great Barton, for example, the excavators suggest that the high numbers of burnt grains suggest grain was dried in preparation for storage (House 2017: 66) while at Hadleigh Quarry analysis of the grains recovered through environmental sampling suggested some may have become spoiled during storage (Sommers 2016: 32). Additionally, at a number of sites investigated through excavation, the evidence was interpreted as relating to possible barn or granary structures such as the large post-pad, interpreted as a possible barn roof support, at Chevington Hall, (Gill 2004: 6), the 'barn-like' structures at Cedars Park, Stowmarket (Mundin & Woolhouse 2006: 27; fig. 2.1: A, B) or the posthole alignments, interpreted as evidence for granaries, at Stoke Road, Clare (Brooks 2015: 36-37; fig. 2.1: C) and Sizewell Wents, Leiston (Gill *et al.* 2013: 25-26; fig. 2.1: D). While identifying storage structures is itself problematic this does not, in itself, shed light on exactly how these structures were used (Bond & Weller 1991: 83) or to what extent storage was a ubiquitous part of medieval peasants' daily lives. Gardiner (2013: 34-35) cites the transition from subsistence agriculture to market-oriented cash cropping as an important factor behind the development of storage infrastructure while, additionally, the rise of powered milling made it more efficient to accumulate large quantities of grain which could be milled in a single episode, rather than milling small quantities by hand on a daily basis as had previously been the norm. While adequate stores of agricultural produce would undoubtedly have provided a buffer against the threat of harvest failure, such considerations suggest that this may not always have been the primary motivation behind storage.

When reserves of agricultural produce proved insufficient to see out a crisis, some relief could be found through alternative foods (Gerrard & Petley 2013: 1070). Peasant houses would have,

[8] Indeed, not only were barns and their produce destroyed by natural disaster, another example of which comes from the coastal floods that struck the English Fenland in 1338 (Dugdale 1662: 254), stockpiled resources also created a draw for would be thieves, as occurred at Shapwick in 1595 (Gerrard 2007b: 995).

[9] This search included all sites with medieval evidence (AD 1066-1539), located outside medieval towns, which had seen an archaeological intervention since November 21st 1990 (the introduction of PPG16) and had been entered into the County Council Archaeology Service's Historic Environment Record by October 2017.

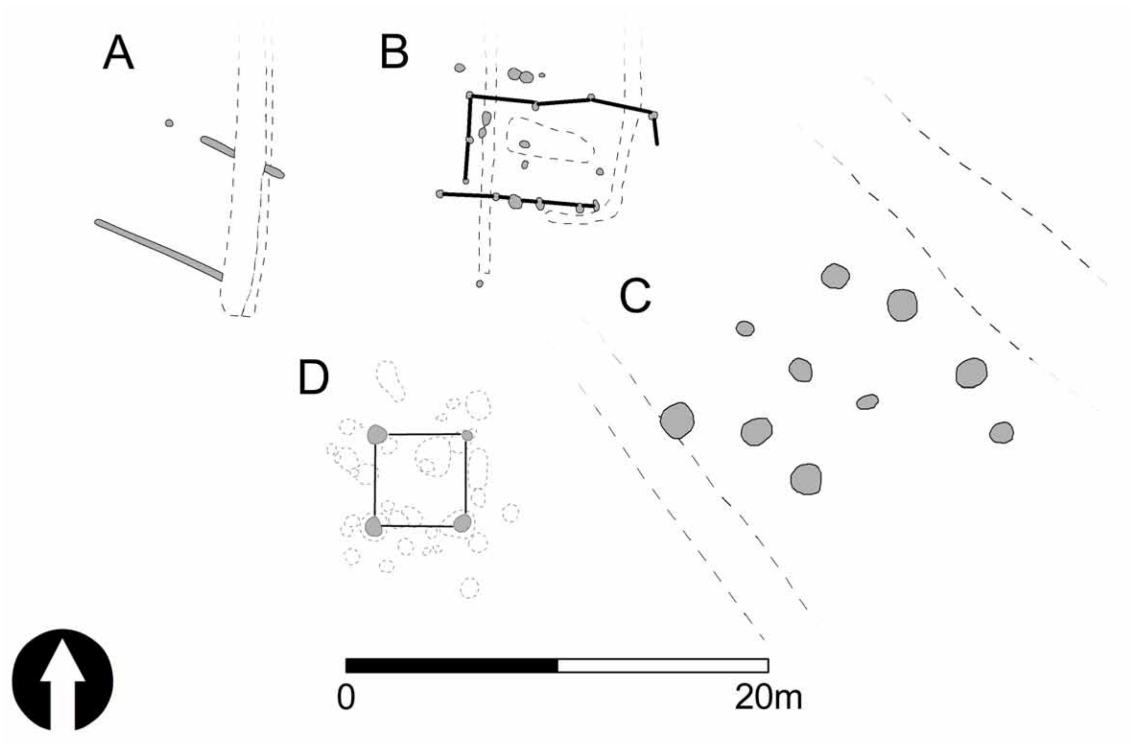

Figure 2.1: Examples of excavated medieval structural evidence from Suffolk interpreted as possible grain storage structures. A and B: Structures 2066 (also listed as 2060) and 2185 from Cedars Park, Stowmarket, interpreted as the remains of 'barn-like' structures with possible grain storage functions. C: Posthole group G0375 interpreted as the remains of a possible granary structure at Stoke Road, Clare. D: Posthole group 0468 interpreted as the remains of a possible granary structure at Sizewell Wents, Leiston. Redrawn by the author after Mundin and Woolhouse (2006: fig. 5), Brooks (2015: 24, fig. 7) and Gill *et al.* (2013: 24, fig. 9).

invariably, had at least a small area of ground set aside as garden in which fruits and vegetables could be grown to augment the staple crops and, in times of dearth, this produce would have increased resilience—although it would probably have been insufficient to act as a fall-back for any length of time (Dyer 2006: 36-38). Such gardens are widely attested by the archaeological record; returning to rural medieval sites in Suffolk, medieval contexts interpreted as relating to gardens or orchards were encountered at Moat Farmhouse, Dennington, (Newman & Boulter 1997), Spexhall Manor, Spexhall, (Sommers 2002: 4) and Church Street, Peasenhall, (Gardner 2005: 20-21)—the latter of which fell within tenement boundary ditches dating to the 13th or 14th centuries. According to Gerrard (2007b: 987) the evidence at Shapwick, Somerset, suggests that many of the tofts contained open areas of pasture, vegetable garden and orchards which must have provided the inhabitants with a valuable and varied source of sustenance. The lack of material culture or structural evidence associated with such remains, however, and the fact that, typically, only small areas are uncovered within the limits of archaeological trenches, means that accurately dating or revealing the full extent of these features is rarely possible. Moreover, the scarcity of waterlogged or carbonised plant remains from medieval rural sites, at least in Britain, limits the extent to which archaeobotanical evidence can shed light on the types of crops grown in such settings—particularly in the case of fruits and vegetables (Van Der Veen *et al.* 2013: 164, 173).

Where the produce from such open areas proved insufficient, however, as was presumably the case under severe famine conditions, scarcity bred desperation driving people to search for sustenance from any available source. During a famine in Novgorod, Russia, in 1230 for example, a local chronicle reports that people were forced to eat moss, snails, pine-bark, lime-bark, lime and elm-tree leaves, cats, dogs, horseflesh and even the flesh of other humans (Mitchell & Forbes 1914: 76).[10] The remains of foods identified as 'famine foods' are sometimes detected on archaeological sites, as in the case of limpets (*Patella vulgata*) at Eldbotle, East Lothian, which, as the excavators note, "are not commonly consumed as part of the human diet" (Hindmarch & Oram 2012: 283). However, beyond projecting modern or anthropologically derived views of certain foodstuffs onto archaeological remains, it can be challenging to make such interpretations. One possible interpretation of the mussel middens at the Sands of Forvie, Aberdeenshire, for example, was as a direct response to the environmental changes caused by wind-blown sand incursions, which could have had a severe negative impact on local agricultural production. On the other hand, the middens find a close parallel in the Iron Age and early medieval middens found in coastal Denmark where shellfish were gathered, processed and possibly preserved, on an 'industrial' scale as part of a specialised strategy (Noble *et al.* 2017). Evidently, it is challenging to differentiate between foods consumed as part of a

[10] It should be noted, however, that the more extreme references, such as to acts of cannibalism, may be cases of Biblical tropes being slipped into the reporting of contemporary events as was certainly the case in some 14th century sources documenting the Great Famine in England which also made mention of cannibalism (Marvin 1998).

routine diet,[11] or as a discrete response to a specific case of environmental stress or disaster.

As well as relying on resources—land, stockpiled agricultural produce or, *in extremis*, forageable famine foods—society itself also provided a safety net in a number of ways. Charity and support were available to those who fell on hard times through accident or illness (the deserving poor) through donations or financial assistance from local benefactors, while poverty deemed to be the result of idleness attracted universal condemnation (McIntosh 1988). Landlords and the exchequer frequently exercised leniency in the collection of rent and taxes in light of genuine difficulties experienced by tenants; when sea floods inundated land at Broomhill, Kent, in the early 15th century, for example, the tenant successfully petitioned the landowner, Christ Church Priory, for a reduction in rent (Draper 2007: 224). In some cases, however, failure to keep up payments meant forfeiture of land (Soens 2011: 349). Further help came from religious fraternities—lay guilds which were usually centred around the worship of a particular saint—which dispensed financial assistance to their members, and sometimes others, in times of need. Local laws enforced by manorial courts also frequently granted concessions to the poor such as the right to take peas growing in the fields or grain left behind in the field after the harvest (Richardson 2005: 406-409). The Church too provided assistance to the needy through almshouses, hospitals and charitable donations. Hospitals established to care for the ill, infirm and poor, known through the historical record, have been widely excavated; for example at Skriðuklaustur in Iceland (Kristjánsdóttir 2010) and throughout medieval England (Roffey 2012; Huggon 2018). Documents specify that certain hospital foundations were especially orientated towards caring for the poor (Hall 2006: 89-90), but, while the ill and infirm were often buried in the hospital burial grounds, the transient nature of the poor means that the evidence they left behind was more ephemeral. The bioarchaeological evidence, however, does attest to high levels of 'stress' among medieval populations. 35% of the individuals considered by Roberts and Cox (2003: 264-265)[12] exhibited evidence for enamel hypoplasia—a condition which relates to episodes of malnutrition, disease, vitamin A deficiency or emotional stress which are likely to correlate with poverty. Evidently, despite the assistance provided to the poor through various channels, many struggled to subsist at a comfortable level. As Dyer (2012: 67) has observed, the motivations behind medieval charity did not prioritise the elimination of such a level of poverty as charitable acts and bequests were largely driven by the desires of benefactors to accrue spiritual benefits, such as a shortening of the amount of time spent in purgatory, rather than to eliminate poverty through the most efficient means available.

One of the most important mechanisms for coping with risk was undoubtedly credit. Where otherwise profitable enterprises were disrupted by disasters or other unexpected events, credit

[11] Or, indeed, resources used for another purpose entirely; at Eldbotle Hindmarch and Oram (2012: 283) suggest the limpets may have been intended for use as fishing bait rather than human consumption. Another possibility is that they were primarily used as a flavouring rather than as a source of sustenance (C. Gerrard pers. comm.).

[12] This research considered the remains of 3,758 excavated individuals dating to the late-medieval period from across the UK.

offered a means by which short-term problems could be solved. Moreover, the knowledge that such lending would be available in the event of an unexpected disaster occurring must have affected how medieval people planned for the future and what measures they took to mitigate risk. Although such relationships do not leave a physical signature unless related documentation survives—which is rarely the case—credit was far from an alien concept during the Middle Ages. Those wishing to undertake a pilgrimage, for instance, could obtain financial assistance from groups such as the Knights Templar who issued 'letters of credit', appropriating the income from the pilgrim's lands for the duration of their journey (Stopford 1994: 66). Specifically relating to disasters, Dyer (*forthcoming*), based on the case studies of the 1483 floods at Henbury-in-Salt-Marsh, Gloucestershire, and the devastating fire of 1478 in Shipston-on-Stour, Warwickshire, has considered the importance of raising credit from wealthy speculators based on the value of the potential profits of agricultural land in order to recover from these catastrophes. Even in such comparatively well documented cases, however, there is no firm evidence for the credit relationships those stricken by disasters entered into. Despite the lack of concrete evidence, though, credit doubtless allowed individuals a good chance of recovery if a lender willing to bet favourably on the individual's chances of returning to profitability could be found.

While there were a number of ways by which medieval populations could guard against risk over the longer-term (months and years)—either averaging out risk spatially, through land holding and crop diversification, or temporally, through storage and the utilisation of credit—compared to modern society, medieval communities were relatively poorly equipped to deal with disasters over the shorter-term (hours and days). This is borne out in reference to fire disasters. Although these events were probably rarer than is often suggested, and medieval fire precautions were largely effective (Garrioch 2016), when fires did break out their effect was acute and responses were limited. Archaeology widely illustrates this fact through a variety of different forms of evidence. At Einbeck, Lower Saxony, for example, which was razed by fire in July 1540, well-dated evidence for widespread destruction has been excavated at many sites across the town (Heege 2005) while evidence for multiple damaging episodes of fire between *c.*1120 and 1476 have been excavated in medieval Bergen (Hansen 2015: 161). Damaging fires in major structures are ocassionally evidenced through scorched stonework; allowing not only an understanding of the fire's spread but also the reuse of, at least superficially, damaged fabric in later repairs—as is the case at Norwich Cathedral (Gilchrist 1998). Excavation of low-status domestic structures at Fuller's Hill, Great Yarmouth, (Rogerson 1976: 159) and Pennard, Swansea, (Moorhouse 1985: 5), on the other hand, provide archaeological evidence for the effects of fires which appear to have been caused when storm winds, and perhaps aeolian sand, caused structures to collapse in upon open hearths. It is clear from the destruction such fires caused that extinguishing them was no easy task. The historical sources reveal that when fires threatened medieval Bergen all available manpower was called upon to assist in bringing the fire under control (Hansen 2015: 159). This is further borne out by an episode from Keyingham, East Yorkshire, in which a lightning bolt struck the parish church, igniting a fire. The fact that the *ad hoc* fire-fighters, who must have volunteered immediately and instinctively, were actually able to extinguish the blaze was interpreted as a miraculous occurrence, made possible only through the intercession of a former rector, Philip Inglebard, whose tomb had been found to exude a sweet oil in the blaze which was later held responsible for a number of miracles (Bond 1868: 194-195). Thus, fire mitigation in the 'moment of disaster' was an extremely challenging task and for most categories of hazard an appropriate immediate response was even less obvious or available. Accordingly, the management of flooding (Galloway & Potts 2007: 376), grain shortages (Braid 2010: 348-351) and earthquakes in southern Europe (Figliuolo *forthcoming*), was reactive—taking place after the 'emergency' phase had passed and without the involvement of bodies resembling modern emergency services.

As this section has explored, medieval society was equipped with a relatively wide array of measures to combat the long term challenges that an unpredictable world could throw up. This was particularly the case concerning strategies against perhaps the most universal and familiar hazard—harvest failure. As Marston (2011: 195) has observed, the majority of these risk adaptive strategies have left little or no obvious traces in the archaeological record with the important exception of grain storage and, to a lesser extent, reliance on 'famine foods'. The practices and concepts outlined above, however, are generally enmeshed in modern concepts of risk and reward, and, while medieval people demonstrably participated in this system—and must have well understood the risks and potential gains—they are unlikely to have conceptualised the dangers of the world, and the methods to mitigate against them, from the same viewpoint or in the same terms as we do today. Therefore, it is important to consider how medieval people interpreted disaster beyond the cold calculations of economic cost, loss and potential profits. The next section of this chapter, therefore, considers the religious and, at times, superstitious framework through which disasters were interpreted during the Middle Ages.

2.2 Religious beliefs, superstitions and disaster

In terms of religion, although the majority of the medieval European population were Christian, widespread Jewish minorities existed with Muslim occupation to varying degrees throughout southern Europe (Catlos 2014) and other distinct groups such as the Pagans of Livonia (Selart 2015). By the 12th century, all of northern Europe had been officially converted to Christianity although Jewish and Pagan minorities persisted throughout the period and Pagan beliefs and rituals continued to be practised by nominal Christians—whether or not this was their intention. In any society, beliefs about natural hazards are built-up over the *longue durée* meaning that, despite the Christianisation of the continent, earlier beliefs represent an important facet to how people perceived these types of event during the Middle Ages.[13]

A wide variety of historical evidence relating to beliefs associated with extreme weather events and natural hazards exists from the Middle Ages.[14] At least from the early medieval period, connections between the weather and the supernatural became common in literary sources. The Icelandic Sagas, for example, contain numerous references to control over the elements through supernatural means (Mitchell 2011: 65-66) and later literature often contains references to earlier beliefs. In the 14th century chivalric romance *Sir Gawain and the Green Knight*, for example, the snowstorm and misty conditions which occur in the build-up to the tale's pivotal scene have been interpreted as references, conscious or not, to pre-Christian Celtic traditions of fairy magic—with comparable scenes found in numerous Irish folk stories, in which snow storms and, particularly, mist accompany magical and otherworldly experiences (Puhvel 1978). That, at least for some early medieval Europeans, magic in relation to the weather transcended folk stories and literature can be seen in certain primary sources. The 8th century Archbishop of Lyon, Agobard, for example, composed a treatise condemning the beliefs of the many among the laity who ascribed hail and thunder to the magic of *tempestarios*—those who conjure up storms through magic (Lewis 2001). Although the practice was not treated credibly by Church officials, such as Agobard who emphasised that only God could control the weather, clearly many of the lay population did believe in the efficacy of human magic over the weather.

Comparable beliefs persisted throughout the medieval period. In the widely circulated 13th century *Travels of Marco Polo*, for example, various ethnic and non-Christian groups, invariably described as idolaters, are ascribed the power to control or exert influence over weather and natural hazards.[15] Whether Polo himself[16] believed these anecdotes or included them merely to embellish the exotic and otherworldly nature of the far eastern lands he describes is unclear. Within medieval Europe itself, magical control of the weather was an ability which was commonly ascribed to witches. Until the 14th century, witches were often invoked as the progenitors of bad weather but from the 15th century this attitude made the transition from an oft repeated 'urban myth' to secular and ecclesiastical policy giving rise to organised and brutal persecutions of supposed witches (Behringer 1999: 345-346)—a phenomena which Behringer (1999) has linked to the climatic fluctuations of the Little Ice Age.

As Agobard's criticism of the laity who believed in weather magic demonstrates, not everyone understood hazards in the same way. While not a natural hazard *per se*, an analogy can be found in medieval debates surrounding the causation of eclipses. While the lay population invoked a wide

[13] Analogously, medieval Islamic scholars often drew on a combination of Islamic teachings and, perhaps without knowing, pre-Islamic traditions in their interpretations of earthquakes (Akasoy 2010: 390-391).

[14] This is discussed again in chapter 5.

[15] The "devilish enchantments" of the people of Kashmir, for example, included changing the weather and bringing on thick darkness (Latham 1958: 78) while Tibetan astrologers are described as having the ability to summon and halt thunderstorms on command (Latham 1958: 173-174). In addition, the Kashmiris and Tibetans employed by the Great Khan (Kublai Khan, who reigned from 1260-1294) were able to clear the skies above the Imperial Palace through "the arts of the Devil" (Latham 1958: 109-110).

[16] Or his co-author Rustichello da Pisa.

variety of demons, magicians and monsters to explain their occurrence, resorting to shouting and panic when an eclipse actually happened (Bartlett 2008: 57-59), the educated classes were aware that eclipses were a predictable natural occurrence—although many still believed that eclipses were miraculous occurrences and/or portents of future events (Bartlett 2008: 62-69). While the ultimate predictability of eclipses convinced some medieval learned men that they were natural events, this appears to have been less the case with unpredictable random events such as storms. Although the oft cited 7th century chronicler Isidore of Seville described storms chiefly as natural events: "storms are created out of a confluence of opposing airs at the midpoint and change of these two seasons [spring and autumn]" (Barney *et al.* 2006: 276), even before his time storms had been connected to the devil and despite official attempts to stamp out these beliefs (Filotas 2005: 95), they persisted into the later Middle Ages—as Marco Polo's descriptions of the magical abilities of various foreign magicians demonstrate. The 13th century encyclopaedist Vincent of Beauvais, for example, described storms as the result of turbulence caused by airborne demons who fell to Earth along with the Devil after being expelled from heaven by God (Bellovacensi 1624: 306). This belief is repeated in other literary sources such as Jacobus de Voraigne's mid 13th century compilation *The Golden Legend* (Ryan 1993: 288) and the writings of later churchmen such as the 15th century preacher Vincent Ferrer's *Sermones Aestivales* (Ferrer 1572: 175). The logic to these beliefs was that the demons had the power to destroy the earth and were only prevented from doing so by God's protection. When a storm occurred, it was not sent by God but God did allow it to happen by choosing not to intervene and prevent the onslaught of the demons. This reluctance on the part of God, which allowed storms to occur, was often interpreted as a punishment for previous sins committed.[17]

Demonic apparitions, referencing their causative role, are widely reported by medieval writers describing extreme weather events. In the chronicle of John Stone, a monk of Christ Church Canterbury, for example, the damage to the belfry in a storm in 1458 is ascribed to the work of evil spirits (Searle 1902: 74). *The Chronicle of Lanercost* reports how during a thunderstorm in York an evil eye was seen within the thunderclouds and the yells of demons were heard screeching through the air (Maxwell 1913: 103). At St Albans in 1251 during a storm, a flaming sword was seen waving about while thunder and murmurings were heard. This caused the onlookers to make the sign of the cross, invoke the holy ghost and chant hymns which caused the storm to pass (Giles 1953: 466). The *Chronicle of Melrose* describes how in 1165 a storm arose in Yorkshire in which the devil was sighted in the form of a huge black horse. Accompanied by thunder, lightning and hail this horse galloped out into the sea but left behind enormous hoof prints, one of which at Scarborough remained visible for at least a year (Stevenson 1856: 130). A similar account from

[17] This can be seen in chroniclers accounts of disasters; in the case of the Great Famine, some chroniclers' accounts specifically discussed the poor weather that exacerbated the scarcity of food (Jordan 1996: 22), as well as rapid onset hazards such as the storm of 1362 (Schmidt 2011: 176-177).

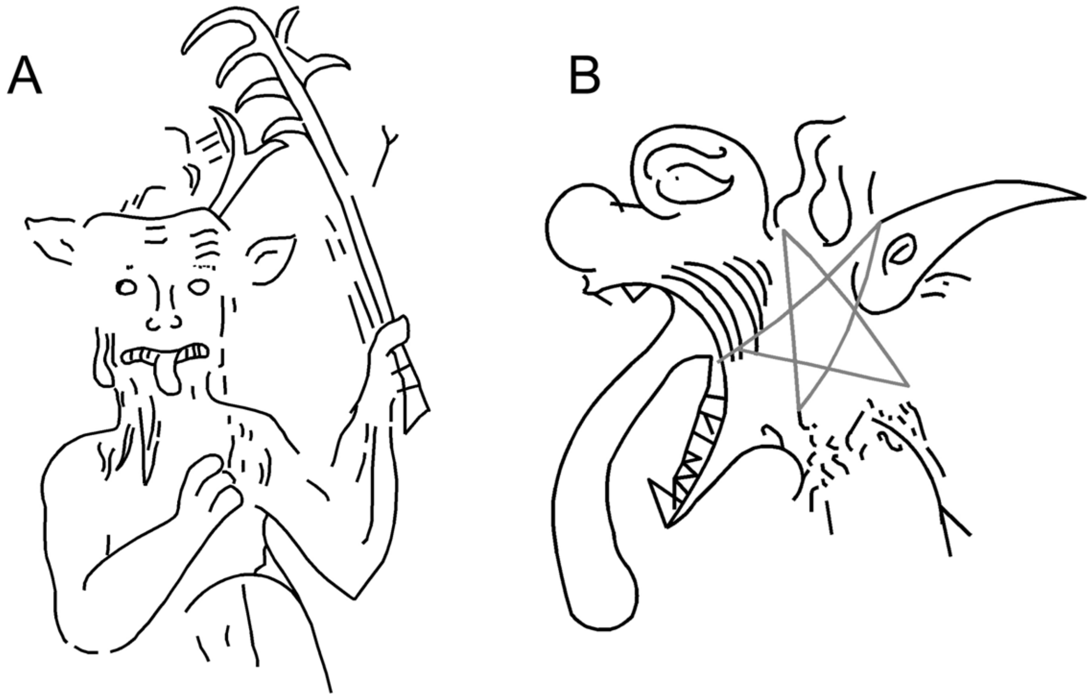

Figure 2.2: Medieval graffito inscriptions depicting demons. A: Demon inscription from Beachamwell St Mary, Norfolk. B: Demon inscription from Troston St Mary, Suffolk, 'cancelled out' by the later inscription of a five-pointed star. Redrawn by the author after Champion (2014: 248, fig. 105; 2015a: 114-115). Scales not given.

1205 is given by Ralph of Coggeshall in which, in the aftermath of a storm, hoof prints were discovered which were attributed to a demonic presence (Stevenson 1875: 155-156). That some of these traditions may have had material inspirations may be suggested by a legend from Lancashire in which prehistoric archaeological features, rock art, a cairn and a cup-marked stone, may have contributed to a local legend in which these marks were attributed to the footprints of the Devil (Barrowclough & Hallam 2008). Such traditions persisted beyond the Reformation as, during a thunderstorm in 1577, the appearance of a demonic black dog was reported at the churches of Bungay and Blythburgh, Suffolk. The dog was reported to have killed five of the parishioners and left burn marks on the doors of the church at Blythburgh as a reminder of its appearance (Stubbs 2011: 37-61). That demons were the root cause of storms, as well as other unwelcome occurrences, certainly appears to have been a widespread belief (Hanska 2002: 128) and, as a variety of material and artistic evidence demonstrates, figured prominently in the imaginations of contemporaries. Examples come from graffito inscriptions depicting demons found in medieval church settings, such as at Beachamwell St Mary, Norfolk, and Troston St Mary, Suffolk (see fig. 2.2), which provide a pictorial representation of medieval fears for the harm that demons could cause in the temporal world. Fears of such destruction were so great that numerous superstitious practices, discussed in chapter 5, were relied upon widely to prevent the harm wrought by these malevolent forces.

Certainly in the case of some events the belief that disasters were 'acts of God'[18] seems to have been at the forefront of the minds of many. This is widely seen in historical sources describing a high magnitude windstorm which struck England in January 1362 (discussed in detail in chapter 3), The *Eulogium Historiarum* states that "it was believed by some [the storm] was a scourging from God" (Haydon 1863: 229) presumably as a punishment for sins. This view is echoed in the contemporary poem *Piers Plowman* in which the St Maur's Day Storm is described as a punishment for "pride and for no point else" (V: 15; Schmidt 2011: 176-177). For an anonymous chronicler of Canterbury, the storm was sent by Satan, and presumably purposefully not deflected by God, as a warning against holding a joust which had been scheduled to take place two days later. Until 1316, jousting had been banned by the Church, seen as a sinful pursuit which distracted militarily-able men from crusading—for which the participants were thought to be guilty of all seven deadly sins (Barker 1986: 70-83; 95). Although by 1362 the ban had been lifted, evidently jousting had failed to shake its sinful image. In this particular joust, which took place despite any protests, the participants seem to have provocatively embraced orthodox disapproval by outfitting themselves in attire symbolising each of the seven deadly sins they were thought to be committing (Tait 1914: 151). A somewhat comparable near-contemporary situation can be seen during the flooding of Cologne in 1374 when the inundation of the town led to the cancellation of a planned carnival which was replaced with "public litanies and processions in honour of God and the Saints" (Rohr 2007: 94). In this case, ecclesiastical authorities seem to have been motivated by the presence of the floodwaters to prevent sinful behaviour, such as alcoholism and sexual misconduct which were probably common at carnival celebrations, instead replacing it with acts of communal piety to appease God, who would hopefully speed the return of floodwaters to their normal bounds.

Clearly human behaviour could provoke God's wrath and, accordingly, disasters were frequently blamed on the behaviour, beliefs or practices of specific groups. Those most frequently linked to disasters in this way were Jews and homosexuals. In *c.*1020, for example, the French chronicler Ademar of Chabannes reported the execution of a group of Jews held responsible for bringing on an earthquake in Rome through their irreverent attitude to a crucifix (Pertz 1841: 139). Comparably, in 1311, James II of Aragon brought charges against Count Pons Hugh IV de Ampurias for alleged acts of sodomy as "such criminal, vile, and horrid [deeds] . . . [cause] earthquakes, famine and pestilence" (Brundage 1993: XVII). These beliefs transcended the medieval period and were exported beyond Europe during the post medieval period.[19]

Despite the view that disasters were punishments from God which is widely gleaned from the historical sources, it must be noted that estimating to what extent such beliefs were representative

[18] Either specifically orchestrated by God or allowed to occur through his decision not to prevent them.

[19] The Portuguese missionary Gaspar da Cruz remarking on the 1556 earthquake in Shaanxi Province, China, for instance stated that "because this sin is common among them, God was willing to send them a grievous punishment" (Boxer 1953: 223). The sins to which da Cruz is referring are 'unnatural vices' a term coined by Aquinas (*Summa Theologica*, II-II, Q.154, Art. 11) comprising bestiality, homosexuality, improper intercourse and masturbation.

of the medieval population as a whole is a considerable challenge. Typically, the available sources emanated from institutional, official or high status voices which may not reflect more popular views—such as those about whom Agobard of Lyon bemoaned—which were coloured by superstition and folk-beliefs. Chroniclers' accounts of disasters are often filtered through a layer of religious interpretation which often exaggerates or distorts the facts. In some chroniclers' descriptions of the Great Famine of 1315-1322, for example, details derived from the Biblical account of the Samarian Famine were intermixed (Marvin 1998) while the English chronicler Matthew Paris,[20] interpreted events in comparison to those he knew through biblical and classical texts. In his *Historia Anglorum*, for example, in two accounts of English floods[21] (Giles 1954: 175, 212) he references Deucalion, the ancient Greek equivalent of Noah. This comparison was also made by the 15th century humanist Enea Silvio Piccolomini[22] in his description of the destructive floods in Bavaria and Austria in 1445 (Rohr 2007: 98). Rohr (2007: 100) interprets the use of this analogy, and similar terminology derived from other classical sources and the Bible, as indicators of the unreliability of these sources which essentially paraphrase earlier texts rather than providing specific details relating to contemporary events. Whilst revealing a potential source of inaccuracy in the documentary record, such references do highlight the interpretive framework through which ecclesiastics interpreted the occurrence of disasters.

The lack of evidence for popular perceptions of natural disasters is paralleled by popular views of other contemporary issues. Discussing the crusades, for example, Ward (1992: 119), cautions that the lack of documentation for popular opinions "should not blind us to the causative role played by popular ideas and groups". Nonetheless, Church teachings undoubtedly greatly coloured the way that ordinary people thought about natural hazards. Disasters featured prominently in Biblical stories such as the Flood of Noah, the plagues of Moses as well as widely throughout the lives of the Saints. In addition, catastrophes were also predicted to signal the coming of the Day of Judgement. To medieval Christians, this meant that the occurrence of a flood, storm or earthquake came with the additional fear that such an event merely presaged worse to come. According to one tradition which gained popularity during the later Middle Ages, the Day of Judgement was to be heralded by 15 days each with its own 'sign of doom' which included a great flood, earthquakes, and the burning of the world by fire (Powell 2004: 310-316). These apocalyptic beliefs were communicated to the lay populace through a variety of mediums including theatre, stained glass, sermons, verse and texts (Powell 2004: 293). The Pricke of Conscience Window in All Saints' Church, North Street, York, for example, which dates to 1410-1420, originally contained 15 scenes accompanied by text explaining the arrival of the Day of Judgement and the various natural hazards that would occur

[20] b. 1200 d. 1259.

[21] In 1256: "Piles of bridges, stacks of hay, the huts of fishermen with their nets and poles, and even children in their cradles, were suddenly carried away, so that the deluge of Deucalion seemed to be renewed", and in 1257: "On the Innocents' day [28th December] in this year such a quantity of rain fell that it covered the surface of the ground, and the times of Deucalion seemed to be renewed".

[22] b. 1404 d. 1464.

Figure 2.3: Two of the scenes in the Pricke of Conscience window at the church of All Saints', North Street, York, which depict natural hazards. Left: flood and burning sea. Right: damage caused by an earthquake. Photographs by the author.

on each day (Powell 2004; see fig. 2.3). With such ideas widely circulating, it is understandable that for many lay people, natural hazards were terrifying not just because of the short-term danger they spelled but also because of their fearful eschatological connotations.

In the same way that the Day of Judgement was to be presaged by disasters, advance warning of the occurrence of hazards was also often thought to be presaged by environmental anomalies. Between 1315-1317 for example, the passing of a comet, 'bloody' rain, an eclipse and two earthquakes were all taken as portents of the Great Famine (Jordan 1996: 22-23). In the case of the windstorm of January 1362, although no contemporary explicitly made the connection, we can imagine that, in hindsight, the eclipse, 'bloody' rain and appearance of a cross of blood in the air reported in the previous year (Hearne 1731: 425-426) would have similarly coloured perceptions of the January gale. To contemporaries, such celestial anomalies and miraculous apparitions were far from coincidental. The literary composition of these disturbing occurrences is somewhat formulaic with strikingly similar occurrences—for example, an eclipse, a comet, hurricanes and floods, immediately presaged the First Crusade in the 1090s (Ward 1992: 121-125). Excluding some of the more fantastic visions, many of these events may have actually occurred but their interpretation as signs of greater calamities to come followed a biblical trope connected to the Book of Revelations and the Apocalypse (Ward 1992: 108).

That such signs were actively interpreted as harbingers of impending disasters, rather than merely signs which could be interpreted in hindsight, is demonstrated by the non-event of the 'universal flood' of 1524. Following the publication, in 1499, of news that a 'grand conjunction' in the stars would take place in 1524 a popular perception, fuelled by printed pamphlets—such as the astrologer Johannes Carion's *Prognostico* (Carion 1521; see fig. 2.4)—gradually developed which held that 1524 would be accompanied by calamities, social unrest and a universal flood. The prognostication gripped contemporary populations with such fervour that some in Italy and Germany began to consider constructing 'arks', while in late 1523 others fled to the countryside

Figure 2.4: A depiction of the flood widely predicted to occur in 1524 from the title page of Johannes Carion's *Prognostico* (Carion 1521), printed in Leipzig in 1521 (VD16 C 1030. Available at `http://mdz-nbn-resolving.de/urn:nbn:de:bvb:12-bsb11216313-5` [Accessed 10/11/2018]. Reproduced under Europana Licence: No copyright - Non commercial use only).

and the mountains to escape the fated disasters—which of course never came (Schoener 2007). The flood of 1524 though, attests to both the medieval belief in the interconnectedness of the celestial system with terrestrial natural hazards as well as, from the mid 15^{th} century, the power of widely circulated printed pamphlets, which people presumably accepted as reliable sources of information, to shape public opinion.

As well as being perceived as possible harbingers of the apocalypse, medieval theology also made natural disasters events worthy of additional fear. While anxiety for the safety and survival of oneself and one's family and friends is a natural concern during the moment of disaster, medieval Christians were also lumbered with additional concern for their eternal soul. As Daniell (1997: 65-71) has explored, death by natural disaster was a particularly problematic end to befall a medieval Christian; certain hazards singled out unlucky individuals as particularly deserving of a heavenly punishment, as in the case of death by a lightning strike or death by drowning, and were reserved, almost exclusively, for non-Christians in medieval literature. In the most severe cases, hazards, such as severe floods, earthquakes or fires, entirely removed the body from circulation preventing proper burial and the administration of last rites. Such unfortunate occurrences were believed to interfere with, if not totally prevent, the soul's ascension to heaven.

Although, as the evidence and considerations discussed above demonstrates, disasters were widely conceptualised as events orchestrated from on high, they were also sometimes seen as entirely natural occurrences. Floods and storms for example, were certainly not always interpreted as anything beyond routine nuisances. At Adstone, Northamptonshire, the everyday annoyance of such occurrences is reflected by the fact that, in 1410, the Pope responded to a petition from the parishioners asking for a baptismal font to be installed and cemetery to be consecrated near the town, as the closest of these important facilities, located about a mile away at the Augustinian monastery of Ashby, were frequently inaccessible due to floods and storms (Bliss & Twemlow 1904a: 229)—a request which contains no overbearing theological interpretation. Similarly, certain bridges, such as those at Godalming and Cobham, Surrey, were especially intended to provide crossings during times of flood, and indeed were only open to the public when the depth of water prevented passage by nearby fords (Malden 1911: 24-25, 442). In these cases, clearly the risk of flood was both frequent and well appreciated, so much so that the provision of contingency crossings was seen as necessary and worthwhile. Such interpretations are also reflected in descriptions of natural hazards found in contemporary literature. In a 15th century Welsh poem by Lewys Glyn Cothi, describing a flood on the River Tywi, although reference is made to religious figures including St James, Noah, St Peter and God himself, the flood is not interpreted as divine retribution and the author only invokes God's help by asking him to "place a bridge over the River Tywi" (Griffiths *et al.* 2017: 98-103), thus clearly accepting the everyday nature of the flooding, which could be expected to be a recurrent problem into the future.

Here we might also consider natural explanations for disasters which were, nonetheless, untrue. While not perceived as a case of divine retribution, the multitude of forest and urban fires which sprang up across central Europe during the 'mega-drought' of 1540 sparked a wave of paranoia around the suspected covert operations of *Mordbrenner*, or clandestine arsonists. The conflagration in the Protestant town of Einbeck, for example, which resulted in over 300 deaths, was immediately seen as a Catholic plot creating a climate of fear and alarm in neighbouring towns. Correspondingly, mysterious marks on doorways were interpreted as secret arsonist codes, extra guards were appointed and possible arsonist hiding places were scoured (Pfister 2017: 159-161). Despite the contemporary conviction that a plot existed, this has largely been dismissed by historians who have argued not only that starting fires against the Protestants would not have matched Catholic interests (Stopp 1970: 205) but also that the widespread occurrence of fires finds a more convincing explanation in the unprecedented drought (Pfister 2017: 164-165) which caused what may have been the driest summer in many parts of Europe in the last millennium (Wetter *et al.* 2014). As Pfister (2017: 184) concludes: "conspiracy theory directed against political opponents offered a means of explaining the seemingly inexplicable".

Offering explanations where no easy one existed was perhaps what united the various explanations for the occurrence of disaster considered above. The exception are those events which were treated as routine natural occurrences but the majority of these were not really disasters—they were low-magnitude, reasonably predictable and, therefore, expected natural hazards. High magnitude unexpected events which caused disasters, on the other hand, were not explicable merely as natural events. Establishing that medieval Europeans believed that disasters were more than simply natural events is important because misidentification of the factor(s) behind the occurrence of a hazard affects how people prepare for, and respond to, such events. Such unpredictable, extreme events provided fertile breeding ground for the development of superstitions and fears. When actions were taken against these poorly understood calamities they were frequently ineffective due to a misunderstanding of the problem. Precautions against plague, for example, were influenced by incorrect identifications of the vector by which the disease was spread (Slack 1988: 433-439). Similarly, in common with meteorological hazards as discussed above, supply and harvest problems were often blamed on scapegoats such as Jewish communities (Anderson *et al.* 2016) and periods of climatic instability seem to have resulted in an increase in witch hunts (Behringer 1999). Such misidentifications of the root causes of problems combined with both the fact that preventative actions rarely seemed to offer long-term safety and the prevalent belief that God allowed or prevented the occurrence of disasters, created an environment in which, for many, a wide array of ritualistic behaviour seemed necessary and logical in order to gain protection against the manifold dangers of the world.

2.3 Summary

As this section has explored, risk was an inevitable part of the lives of medieval populations for which, to some extent, they were prepared. There were a number of well-established strategies medieval people could follow to reduce their vulnerability to the hazards that could be foreseen occurring during an average year. The accumulation of land, maintenance of adequate grain reserves and adherence to best agricultural practice—by rotating crops and, perhaps, scattering holdings—were all important considerations to minimise the chance of harvest failure and/or mitigate its consequences. At the same time, however, those truly disastrous events—high-magnitude and unprecedented natural hazards—which nobody saw coming sat somewhat removed from the natural world. Their occurrence was difficult to explain through natural means and could, therefore, only be explained through resort to supernatural means—punishments from God, indicators of the coming Judgement or the mysterious magic of malevolent groups. Accordingly, to protect against these types of events practical measures alone were insufficient. Of course, after a high magnitude event had occurred, and where high-magnitude events were not 'one-offs',[23] practical measures might be taken to guard against any future recurrence. The following three chapters explore this interplay between, on the one hand, the occurrence of high-magnitude natural hazards, detailed case studies of which are considered in Chapter 3, the practical measures taken to mitigate and protect against their occurrence, in Chapter 4, and the religious and superstitious practices believed to provide additional protection, in Chapter 5.

[23] As in the case of recurrent North Sea storm surge flooding over the late 13th and 14th centuries.

Chapter 3

A litany of disasters

In this chapter, a number of case study events are selected and explored in detail. These events are chosen for a number of reasons. Some have been chosen as they are attested by numerous and high resolution data sources, allowing a particularly deep exploration of the occurrence of the event(s) and their aftermath. Others illustrate the types of impacts caused by particular hazards or the limitations of the surviving historical and material record. Although an argument could be made for preserving the comparability of the events analysed by choosing a specific type of hazard, region or type of impact, a number of different types of hazard have been selected allowing 'natural disasters' as a broad category to be examined. To this end the selected events cover different types of hazard, different areas of effect and different scales of effect, both geographically and temporally.

Throughout the remainder of this thesis, different aspects of these events will be examined, explored and compared in order to, as fully as possible, understand the various ways in which human society was affected in the wake of natural disasters.

3.1 The storms and floods of 1287/88

During the winters of 1286/7 and 1287/8 a particularly severe series of storms caused dramatic flooding on the east coast of England as well as in the Low Countries. The sources which describe these floods invariably speak of "*venti vehementia quam maris violentia*"[1] (Ellis 1859: 268) which caused damage to buildings—"*prostrata sunt aedificia*" (Ellis 1859: 268)—in addition to severe casualties amongst both people and livestock—"*homines innumerabiles et jumenta pariter infinita submersit.*" (Luard 1869: 312). Although such storms are a recurrent feature of the North Sea basin and many comparable examples are known from the medieval period (*eg.* Gottschalk 1971; Bailey 1991), the 1287/88 storms stand out in the historical record, and, as we shall see, there is a wide variety of material evidence which attests to their occurrence. The following analysis of these events will focus on England while making reference to their impact in continental Europe.

[1]Strong winds and violent seas

3.1.1 Historical background

The documentary evidence relating to this series of storms is relatively rich with descriptions in at least 15 different extant chronicles. The information they provide, however, is difficult to interpret; many fail to give dates at all and where these are included years and seasons can be unclear. Some events are only reported by a single source while equally, those that are mentioned in several sources may reproduce errors copied from a single incorrect source. These are all common concerns with this type of source material (Gottschalk 1971: xiii; Brázdil *et al.* 2005: 373-374), but despite these issues useful information can still be extracted. Many of the sources appear to discuss the same events—with the majority recording storms on 1st January 1287 and 4th February 1288 but there is also some disagreement. For example, the *Chronicon of Thomas Wykes* mentions a storm on 1st January **1286** (Luard 1869: 308). This can be explained by the calendrical differences in use throughout the period which meant that there were up to 12 different dates from which the new year could be counted (Cheney & Jones 2000: 8-9). Wykes probably used the system whereby the new year was counted from 25th March rather than 1st January meaning that, by modern reckoning, his 1st January 1286 corresponds to 1st January 1287. Correction for these differences brings the majority of the dates given by the chroniclers into agreement (see tables 3.1 and 3.2).

One of the most detailed accounts comes from John of Oxnead, a contemporary chronicler, who records four storms: one on the feast of the holy circumcision [1st January] 1287, one on the 12th January 1287, one on 7 kalends January 1288 [December 26th 1287] and one on the 4th February 1288 (Ellis 1859: 268-271). The storms on 1st January, 4th February and to a lesser extent 26th December are mentioned to some degree by most of the other English sources (summarised in table 3.1) including the *Annales de Wigornia* (Luard 1869: 493), the *Annales de Dunstaplia* (Luard 1866: 338), the *Flores Historiarum* (Luard 1890: 68), Gervase of Canterbury (Stubbs 1880: 293), the continuation of the *Chronicon ex Chronicis* (Thorpe 1849: 237-239), the *Chronicon of Thomas Wykes*[2] (Luard 1869: 308-312), *Bartholomæi de Cotton* (Luard 1859: 167-168), the Hagnaby Abbey Chronicle (Owen 1986: 61-62) and the *Chronicon Abbatie de Parco Lude* (Venables 1891: 19).

On the other hand, the evidence from continental Europe shows only limited correlation with the English sources. The Belgian *Annales Floreffienses* record floods in Zeeland, Frisia and Holland at some point during 1287, providing no date, but no storms are mentioned in 1288 (Pertz 1859: 628). The contemporary German churchman Alexander of Roes on the other hand, describes a single flood in 1288 in the same areas, Zeeland, Holland and Frisia (Grundmann & Heimpel 1949: 72-74). This may be supported by the French *Annales Colmarienses Majores* which record strong winds in eastern France and terrible floods in Flanders responsible for 50,000[3] deaths on 2nd February

[2]Although Wykes also mentions another storm between 25th January–2nd February 1288. This date finds support in the *Annales Colmarienses Majores*.

[3]As noted in chapter 1, this number is certainly an exaggeration as it seems doubtful the chronicler would have had access to any accurate figures if these were even produced. High figures such as these were merely used by medieval writers to illustrate that a very high number had died (Ziegler 1969: 51-53).

and a thunderstorm on 4th February 1288 (Pertz 1861: 215). The anonymous continuation of the *Menkonis Chronicon*, from the Premonstratensian monastery of Bloemhof, present day Netherlands, describes in remarkable detail a flood on 14th December 1287 as well as storms at sea which wrecked many ships in the summer of 1288 (Pertz 1874: 565). The Dutch rhyming chronicle of Melis Stoke[4] records the 1287 December flood on the 17th[5] while the February 1288 flood is dated to the 5th (Brill 1885: 233-234). Clearly, this is a complex picture which is difficult to reconcile but when viewed in a tabular form (table 3.2), we can be sure that extreme floods struck the Low Countries in December 1287 and February 1288, although the precise dates are debatable.

Therefore, the historical evidence suggests that between 1287 and 1288 storms were limited to 4 months[6], with the most severe occurring in January 1287, December 1287 and February 1288. The 14th/15th August 1288 storm is only recorded by one British source (Owen 1986), which describes damage at Mablesthorpe, Lincolnshire, while the continental source in which a storm in August is mentioned only describes damage to shipping, failing to specify if any damage occurred on land (Pertz 1874: 565). This was probably, therefore, a less damaging event, although as severe conditions and structural damage are recorded in Lincolnshire, it is likely that similar conditions were felt at other locations along the east coast of England. As the evidence for this storm is sparse, however, it has been excluded from further analysis below.

The sources which record these events show a relatively high level of conformity (See tables 3.1 and 3.2). Gottschalk (1971: 261) argues that the 1st January 1287 event should be regarded as a calendrical error and must in fact have occurred in January **1288**. If this were the case, the storm would fit into the same season as the other two, or more, events but this scenario is unsupported by the documentary evidence which always presents the January 1st storm separately and before the accounts of the December 1287 and February 1288 storms suggesting it took place in the preceding winter. Further support for this comes from the records of Canterbury Cathedral Priory which record a meeting at Snargate, Kent, in 1287 at which it was decided a new sea wall should be built to protect against flooding at Holewest.[7] This work was to begin on 10th February and would be finished by Easter (Smith 1969: 170). Assuming the years have not been confused in all the chronicles as well as this document, this provides circumstantial evidence of flooding in January 1287.[8]

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[4] *c*.1235- *c*.1305.

[5] The same date given by Bartholomæi de Cotton.

[6] The only other extreme weather events reported over this period are a drought in 1288, which is mentioned in some of the English chronicles (Luard 1869: 495) and may also have affected Normandy (Golb 1981: 168-169), as well as a hail storm which fell in Lincolnshire on 10th July [sixth of the Ides of July] 1288 (Venables 1891: 20).

[7] Tatton-Brown (1988: 108) connects this place to an area within the parish of Dymchurch and suggests the wall in question was the precursor to a major sea wall still in existence in the 16th century which ran north from St Mary's Bay up to Palmarsh.

[8] It seems unlikely that the dates are incorrect as this would mean the work was to begin on 9th February 1288, the Monday during the octave of the purification. This would have been only *c*.5 days after the major storm surge of 4th/5th February but it seems unlikely that such a fast response, which would have involved organising the meeting, agreeing on when and where the work was to commence and who would carry it out would have been possible in such a short timeframe. If the storm had occurred at the start of the previous January however, this would have allowed a little over a month for this organisation to have been put in place which seems more realistic.

Only the events in December 1287 are difficult to reconcile—either this was a particularly stormy period with more than one event affecting different areas, which is perfectly possible (Gottschalk 1971: 262), or many of the authors were careless or ignorant as to the precise dates. The date given by *Bartholomæi de Cotton*, 17th December, matches that given by the Dutch chronicler Melis Stoke but Cotton's account of the event is very similar to the description of John of Oxnead, who gives the date as 26th December. Both chroniclers describe flooding at Hickling, Norfolk, and the deaths of *c.*200 which would support the interpretation that only one major flood occurred during this month.

The February 1288 storm appears to have had the greatest impact as it is reported by the most sources, both in Britain and the Low Countries. It should be remembered, however, that due to the occurrence of the preceding storms, which may have damaged existing sea defences, exacerbating the impact of future storms, it was not necessarily the event of greatest magnitude. As de Kraker (2015: 2680) points out in reference to flooding in the Netherlands, akin to communities hit by successive years of harvest failure, communities were rarely able to cope with extreme flood events occurring in quick succession as such rapid recurrence put their resilience strategies to "the highest test".

An important point is that a correlation can be demonstrated between the dates presented above and the phases of the Moon. The position of the Earth in relation to the Sun and Moon are what control global tides. When the Sun and Moon are in alignment, at a full or new Moon, tide levels are at their maximum.[9] In relation to the major storms listed above, during 1287 full moons occurred on 1st January and 21st December.[10] The former exactly coincided with a documented extreme storm while the latter seems to have been a few days before or after the storm depending on which dates are taken as reliable. It seems likely therefore, that the December flood would have been less severe due to the tidal conditions. The following year, 1288, a new moon occurred on 3rd February while a full moon fell on 13th August, in both cases one day prior to a recorded storm. This suggests that the most devastating floods occurred when severe storms coincided with natural tidal maxima, a phenomenon which appears to have happened at least three times in the space of two years.

[9] This is reversed when the Moon is in its first or third quarter when tides experience minimum or 'neap' levels.
[10] Dates obtained from http://astropixels.com/ephemeris/phasescat/phases1201.html [Accessed 07/03/2017]

British Sources					
Source	January 1287	December 1287	February 1288	August 1288	Reference
Chronica Johanis de Oxenedes	**1st, 12th**	**26th**	**4th**	**-**	(Ellis 1859: 268-271)
Annales de Dunstaplia	**X**	**-**	**X**	**-**	(Luard 1866: 338)
Chronicon of Thomas Wykes	**1st**	**-**	**25th Jan-2nd, X**	**-**	(Luard 1869: 308-312)
Flores Historiarum	**-**	**26th, X**	**-**	**-**	(Luard 1890: 68)
Annales de Wigornia	**1st**	**-**	**X**	**-**	(Luard 1869: 493-495)
Gervase of Canterbury	**-**	**-**	**4th**	**-**	(Stubbs 1880: 293)
Bartholomæi de Cotton	**1st**	**17th**	**-**	**-**	(Luard 1859: 167-168)
Hagnaby Abbey Chronicle	**1st, 13th**	**-**	**4th**	**14th**	(Owen 1986: 61-62)
Chronicon Abbatie de Parco Lude	**X**	**X**	**-**	**-**	(Venables 1891: 19)
Continuatio Chronici Florentii Wigorniensis	**31st Dec 1286, 13th**	**X**	**3rd**	**-**	(Thorpe 1849: 237-239)
Chronica Buriensis	**-**	**-**	**3rd**	**-**	(Arnold 1896: 35)

Table 3.1: British historical sources recording the storms of 1287/88. Created by the author.

Continental European Sources					
Source	January 1287	December 1287	February 1288	August 1288	Reference
Menkonis Chronicon	**-**	**14th**	**-**	**15th**	(Pertz 1874: 565)
Annales de Floreffe[a]	**-**	**X**	**X**	**-**	(Pertz 1859: 628)
Annales Colmarienses Majores	**-**	**-**	**2nd, 4th**	**-**	(Pertz 1861: 215)
Alexander von Roes	**-**	**-**	**X**	**-**	(Grundmann & Heimpel 1949: 72-74)
Rijmkroniek van Melis Stoke[b]	**-**	**17th**	**5th**	**-**	(Brill 1885: 233-234)

[a] The *Annales de Floreffe* only describe one event in 1287 affecting Zeeland, Frisia and Holland but, as no date is given, it is impossible to be sure which one is being described. The most likely events are the flood described by the *Chronicon Menkonis* on 14th December 1287 or, due to the calendrical differences discussed above, it is possible that the description is of the 4th February 1288 event. This would agree with the description given by the *Annales Colmarienses Majores* which describes a flood affecting the same areas on this date.

[b] Both floods described by Melis Stoke are treated together making it unclear whether they flooded the same areas or if only one is being described. Therefore, locations mentioned in this source are omitted from figures 3.1-3.3.

Table 3.2: Continental European historical sources recording the storms of 1287/88. Created by the author.

With the chronological occurrence of these events somewhat clarified, one of the main unanswered questions is the geographical areas that were affected by each storm. Only a minority of the sources name specific locations or regions in their accounts. Where these do occur however, they have been extracted (see tables A.1-A.3). This, combined with the information discussed above allows maps to be produced illustrating the known areas that were affected by each storm event (Figs. 3.1-3.3), although as there is considerable disagreement on the specific dates, it is best to view these as maps of storm damage in the three months rather than maps of storm damage from three individual storm events. In addition, these maps have the caveat that they only show areas where historical sources record the effect of the storms. Certainly, each storm would have had a negative effect for neighbouring coastal towns, for which either no documentation exists or such documentation is lost or unknown.

What the available evidence does reveal is that the storms which occurred in January 1287, the worst of which seems to have occurred on the feast of the circumcision [1st January], appear to have affected England to a greater extent than the Low Countries. It is certainly possible, as a result of differing storm tracks, speeds, wind direction and tidal conditions, for the effects of storm surges to differ markedly (Gottschalk 1971: xiii; Gerritsen 2005: 1276; Wadey *et al.* 2015). This could explain why no damage was reported in the Low Countries in January 1287 where damage was presumably relatively minor. The following December, storms hit Frisia, and perhaps Holland and Zeeland (Brill 1885: 233-234), in addition to England. The English sources suggest this storm or storms came later in December, either 17th or 26th, while in the Low Countries the storms are reported on the 14th or 17th. This divided picture is resolved during February 1288 when both the English and continental sources agree that a severe storm caused extensive flooding on the 4th/5th February. It is also possible that, thunderstorms and/or a less severe storm occurred in the days before this event, most likely the 2nd/3rd February. Also in agreement, the two sources that mention a storm in August, the Hagnaby Abbey Chronicle and the Menkonis Chronicle, give the same date 14th/15th August (assuming the storm struck at night and continued into the following morning).

The locations affected by flooding in these three, or more, events are all consistent with North Sea storm surges. These occur when extratropical cyclonic storm systems track across the North Atlantic, directing huge volumes of water into the North Sea basin, where the surrounding landmasses cause the water to pile up so that the sea level is significantly raised. As the sea is ‘funneled’ against the coasts of England and the Low Countries, with a narrow exit through the English Channel, the rise in sea level is particularly pronounced in these areas; precisely those which were affected in all three months described above. A modern occurrence of this phenomenon is the 31st January/1st February 1953 storm which resulted in the deaths of over 2,000 people in the UK, Netherlands, Belgium and Germany (Gerritsen 2005). Its co-incidence with a full moon, which had occurred 2 days prior, along with the comparable area of effect makes this a particularly useful analogy for these storms, and particularly the February 1288 event.

The historical sources provide a wealth of information concerning the impact of the 1287/88 storms on certain spheres. The accounts of chroniclers widely report high numbers of casualties

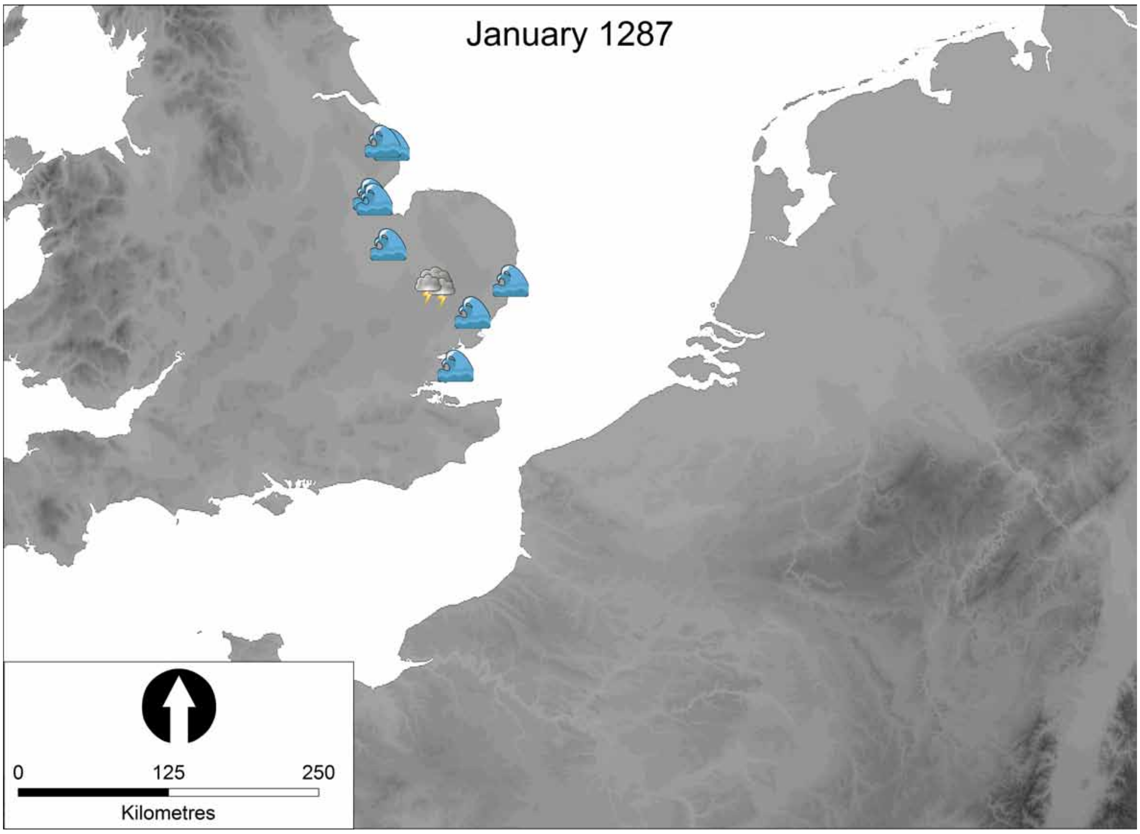

Figure 3.1: The extreme weather recorded occurring in January 1287 as presented in tables 3.1. Locations are listed in Appendix A.1. Created by the author.

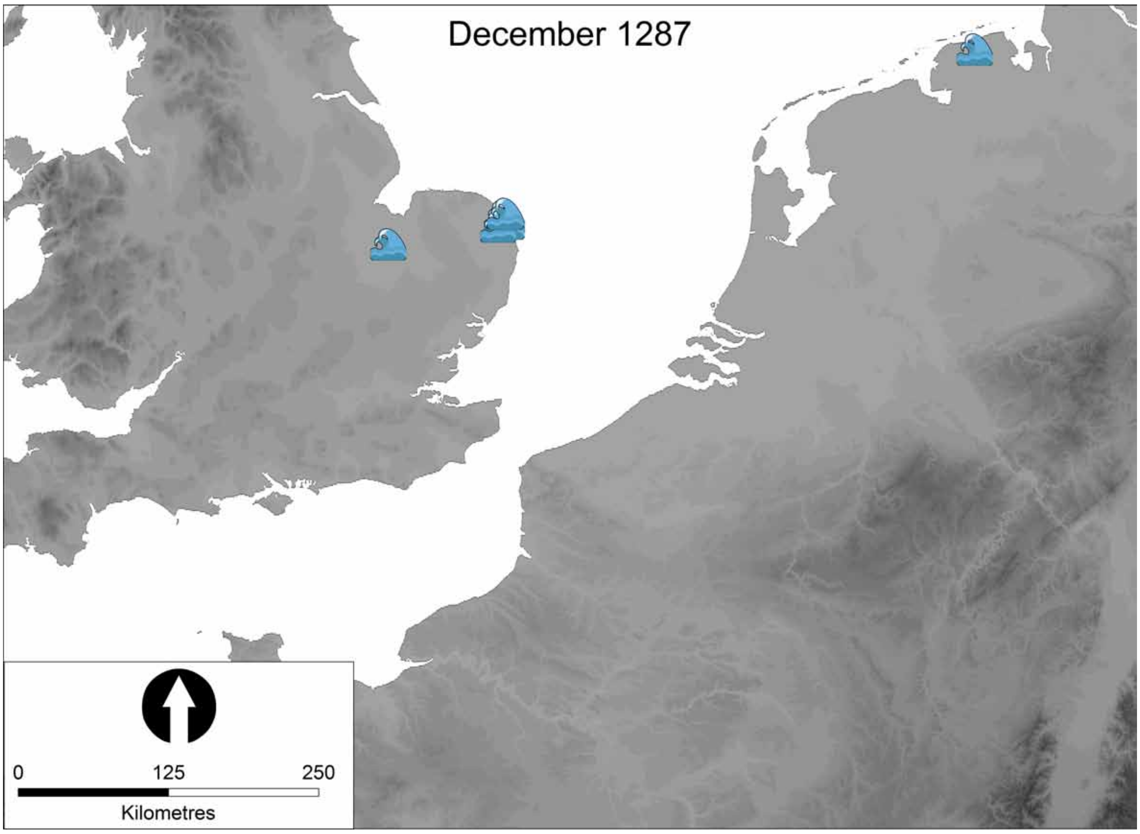

Figure 3.2: The extreme weather recorded occurring in December 1287 as presented in tables 3.1 and 3.2. Locations are listed in Appendix A.2. Created by the author.

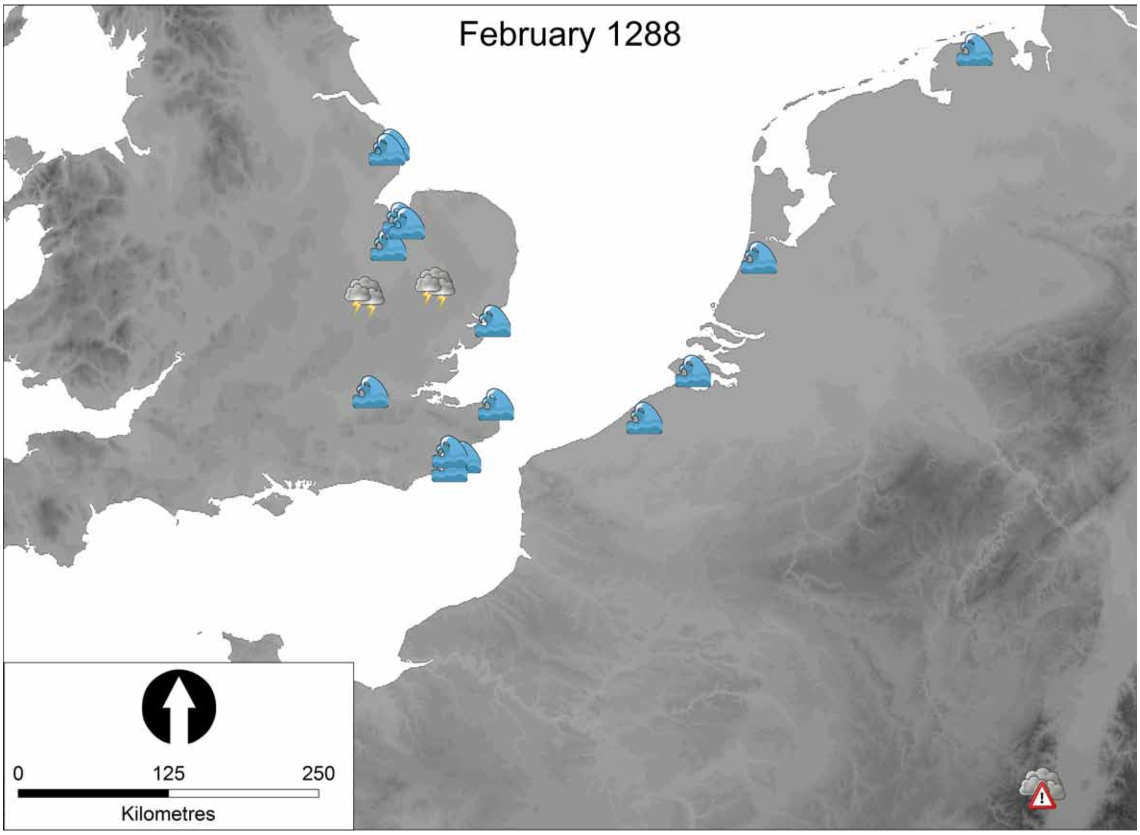

Figure 3.3: The extreme weather recorded occurring in February 1288 as presented in tables 3.1 and 3.2. As well as the floods and storms around the coasts of the North Sea, extreme winds caused damage at Hohenack, Haut-Rhin, north-eastern France. Locations are listed in Appendix A.3. Created by the author.

who drowned in the floods (for example see Thorpe 1849: 237-239; Luard 1869: 311-312, 493, 495). John of Oxnead, for example, describes how many climbed trees to escape the floodwaters but, unable to hang on as they waited for help to arrive, they fell back into the water and drowned (Ellis 1859: 270-271). Damage to structures is also frequently reported. In the January 1287 floods, the church of Mablesthorpe St Peter, Lincolnshire, was damaged, causing the chalice and pyx to be crushed underneath fallen masonry, while in the 1288 floods, which came the following February, the already damaged structure was "completely destroyed" (Owen 1986: 61-62). At Hickling, Norfolk, floodwaters rose a foot above the high altar of the church of the Augustinian priory before subsiding (Ellis 1859: 270-271), suggesting that this structure, as well as other nearby buildings in the town, was damaged by the floodwaters. Structural damage is reported from Great Yarmouth in the December 1287 floods when the stone walls of the cemetery were broken by the sea (Luard 1859: 168). Livestock and agricultural produce were also acutely affected. At Boston, Lincolnshire, innumerable cattle were lost along with human victims (Luard 1869: 308) while the *Annales de Dunstaplia* and the Hagnaby Abbey Chronicle both report the loss of high numbers of sheep and cattle (Luard 1866: 338; Owen 1986: 61-62). At the Benedictine Abbey of St Benet at Holme, Norfolk, although the monastic community were forced to evacuate the Abbey precinct, two monks stayed behind to tend to the horses who would, no doubt, have otherwise perished (Ellis 1859: 270-271). The historical record, therefore, provides a wealth of detail in certain areas regarding the impact of the storms and the floods they caused. As we will see, however, there is much that can be added to this picture by turning to the material record.

3.1.2 The archaeological evidence

The high-number of historical sources, and the magnitude of flooding they describe, clearly indicates that the 1287/88 series of storms inflicted severe destruction across the area of effect. As a result, it would be expected that material evidence for the storms would be manifest in the form of stratigraphic layers deposited by the storms themselves[11] in addition to evidence for destruction during the late 13th century at areas across the affected zones. Of course, in the immediate aftermath of the floods the damage must have been cleared and restored—ground might be levelled and repairs would take place to remedy the damage caused by the storms. Despite this, it is still possible that damage on the scale that the documentary sources suggest may have left traces that can still be identified in the present day.

Notably, a number of geological and geomorphological sequences have been linked to the storms. For example, according to Hearne *et al.* (1995: 243), the shingle spit at Deal, Kent, was significantly

[11] Although in archaeological terms it is effectively impossible to distinguish between the, three or more, storm events, in theory it is possible that separate events could be distinguished archaeologically if distinct layers were formed by flood deposits. However it is likely that, as the storms occurred so close together in time, the later events would have incorporated and mixed sediments deposited by the earlier storms. Additionally, it is unlikely that absolute dating methods applied to a single layer could be resolved to a resolution that would allow the layer to be confidently ascribed to a single storm event.

extended by storm beach sediments deposited by the storms. In Romney Marsh, Kent and Sussex, the extent of flooding caused by the storms of the late 13th century can be traced through the later history of reclamation, place names and comparison of soils (Rippon 2000b: 196-197). In a core from Winchelsea, East Sussex, Dhoop (2016: 107-117, 206) has identified a period of turbulent, stormy weather in the decades leading up to the 1287/88 storms, attesting to the occurrence of undocumented, lower magnitude events during this time, while the 1287/88 storms themselves appear to be represented by a slope-wash deposit of sandy/clayey sediments. Late Holocene high energy deposits from Brittany, which are late 13th or early 14th century in date, have also been connected to this series of storms (Haslett & Bryant 2007b: 217) but as there is no known historical evidence for the effect of the storms in Brittany in 1287/88[12] and other regional studies attribute comparable deposits to a different storm event, (Bailiff *et al.* 2014: 900), it seems more likely that the deposits identified by Haslett and Bryant relate to a different storm.

Excavated deposits, such as an assemblage of pottery discovered in 1951 at Chapel St Leonards, Lincolnshire, have also been interpreted in relation to the storms; in this case as evidence of a site abandoned in the aftermath (Thompson 1953). Similarly, at South Denes, Yarmouth, an assemblage of medieval pottery dated to the 13th century, discovered sealed by a layer of silt, was interpreted as the result of the storms (Green 1961: 21). Although documentary evidence for the impact of the storms at Hastings is lacking, the archaeological evidence may support the fact that damage occurred at this location as a layer of clay encountered at a number of sites may attest to their occurrence (Vahey 1989: 2-3; Vahey 1991: 2). This interpretation is strengthened by cores from the nearby deserted medieval village of Northeye, Sussex which suggest the salt-works upon which the village's economy depended were severely affected by storms during this period (Oxford Archaeology 2009: 11). A number of sites have also been investigated in New Romney, Kent, with evidence convincingly interpreted in relation to these storms, *eg.* Draper and Meddens (2009: 59-69). This is discussed in detail below. The wider Romney Marsh area (including 'Romney Marsh proper' and Walland Marsh; see fig. 3.4) has been investigated in detail and a number of sites are known through both historical and archaeological evidence relating to the 1287/88 storms. At Broomhill, East Sussex, for example, Gardiner (1988: 125) suggests that the lack of evidence found during the excavation of the church which predates the late 13th century may indicate that the church was rebuilt at a new location after the occurrence of the storms which caused flooding throughout the majority of Walland Marsh (Rippon 2000b: 194; Gardiner & Hartwell 2006: 148-149; see fig. 3.4). The failure of the dikes protecting low lying reclaimed land in this area (Gardiner & Hartwell 2006: 152) resulted in widespread damage including the destruction of a number of known structures such as the Court Lodge at Agney and the church at Midley (Tatton-Brown 1988: 108).

[12] Bryant and Haslett suggest that the 1287/88 storms are candidate events because these floods affected northern France. In the source cited for this information, however, [Bryant E (2005) Natural Hazards. (2nd Ed) Cambridge University Press, Cambridge p. 32], it is unclear from where this information is derived.

Some archaeological evidence that has not traditionally been tied to the 1287/88 storms could also be products of their occurrence. The bridge repair at Heigham Bridge, Norfolk, (discussed in Chapter 4.4.1), for example, provides a possible case of structural damage caused by the storms. Excavated flood deposits at Wisbech, Norfolk, on the other hand, which date to *c.*1250-*c.*1350 and are 30cm at their deepest,[13] appear to have instigated a new phase of building (Hinman & Popescu 2012: 24) and accord well, both geographically and in terms of magnitude, with the 1287/88 storm series. Similarly, a flood level visible at more than 20 sites across King's Lynn, Norfolk,[14] where flooding is recorded in the February 1288 storm (Luard 1869: 495), dates to the late 13th or early 14th centuries (Clarke & Carter 1977: 63). It may be possible to refine the dating of these flood deposits, if they were encountered at a nearby undisturbed site, using optically stimulated luminescence dating. Currently, however, it remains a possibility that such layers were deposited by the storm but this cannot be stated with certainty.

3.1.3 New Romney, Kent

At New Romney, Kent, there is a significant body of archaeological evidence relating to one, or more, of the 1287/88 storms. As a result of the introduction of developer funded archaeology in the early 1990s, a wealth of well-recorded excavations have been undertaken across New Romney. This provides the opportunity to investigate a detailed case study of the effect of an extreme storm on the medieval population living in a single town. In order to assess the extent to which New Romney was affected by the 1287/88 storms, all of the available archaeological grey literature reports, held by Kent County Council,[15] relating to archaeological investigations in the town have been assessed. This allows a limited reconstruction of the impact of the 1287/88 storms and their aftermath. Following a brief review of the town's early history, the results obtained from this grey literature survey are presented below.

New Romney's underlying geology is made up of pebbly sand and shingle (Green 1968: 22) which are encountered by excavations across the town (*eg.* Wilson & Linklater 2002: 14; Linklater 2003). The early history of settlement at New Romney, however, is debated. Tatton-Brown (1988: 107-108) suggests the settlement emerged as a re-foundation of a Saxon town located at present-day Old Romney, 3.2km to the west (see fig. 3.4), while Gardiner (1994: 344-345) argues that New Romney evolved naturally from an existing nucleus of settlement. Whichever the case, the town expanded rapidly from relative obscurity during the 12th century, becoming an important maritime trading centre, and one of the Cinque Ports, able to benefit from its fortunate location within easy sailing distance of some of north western Europe's largest urban centres (Gardiner 2000: 86; Martin & Martin 2004: 7-19; Campbell 2010a: 28). This expansion was short-lived however. During the

[13]The surface of the flood level at Wisbech is *c.*4.5m above sea level.
[14]The surface of the flood level at King's Lynn is between 4.15m and 4.2m above sea level.
[15]As of 27/02/2017 this included 55 reports spanning 1993-2016.

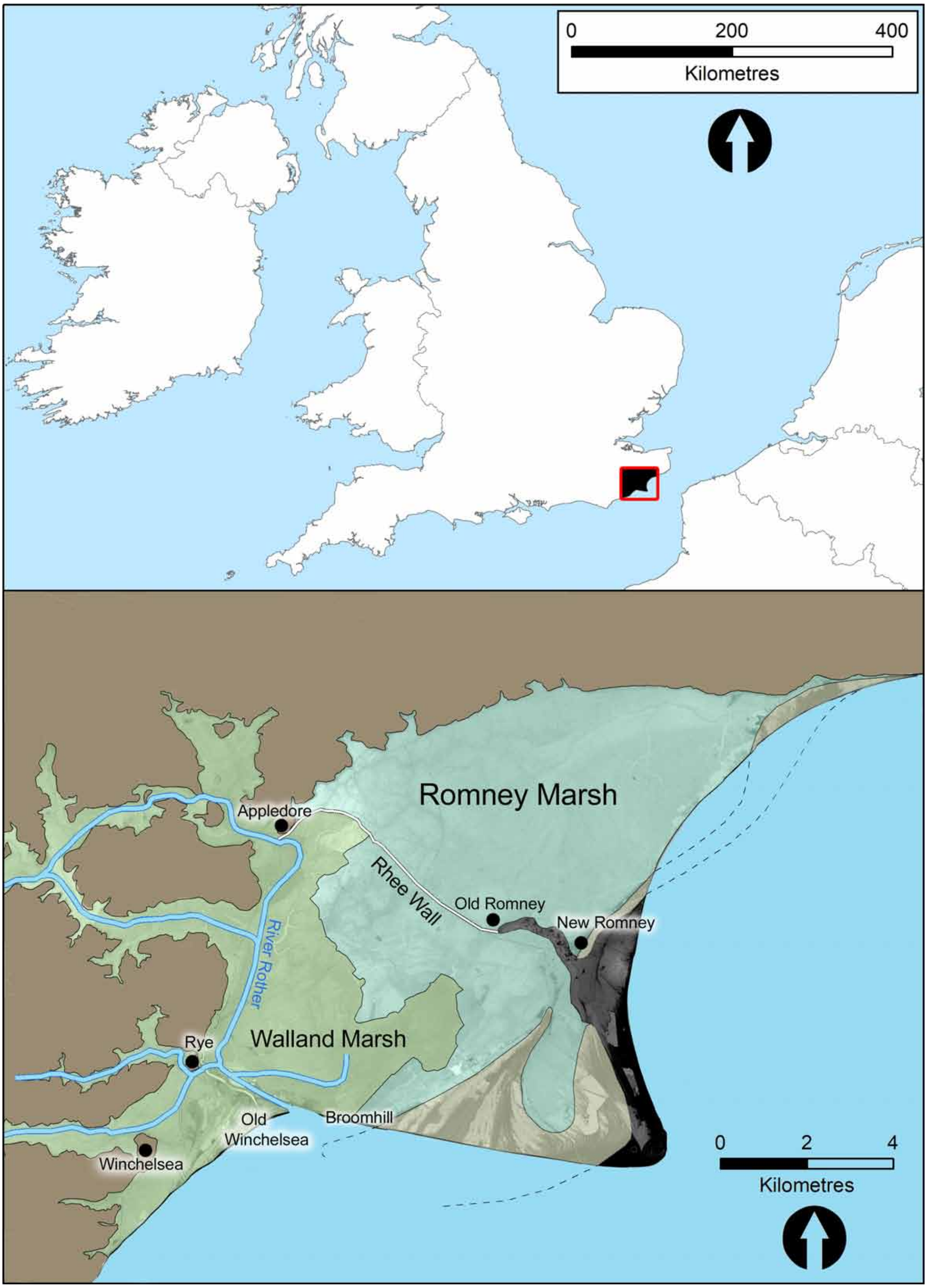

Figure 3.4: New Romney and Romney Marsh at the time of the storms of 1287/88 overlain against present-day LiDAR data. Postulated coastlines in the late 13th century are indicated by the dotted line. Created by the author after Rippon (2000b: 193).

12th century, the River Rother, which up to that point had drained out into the North Sea at New Romney, shifted south to drain out near Rye, Sussex. At least since the time of William Camden, this change in the course of the Rother has often been interpreted as a result of the 1287/88 storms themselves (Camden 1610: 350-351) yet the available historical and palaeoenvironmental evidence demonstrates this change had already occurred by the 12th century (Rippon 2000b: 191). To remedy this alteration in the Rother's drainage regime, a major water channel, the Rhee Wall (see fig. 3.4), was dug in sections from Appledore to Old Romney in an attempt, by diverting water from the Rother, to flush out silt clogging up the tidal creek upon which the harbour at New Romney was located. Following a phase of storms in the early 1250s, described by the chronicler Matthew Paris (Luard 1880: 395, 453; Luard 1890: 402), this feature was extended to New Romney itself but it did not prove effective in the long term and was unable to prevent the development of problems caused by siltation (Rippon 2000b: 197-198).[16] At least in New Romney, therefore. the storms of 1287/88 came in a context of decline as a result of pre-existing environmental conditions.

The only chronicler to record the effect of the 1287/88 storms in Romney Marsh was Gervase of Canterbury who states that:

"On the day before the nones of February [4th February] the sea swelled up so high in Thanet, and in Romney Marsh and in all other adjacent places, that all walls were broken and almost all the land was covered from the Great Wall of Appledore to Winchelsea to the south west." (Stubbs 1880: 293)[17]

It remains a possibility that damage also occurred in this area in one, or all, of the 1287 storms. The identification of the 1288 event as the storm of greatest intensity in this particular area, though, is strengthened by the fact that a charter of unknown provenance from nearby Rye, Kent, referenced by the 17th century antiquary Samuel Jeake states that:

"In the year MCCLXXXVII [1288],[18] on the night of St Agatha the Virgin [5th February], the town of Winchelsea was flooded as well as all the land between Cliffsend and Hythe" (Jeake 1728: 105).[19]

The fact that the text of this document provides fresh information—Cliffsend, Hythe and St

[16] The effectiveness of such a feature would have been highly dependent on the velocity of the water flowing through the tidal creek at New Romney—without a sufficient gradient to produce fast flowing water, therefore, it seems unlikely that the Rhee Wall could have had much impact on the silting up of the harbour and, if the water carried by the Rhee Wall flowed slowly enough, it could even have exacerbated the problem by increasing sediment deposition in the tidal creek.

[17] Translation by the author. Original latin text: "*Pridie nonas Februarii mare ita erexit se in Thaneto, et juxta, et in marisco de Romenal et omnibus locis adjacentibus, quod omnes wallias dirupit, et fere omnes terras operuit a magna wallia de Apuldre usque Winchelese versus austrum et versus occidentem*". Note that this text, which is considered to be original rather than a later copy from an earlier document (Stubbs 1880: xxxiv), was very likely the "ancient French Chronicle, sometime belonging to the Church of Canterbury" cited by Somner (1693: 57-58).

[18] This date almost certainly relates to 1288 by modern reckoning due to the medieval New Year not being counted until 25th March.

[19] Translation adapted by the author. Original latin text: "*M.D. quod anno Domino Millesimo CCLXXXVII. In vigilia sanct. Agathæ virginis, submersa fuit villa de Wynchelsee, & omes terræ inter Climesden usq. le Vochere de Hethe*".

Agatha's Day all go unmentioned in the English sources discussed in Section 3.1.1—as well as the fact that it agrees with the other available sources suggests, since it is unlikely to have been copied from any other known source, that the document is genuine or at least preserves a communal memory of an event, only written down at a later date. Taken together then, the historical evidence suggests that if only one of the 1287/88 storms struck New Romney, this was the 4th/5th February 1288 storm. The meeting at Snargate to discuss flooding at Holewest in 1287 (Smith 1969: 170), discussed above, however, may provide evidence that Romney Marsh was also affected by flooding in the January 1287 storm although, if this was the case, the damage does not appear to have been as severe as in the subsequent February 1288 storm. As discussed above, this storm caused severe damage and destruction across the wider area and especially in Walland Marsh (Tatton-Brown 1988).

In order to gauge the impact of the storms across the unit of an entire town, all of the 'grey literature' held by Kent County Council[20] relating to excavations in the town was assessed. This allowed the locations of all excavations, test pits, boreholes and watching briefs to be plotted in a GIS. The result of this activity produces a plot containing records of 351 archaeological interventions (see fig. 3.5 and Appendix C). To this spatial data was added any stratigraphic information noted in the reports of relevance to the impact of the storms on the town. This has been broken down into six main categories of evidence:

1) Evidence for destruction sealed by stratigraphic layers identified as material deposited by 13th century storm surges. This category relates to in-situ remains of the pre-storm town which were heavily damaged and sealed by sediments deposited by the storm.

2) Layers identified as medieval storm deposits. This category covers areas where no archaeological pre-storm material was encountered below the storm deposited layer or where the excavations did not penetrate beneath this layer.

3) Contexts with evidence for abandonment or decline contemporary with the storms of 1287/88. This category reveals areas which may have been abandoned, fell out of use or ceased to be maintained in the aftermath of the storm. This could relate to depopulation and/or declining economic opportunities caused by the storm.

4) Stratigraphic layers identified as marine which are now located in terrestrial locations which assist in defining the town's coastline at the time of the storm.

[20]This analysis included all of the archaeological grey literature relating to New Romney held by Kent County Council up until 12/08/2016. I am grateful to Paul Cuming for assisting me in accessing these data.

5) Contexts containing archaeological material which can be dated to between *c*.1250 - *c*.1350. These are mainly dated through ceramics which provide a date range of about 75 years meaning there is some uncertainty as to whether these locations were occupied before or after 1287/88.

6) No contemporary archaeological evidence. These contexts may have been truncated by later development or sit outside the zone of medieval occupation and do not reveal anything about the effects of the storm on the town.

This grey literature survey provides another method of gauging the impacts of the storms of 1287/88. The occurrence of severe storms in the town, however, was not without precedent, and several of the excavations revealed evidence for earlier flood events—presumably those recorded by Matthew Paris (Luard 1876: 379; Luard 1880: 395, 453; Luard 1890: 219, 402). At the Southlands School site, off Dymchurch Road—along what would have been the medieval waterfront, the early 13th century beach front was sealed by up to 50cm of storm deposited sand. This layer contained a silver long-cross penny which dated to the reign of Henry III (1247-1272)[21] (Draper & Meddens 2009: 60). This accords well with one of the inundations recorded by Matthew Paris in the 1250s, however, Gottschalk (1971: 190, 199) argues that these must in fact have occurred in 1248 or 1249 due to the fact that no storm surges of comparable magnitude are recorded in the Low Countries in the early 1250s. In either case, the coin supports the dating although it must have been relatively recently minted at the time of deposition.

Focussing on the storms of 1287/88, archaeological evidence across the town has been widely attributed to their occurrence. Work along the High Street in advance of the installation of a gas main in 1995, for example, uncovered contexts containing evidence for early 13th century activity—dated by ceramics—sealed by layers[22] of silty sand with a high gravel content which were interpreted as storm deposited (Herdman & Jarman 1996: 15-16). As is the case with many of the excavations undertaken across New Romney, there is some doubt as to whether these layers were deposited as a result of storm action or not (Herdman & Jarman 1996: 15). In the absence of geomorphological analysis, which may have allowed such contexts to be more firmly attributed, these interpretations should be appraised critically.

Nevertheless, many of the archaeological sequences obtained from sites across the town appear to correlate closely with the historical evidence. Excavations off Church Road, for example, appear to have encountered the banks of the medieval river mouth. Geoarchaeological analysis in this area revealed two phases of erosion, evidenced by two sharp contacts between stratigraphic units, which could correspond to the 13th century storms. These were both followed by periods of reduced energy

[21] The coin was initially thought to post-date 1250 due to its heavily worn condition (Meddens & Wooldridge 2002: 17) prior to post-excavation analysis.

[22] The contexts interpreted as the result of the storms of 1287/88 are contexts 10, 21 and 29.

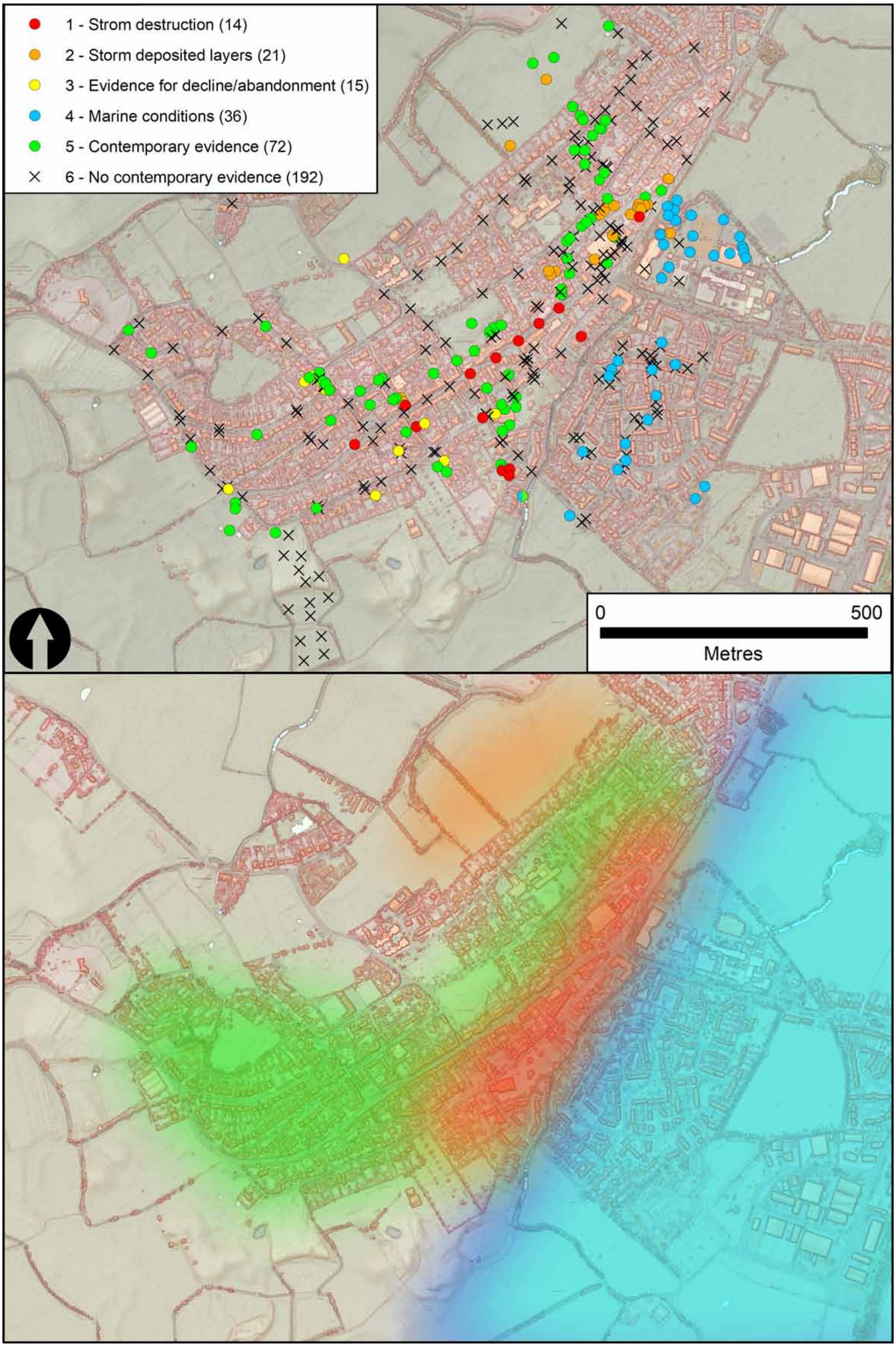

Figure 3.5: Above: The results of a survey of the grey literature relating to archaeological excavations in New Romney, Kent. The classification of this evidence is described in more detail in Section 3.1.3. Below: A schematic plan of the impact of the storms of 1287/88 based on the evidence presented above. Green corresponds to the contemporary area of settlement while red indicates the likely limit of storm damage. Orange indicates less certain storm-associated sediment deposition north of the town. Blue indicates the likely extent of the sea. Created by the author.

sediment deposition (Priestley-Bell 1999: 11) which accords well with the hypothesised gradual siltation of the river mouth over the course of the 13th century. Similarly, outside the church of St Nicholas, the east end of which is thought to have been largely swept away in the 1287/88 floods (Tatton-Brown 1987: 344), excavation for a manhole revealed two earlier phases of road surface separated by 20-40cm of 'storm deposit' (Canterbury Archaeological Trust 2010: 6.1.3).

The highest volume of evidence for the impact of the storms of 1287/88 comes from the area presumed to have been the shoreline during the 13th century. This roughly corresponds to Church Road, which becomes Dymchurch Road to the north. At the Old School House, located *c.*100m seaward of St Nicholas' Church, which would have been a coastal location in the medieval period, occupation layers, evidenced by early-mid 13th century pottery and detritus such as animal and fish bones, were sealed by high energy gravel deposits (Thomason & Stafford 2001: 7-11). In this case, the excavators suggest the important point that the storm(s) may have initially caused erosion prior to the deposition of sediments. In certain circumstances, this could have resulted in the immediately pre-storm remains being heavily disrupted or entirely removed which would have erased evidence for any earlier storms which had recently occurred. Further damage can be seen at a site on the seaward side of Church Road where a timber structure was destroyed and overlain by 40cm of coarse yellow sand and rounded beach pebbles[23] (see fig. 3.6). This was interpreted by the excavators as "deposited by severe marine action" (Wilson & Linklater 2002: 9-10). The flood layer which sealed this structure was overlain by a later stone building which, at some point, also became inundated by the sea—a fact demonstrated by the presence of a marine deposited layer.[24] Unfortunately, no dateable material was recovered relating to the earlier timber structure although unstratified 13th century pottery from the site is indicative of activity contemporary with the storms (Wilson & Linklater 2002: 15). The later inundation, which affected the masonry structure, sealed a pit containing late 15th-early 16th century pottery, demonstrating that this was a significantly later flood (Wilson & Linklater 2002: 12). A possible interpretation, therefore, is that the earlier timber structure was destroyed as a result of the 1287/88 event.[25]

A similar narrative was revealed at the Southlands School site, less than 300m to the north-east of the Church Road site, where 'Building 2' was severely truncated on its south-eastern half by *c.*50cm of storm deposits—attesting to the storm's erosive power (see fig. 3.7). The structure measured 7x11m and was probably timber framed with a floor constructed of either timber or trampled earth and can be roughly dated to the mid 13th century by ceramics and other artefactual evidence (Meddens & Wooldridge 2002: 21). At some point a small extension, measuring 2x2.3m was added to the structure's north-western side where a contemporary area of burning and a number

[23] Context 28.
[24] Context 17.
[25] The thickness of the layer, context 28, representing the earlier inundation presumed to relate to the 1287/88 event, preserved in section 5 is *c.* 40cm which is roughly double the thickness of the later 15th or early 16th century inundation attested by context 17. This suggests that the earlier flood was significantly more severe, mobilizing and depositing a significantly higher volume of sediment.

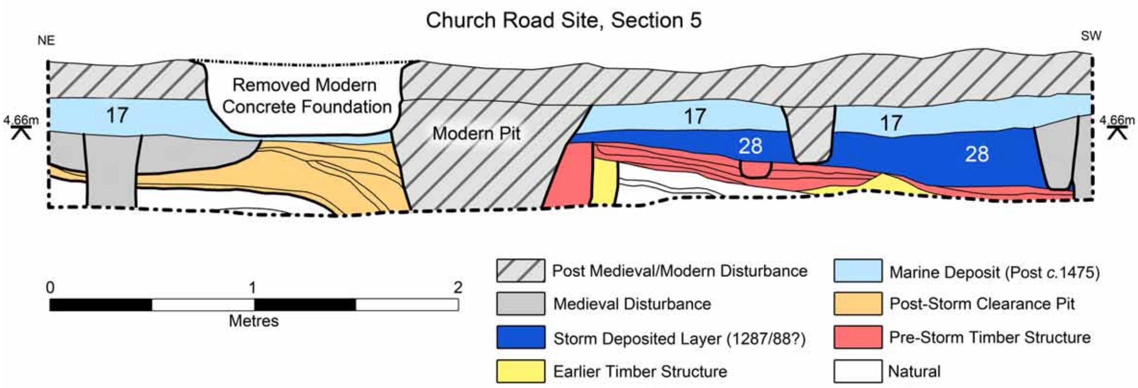

Figure 3.6: Section 5 from the Church Road site, New Romney. The medieval timber structure, shown in red, was destroyed and overlain by a 40cm thick layer of storm deposited material (context 28 shown in blue). Although limited dating evidence was recovered, this layer is very likely to relate to the storms of 1287/88. After the storm a pit, shown in light brown, close to the site of the destroyed structure, was dug, presumably to clear the site of debris which had resulted from the storm. Redrawn by the author after Wilson and Linklater (2002: fig. 11).

of hearths were also encountered. The building's coastal location, as well as the recovery of finds such as lead fishing weights and a bone net needle, suggest a function related to fishing and seafaring (Meddens & Wooldridge 2002: 21). The impact of the storm(s) is evidenced by the absence of a large portion of the south-eastern half of the structure which was, at some point, entirely eroded and destroyed by the powerful action of sea and storm (see figs. 3.7 and 3.8). Notably, the excavators suggest that this portion of the building collapsed after the storm had swept the sands upon which it was built out from underneath the building (Meddens & Wooldridge 2002: 23). The void caused by this erosional activity was in-filled with layers of sand which incorporated pottery dated from *c.*1150-*c.*1450 and two coins dating to 1180-1247 and 1100-1135 respectively (Meddens & Wooldridge 2002: 23). The early date of the latter of these coins suggests that the force of the storm was possibly disturbing and reworking material contained in earlier contexts. In the aftermath of the storm event which caused this pattern of erosion, the entire building was sealed by a layer of sandy, gravel and silt which was interpreted by the excavators as an attempt by the townspeople to repair the damage of the storm and stabilise the shoreline (Meddens & Wooldridge 2002: 23). As well as loosely dated 12th-15th century pottery, a silver farthing of Edward I was recovered from this layer which provides a *terminus post quem* of 1272 (Meddens & Wooldridge 2002: 23)—thus excluding the earlier storms of the 1250s as candidates—securing the identification of the 1287/88 storms, and most probably the 4th February 1288 event, as the most likely event(s) to have caused the destruction of 'building 2'.

The picture obtained from the archaeological evidence in New Romney is that the floods appear to have affected a significant swathe of the town (see fig. 3.5). The clearest examples of storm damage, identifiable through the archaeological record, are found along the medieval shoreline where, presumably, structures would have faced the full force of the storm. The evidence also points to the

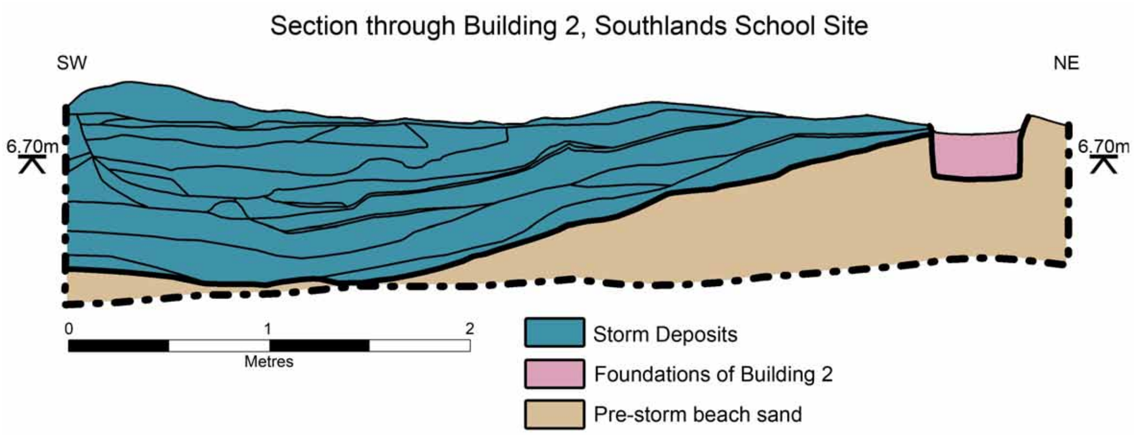

Figure 3.7: Section through Building 2, Southlands School site, New Romney. The south-eastern portion of Building 2, evidenced in the section by a foundation trench, was severely truncated as a result of the erosion and deposition of the storms of 1287/88. The location of this section is indicated by line A in fig. 3.8. Redrawn by the author after Draper and Meddens (2009: 65).

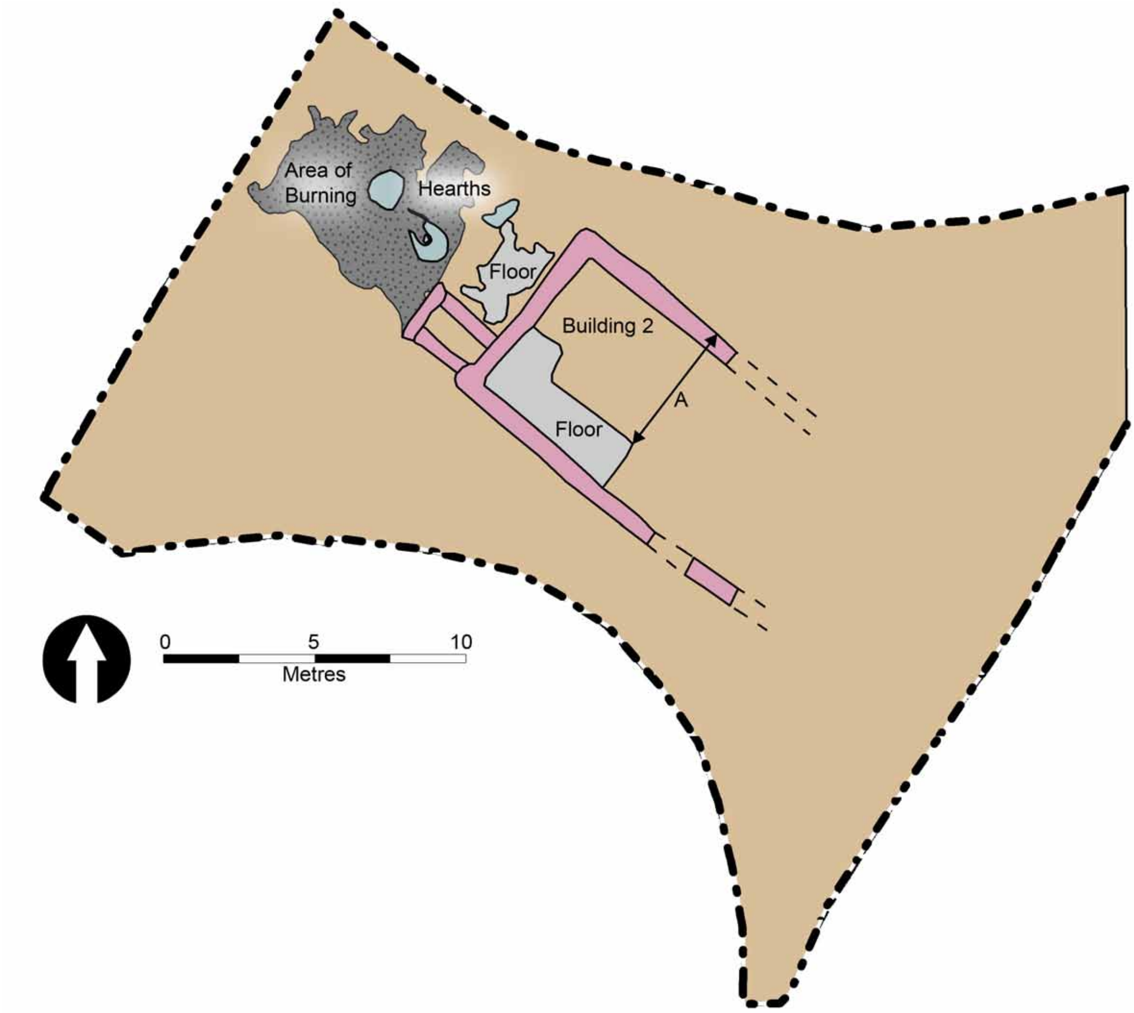

Figure 3.8: Plan of Building 2, Southlands School Site, New Romney. Building 2 was severely truncated to the south-east by the storms of 1287/88. Only evidence of the north-western half of the structure was detected due to the storm erosion and deposition visible in a section through the structure, fig. 3.7, the location of which is indicated by line A. Redrawn by the author after Meddens and Wooldridge (2002: 22) and Draper and Meddens (2009: 63).

fact that the effect of the storm penetrated beyond Church Road and even the High Street—as the 1995 gas main excavations make clear. This picture supports the conclusions of Parkin (1973) who argues that the floor levels of many of the oldest standing buildings of the town, which are below the current ground level, relate to the original land level of the town prior to the deposition of sediments by the late 13th century storms. This is especially the case in buildings along the High Street, and adjoining roads, (Parkin 1973: 122, fig. 2) in broadly the same area indicated by the excavations in Figure 3.5. The archaeological intervention with evidence interpreted as a storm deposited layer which penetrated furthest inland comes from a field abutting Rolfe Lane on the town's western fringe (Margetts 2010: 57, 60). Assuming this interpretation is reliable, it presents the possibility that the town was either entirely overflown by floodwaters or, perhaps more likely, encircled as the floodwaters broke through neighbouring low-lying areas. Clearly, the historical and archaeological evidence relating to the 1287/88 storms are complementary with the material evidence largely corroborating the historical sources. At the local level the storm(s) had a catastrophic impact, especially on buildings fronting the seafront which must have led to a serious disruption in town life for some time after the occurrence of the event. The evidence for exactly what happened in the aftermath of this episode of catastrophic flooding is discussed in more detail in Chapter 4.

3.2 Flooding in Marshland, Norfolk, 1287-1349

Another area where flooding occurred in 1287/88 was Marshland, Norfolk, (Maxwell Lyte 1893: 298)[26]—a group of parishes situated in an area of low-lying wetland which had been gradually enclosed against inundation from marine and freshwater from the late Saxon period (Silvester 1988: 160; Rippon 2002a: 65; Rippon 2013: 335-339). This section investigates the numerous flood disasters which occurred over the 13th and 14th centuries during the reigns of the three Edwards[27] between 1287-1349 and their impact on the local populations in this area. This case study has been selected based on the availability and survival of source material including extant historical maps—of which the earliest examples date to *c.*1582[28] and *c.*1610[29]—which show the layout of the late medieval field system complete with local toponyms. In addition, the rich documentary record relating to flooding and sea defence in the area provides well dated descriptions of flood events, the damage they caused and the steps taken by society in their aftermath. The 17th century antiquarian William Dugdale's '*The history of imbanking and drayning of divers fenns and marshes*'

[26]At least, a Royal Commission *de Walliis et fossatis* (on walls and ditches) was instigated in 1288 to address a complaint that the lands of Robert de Scales in Marshland had been inundated as a result of a defect in the repair of flood defences on lands belonging to William de Carleton and William de Middilton (Maxwell Lyte 1893: 298).

[27]Edward I (1272-1307), Edward II (1307-1327) and Edward III (1327-1377).

[28]The *c.*1582 map is held by the British Library under shelfmark: Add. MS 71126 f.1 and is available at: http://www.bl.uk/ [Accessed 04/02/2018].

[29]The *c.*1610 map is believed to be a copy of an earlier map from *c.*1591 and is held by the British Library under shelfmark: Cotton Augustus I.I f.79 and is available at: http://www.bl.uk/ [Accessed 04/02/2018].

provides an invaluable collection of primary sources which record this type of information—some of which have subsequently been lost or are no longer extant (Silvester 1988: 5). The region has also been the subject of extensive archaeological research, including detailed surveys of the parishes listed above (Silvester 1988). This constellation of high-resolution source material, combined with modern technology such as GIS analysis and LiDAR data, permits a detailed exploration of the impact and subsequent responses provoked by severe flooding on medieval society.

As a term, Marshland usually refers to the west Norfolk parishes of Clenchwarton, Tilney, Terrington, Walpole, West Walton, Walsoken and Emneth (Silvester 1988: 4; see fig. 3.9). Wiggenhall is sometimes also considered a Marshland parish, as is the case here, and it is frequently included alongside the parishes listed above in many of the contemporary historical sources. This area of Norfolk is formed of flat, low-lying, siltlands which formed a region with important stock rearing and salt-manufacture industries during the Roman and Saxon periods (Silvester 1988: 156-160). Although definitive historical evidence for drainage and embanking comes only after the Norman Conquest, a number of strands of evidence suggest that this process began somewhat earlier. An intensification and shift in the settlement pattern from the inland margins of the intertidal zone to the coastal marshes took place around the 8th century. This was accompanied by a shift in the character of settlements, from what had most likely been only seasonally occupied locations[30] to permanently occupied nucleated settlements, suggesting that early medieval populations actively decided to move out into these wetland locations forcing them to adapt to the difficulties associated with such locations (Rippon 2009: 43-44). Palaeoenvironmental sequences from Fenland Saxon sites indicate that the area remained intertidal—meaning unembanked—until the 10th century when the sequences demonstrate a switch from tidal to freshwater conditions—presumably related to the construction of sea walls preventing marine inundation of the area (Crowson *et al.* 2005: 168-170). Confirmatory evidence for this process comes from the trio of villages, known to have been in existence by the 10th century, on the western edge of Marshland with names including the 'wal' prefix: Walsoken, Walton and Walpole, which may relate to the presence of nearby sea walls at an early date (Beloe 1895: 315; Silvester 1988: 160).

Stephen Rippon (2002a: 64-65) has suggested that the morphology of the field boundaries visible in some of the Marshland parishes, notably Walpole St Peter and West Walton, is indicative of piecemeal reclamation—with core areas enclosed against tidal flooding prior to the construction of a cohesive sea wall along the entirety of the coastline. From the beginnings of the embanking process in the 10th century, progress probably continued gradually as and when new land was required, sufficient manpower and capital were available and favourable market conditions existed, with most of the medieval field systems discernible on later maps in place by the close of the 13th century (Silvester 1988: 164). The banks and ditches which drained this field system, preventing the

[30] Exploiting the rich grazing available in the marshes during the summer months.

ingress of both sea- and fresh- water, emerged in concert with this field system and are visible both on historical maps and in the modern landscape. The agricultural exploitation of the fertile soils in this wetland zone, permitted through the creation of an infrastructure of flood embankments and drainage channels, permitted the Marshland parishes to prosper, achieving a high level of economic prosperity by the 14th century, with an average taxable wealth per square mile across the area of over £30 by 1334 (Glasscock 1975: xxvii). This prosperity, however, was at constant risk—any failure in the dikes or the drainage infrastructure had the potential to flood large areas of arable cultivation or human settlement and cause considerable losses.

3.2.1 The medieval landscape

To investigate the medieval landscape, it is helpful to exclude areas of post-medieval and modern reclamation which in Marshland, north towards the sea, have been extensive (Allen 1997: 24). The late medieval field system depicted by the maps of *c.*1582 and *c.*1610 more or less represents the farthest extent of medieval arable agriculture in the area. This is clearly demonstrated by LiDAR data covering the region. As areas of artificially embanked wetland typically experience a decrease in land level, relative to neighbouring unenclosed areas, land level can allow the relative dating of discrete landscape units (Shennan 1992: 79-80; Allen 1997: 20). This is due to a combination of factors including increased sedimentation on the seaward side relative to the landward side, a decrease in land surface altitude on the landward side as a result of sediment compaction and sea level rise (Gardiner 2002: 108-109). As a result, subject to local anomalies, an area of early embankment which saw little alteration for a number of centuries would be expected to occupy a noticeably lower level than swathes of ground reclaimed in a later phase. This is the picture visible in Marshland, with the area of medieval agriculture closely corresponding to an area of topographically lower ground with a sudden rise immediately beyond the bounds of this area (see fig. 3.10).

3.2.2 Edwardian floods (1287-1349)

Dugdale's compilation of documentary evidence provides a substantial body of evidence relating to the impact of flooding in Marshland during the reigns of the Edwardian Kings between 1287-1349. The first of these incidents occurred during Edward I's 16th regnal year, 1287-1288 (Dugdale 1662: 245; Maxwell Lyte 1893: 298) and was presumably a result of the storms of 1287/88 discussed in Section 3.1. In this case breaches occurred at Islington, a hamlet in the modern day parish of Tilney St Lawrence, and 'the Hawe'. The latter toponym does not appear on either the *c.*1582 or *c.*1610 maps. Etymologically, *hawe* describes an enclosed area (Hanks *et al.* 2016: 1225) which could correspond to a parcel of land defended by flood embankments. A further clue comes from the appearance of a mention of land called 'Howe' in the 15th century *Inquisition Post Mortem*

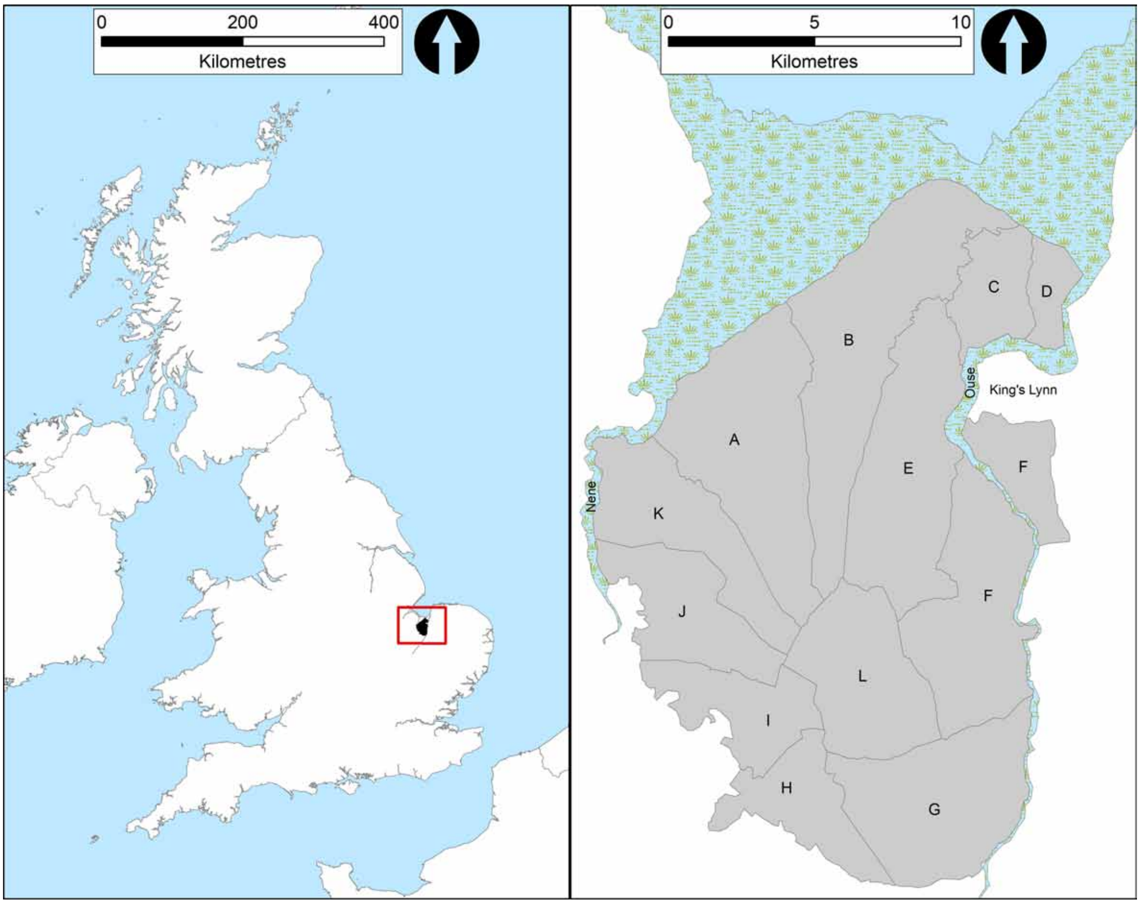

Figure 3.9: Map showing the location of Marshland, Norfolk, (left), and the medieval parishes within (right). Parish boundaries after Southall and Burton (2004). Created by the author.
A=Walpole
B=Terrington
C=Clenchwarton
D=North and West Lynn
E=Tilney
F=Wiggenhall
G=Common Fen
H=Outwell
I=Emneth
J=Walsoken
K=West Walton
L=Common Fen

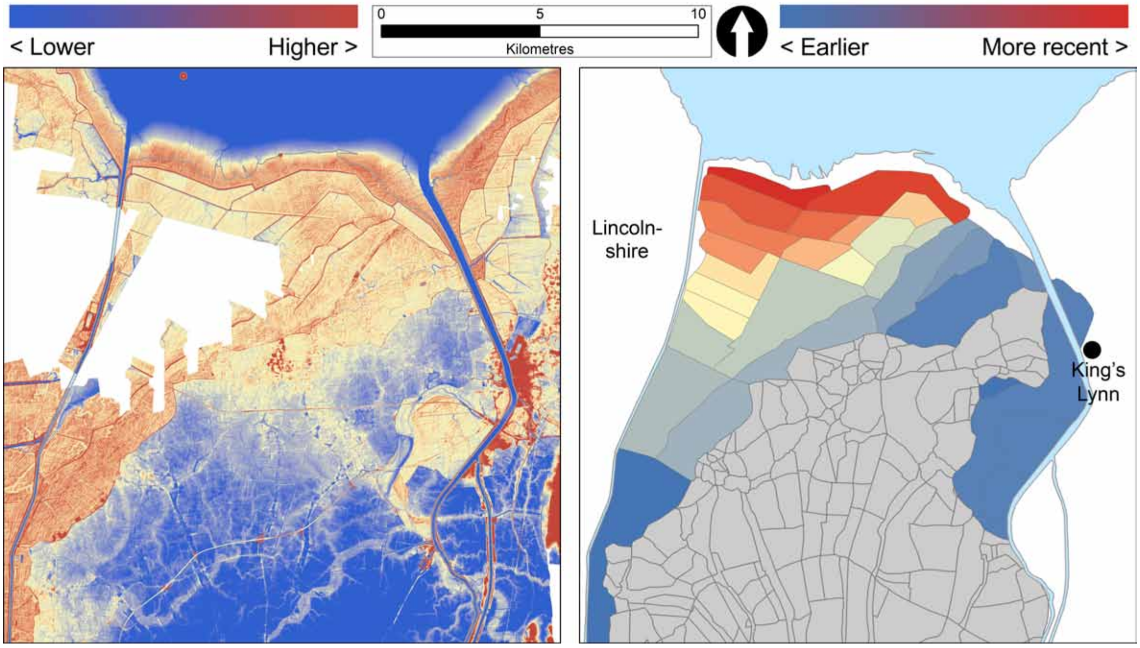

Figure 3.10: Two views of the seaward half of Marshland, Norfolk. Left: Digital Terrain Model (DTM) derived from 1m LiDAR data with blue representing low-lying ground and red representing areas of topographically higher altitude. Right: A schematic diagram of historical land-use. The fields in grey corresponds to the area marked on William Hayward's *c.*1610 map. The area to the north represent areas of more recent land-claim, starting in the 17th century, colour coded by date, from blue to red representing older to more recent enclosure, after Allen (1997: 24). Note that the fields marked in grey on the right show a strong correlation with relatively low-lying (blue) areas on the left demonstrating the early enclosure of this area relative to the lower (red) areas beyond. This is particularly obvious along the western boundary. Created by the author.

of Robert Scales—whose ancestor held 'the Hawe' and Islington in 1287/88 (Dugdale 1662: 245). This document lists a "manor called Howe by King's Lynn" (Kirby & Stevenson 2002: 75) which can be linked to the manor of Scales Hooe shown on an 18th century map, located on the banks of the Ouse to the immediate south of King's Lynn and defended against the sea by a, now vanished, dike visible on early aerial photographs.[31] The *hawe* place-name element, and its variations, can also be seen nearby at an area beyond the Clenchwarton sea wall shown on the *c.*1610 map named 'Popeshowe' and, although very faint, this can also be seen in the *c.*1582 map. Both locations containing the *hawe* place-name element, or a variant, appear to have been areas which were highly vulnerable to flooding—exposed to both the full force of the sea and riverine flooding from the Ouse. Indeed, the 'Hawe' belonging to the Scales family was again reported to have been flooded in 1369/70 (Dawes & Chapman 1938: 400). It is unclear to what extent such areas would have been permanently occupied. The 'Scales Hooe' is now part of King's Lynn, and has seen heavy modern development,[32] while, although not a main focus of the fieldwalking undertaken by Silvester (1988), 'Popeshowe' and its adjacent areas have not revealed evidence for anything beyond low level industrial activity such as salt-production (Silvester 1988: 18-22; 26-27).

As can be seen, the descriptions of flood events in the medieval sources often provide locational information which, using historic maps (*eg.* those of *c.*1582, *c.*1610, Tithe Maps and 1st Edition Ordnance Survey), can often be linked to a precise or, at least, rough location within the landscape. As in the latter example, this often comes with some difficulties or uncertainties and reconciling some toponyms mentioned in medieval sources with real-world locations is not always possible. Despite these difficulties, as far as possible, the flood events which occurred in Marshland between 1287-1349 (see fig. 3.11), after which Dugdale's sources become less detailed, have been examined in order to assess their landscape impact. This produces a database of 'point-data' recording flood damage at particular locations in specific years. When plotted by decade, as in Figure 3.12, some patterning is evident both spatially—with a number of areas registering as weak points which suffered damage repeatedly—as well as temporally—with relatively consistent low levels of damage evident across the period. The decade of the 1330s is the obvious outlier with a high number of reported impacts all along the Sea Wall that protected the Marshland parishes from marine inundation. This is unlikely to be a complete dataset of all the flood events which occurred in the area over this period, with studies both nearby—in eastern England (Bailey 1991: 190-191)—and further afield—in the Netherlands (Gottschalk 1971: 215-465)—attesting to a higher frequency of significant flood events than is suggested by Figure 3.11. It is likely, therefore, that the evidence presented here represents only the inundations that had a severe impact locally, or at least those

[31] Norfolk Historic Environment Record No. 21808. Available at http://www.heritage.norfolk.gov.uk/record-details?MNF21808-Scales-Howe-Bank-medieval-sea-defence-bank [Accessed 13/12/2018].

[32] Although a desk based assessment of the area in advance of a proposed Paper Mill development in 2007 noted the potential for medieval remains related to the Scales Hawe manor, the proposed development was judged unlikely to impinge on these deposits (Meager 2007).

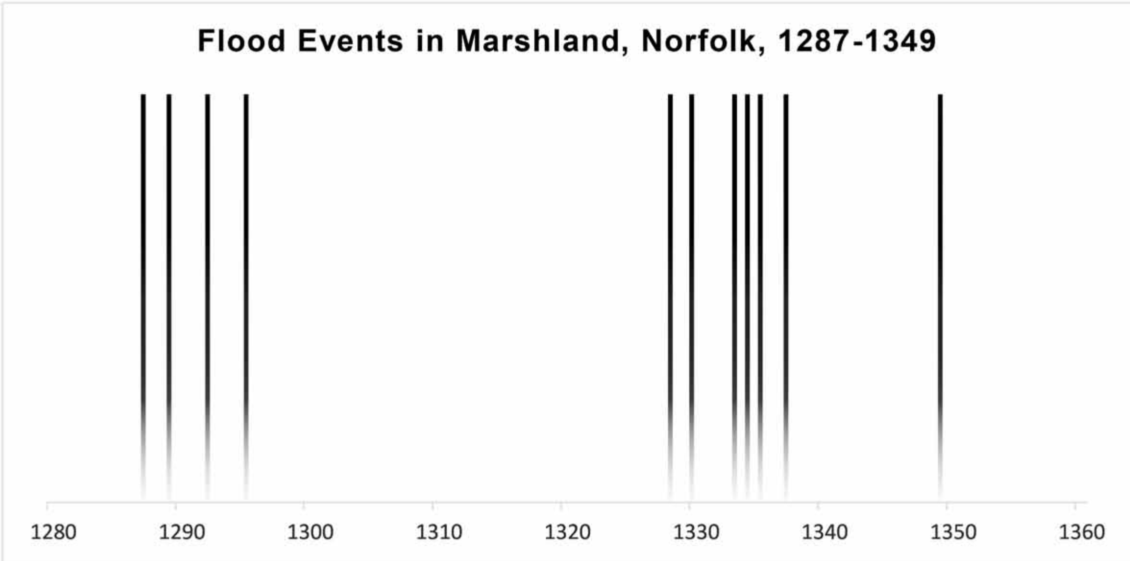

Figure 3.11: Flooding in medieval Marshland, Norfolk, between 1287-1349 as revealed by the sources amassed by Dugdale (1662: 245-260). Compiled by the author.

flood events which generated a high volume of documentary evidence—as a result of disputes between landowners and the escalation of issues to higher authorities. Presumably, more minor flood events were relatively routine and occurred on a near annual basis.

Prior to the 1330s the floods reported in Marshland appear to have been relatively minor events. Indeed, in the 1290s, the only reports of damage to the flood defences are as a result of misdeeds by members of the community rather than extreme weather events. In 1293, therefore, certain "persons... perforated the dyke called Pokediche" (Dugdale 1662: 246; Maxwell Lyte 1895b: 24)—the main dyke which kept inland freshwaters from flowing through the Marshland parishes, diverting them along drainage channels to the nearby town of Outwell where they flowed out into the Nene. The damage to the 'pokediche', or podike, in this case resulted in the flooding of "land and pasture" (Maxwell Lyte 1895b) but does not seem to have caused significant damage. More disastrous flood events seem to have begun to occur from the early 1330s. On 7th January 1330[33], for example, a bank on the west bank of the Ouse in Wiggenhall was breached, reportedly causing the inundation of 1000 acres of corn. Although this figure is unlikely to be reliable, it is not an entirely fanciful estimate if the breach allowed the river to flow into a large area of low-lying farmland. Although the stretch along which this bank must have run is easily identifiable, the precise location of the breach is unknown—the only toponym provided "Burtys bithe", cannot be found on historic or modern maps. The vulnerability of this area, however, is demonstrated by the fact that it was flooded once more on 29th November 1334 and again in January 1338 (Dugdale 1662: 257). The 1334 inundation also breached the sea bank at Ristoft field in the parish of Walpole leading to the flooding of 200 acres (Dugdale 1662: 255) while in the same year, further

[33]The morrow after the Epiphany, in the third year of the then King [Edward III] (Dugdale 1662: 257).

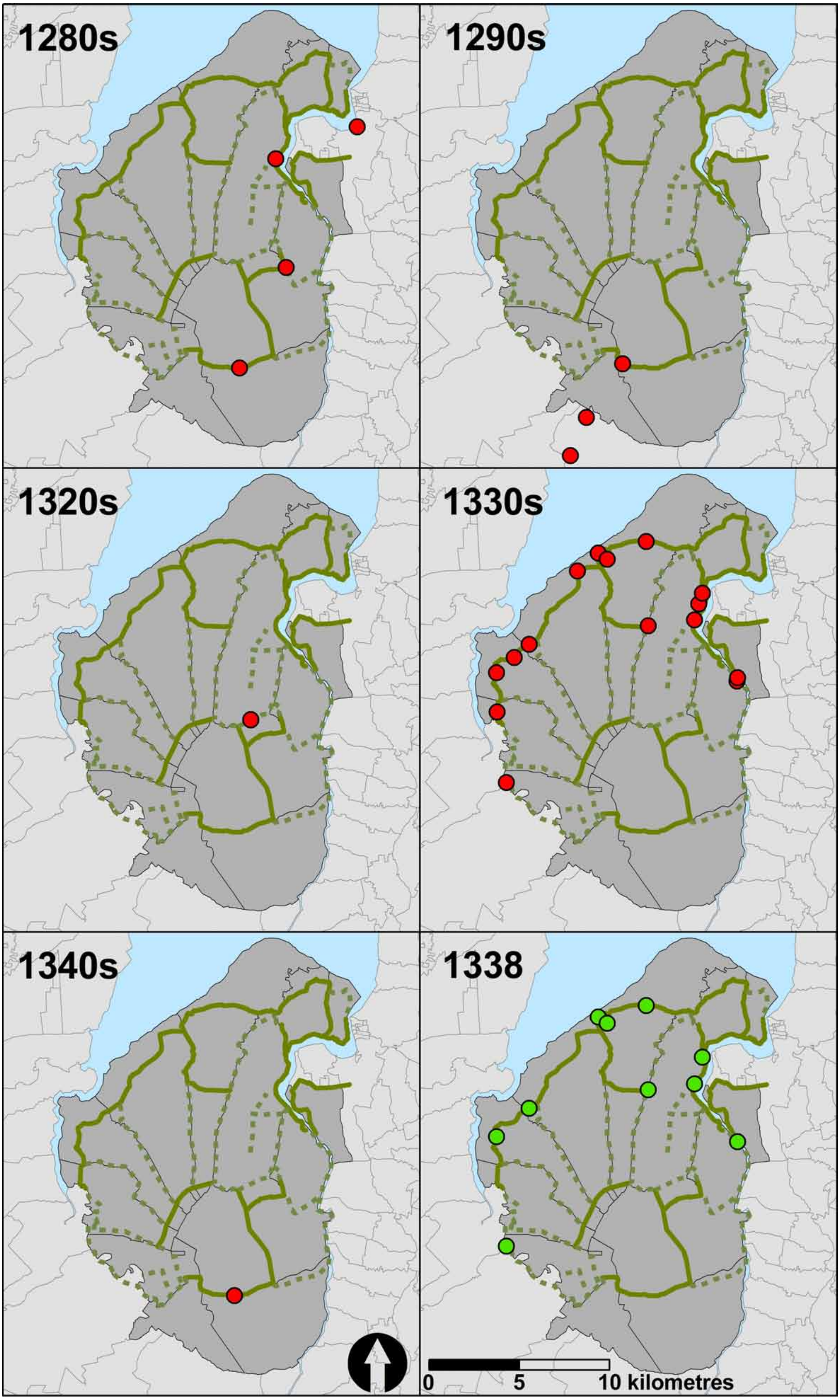

Figure 3.12: The impact of flooding in Marshland by decade between 1287-1349. (*Caption continued overleaf*)

Figure 3.12: (*continued*) The locations referred to in the historical evidence are often vague or refer to a large area or feature. As a result the precise location of the points shown in the maps above have been assigned with a degree of uncertainty although always with supporting evidence, mostly derived from earlier maps. Flood banks marked in solid green are those marked on the medieval period parish maps by Silvester (1988) while those indicated by a dotted line are dikes shown on Hayward's *c.*1610 map. These are less certain as, during the medieval period, 'dike' could refer to either a raised embankment or "a deliberately cut or managed stream" (Jones *et al.* 2017: 58). Perhaps the most remarkable conclusion from this plot of the historical data compiled by Dugdale (1662) is the swarm of flood damage reported in the 1330s relative to the other decades for which floods were reported. Notably, the majority of the damage in the 1330s seems to have occurred in a single flood event in January 1338. Created by the author.

flooding was caused by a drainage problem in Walsoken which had emerged the year before, but had evidently not been rectified (Dugdale 1662: 256).

The flood with the highest volume of historical data to have affected the region occurred in January 1338. A number of sources refer to a similar flood in 1337,[34] while Dugdale's sources state that this event struck the Fens (including the coasts of Lincolnshire, Cambridgeshire and Norfolk) in the 11th year of the reign of Edward III[35] (1337-8). The majority of Edward III's 11th regnal year, therefore, corresponds to 1337 but as the sources which give a calendrical date agree the floods occurred on 12th and 13th of January, these would have in fact taken place in 1338 by modern reckoning. Supporting evidence for this event can be found in the rolls of Edward III; the Close Rolls record the inundation "by sea storms" of Tilney, Walpole, Walsoken, West Walton and Emneth on "Monday before Hilary" [12th January 1338] while Wiggenhall and Terrington were flooded the following day [13th January 1338] (Maxwell Lyte 1900a: 293). Dugdale's sources do not specifically mention the date mentioned above but a passage does refer to a flood on "the Eve of Hijlarie then last past" which, if 1338 is the year referenced, would correspond to 12th January (Dugdale 1662: 257). The Fine Rolls covering the period also reference the fact that the residents of the seven towns listed above were affected by flooding in 1338 (Maxwell Lyte 1915: 62). Several secondary sources[36] report supporting evidence for a flood in the area at this time (Pevsner 1962: 745; Watt & Colston 2000: 738), particularly mentioning severe damage to the church of Walpole St Peter a fact which is also referenced by Dugdale (1662: 255). This claim is repeated in the church guidebook with the additional assertion that this was in some way the result of "a tidal wave from a volcanic eruption off Iceland" (Anon. n.d.: 3). The evidence on which this claim is based is unclear; no major Icelandic eruption is known from 1337/8 and a hypothetical 'tidal wave' generated off Iceland would need to be of an extremely high-magnitude to cause inundation in the Wash. The structural evidence of the standing church, however, does fit the narrative that the original church was destroyed in the early-mid 14th century. The tower is the only surviving part of the original structure with a later nave constructed in the transitional perpendicular style by about

[34] *eg.* TNA: SC 8/152/7565, TNA: SC 8/170/8456 and TNA: SC 8/78/3856; Pevsner 1962: 745; Watt & Colston 2000: 738.
[35] The 11th regnal year of Edward III lasted from 25th January 1337-24th January 1338.
[36] No references are given for this information in either of these works.

Figure 3.13: The west front of the parish church of Walpole St Peter, Norfolk. Note the clear distinctions between architectural phases with the original tower, constructed in *c.*1300 (the only surviving part of the original church with the rest thought to have been swept away in a marine inundation), the later nave dating to the 1360s and the later south porch (*c.*1425) on the right-hand side. Photograph by the author.

1360 and a later perpendicular chancel added in around 1425 (see fig. 3.13). Although the material evidence is scarce, it appears that a severe flood occurred in January 1338. While it is possible that a similar event occurred during the previous year, it is also possible that a 1337 flood, referenced in subsequent literature, has been confused with the 1338 event due to calendrical differences.

The documentary sources which reference the impact of the 1338 flood particularly stress the fact that the sown corn as well as many goods and chattels had been destroyed or lost (Maxwell Lyte 1900a: 293). More detailed evidence for the inundation of 1338 chiefly comes from the sources brought together by Dugdale (1662) (see appendix D). These provide acreages of land lost to flooding for each parish,[37] and the financial costs of repairs, as well as qualitative information such as the nature of flooding at particular locations. While the acreages lost to flooding must be regarded with care, they provide a rough picture of the relative impact of the floods in the different parishes (see fig. 3.14 and table 3.3). In a number of instances, the qualitative information

[37]These figures cannot be taken at face value as medieval information of this type is renowned for its inaccuracy. For an example see Ziegler (1969: 51-53). Although as these documents relate to a petition for the reassessment of taxes, more attention may have been paid to the figures than by most chroniclers recording similar circumstances.

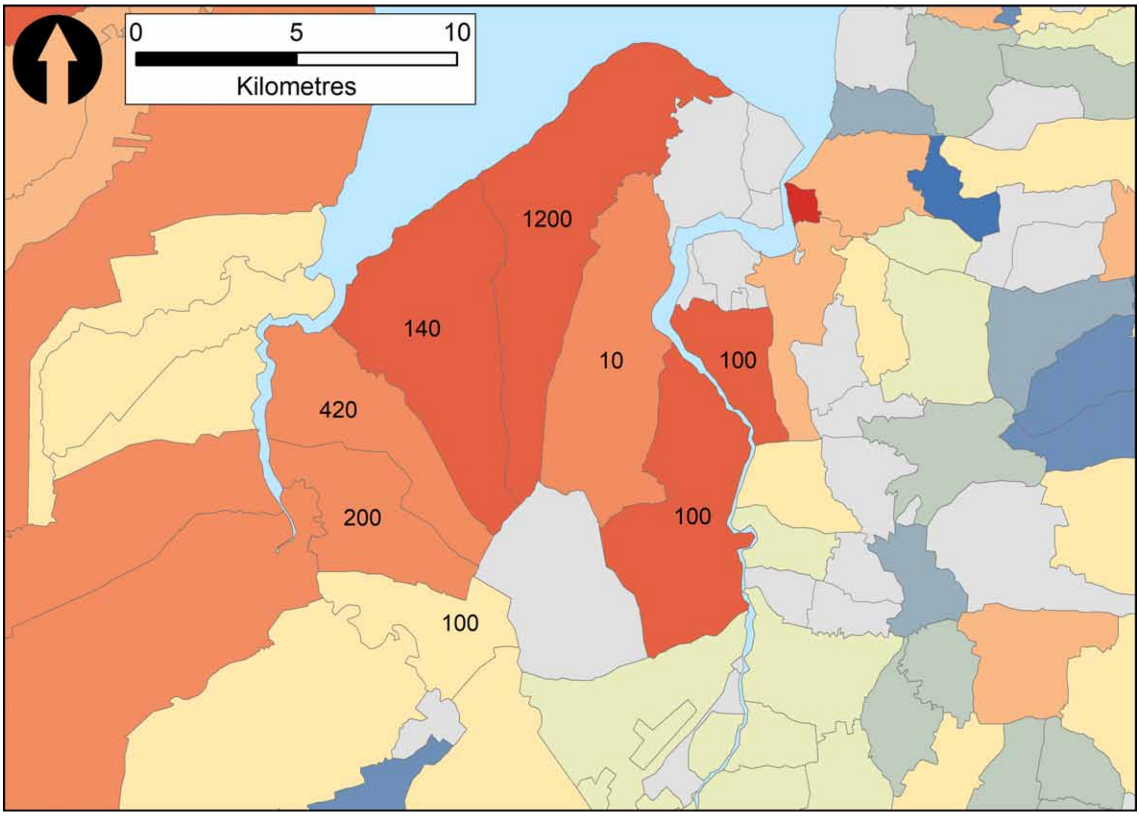

Figure 3.14: The acreages affected by flooding in the parishes of Marshland after Dugdale (1662) (see appendix D) overlain against taxable wealth in 1334 (red=more taxable wealth, blue=less taxable wealth) derived from the Lay Subsidy of 1334 (Glasscock 1975: 197). Grey parishes go unmentioned in the Lay Subsidy of 1334. Created by the author.

allows specific affected areas to be identified. We are told, for example, that 'Rushemershe' and 'Newemershe', belonging to the parish of Terrington, were inundated (Dugdale 1662: 259). While the location of the latter is unknown, the location of the former can be inferred from the location of 'Rushgate' shown on Hayward's map set into the sea walls running along the northern edge of the parish (see fig. 4.15). These two areas, therefore, were probably areas of salt marsh beyond the sea walls and as such are unlikely to have contained much human settlement beyond functional and productive structures such as small outbuildings and, perhaps, structures related to salt-production.

Evidently, the existing flood defences were insufficient to protect the Marshland parishes in January 1338. Non-specific breaches in the sea banks which embanked the area are frequently reported in the documentary account (Dugdale 1662: 254-259). When sea banks were insufficient to withstand marine or fluvial forces, the resulting breaches could range from relatively minor holes, which typically occurred at points which were particularly vulnerable, or had been weakened for some reason, to, in the most extreme conditions, the removal of long stretches of embankment which could be over 100m in length (Gardiner & Hartwell 2006: 138). Small scale breaches were usually repaired with an encircling repair, surrounding the scour hole created by the water pouring through the hole in the embankment[38] while the loss of longer sections was more likely to be repaired by a

[38] This is discussed in greater detail in Chapter 4.5

Parish	Affected Acreage	Costs	Details
Walpole	140	£162	Repairs to sea bank, 'Pokediche' and other works
Terrington	1200	£102 18s 24d	Lost income from inundated lands and repairs to the Sea-bank and the 'Bank of Pokedich'
Tilney	10	£236 13s 4d	Damage to the town by flooding, Repairs to 'Pokediche' and 'Blakediche' other works and maintenance
Wiggenhall	100	£125	Repairs to sea banks and the 'pokediche'
Emneth	100	£30	Repairs to the 'pokediche'
Walsoken	200	£50	Repairs to the sea bank, the 'pokedike' and a sewer 'containing five miles in length'
West Walton	420	£90	Repairs to sea-banks, the 'Pokediche' and other 'gutters and sewers'

Table 3.3: Repairs and maintenance costs to the flood defences in Marshland following the 1338 flood. Created by the author after data derived from Dugdale (1662: 258-259).

more significant realignment of the sea wall. This often forced the construction of a new defence connected to the limits of the breach. Often these were removed some distance inland from the original location in order to provide increased protection (Gardiner & Hartwell 2006: 139). Over a long period of time, therefore, intermittent breaches, and the repairs and adjustments to the sea walls these forced, generate distinctive patterns in the landscape which often remain recognisable today. Archaeologically, breaches of medieval date can be found in the parish of Terrington St Clement in the sea bank running toward Clenchwarton (Silvester 1988: 41; see fig. 3.15) where two 'horse shoe' shaped features indicate encircling repairs constructed around failures in the sea bank. Although it is difficult to precisely date these features, the fact that they appear on the *c.*1582 map of Marshland (see fig. 3.16) provides a *terminus ante quem* for their breaching and subsequent repair. Silvester (1988: 41) ascribes them to the 13th or 14th centuries and although it is impossible to confirm with certainty when these breaches occurred, their location is consistent with the repair pattern described after the 1338 inundations (Dugdale 1662: 259). A further possible medieval breach may be indicated by toponym 'the breach' shown on the *c.*1610 map in the sea bank between Terrington St Clement and Walpole Cross Keys (see fig. 4.15). In addition, the re-alignment of the sea bank in the parish of Walpole St Andrew, evidenced by the continuity of field boundaries underneath its current path, could indicates an adjustment necessitated by the loss of a significant stretch of sea wall to flooding—although when exactly this may have occurred is unknown (Silvester 1988: 41; Rippon 2001: 20-22).

Some effects of the 1338 floods are, however, more difficult to identify. Reference is made to a sluice known as 'Scales Gole', which was presumably located on land belonging to the already mentioned Scales family,[39] throughout the material amalgamated by Dugdale. The various references to the sluice place it in the parish of Tilney but the fact that it does not appear on either Hayward's

[39]Reference is particularly made to Robert de Scales who owned land in Islington, Tilney Parish, and the Hawe, near King's Lynn (Kirby & Stevenson 2002: 75). For example see Dugdale (1662: 245, 251, 253, 255).

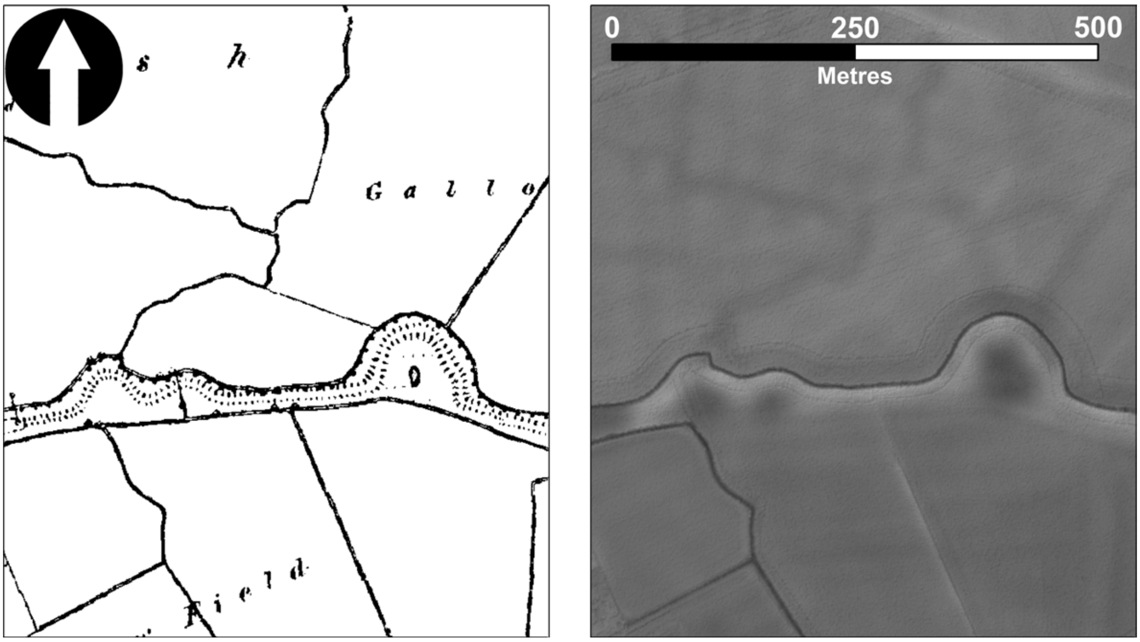

Figure 3.15: A possible breach in a medieval flood defence located between Clenchwarton and Terrington St Clement. Left: 1^{st} Edition Ordnance Survey County Series 1:10560 Map. Right: 1m LiDAR.

Figure 3.16: The breaches visible in figure 3.15 appear to be visible in this map of anonymous authorship of Marshland thought to date from *c.*1582 demonstrating that these breaches occurred at some point before this date. British Library Add. MS 71126 f. 1. Reproduced by kind permission of the British Library Board.

map nor the first edition OS map may be explained by the fact that, in the 1338 floods, Scales Gole was "destroyed by the Sea-tides; by reason whereof, a great part of the said Town was drowned and made yearly much worse" (Dugdale 1662: 259). Its rough location can be inferred through further information such as the fact that, in the same flood, land in Terrington Parish was flooded as a result of the loss of Scales Gole, which, in turn, had caused damage to a sluice "called Oxhowe" which channelled freshwater downstream to Scales Gole (Dugdale 1662: 259) where it presumably drained into the Ouse. 'Oxhowe' may relate to 'Oxhow Clough', which is marked on the first edition OS map at the boundary between the modern parishes of Terrington St Clement, Terrington St John and Tilney St Lawrence (see fig. 3.17) where several drainage ditches run together (see fig. 3.18). Today the waters which meet here flow to the south before being diverted towards the Ouse. As the Scales family held land in the parish of Tilney it is most likely that Scales Gole was located in this parish. Possible drainage from Oxhow Clough to the Ouse which would have run through this parish are shown in 3.17. One possibility is that the 'Tilney Goole', which goes unmentioned by Dugdale, was known by a different name during the medieval period or that an antecedent sluice that served the same function in an earlier period, has changed from Scales Gole to Tilney Goote over the intervening years.

As seen above, many of the locations in Marshland which experienced damage during the floods of 1338 can be located and explored through a variety of sources. Together with the historical descriptions of the inundation, the spatial data marks out the 1338 flood as a particularly damaging event. In light of the record of flood events in Marshland from the 1280s, however, the community was clearly experienced in dealing with these disasters. The social organisation and structural responses which allowed them to cope with these events are discussed further in Chapter 4.

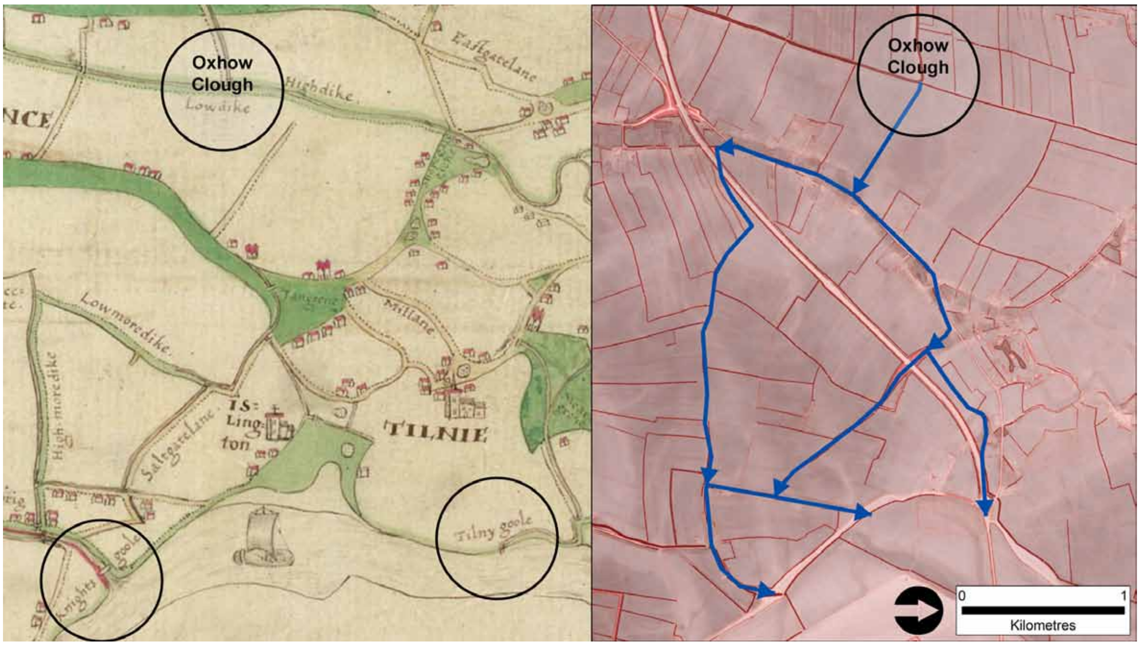

Figure 3.17: Oxhow Clough and possible locations of ‘Scales Gole’. Left: Detail of the *c*.1610 map covering the area of Oxhow Clough and the presumed location of ‘Scales Gole’. Right: Possible drainage pattern at the time of the 1338 floods based on drainage channels visible on present-day LiDAR. ‘Scales Gole’ may have been a sluice at one of the deviations where the drainage channels bifurcated or, alternatively, may have been another name for the Tilney Goole or Knights Goole seen on the *c*.1610 map. Left: British Library Cotton Augustus I.I, f. 79. Reproduced by kind permission of the British Library Board. Right: Created by the author.

Figure 3.18: Oxhow Clough in the present day. Today this confluence of ditches drains water from the surrounding fields south to the fen. Based on the historical sources, it is likely that this has changed since the medieval period as, in 1338, it seems to have been connected to a sluice in the parish of Tilney. Photograph by the author.

3.3 The St Maur's Day windstorm of 1362

On January 15th 1362 an extreme windstorm tracked across England from the south west across central southern England to East Anglia moving across the North Sea and arriving at the coasts of Denmark and northern Germany the following morning. In England the chroniclers' descriptions of the damage caused by this storm are evocative of what must have been an alarming occurrence. *The Brut Chronicle*, for example, describes how the storm "blew down to [the] ground high houses and other strong things and all other strong works ... were so shake[n] therewith that they ... shall be evermore the feebler and weaker" (Brie 1906: 315).[40] The historical sources, discussed in more detail below, reveal that the 1362 windstorm resulted in widespread damage across the area of effect, uprooting trees and bringing buildings crashing down. In these respects, and given the geographical coverage of the storm, it is somewhat comparable to the more recent 15th-16th October 1987 storm, known as the 'Great Storm' of 1987, which caused similar levels of destruction across a broadly comparable area. The peak wind-speeds recorded in 1987 were 196 km/h. While such speeds are not exceptional for the British Isles as a whole, south west of an imaginary line between Norwich and Southampton, wind speeds of this magnitude have an estimated recurrence interval of 200 years (Burt & Mansfield 1988: 101-103). Rowe (1988) has identified the storms of 1362, 1662, 1703 and 1987 as the events which best fit this pattern, although each event followed a slightly different track and, although instrumental readings are lacking for the three pre-modern storms, with differing wind speeds—resulting in variations in the levels of damage and areas affected across the British Isles.

3.3.1 Historical background

The 1362 storm is primarily known through the descriptions of chroniclers (see appendix F). There is, however, some difficulty in assessing to what extent their descriptions are contemporaneous. While some may have been composed soon after the event, others could have been recollected or copied from other sources decades later. Ranulph Higden's *Polychronicon* provides one such example. The core of this historical work comes to an end in the year 1348 but an anonymous continuation extends the text to 1362, including a succinct record of the storm (Lumby 1882: 360; and see fig. 3.19). This continuation was most likely composed during the late 14th or early 15th centuries but as the authorship is unknown it is difficult to gauge its reliability.

Although not always a good indicator of reliability, the vast majority of sources agree on the date of the storm's occurrence, its timing and direction. Most state it struck on the evening of St Maur's Day (15th January) 1361 (Venables 1891: 40-41; Brie 1906: 315; Tait 1914: 150), a date which is also found in a contemporary legal document referencing the storm.[41] Note that this

[40] Spellings modernised by the author. See Appendix F.15 for the original text.
[41] TNA: JUST 2/18/58.

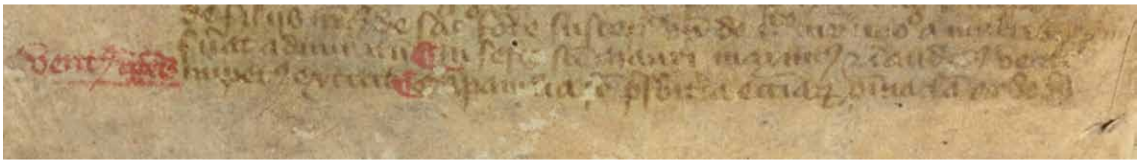

Figure 3.19: Excerpt from Ranulph Higden's *Polychronicon* describing the 1362 windstorm. The text reads: "*In festo Sancti Mauri maximus et inauditus venti impetus extitit, campanilia super presbyteria, ecclesiarum pinnacula, arbores. . .*" This particular volume is incomplete and ends at this point, mid-text. The continuation can be found in the version of Higden's *Polychronicon* published by HM Stationery Office (Lumby 1882: 360) which contains the remainder of the section: "*. . . domos ultra modum prosternens, multaque alia mala fecit: inundationes aqaurum protinus sequebantur*". A loose translation of the combined text would therefore read: "In the feast of Saint Maur(us), a great and unprecedented wind arose. Steeples above presbyteries, church towers, trees and houses beyond measure were prostrated and many other bad things occurred: inundations of water immediately followed". Reproduced from www.hathitrust.org. This image comes from UIUC Online Collection MS 0132. Public Domain. Translation by the author.

date corresponds to 15th January 1362 by modern reckoning as during the medieval period the new year was commonly counted from Lady Day (25th March) rather than 1st January (Pfister 1996: 96). Outliers include *Knighton's Chronicle* which dates the storm to St Anthony's Day (17th January) (Martin 1995: 185), probably a simple lapse of memory, and the Irish *Annals of the Four Masters* which gives the year as 1363 (O'Donovan 1856: 625). Errors of misdating, usually to one year before or after, are very common with this category of evidence (Pfister 1996: 96) and whilst the Irish source conceivably documents a different storm in the following year, further evidence demonstrating that the St Maur's Day storm certainly affected Ireland (Gilbert 1884: 396) suggests this is not the case. The timing of the event can be narrowed with some precision as a number of sources indicate the storm struck at evensong/vespers—evening prayers usually conducted at around 6pm (Hingeston 1858: 221; Haydon 1863: 229; Schmidt 2011: 176-177). The majority of continental sources on the other hand, document the storm occurring on St Marcellus Day (16 January) (Weikinn 1958: 232-235; Gottschalk 1971: 371-376). This suggests that after passing over England on the evening of 15th January, the storm arrived at the North Sea coasts of the Low Countries, Germany and Denmark early the following morning. This accords well with a chronology based on the speeds and progression of comparable modern storms such as the Great Storm of 1987, 15th-16th October 1987, or the St Jude's Storm, 28th October 2013. Had these storms arrived over England at 6pm, they would have reached the German and Danish coasts around 5am the following morning[42] (see fig. 3.20). Although a number of chroniclers state that the storm continued for seven days after St Maur's Day (Brie 1906: 315; Tait 1914: 151), this is almost certainly an exaggeration—although the weather may have remained inclement during this period. All of the chroniclers who discuss the direction also agree that the storm came from the south or south-west (Hog 1846: 196; Venables 1891: 41; Tait 1914: 150). The evidence therefore

[42] This conclusion has been drawn through comparison with data from www.europeanwindstorms.org. [Accessed 05/05/2016], Copyright Met Office, University of Reading and University of Exeter. Licensed under Creative Commons CC BY 4.0 International Licence: http://creativecommons.org/licenses/by/4.0/deed.en_GB.

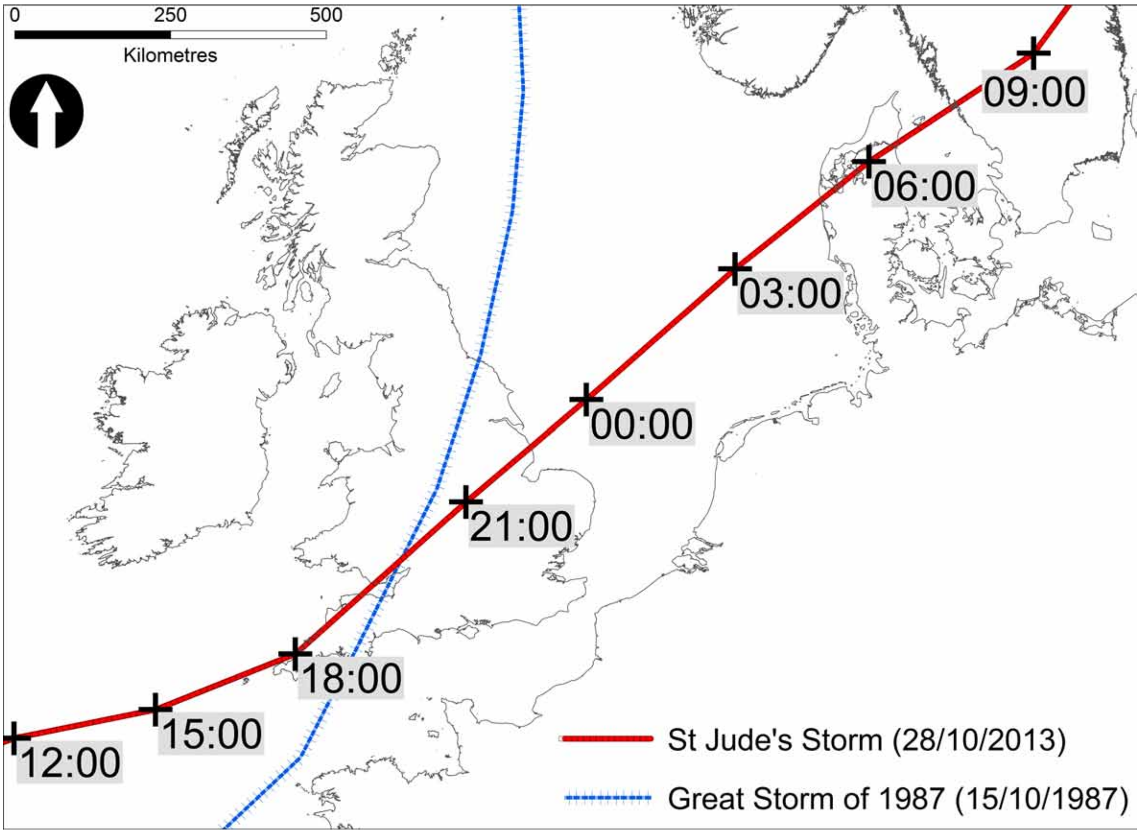

Figure 3.20: Reconstruction of the timing of the storm of 15th January 1362. Shown are the tracks of two comparable modern storms, the Great Storm of 15th October 1987 and the St Jude's Storm of 28th October 2013. The timings shown indicate the location of the eye of the storm based on the progression of these modern storms but recalculated based on an arrival over England at 6pm as reported by a number of historical sources. Assuming a track similar to the 2013 St Jude's Day storm, this supports the historical sources which report the storm's arrival over England in the early evening of 15th January, reaching the coasts of Denmark and northern Germany by the following morning. Created by the author. Modern storm data from www.europeanwindstorms.org. [Accessed 05/05/2016], Copyright Met Office, University of Reading and University of Exeter. Licensed under Creative Commons CC BY 4.0 International Licence: http://creativecommons.org/licenses/by/4.0/deed.en_GB.

supports the identification of the St Maur's Day event as a high-magnitude extratropical windstorm which tracked from west to east, from south-west England across to the east coast, on the night of 15th January 1362 before proceeding across to the North Sea coasts of continental Europe early the following morning.

The documentary evidence widely attests to the storm's impact in England. Most of the chronicles provide qualitative statements describing, for example, damage to structures and felled trees. A typical example is the *Chronicon Angliae Petriburgense* which describes "*domos et molendina innumera prostravit, arbores et integras silvas in multis locis a fundamentis evulsit*" (Giles 1845: 172). In some cases, local details such as damage to specific prominent buildings are included such as at the Dominican Friary in Dublin (Gilbert 1884: 396), the Augustinian Friary in London, the bell towers of Bury St Edmunds, Suffolk, and Norwich, Norfolk (Galbraith 1927: 50), as well as the gatehouse of the Benedictine Abbey of St Albans, Hertfordshire (Riley 1869: 387). Some chroniclers provide anecdotal accounts of local occurrences. For example, at St Augustine's Abbey in Canterbury, Kent, a chaplain was killed after seeking shelter from the storm when a roof beam of the chapel of St Pancras was blown down into the nave (Davis 1934: 564). Similarly, in London, an Augustinian friar was reportedly blown through a window by a particularly strong gust (Scott-Stokes & Given-Wilson 2008: 119). Such incidents, together with the recorded structural damage, would correspond to a storm of force 11-12 on the Beaufort Scale. This, together with the use of terminology describing the storm as "never . . . seen or heard before . . . in England" (Scott-Stokes & Given-Wilson 2008: 119) or "as it was thought had never been seen in earlier times" (Martin 1995: 185), leaves no doubt that this event was beyond what was considered 'normal' during a winter storm season.

Beyond written chronicles, a number of other types of document provide evidence for the damage wrought by the storm. Many of these sources, however, only date the storm to the year 1362 so it must be assumed that they deal with the 15th January event rather than a separate storm. The coroner's rolls provide further evidence for fatalities, describing how two parishioners were killed inside the church at Longstanton, Cambridgeshire, when a tree was blown against the building, causing masonry to fall down upon them (see fig. 3.21).[43] Manorial accounts such as those from Thaxted, Essex, where two windmills and a grange were heavily damaged (Newton 1960: 71, 75), highlight the damage faced in affected rural areas. A particularly useful source is the *Register of the Black Prince* which covers the administration of the estates held by the heir to the throne, Prince Edward[44] (see Appendix G). These provide details of felled trees in the Prince's parks as well as damage to housing, mills, manors and infrastructure across his estates (Dawes 1931: 188-189; Dawes 1933: 416, 420, 426, 429, 431).

The widespread damage at royal parks, which contained swathes of woodland, documented in the Black Prince's *Register* are symptomatic of the high numbers of trees blown down across England. For example, in addition to damage to structures and park paling (fencing) "*per tempestatem venti*"[45] a high number of trees were felled by the wind at the royal palace and deer park at Clarendon, Wiltshire (Maxwell Lyte 1912: 117, 183). Interestingly, Clarendon was again a victim to storm damage in October 1987, with extensive damage caused across the site (Beaumont James & Gerrard 2007: 177). For comparison, the 'Great Storm' of 1987 toppled around 15 million trees in England—although as the 1987 storm struck in mid October, when the leaves were still largely on the trees, the proportion blown down in 1987 may have been higher relative to January 1362 (Quine 1988: 115). One characteristic of the damage in 1987, which is likely to have also occurred in 1362, was the almost total felling of 'swathes' of woodland, clusters of trees ranging from *c.*10 trees covering 0.025 ha to hundreds spread over areas up to 5 ha (Allen 1992: 340). A wide range of documentary sources attest to the felling of trees at other locations, illustrative of the high number

[43] TNA: JUST 2/18/58.
[44] b. 1330 d. 1376.
[45] TNA: E 101/460/2.

Figure 3.21: All Saints' Church, Longstanton, Cambridgeshire, surrounded by trees. The Coroner's Rolls report structural damage to the church when a tree fell against the structure in 1362, resulting in the deaths of two worshipping parishioners. Externally, however, there is no obvious evidence for the incident although multiple phases of repair, enlargement and renovation are discernible. Photograph by the author.

of trees affected across a wide area. For example, felled trees are reported at Eaton, Norfolk (Pribyl 2017: 241) while at Alveston, Warwickshire, one aubel[46] as well as four elms were toppled by the wind. The fact that one of these elms was valued at 13s 4d (compared to the 2s value assigned to one of the others) indicates that this must have been a very large, old tree and perhaps a local landmark.[47] The records of the repairs at Wallingford Castle in the storm's aftermath provide further evidence for the toppling of woodland resources by the wind, with 1700 beech trees felled at nearby Watlington, Oxfordshire. Some of this timber appears to have been put to use in the repairs of the castle while the remainder was sold for £28 6s 8d (Keats-Rohan 2015: 94).

Documentary evidence, in a number of different forms, records damage affecting many structures across a wide area which can be linked to the St Maur's Day windstorm. At high status structures such as Wallingford Castle, Oxfordshire, mentioned above, the damage and repairs are described in considerable detail by the surviving documentary evidence. Within the castle, the *Register of the Black Prince* specifically mentions the storm causing damage to the roofing of the chapel of St Nicholas, as well as housing belonging to the chaplain and clerks (Dawes 1933: 426). A campaign of repairs followed between 1363 and 1367 although some of these addressed issues which pre-dated the storm (Keats-Rohan 2015: 84) and may have also sought to make the castle more habitable as it was to become the main residence of the Black Prince's new wife, Joan of Kent (Keats-Rohan 2015: 64). It is therefore likely that, although the storm provided a catalyst for repairs, high winds were not responsible for all of the works undertaken over these years. Some of the damage most likely to have been caused by the storm itself include the ironwork and glass in a window of the Tower chapel (Keats-Rohan 2015: 94) while the re-roofing by, one John Tyler, of the wardrobe, Queen's chamber, another chamber and a hall (Keats-Rohan 2015: 86) likely attests to significant damage to the castle's roofing by the storm. Low status structures, on the other hand, attracted considerably less detail in the documentary record—where they were recorded at all. A typical example comes from the records of Worcester Cathedral Priory which records that the house of one Nicholas Robines "was prostrated by the wind".[48] There is, therefore, a significant bias in the historical record towards high status structures and the affairs of the elite more generally.

In a number of cases, although evidence exists documenting repairs in 1362 which could relate to storm damage, this connection cannot be made with certainty. This can be seen when, in mid-February 1362, the Black Prince ordered his steward in Cornwall, John Dabernoun, to tour his Cornish estates to assess the damage (Dawes 1931: 189). As no specific locations are named, however, no locations can be linked to the storm with certainty. Later in the year though, repairs are mentioned at a number of sites, possibly indicating affected locations. On 20th September 1362, for example, the Prince ordered that the carpenters working at Liskeard, Cornwall, were to be paid

[46] A term for a white poplar (*Populus alba*).
[47] WCL: E20. I am grateful to Chris Dyer for this information.
[48] WCL: E20. I am grateful to Chris Dyer for this information.

60 shillings as a gift (Dawes 1931: 193-194) which may indicate ongoing repairs were taking place. Another uncertain but possible location where damage may have occured is indicated by an entry from 6th October 1362 when the Prince ordered repairs to "the Chapel of the Trinity in the park of Lostwithiel" (Dawes 1931: 194). A number of conspicuous repairs to bell towers in the region affected by the storm shortly after its occurrence provide some likely if still unconfirmed cases of storm damage. One such case is the donation of £100 towards the construction of a new bell tower at the Augustinian friary of Clare, Suffolk, in 1363 (Harper-Bill 1991: 85) while, similarly, a bequest in 1364 to fund the repair of the belfry at St Nicholas, Hinxworth, Hertfordshire, provides another probable candidate (Pevsner 1977: 196). Less certain are the repairs ordered to the Tower of London on 10th June 1362 (Maxwell Lyte 1909a: 336), specifically to one of the towers in which the chancery rolls were kept, perhaps indicating that damage occurred here in the storm, although it is impossible to be certain. Other reports of damage and repair in southern England in that year can probably be discounted or, at least, qualified. For example, on 12th February 1362 Edward III commanded 200 masons to be sent to work at Windsor Castle (Maxwell Lyte 1912)[164], but there was an ongoing building programme and the shortage of labour resulting from the 1361 plague outbreak, rather than storm damage, may have been the primary driver for this command (Tighe & Davis 1858: 173-174). Similarly, although extensive damage was reported at St Briavel's Castle, Gloucestershire, on 20th May 1362 (Stamp 1937: 185-186), the damage was described as occurring "when Robert de Sapy was sensechal" which would have been decades before the storm, either 1322-1325 or 1330-1335 (Baggs & Jurica 1996: 414).[49]

Although in many cases the historical record recording the storm of 1362 is highly detailed it also has many caveats. The historical record is richest for high status and ecclesiastical buildings and estates which were better documented and have survived in greater numbers into the present. Certain spheres that such a high magnitude storm might reasonably have been expected to affect are conspicuously absent from the record. The storm's effect on shipping for example is attested by very few known sources. The only vessel known to have been affected, the *Tarrit*, was forced to shore at Plymouth by the storm and subsequently became the subject of a legal dispute after being plundered by the locals (Hardy 1869: 420).[50] The vague statement from the Irish *Annals of the Four Masters* that the storm "also sank many ships and boats" (O'Donovan 1856: 625) demonstrates that although no further specific cases are known in detail, the case of the *Tarrit* cannot have been an isolated incident. Certainly, when another great storm occurred in 1703, high numbers of both naval and civilian shipping were lost at sea (Defoe 1704: 165-224).

The evidence presented above goes some way to reconstructing the occurrence of the 1362 windstorm. It is briefly necessary, however, to clarify some points suggested by a number of secondary

[49] Although note that a severely damaged castle would have been particularly vulnerable to what appears to have been the period's highest magnitude storm.
[50] TNA: SC 8/247/12320.

sources in relation to the windstorm. Firstly, it has been suggested that the storm was the result of, or at least exacerbated by, the Icelandic volcano Öraefajökull which erupted in 1362 (James & Robinson 1988: 39). This can be swiftly debunked, however, as the windstorm struck England on 15th January while the sources which record the eruption suggest that Öraefajökull lay dormant until early June (Thorarinsson 1958: 29)—long after the storm had come and gone. Furthermore, in a number of cases the windstorm of 1362 has been associated with flooding around the shores of the British Isles yet there is no concrete evidence to support such an assertion. The only chronicle which mentions flooding in association with the windstorm is the continuation of Ranulph Higden's *Polychronicon* which states: "*inundationes aquarum protinus sequebantur*" (Lumby 1882: 360).[51] This description, however, is very general and fails to specify any affected locations. Nevertheless, certain sites have traditionally been connected to flooding caused by the storm of 1362. For example, the loss of the port of Ravenser Odd on Spurn Point, East Yorkshire, has been attributed by some to the 1362 windstorm (see for example Murphy 2009: 35). The available documentary evidence, however, suggests that the town was lost prior to the occurrence of this storm (Maxwell Lyte 1909a: 453; de Boer 1964: 83). Severe flooding, presumably as a result of water driven across the North Sea overnight on the 15th/16th January 1362, is, however, attested from the German, Frisian and Danish coasts, in both the documentary record (Hybel & Poulsen 2007: 47-48; Mauelshagen 2012: 63-65) as well as the archaeological record. As well as traces of former settlement identified through remote sensing (Gade *et al.* 2017),[52] a discrete high-energy layer has been detected through geo-archaeological investigations around Hallig Südfall, North Frisia, Germany. This layer is dated through association with a mollusc which yielded a calibrated radiocarbon age of AD 1312-1445 and a piece of wood dated to AD 1228-1269, thought to relate to the enclosure of coastal marshland in the preceding century, providing a secure *terminus post quem* for the deposition of the storm layer (Hadler *et al.* 2018: 51) consistent with the historically attested flooding which the 1362 windstorm caused in that area.

3.3.2 The material evidence

As the storm layer detected on the German coasts attests, the storm did leave a physical signature and it is also possible to detect traces across the area of effect in the British Isles. Structural evidence is perhaps the most frequently documented impact of the storm and as such, it is a reasonable assertion that standing buildings dating from the time of the storm may preserve evidence for its occurrence. There are many of these cases for which no obvious supporting material evidence can be found. At Rochester Castle, Kent, for example, although extensive repairs motivated by storm damage took place between 1367 and 1370, the castle had been in a state of disrepair and

[51] Inundations of water immediately followed. Translation by the author.

[52] Although note that these remains cannot be accurately dated without ground-truthing and, as another severe storm surge affected the region in the 17th century, there is significant potential for misidentifying later remains as those of medieval settlement.

neglect since a siege in 1264 (Allen Brown 1969: 18-19). Thus, although documentary evidence does describe the damage suffered in the storm (Stamp 1937: 282) and the 14th century repairs do seem to have particularly focussed on the east curtain wall and the two towers in this area (Allen Brown 1969: 29), disentangling in detail the damage which occurred in 1362 as opposed to existing issues of disrepair and neglect proves impossible. Similarly, at Portchester Castle, Hampshire, although extensive works were instigated on 20th January 1362, a major part of which were roofing repairs employing plumbers and tilers, this cannot be correlated with the surviving archaeological evidence (Cunliffe & Munby 1985: 145, 302).

In a number of cases where damage is documented at specific structures, however, it is possible to trace this through the archaeological record, mainly through standing building evidence. A good example is Norwich Cathedral, where the Romanesque arches on the ground and first floors are superseded by a later Gothic clerestory (Woodman 1996: 179, 192). Although later remodelling has taken place, this stylistic disjuncture (see fig. 3.22) must be a direct result of the storm which, in blowing from the east, caused the spire to fall into the presbytery, destroying the roof and upper stories in this area, a detail corroborated by the written evidence which records severe damage to the presbytery (Wharton 1691: 415). Similarly, the gatehouse at St Albans, Hertfordshire, which was built in the aftermath of the storm on the site of an earlier gatehouse and almonry which had been heavily damaged (Niblett & Thompson 2005: 254), contains structural elements which predate the current structure. A plausible scenario, therefore, is that these fragments belonged to earlier structures destroyed or damaged by the storm, which were later re-used in the construction of the new gatehouse (RCHME 1982: 31).[53]

One building which goes unmentioned by the documentary record in connection with the storm can be linked through a combination of alternative strands of evidence. St Mary's Church, Ashwell (see fig. 3.23), Hertfordshire, contains a graffito at the base of the tower (see fig. 6.3) which mentions the St Maur's Day storm.[54] The graffito is *c.*2m above ground level and would have been challenging to carve from the current floor level. This observation, together with other nearby graffiti which seems to record workers' wages (Champion 2015a: 209), suggests that soon after the storm, a number of masons were at work in the tower with scaffolding in place. The chancel was completed in 1368 whilst work on the tower continued until 1381 (Pevsner 1977: 74-75) with structural timbers from the tower tree-ring dated to 1365-1376 (Miles *et al.* 2003: 110-111). It is therefore possible, although unconfirmed, that the unfinished building was damaged in the St Maur's Day storm, necessitating repairs which would have been made over the following decade as the building was completed. In any case, one of the masons working on the structure chose to commemorate what must have appeared a troubling and noteworthy event through the graffito inscription.

Dendrochronological dating of timbers from contemporary structures may indicate a number of

[53]This is discussed in greater detail in chapter 4.4.2.
[54]This is discussed in greater detail in chapter 6.2.

Figure 3.22: View of Norwich Cathedral's clerestory showing the stylistic disjuncture between the lower Romanesque arches supplanted by later Gothic arches above—a tangible result of the storm of 1362 and the repairs required in its aftermath. Photograph by the author.

Figure 3.23: Exterior view of Ashwell St Mary, Ashwell, Hertfordshire. The evidence suggests that masons were working on the building when the storm occurred or shortly after. One possibility, therefore, is that the unfinished building was damaged by the storm. Photograph by the author.

additional cases of storm damage. The tower of the church of St Peter and St Mary, Stowmarket, Suffolk, for example is constructed around an internal timber framework felled in one phase during 1362/3 (Howard 1994: 38; see fig. 3.24). That this is likely to have been a repair rather than a fresh construction is indicated by a will from 1453 which describes it as "the new tower" (Pevsner 1974: 443). Similarly, at St Patrick's Cathedral, Dublin, only 750m from the documented storm damage at the Dominican Friary (Gilbert 1884: 396), a timber has been dated to winter 1361/1362, the season of the storm (Brown 2010: 120). In this case the damage itself has been interpreted as the result of a fire in the 1350s but the timber could have come from a tree felled by the storm. Another possible candidate is a low-status house from Long Wittenham, Oxfordshire, the timbers of which date to *c.*1363 (Alcock 1989: 43-44). While this close dating alone is inconclusive, documentary evidence does record damage to the local parish church of St Mary in the St Maur's Day storm (RCHM 1874: 128) strengthening the possible identification of the house as a structure which either required repair or reconstruction as a result of storm damage.

Through the collation of both the documentary and material evidence (see appendix E) a picture

Figure 3.24: The church of St Peter and St Mary, Stowmarket, Suffolk. While the storm of 1362 is not specifically recorded affecting the building, the fact that the tower is constructed around a timber framework dating to 1362/3 and later documentary evidence describes it as the *new* tower, strongly suggests the St Maur's Day storm damaged the tower which was repaired in the aftermath. The current spire is a replacement for one blown down by the great storm of 1703 Photograph by the author.

of the damage across the area of effect can be reconstructed (see fig. 3.25). Although the available evidence does not permit many sites to be definitively attributed to the St Maur's Day storm, the evidence certainly attests to extensive damage throughout eastern England. According to a kernel density plot of these data (fig. 3.25: 3), London and its surroundings register as the epicentre of the damage—and, indeed, urban areas must have focussed the damage with their higher densities of population and structures. It must be remembered, however, that only the density of known, documented damage rather than the density of the total damage which occurred is mapped—and damage was more likely to be recorded in areas of high population. This may explain why there is no known data from south Wales and little evidence from Cornwall and Devon—even though the storm almost certainly affected these areas. The known area of effect, and particularly the areas where damage certainly occurred, on the other hand, covered some of England's most populous counties (fig. 3.25: 4), especially Norfolk, Suffolk, Essex and Kent. Taken together the evidence augments that derived solely from the written evidence; that the storm originated from the south west and particularly severely affected the south east.

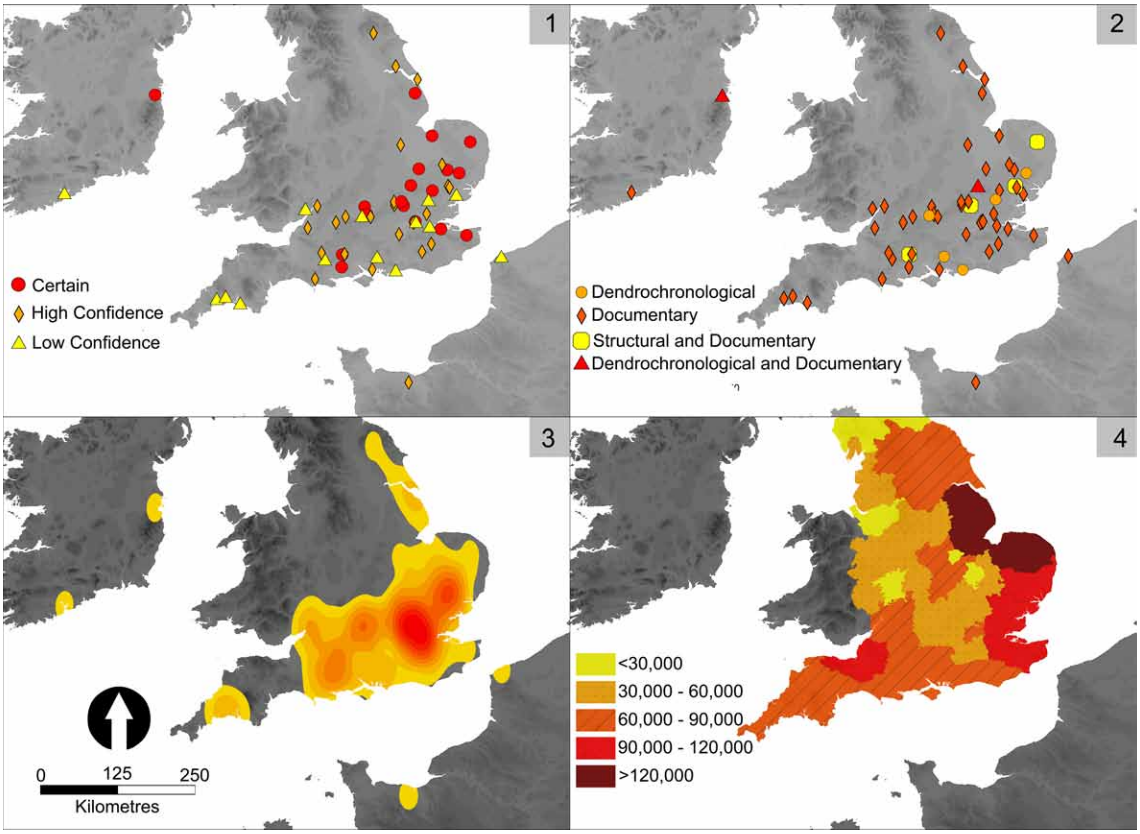

Figure 3.25: Four maps exploring the impact of the 1362 windstorm in the British Isles. Clockwise from top left: (1) Confidence rating of data. (2) Different data types. (3) Kernel density plot of known damage created in ArcGIS 10.4. (4) Contemporary spread of the English population at the county level as derived from the poll tax return of 1377, after Broadberry *et al.* (2015: 25-26), only 15 years after the storm. Created by the author.

3.4 Landslides in medieval northern Europe

As discussed in chapter 1, landslides or mass movements are common occurrences in some parts of northern Europe today. The triggering of such events bears a strong linkage to meteorological conditions, particularly precipitation, temperature and wind action (Jaedicke *et al.* 2009: 475). Just as today, such events must have occurred during the medieval period although they are rarely recorded in contemporary documentary accounts. Their relative scarcity in the written record is presumably strongly correlated with the types of location where they are most likely to occur. Predominantly, these would have been upland areas with steep slopes. These type of landscape have generally only ever been thinly populated, reducing the likelihood of the occurrence of landslides affecting human communities or being documented by contemporaries. Where events which might be categorized as landslides are documented from the medieval period in British sources, it is notable that they exclusively occurred within settlements or affecting ecclesiastical institutions, both of which understandably attracted the attention of contemporary chroniclers. An example of one such event is the collapse of a mound at Perth in 1209, which seems to have been destabilized by sudden-onset high-magnitude flooding (Corner *et al.* 1998: 457). Another is the Cleeve Landslide,

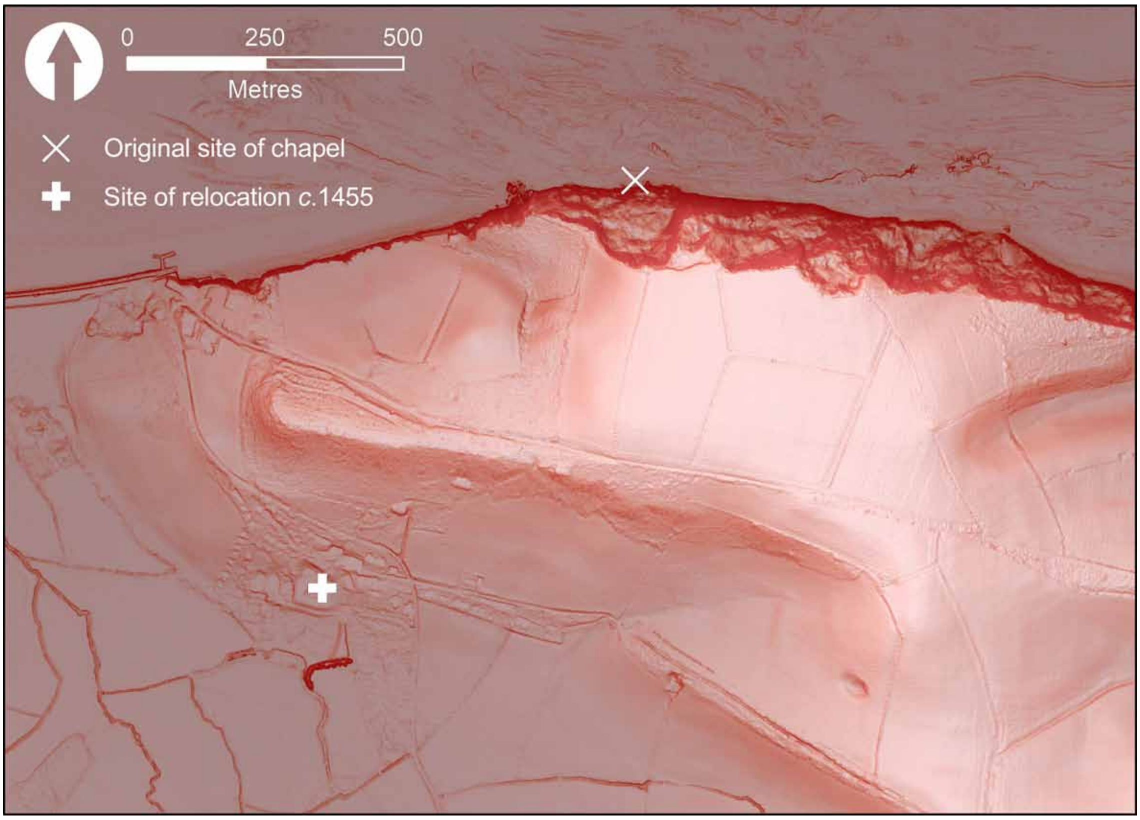

Figure 3.26: Map of Chapel Cleeve, Somerset, indicating the re-foundation of the chapel of St Mary at a new site in response to a coastal cliff collapse at some point shortly before 1455. Red indicates slope steepness. Black-white indicates elevation from low-high.

Somerset, which caused the destruction of a chapel dedicated to the Virgin Mary and is discussed more fully below. In both cases, the rationale for recording these events, which would have been relatively unremarkable occurrences had they struck in remote areas far from human habitation, is clear.

3.4.1 The mid-15th century landslide at Cleeve, Somerset

Heavy rains precipitated a cliff collapse on the Somerset coast at Old Cleeve in the mid-15th century. This slope failure caused the destruction of a chapel dedicated to the Virgin Mary which had been located at the site since at least 1320 (Hobhouse 1887: 186)—although, as later documents reference the chapel's antiquity (Randolph-Hingeston 1886: 62; Maxwell Lyte 1897: 527), it may have had significantly earlier origins. This chapel seems to have been located on low lying ground at the base of sea cliffs (Bliss & Twemlow 1904b: 400) and belonged to the Cistercian house of Cleeve Abbey. By 1398 it was receiving frequent damage from the sea and was in need of structural repairs (Randolph-Hingeston 1886: 62). This remained the case in 1400 (Bliss & Twemlow 1904b: 400) and by 1455 the chapel had been rebuilt—as the Bishop of Bangor was to lead the dedication of the new chapel to the Virgin Mary (Weaver 1906: 10). Then, in a Royal grant to Cleeve Abbey dated 1466, it is stated that "through the continuous rain a great hill lately fell upon a chapel founded

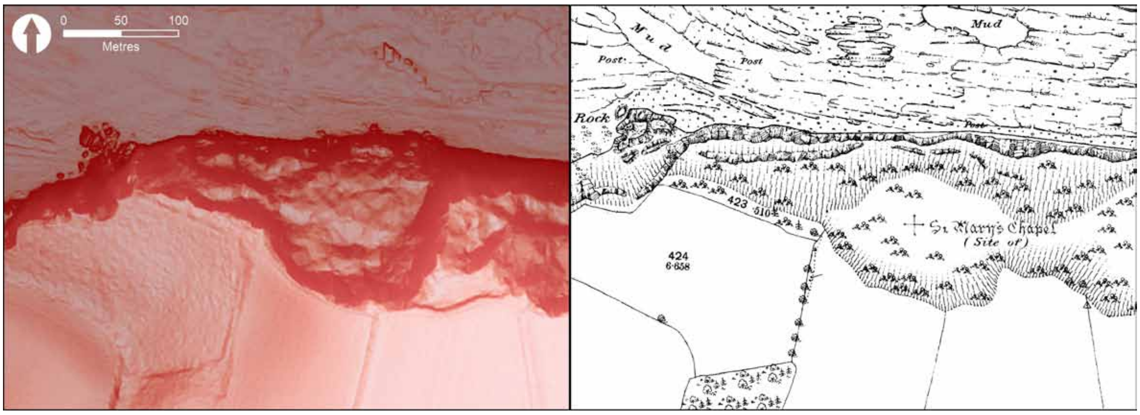

Figure 3.27: Comparison of modern LiDAR data with 1st edition OS map of the site of the first St Mary's Chapel at Chapel Cleeve, Somerset, which was destroyed during a cliff collapse in 1466. Note that a number of rocks visible in both maps to the west must have eroded out of the hillside at some point. Wave action has presumably eroded and removed evidence closer to the site of the chapel. In the left image red indicates slope steepness. Black-white indicates elevation from low-high.

long since upon the sea-shore in their manor of Clive. . . and [the Abbey has] begun to build another chapel in another place within the precinct of the manor" (Maxwell Lyte 1897: 527). Weaver (1906: 9) interpreted this sequence of events as indicating three chapels dedicated to the Virgin Mary had existed at Cleeve—the first, had been founded close to the sea shore at the base of the cliff before 1320, the second, indicated by the 1455 dedication of a new chapel, on top of the cliff above the original site, and the third, around 1466 after the reported destruction in the Royal grant, at a new location—the site of which is known from later evidence to have been at Chapel Cleeve *c.*900m southwest of the original site (Somerset Historic Environment Record 1984). This interpretation, however, is over complicated and does not fit well with the available evidence. As the 1466 grant specifically mentions that the chapel destroyed by the cliff collapse had been "founded long since upon the sea-shore" (Maxwell Lyte 1897: 527) it is unlikely that this would be describing a very recently reconstructed chapel. In addition, this document does not state exactly when the cliff collapse occurred. A preferable interpretation of the documentary record, therefore, is that the cliff collapse occurred shortly before 1455 and the new dedication, for which the Bishop of Bangor was required, was in fact intended for the relocated chapel at Chapel Cleeve. It is more likely, therefore, that there were only ever two chapels dedicated to the Virgin Mary at Cleeve—the presumed sites of both are indicated on the area's first edition Ordnance Survey map (see figs. 3.26 and 3.27).

Assuming the interpretation presented above is accurate, the precise date of the pre-1455 landslide event is unknown. The disaster is only described in the 1466 grant, which certainly gives an impression of a high magnitude slope failure as the chapel was apparently "crushed to the earth with the adjoining buildings" although, remarkably "the image of the Virgin and the altar of the chapel [were] uninjured"[55] (Maxwell Lyte 1897: 527). Additionally, this document specifies that

[55]It may have been important, in a case such as this, to emphasise that the chapel's relics had survived the disaster as these were a significant draw to potential pilgrims.

the cliff collapse was brought on by sustained rain (Maxwell Lyte 1897: 527). Rainfall is the most common cause of landslides but the physical factors behind such events are complex. In addition to the intensity and duration of precipitation, the local topography, geology, soils, land use and hydrological properties are all important factors (Iverson 2000: 1897). As this appears to have been a coastal cliff collapse, it is possible that, while perhaps an extreme rainfall event was the catalyst, erosion by the sea at the cliff's base over the long-term may have made such a failure inevitable. Although no archaeological evidence is known at the original site, or indeed for the replacement chapel constructed at Chapel Cleeve (Somerset Historic Environment Record 1984), LiDAR data provides a useful illustration of the cliff collapse (see fig. 3.27). Conceivably, the slope failure could have preserved evidence of the original chapel beneath the landslide deposit which archaeological excavation could recover—although, equally, coastal erosion since the occurrence of the disaster may have resulted in the disruption and destruction of any remains.

3.4.2 Landslides in medieval Norway

While the historical record does not generally preserve evidence for a high number of landslide events during the medieval period, one area of northern Europe from which a significant number of medieval landslides are known is Norway. As a result of the high relief terrain found widely across the country—with 30% of the country covered by mountains, 6.7% of which are slopes greater than or equal to 30° (Jaedicke *et al.* 2009: 469)—rock, debris and clay slides as well as avalanches have posed an inevitable problem for human settlement. The maxima of medieval population in Norway has been estimated by Benedictow (1996: 181) at *c.*325,000[56] while the medieval Kingdom of Norway covered approximately 350,000 km² (Benedictow 2004: 147). This would mean that, at its 14th century height, medieval Norway would have had an average population density of between 0.9-1 persons per km². As Benedictow (2004: 148) discusses, however, this estimate is flawed as population was, in fact, heavily clustered in areas with fertile soils suitable for arable and pastoral agriculture, while the extensive areas of woodland, mountains and lakes were only very thinly peopled. As such it is clear that, despite the high potential for landslides to occur during the medieval period in Norway, their potential to affect human populations was, given the density and clustering of population, rather limited.

Nonetheless, their occurrence during the medieval period is recorded in a number of formats including land registers (Unger & Huitfeldt-Kaas 1889: 1), Icelandic Annals (Storm 1888: 211-212) as well as early antiquarian accounts, such as the 16th century travel journals of Bishop Jens Nilssøn[57] (Nielsen 1885: 447-448). A database of landslide events, including historical data, compiled by the Norwegian Water Resources and Energy Directorate (NVE) records 98 landslides thought to

[56] With more conservative and more liberal estimates ranging between 276,000 and 377,000.
[57] b. 1538 d. 1600.

have occurred between 900 and 1550[58] (see fig. 3.28). The historicity of a number of these events, however, can be questioned. For example, the dating of some events have been inferred, in the words of the database, 'through pure guesswork'.[59] Many rely on oral history, which while perhaps providing good evidence for the occurrence of a landslide event at some point in the past, can rarely provide accurate evidence for the dating or magnitude of such events over such long time-scales.[60] In investigating more recent Norwegian landslide events in the 17th and 18th centuries, Grove (1972: 134) judged orally preserved accounts of landslides during the LIA to provide supporting evidence for the relative severity of these slides compared to more recent occurrences. While this remains a possibility, another consideration is that the oral memory may have, over time, become exaggerated and elaborated as different generations told and retold these stories. The folk memory of these events may therefore suggest, erroneously, that these were more severe events than more recent, less mythologised slides. Bearing this in mind, events based solely on oral history should not be regarded as entirely reliable accounts where no archaeological, geological or historical data can be found to substantiate the oral account. Two examples which illustrate the type of human impacts that Norwegian landslides had during the medieval period, as well as the resolution and limitations of the data, are presented below.

3.4.3 Landslide at Leirfall, Stjørdal *c.*1200

While details are scarce, a landslide at the modern day place-name of Leirfall, located in Stjørdal, Norway, is attested by the *Jordebog for Jonskirken i Nidaros* around the year 1200 (Unger & Huitfeldt-Kaas 1889: 1). A literal English translation of the modern day place name, Leirfall, is 'clay slide' and Leirfall notably stands out as a relatively late place-name compared to the surrounding traditional toponyms which are overwhelmingly of Iron Age origin (Sognnes 2011: 186). Therefore, this landslide supposedly destroyed an existing farm at this location, which resulted in the original name being lost and replaced by 'Leirfall'. A possible landslide deposit is visible in LiDAR data covering the area (see fig. 3.29) and, notably, its location corresponds with the location to which the Leirfall toponym refers. The appearance of the Leirfall place-name in a land register of the 15th century (Jørgensen 1997: 201) attests to the reoccupation of the area by this time although this reoccupation may have occurred only a short amount of time after the landslide had taken place. This example illustrates the relatively low resolution of data which affects many of the landslide events known from the medieval period.

[58] https://www.nve.no [Accessed 04/12/2017].
[59] For example see OBJECTID 41147 at https://atlas.nve.no.
[60] This is disucssed in more detail in Chapter 6.

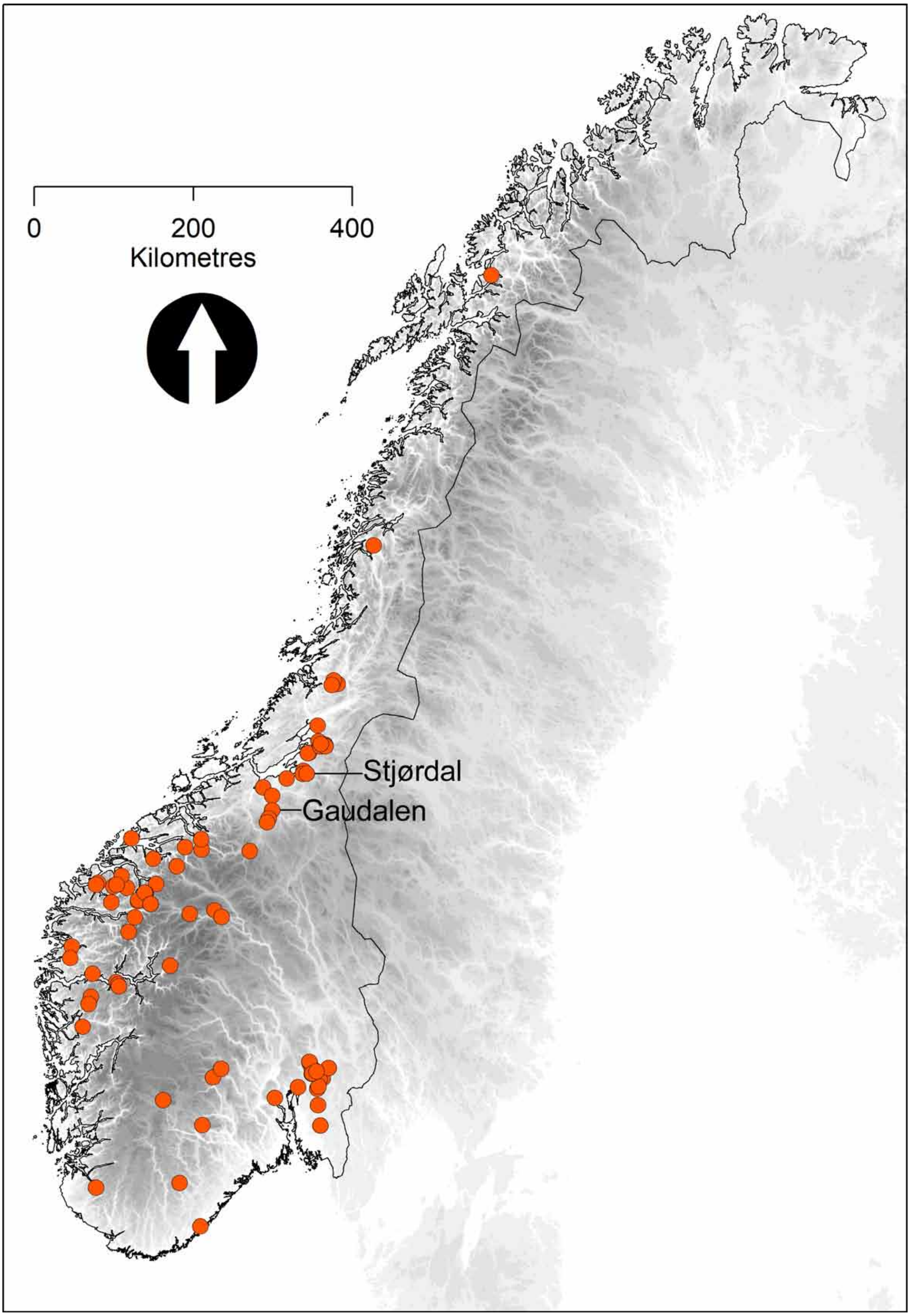

Figure 3.28: Map of medieval landslides in Norway using data from `https://www.nve.no`. Data correct as of 04/12/2017. Created by the author.

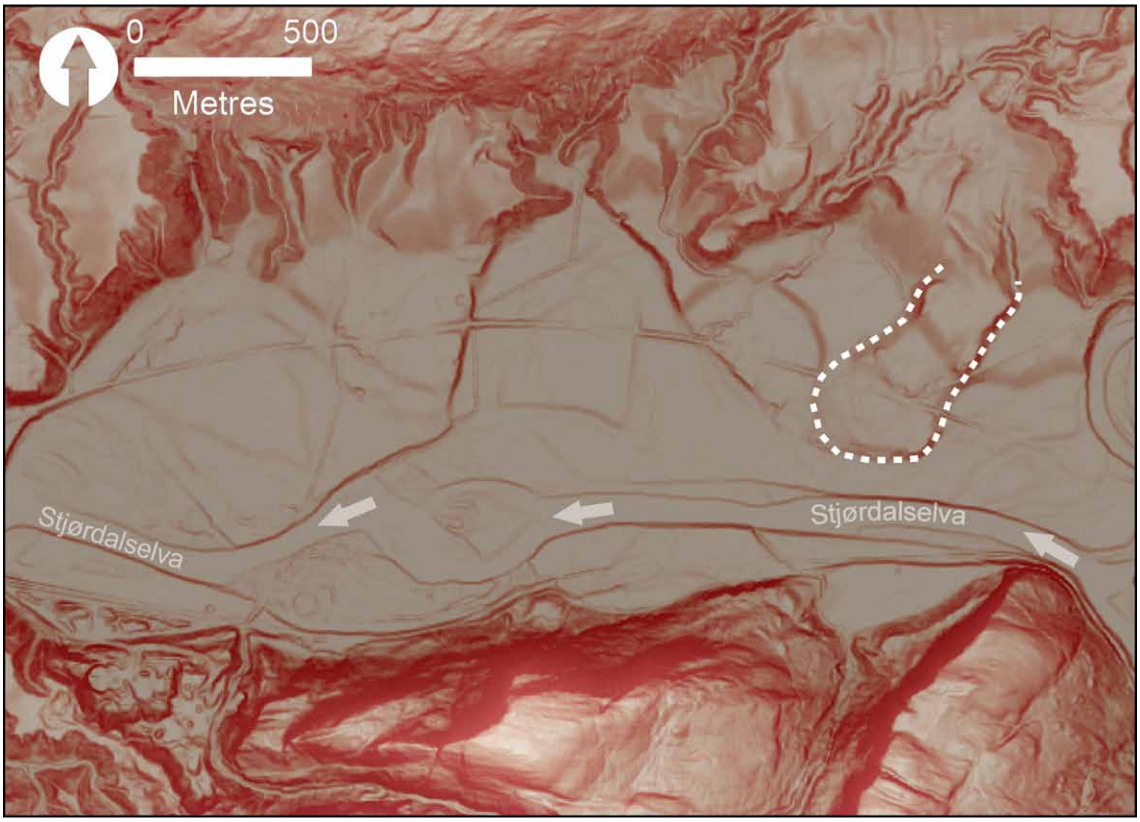

Figure 3.29: Possible landslide deposit at Leirfall, Stjørdal, Norway, visible through LiDAR data. The landslide which occurred in this area supposedly destroyed a farm but the appearance of the place-name Leirfall in later land registers demonstrates the area was quickly re-ocuppied. Red indicates slope steepness. Black-white gradient indicates elevation from low-high. LiDAR data from `https://hoydedata.no/LaserInnsyn/` [Accessed 10/2017]. Created by the author.

3.4.4 The Gauladalen landslide of 1345

A more detailed case illustrates the utility of oral history where this may be linked to historical and material evidence. The landslide which occurred in the Gaula valley (Gauldalen) in 1345 is thought to have been the worst natural disaster (by number of casualties) in Norwegian history. The occurrence of this landslide is documented by a single historical source, the *Skålholt Annals*, which is thought to have been composed less than three years after the landslide (Rokoengen *et al.* 2001: 57). The most important points which this account relates are that: firstly, the river Gaula disappeared, subsequently a landslide filled the valley causing a flood which drowned many people and animals. Then, on the Feast of the Cross [14th September] 1345, the dam blocking the valley burst, sending the water held back by the dam downstream. This led to the deaths of *c.*500 individuals, including local farmers, women and children, priests and clerics as well as wealthy people, travellers and paupers. 48 farms and some churches were also reportedly lost in this flood (Storm 1888: 211–212). The busy medieval pilgrim route to Nidaros[61] lay through Gualdalen which would explain the presence of high numbers of travellers in the area at the time of the disaster. The oral tradition, recorded in a number of versions since the 18th century (Rokoengen *et al.* 2001: 58-59), also preserves an important point, unmentioned in the Skålholt Annals that, at the time of the disaster, a lake named Hagevatnet disappeared.

Based on the reconstruction of the event proposed by Rokoengen *et al.* (2001), the disaster began to unfold in the neighbouring valley of Langdalen which sits high above, and drains into, Gauldalen. One possibility is that here, prior to the disaster, a dam of glacial deposits contained a lake. Somehow this dam failed, causing the lake waters to pour into the Gauldalen valley, initially precipitating a flood but also depositing sediments, eroded from the adjacent Granmo terrace, in the valley bottom which would have built-up and dammed the Gaula. Although this scenario is not documented in the *Annals*, if the lake in Langdalen is equated with the mysterious disappearance of Hagevatnet, it is supported by the local oral tradition. Palaeoenvironmental investigations, meanwhile, have confirmed the disappearance of a lake in Langdalen between AD *c.*1000–*c.*1500 (Rokoengen *et al.* 2001: 63). Assuming this is correct, the most likely location for the dam across the Gaula to have formed is at the base of the Granmo terrace on the east bank of the Gaula. As shown in Figure 3.30, two possible landslide scars are visible in LiDAR data for the region at this location. A landslide from either of these scars could have precipitated a scenario which accords well with the key points described in the *Skålholt Annals*—specifically that the river Gaula disappeared, as would have been the case downstream from a dam formed by the landslide of Granmo terrace material, and a catastrophic flood occurred down the valley, when this dam failed and burst causing a sudden downstream discharge.

[61] The medieval name for Trondheim.

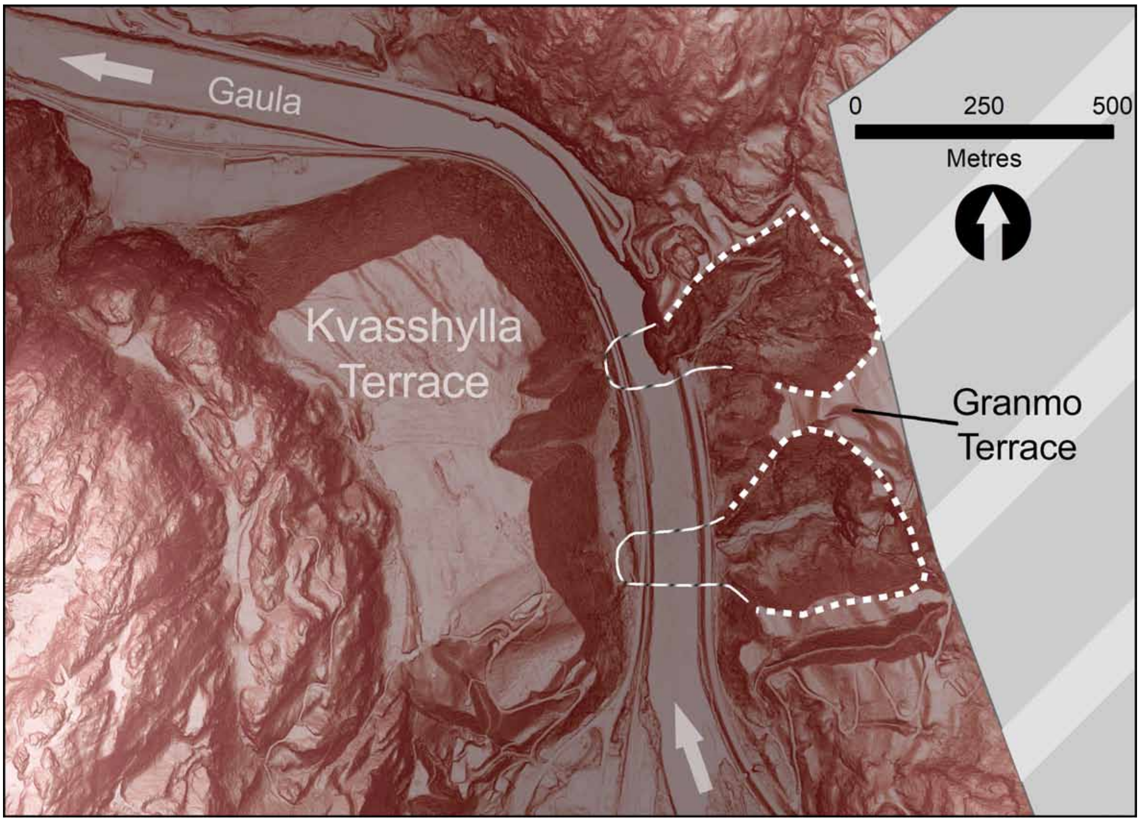

Figure 3.30: Scars in the Granmo terrace which may relate to the landslide of 1345 revealed through LiDAR data. A landslide at either of these locations could have created a dam across to the Kvasshylla terrace to the west. Possible dam locations at the foot of these landslide scars are indicated by white and black dashed lines. This would have dammed the river until the dam gave way. At this point, the waters held back by the dam would have been unleashed down river. River flows from south to north. Red indicates slope steepness. Black-white gradient indicates elevation from low-high. Grey stroked area not included in LiDAR dataset. LiDAR data from `https://hoydedata.no/LaserInnsyn/` [Accessed 10/2017]. Created by the author.

3.5 Summary

This chapter has explored what happened when natural hazards struck medieval communities. A combination of documentary and archaeological evidence allows these events, and how they affected contemporary populations, to be explored in detail. For those individuals and communities directly affected, these severe events frequently had stark implications but, in many cases, there remains much that is difficult or impossible to reconstruct from the available evidence. While knowledge of the occurrence of a disaster is often quite limited, these events were only the start of a chain of events that, in some cases, continued for years after the original disaster. As a result, the decisions taken in the aftermath of a disaster, or disasters, generated a further body of evidence which is the subject of the chapters which follow. Chapter 4, therefore, considers the practical measures taken to ameliorate the conditions created by disasters as well as the steps taken to protect against the possible recurrence of disaster. Then, Chapter 5 explores the spiritual and religious measures adopted by medieval populations in order to secure protection from disasters and to guard against the risk posed by the natural world more generally. Finally, Chapter 6 considers how communal memory of these events was maintained and passed on long after the time of their occurrence and to what extent this affected medieval preparedness and responses in the face of future disasters.

Chapter 4

The aftermath and practical responses against hazards

As we have seen in Chapter 3, during the emergency phase, disasters had highly destructive impacts on affected medieval populations. The most serious disasters commonly caused human casualties, drowned livestock, reduced agricultural outputs and damaged buildings and infrastructure. As such, in the immediate aftermath of these catastrophes, medieval societies had to come to terms with altered realities and deal with the changed circumstances as best they could. Over the longer term, as well as restoring the damage and trying to compensate for the losses inflicted by disasters, they had the option to take action to try to prevent hazards from causing similar disastrous impacts in the future. This chapter, therefore, considers the practical steps taken by medieval populations, in the immediate aftermath and beyond, while also exploring to what extent they attempted to protect themselves against the recurrence of future hazards.

A number of considerations affect whether or not societies take practical steps to reduce risk from possible future threats. Most importantly, the risk from possible hazards must be regarded as credible and of a likelihood high enough to justify the costs of intervention—whatever form that may take. If disasters are perceived as inevitable—events which cannot be avoided—the impetus to take proactive preventative measures is greatly reduced. In the medieval period, the widely held view that natural hazards were ultimately caused by God, either through His action or inaction (see Chapter 2.2), did cause some to question whether practical steps to protect against disasters, thereby interfering with an event orchestrated from heaven, could be effective. Such fatalism can be seen in the case of the 14th century Florentine politician Coluccio Salutati[1] who condemned attempts to flee from outbreaks of plague as pointless exercises—for it was impossible to escape God's will (Schenk 2017: 143). As a corollary to such views, raising a flood defence would not protect against a flood which God intended to affect a particular community, for He would only heighten the floodwaters accordingly. Counter to this argument, however, is the idea that human reactions, and the ability to protect against natural hazards, also ultimately stem from the divine. In this world-view therefore, while hazards themselves are heaven sent, so too are the tools to

[1] b. 1331 d. 1406.

defend against them: “human knowledge, ability and action” (Schenk 2017: 142). Accordingly, it could be said that to fail to take practical precautions was to neglect these divine gifts. While such theoretical justification probably seemed important to theologians and scholars, in most cases medieval people probably acted primarily from a rational standpoint to minimise their chance of being negatively affected by the hazards they knew through experience, without considering the wider theological ramifications. While in the immediate aftermath such measures were common (as this chapter explores), their long-term endurance was only possible where memory of their utility—and, therefore, memory of the disaster that had been the catalyst for their creation—was maintained.[2]

The ability of medieval populations to respond practically against recurrent threats from hazards was limited by a number of related factors. Firstly, understanding and awareness of the underlying causes and physical characteristics of a hazard, secondly, the level of scientific and technological advancement of the age and, finally, practical and economic considerations. Illustrations of these limitations are evident throughout contemporary documentary sources. In Udine, Italy, in 1511, for example, the mis-identification of the cause of earthquakes based on Aristotelian models provoked legislation to re-open disused wells to allow the escape of subterranean winds held responsible for earth tremors, a practice which was also suggested in response to other Italian earthquakes (Forlin & Gerrard 2017: 99). Beyond understanding the mechanics of hazards, resilience was also hampered by an inability to accurately model how these phenomena affected medieval architecture. In the absence of modern computational modelling of building stresses and structural lodes, the design of resilient structures in seismically active zones had to reactively take its cues from what could visibly be seen to withstand past earthquakes. This process of trial and error is illustrated by the importation of Frankish Gothic architecture to Cyprus and the gradual reversion to traditional Byzantine building conventions[3] which occurred over time when it became clear that the Gothic style was unsuited to a seismically active zone (O’Neill *forthcoming*). Cost was also a significant factor as major repairs were often prohibitively expensive, a fact demonstrated by evidence of cost-cutting visible in campaigns of repair such as the work carried out to the spire of Norwich Cathedral[4] following a lightning strike in 1463 (Feilden 1996: 730-731). In spite of these limitations, however, as this chapter will explore, a surprisingly large suite of practical interventions were available and put into action during the medieval period to provide protection from nature’s extremes.

[2]This is the subject of Chapter 6

[3]These included a reduction in the number and size of window and door openings, a reduction in the height of the building overall and individual structural elements, buttresses which were stronger and more massive and a centralized more symmetrical plan—all features which increased resilience to earthquakes.

[4]The repairs to the spire were executed in brick faced with stone rather than pure masonry, a more expensive option, and appear to have been carefully thought out to minimise the amount of scaffolding required.

4.1 The immediate aftermath

The need to take practical action arose swiftly—in the hours and days that followed the occurrence of a hazard. This stage can be seen in both the historical and material evidence relating to the disasters considered in Chapter 3. In the immediate aftermath of the storms of 1287/88, for example, at the manor of Eboney, Kent, a boat was used to reach livestock on a portion of land that had been cut off by the floodwaters (Gross & Butcher 1995: 113), while nearby in New Romney, the evidence from the Southlands School site suggests a phase of site consolidation as a layer of sand, gravel and silt was deliberately deposited across the site perhaps to stabilise the shoreline and cover over the remains of the structure badly damaged by the storm (Meddens & Wooldridge 2002: 23, 78). At a site off Church Road, fragments of clay flooring, clay walling material, ash and carbonised material were cleared into a large pit which the excavators interpret as the clearance and disposal of the structural debris from a timber structure destroyed by a storm event. Following the clearance of the structural remains, after an indeterminate period of time, a new structure was built at the site, occupying some of the footprint of the previous building but on a different layout (Wilson & Linklater 2002: 10-11). This demonstrates that, although many sites across the town were marked by a period of demolition and/or abandonment in the aftermath of the storms,[5] storm damaged structures were also repaired and rebuilt. Clearly, although the storms introduced many short-term difficulties, the inhabitants of New Romney were able to struggle through these problems. A comparable phase is seen at Wisbech and King's Lynn in the aftermath of medieval flood events. At these two towns the retrieval and reuse of timbers from structures damaged by flooding (Clarke & Carter 1977: 65; Hinman & Popescu 2012: 25, 36, 73), perhaps motivated by the lack of timber available locally (Fletcher 2010: 73), provides evidence for the steps taken to clear the debris created by a flood event while maintaining an eye for what might be reused in the future.

In the immediate aftermath of the January 1362 windstorm, the widespread structural damage, across the area of effect, meant there was high demand for both building materials and labour in order to carry out repair work. This can be seen at King's Langley, Hertfordshire, where 123,500 tiles were purchased from Roger "Tiller" for 5s 6d per thousand (Page 1914: 265). The Crown was clearly concerned that this sudden spike in demand would motivate tilers, roofers and other labourers to inflate their prices in order to take advantage of a captive market forced to make repairs. To prevent this, immediately following the storm, Edward III issued a proclamation stating that "tiles and other roofing shall be sold at the price at which they used to be before Christmas last and no dearer" and "tilers, their grooms or assistants and all other their servants, craftsmen and workmen shall take no higher wage for their daily labour" (Maxwell Lyte 1909a: 238). This proclamation was re-issued to the populace across the country, as is documented in St Albans,

[5] Discussed below in Section 4.7

where the Abbot ensured the townspeople were aware of the regulation (Riley 1869: 46-47), and in Peterborough, where the Abbot wrote back to the Crown to confirm that the order was being followed within the town (Stamp 1937: 177). In London too, a writ was delivered to the Mayor, the Recorder and the Sheriffs in late March 1362, demanding that a proclamation be made to forbid any price increases on tiles or tiling in light of the recent tempest (Sharpe 1905: 138).

That not everyone was aware of this new ordinance or, more likely, that they chose to ignore it, is demonstrated by the fact that one Suffolk-based thatcher named William Champeneys was able to charge up to four times the usual rate for his services in the year of the storm[6] (Penn & Dyer 1990: 370). Although thatchers were not specifically mentioned, the wage for tilers had been fixed to 3d per day by the Statute of Labourers in 1351 (Raithby 1810: 312) in response to the shortage of labour and ability of workers to demand high wages as a result of the high mortality of the Black Death. This meant that anyone earning more than this sum was doing so illegally. The continued presence of thatchers and tilers in the *Proceedings Before Justices of the Peace* from Suffolk in the storm's aftermath demonstrate that, in an area known to have been badly affected, roofing work was in high demand in these years allowing some contractors to inflate their prices. Examples include John Thatcher[7] who was paid 30 shillings, in addition to complimentary food, for work, over an unspecified period, in Little Livermere, Suffolk (Putnam 1938: 376). Others seem to have only exceeded the wage by a small amount, including the tilers John Barkesdale and Thomas Tiler, who charged 4d, in addition to food, between 1361 and 1363 (Putnam 1938: 372) and the thatcher Symon Wygenhale who was found to be at fault for receiving 3d in addition to breakfast (Putnam 1938: 367).

The high demand for the services of roofers, tilers and thatchers as well as other workmen in the storm's aftermath must have been compounded by the unfortunate coincidence of an outbreak of plague in 1361 (Galbraith 1927: 50; Martin 1995: 184-185), its first recurrence in England since the Black Death. This would have reduced the number of available labourers and workmen to carry out repairs, and may have further added to the ability of those who were still working to inflate their prices. For those who could not afford to pay the increased market rate, or were simply unable to contract available workmen, damage went un-repaired for a number of years, a fact commented on by a contemporary chronicler who wrote that "houses and buildings which were . . . destroyed by this wind remained ruined and unrepaired because of the lack of workmen"[8] (Scott-Stokes & Given-Wilson 2008: 118-119).

[6] His wages went from a usual minimum of 3d to a maximum of 12d in the year of the storm.

[7] Iohannes Thecchere.

[8] *"mansionesque et edificia per dictum ventum sic diruta pro defectu operariorum irreperata deformiter remanserunt."*

4.2 The victims of disaster

A further strand of evidence attesting to the aftermath of disasters are burials. As the historical sources considered throughout Chapter 3 widely document, disasters frequently resulted in significant numbers of casualties among both human and animal populations.[9] Where the disaster did not also make these bodies inaccessible, as may have sometimes occurred during severe floods, it would have been necessary to clear them away. For medieval Christians, burial was a requirement for the human dead and this was also an expedient way of clearing away the carcasses of livestock.

The unusual nature of the fatalities caused by disasters may frequently leave a physical signature which can be identified by archaeologists. Kacki (*forthcoming*), for example, has explored to what extent it is possible to relate evidence for burials detected through excavation with documented crises. In the case of plague, where preservation is suitably high, scientific techniques may permit the identification of concrete evidence relating to the disease.[10] Where the extraction of such evidence is not possible, or in the case of hazards other than disease, skeletal analysis as well as the context of the burial holds the potential to distinguish routine burials from evidence likely relating to a disaster. Firstly, in such circumstances, the treatment of the dead is likely to differ from 'normal' burial rites. For example, in many contexts identified as plague burials, multiple individuals were interred together, differing markedly from the standard, individual inhumations which characterise medieval burial practices (Kacki *forthcoming*).[11] This alone is insufficient evidence however as multiple burials can be explained in other, non-catastrophic ways—in the case, for example, of family groups buried together. Further evidence may be provided, therefore, through the analysis of the remains of the interred population. Compared to 'normal' patterns of mortality, which disproportionally affect the very old and very young, disasters are likely to be more egalitarian killers—although older adults, who are perhaps less able to flee from disasters, are especially vulnerable (Lee & Vink 2015), rapid-onset hazards such as floods, storms and earthquakes are significantly more indiscriminate causes of death than old age or childhood disease. In the case of plague, excavated evidence suggests that the disease's fatalities were healthier than would be expected from a non-disaster related burial context, with less evidence for pre-existing health conditions. Particularly, starkly, a clear demographic profile can be extracted from excavated plague victims, relative to a 'normal' burial population, characterised by significantly greater numbers of individuals between 5-14 years old, late-adolescents and young-adults along with a relative scarcity of fatalities younger than 5 years old. According to Kacki (*forthcoming*), this suggests that these excavated plague burials "mirror the overall demographic composition of the populations from which they are derived".

[9] This is particularly the case in relation to the storms and floods of 1287/88.

[10] This is accomplished through either the extraction of aDNA relating to the pathogen or, in the case of *Yersinia pestis*, palaeoimmunological techniques may allow the identification of the F1 envelope glycoprotein antigen unique to that particular pathogen.

[11] This was notably also the case in mass graves associated with war dead. See for example Annis *et al.* (2018: 25-31).

One could reasonably expect mass graves arising from rapid-onset hazards to follow a comparable signature. To make such an identification, a statistically meaningful number of individuals would be required to differentiate between 'normal' and disaster-related burials. Although no mass graves arising directly from rapid-onset natural hazards have been identified from the medieval period, an example is known which may relate to the secondary impacts of such a hazard. The mid-13th century burials at Spitalfields Market, London, which exhibited a typical profile for famine victims, for example have been connected to a historically documented episode of high mortality (Connell *et al.* 2012: 230) linked to the eruption of Samalas Volcano, Lombok Island, Indonesia in 1257 or 1258. Campbell (2016a), however, cautions that the difficulties experienced in the late 1250s stemmed from a harvest failure which pre-empted, and was ongoing at the time of, the volcanic eruption. Although the eruption may have exacerbated the crisis, its roots were in longer term climatic trends.

While it is unclear that rapid-onset hazards sparked mass graves in the same way as plague or famine, Gidney (*forthcoming*) suggests that severe weather could have caused the impetus for mass burials of livestock. One interpretation of a pit containing the remains of at least seven cattle discovered at Shapwick, Somerset (see fig. 4.1), for example, is that, following an extreme episode of cold, which decimated the herd, the victims were disposed of collectively. Gidney (*forthcoming*) observes that such a scenario is perhaps only envisionable when livestock lacked sufficient fodder as, in ruminants (*eg.* cattle and sheep), the main source of body heat comes from bacterial fermentation of food in the rumen. In times of dearth, therefore, when sufficient fodder was unavailable, livestock would have struggled to maintain core body temperatures and would have been particularly vulnerable to sudden cold snaps. Support for this possible interpretation comes from both the historical record—several cold spells which had a particularly severe impact on cattle are described by the Anglo-Saxon Chronicle (Giles 1894: 418, 485-486), for instance—as well as modern analogues—the winter of 1947, for example, brought blizzards which caused high losses among cattle herds in some areas (Gidney *forthcoming*). Mass mortality caused by a blizzard or sudden cold weather certainly remains a possible if, in this case, unverifiable possibility to explain the Shapwick pit but a competing interpretation remains the outbreak of disease amongst the herd. This could have had a similar effect and the fact that the pit in which the cattle were buried is an abandoned lime-kiln lends some support to this view—as lime is often thought to accelerate the decomposition process which may have been deemed desirable for the safe disposal of such an unusual quantity of cattle. This is more likely to have been the case if the cattle fell victim to a disease, rather than dying *en masse* in a sudden cold spell, as concerns for the disease spreading from their carcasses to other members of the herd make more sense in this context (Gidney *forthcoming*).

Figure 4.1: Pit containing the remains of at least seven cattle excavated at Shapwick, Somerset. Photograph by Christopher Gerrard. Reproduced with permission.

4.3 Agricultural management

As some of the case studies considered in Chapter 3 make clear, disasters frequently disrupted the agricultural cycle and, in some cases, destroyed the harvest. This was despite the fact that, as discussed in Chapter 2, elements of the medieval agricultural regime were arranged to minimise the impact of disasters. Where these failed, plunging communities into crisis, there appear to have been discrete strategies adopted to ameliorate bad situations brought on by the sudden and unexpected impact of natural hazards. A switch from cereal cultivation to pastoralism, although a general trend of the late Middle Ages, was particularly applicable to coastal wetlands due to their high fertility—which provided abundant pasture (Rippon 2001: 27). As well as tying into wider economic trends, such a switch may have afforded communities in locations vulnerable to flooding a greater degree of resilience as—where crops are unlikely to survive a severe inundation—livestock can be moved to safety. Thus at Appledore and Eboney, Kent, the sheep were, as much as possible, kept away from the areas most liable to flooding, during the winter months when this was most likely to occur, and a portion of the Eboney flock was routinely moved to Appledore for the winter where there was more high ground to accommodate them (Gross & Butcher 1995: 112). The introduction of legumes too appears to have offered tangible benefits in areas which had suffered recent inundation. In addition to providing a nutritious, and easily preserved, source of sustenance for humans and livestock, beans are more tolerant of saline soils than cereals and play a role in improving soil fertility by replenishing nitrates—a fact which was appreciated by contemporaries (Gross & Butcher 1995: 109; Rippon 2001: 30-31). Beans appear to have been disproportionately introduced to wetland areas in the late Middle Ages (Rippon 2001: 30-31) and, therefore, appear to have been a deliberate strategy for farmers in these flood-prone areas. Throughout the 14th and 15th centuries, legumes formed an important component of the agricultural output in Fenland (Rippon 2001: 29-30) while at Eboney the introduction of beans in 1288-1289 may have been a pragmatic reaction to the

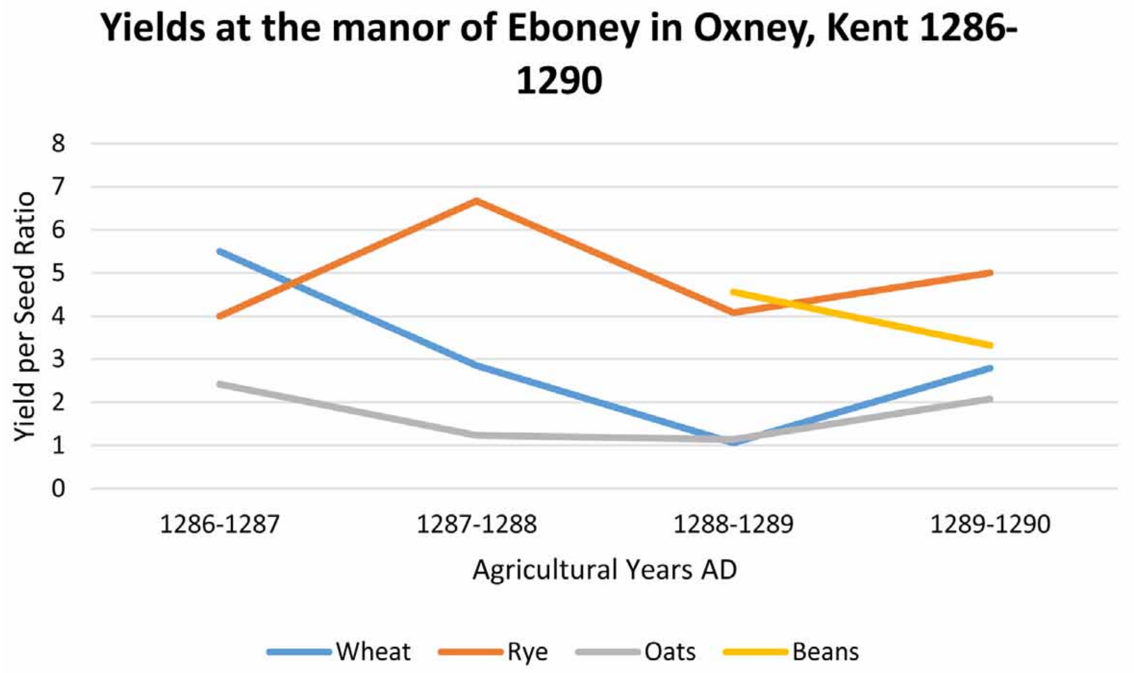

Figure 4.2: Agricultural yields at the manor of Eboney in Oxney, Kent, 1286-1290. Created by the author using data from Campbell (2007).

storms of 1287/88 (Campbell 2007; see fig. 4.2). As illustrated in Figure 4.2, over the years of the storms and floods, from 1287-1289, wheat and oat yields declined while rye, although initially experiencing a rise in 1287-1288, also saw a decline in 1288-1289. Together with restoring and improving flood defences, soil improvement strategies were a key area of investment on the lands of Canterbury Cathedral Priory at this time (Gross & Butcher 1995: 109-110), and in addition to the deliberate cultivation of beans, the historical evidence suggests both that lime may have been applied to the soil, which was expensive and reduced soil acidity, as well as increases in expenditure on weeding and manuring. Clearly, landowners such as Canterbury Cathedral Priory were willing to make the high investment necessary to ameliorate the effects of the storms and enhance the profitability of their estates.

An additional agricultural response to crises is suggested by Gidney (*forthcoming*), particularly in reference to events which sparked high mortality among livestock herds although perhaps with wider significance. Where herds were decimated by natural hazards the only way for landowners, and their tenants, to quickly replace these losses was to purchase replacement animals—as breeding, the traditional method of maintaining or increasing herd numbers, would be too slow to account for such drastic reductions in livestock numbers.[12] This occurred on the lands of the Bishop of Ely following the drowning of 373 sheep due to a marine inundation in December 1398 at Wisbech High Fen, Cambridgeshire (Stone 2005: 123, 151). Such events, therefore, placed great strain on

[12]Note also that, although breeding was certainly cheaper than buying new stock it was more likely to lead to the spread of disease amongst herds (Stone 2005: 151). If mass mortality amongst livestock had occurred due to an outbreak of disease, this would have meant that purchasing new, healthy animals would have been doubly important to prevent the disease from spreading further.

financial resources which, in turn, may have influenced contemporary agricultural practices. Indeed, immediately after the significant losses experienced by the sheep flock at Wisbech High Fen in 1398, the provision of pasture and, correspondingly, the management of arable cultivation, on the Bishop of Ely's neighbouring estates was re-organised (Stone 2005: 143-144; note 36). Fox (1973) interpreted the evidence for the irregular cultivation of areas which were usually set aside as pasture, such as manorial waste, in post-medieval Devon and Cornwall, as a means of maximising returns when grain prices were high. Such a system of 'outfield' cultivation is well documented from the medieval period (Rippon 2002a: 54) and confirmed through fieldwalking (Jones 2004). Rippon (2002a: 64-65) suggests that, in coastal wetlands, un-embanked areas of marsh were sometimes exploited in a similar way by marshland communities. Gidney (*forthcoming*) proposes that such opportunistic cultivation of outfields may have permitted populations hit by a major mortality event to raise the capital required to restock their herds—an interpretation particularly applicable to livestock mortality events, as opposed to other hazards, as there would be far fewer animals to take advantage of the pasture that these areas usually provided and the labourers who usually tended the animals would be free to cultivate extra areas beyond the core areas of cultivation or 'infields'. In areas lacking additional expanses of potentially cultivable land Gidney (*forthcoming*) suggests that the livestock panzootic of 1315-1322 could have provided the impetus for the switch from the traditional two field system, in which the fields alternated between sown crops and fallowing on an annual basis, to a more flexible three field system (Fox 1986: 530-532). Up until 1333, in the two field system operated at Podimore, Somerset, the fallow seems to have also provided pasture for livestock (Fox 1986: 532-533). With the reduced requirements of a diminished herd, therefore, Gidney (*forthcoming*) argues that the subdivision of the lands of the manor into three fields may have allowed more efficient arable cultivation. While the latter strategy, if in fact unusually high livestock mortality did provoke the shift from two to three field systems, is closely linked to anomalous fluctuations in herd numbers, the occasional expansion of arable onto areas of 'outfield' could have provided a method of coping with more general crises—such as natural disasters. In the aftermath of such events a bonus yield from areas beyond the confines of the core agricultural areas would have provided a much needed financial boost to communities struggling to meet the costs of repair.

4.4 Structural responses

The repairs required in the aftermath of disaster produced another category of practical response against natural hazards for which evidence survives. By their nature these types of interventions were often reactive, *ad hoc*, solutions carried out in the immediate aftermath of a calamity. Where hazards led to repeated damage and destruction the process of repair and reconstruction could foster a degree of experimentation, with attempts to create more resilient structures. Two classes of structure in which this is particularly visible are bridges, which, due to their riverine locations, frequently became victims of severe flooding—either resulting in damage or total destruction—and ecclesiastical structures which, while less likely to be situated in hazardous locations, when they were affected by floods and storms the damage was likely to be recorded, assisting the interpretation of any structural adaptations introduced in the aftermath of such events. While, no doubt, adaptations took place in other architectural contexts, more so than most other types of structure, many medieval bridges and ecclesiastical structures remain standing (to a greater or lesser extent) meaning that these types of structure are particularly revealing in this line of enquiry.

4.4.1 Bridges

The repeated need to repair and replace bridges was cause for considerable investment and consideration as to the best method of construction, as illustrated by well documented examples (Boyer 1981). Incidents which befell bridges as a result of floods or other hazards are often documented and the archaeological evidence can provide confirmation of episodes of repair or bridge renewal across a span. During the medieval period bridges were either constructed of timber, stone, brick or a combination. All materials had their advantages and drawbacks with timber bridges, although cheap and easy to construct, relatively impermanent, flammable and requiring frequent maintenance (Harrison 2004: 86). Stone and brick bridges, on the other hand, were more durable but expensive and difficult to construct, requiring firm foundations which could cope with problems of scour and increased flow in times of flood (Harrison 2004: 87-91). Over the course of the medieval period bridge construction evolved somewhat with a shift away from piers supported on piles driven into the river bed towards solid foundations constructed using cofferdams (Boyer 1976: 151-153). In addition, features such as cutwaters, to prevent scouring around the piers, and flood arches, to enable the structure to cope with increased flows in times of high water, became more sophisticated.

An example of a bridge which suffered structural damage as a result of flooding, as well as the subsequent phase of repair, may be provided by the medieval bridge at Heigham, Norfolk. Evidence suggests that this structure may have been a victim of the 1287/88 floods. John of Oxnead, a monk of the Benedictine Abbey of St Benet at Holme, Norfolk, describes in detail the effects of the floods caused by the 26th December 1287 storm on his own abbey as well as in nearby Hickling (Ellis 1859: iii; 270)—while, according to other chroniclers, the nearby towns of Waxham, Horsey and Martham were also affected by a storm (or storms) in December 1287 (see Appendix A). Given that the flooding directly affected Oxnead's abbey and the surrounding area, his account is clearly one of local events and he was probably, therefore, an eyewitness to the events he describes.[13] One of the actions of the Abbey in the aftermath of the flood is indicated by a petition, roughly dated by handwriting to *c.*1275-*c.*1300, which notified the King that the Abbey of St Benet at Holme had

[13] Although note that his date for the event, 26th December, does not agree with the date given by Bartholomæi de Cotton, 17th December, who seems to describe the same event and agrees with a source from the Netherlands.

imposed a toll on the nearby crossing at Bastwick, where the bridge had been "broken by a storm at sea", which was negatively affecting the local inhabitants, especially the poor. The petitioner added that this toll rightfully belonged to the King, not the Abbey, and sought to re-appropriate the funds raised to repair the bridge.[14] If this petition does relate to the storm recorded by John of Oxnead, which—given the location and close-dating of the petition to the time of the storm—seems a plausible interpretation, then it appears that, in the aftermath, the Abbey attempted to raise funds through increasing or imposing a toll on the crossing.[15]

The most likely candidate for the bridge in question is Heigham Bridge, located between the parishes of Repps with Bastwick and Potter Heigham, which is only 4.5 km from the Abbey. The bridge's location, between the Abbey of St Benet at Holme and the nearby towns which were also affected in the December 1287 floods, is consistent with the damage described in the petition as the low lying river valley in which the bridge is situated would have been particularly vulnerable during a severe marine inundation (see fig. 4.3). Structurally, the bridge is formed by two narrow chamfered Gothic arches, one at either side, with the gap between spanned by a wider rounded arch in between. An assessment by the Norfolk Archaeological Unit in 1985 concluded that the side arches dated to the 13th century while the central arch belonged to a later phase[16] (see fig. 4.3). While not definite, the material evidence is consistent with the documentary record—suggesting that the original bridge was composed of the two Gothic arches at either side with a, now no longer extant, central portion that was damaged by the 1287/88 storms. It is unclear if this central section was completely destroyed by the storms, meaning that the 'crossing' on which the toll was imposed must have been a ferry or other alternative means of crossing the river, or was just significantly damaged, perhaps threatening the bridge's collapse and/or making it more difficult for traffic such as carts and livestock to pass. At a later date, the damage was repaired through the insertion of the wide rounded arch visible in the standing structure today.

A comparable case is the succession of bridges at Hemington, Leicestershire, on the River Trent. Here the remains of three medieval bridges dating from *c.*1111-*c.*1310 were destroyed or abandoned as a result of both historically documented high-magnitude flood events and channel migration (Ripper & Cooper 2009: 38, 222), an unusual occurrence in post-Iron Age British lowland rivers (Brown *et al.* 2001: 77). This series of bridges (see fig. 4.4) preserves possible evidence of experimentation in bridge design with the first bridge, built in the late 11th century, supported by timber-constructed caisson plinths filled with sandstone rubble supporting a timber superstructure above. Following a flood in the early 12th century, attempts were made to repair this structure using simple oak piles. Channel migration in the decades that followed meant that this crossing was only short-lived and

[14] TNA SC 8/69/3407.

[15] A possible explanation for the Abbey's actions without first gaining the King's assent is that Edward I was away in Gascony 1286-1289 (Burt 2013: 240) which may have made it easier for the Abbey to overlook proper procedure during this period.

[16] NHER 8525. Available at: http://www.heritage.norfolk.gov.uk/record-details?MNF8525. [Accessed 04/06/2016].

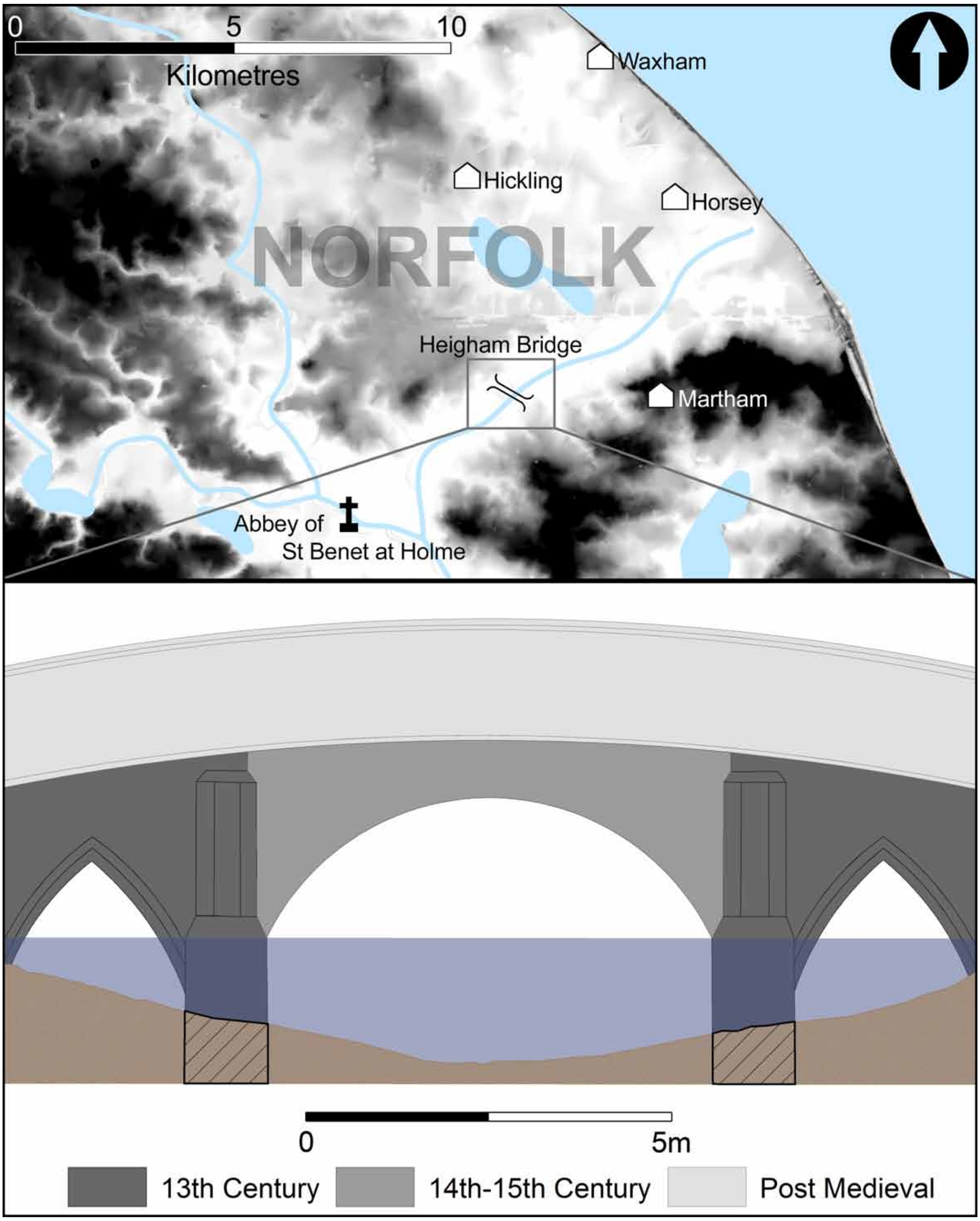

Figure 4.3: Map of the location of Heigham Bridge, Norfolk with a schematic diagram. Above: Map of the location of Heigham Bridge in relation to other locations which, according to contemporary chroniclers (see Appendix A), were affected by the floods of December 1287. Below: An interpretation of the structural phasing of Heigham Bridge. Redrawn by the author after Guy (2011).

during the late 12th century, a new bridge formed of braced-wooden piles was constructed upstream. This was replaced during the 13th century by a bridge with masonry supports on the northern side, masonry piers on sandstone rubble bases and a timber superstructure. Unfortunately, none of these bridges was able to withstand the forces of flood and river migration over the long-term.

At Ballingdon Bridge, Sudbury, Suffolk, a crossing is attested through both documentary and archaeological evidence from the 13th century. The earliest structure was a masonry bridge known only through structural fragments unearthed from the riverbed (Gill 2007: 21-22). That this structure was likely damaged beyond the point of repair is suggested by its replacement by a brick-built bridge in the late 15th century. The shift in building material may have reflected, as well as the changing fashions of the time, an attempt to build a stronger crossing than the one that had stood before. Alas, this structure was damaged by a historically documented flood which struck on 4th May 1521, with associated structural repairs evident in the archaeological record, and another flood destroyed the bridge entirely in September 1594 (Gill 2007: 35). In both cases, Sudbury and Hemington, the continued replacement and renewal of bridges despite the repeated damage and destruction incurred during severe riverine floods demonstrates an acceptance of the risk posed at certain locations. In the case of Ballingdon Bridge, its location was connected to the layout of the town of Sudbury, providing an important route for entering and exiting the town. Relocation of the bridge may not, therefore, have been a viable option and this, combined with the relatively infrequent occurrence of floods which threatened its structure, must have made repair and reconstruction on the existing site the most attractive option. At Hemington, where the precise location of the crossing was not constrained by urban layout, each bridge incarnation spanned the Trent at a slightly different point. This was likely related to the migration of the course of the Trent and the changing morphology of the river banks, meaning the most favourable crossing point shifted with time. The frequent replacement of bridges made necessary by flood events seems to have spurred a degree of development aimed toward creating more resilient crossings. The general shift from timber to stone crossings evidenced across Europe (Daly 2006: 42-43) may also owe partially to this desire to make bridges stronger, more flood resistant, structures.

4.4.2 Ecclesiastical structures

Ecclesiastical structures, which are similarly well furnished with documented histories and well studied standing remains, also preserve evidence of structural adaptation to hazards. An example is Chichester Cathedral where, following a storm in 1210 which brought down two of the Cathedral's towers, the south-western tower was rebuilt with an enlarged buttress (Tatton-Brown 1996: 49). This was presumably to reduce the likelihood of the tower collapsing in a future storm. Comparable responses can be suggested in the aftermath of the 1362 windstorm. For example, although no known contemporary sources reference the effect of the storm at Hitchin, Hertfordshire, Parker

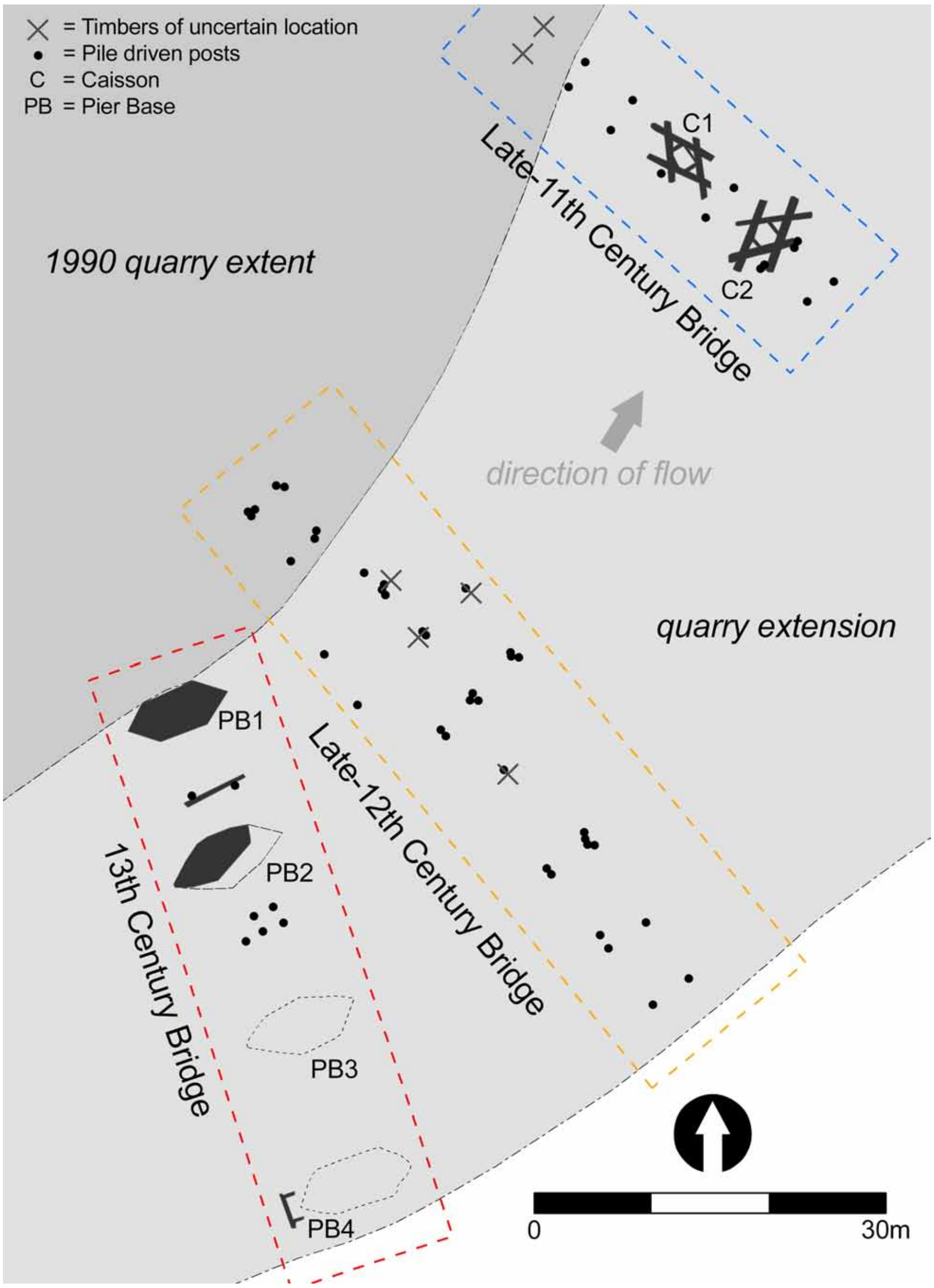

Figure 4.4: The succession of medieval bridges on the River Trent at Hemington Fields, Leicestershire, discovered during expansion of a gravel extraction quarry. Redrawn by the author after Cooper and Ripper (1994: 155; fig. 2).

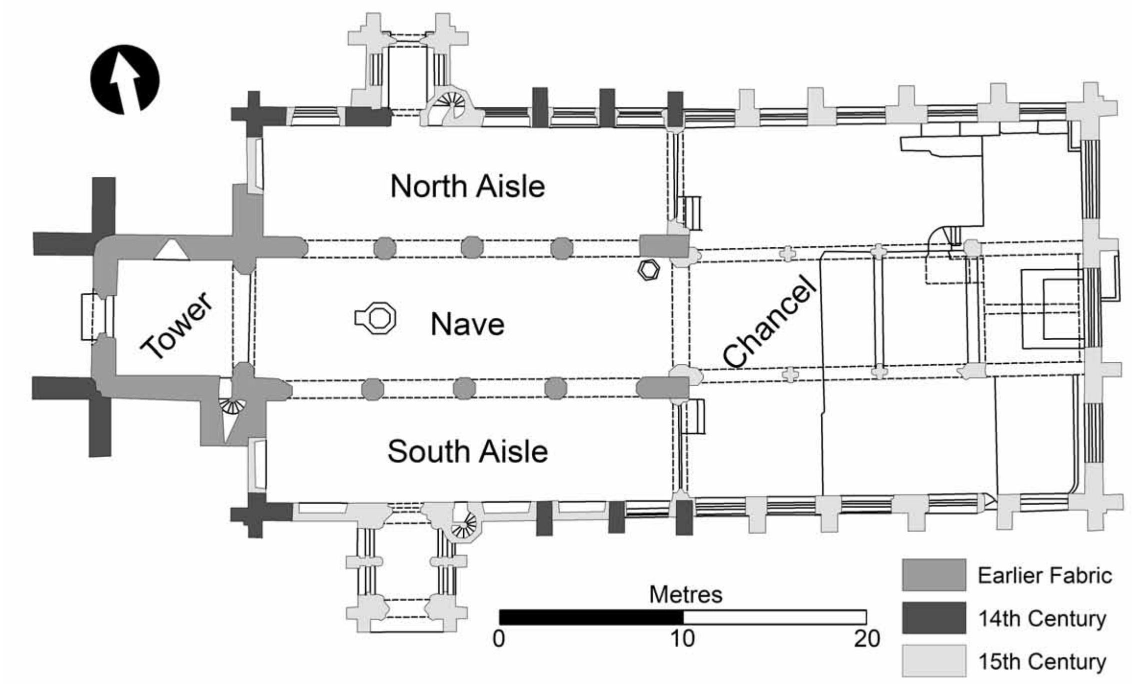

Figure 4.5: Plan of St Mary's Church, Hitchin, Hertfordshire. Note the large buttresses supporting the west face of the tower which were added in the 14th century. Parker (1904) suggested these were a structural response to the storm of 1362 intended to prevent damage in future storms. Redrawn by the author after Parker (1904: 37).

(1904: 38) was under the impression that the storm had caused severe damage to the parish church[17] going as far to suggest that the large buttresses which support the earlier 13th century tower, inserted shortly after the time of the storm, were a structural response to mitigate future storm damage (see fig. 4.5). More certainly, at Austin Friars, London, following the collapse of the steeple in the 1362 storm (Galbraith 1927: 50), a secondary arch, supported by new piers, was inserted beneath the original arch which had supported the steeple above (I'Anson 1866: 71). This course of action was presumably taken both to make the structure safe as quickly as possible and also to avoid further costs by saving as much surviving structural fabric as possible. It is also possible that this structural intervention aimed to make the new spire more stable and resistant in the face of future high magnitude storms. Compared to the engineering problems associated with bridges, reinforcing buttresses and arches was relatively simple and was conducted as and when the need arose. The same type of *ad hoc* interventions were also called on when structures experienced problems with subsidence or other structural weaknesses as was the case at Wells Cathedral after the heightening of the tower, between 1315-1322, introduced subsidence and instability threatening collapse (De Blasi 2008: 204-205).

As with the repairs at Austin Friars, London, the Abbey of St Albans also sought to make

[17]It is unclear exactly why Parker was of this opinion. It is possible that an orally transmitted memory of storm damage had survived or, alternatively, some historical evidence that the storm affected the church at Hitchin may exist which is unknown to the author. Note that the history of the nearby church of All Saints', St Paul's Walden, Hertfordshire, given on the church's website (http://stpaulswaldenchurch.org/history/) [Accessed 03/03/2017] also states that Hitchin was damaged in 1362, although it has not been possible to trace the source of this information.

Figure 4.6: The gatehouse of St Albans Abbey constructed after the storm of 1362, replacing buildings damaged by the St Maur's Day storm and making use of structural fragments from these earlier structures (Photograph by the author).

the most of the existing structural fabric from the buildings which had been damaged in 1362. A gatehouse and almonry were probably among the storm's victims (Riley 1869: 387; Niblett & Thompson 2005: 254) and in the aftermath of the event a new gatehouse was constructed by Abbot Thomas de la Mare (Riley 1869: 387), presumably on the site of these earlier structures. The new gatehouse (see fig. 4.6) incorporates elements thought to be reused from these earlier structures (RCHME 1982: 31) damaged by the storm.[18] These elements include ribs in the vaulting of one of the ground floor chambers as well as decorative corbels (see fig. 4.7) now in place on the second floor. While, stylistically, the triple-roll ribs suggest a 13th century date, the corbels find a close parallel in the *c.*1400 corbels supporting the roof of the church of the Holy Trinity, Penn, Hertfordshire (Pevsner & Williamson 1994: 595). Although a number of the St Albans corbels do display signs of damage, as might be expected from sculptural fragments reclaimed from another structure, it is impossible to confirm at what time this occurred. Taken together, the corbels likely post date the storm of 1362 (Pevsner 1977: 196) and, therefore, most likely date to the period of reconstruction in the storm's aftermath. Although the corbels were probably created for the post-storm gatehouse, the ribs attest to the pragmatic re-use of available building material from structures damaged by the storm. An eye to the future may be suggested by the documentary account of the construction of the new gatehouse which emphasises that this building was "roofed with a very strong covering of lead"[19] perhaps indicating that the old roof had fared especially badly in the storm and, despite its enormous weight, lead was thought to provide a more resilient roof covering (Riley 1869: 387).

[18] I am grateful to Nigel Wood-Smith for providing information on the structural history of the gatehouse of St Albans Abbey and for kindly showing me around the building, now part of St Albans School.

[19] *et fortissimum tectum ipsius cum plumbo cooperuit.*

Figure 4.7: Left: Rib vaults in one of the ground floor chambers. These date stylistically to the 13th or early 14th century and therefore predate the storm of 1362. Therefore, they must have been re-purposed from an earlier structure. Right: Decorated corbels now located inside chambers on the second floor of the gatehouse of St Albans Abbey. Although these were similarly thought to pre-date the storm, close parallels with other late 14th century sculpture suggests they are more likely to relate to the reconstruction phase in the storm's aftermath. Photographs by the author.

Resilient adaptations in roof re-design may be most evident, on the heels of the occurrence of a natural hazard, at Salisbury Cathedral, Wiltshire. Here, the storm of 1362 damaged the uppermost *c.*9m of the spire as well as the free-standing belfry. As the belfry was demolished in the late 18th century it is impossible to analyse the impact of the storm in this structure but the spire is extant and the repair pattern observable. Perhaps most interestingly, dendrochronological analysis of the timbers in the spire's internal scaffold return felling dates between 1344-1376, at least a generation after the initial construction of the spire. The scaffold has therefore been interpreted as an insertion necessitated by storm damage in 1362 (Miles *et al.* 2004: 20-22), which is corroborated by the documentary record (Bliss & Twemlow 1902: 462-463). Although this scaffold may have facilitated the repairs required to the spire, a possible interpretation is that it was intended to offer structural reinforcement against any future storm winds. This possibility is given credence by both the location of the scaffold, internal rather than external, as well as the choice of material, oak rather than lighter alder or pine more commonly used in temporary scaffolding (Miles *et al.* 2004: 22).

Flooding affecting ecclesiastical structures provoked a different set of structural adaptations. At Clare Priory Church, Suffolk, for instance, the wall footings were cut into made-ground which had been imported or redeposited during the construction process to raise the site by up to 1m to provide protection from flooding by the nearby River Stour. The redeposited soil contained charcoal, broken tile and mortar, suggesting that it may have been demolition waste from an earlier structure which had been pragmatically spread across the site to reduce the risk that the new structure would suffer inundation (Gill 2013: 20). Similarly, at the Cistercian foundation of Bordesley Abbey, Worcestershire, the internal floors of the south transept were raised by 20-26cm in the aftermath of a flood event in order to prevent the same thing happening in the future (Hirst *et al.* 1983: 54-55). An alternative strategy was to allow flood-waters into the lower levels of a building by design. This seems to have been the preferred strategy in the Fenland villages of Tydd St Giles, Cambridgeshire, West Walton, Norfolk, Terrington St John, Norfolk, and Long Sutton, Lincolnshire, the free-standing bell-towers[20] of which have (or originally had) open ground-floors, with open arches supporting the tower above. According to Parker and Pye (1976: 107) the motivation for this design feature was to allow the region's frequent floods to simply wash through causing only minimal damage. As the next section explores, away from the confines of individual structures there were many other ways in which medieval communities guarded against flood risk.

4.5 Flood defences

Risk from flooding is ever-present. Whether it be coastal flooding, through storm surges, riverine flooding, as a result of a rapid downpour or sudden snowmelt, or groundwater flooding as a result of sustained rainfall—a flood can occur quickly and without warning. In order to reduce risk to land

[20] A relatively rare feature in English parish church design.

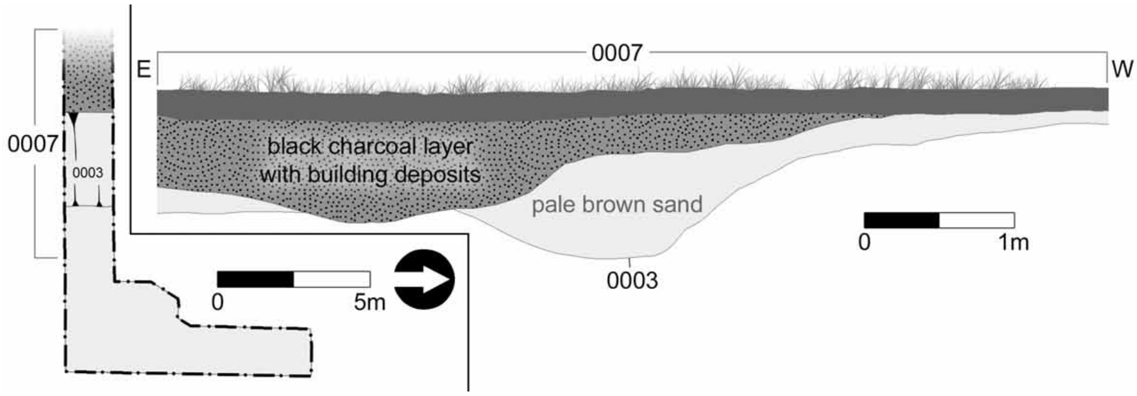

Figure 4.8: Ditch 0003 at Flempton, Suffolk. Interpreted by the excavators as a flood defence ditch to protect against flooding from the River Lark. Redrawn by the author after Gill (1997: Figure 2).

which sits at a level threatened by flooding, therefore, artificial intervention is required. As seen in the examples above, this may involve the artificial raising of the local ground level or internal floors out of the reaches of flood-waters. This strategy is, however, only practicable over a relatively limited area. On the other hand, through the erection of dikes and digging of drainage ditches, large areas can be protected from flooding. This section will assess the archaeological and historical evidence for the application of such defences during the medieval period.

In flood prone areas, human settlement—from individual land holdings right the way up to villages and towns—relied on some form of flood defence. In general, these took the form of raised embankments, drainage ditches or a combination of the two. These features are commonly encountered through archaeological excavation and/or field survey. Medieval property boundaries often take the form of ditches or, less commonly, embankments, which, as well as demarcating property ownership, may have often provided a degree of flood protection (Coleman 2004: 290-291). At Swavesey, on the edge of the Cambridgeshire Fens, for example, property boundaries within the medieval town were delineated by, or oriented in relation to, drainage ditches—although a number of these ditches contained molluscs indicating they had, at some point, become flooded by a large body of water (Sayer 2009: 139-141). Similarly, at Flempton, Suffolk, a large ditch—ditch 0003—located on the edge of the medieval green, detected during a routine archaeological assessment, seems to have provided medieval settlement at the site with flood protection against the seasonal flooding of the River Lark (Gill 1997; see fig. 4.8). At Bordesley Abbey, Worcestershire, in addition to the raising of internal floor levels, analysis of the upstanding earthworks reveals a bank between the abbey precinct and the River Arrow which would have provided protection against flooding (Aston 1972: 135).

Doubtless, embanking—the process of erecting flood defence barriers, took place on the largest scale in low-lying wetland environments where the erection of banks and ditch digging allowed the fertile soils characterizing these dynamic landscapes to be exploited for agricultural purposes. Indeed, Soens (2011: 333) has argued that such defences are a 'pre-condition' for the settlement of these areas above a certain threshold. These defences were usually constructed of earth, which was both economical and readily available. The required earth was often obtained by digging a ditch parallel to the line of the bank, usually on the landward side of the defence. This had the added benefit of creating a drainage ditch to allow excess water to drain away from enclosed agricultural land (Allen 1997: 5, 9). Earthen banks can be reinforced with wood or stone either to provide a supporting internal core, which is covered over with earth, or as a strong facing to provide greater strength against strong waves or the increased power of currents in times of flood (Allen 1997: 5). An example of one such flood defence is the 'Pokediche' in Marshland, Norfolk, which bridged the land between the Nene and the Ouse, protecting the low-lying land of the parishes to the north from freshwater inundation—and seawater ingression when severe marine floods brought seawater upriver (Silvester 1988: 32). Its path is marked on the anonymous map of *c.*1582 and is still labelled on the 1st edition OS map as 'Old Podike Bank'. This feature was, according to Dugdale (1662: 245), constructed in *c.*1223 although some evidence suggests it may have been in existence at an earlier date (Hallam 1988b: 157). As it provided protection for the whole area to the north, including all of the Marshland parishes, each parish was responsible for its upkeep and contributed towards the costs of maintenance (Dugdale 1662: 258-259).[21]

In addition to raised embankments, it was also necessary to drain freshwater from within areas of enclosed land. As well as a network of drainage channels, therefore, sluices or flood gates[22] were required in order to control the level and flow of water. These were pipes which ran through the flood banks and sea walls and were equipped with doors so they could be closed when flood risk was high (Hallam 1988a: 502-503). Thus, at Bicker, Lincolnshire, the flood gate was to be closed "in time[s] of mighty floods from the Sea" (Dugdale 1662: 200). Such features are mentioned in the historical sources discussed in Chapter 3.2.2—"a certain Floud-gate of Waltone, called Nobeche gote" (Dugdale 1662: 258), for example, is described in the sea wall which bounded the parish of Walton to the north and west. 'Nobeche gote' is unmarked on the early maps of the area but a field abutting the sea wall in the parish of Walton shown on the *c.*1610 map of Marshland[23] is named 'Nobitch', giving a likely location for this flood-gate (see fig. 4.9). A parallel for such a structure may be the culvert formed of three hollowed out tree trunks, tree-ring dated to AD 1250±40, excavated *c.*5km away within the medieval sea bank at Newton, Cambridgeshire (see fig. 4.10). According to (Taylor 1977: 65), this culvert would have originally been furnished with a door allowing the flow of water to be controlled.

By their very nature, flood defences (embankments, drainage ditches and flood gates) require frequent maintenance to remain effective. In complex flood defence systems covering a large area, the failure of defences protecting a neighbour's land can result in knock-on flooding to land owned

[21] As was frequently required both as a result of damage caused by flooding and human interference, as discussed in Chapter 3.2.2

[22] In the Fens these were also known as 'gotes', 'goles' or 'clows' (Hallam 1988a: 501-502).

[23] British Library Cotton Augustus I.i, f. 79. Accessible at http://www.bl.uk. [Accessed 05/02/2018].

Figure 4.9: Left: Detail of the *c*.1610 'Chart of the Fens between Lynn Regis, Denver Sluice and Wisbich' between West Walton and Walpole, Norfolk. Note that the field named Nobitch is located north east of West Walton. Right: The first edition OS map of the area with the sea wall marked in black and the area of the 'Nobeche/Nobitch' field highlighted. Left: British Library Cotton Augustus I.I, f. 79. Reproduced by kind permission of the British Library Board. Right: The First Edition OS Map draped over present-day LiDAR data. Compiled and annotated by the author.

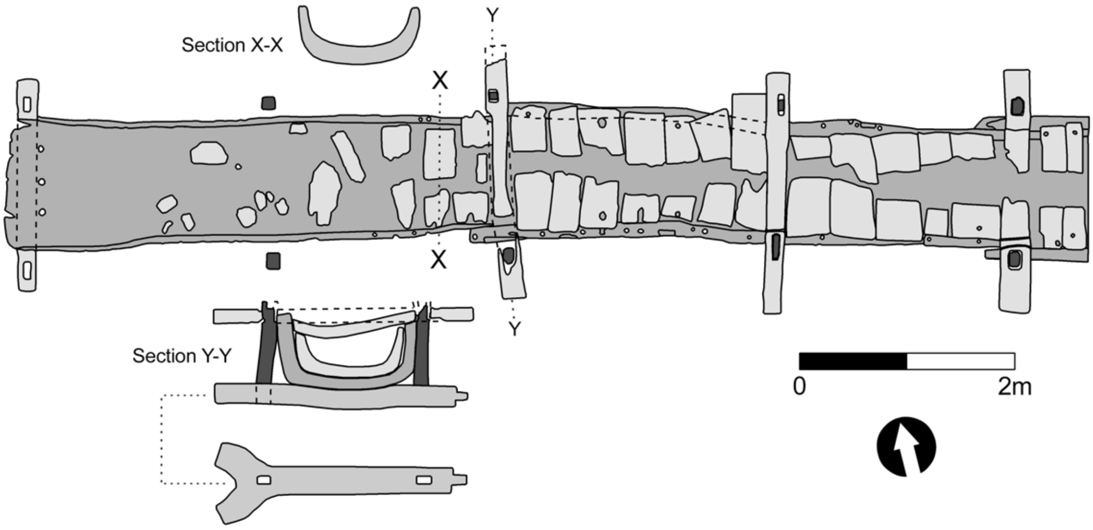

Figure 4.10: A 13th century culvert excavated running through the medieval sea wall in 1977 at Newton, Cambridgeshire. This structure is formed of three hollowed out tree trunks, dated through dendrochronology to AD 1250±40 and would have allowed freshwater to be drained from behind the flood defences. Originally, a sluice gate may have allowed floodwaters to be excluded when necessary. Redrawn by the author after Taylor (1977: 64, fig. 1).

by others. As a result of such situations, a continuing concern during the medieval period was to ensure that all parties responsible for the upkeep of specific flood defences were contributing to their maintenance fairly and regularly. To this end, often at the request of local landowners in areas where flooding posed a recurrent risk, Royal Commissions *de walliis et fossatis* were established with powers to compel landowners to pay for repairs, press charges against those who failed to comply with regulations and even to arrange for and oversea the execution of necessary works (Galloway 2009: 178). One such commission was established in the aftermath of the storms of 1287/88 to investigate the extent of flooding and ensure defences were properly repaired and maintained in Romeny Marsh, Kent (Anon 1726: 155-163; Maxwell Lyte 1893: 309).

The complex system of flood defence infrastructure, which emerged over time in reclaimed wetlands, encouraged the concomitant development of social systems to organise their regulation and maintenance. Analogous to the arid regions of southern Europe, especially those influenced by Islamic traditions, where land came with associated rights to irrigation (Gerrard 2011: 19), in many reclaimed wetlands the rights to specific parcels of land came with the duty to maintain or contribute towards the flood defence infrastructure. In Marshland, for example, in an early 13th century land grant to "Adam the priest of Walton" came the attached condition that "he is also to " do[24] " half a perch of sea bank and half a perch of drain." (Bullock 1939: 51). Where a dike or drain needed construction or repair the community who benefited from the protection these defences afforded came together to carry out the work (see fig. 4.11). This obligation was known as 'menework' and provided the manpower resources required in order to maintain the flood defence infrastructure. This system is clearly descirbed in the records of the Commissions for Sewers in Wiggenhall in the early 14th century:

"If anyone's dike is defective, a day is to be arranged provided that no danger is expected . . . Anyone who has not come to the summons for repairing 'grundegole'[25] shall give 6d. Anyone who has not come to the summons for simple menework shall give 4d. and nevertheless do his menework on the morrow." (Owen 1981: 51).

Such regulations were enforced in Marshland by 'dike reeves', elected by each town,[26] whose role included the financial administration, organisation and overseeing of flood defence and drainage works in addition to liaising with Royal officials (Owen 1981: 42-44). Each parish looked after its own defences with some of the major banks and ditches, such as the main sea-wall and the Pokedike, maintained in concert by all the Marshland towns. The cost of maintaining the flood defences was

[24] *faciendo.*

[25] This refers to a breach in a dike, something that was more urgent to repair than the usual maintenance or 'menework' and therefore carried a greater financial penalty for failure to respond to the summons.

[26] Wiggenhall elected two annually in the 1320s (Owen 1981: 42) while Tilney and Islington had 3 (Dugdale 1662: 251).

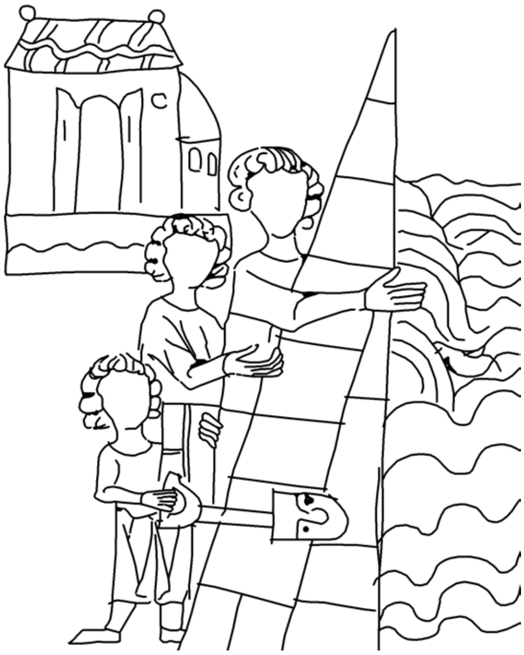

Figure 4.11: A family supports a dike against the forces of the sea illustrating the communal nature of dike maintenance. Illustration from the Oldenburger Sachsenspiegel, produced in 1336, LBO CIM I 410, 58r. Redrawn by the author.

divided among the parishioners proportionally to individual land holdings. Penalties were imposed for failure to make the repairs according to one's responsibilities, and these escalated upon failure to carry out the work (Dugdale 1662: 254). Along with the relatively complex physical system of flood defence infrastructure, therefore, an equally sophisticated, and somewhat bureaucratic, system existed in Marshland to regulate and enforce dike maintenance and collective flood-security.

Of course, in some cases maintenance was not carried out properly or flood defences were simply too weak or too low to withstand floodwaters. In such an event, a breach with potentially devastating consequences for the land behind occurred. Such failures severely disrupted the defences themselves. As an example, when a sea wall thought to have originated in the 16th century was monitored for archaeological remains during an archaeological evaluation on the Trimley Marshes, Suffolk, the constituent reddish-brown clays reinforced with wooden poles, chalk rubble and brick, which formed the defence, were interpreted (based on analysis of the types of brick and the presence of saw marks on the timbers) as 20th century reconstructions in the wake of the 1953 storm surge (Everett 2000). Those defences which have suffered recurrent damage as a result of floods and storms, therefore, are likely to have been repaired and renewed at frequent intervals. As a result, unaltered original defences constructed in the medieval period are likely to be relatively rare survivals in the modern landscape. Additionally, in many areas, especially reclaimed landscapes, the medieval sea walls, dikes ditches and banks are very often now located behind more recent defences as subsequent reclamation has proceeded seaward or the medieval defences have been superseded in a later phase of reclamation, as at Broomhill, East Sussex (Gardiner & Hartwell 2006: 151-152). As a result, medieval flood defences have very often lost their local importance as flood protection. As this most often occurred during the pre-modern period, when the earlier flood defences were not recognized as historical monuments of any value, they have often ceased to be maintained or have been subsumed into modern roads, tracks or to provide reliably dry building plots for later structures (Allen 1997: 6).

Such issues mean that detecting archaeological evidence for the failure of medieval flood defences is a difficult task but there are a number of ways in which such events leave a physical signature. Reclaimed land which becomes inundated following a breach may preserve identifiable evidence of former agricultural use as creeks often form along existing drainage channels forming distinctive and unnatural creek networks (Gardiner 2002: 106; see fig. 4.12). Repairs following a breach also often leave a distinctive pattern which can be discerned through analysis of historic maps. Most repairs follow one of three possible routes (see fig. 4.13): either a reconstruction of the original path of the defence or a redesign, encircling the breach externally or internally. A succession of the former type of encircling repairs can be seen at Broomhill, East Sussex, in response to continued floods which Gardiner and Hartwell interpret as those which occurred in the 1450s and 1460s (Gardiner & Hartwell 2006: 155-156). The latter type of repair—encircling the breach internally—is a less common response as it typically requires a longer, more costly and manpower intensive, alteration and results in the permanent surrender of some of the ground affected by the breach. Nevertheless, a medieval example can be found at Horseshoe Corner, on the Thames near Dagenham, which Galloway (2012: 82) suggests may have been created by a flood in 1409. A similar, although post-medieval, example can be observed in Marshland, Norfolk, from an area enclosed in 1775, and therefore breached at some-point after this date. In this case, however, repairs were made with an external encircling bank but, in common with the breach near Dagenham, the dike failure came to be known as 'Horseshoe Hole'.[27] An earlier breach in the area is marked on William Hayward's map in the sea wall between Terrington St Clement and Walpole Cross Keys and marked simply as 'The Breach' providing a *terminus ante quem* of 1591[28] (see fig. 4.15). That this particular area was liable to damage is confirmed by the fact that by the mid 18th century it had been abandoned to the sea, and the route of the sea-wall had been re-aligned (Silvester 1988: 41). This re-adjustment has erased evidence for the former route of the defences depicted in Hayward's map—making it difficult to assess the relative chronology of the breach and the sea wall.

When breaches occurred, or the incidence of flooding increased, medieval communities adapted to meet the challenge. A variety of evidence, therefore, attests to the building of flood defences—or their strengthening and/or redesign—by medieval communities in response to episodes of flooding. At Thornton Abbey, North Lincolnshire, for example, a bank interpreted as a flood defence was

[27] This is the toponym given on the 1st edition Ordnance Survey map of the area.

[28] The *c.*1610 map held by the British Library is thought to be a later copy of a no longer extant original dating from 1591.

Figure 4.12: Aerial photograph of tidal creeks on the Dengie Peninsula, Essex. The straight morphology of the creeks closest to the fields indicate their form is the result of human alterations or modifications at some point in the past (Gardiner 2002: 114-115). Photograph by the author.

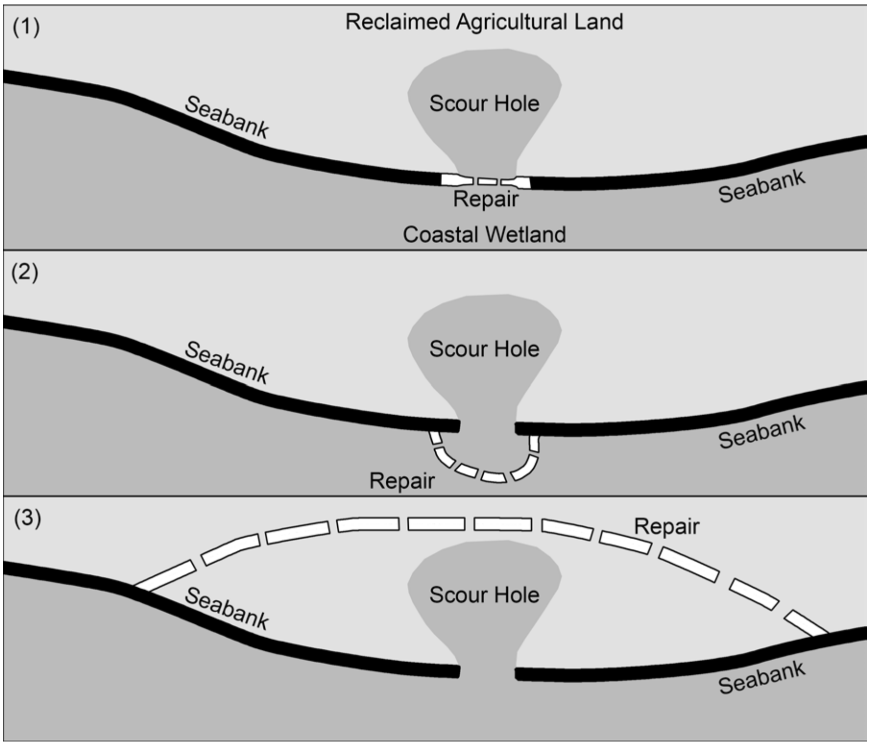

Figure 4.13: Schematic diagram showing the different options in repairing breaches in flood defences. 1) - The breach is repaired by bridging the hole in a straight line. 2) - the breach is repaired by creating a 'bastion-like' protrusion to the original route of the dike. 3) A new internal wall is constructed, abandoning the area affected by the breach. Redrawn by the author after Allen (1997: 15).

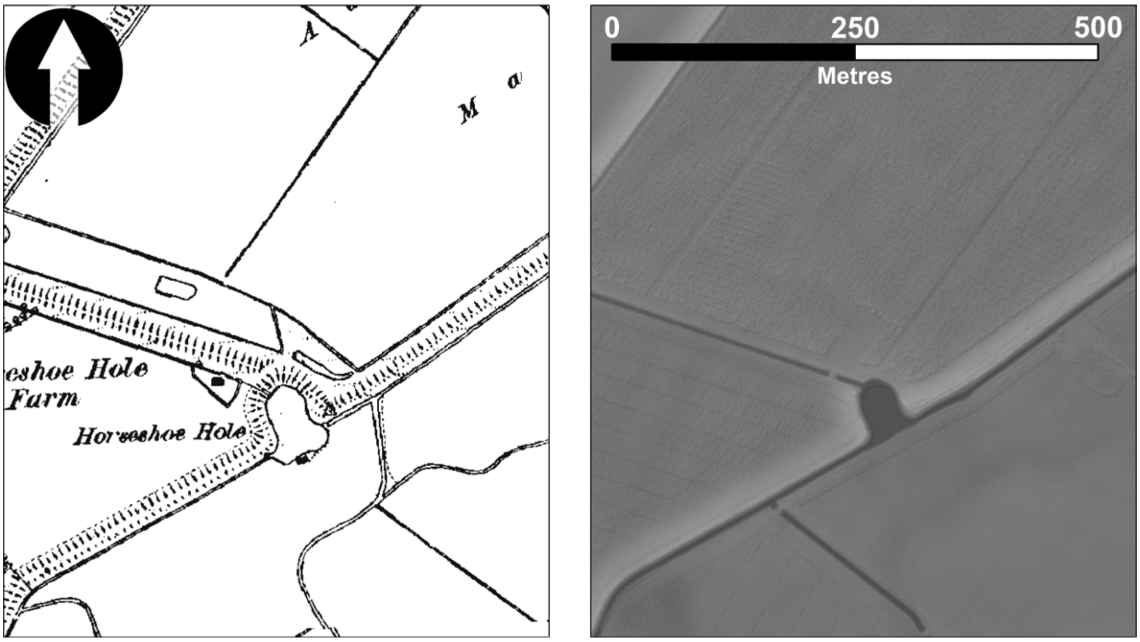

Figure 4.14: An 18th century breach north of Terrington St Clement known as Horseshoe Hole. Left: 1st Edition Ordnance Survey County Series 1:10560 Map. Right: 1m LiDAR.

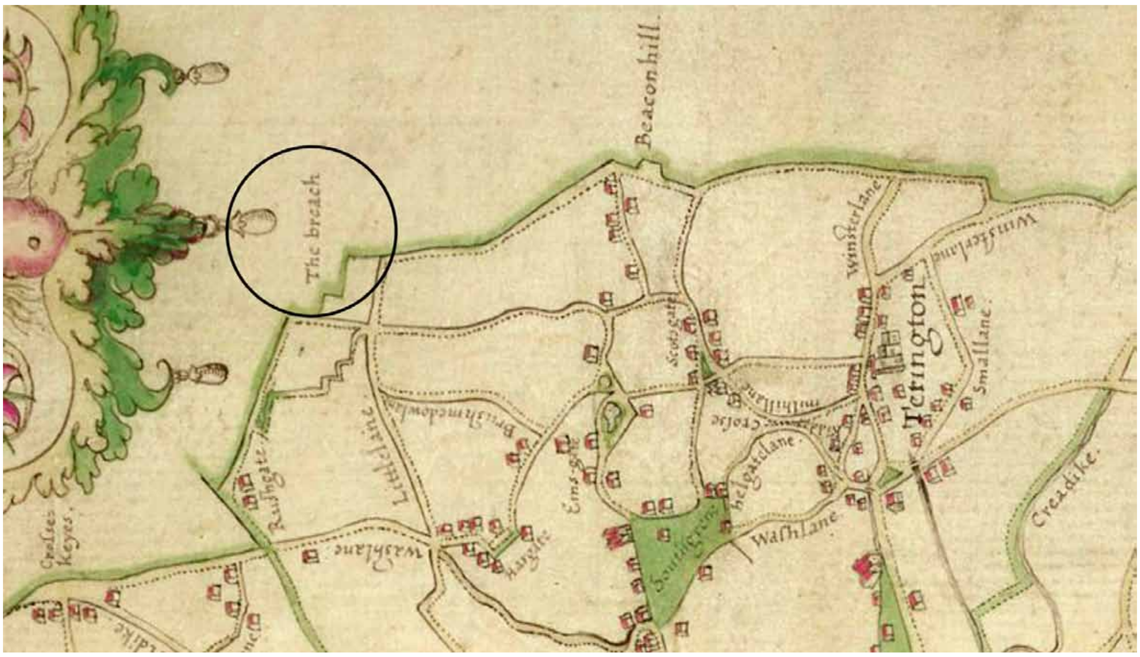

Figure 4.15: The location of a breach marked on William Hayward's *c*.1610 map of Marshland. The breach is labelled in the sea bank west of 'Beacon Hill'. The route of the sea bank in this area has been altered since this configuration (Silvester 1988: 41). 'Rushegate' is located to the east of Cross Keys (bottom right-hand corner). North is towards the top. British Library Cotton Augustus I.I, f. 79. Reproduced by kind permission of the British Library Board.

twice breached by flooding from the nearby Skitter Beck, leaving behind layers of alluvium, and, each time, the bank was subsequently heightened—presumably with the aim of preventing future flooding (Willmott & Townend 2012: 19). Similarly, at Broomhill, East Sussex, in the aftermath of the 1287/88 floods, the sea walls, the breaching of which contributed to catastrophic flooding in Walland Marsh, were redesigned (Gardiner & Hartwell 2006: 151-152). In this case, however, in addition to a desire to prevent such a disaster in the future, the significantly altered landscape no doubt affected the decisions taken in the rebuilding of the flood defence system. Contemporaneously, in the nearby Brede Valley, East Sussex, the increased incidence of sea floods in the 13th century seems to have sparked the construction of a linear embankment known as the *Damme*, through which a sluice allowed freshwater to flow (Gardiner 1995: 131). The evolving challenges imposed by flooding on medieval communities, therefore, were met with both highly practical solutions—which display a high level of understanding of water and its physical properties—as well as complex social systems which attempted—although not always successfully—to ensure the flood defence infrastructure was fit for purpose.

4.6 Financial relief

Money was one of the foremost concerns in the minds of those affected by hazards—or, at least, this is the conclusion gleaned from many of the historical documents which primarily relate to financial matters. As has already been seen, agricultural management largely revolved around the profitability of different farming practices and the pay-off that investment in particular areas, such as soil improvement, could bring. Following the 1338 flood in Marshland the affected communities appear to have been particularly vulnerable from a financial standpoint. The historical sources emphasise the general impoverishment of the people in the wake of the flood (Maxwell Lyte 1915: 62) and, in order to remedy the situation, a petition was sent to the King by 15th January 1338, just 3 days after the floods had struck (Maxwell Lyte 1915: 61-62). In response to this petition, on the same day, the king ordered a commission *de walliis et fossatis* to investigate the situation in the Fens (Maxwell Lyte 1895a: 581). Since 1337, a tax of a fifteenth of the value of all movable goods had been imposed throughout the realm[29] for the following three years to raise money for the ongoing Scottish Wars (Maxwell Lyte 1915: 50). The inhabitants of Marshland successfully petitioned the King to order their movable goods to be reassessed on account of the flood of 1338 (Maxwell Lyte 1915: 61-62) in order to reduce their contribution. Several elements of this petition suggest an attempt to exaggerate the plight of the community in order to maximise the concessions they might receive from the Crown. The lands of the parish of Wiggenhall, for example, were described as being split in two by the sea (Dugdale 1662: 258). As Wiggenhall was made up of land on both sides of the Ouse (see fig. 3.9), this may have been an exaggeration of the normal

[29] The tax was levied as a fifteenth for rural dwellers but only a tenth for those who lived in urban areas.

state of affairs to make the problems with flooding appear even more precarious than the reality. Equally, the loss of areas of marsh, as the parishioners of Terrington complained had occurred at Rushemershe and Newemershe (Dugdale 1662: 259), may be another case of exaggeration. Such areas of marsh were most likely outside the embanked area and would have been largely undeveloped land—perhaps used for pasture—the high flood risk of which the local community would have been well aware. It is unlikely, therefore, that the inundation of these areas amounted to the significant loss that it appears in the parish's petition to the Crown. Although the reassessment of the area's tax burden seemingly ameliorated the situation for the communities of Marshland, it seems that, subsequently, the tax was collected based on the pre-flood assessment—rather than the one carried out with Royal consent in the aftermath of the disaster (Maxwell Lyte 1903: 394-395)—although this was eventually rebated (Dugdale 1662: 260).

In petitioning the King for a tax concession in 1338 the people of Marshland were far from unique. To cherry pick some comparable examples, the people of Saint-Sever, Landes, within the English possession of Gascony, were granted a tax exemption lasting for two years due to the damage caused by floods to the town's defensive walls in the late 1420s.[30] Comparably, when the buildings of the Augustinian nunnery of Lacock Abbey, Wiltshire, were severely damaged by a fire ignited by a lightning strike in 1447 the Abbess was able to negotiate an exemption from "all tenths and other subsidies, quotas, aids and contributions whatsoever for a term of 40 years" (Maxwell Lyte 1909b: 86). In a similar vein, in the aftermath of the 1362 windstorm, the Black Prince was willing to forgo a percentage of rent from his Cornish tenants who had been ill-affected by the storm (Dawes 1931: 189) while according to Ormrod (1996: 169), compared to earlier periods, the exchequer was particularly amenable to requests for the remission of debts in light of storm damage. Such remissions of rent and tax obligations allowed recovery from short-term shocks, while for landlords and authorities, loosing out on a small portion of rent or tax may have made good economic sense over the longer-term by preventing their tenants from suffering so acutely that they would be plunged into poverty—and be unable to make any future payments.

In some ways hazards brought relief with them. In the aftermath of the 1362 windstorm the trees blown down by the storm provided not only a ready source of raw materials to make repairs but also a potential source of income. This can be seen widely across the royal parks belonging to the Black Prince. Only one month after the storm, for example, the Prince instructed his steward at Cottingham, East Yorkshire, to sell the trees felled by the wind at Cottingham and Kirbymoorside, North Yorkshire, for profit. At the royal park at Byfleet, Surrey, the Black Prince gave orders that the wind-felled timber was to be sorted into wood suitable for timber, wood that could be used as park paling and firewood (Dawes 1933: 416) while the wood felled in Cornwall was to be used to make repairs across the Prince's estates, although some was also to be given to the Prince's tenants

[30] TNA: C61/125: 26. A transcription is available at: http://www.gasconrolls.org [Accessed 12/02/2018].

to allow them to make repairs (Dawes 1931: 189). At the parks of Berkhamsted and Gaddesden, Hertfordshire, meanwhile, the timber was to be sold “as profitably as possible” (Dawes 1933: 431) and this also evidently took place at Clarendon, Wiltshire.[31] The unprecedented number of trees felled at Berkhamsted even led the Prince to renegotiate the long-held custom that his parker, the administrator who oversaw the management of the park, was entitled to the profits from wind-felled trees which, after the 1362 storm—so great was the quantity of trees felled—was changed to a fixed sum of 100 shillings (Dawes 1933: 431, 464).[32] Of course, access to the wind felled timber was unequal across society; although landowners, such as the Black Prince, were free to make a profit from the fallen timber on their land, the rights to trees on land held by tenants typically belonged to the landowner. That the storm exacerbated poverty among the lower classes is suggested by a petition to Parliament in 1362 which, in light of the storm, sought to secure the rights of tenants to sell such wind-felled timber “and make a profit” (Ormrod *et al.* 2017: 147-148), although how Parliament responded to this petition is unknown.

Although landowners sometimes assisted their tenants, often it seems to have been the tenants responsibility to make the repairs necessitated by storm damage. Details of a court case from London conducted four years after the storm’s occurrence demonstrate that, at least in the case of the burler Henry Maynburgh,[33] tenants were expected to pay for repairs to rented properties (Thomas 1929: 61-62) which, for some, must have been a significant financial burden. Such difficulties offered opportunities for other groups. This is hinted at by a description of the activities of the Archbishop of Canterbury, Simon Islip, in the storm’s aftermath. In 1362 Islip acquired land in Oxford in order to found Canterbury Cathedral Priory’s college at the University: Canterbury Hall. The source which describes this purchase strongly implies that the land was available and perhaps cheaper as a result of the damage caused by the storm (Wharton 1691: 415). It therefore seems to be the case that the Archbishop seized on the opportunity that the storm had provided by purchasing land below the market value, taking advantage of the short term financial needs of the previous owner. This illustrates that for those with sufficient financial capital to hand, such an event could offer welcome new possibilities.

Ecclesiastical authorities were particularly well placed to raise additional revenue as a result of damage caused by hazards. The Church was often a beneficiary of gifts from the aristocracy and wealthy middle classes in the wake of such events. Following the storm of 1362, for example, the Black Prince (the heir to the throne) donated timber blown down by the storm across his estates in Lamarsh, Essex, to enable the repair of the chancel of the church at Great Henney, Essex (Dawes 1933: 432). Similarly, wood for fuel was donated to the Dominican friary of Dunstable

[31]TNA: E 101/698/4.

[32]This change guaranteed the parker an income but it was rather less than that derived from wind-felled trees in an average year (Dawes 1933: 464).

[33]The court case, conducted in 1366 concerned damage to the roofing of the property rented by Maynburgh in St Lawrence Lane, London. The rental agreement proscribed that the tenant was financially responsible for making the repairs, which, although Maynburgh attempted to do, led to a disagreement with the landlord (Thomas 1929: 61-62).

from wind-felled timber in the park of Berkhamsted (Dawes 1933: 417). That such largesse may relate to a wider Christian tradition is suggested by the fact that gifts of timber or rights to take wood were also frequent donations to churches affected by natural hazards in medieval Iceland[34] (Swedo 2012: 150-153). Gifts of this nature were not just charitable donations, most donors had clear expectations when they made contributions to the Church. Amongst a populace inherently concerned with the final destination of their souls and those of their relatives, such gifts could provide peace of mind. This is demonstrated by a local alderman's donation of £100 towards the construction of a new bell-tower for the Augustinian friary of Clare, Suffolk, in 1363.[35] In this case, the size of the donation along with the "munificent largesse in alms and other benefits" of the benefactor led to the appointment of a priest to hold prayers for him, his parents and any to which he "is obliged, both in life and in death" (Harper-Bill 1991: 85).

Where the donations of wealthy individuals were insufficient to cover the cost of repairs, other fund-raising methods were required. *In extremis*, this could include the sudden development of an attraction to stimulate a tourist industry—as occurred at Glastonbury in 1191 when the bodies of King Arthur and Queen Guinevere were miraculously discovered a few years after a destructive fire, providing a ready flow of both visitors and cash (Rippon 2004: 128-129). Another atypical example may be the Royal grant to Cleeve Abbey, which came in the aftermath of the cliff collapse that destroyed the chapel of St Mary the Virgin,[36] which gave the Abbey the right to hold a weekly market and fairs on appointed days of the year (Maxwell Lyte 1897: 527)[37] in order to raise additional revenue to recover from the impact of the disaster. More dependable and universally applicable methods to generate capital in response to disasters were also available. Indulgences allowed the Church to elicit donations of money and labour from the lay populace in return, theoretically, for reductions in the amount of time an individual's soul would spend in purgatory (Swanson 2007: 61-63, 149-160). Particular indulgences were connected to specific locations or causes and reduced the stay in purgatory by varying lengths of time, with the indulgences promising the longest reductions attracting donations of higher amounts and from further afield than those which made more modest claims. Indulgences were commonly issued in the aftermath of a disaster as can be seen at the Benedictine priory at Molycourt, Norfolk, located immediately south of Marshland, which was granted an indulgence of 40 days by the Bishop of Ely in 1385 due to poverty exacerbated by storms and floods (Page 1906: 349). Similarly in 1394, Ankerwycke Priory, Buckinghamshire, was granted an indulgence for "relief of [the] poor nuns . . . whose goods [have been] destroyed by floods" (Gibbons 1891: 399) while in 1485 a Papal indulgence was granted to raise money for repairs to flood defences in the Isle of Ely (Lee 2015: 142).

[34] Although the scarcity of timber in Iceland must have given these gifts particular importance in this setting.

[35] There is no certain evidence that the Augustinian Friary of Clare was a victim of the storm of 1362 although this would be consistent with both the date of this donation and the friary's geographical location.

[36] This is discussed in Chapter 3.4.1

[37] These were the feast of Saint James (1st May) and the feast of the Exaltation of the Cross (14th September)—and the three days that followed.

Following the January 1362 storm indulgences were issued widely by the Papacy in an attempt to speed the completion of necessary repairs. Thus, from 1363, those who contributed towards the restoration of Norwich Cathedral saved themselves seven years and seven quadragene[38] in purgatory (Bliss 1896: 418). At Salisbury Cathedral, another victim of this storm, no indulgence was advertised but the Papacy granted the appropriation[39] for six years of the nearby church of St Thomas, which annually amounted to £10, towards the cost of repairs (Bliss 1896: 462-463; Bliss & Twemlow 1902). Lesser Ecclesiastical foundations attracted correspondingly proportioned indulgences in the wake of the 1362 storm: Cloyne, County Cork, and Stone, Kent, were both issued indulgences of three years and three quadragene (Bliss 1896: 414, 421-422) while Whitechapel, London and Colchester, Essex, both attracted indulgences of one year and one quadragene (Bliss 1896: 444, 468). Two indulgences were issued to stimulate the donation of alms towards the repair of the chapel of Saint Mary the Virgin, at Cleeve, Somerset, (which was later destroyed by a cliff collapse)[40] to remedy the damage caused by marine floods—the first was issued in 1398 by the Bishop of Exeter (Randolph-Hingeston 1886: 62) while in 1400, either as a result of continued problems with flooding or the failure of the first indulgence to raise the necessary funds, the Papacy granted an additional indulgence of three years and three quadragene (Bliss & Twemlow 1904b: 400). Although indulgences might be considered a spiritual reaction to natural hazards, their ability to generate money and manpower from within medieval society made their issuance a sensible and pragmatic response, employed widely throughout Christendom (Rohr 2003: 138), in the face of severe destruction.

4.7 Migration, Abandonment and Decline

The long-term effect of disasters and their impact on the trajectory of development, at the level of individual settlements and wider hinterlands, is an important question. Investigating the trajectories taken by medieval settlement and activity in the aftermath of disaster, however, is far from a simple task. Traditionally, historians have relied on tax records to estimate economic or demographic change in regions and individual towns but such sources are beset by a number of problems—the lengthy gaps between available records and the discrepancy between how taxation was levied in urban and rural areas to name but two (Rigby 1979). The archaeological record offers some alternative routes to shed light on these questions—for example through excavated evidence for desertion or continuity and trends in material culture—such as a decline, shift in production, change in style *etc.* (Jervis 2017: 6-7). A combination of the historical and archaeological evidence readily demonstrates the diversity in possible outcomes in the aftermath of a disaster but, as will become clear, isolating the contribution made by an individual disaster from wider, pre-existing endogenous

[38] A period of 40 days.
[39] Income from tithes.
[40] This is discussed in Chapter 3.4.1.

forces proves to be a challenging task.

In the moment of disaster, one of the primary responses open to medieval communities was to flee—to leave the area of danger until it was safe to return. Relocation away from the usual place of settlement, in the face of environmental change is a complex topic which, in light of contemporary climate change, has generated a vast literature. Within studies examining modern populations there is disagreement over the extent to which environmental migration as a concept exists—with different researchers emphasising the environmental aspect, as opposed to economic, social, political or cultural concerns, to any given migration to varying degrees (Lübken 2012: 11). In the case of medieval examples, the archaeological and historical sources rarely furnish us with the level of detail required to make a nuanced assessment of the factors and decisions behind an apparent shift in population. In the most extreme cases, however, the evidence is stark. Sudden-onset and unexpected high magnitude hazards left medieval populations with no choice but to 'up-sticks' and relocate to less vulnerable locations. What they chose to do next however, is more nuanced. Few displaced populations would readily renounce their connection to the land they had previously called home. This is exemplified in the case of the landslide at Leirfall, Stjørdal, in *c.*1200. Despite the fact that the landslide presumably totally destroyed the pre-existing farmstead, the site was subsequently resettled, perhaps indicating that those displaced by the disaster were unwilling to relocate.[41] This was perhaps also the case in medieval Iceland. Close to the Mýrdalur mountain range, in southern Iceland, the historical evidence suggests that pre-14th century medieval settlements were abandoned as a result of floods although the presence of post-medieval farms in the area suggests the area was resettled in the aftermath (Vésteinsson 2000: 100-101).[42]

Permanent relocation was only a favoured option when factors made it impossible for resettlement to take place. Certainly in some cases natural hazards made it so: based on the lack of evidence unearthed during the excavation of the church at Broomhill, East Sussex, predating the late 13th century, Gardiner (1988: 125) suggests it had been relocated following the storms of 1287/88. If correct, this would suggest that this flood disaster forced the permanent abandonment and relocation of human settlement. Nearby, at Winchelsea, an earlier series of storms in the 1250s instigated a gradual process of migration from the town's original coastal situation to a new planned town occupying a nearby hilltop (Martin & Martin 2004: 4-6). As conditions deteriorated at the town in the wake of the mid-13th century storms, Edward I took an active role in the planning and redesign of the new town (Lilley 2014). Although this process was certainly underway by 1280, the official transfer of land at the new site to the Winchelsea residents did not occur until July 1288 (Martin & Martin 2004: 5)—a process which may well have been brought forward due to the occurrence of the storms throughout 1287 and early 1288 which probably made what remained of

[41] See Chapter 3.4.3.

[42] Although note that the inclusion of folkloric themes in the account describing these events, which seems to have been composed at a significantly later date, casts some doubt over their historicity.

the old town uninhabitable. The particularly vulnerable location of Winchelsea, therefore, forced the town to be abandoned although in this case, through the support of the Crown, a nearby location was developed to replace what had been lost. Similarly, in South Holland the Saint Elizabeth's Day Flood of 1421 permanently submerged a number of villages which displaced survivors to nearby towns such as Dordrecht[43](Pollman 2017: 122-123).

Several additional examples of permanent abandonment are known in the face of wind-blown sand. The settlement at Forvie, Aberdeenshire, in existence from at least the 12th century, appears to have been besanded suddenly in the early 15th century. The site was never subsequently resettled and the 'best guess' for the location to which the survivors relocated comes from the foundation, shortly after the occurrence of the sand inundation, of a chapel 8km away at Leask dedicated to Saint Adamnan—the same dedication as Forvie's parish Church and a relatively rare dedication locally (Brown 2015: 142). While the pull-factors of the new places settled by the Forvie residents are unknown, it seems unequivocal that the inundation by sand provided the primary impetus for their relocation. In this case the sand inundation may have also affected a substantial portion of the town's agricultural land which would have made any attempted resettlement particularly challenging, ensuring that what may have been initially intended as only a temporary migration slowly morphed into permanent abandonment. In a similar vein, in the mid 16th century a sizeable settlement, attested by a significant archaeological assemblage (Griffiths *et al.* 2007: 434), at Meols, Merseyside, appears to have been erased suddenly by a sand inundation. The archaeological evidence supports a shift in activity to the nearby location of Great Meols, which regression analysis of later tithe maps suggests was most likely an area of marginal land, re-organized after the disaster to provide a new area of settlement (Griffiths *et al.* 2007: 414, 409-411). In this case, however, the precise causation of the migration to Great Meols can be questioned. The assemblage from the Meols site is indicative of an economic decline in the century before the final abandonment (Griffiths *et al.* 2007: 435) and the shift to Great Meols could have begun before the inundation of the Meols site by sand. It is possible, therefore, that, while the natural hazard must have provided a short-term catalyst, there may have been underlying endogenous factors behind the relocation which predated the onset of disaster. While in the most extreme cases therefore, it certainly seems that disasters forced temporary or permanent abandonment and migration, the resulting depopulation and economic decline may have had other root causes—such as a shift in the availability of markets or trends in regional trade—which may have been entirely unrelated or, at least, less closely correlated with the occurrence of disasters.

The relocation of monastic foundations provide further examples of site-based abandonment and migration—particularly in the face of flooding. Monasteries actively managed water supplies for practical purposes such as milling, waste disposal and the provision of water. As a result,

[43]Note that the disaster which caused this abandonment is depicted in fig. 6.4.

they were frequently sited in locations which were liable to flood. One example comes from the Premonstratensian house of Leiston Abbey, founded on the Suffolk coast in *c.*1182, which in 1363 was moved further inland as a result of damage caused by marine inundations. To make the most of the existing assets, the original foundation appears to have been carefully demolished so that the building materials could be reused in the structure of the new Abbey buildings. This activity necessitated the transportation of structural fragments over 3km inland. On the highest ground on the original site, a chapel was constructed to make use of the abandoned land while avoiding, as far as possible, further problems with flooding (Boulter 2008: 40-41). Such relocations affecting monastic foundations, especially those of the Cistercian order, in response to flooding and other environmental, or political concerns, were relatively common (Donkin 1959: 253-255). Most often, however, monastic foundations were re-sited as a result of routine and recurrent low-level problems rather than one-off, unprecedented disasters.

The many cases described above illustrate that disasters did force abandonment and the migration of populations but undoubtedly more common was continuity and the persistence of settlement. In such cases, however, disasters still exerted an impact. Such a picture may be traced across New Romney in the aftermath of the 1287/88 storms through the survey of archaeological grey literature discussed in Chapter 3.1.3. The period directly following the occurrence of the storm(s) was marked by a phase of abandonment and demolition visible at many excavated sites across the town (*eg.* Draper & Meddens 2009: 68). This presumably corresponds to a dramatic reduction in both population and economic activity as a result of the damage wrought by the storm—which obliterated the town's harbour (Canterbury Archaeological Trust 2010: 8.2) as well as many of the structures abutting the beachfront (*eg.* Wilson & Linklater 2002: 14-15; Draper & Meddens 2009: 67-68)—in addition to the ongoing siltation problems facing the harbour. This period of presumed decline is evidenced at the Southlands School site, by a phase of low-intensity activity (Meddens & Wooldridge 2002: 23) while buried soil horizons overlain by windblown deposits identified at St Martin's Field, dated through ceramics to the mid 13th-early 14th centuries, could relate to areas which fell out of use in the storm's aftermath (Gollop 2008: 38). At 16 High Street the excavators suggest that the notable lack of material datable to the time of the storm (*c.*1250-1350) may relate to the impact of the storms on the town (Wessex Archaeology 2012a: 18). In the North-east of the town at 'The Elms' glazed peg tiles were interpreted as evidence for the primary deposition of roofing in the demolition of a high status building dating to the 13th century (Stevenson 2006: 21)—perhaps indicating a period in which buildings fell out of use and into disrepair in the aftermath of the storms. This could relate to a phase of demographic and economic decline or stagnation which saw a significant proportion of the population migrate from New Romney to other more prosperous towns leaving buildings, such as the one detected at this site, to fall into a state of disrepair. The shift in the style of pottery in use between pre- and post-storm contexts may also hint at one of the storms' negative effects. The local pottery industry, which up to the time of the storm(s) appears to have supplied the majority of the town's ceramics, seems to have ceased production with the pottery from contexts post-dating the storm imported from the nearby production centre at Ashford (Canterbury Archaeological Trust 2010: Appendix 5). The decline of the local ceramic industry may be explained either by the destruction of pottery production facilities by the storms themselves, a lack of available manpower, the fact that the damage to the town's harbour had removed the local potters' access to important markets, making their business unsustainable, or a combination of a number of these factors. Although, much of the archaeological evidence for decline is relatively circumstantial, a sizeable body does appear to suggest that the town was gripped by decline in the aftermath of the 1287/88 storms.

The survey of the archaeological grey literature relating to New Romney[44] revealed 15 sites with evidence interpreted as relating to decline in the post-storm era (see fig. 3.4). In addition, a reclassification of those sites where the storm(s) directly caused damage or deposited discrete layers of sediment,[45] based on any evidence for what transpired after the occurrence of the storm(s), added an additional 10 sites with evidence for decline or abandonment in the aftermath. To these commercially funded excavations may also be added the 1987 discovery of two 13th century medieval structures on the town's southern periphery, which show evidence for abandonment in a time-frame consistent with the aftermath of the storms (Wilson 1987: 204)—giving a total of 27 sites indicative of a post-storm decline in the town. These sites are plotted in Figure 4.16 where they are contrasted with those sites which indicated continued, undisrupted occupation in the town—of which there were a total of 92. Interestingly, the sites interpreted as indicating disruption or decline display some patterning with a pronounced cluster discernible in the town's southern margin. This may indicate a sector of the town which was hit particularly severely by the storms, although this is not an obvious conclusion based on the results presented in Figure 3.4, or, as a relatively marginal area, buildings in this area of the town may have been more readily abandoned in the aftermath.

It should be noted, however, that the decline detected across New Romney may be misleading. High uncertainties in dating the archaeological contexts across the town make it possible that the occurrence of this decline may have overlapped with the Black Death (1348-1352). Although the occurrence of the storms of 1287/88 would have compounded any subsequent decline as a result of the epidemic, the acute impact of plague on demography and economic activity resulted in a general trend of decline visible in the archaeological record more generally—at least in East Anglia (Lewis 2016). Furthermore, it should be noted that the majority of sites with evidence for continuity among those considered in the grey literature survey—those taken to indicate continuity in Figure 4.16—did not reveal any obvious evidence for the impact of the storms, either directly or through a subsequent phase of decline. Due to the low resolution of the chronologies which can be established based on the ceramic evidence, whether these sites relate to pre- or post- storm activity cannot be

[44] This is discussed in detail in Chapter 3.1.3.
[45] Those in classes 1 and 2 as defined in Chapter 3.1.3.

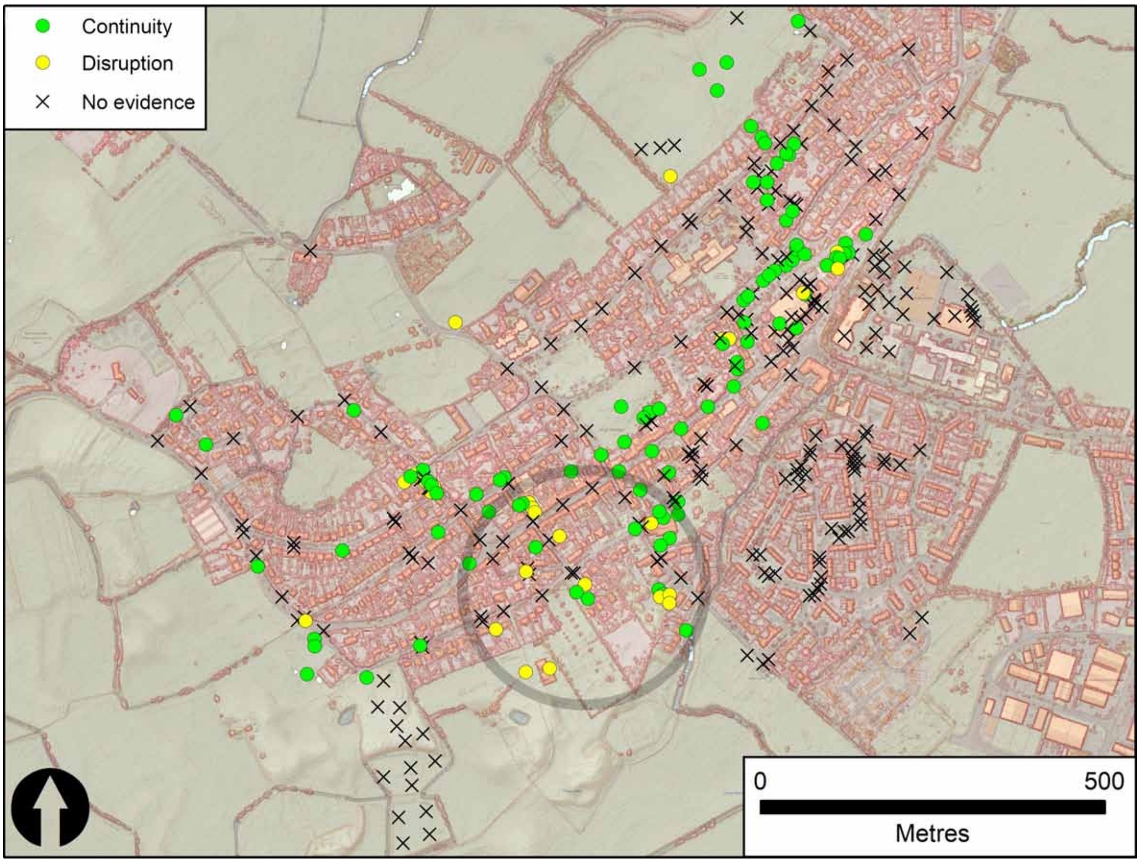

Figure 4.16: Disruption and continuity in New Romney after the storms of 1287/88. The yellow dots indicates sites which revealed evidence for abandonment, disruption or decline in the aftermath of the late 13th century storms. The green dots indicate sites which reveal evidence for undisrupted occupation at the time of the storms. Note that, due to the difficulty in accurately dating sites based on ceramic evidence alone, there is a high level of uncertainty around exactly when the occupation at those sites interpreted as indicating continuity occurred. This may mean that the level of disruption indicated here under-represents the reality. The dark circle highlights a cluster of sites interpreted as indicating disruption. Created by the author.

reliably differentiated. In addition, the survival of evidence for a relatively short phase of disruption and decline in the aftermath of the storm(s) is likely to be the exception rather than the rule—later site clearance and construction can be expected to have widely destroyed or truncated contexts relating to this period. These considerations mean that, while the interpretation of many of the sites as indicating continuity of occupation throughout the occurrence of the storms and their aftermath is probably reliable, the precise form that this continuity took in the short-term is difficult to assess. Moreover, the picture revealed by the evidence presented in Figure 4.16 may over-emphasise the extent of continuity compared to disruption sparked by the storm(s) in the short-term.

The picture of decline and continuity in the town is further muddied when the town's longer-term economic and demographic trajectory is considered. Shifts in the wider economy of Romney Marsh over the long-term—principally the switch from arable agriculture to less labour intensive pastoral farming combined with the reduction in maritime trade as a result of problems with siltation and protracted conflicts with the French—led to a general trend of depopulation (Rippon 2001:

31-33).[46] In addition, in reference to the archaeological evidence for decline in the neighbouring ports of East Sussex, (Rye, Winchelsea, Hastings, Pevensey, Seaford and Shoreham) which were also affected by the 1287/88 floods, Jervis (2017) highlights the diversity in the long-term trajectories of each town. While some experienced depopulation and economic adversity many aspects of life continued and civic administration appears to have remained strong throughout the medieval period (Jervis 2017: 21-26). Exactly what component the storms of 1287/88 played in the decline visible in the archaeological record across New Romney is, therefore, difficult to gauge due to the low-chronological resolution of much of the evidence indicative of decline, the likelihood of such evidence to have suffered destruction during later phases and the alternative explanations for decline operating across different time-scales. The long-term impact of disasters in settlements, therefore, is challenging to disentangle. Existing endogenous processes as well as other near-contemporary catalysts for decline—such as the Black Death—may have been more important factors in shaping long-term trajectories of change. Undoubtedly, however, disasters, such as the 1287/88 storms did play a critical role in the short-term.

4.8 Summary

Clearly, despite the theological predispositions of the age, which emphasised the inevitability of disasters as events brought about according to God's plan, medieval populations were not fatalistic and widely adopted practical responses to mitigate the impact of hazards. This is evident across many strands of evidence including the pragmatic agricultural management strategies, structural repairs and adaptations and the repair and re-design of flood defences. It is clear from the level of organization evident in the historical records relating to communities occupying flood-prone areas, and the system of flood defence attested by the upstanding remains, that flooding as a hazard was well understood as a recurrent risk that could be prevented through human action. This is precisely the same interpretation reached by Morgan (2015: 48-49) in relation to responses to flooding in early modern England; clearly, therefore, this was not a phenomenon of the early modern period but a system with roots which were well-established by the medieval period.

[46] See also Chapter 7.2.1.

Chapter 5

Systems of protection: religious and superstitious defences against hazards

This chapter investigates the development of beliefs associated with protection, the material and historical evidence for these practices and, where possible, a detailed investigation of a number of case studies to more fully understand how religious and superstitious rituals and practices were believed to provide protection from natural hazards. From much of the evidence discussed in Chapter 4 it certainly appears that medieval populations occupying locations which were regularly exposed to risk from natural hazards appreciated their vulnerability. Despite this fact, natural hazards do not seem to have been considered a discrete category against which special precautions were required. Instead, it was probably the case that natural hazards were unconsciously grouped together with other 'naturally' occurring misfortunes such as disease, crop-failure, blight, pestilence and general ill-luck. To combat against these diverse problems an equally broad suite of both overtly Christian as well as superstitious behaviour, and a blurred combination of the two, was practised to gain protection, avoid risk and provide peace of mind. These apotropaic and ritualistic practices believed to provide protection, which are often difficult to understand from a modern perspective, are the subject of this chapter.

An important and understudied area of medieval ritual behaviour are superstitions connected to protection. Although it is very difficult to trace the origins of superstitious practices, it is likely that many have their roots in earlier pagan beliefs. Certainly, many early medieval and Viking-Age artefacts have been interpreted as holding apotropaic or amuletic significance (Fuglesang 1989). For example, according to Dickinson (2005: 161) the animalistic designs on Anglo-Saxon shields added "a supernatural protective layer to the shield itself, and hence to its bearer". An early shield boss from Thorsberg, Schleswig-Holstein, Germany, bore a runic inscription that referenced 'hail', perhaps channelling the powerful and dangerous associations of this type of weather to protect the shield bearer. Similar inscriptions invoking the power of hail are also found on other later inscriptions such a pendant from Ølst, Denmark, and a small soapstone tablet from Kinneve, Sweden (Macleod & Mees 2006: 89-90). References to the popular Norse God Thor also frequently made reference to his ability to control the elements, especially thunder and lightning. This can be seen on an amulet from South Kvinneby, Öland, Sweden which called on the God's lightning for protection (Macleod & Mees 2006: 27-29).[1] Coins too held magical significance in this period with both Byzantine and northern European traditions attributing protective qualities to coinage from ancient Greece and Rome (Maguire 1997). Early medieval documentary evidence also specifically attests to superstitious beliefs connected to protection from hazards. For example, the early English text *Medicina de Quadrupedibus*, which was known across Europe from Late Antiquity to the Reformation, tells how the teeth of a badger, properly kept and carried, provide protection as "neither heavenly body, nor hail, nor strong storm, nor evil man" will cause harm to the bearer (Cockayne 1864: 327). Similarly, the late Roman writer Palladius described how hail could be warded off with bloody axes lifted towards heaven, owls fixed to the ground with outstretched wings or by coating knives used for pruning plants with bear's fat (Owen 1807: 49-50). This account also reveals an interesting dimension to superstition, which is that for such activities to be effective, it was necessary for them to remain secret. This may relate to a social taboo around admitting belief in the efficacy of superstitious activity which explains why such behaviour is only relatively rarely included in documentary accounts and, in some cases, archaeologically attested practices are completely undocumented. Clearly, during the early medieval period, an extremely wide gamut of beliefs existed related to different aspects of the natural world. Such beliefs came to be regarded as superstitious due to their relation to Pagan worship or, as Christians perceived it, the worship of daemons posing as alternate deities (Bailey 2009: 638). Early Medieval writers, such as Isidore of Seville (Barney *et al.* 2006: 174, 181-183), widely dismissed these superstitions and advanced Aristotelian explanations for the occurrence of many hazards. During the later Middle Ages although attitudes towards superstitious magic stiffened (Bailey 2007b: 100-101), some scholars have argued that such behaviour became more prevalent during the 15th and 16th centuries. Certainly, the witch hunts which began during this period were characterised by authorities extolling the abilities of witches and magicians to exert control over demonic and diabolic forces (Bailey 2001). According to Bailey's assessment (2009: 658-660), however, superstitions were essentially a continuum of belief which operated from at least the early Middle Ages right through to the 18th century when they were largely swept aside by the Enlightenment. In some cases though, elements of superstitious folklore appear to have persisted from the the pre-Christian era at least until the late 19th century (Heanley 1898: 186).

The boundary between superstitious and Christian material culture was permeable and open to interpretation. Many practices which at first may be regarded as superstitious are clearly connected to Christian liturgy and beliefs (Bailey 2009: 657) and although in writing the orthodoxy was swift to condemn such practices, in actuality the Medieval Church appears, in many cases, to have

[1]The inscription is fully detailed on the website of the Skaldic Projet detailed at: http://skaldic.abdn.ac.uk/db.php?id=15517&if=runic&table=mss. [Accessed 23/01/2017].

sanctioned and even encouraged the use of charms, amulets and other apotropaic material culture. As Thomas (1971: 303) highlights, the official Church stance had no aversion to the use of holy water or church bells to drive away storms. At a local level however, it is likely that some parish priests were liable to misinterpret or even disregard official Church guidelines. An example can be seen in the initial veneration afforded to the Holy Sacrament allegedly discovered near Passau, Bavaria, Germany, in the late 15th century by the local clergy which was quickly denounced when higher Church officials were made aware of the situation (Zika 1988: 28-29). Such inconsistencies would have resulted in a patchy and shifting application of official Church guidelines with some parishioners receiving the impression that certain practices were legitimate while those from other parishes regarded them as fraudulent or even heretical. The development of beliefs was also far from unilateral with the laity exerting some control over the Church's attitude to particular issues. This can be seen in the examples given by Zika (1988: 35) of German parishes in which priests were shunned by their parishioners for attempting to reform traditional practices, including processions of the Eucharist to bless crops against hail. Unlikely artefacts may even have held a Christian, although superstitious, significance. Prehistoric arrowheads, for example, were frequently interpreted as 'elf-shot' which was believed to protect against disease, thunder and lightning. Hall (2011: 94), however, theorizes that a Bronze Age example discovered at Perth could have had its protective powers enhanced by being touched against a relic of St Sebastian, who was martyred by being shot with arrows and was thus widely held to protect against both physical archery and elf-shot. Such practices however, operated within a difficult grey-area as misunderstandings or improper interpretations of genuine Christian rites ran the risk of inviting in demons or the devil (Bailey 2009: 645). By the reformation many of the practices of the monasteries were considered superstitious (Heale 2007) and the switch to Protestantism saw the end of many officially sanctioned Church festivals and rituals with superstitions connected to protection. Equally however, many practices, and crucially, beliefs did continue, sometimes in a different form, into the post-medieval period.

The extent to which archaeology can provide an insight into past beliefs has long been a major debate within the discipline. Hawkes (1954: 162) famously described archaeological research on the religion of past societies as "the hardest inference of all". Despite this early negativity, religion and belief have risen to become major themes in contemporary archaeological research. Although, for the medieval period, many of the problems encountered by prehistorians are mitigated by documentary evidence, providing a primary record of contemporary rituals, beliefs and theological debates, there remain many practices revealed by the archaeological record that have no basis in known texts (see for example Champion 2015a: 9-10). Material and documentary evidence are therefore most valuable in unison as while archaeology, in some cases, can provide an insight into the practices of individuals or groups, such as the peasantry, which are usually marginalized in the surviving documentary sources, so too documentary sources testify to activities, such as processions, which do not normally leave a significant material signature.

Through historical evidence and careful interpretation of the archaeological evidence, many types of artefact can be demonstrated to have been believed to offer protection from particular dangers and hazards. These included personal items such as jewellery, coins, symbols of pilgrimage and a wealth of items relating to the cult of the Saints. Where documented beliefs related to protection can be connected to specific types of artefact it is logical to assume the owner, wearer or bearer expected to receive these protective benefits. In Britain a useful resource for this research is the Portable Antiquities Scheme (PAS), an online database of finds reported voluntarily by the general public throughout England and Wales. To date[2] the database holds over 880,000 records, about 23% of which are medieval in date. This mass of data, however, is not without its problems. The uptake of the scheme has been far from uniform across England and Wales and as a result some areas are over represented, such as the Isle of Wight, Norfolk and Lincolnshire, while others have very few reported finds, as is the case throughout most of Wales as well as the far north and south-west of England. This can be seen visually in Figure 5.1 which shows the density of medieval finds reported to the PAS across England and Wales. To some extent this disparity may indeed reflect differences in the archaeological record as both Norfolk and Lincolnshire were among the most populous counties during the medieval period (Broadberry *et al.* 2015: 25-26). By comparison with the map on the right in Figure 5.1, however, which shows the average population density of England throughout the medieval period, it is clear that some areas, notably the south coast, are overrepresented while the counties around London seem to be reporting less medieval material than would be expected from the estimates of contemporary population. In addition to the spread of population during the medieval period itself, the PAS database, in common with other national archaeological datasets (Van Der Veen *et al.* 2013: 154-156), is biased by factors related to the collection of data in the present. In the case of the PAS, these are connected to factors such as the accessibility of potential metal-detecting sites, land-ownership and permissions as well as the differential reporting of finds to the scheme by detectorists (Robbins 2013). While such problems must be acknowledged, the PAS remains an enormously useful resource and, where appropriate, data derived from it is discussed below in relation to broad categories of evidence relating to medieval beliefs in protection from natural hazards.

5.1 Saintly relics

The saints, through their material remains, were regarded as intercessors who had the power to avert crises in the material world. This belief was reinforced by a multitude of Church teachings and Christian popular culture, including Saint's lives, mystery plays, wall paintings, stained glass (see fig.5.5) and sculpture (see fig. 5.6) which provided examples of the marvellous acts of individual saints on the behalf of penitents. The recourse of medieval Christians to seek assistance from a

[2] www.finds.org.uk [Accessed 07/11/2018].

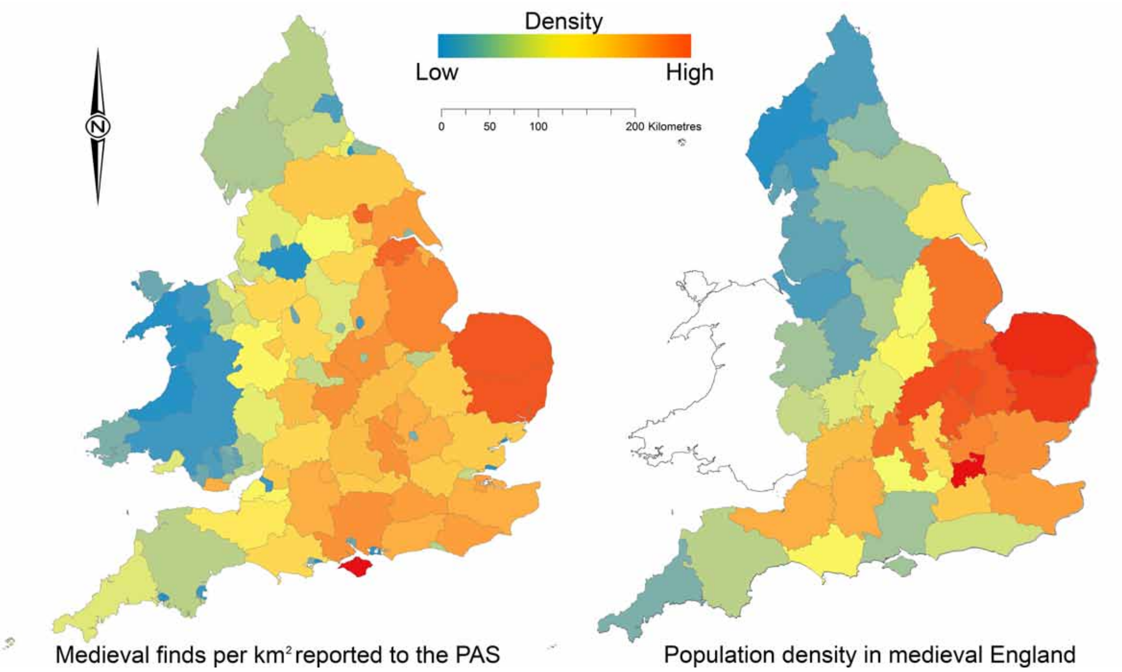

Figure 5.1: Left: The density of medieval finds (finds/km²) reported to the PAS by current administrative areas as of 29/09/2016. Red corresponds to higher density of finds while blue indicates lower densities. Medieval finds are defined as those dating from AD 1000-1600. Right: 'Heatmap' representing average medieval population after Broadberry *et al.* (2015: 25-26) by historic English county. Red corresponds to denser population with blue representing sparser population. Population data not available for Wales. Average population is calculated as the sum of Broadberry *et al.*'s figures for 1066, 1290, 1377 and 1600 divided by four. This figure was then divided by the area of the historic county. Created by the author.

saint in times of need can be seen in the historical record documenting the windstorm of 1362. For example, at St Augustine's Abbey, Canterbury, the chronicler's account details how, during the storm, a chaplain named Ralph sought shelter in a chapel dedicated to Saint Pancras where he prayed before the image of the Virgin Mary. Unfortunately, his prayers do not appear to have been heard as the force of the storm blew one of the chapel's roof beams down into the chapel fatally injuring Ralph, although miraculously "the image [of the Virgin] re-mained untouched" (Davis 1934: 564). Similarly, at Longstanton, Cambridgeshire, the fierce conditions of the storm drove two parishioners to pray inside the Church, although again, they were killed when a tree, blown by the wind, fell against the church, knocking masonry down on top of the two parishioners at prayer.[3] That the two known examples of prayer for protection from the storm were swiftly followed by fatal accidents indicates that, in such circumstances, prayer was so routine that it was only remarkable when it coincided with calamitous events.

Prayer for protection in ecclesiastical settings was believed to be efficacious due to the fact that all altars contained saintly relics (Snoek 1995: 185). Saintly relics were the personal remains, including body, clothes and possessions, of a saint. The location of the body itself, what Nilson (1998: 3-5) terms a 'Major relic', constituted a sacred place or shrine and was usually outfitted with an impressive reliquary. Small parts of a saint such as hairs, small bone fragments or possessions, defined as lesser relics (Nilson 1998: 4), were usually kept in smaller more modest portable reliquaries. Through their connection to the saint, these relics were considered to be powerful, almost magical objects and it is clear that they were widely believed to offer an effective means of protecting against or influencing the natural world. For example, in the parish of Fintray, Aberdeenshire, the silver head of the patron saint, St Modan/Meddan, was processed through the parish in order to summon rain or put an end to bad weather (Leslie & Leslie 1845: 168). In the *Vita Sancti Columbae* processions of Columba's tunic were able to conjure rain (Reeves 1857: 174-176) and submersion of the staff of Fergus in the sea could bring storms to a close.[4] Likewise, during a severe dry spell the procession of the relics of John of Beverley around the church caused a sudden rainstorm easing the drought (Raine 1879: 269-271). At St Albans, Hertfordshire, a wax Papal Agnus Dei disc was fixed atop the steeple to protect against lightning. As an analogy to this, Riley (1869: xxxiii) points to the collection of relics discovered attached to the cross in the bell tower of the cathedral of Saint Paul's in London when it was taken down to be repaired, in *c.*1313 (Aungier 1844: 38), which were presumably deliberately placed to protect against lightning and fire. Processions of relics had always been an important method both of protecting against environmental hazards and also abating them during their occurrence. This emerged out of the Roman practice of *robigalia*, an annual procession to secure protection for crops, which was combined with a 5th century church tradition in which processions had been held in supplication against the occurrence of earthquakes and lava flows in

[3] TNA: JUST 2/18/58.
[4] Aberdeen Bestiary, Pars Aestivalis, f. 164.

Auvergne, France (Stilgoe 1976: 15).

Alongside the Church's very public use of relics, some individuals possessed their own personal relics contained in, sometimes lavishly decorated, portable reliquaries. A small number of these are documented within the PAS database[5] although at the time of writing[6], only *c.*20 medieval reliquaries were recorded demonstrating their rarity. Half of these took the form of crucifixes, perhaps the most obvious Christian symbol which was certainly connected to protection from hazards. In Jacobus de Voraigne's popular hagiographical compendium he describes the use of, in this case, processional crosses to combat storms[7] (Ryan 1993: 288), a practice also recommended by the 11th century guidelines of Abbot William of Hirsau (Herrgot 1726: 524). The other half of the portable reliquaries contained in the PAS database were a variety of different shapes including lozenges[8], circular[9], rectangular[10] and one in the shape of a miniature arched doorway.[11] In some cases it is difficult to be sure whether an object contained a relic or not as only part of the object survives. In these cases the possibility is usually inferred through comparison to analogous artefacts. For example, **CAM-2136A3**, a sub-circular disc bearing the sacred monogram 'IHC', appears to be the top plate of a reliquary very similar in design to **YORYM-6CE0B1**, which in turn is closely comparable to an example from Gleaston, Cumbria (Enticott 1996: 10). It should be noted that the PAS database also records over 100 mounts which may have originally been attached to reliquaries, as fittings and ornamentation. These reliquaries would have mainly been in the form of caskets. As this identification cannot be confirmed, however, these objects were not further considered. By the 15th and 16th centuries many of the functions of relics, including as foci for processions in order to accrue protection, had been assumed by the sacred host (Zika 1988: 33-34), although relics continued to attract lay devotion. Due to the lower number of examples in the PAS database, the geographical spread of the artefacts' find spot locations does not demonstrate a noticeable pattern, other than a notable cluster close to York (see fig. 5.3). In terms of chronology, based on the dates recorded in the PAS, as with a number of other categories of artefact related to protection, discussed below, portable reliquaries were most popular during the 15th century (see fig. 5.4). It must be noted however that due to the low number of portable reliquaries recorded through the PAS and the, sometimes high, uncertainties in the dating of these artefacts, these results alone may not be indicative of wider trends.

[5] See Appendix H.1.

[6] 23/01/2017.

[7] "when storms come up, the cross is brought out of the church and held up against the tempest . . . and the bells are rung that the demons who are in the air may flee in fright and desist from harassing us".

[8] **YORYM-09903A**.

[9] **YORYM-6CE0B1**.

[10] **PAS-5BA841**.

[11] **NMGW-9E8024**.

Figure 5.2: Four reliquary crosses from PAS database. Top left: **SWYOR-73122C**: a silver reliquary cross dating from 1400-1600 found at Stockton-on-the-Forest, North Yorkshire. Top right: **ESS-7AB096**: a copper-alloy Byzantine reliquary cross from the late medieval period discovered at Tendring, Essex. Bottom left: **WMID-1006A0**: a 15th century hollow gold cross which may have contained a saintly relic found at Chicheley, Buckinghamshire. Bottom right: **WMID-115B76**: a 15th century hollow gold cross which may have contained a saintly relic found at Harlaston, Staffordshire. Combined by the author, original photographs reproduced from the PAS website, www.finds.org.uk, under CC BY-SA 4.0 licence available at https://creativecommons.org/licenses/by-sa/4.0/.

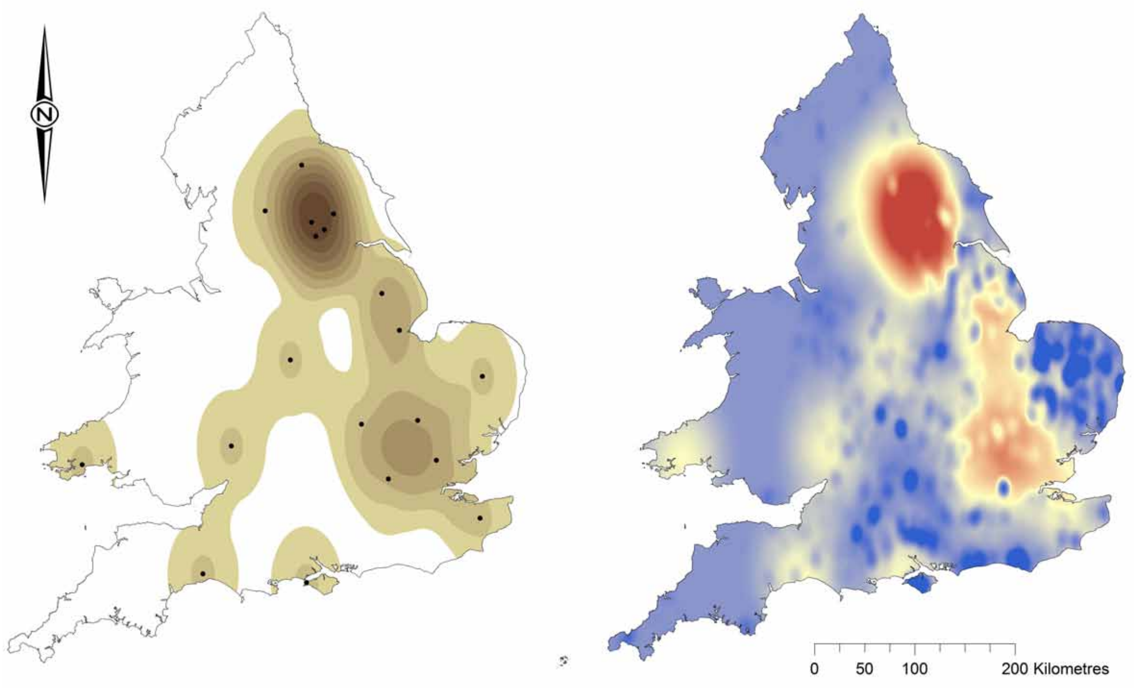

Figure 5.3: Left: The geographical distribution of reliquaries recorded in the PAS database as of 23/01/2017. Right: A comparison of the distribution shown to the left with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

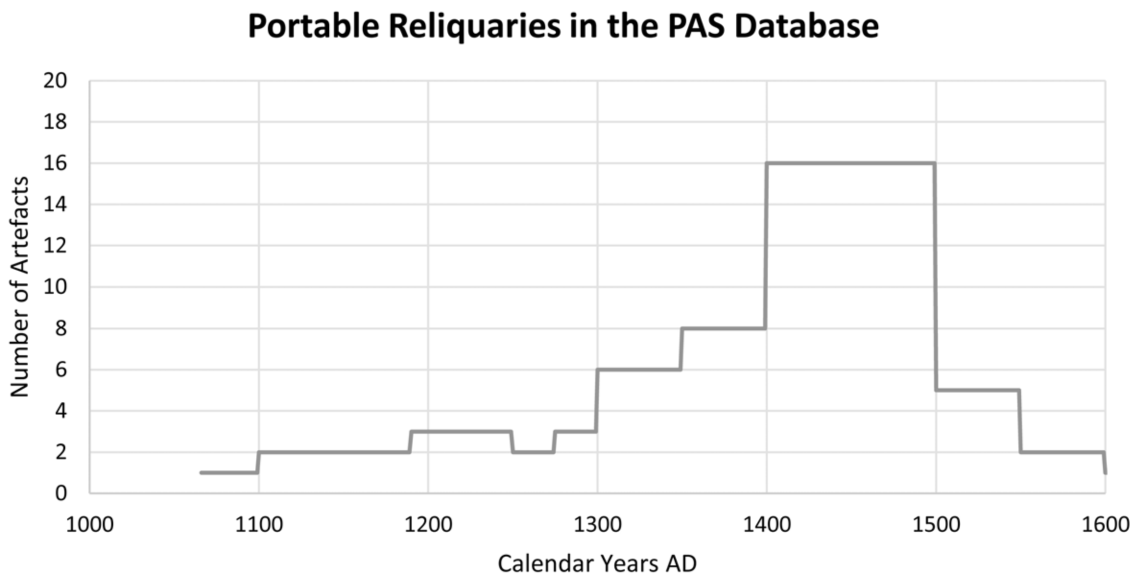

Figure 5.4: The chronological distribution of reliquaries recorded in the PAS database as of 23/01/2017. Created by the author.

5.2 Images of the Saints

As described above, saints were believed to offer protection from the hazards of the world. Just as their relics were powerful, so too were their images. This is perhaps best exemplified by St Christopher whose image was commonly displayed in churches due to the belief that by looking on his visage the onlooker would gain protection from sudden death or misadventure for the rest of the day. The wall painting of St Christopher at Woodeaton, Oxfordshire, is accompanied by a painted caption, bearing this out, stating: "He who sees this image shall not die an ill death this day" (Tristram 1955: 115). Sudden deaths, such as those caused by lightning, earthquakes or floods, caused particular concern for medieval Christians as death without proper preparation, with repentance and administration of last rites, put the soul in danger of failing to successfully pass into heaven. Therefore, it was especially important to guard against a sudden death and, in addition to beholding the image of St Christopher, there were a number of ways in which protection could be gained. Somewhat comparable to the practice associated with the image of St Christopher, John Myrc's 15th century *Instructions for Parish Priests* states that sight of the raised host during the celebration of mass conferred protection from sudden death upon all witnesses for the duration of the day (Peacock 1868: 10). A number of textual amulets, discussed below, also claimed to offer protection from death without preparation. In addition to St Christopher, the cults of St Barbara and the Three Kings (or Magi) of Cologne were particularly believed to protect against sudden death. Through an analysis of the material relating to these three cults in the PAS database it is possible to draw some conclusions as to the distribution of material, both geographically and chronologically, similarities and differences between the three cults and some more detailed aspects to the popularity of their cults in medieval Britain.

5.2.1 St Christopher

As detailed above, the cult of St Christopher is an obvious starting point. St Christopher's most famous deed is the widely retold story of how he helped a child cross a river. During the crossing St Christopher experienced difficulties due to the weight of the child, who seemed to have become unbelievably heavy, and the strength of the current. With difficulty, St Christopher was able to cross safely, whereupon it is revealed that the future saint had, in fact, borne Christ and the weight of the world during the crossing (Ryan 1993: 398). As a result he was particularly regarded as a protector of travellers and misadventure but the riverine setting of the story, combined with an early textual tradition that his later burial had protected the local town from flooding, also meant that he could be relied on to protect against floods (Pridgeon 2010: 9). At Norton Priory, for example, after a spate of flooding in 1331, a statue of the saint may have been thought to offer protection against future floods (Greene 1989: 67). As described above, images of the saint were held to protect the viewer from sudden death for the duration of the day. For this reason, images of

Figure 5.5: Left: The stained glass window depicting Saint Christopher at the church of All Saints', North Street, York. Beholding the image of the saint was believed to bestow protection from sudden death upon the observer for the rest of the day. Right: A painted panel depicting Saint Barbara at the church of Walpole St Peter, Norfolk. In this depiction, thought to be of Flemish origin or influence and dating from the mid 15th century, she is depicted holding a palm frond and a tower, the site of her imprisonment. Due to a detail of her well known life she was widely regarded as an efficacious protector against lightning. Photographs by the author.

the Saint were commonly placed in prominent places such as the north wall of a church opposite the entranceway so that passers-by could see him without even entering the church (Tristram 1955: 115). This was the case at the church of All Saints', North Street, York, where a stained glass window depicting Saint Christopher (fig. 5.5) was originally set into the north window opposite the door, although it has since been moved to the east-end of the church (Pedersen 2000: 38). Unfortunately, precise beliefs associated with individual images are very rarely recorded so where helpful captions, such as the one at Woodeaton, are lacking it must be assumed that the same beliefs applied as those documented at other locations, or more generally in regard to the saint's cult. This probably holds true for popular international cults such as St Christopher but beliefs are more likely to have been geographically variable where local and less popular cults are concerned. Certainly, it is a strong possibility that where his image occurs on personal artefacts, the intention was that his image would protect the wearer.

5.2.2 St Barbara

Saint Barbara was another saint whose cult offered protection from sudden death as well as lightning. The basic story of her life concerns how her heathen father, Dioscorus, imprisoned her in a tower, initially to protect her from unsuitable male wooers. During her captivity, Barbara became a Christian but when her father discovered her conversion he had her persecuted and eventually executed for refusing to renounce her faith. After the execution her father was struck by a bolt of lightning which burnt up his body leaving no trace of his existence (Wolf 2000: 2-3). Due to this final detail, Saint Barbara's cult became widely associated with protection from lightning, fire and sudden death (Lockwood 1953: 24). Although it is not specified that her images offered similar instantaneous protection to those of Saint Christopher, her iconography is similarly prevalent in later medieval material culture with images of Saint Barbara frequently found on pilgrim badges, rings and as decoration in churches (see fig. 5.5). One possibility is that these images themselves were believed to bestow protection upon the bearer. If this was not the case then presumably possession of the object was believed to increase the chance of the bearer receiving intercession and protection from the saint.

5.2.3 The Magi (The Three Kings of Cologne)

The Three Kings of Cologne, or the magi, were the three kings who visited Jesus at birth, bestowing gifts of gold, frankincense and myrrh. Their names, recorded in the medieval texts which document their lives, were Balthazaar, Caspar (or Jasper), and Melchior. Although commonly depicted in religious art from the early Christian period, interest in their cult appears to have been ignited in 1154 when their relics are reported to have been discovered in Milan and ten years later these were translated to Cologne (Harris 1959: 23-24). The 'Adoration of the Magi', the episode in which the three kings visited the newborn baby Jesus, became a popular scene in religious sculpture and painting which would have been familiar to lay populations throughout medieval Christendom (see fig. 5.6). Various traditions relate their cult to protection from sudden death, perhaps as a result of the way in which their deaths are described in the most popular medieval account of their lives, the: *Historia Trium Regum*, which dates to 1375. An old English translation of this text describes Melchior's death as follows:

"So in the feast of the circumcision Melchior, that was king of Arabia and of Nubia, said a mass solemnly in the church; and [when] he had said his mass, before all the people he laid him[self] down and without any disease he yielded up his spirit to the father of heaven, and so died." (Horstmann 1886: 118)[12]

[12] Spelling modernized by the author. Original Spelling: "so in þe feest of þe circumcisioun Melchior, þat was kyng of arabie and of Nubye, seyde a masse solemplich in þe chirche; and [whan] he had seyde his masse, tofore alle þe pepil he leyde hym downe and withoute any dissese he ȝelde vp his spirit to þe fadir of heuene, and so deyde".

Figure 5.6: Alabaster relief depicting the Adoration of the Magi from Holy Trinity Church, Long Melford, Suffolk. Photograph by the author.

The others are described as dying in similar circumstances, Balthazaar 5 days later, and Jaspar 6 days after this (Horstmann 1886: 118-120). Perhaps as a result, in addition to their association to the birth of Christ, charms and amulets bearing their names, rather than their image, were regarded as efficacious against an unprepared death (Gilchrist 2008: 126). In addition, their cult was also believed to protect against epilepsy and general misadventure (Hildburgh 1908: 83). As well as several examples known through excavation, the names of the Magi are found on a number of rings, brooches and other items of jewellery recorded in the PAS database.

5.2.4 Summary

These three cults, St Christopher, St Barbara and the Magi, can be investigated through the material culture in the PAS database which bears pictographic or textual references to the saints. This reveals some important differences in the audience and veneration of these three cults. St Christopher was a popular saint with *c.*30 items in the PAS database bearing his image.[13] The distribution of these objects suggest a particular focus in towns such as Norwich, Gloucester and Chester with lesser clusters around York and in Hampshire (fig. 5.10). The different types of artefact associated with Christopher, predominantly straps and buckles as well as jewellery (fig. 5.11), suggest his image appealed to a broad audience who must have been keen to take advantage of the general protection he offered against misadventure and sudden death to those who beheld his image.

St Barbara's cult was similarly popular but appears to have had a more generally southern

[13]See Appendix H.2.

orientation, with a particular focus around London (fig. 5.10). Pilgrim badges make up the majority of the artefacts with mounts and jewellery the next two most popular object categories (fig. 5.11).[14] This suggests her cult had a more continental focus, with a large proportion of the material culture perhaps brought back by pilgrims returning from popular European pilgrimage centres. This is supported by the fact that pilgrim badges depicting St Barbara are particularly common in France and the Low Countries—although exactly where many of the pilgrim badges were cast and sold is unknown.[15] This agrees with the historical evidence which attests to the strength of Saint Barbara's cult in France and Belgium (Wolf 2000: 29). By contrast there is relatively sparse evidence for her veneration in medieval England, with only one church dedication, at Ashton-under-Hill, Tewkesbury, known with certainty. On the other hand French (2008: 140) claims that Barbara's cult was "tremendously popular in late medieval England" while Lockwood (1953: 23) highlights the popularity of her cult in Norfolk and East Anglia. With three artefacts related to her cult discovered in East Anglia the PAS evidence may corroborate Lockwood's theory but it should be noted that the majority of objects were discovered in the central south of England. Certainly, the PAS evidence demonstrates that her cult attracted greater veneration than might be inferred from Church dedications alone.

Of the three, the Magi seem to have been the least popular, with only 15 items which can be related to them,[16] but their cult was widespread (fig. 5.10) and the vast majority of objects were items of personal jewellery (fig. 5.11); finger rings, brooches and pendants, many of them silver or gold, suggesting the Magi were a more exclusive cult that appealed to a wealthier sector of society. In a number of towns, such as Dublin and Aberdeen, the Magi were the subject of urban plays organised by the local goldsmithing guilds which may suggest their cult was particularly popular among the makers of these valuable items (Williamson 2009: 165). Although pilgrim badges depicting the Magi are absent from the PAS database, a low number originating from Cologne, Germany, have been discovered in London, King's Lynn, Canterbury and Huntingdon[17] indicating that this cult did attract low numbers of English pilgrims. In terms of chronology the three cults seem to have peaked in popularity during the 15th century although St Christopher was most popular at the beginning of the century, while St Barbara and the Magi appear to have peaked towards the end. The dating of these types of material culture is usually based on developments in iconography. For example in the case of St Christopher, the position of the Christ-child; at the waist in the earliest depictions and carried over the head in later images, as well as his characteristics, becoming more muscular and heavy-set with time are drawn on in order to provide a rough date (Pridgeon 2013). Interestingly, when the chronology of St Christopher images gained from the PAS database is compared against that of datable English and Welsh wall paintings of the saint

[14] See Appendix H.3.
[15] As recorded in the database of pilgrim badges at www.kunera.nl [Accessed 26/01/2017].
[16] See Appendix H.4.
[17] See note 15.

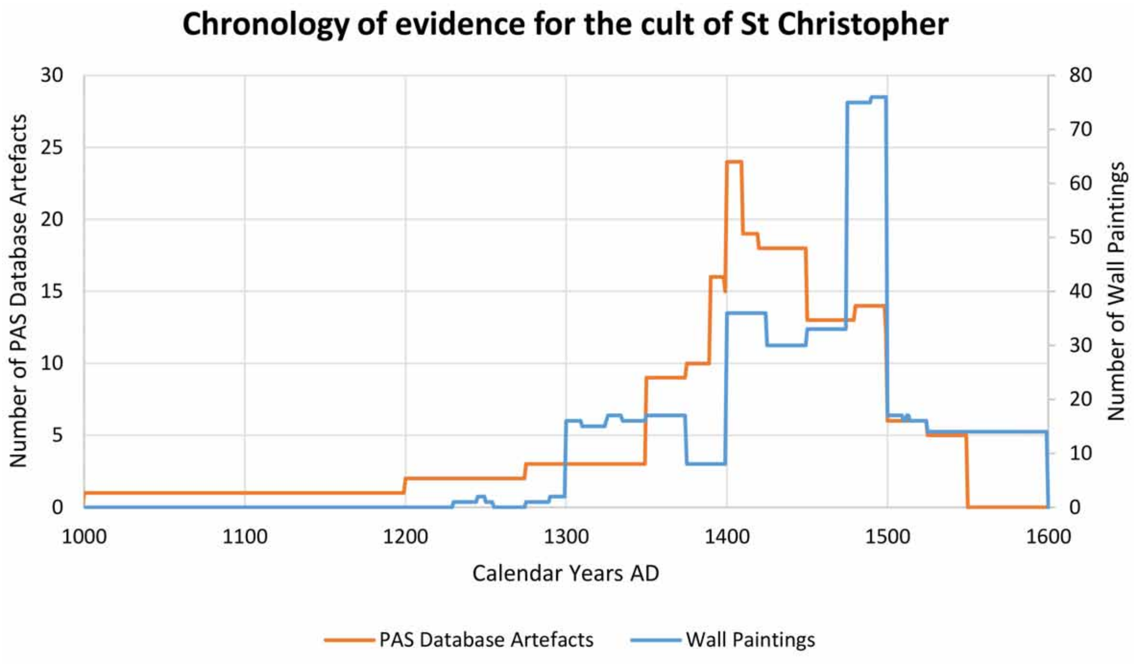

Figure 5.7: The chronological distribution of artefacts in the PAS database related to the cult of St Christopher, as of 03/10/2016, against the chronology of wall paintings depicting the saint in England and Wales. Created by the author. Wall painting data is derived from the database compiled by Pridgeon (2010: 307-338).

(see fig. 5.7), obtained from Pridgeon's (2010: 307-338) database, it becomes clear that the two chronologies exhibit clear divergences. Notably, a large spike in wall paintings during the late 15th century is not reflected by the material evidence from the PAS. This indicates that the trend in wall painting at this time was out-with the popularity of St Christopher's cult more generally. In the case of the Magi, the chronology of the material culture from the PAS database reflects wider trends in the popularity of the cult in Britain (Williamson 2009: 174-179). St Barbara's cult too, at least in a western European context, reached its apogee contemporaneously with the spike in material culture reported to the PAS (Wolf 2000: 41, 45).

5.3 Pilgrim badges

These saintly insignia were widely available at the shrines of saints and other pilgrimage sites in the medieval period. As a result of their widespread circulation throughout Europe they are frequently encountered on archaeological sites dating to the medieval period. As well as indicating a pilgrim's status to society, pilgrim badges were also believed to hold apotropaic powers due to their connection to the saint, of whom many bore an image. The power of the image alone was sometimes enhanced through touching the badge against relics of the saint or perhaps through being submerged in holy water. As a result, these pilgrimage souvenirs became mini-relics which bestowed the protection of the saint upon the wearer. The deposition of pilgrim badges in 'wet' locations has traditionally been interpreted as ritual deposition. This interpretation sees the deliberate disposal

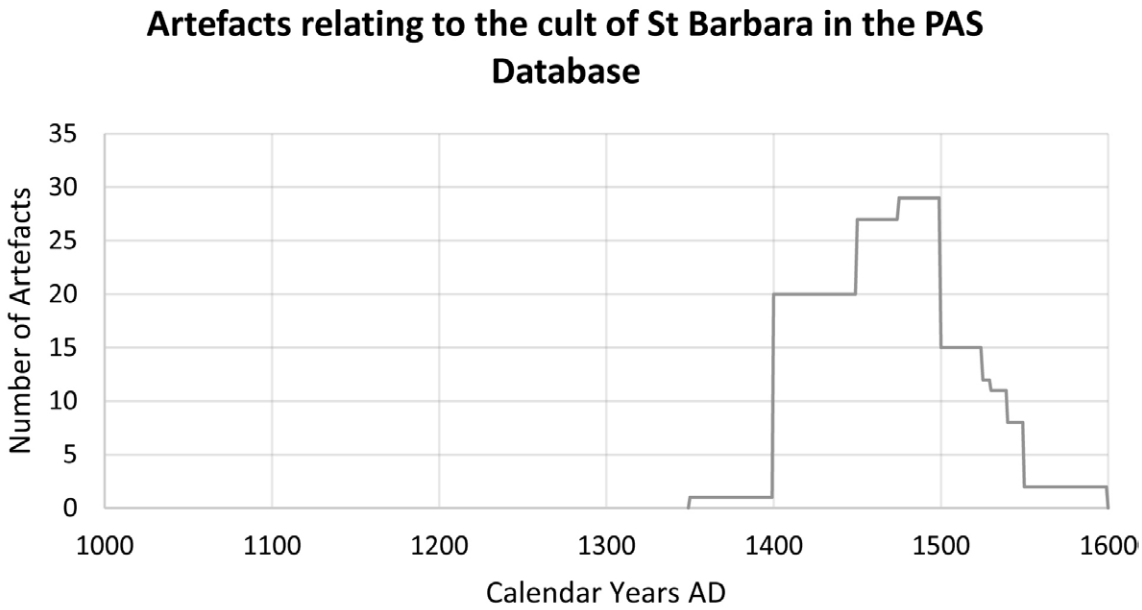

Figure 5.8: The chronological distribution of artefacts in the PAS database related to the cult of Saint Barbara as of 03/10/2016. Created by the author.

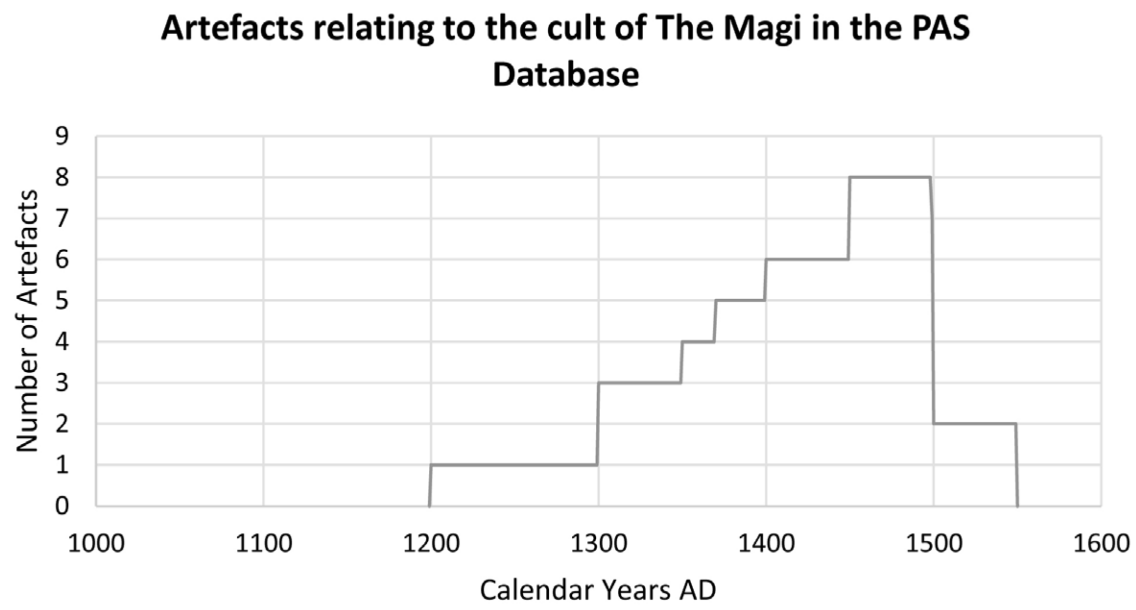

Figure 5.9: The chronological distribution of artefacts in the PAS database related to the cult of the Magi as of 03/10/2016. Created by the author.

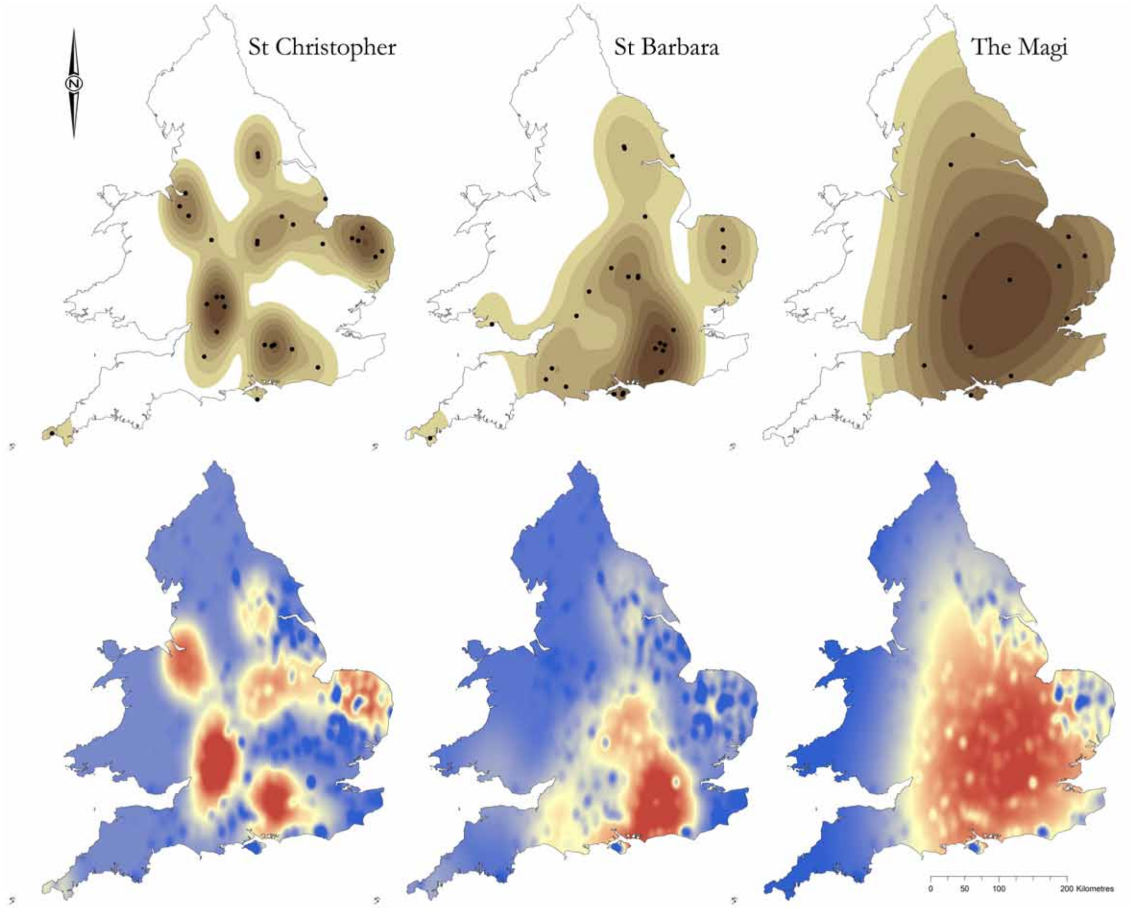

Figure 5.10: Above: The geographic distribution of artefacts in the PAS database related to the cults of St Christopher, St Barbara and the Magi as of 03/10/2016. Below: A comparison of the distributions shown above with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

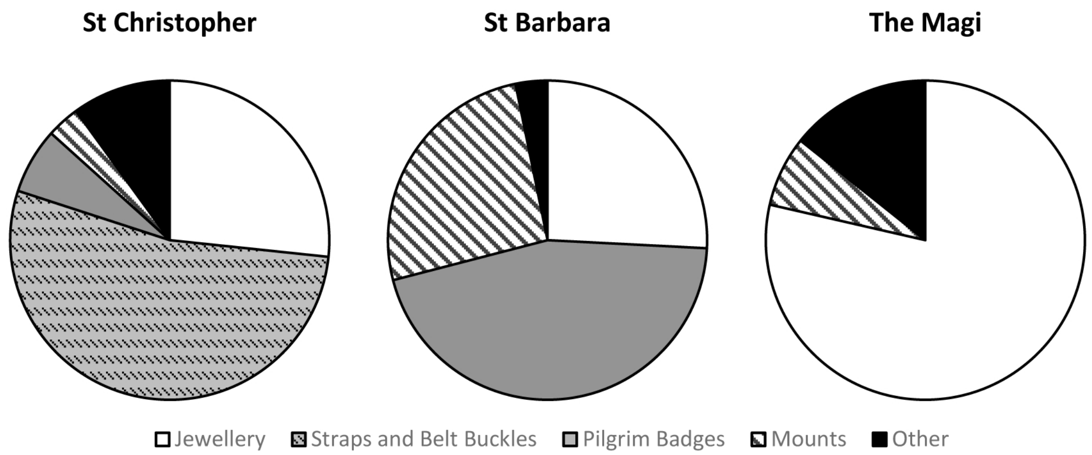

Figure 5.11: The different types of artefact belonging to each the cults of St Christopher, St Barbara and the Magi in the PAS database as of 03/10/2016. Created by the author.

of pilgrim badges in water bodies and rivers as a continuum of a pre-Christian practice which is well-attested by archaeological evidence in western Europe throughout the Bronze and Iron Ages (Yates & Bradley 2010a;b). Recently, however, this interpretation has been reappraised by Lee (2014) whose re-analysis of the archaeological, art historical and documentary evidence finds little evidence for a ritual component to the majority of pilgrim badge depositions in watery contexts. On the contrary, Lee interprets the frequent recovery of pilgrim badges in riverine contexts as a result of the discard of objects which retained no value to their medieval owners. This contradicts the accepted wisdom that pilgrim badges were items of great value believed to hold apotropaic powers as a result of their relationship to the shrines of saints (Spencer 1990: 10-11). Such valuable items would be unlikely to have been disposed of in watery contexts unless this act held some kind of ritual significance. Garcia (2005: 6-7) advances the possibility that this action signified a successfully completed pilgrimage. While this may have been the case, pilgrim badges were certainly believed to have held protective powers by medieval people. This is demonstrated in a number of different ways. For example, a number are found in burial contexts (Gilchrist 2011: 164), often in positions or with associations which suggest amuletic significance. Furthermore, from the mid 15th century, many pilgrim badges were collected and curated, as demonstrated by the fact that they are found attached to the pages of prayer books, or in some cases where the actual badges were not available, artistic representations are found (Foster 2011: 39-40). In these cases, the badge's retention and inclusion with prayers and holy scripture suggests that these items were considered far from worthless. In one case, from East Haven, Angus, a 13th-14th century lead pilgrim badge was modified by cutting off parts of the badge to form a crucifix, suggesting the badge itself was considered an item of holy significance (Shiels 2005: 21).[18]

The sudden appearance of many new forms of pilgrim badge in the aftermath of the Black Death has led some to interpret these objects as a form of ritual protection against the disease (Gimbel 2012). Analysis of the chronological distribution of pilgrim badges reported through the PAS database certainly demonstrates a peak in the overall number during the 15th century, as shown in Figure 5.12.[19] This roughly coincides with the demographic decline instigated by the Black Death, which latest estimates gauge to have precipitated a drop in population of *c.*48% (Broadberry *et al.* 2015: 21) matched by a concomitant decline in material culture (Lewis 2016). This illustrates that despite a dramatic drop in population, more people were going on pilgrimage and/or when on pilgrimage people were acquiring more pilgrim badges. The reasons for this are likely to be multi-faceted, perhaps the rise in living standards meant people had more disposable income with which to purchase such things. It is far from unbelievable, however, to suggest that the uncertainty created by the recent trauma of the Black Death created a milleu in which superstitious

[18] Note that it is not possible to date when the badge was modified as the item was an unstratified find discovered through metal detecting.

[19] The data used to create this figure is listed in Appendix H.5.

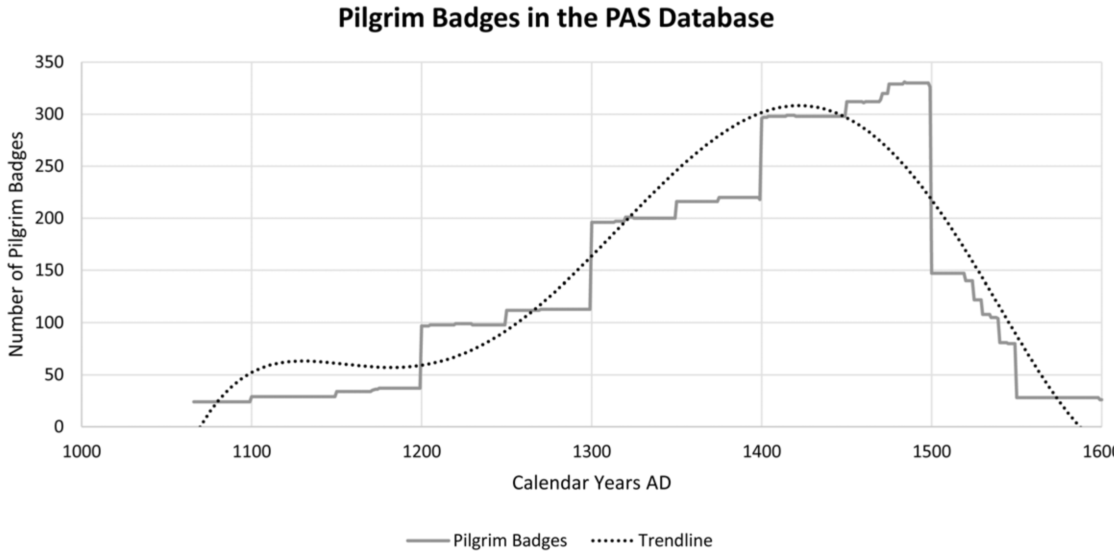

Figure 5.12: The number of pilgrim badges reported to the PAS database, as of 12/12/2016, against time. Created by the author.

beliefs and fears increased. In such a social environment it is easy to understand why people would have been more likely to undertake a pilgrimage and, while away, see the value in material culture which offered protection from 'natural' dangers such as those that had made such a strong impact within living memory.

5.4 *Ampullae*

Another artefact class related to pilgrimage are *ampullae*. These were vessels, usually cast in lead or lead alloy, which contained water, oil, dust or other substances from the shrine of a saint. In England, although the practice had earlier origins, *ampullae* became common following the murder at Canterbury, in 1170, and canonisation, in 1173, of St Thomas Becket. The Saint's 'blood', theoretically the blood spilt at the murder (Finucane 1995: 90), mixed and diluted with water, a process depicted in stained glass in Canterbury Cathedral's Trinity Chapel (Koopmans 2016), was sold in *ampullae* and held responsible for miracles of healing (Webster 2016: 6-8) leading to high demand from the thousands of pilgrims who flocked to Becket's shrine following his canonization. As mass produced, inexpensive and widely available items, which offered to provide healing and protection from a multitude of dangers and ailments, the uptake of *ampullae* was high. This can be seen in the PAS data which, as of 12/12/2016, recorded the details of 1,568 *ampullae*,[20] the majority of which were recovered through metal detecting. Most *ampullae* are lentoid in cross-section with a rounded base and flared opening, usually with suspension loops on either side of the body.

The form of the containers has been the subject of some debate. The traditional view has been that the majority were intended to resemble scallop shells as a reference to the widely recognised

[20] These are listed in Appendix H.6.

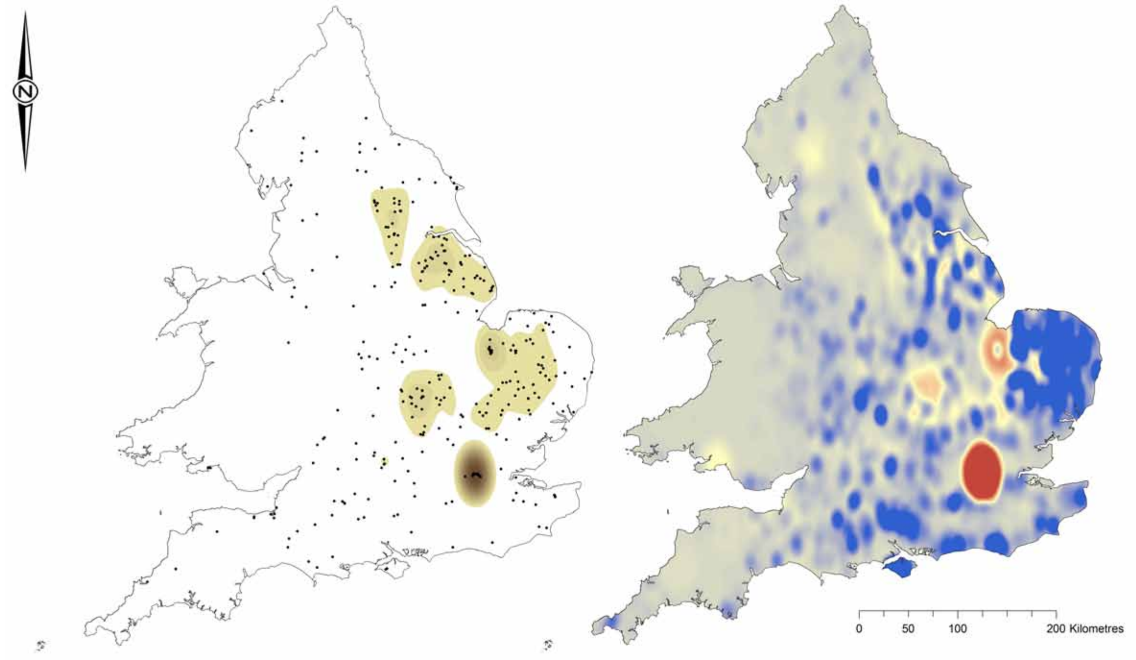

Figure 5.13: Left: The geographical distribution of pilgrim badges reported to the PAS as of 12/12/2016. Right: A comparison of the distribution shown to the left with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

symbol of the pilgrimage to Santiago de Compostela (Anderson 2010: 184). This was seemingly confirmed by the decoration of radiating lines commonly found on the rounded base which is usually interpreted as mimicking the ridges found on scallop shells. Recently, however, Campbell (2015: 129) has argued that only a minority depict scallop shells with most *ampullae* taking the form of contemporary purses or pouches. He argues that with this form, lead-cast *ampullae* aped actual cloth or leather purses and pouches which contained glass vials of sanctified dust, water or oil. These were presumably similarly available at pilgrimage sites although these items would have been both rarer and more expensive than their lead-cast counterparts. Furthermore, due to the comparatively poor durability of glass, cloth and leather, these artefacts have not survived in the archaeological record in comparable numbers to lead-cast *ampullae* (Campbell 2015: 125). This re-interpretation does not alter the fundamental way in which *ampullae* are viewed but it does reorient their symbolism. As only the minority were decorated with the scallop shell symbol, rather than acting as universal symbols of pilgrimage, the form of the majority of *ampullae* may have more simply acknowledged their contents, and its protective and healing power.

The efficacy of the substances contained by *ampullae* is hinted at by the sweet oil found to be emanating from the tomb of Philip Inglebard at Keyingham, East Yorkshire, after a blaze caused by a lightning strike (Bond 1868: 194-195). Although undocumented, it is likely that, just as in the case of St Thomas Becket, this oil, or another substance substituted by the local church, was preserved and supplied to parishioners and pilgrims in *ampullae* for general protection or for

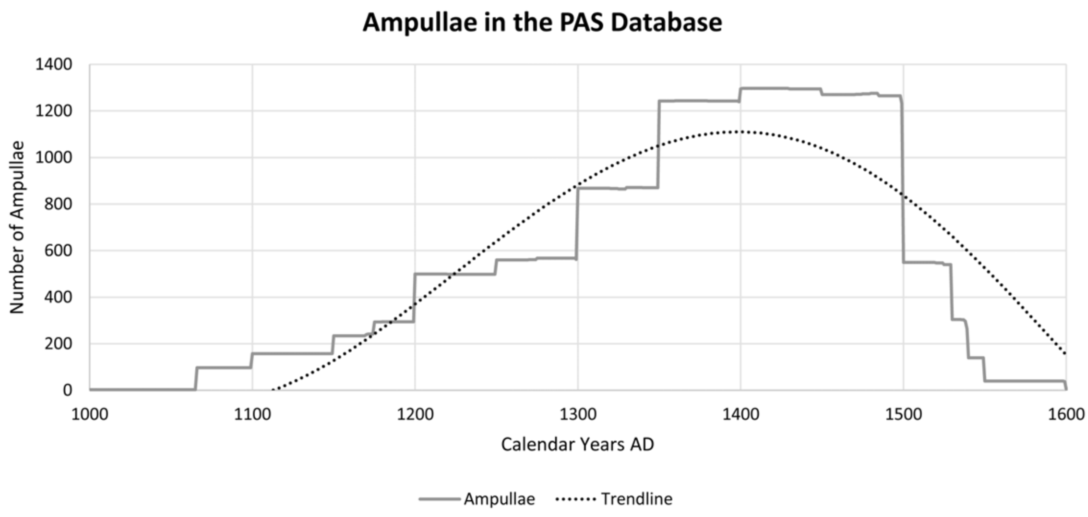

Figure 5.14: The number of *ampullae* reported to the PAS database, as of 16/12/2016, against time. Created by the author.

use in times of need. Similarly, though not specifically held in *ampullae*, a 16th century reformist condemnation of the parishioners of Northgate, Canterbury, describes how "against tempests of thunder and lightning many run to the church for holy water to cast about their houses to drive away ill spirits and devils" (Brodie 1902: 300). It should also be noted that the containers were sometimes reused and refilled with other substances signalling that their curative and protective powers were not exclusively associated with the contents (Finucane 1995: 90). Given the widespread discovery of *ampullae* in settings which are presumed to have been core agriculture areas in the medieval period, Anderson (2010: 199-200) has convincingly suggested that the deposition of these vessels, containing substances of apotropaic significance, was deliberate with the probable intention of securing a bountiful harvest through the protection of crops from bad weather, disease, blight or other hazards. The distribution of *ampullae*, as revealed by the PAS database (fig. 5.13), are suggestive of some interesting trends with the highest concentrations found in central Norfolk and Lincolnshire. This pattern is the result of a number of factors. Firstly, these areas contained important pilgrimage centres, most notably the shrine of Hugh of Lincoln at Lincoln Cathedral and the cults of Our Lady of Walsingham and the Holy Rood of Bronholm in Norfolk, in addition to the shrine of William of Norwich in Norwich Cathedral (Sinners 1988: 133). Secondly, Norfolk and Lincolnshire were two of the most densely populated English counties during the medieval period (see fig. 5.1). Thirdly, and perhaps most importantly, these areas are both represented in the PAS database by high levels of find reporting suggesting that, compared to other regions, more metal detecting has been carried out in these counties and a high percentage of these finds are reported to the authorities (see fig. 5.1). As a result, although there may be a historical basis for the densities visible in the PAS data it is difficult to disentangle this from the biases in the reporting of finds.

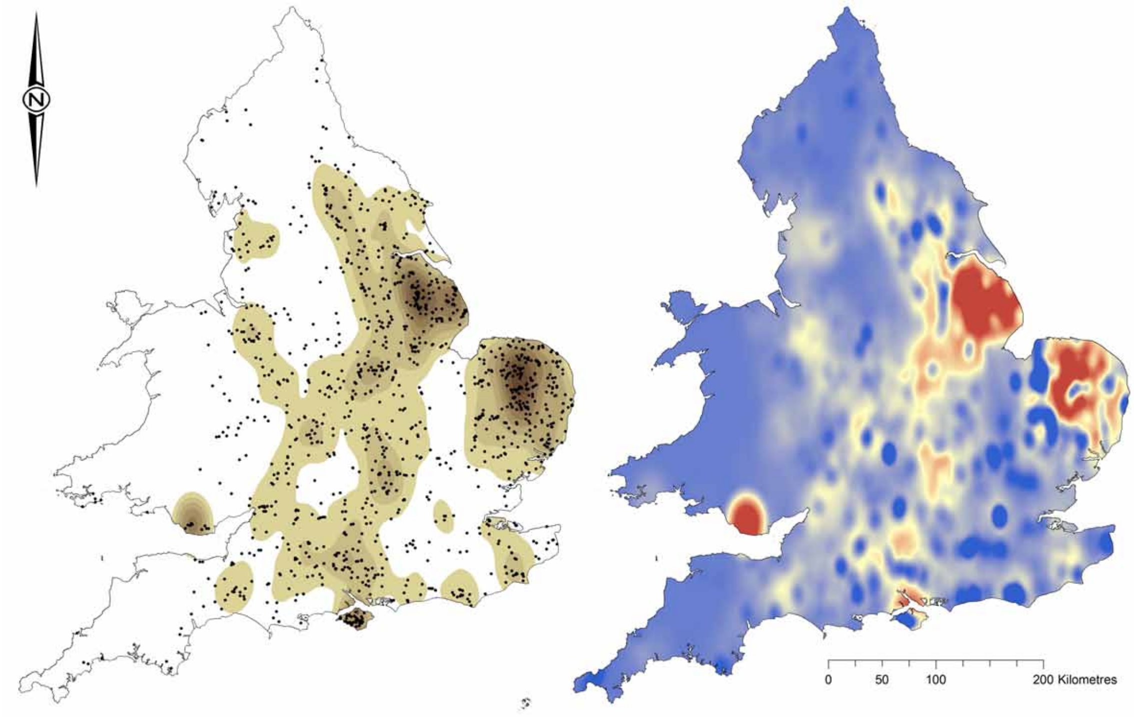

Figure 5.15: Left: The geographical distribution of *ampullae* reported to the PAS as of 16/12/2016. Right: A comparison of the distribution shown to the left with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

5.5 Charms and textual amulets

Another category of amulet from this period are those which take the form of documents. These are usually sheets, parchment or paper, of text including magical charms, seals and words which claimed, and were believed, to offer protection to the bearer. These were certainly in use up to the reformation as can be demonstrated by the denouncement of their use "as a protective charm against thunder and lightning" by Martin Luther (Luther 1912: 628; Skemer 2006: 67). Another type of document which may have been used in this way are 'heavenly letters', which claimed to have come from Christ. Their supposed provenance gave these medieval forgeries protective powers, a belief which in some regions survived into the post-medieval period (Jones 1975: 173). Chardonnens and Hebing (2010: 190) describe a 15th century English example of the 'heavenly letter' which contained a charm which promised that "who that bere this lettre vppon hym shall not deye of no euel dethe . . . nor water nor lightnyng nor thondryng". Some charms provided protection through recitation while others were carried about the person to provide long-term safety. One of the miracles of St Cuthbert retold by Reginald of Durham in the 12th century, for example, tells how an engineer hired by the Abbot of Durham carried with him a sack full of textual amulets to resist evil (Raine 1835: 94-98). A particularly interesting example is the Canterbury Amulet,[21] a

[21]Canterbury Cathedral Library, Additional MS 23

mid-13th century manuscript, on the reverse of which are 17 seals which offer protection against particular hazards including fire, storm, flood and sudden death (Skemer 2006: 204-205). The high number of different protective charms which offer protection against various hazards, diseases and injuries essentially provides general protection against almost any conceivable threat. The amulet was probably folded up, allowing easy transportation so that it could be carried around but, by unfolding, the owner could view the seals and read their accompanying text for stronger protection (Skemer 2006: 199, 206). While it is possible that the manuscript was used in this way to provide personal cover-all protection, another interpretation is that it served as a blueprint that could be copied in order to produce bespoke textual amulets for almost any individual or situation as and when they were required (Skemer 2006: 210). Of course, it is possible that a combination of the above is true, and although the pre-Reformation provenance of the document is unconfirmed, references in the text suggests it belonged to a lay Kentish landowning family (Skemer 2006: 212). Another example is manuscript Kane MS 21, produced in the London area, which gives a lengthy list of the various threats against which it protected. These included wind, water, fire, lightning, storm and thunder (Skemer 2006: 152) illustrating that natural threats were a concern against which protection was required. The invocation of holy names was another way to add protective qualities to a textual amulet with some examples specifying that the list of names would protect the bearer from fire, drowning, storms and lightning (Skemer 2006: 256). Sudden death could be avoided, by beholding the measure or length of Christ each day. This was a horizontal line often drawn in textual amulets, the length of which could be multiplied by a specific number to give the true height of Jesus (Skemer 2006: 143). Textual charms could also be used to augment the power of other forms of protection. For example, in a 15th century ceramic jar which was inserted into a wall in St Mary's Church, Bexley, Kent, a piece of parchment was recovered (Tester 1956: 260-261) which Merrifield (1987: 121) suggests would have originally been a written charm, probably containing spells and incantations to protect the church. Gilchrist (2012: 234) puts forward the possibility that the parchment may have been a prayer, most likely petitioning for assistance from the Virgin Mary, the patron saint of the church. As with foundation deposits, discussed below, the placement of the jar may have been motivated by the belief that such a vessel could act as a trap to protect a structure from evil spirits and the devil. This interpretation, is strengthened by the fact, not previously commented on, that the jar came from the North wall of the church, which as discussed below, held particular associations with the Devil in the medieval mind.

5.6 Papal *bullae*

Papal *bullae* are lead seals attached to documents originating from the Papal curia, either in Rome or, during the schism between 1378 and 1417, Avignon. On the obverse they are inscribed with the name of the pope at the time of issue while on the reverse an image of St Peter and St Paul is

Figure 5.16: Three Papal *bullae* from the PAS. Top left: **YORYM-7B3582**: A typical Papal *bullae* in good condition, in this case dating from the papacy of Innocent IV (1243-1254), discovered at North Ferriby, East Riding of Yorkshire. Top right: **SOM-DB4323**: An example of a *bulla* converted into an amulet, in this case the face of St Paul has been carefully trimmed from the rest of the *bulla* and a hole for hanging pierced through the bottom, found at St Cuthbert Out, Somerset. Below: **SUSS-F5E022**: an example of a *bulla* which may have been nailed to a structure, perhaps to gain protection, issued during the papacy of Innocent IV (1243-1254) from Lancing, West Sussex. Combined by the author, original photographs reproduced from the PAS website, www.finds.org.uk, under CC BY-SA 4.0 licence available at https://creativecommons.org/licenses/by-sa/4.0/.

shown. This format did not change throughout the medieval period, save for the Papacy of Pope Paul II (1464-1471) when a new design was introduced, although the old style was readopted by all subsequent popes. Through their connection to the Papacy, the fact they came from Rome, one of the most important centres of pilgrimage, as well as the fact that they were inscribed with images of St Peter and St Paul, some considered them to hold apotropaic significance. They are frequently found in burials where it is presumed they may have been attached to documents granting indulgences, or remissions from sins, in order to ease the journey of the deceased through purgatory. Gilchrist (2008: 130-131) observes that the inclusion of *bullae* in burials is a notable facet of the 14th and 15th centuries, which she suggests may have been a response to the Black Death. The PAS contains records of 418 Papal *bullae*,[22] of which 34 (8%), have been removed from the documents they were originally attached to and pierced to allow a string to be put through them. While pierced holes could conceivably have been added as a way of facilitating easier attachment to documents, this is perhaps unlikely because the main value of *bullae* was as a means of authentication. Therefore, attaching them to documents in unofficial ways, such as by piercing holes through them to attach strings, demonstrated that the document had not been sent out from the Papal Curia in that condition and could therefore not be trusted as an official document. This suggests that where *bullae* have pierced holes this is likely to relate to apotropaic reuse of the Papal seals as amulets. Perhaps the clearest example of this is **SOM-DB4323**, originally a *bulla* of Pope Boniface IX (1389-1404) found in Somerset, which was carefully trimmed around the face of St Paul and a hole pierced at the bottom of the saint's face (see fig. 5.16). Presumably this would have enabled the saint's image to be worn as a protective amulet. Another interesting example is **SUSS-F5E022**, a *bulla* of Innocent IV (1243-1254) from Sussex, which has a number of holes pierced through it suggesting it may have been nailed to a structure, perhaps onto a door (see fig. 5.16). Such an act may have been believed to bestow protection upon the structure. Standley (2016: 284-285) argues that two of the *bullae* with pierced holes reported to the PAS[23] were reused as spindle whorls although in these cases she concedes that the selection of Papal *bullae* for this seemingly utilitarian purpose must have had theological significance. By analysing all the *bullae* reported to the PAS to date,[24] it is possible to plot the distribution of this type of artefact over time (fig. 5.17). As the pope at the time of issue is included on each *bulla* it is usually possible to date each *bulla* to within a decade. In a small number of cases this is not possible because the name of the Pope is illegible or not present due to later damage. The results of this analysis demonstrates a relatively close correspondence between the numbers of *bullae* reused as amulets and the overall number of *bullae* in circulation. This correlation between *bullae* with evidence for later reuse for apotropaic purposes and the overall availability of *bullae* is further demonstrated when the *bullae* in

[22] As of 14/12/2016.
[23] **HESH-1517A7** and **SWYOR-F52016**.
[24] This data is presented in Appendix H.7.

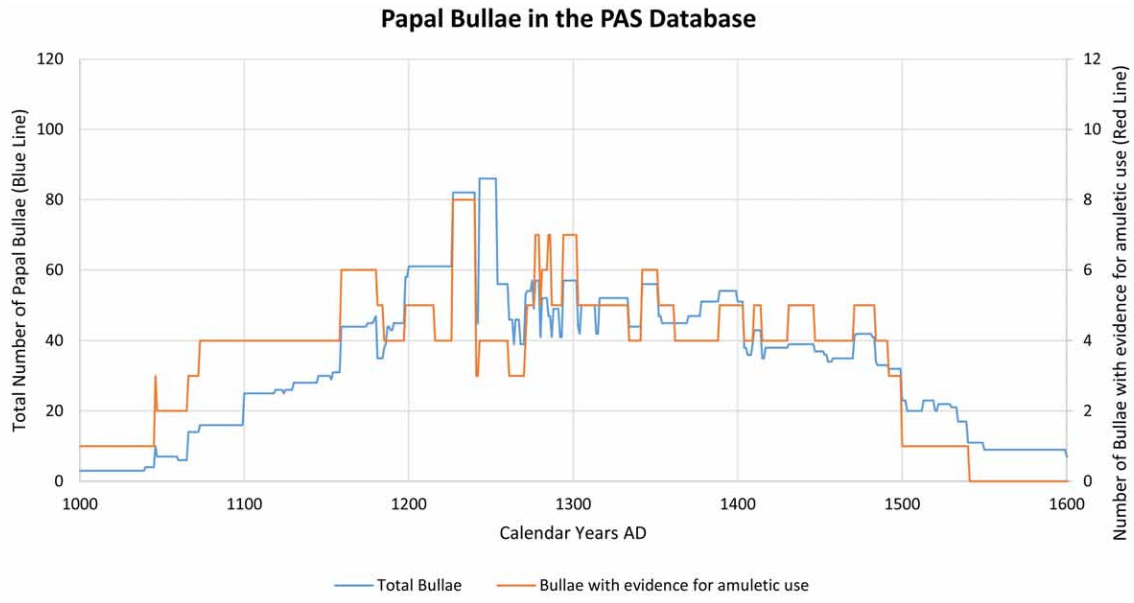

Figure 5.17: The chronological distribution of Papal *bullae* reported to the PAS, as of 14/12/2016, against time. The total number of *bullae* is plotted in blue (left axis) while the number with evidence for reuse as amulets are plotted in red (right axis). Created by the author.

the PAS are analysed spatially–as those with evidence for amuletic reuse show a remarkably similar distribution to the total spread of *bullae* across England and Wales. The PAS evidence suggests a notable absence of *bullae* with evidence for amuletic reuse in Norfolk and Suffolk but this may simply be a result of the relatively low number of artefacts which fit into this category reported to the PAS database. Certainly, *bullae* of this type have been discovered in these counties as, for instance, a pierced *bulla* dating to the papacy of Innocent VI (1352-1362) found at Strumpshaw, Norfolk, in 2004 (Gurney 2005: 749) demonstrates. An important point is that the supply of *bullae* was limited by the number of Papal documents reaching Britain which may have prevented the reuse of *bullae* as amulets from growing into a more popular practice. Although a significant number of *bullae* were found broken in two halves or folded in a manner superficially similar to folded coins, discussed below, in the case of *bullae* this can likely be explained by the fact that they were originally attached to documents through a hole running through their centre from top to bottom which must have introduced a weakness to the object making it more likely to fold or break along this line. Some however, display clear evidence of cutting as opposed to accidental breaking. This may relate to deliberate destruction in order to prevent their reuse on fraudulent documents.

Clearly, although the reuse of *bullae* for apotropaic and protective purposes can only be suggested for a relatively low percentage of the overall corpus reported to the PAS, the practice was geographically widespread and seems to have been carried out consistently throughout the medieval period.

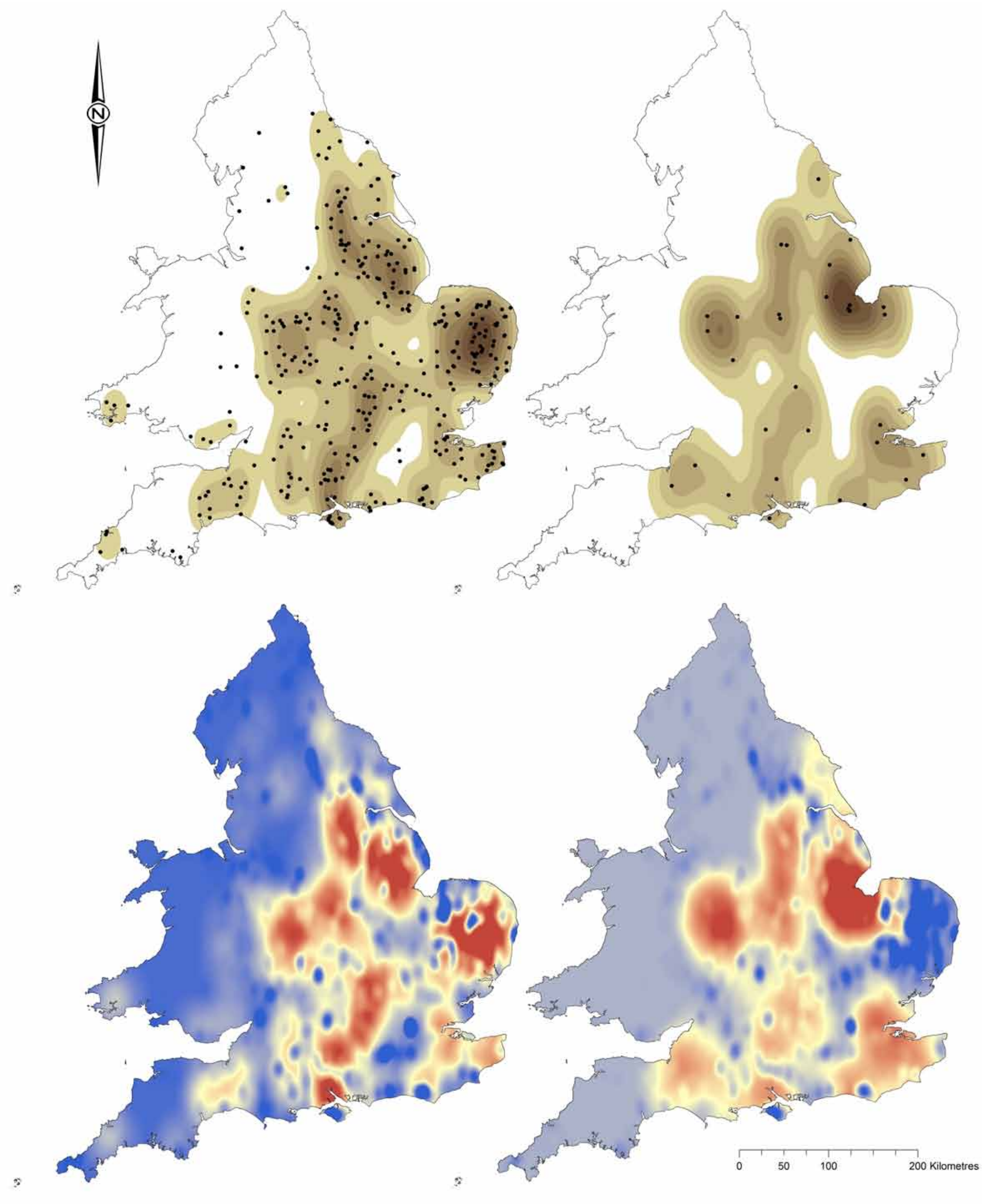

Figure 5.18: The geographical distribution of Papal *bullae* reported to the PAS, as of 14/12/2016, against time. Above Left: The distribution of all *bullae* reported to the PAS. Above Right: The distribution of *bullae* with evidence for reuse as amulets. Below: A comparison of the distributions shown above with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

Year	Church	Detail	Payment
1450	St Mary-at-Hill, London	*Dat' hominibus pulsantibus in nocte Sci Petri pro tornitura*	viij d.
1457-8	Yeovil, Somerset	*In potacione dat' pulsatoribus dum tonatruat*	j d.
1464	St Mary, Sandwich, Kent	For bred and drynke for ryngers in the great thunderyng	iij d. ob.
1519	Spalding, Lincolnshire	Pd for ryngyng when the Tempest was	iij d.

Table 5.1: English Church Warden Accounts recording bell ringing in response to storms. After Cox (1913: 212).

5.7 Church bells

During the medieval period church bells served more than simply the practical function of signalling the time of day and notifying parishioners of religious and social events. They were also imbued with ritual significance. A newly cast bell was blessed and these blessings usually included a reference to the bell's ability to protect against storms and lightning (Arnold & Goodson 2012: 119). This belief is further reflected by inscriptions found on medieval bells. For example, the inscriptions on a 13th century bell from Assisi, Italy, described the various powers of the bell including: "I break lightning"[25] and "I disperse the winds"[26] (Arnold & Goodson 2012: 120). While some church bells were inscribed with such phrases, directly referencing their power to avert storms, others had more general prayers such as a church bell from Malma, Västergötland, Sweden, which simply invoked the intercession of the Virgin Mary.[27] The church bells from Burg, Schleswig-Holstein, Germany, and Garyp, Freisland, The Netherlands, bore, respectively, an inscription and a depiction of Saint Barbara (Wolf 2000: 52-53). Given the association with lightning in her hagiography, imbuing bells with the power of her cult may have been thought to grant particular protection against storms. English church bells also commonly invoked the assistance of a saint, often the saint of the church's dedication. Some indirect references to the belief that church bells could drive away storms are known from England. For example, many from Devon and Somerset are inscribed with the line "With my living voice I drive away all hurtful things"[28] (Walters 1912: 325-326). That these blessings were more than just words is demonstrated by the widely documented practice that bells were rung during storms to drive away the evil spirits which guided them (Ryan 1993: 288). In Britain this practice is documented in a number of sources. At Malmesbury Abbey the great bell of Saint Adelm was rung to disperse thunder and lightning (Britten 1881: 22) and surviving church warden's accounts (see table 5.1) attest to payments made to bell-ringers for their services during storms.

[25] "*fulgura frango*"
[26] "*dissipo ventos*"
[27] The inscription is given in full on the website of the Skaldic Project at: http://skaldic.abdn.ac.uk/db.php?id=16751&if=runic&table=mss. [Accessed 22/01/2017].
[28] *"Voca mea viva depello cunta nocina"*

5.8 Foundation and special deposits

Merrifield (1987: 119-136), in his seminal text on the archaeological evidence for ritual and magic, discussed a number of types of foundation deposit commonly encountered in medieval and post-medieval structures. These included skeletal or mummified animal remains (including chickens, cats and horses), shoes, coins and pots. Such cases are widely interpreted, sometimes through surviving folklore, as strategies to secure protection or good luck for the building and those who dwelt within. Cases are found widely throughout Britain, including a cistern containing an iron key buried under the foundations of a house in Oxfordshire (Hinton 1968). In this case, the difference in date between the 12^{th}-13^{th} century cistern and 14^{th}-15^{th} century key suggests the deposition of a curated cistern from an earlier period, a practice evidenced through a wide range of artefact types (Gilchrist 2012: 241-242), which may have been deemed of greater significance due to their age. In relation to disasters, one of the most interesting cases is that of the medieval houses at Culemborg, the Netherlands, which, after being razed by fire in 1422, were rebuilt with jugs deposited in the foundations of the structures. The ceramic vessels may have been thought to act as a trap for evil spirits and, as such malevolent forces were held responsible for causing disasters,[29] this would have provided protection for the community against a repeat of the blaze which had recently affected their town so severely (Merrifield 1987: 120). It should be noted, however, that not all ceramics buried beneath structures served a protective purpose, with documentary evidence attesting to functional reasons, including fermenting, distillation and as containers for hot ashes and embers from fires (Moorhouse 1978: 12-13).[30]

In the case of two miniature bronze cauldrons found separately within two different medieval flood embankments in the Netherlands there is no obvious functional explanation (van Vilsteren 2013). The cauldrons can be confidently dated on stylistic grounds to the 14^{th} century and, based on documentary evidence, the dikes within which they were buried date from the same period (van Vilsteren 2013: 173-174). This suggests they were purposefully deposited during the construction of the dikes. It is possible that, as with the jugs from Culemborg, the cauldrons were believed to protect the dikes from harm and make them more effective flood defences with van Vilsteren (2013: 180) theorising that such offerings were a relatively common practice which has not previously been recognised in the archaeological record. The deposition of cauldrons has pre-Christian ritual significance—during the Viking Age, cauldrons were commonly deposited in lake edge settings in Scandinavia, with analogous practices in Britain and Ireland (Lund 2008)—so in the case of the medieval Dutch examples, these may have harnessed traditional folkloric beliefs attached to the deposition of cauldrons in order to enhance the protection offered by the dikes within which they were deposited. Of relevance here is an oft cited literary description of a foundation deposit with

[29] As discussed in Chapter 2.2.

[30] Such a functional interpretation likely explains the complete clay vessel discovered incorporated into the floor of a medieval structure at New Romney, Kent (Linklater 2004: TP56).

a similar context and motivation. In Theodor Storm's *Der Schimmelreiter*[31] Frisian farmers who are constructing a new flood embankment plan to include a still-living dog within the earth of the dike as a living sacrifice[32]—presumably to enhance the protection afforded by the flood defence (Storm 1908: 112). While this is a fictionalised account, it is widely thought to have some basis in the beliefs and folklore of the early modern communities along the Frisian coast (*eg.* Van de Noort 2011: 122-123) and provides an interesting analogue for the medieval cauldron deposits which appear to have been similarly deposited within the fabric of dikes during construction.

Aside from foundation deposits in domestic settings, an array of evidence relates to foundation and 'special' deposits in ecclesiastical settings. A British example of this recorded through documentary evidence comes from the Abbey of St Albans, sometime between 1326-1335, where, when the foundations of the new cloister were being laid, saintly relics were 'sprinkled' beneath the foundation stone[33] (Riley 1867: 282). An Italian parallel records how, in 1325, in addition to coins placed in the foundation of the Torre del Mangia, Siena, stones were placed in each corner, inscribed in Hebrew, Latin and Greek,[34] to protect the tower against thunder, lightning and storm (Travaini 2015: 219). 'Special' deposits in churches are also known widely through archaeology although many of these are interpreted as acts to safely remove sacred objects from circulation (Gilchrist 2012: 234-235) rather than to accrue protection for the church and local community. Special deposits in the vicinity of Saint's shrines were probably intended as offerings to the respective Saint for healing, protection or good fortune. Such a case can be seen in the votive wax figurines and other objects, which included body parts, strings[35] and male and female figures, which were discovered hidden above the tomb of Bishop Edmund Lacey (d. 1455) in Exeter Cathedral (Radford 1949: 164). Lacey, although uncanonized, was held responsible for a number of posthumous miracles (Radford 1949: 165) and therefore, these objects were almost certainly left, at or near Lacey's tomb, by pilgrims in the hope of receiving his help in their temporal woes. It is unclear how they came to be hidden within the masonry surrounding the tomb, whether this was done following routine clearing of the tomb or surreptitiously in the years of upheaval surrounding the Reformation. Presumably, though, the act of hiding these votive objects in a location so closely related to Lacey's tomb was motivated by the belief that he would continue to help those who had left the objects at his tomb.

The practice of foundation and 'special' deposits was widespread throughout western Europe. In southern Scandinavia, for example, artefactual deposits in the foundations of houses and churches were interpreted by Falk as offerings to protect against external forces (Falk 2006: 204). The spatial distribution of depositions in churches in particular, clustered to the north and around the altar,

[31] Originally published in 1888.

[32] We are also told that, in the past, children had been the preferred sacrifice for this task.

[33] *"et sub eodem lapide conspersit fundamentum de minutis reliquiis Sanctorum"*

[34] The three languages used on the plaque on Jesus' crucifix, known as the *Titulus Crucis*.

[35] Note that although Radford (1949: 164) interpreted the strings as a method to hang the other objects around the tomb, she also mentions that some were "twisted thread dipped in wax not unlike candle-wicks". This would accord with the widely documented practice that a person, or an injured body part such as a limb, or an object such as a ship would be measured using a string, which would then be made into a candle and donated at the shrine of a saint (Finucane 1995: 95-96).

was interpreted as evidence that these artefacts were motivated to gain protection against the devil (Falk 2006: 203). Interestingly, the medieval depositions were also, in comparison to earlier and later periods, found overwhelmingly in liminal areas on the boundary between the internal and external worlds. Falk again relates this to contemporary theology which emphasised the need to protect the home from the devil (Falk 2006: 202-204). Parts of a structure which mediated between the internal and the external certainly seem to have been foci for such deposits. Another example for this comes from the inscribed slates unearthed in a doorway at Nevern Castle, Pembrokeshire, (Caple 2012: 440-441) the graffiti on which is discussed below. Interestingly, continuity for this practice can be demonstrated between both earlier and later periods. For example, with regard to the find-spot locations of archaeological evidence for special deposits in Anglo-Saxon England, Hamerow (2006: 27) detected an "emphasis on transitional places (i.e entrances and boundaries)". Equally, post-medieval burn marks, the vast majority of which have been conclusively demonstrated to have been intentionally created (Dean & Hill 2014), are frequently found on structural timbers, similarly found primarily in liminal locations throughout domestic structures such as roof timbers as well as on the north side of churches (Lloyd *et al.* 2001: 66, 69).

Evidently, the location in which a special deposit was made was of equal importance to the objects included in the deposition. In addition to liminal locations within structures, a relationship between ritualised deposits and specific environmental settings has been proposed (*eg.* Yates & Bradley 2010a). Although Viking Age hoards have traditionally been interpreted functionally (Graham-Campbell & Batey 1998: 243, 246)—deposited in times of unrest with the intention of retrieval at a later date—the high number which were never recovered as well as the preponderance discovered in environments such as lakes, bogs and wetlands—in which it would be difficult to precisely mark the location of, and subsequently retrieve, precious objects—makes functional interpretations unlikely (Lund 2008: 55-56). The high number of Viking Age ritual deposits from 'watery' contexts (Lund 2008: 57-58), especially the shores of lakes, in common with some of the classes of object considered here, such as pilgrim badges, advances the possibility that, in some cases, such acts were motivated by a desire to accrue protection against hydrological hazards—as has been theorised for lake side ritual deposition in a prehistoric context (Menotti *et al.* 2014). A connection may also be drawn between the Norse custom of ritualised hoard deposition and sites which were abandoned in environments affected by wind-blown sand (Brown 2015: 139-141). In these cases, it is possible that the experience of the hazard provoked an act of ritual deposition—either for future protection or to calm the unseen forces behind the mobilisation of sand.

5.9 Folded coins

Coin folding is an activity which is well attested by the archaeological record. As as a ritual practice, the act was connected with gaining saintly protection during the medieval period. Folded coins

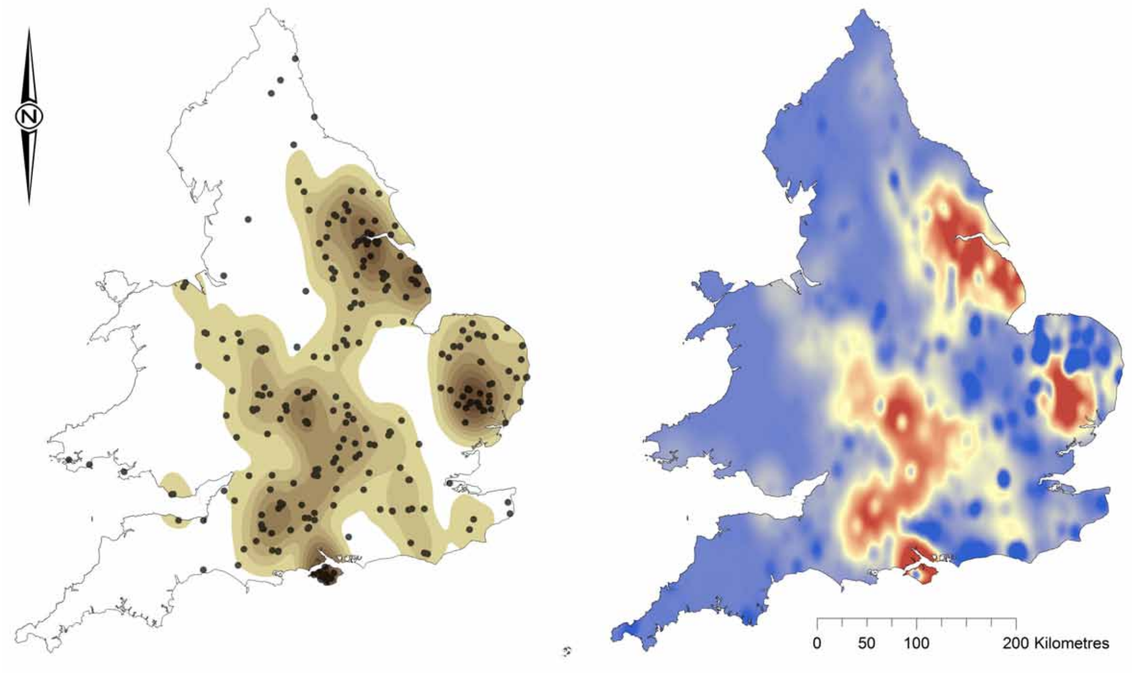

Figure 5.19: Left: Distribution map of the folded coins in the PAS database as of 01/04/2016. Density is indicated in brown. Right: A comparison of the distribution shown to the left with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

make up a low yet significant number of all numismatic finds from the medieval period (almost 1%) (Kelleher 2011: 1499) and are routinely encountered on a variety of archaeological sites. The majority (76% of those in the PAS database) are clearly the result of a deliberate act and are folded in half, often along the arms of a cross where these are present. A much lesser number are folded in complex arrangements. These include coins folded into thirds and quarters and those which contain other coins or are associated with other artefacts. Equally rare are coins with more ephemeral folds. These could conceivably have occurred by accident or as a result of post-depositional factors although an intentional act remains possible. Excluding the latter category, the folding of coins was clearly a well-established practice during the medieval period which, as the PAS database finds demonstrate, was spread widely throughout England (see fig. 5.19).

A number of explanations have been advanced to explain the folding of coins in the Middle Ages. These have included functional interpretations, that the fold was a means of testing the metal content of the coin (North 1994: 42) although this can only explain a small minority of folded coins (see Kelleher 2013: 252). On the other hand, a large volume of evidence exists for folded coins as objects of apotropaic and ritual significance. Coins certainly held ritual significance, including protective powers, in the early Middle Ages (Maguire 1997). Although the practice changed somewhat, there is clearly some continuity with belief into the later Middle Ages. This can be demonstrated beyond doubt by a number of the folded coins from the PAS database. For example, **SWYOR-4F7776**, a half-groat of Henry VII, was found folded over with a short strand

Figure 5.20: Three folded coins from the PAS database. (Left to Right) **NMGW-1223EC**: This penny (1272-1327) found at Llanasa, Flintshire is a typical example of a coin that has been deliberately folded in half. **SWYOR-4F7776**: A half-groat (1485-1509) found at Fulford, North Yorkshire, folded (now unfolded) along with a strand of fabric suggesting use as jewellery. **LON-070A60**: A penny (1272-1301) folded with a half-penny (1279-1377) inside found at Totteridge, London. Combined by the author, original photographs reproduced from the PAS website, www.finds.org.uk, under CC BY-SA 4.0 licence available at https://creativecommons.org/licenses/by-sa/4.0/.

of textile within the fold suggesting the coin had been converted into an amulet or piece of jewellery and **SWYOR-6FA7C6**, was folded within a sheet of lead. Five other finds (**NMS-7BF5A3**, **BH-E654B1**, **KENT-6AB814**, **LIN-2BCE24** and **LON-070A60**) record coins folded within other coins. Furthermore, a number of folded coins are known from burial deposits—such as **NARC-03B111**, a silver groat of Edward IV which came from the mouth of a skull—as well as the foundation deposits of structures (Hall 2012: 79-80). These practices are clearly inconsistent with a functional explanation and can therefore only be explained as ritual practice. In addition there is a wealth of documentary evidence which records the folding of coins as a vow to particular saints in which the coin folder promised to make a pilgrimage to the shrine of a particular saint. In return, the supplicant would ask for and receive the help and protection of the saint in the material world (Duffy 1992: 183). This practice was followed particularly in times of need, for example: to extinguish fire, cure sickness or for protection in storms at sea (Finucane 1995: 94; Bartlett 2013: 355). The miracles of the canonized king, Henry VI, for example provide a wide array of examples of the practice. One such tells how a certain Ralph Gabbott was restored to health after a long illness lasting three years by bending a coin in the name of "the blessed King Henry" while another relates how a victim of the plague was cured after bending a penny (Knox & Leslie 1923: 192, 195). The bending of coins was described as 'the English custom' by the commissioners investigating the canonization of Thomas Cantilupe in 1307 which may suggest the practice was more common in Britain than in continental Europe (Finucane 1995: 95).

Folded coins are well represented in the PAS database. A search for coins of medieval date which contained the word 'fold' in the object description returned 337 results as of 1st April 2016. Each of these was analysed to confirm whether the fold was deliberate or due to post depositional factors. The folding of 23 of the coins was classed as non-deliberate and these coins were excluded from subsequent analysis. As it was not always possible to decide with certainty, the remaining coins were assessed and sorted into four categories which are described below (fig. 5.21).[36] In order to assess how common the practice of coin folding was throughout the period, all of the PAS finds were then graphed against time (see fig. 5.22). This data was then compared with Allen's (2001) estimates of the volume of the English currency for the period to provide a benchmark with which to compare fluctuations in folded coin numbers. The two sets of data match relatively closely although there are disparities. Notably, the period *c*.1180-*c*.1310 saw a relative increase in the practice compared to the general supply of coinage. A spike in the late 14th century also suggests a resurgence in the practice out of proportion to the number of coins in circulation although it must be conceded that the estimates for the volume of English currency during these years lack data points. An important caveat in this analysis is that although many of the coins can be dated with great accuracy, sometimes to particular years, this date is the date of production providing only a *terminus post quem* for when the act of folding took place. As a result, fig. 5.22 indicates the likelihood of coins struck in different periods to be folded rather than periods when the practice of folding was most prevalent.

This can still be useful however. The folding of a coin was not the same as a coin being taken out of circulation due to general wear and tear. A coin could just as easily be folded 1 year after it had been struck as 40 years later so, theoretically, folded coins should randomly represent coins at different stages of their lives; those that had been struck recently and those that had been in circulation for many years. One account, telling of a vow made to Henry VI bears out the random nature of folding. The supplicant, in his haste to pledge himself to the Saint was forced to bend a gold coin as he could not find any silver coins in his purse although he knew them to be there (Knox & Leslie 1923: 129). Due to this random element, there is no way to estimate accurately at what stage in the life of each coin it was folded. Some medieval coins remained in circulation for extended periods, as demonstrated by the contents of coin hoards, with at least one case of a coin remaining in use for 110 years (Spufford 1963: 128). As a result, the arbitrary application of a conservative estimate, in this case 20 years, seems the best solution. In addition, to exclude coins which may not have been folded deliberately, all those in the 'Unknown' and 'Slightly Folded' categories were removed from the analysis. With the allowance of 20 years to take account for circulation, the peaks in the numbers of folded coins much more closely match those in Allen's (2001: 607) estimate of the volume of the English currency (see fig. 5.23). Although the argument is somewhat circular, this makes sense because coins would be more likely to be folded when more coins were in circulation.

While the biases of the PAS database make any analysis of the find-spot locations of folded coins difficult, some conclusions can be drawn from their distribution. Taking a smaller unit of analysis, in

[36] This data is presented in Appendix H.8.

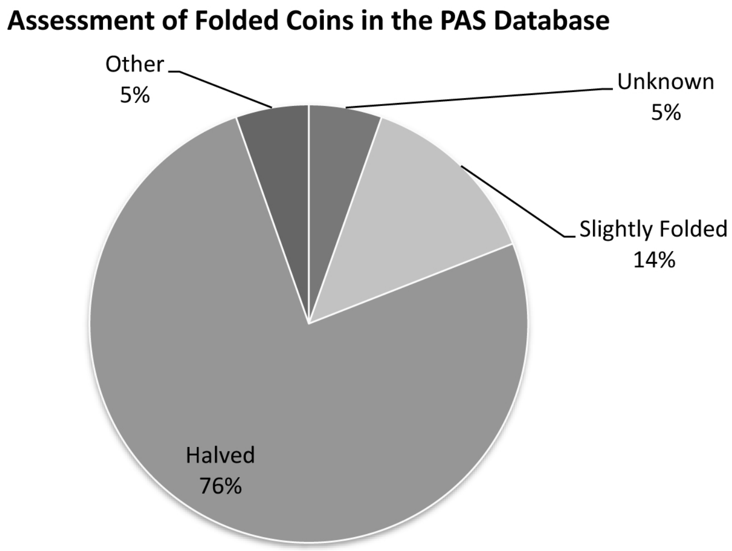

Figure 5.21: Analysis of the type of fold found on folded coins in the PAS database as of 01/04/2016. Created by the author.

Unknown - Where the PAS record is not accompanied by photographs and the object description is not detailed enough to allow attribution to one of the other categories.

Slightly Folded - A minor fold, often only affecting one side of the coin rather than the entire object. These are the most likely to be non-deliberate although the fold is significant enough not to exclude the possibility that they were folded on purpose.

Halved - A clear, deliberate fold in half. On cross pennies this is often along one of the arms of the cross.

Other - This category includes all other non-standard folding, (for example into thirds, quarters, or in connection with other artefacts.

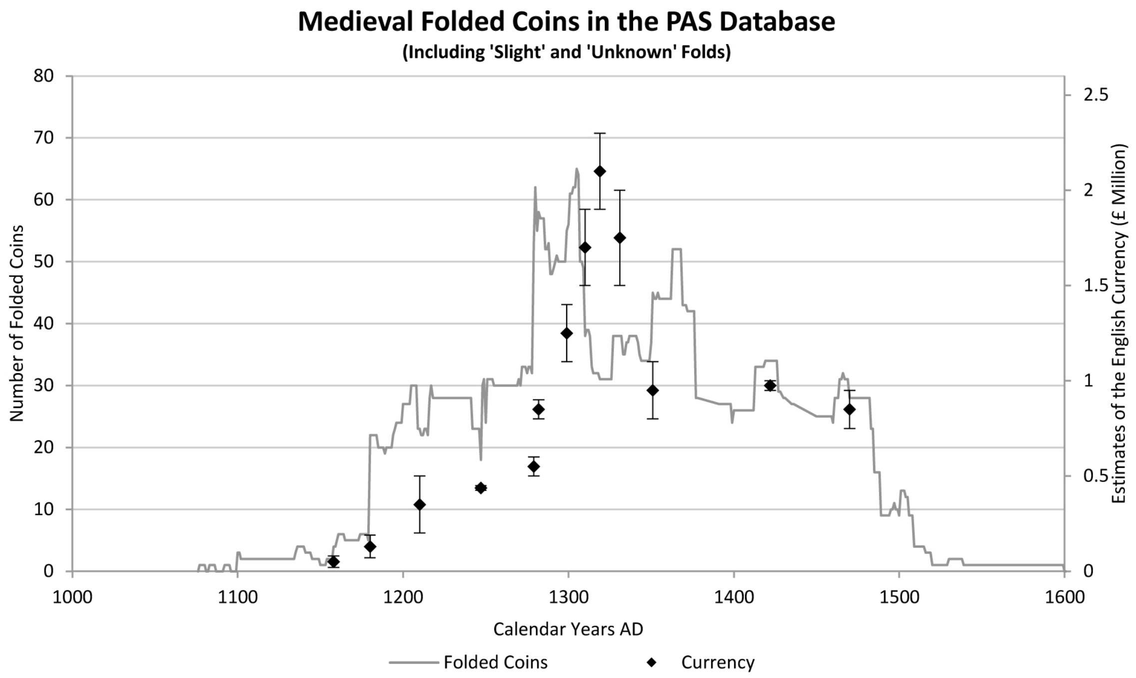

Figure 5.22: Folded coins in the PAS database as of 01/04/2016, including those classed as 'Slightly Folded' and 'Unknown', plotted along-side estimates of the volume of the English currency by Allen (2001: 607). Created by the author.

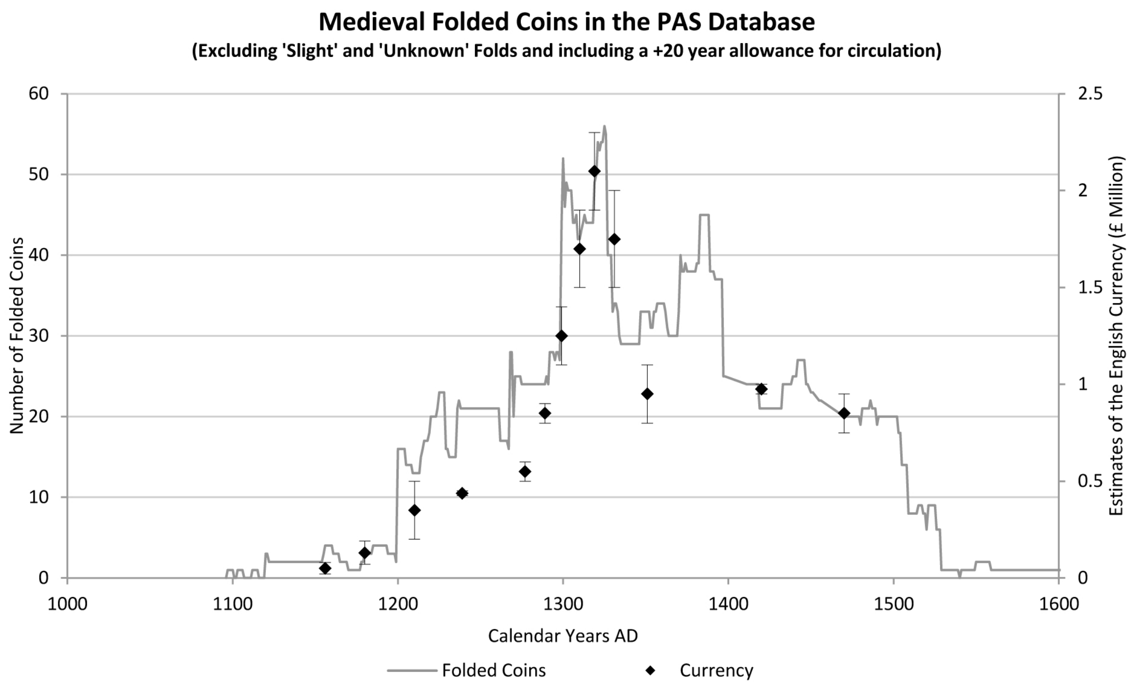

Figure 5.23: Folded coins in the PAS database as of 01/04/2016, excluding those classed as 'Slightly Folded' and 'Unknown', plotted along-side estimates of the volume of the English currency by Allen (2001: 607). To take account for the circulation of coinage after production, 20 years has been added to the dates of the coins. Created by the author.

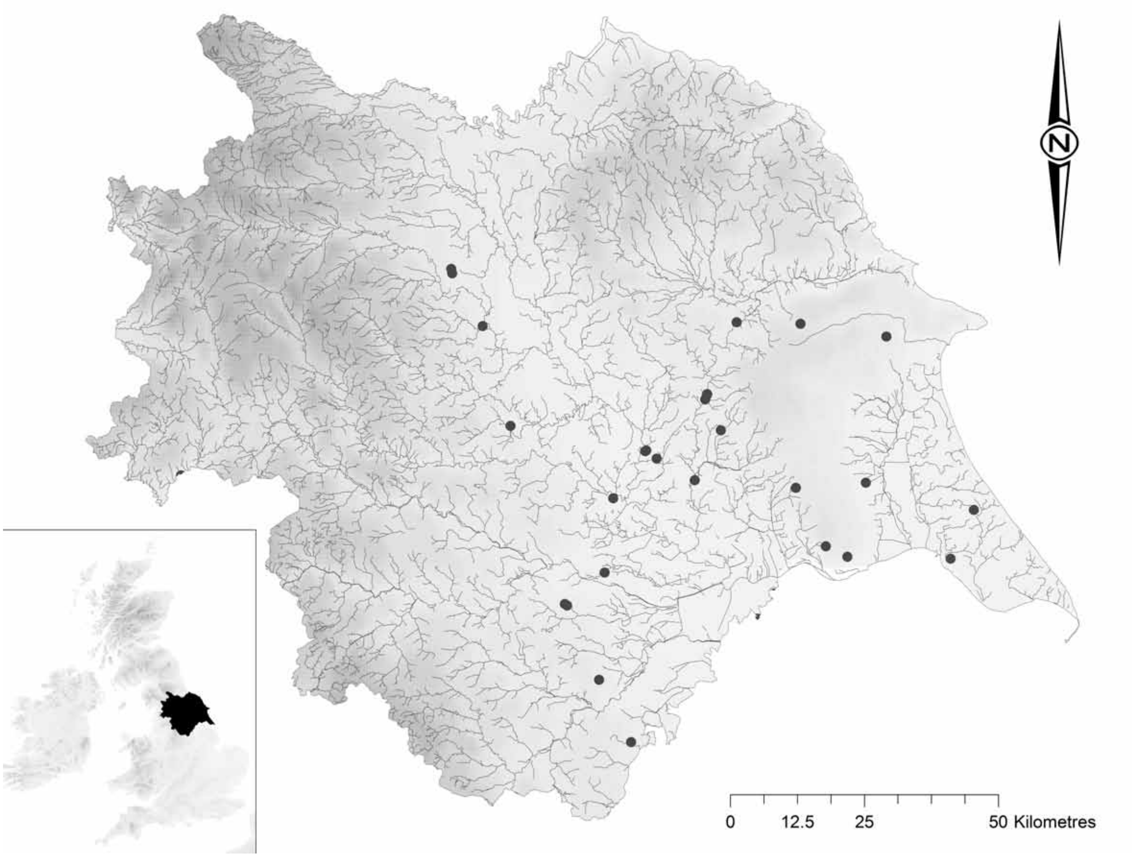

Figure 5.24: The spread of folded coins in Yorkshire as of 01/04/2016, indicated by black dots, with river courses marked. Created by the author.

this case Yorkshire, the spread of an admittedly small sample does appear to bear some relationship to rivers—with the vast majority of coins found along river courses (fig. 5.24). Of course in a British setting, rivers are never very far away and settlements are invariably located close to freshwater, focussing population and movement along river valleys. Rivers and water bodies, however, are widely associated with ritual deposits, both in the medieval period and throughout earlier periods. Prehistoric metalwork deposited in rivers and water bodies have been frequently and convincingly interpreted as ritually motivated acts (Yates & Bradley 2010a;b) and the deposition of coins in springs and water bodies seems to have become a widespread phenomenon during the Roman period (Sauer 2012). As discussed above, the distribution of pilgrim badges in riverine contexts, perhaps as a result of ritual acts associated with pilgrimage (Spencer 1990: 11), may testify to a continuity in the ritual significance of rivers and water bodies into the medieval period. The possibility exists, therefore, of a continuity, of some form, in folklore and ritual practice from prehistory into the medieval period. In light of this, the interpretation of many of the folded coins from the PAS database as deliberate depositions in areas close to rivers gains some credence although further research into this area would, no doubt, reveal a more nuanced picture.

In summary, the evidence of the folded coins in the PAS database demonstrates that the ritual practice of coin folding remained popular throughout the medieval period, broadly following the trend of available coinage. The largest departure from this trend occurred in the late 14th century, perhaps reflecting a greater need for spiritual protection in the uncertain times that followed the Black Death, although this cannot be proven with certainty. The distribution of coins show some relation to river courses and this may imply that not only the act of folding itself held apotropaic significance but the location in which this occurred was also important. While the graphs shown in Figures 5.22 and 5.23 seem to indicate the practice faded out with the reformation, this is likely to be primarily because only coins in the PAS database catalogued as 'Medieval' were included. Further work including 'Post-Medieval' coins would doubtless show that the practice continued beyond into later centuries as many later examples are known; a number of folded 18th and 19th century coins, for example, have been recovered from the River Wear at Durham (G. Bankhead pers. comm.).

5.10 Graffiti

Graffiti commonly encountered in medieval standing buildings offers another area in which superstitious beliefs were expressed. These included both Christian symbols such as the holy monogram and the name of God as well as more obscure patterns such as pentangles and circular compass drawn designs, or daisy wheels, all of which were probably linked to accruing spiritual protection (Champion 2014). The protection these signs offered is sometimes expressed pictorially as in the depiction of a daemon at St Mary's, Troston, Suffolk, which is overlain by a pentangle (see fig. 2.2). Champion (2014: 249-250) has interpreted this as a visual expression of the symbol of the pentangle's power to cancel out the threat of daemons, which were believed to threaten humanity.[37] While daisy wheels have been interpreted by some as purely functional designs, perhaps relating to the teaching of Vitruvian geometry, it is now generally accepted that they held ritual, and probably protective, significance (Meeson 2005: 46). The thinking behind these designs may have been that their endless lines entrapped the devil who was unable to escape from their continuous loops. Perhaps echoing the practice of depositions and burn marks described above, some examples of protective symbols are found on north facing walls of churches such as at Baddesley Clinton, Warwickshire, where the most extensive graffiti was on the north wall of the entrance lobby (Meeson 2005: 41). Such a distribution of ritualised graffiti may relate to the fact that the northern door of a church was frequently known as the Devil's door and was thought to allow the devil a way out of the church after being forced out of a new-born child through the baptism ceremony (Champion 2015a: 41). The association between the northern door of the church and the Devil certainly explains why these would have been particular foci for protective graffiti. However, doorways in general seem to have been regarded as requiring special protection. In Norway, runic and Latin inscriptions are frequently found on, or surrounding, medieval Church doorways, perhaps due to the perceived need

[37] As discussed in Chapter 2.

for protection at liminal areas of the structure (Jones 2010). Comparably, slates with a wide variety of inscribed apotropaic symbols were unearthed beneath the south entrance at Nevern Castle, Pembrokeshire (Caple 2012). While the exact meaning of many of the symbols is unclear, many of them can be interpreted in relation to protection from nature or evil forces, for example lightning bolts and pentangles. The fact that, of the many slates unearthed in the course of excavation, no others bore comparable inscriptions—as well as the deliberate positioning of these slates in the entranceway by the construction workers—demonstrates that these particular slates held apotropaic significance (Caple 2012: 440-441). In these cases, perhaps where structures did not have a dedicated 'Devil's door' it was thought necessary to bestow special protection on the other means of entrance and exit.

As with the other types of ritual practice described in this section, the precise motivation behind the inscription of graffiti is usually extremely difficult to appraise. Protection was usually sought against a broad suite of dangers rather than any one specific hazard. To what extent, if any, protection from natural hazards was a component in the cognitive process behind the creation of these marks is usually unknowable. However, in one case there is strong, if circumstantial, evidence to suggest protection from a recurrent natural threat was a key factor in both the choice of symbols as well as the location of the graffiti. At St Nicholas Church, New Romney, Kent, the church and town were devastated by a series of floods, probably North Sea storm surges, in 1287 and 1288.[38] The church was badly damaged especially the chancel, which was rebuilt after the event (Tatton-Brown 1987: 344), while the Norman pillars in the nave were stained by the floodwaters to a height of *c.*135cm. A number of these pillars bear visible graffiti inscriptions including pillar B2, as marked on fig. 5.25, which is inscribed with a partially-complete compass drawn circle and a difficult to interpret symbol formed of two superimposed crosses; perhaps an unfinished heraldic badge.

A particular concentration of graffiti, however, is found on pillar D2 which is inscribed with a number of inscriptions which may relate to the flood event. The symbols engraved on this pillar (fig. 5.26) include a cross (A), two six-pointed stars (B, D), a compass drawn design or 'hexfoil' (C), a set of two interlocking circles (E) a full circle and an unfinished circular arc. The cross could be explained as a consecration cross although its simplicity and small scale tend to suggest otherwise. Another possibility is that it was intended to ward off demonic forces, a well attested attribute of the sign of the cross. Similarly, as discussed above, the compass drawn design was a symbol of ritual protection (Champion 2015a: 39-44) thought to entrap the Devil or demons preventing them from causing harm. The interlocking circles and other circular marks may be interpreted as simplistic and unfinished 'hexfoils' similarly intended to provide ritual protection.

Stars too were regarded as symbols of protection during the medieval period (Champion 2015a:

[38] Discussed fully in Chapter 3.

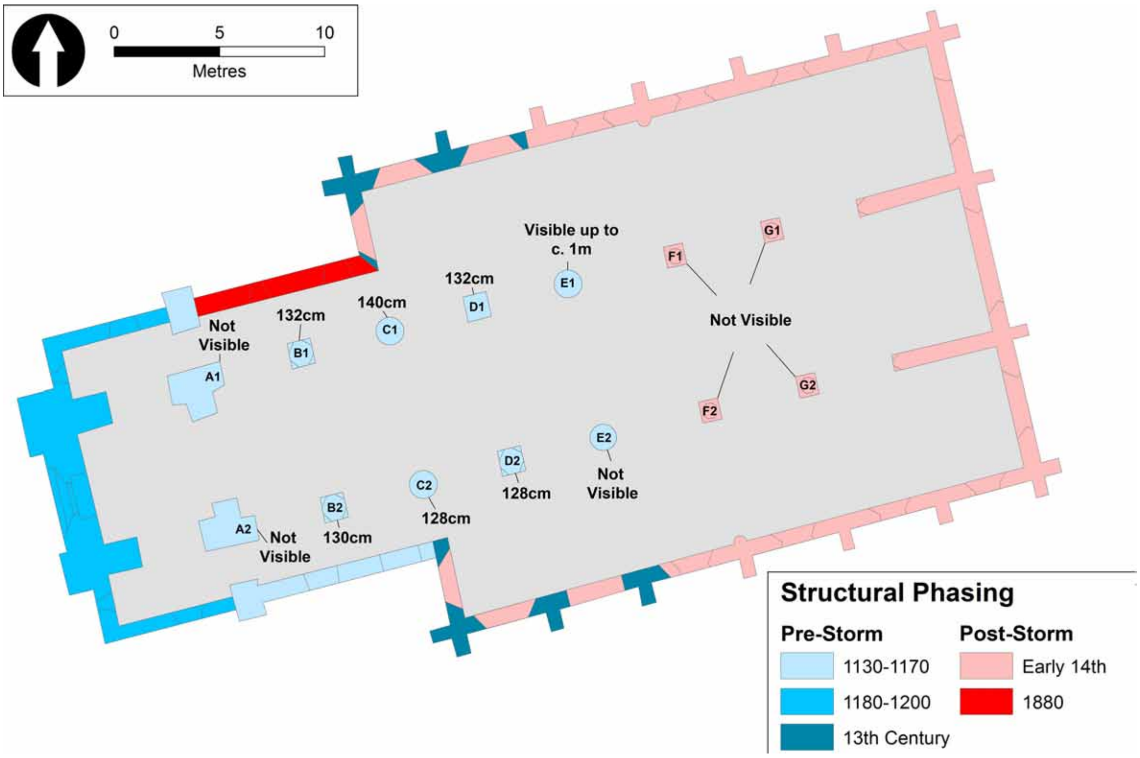

Figure 5.25: The structural phasing of St Nicholas Church, New Romney. Redrawn by the author after Tatton-Brown (1987: 345).

51). The six-pointed sign of Solomon, or hexagram, and five-pointed pentangle were synonymously employed as protective signs, a fact attested by the late 14th century work *Sir Gawain and the Green Knight*[39] (Gardner 2011: 119). In Scandinavia, pentangles were inscribed "above doorways and on wall posts" to protect corn in threshing barns (Merrifield 1987: 125). Medieval dress accessories bearing the six pointed star are common occurrences, with the symbol usually interpreted as apotropaic as in the case of the 16th century pewter brooch from Christchurch, Dorest (Spencer 1983: 81-82) or a mount excavated in London (Egan & Pritchard 2002: 203). Six-pointed stars are found on a wide array of artefacts documented in the PAS database and this provides a method to assess the chronological and geographic distribution of the six-pointed star as a protective symbol. Only stars formed of two opposing triangles, rather than six-spoked stars were included, and several artefact types were excluded. These were: seals, as stars in this context may relate to the identity of the owner rather than beliefs in protection, as well as coins and jettons which as objects of value cannot be taken, at least at face value, as indicative of the beliefs of the owner. As of 1st October 2016, 83 objects in the PAS database met these requirements, including artefact types such as spindle whorls, mounts, brooches and rings.[40] By plotting the date ranges of these objects (see fig. 5.27) it becomes clear that the six-pointed star was a consistently popular symbol of protection

[39] The description in Sir Gawain and the Green Knight is slightly confusing as the symbol is described as "the sign of Solomon" a "pentangle" and "the endless knot" (Gardner 2011: 119). On balance this description seems to best fit a five-pointed star but Champion (2015a: 51) believes that six and five pointed stars were believed to offer comparable levels of protection.

[40] See Appendix H.9.

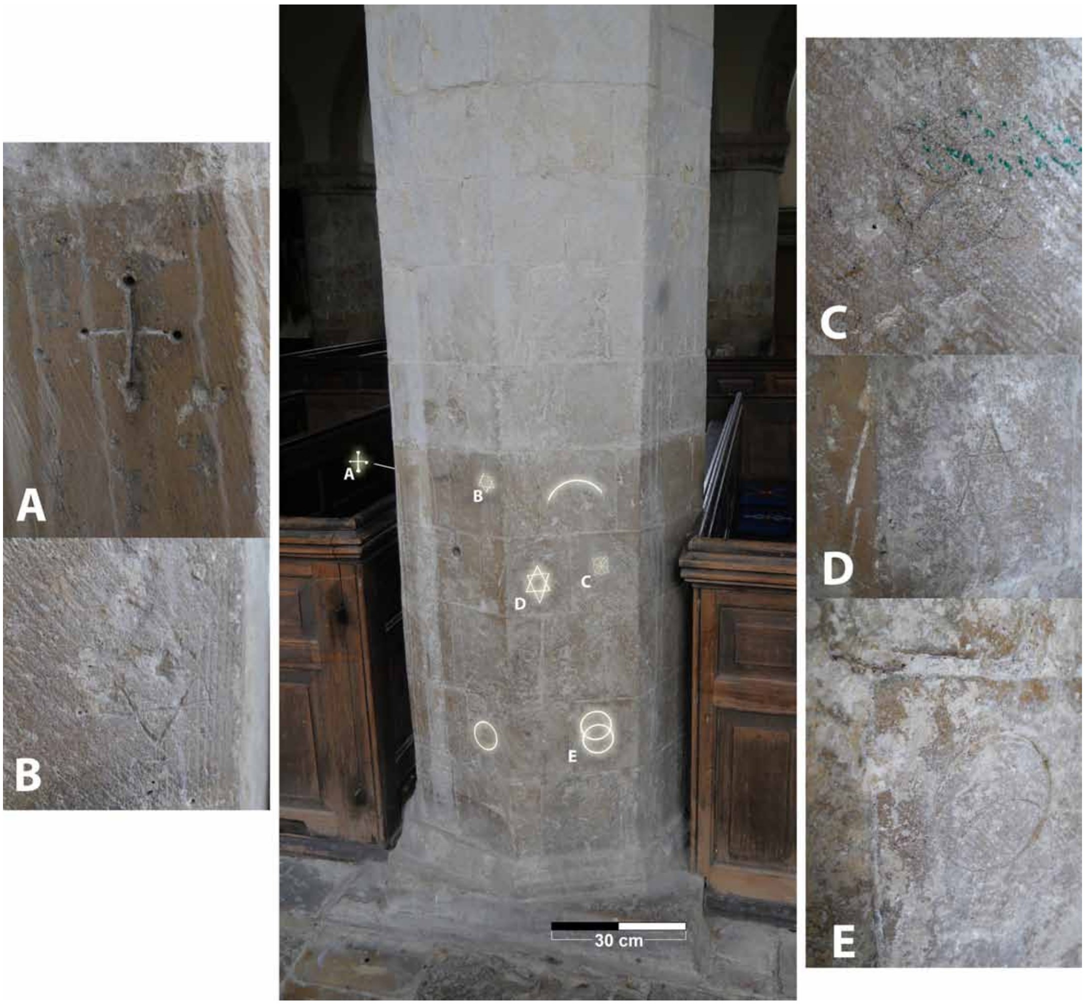

Figure 5.26: The graffiti on pillar D2 at St Nicholas Church, New Romney, with close-ups of the most important symbols. Photographs by the author. Symbols artificially highlighted in central image.

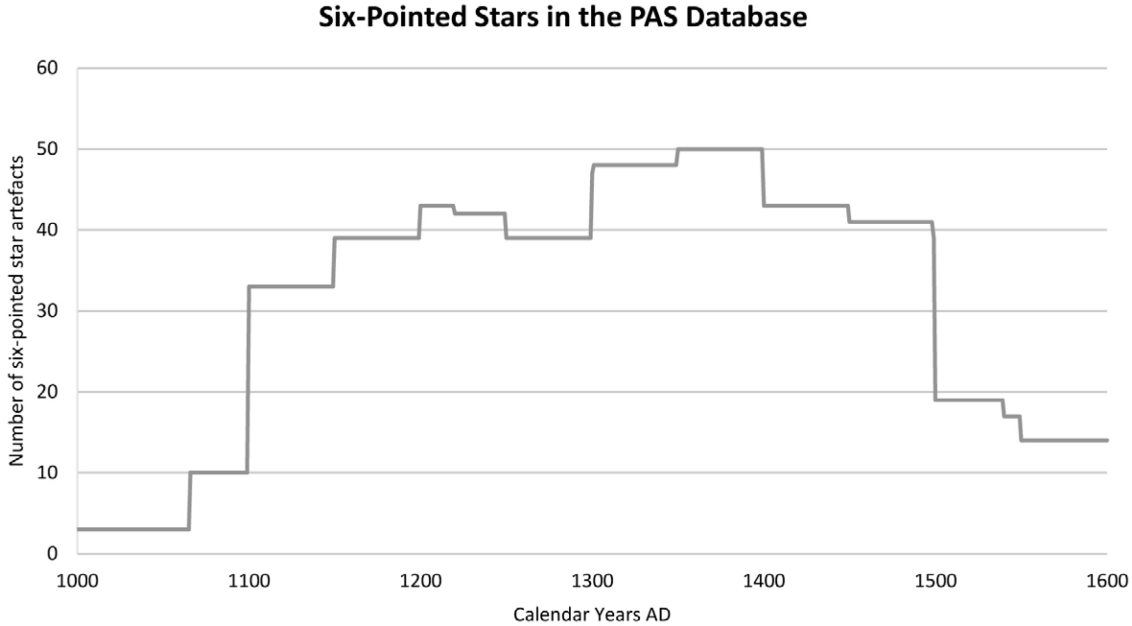

Figure 5.27: The number of artefacts in the PAS database bearing six-pointed star motifs against time as of 01/10/2016. Created by the author.

but the 14th century stands out as the time when the symbol was most common. It should be remembered, however, that this chronology is somewhat crude as many of the artefacts can only be dated broadly to a period sometimes spanning two or three centuries. Geographically, the artefacts bearing the six-pointed star symbol appear to be most common in the east of England with a few examples also found in the north west, central and southern England (see fig. 5.28). Kent is notable by the complete absence of finds bearing the six-pointed star motif although clearly the symbol was known in this region and this is perhaps related more to the biases of the PAS data rather than actual differences in the use of the symbol. Perhaps noteworthy is the frequency of the symbol on spindle whorls, "the most ubiquitous item associated with women's work" (Gilchrist 2012: 146), representing over 25% of the artefacts bearing the six-pointed star motif. An interesting parallel may be the fact that Champion (2015a: 39) theorizes that compass-drawn graffiti was likely inscribed using scissors which were most commonly carried by women. The frequent graffiti of another symbol, that was certainly current within the female arena, may provide further evidence that women were often the creators of these ritual marks of protection.

In support of the interpretation that the symbols on pillar D2 were intended to protect against a comparable flood to that experienced at the end of the 13th century is the fact that the graffiti is exclusively inscribed below the high water mark stained on the pillar in 1287 or 1288 and only on the side facing southeast out to sea. Notably, both pillars with appreciable graffiti, B2 and D2 are the only two octagonal pillars on the south side of the nave, the others being cylindrical, with the flat faces of these pillars probably preferentially selected over the curved surfaces of their neighbours. Of course, the location of the graffiti may not be of great significance—it may simply relate to where

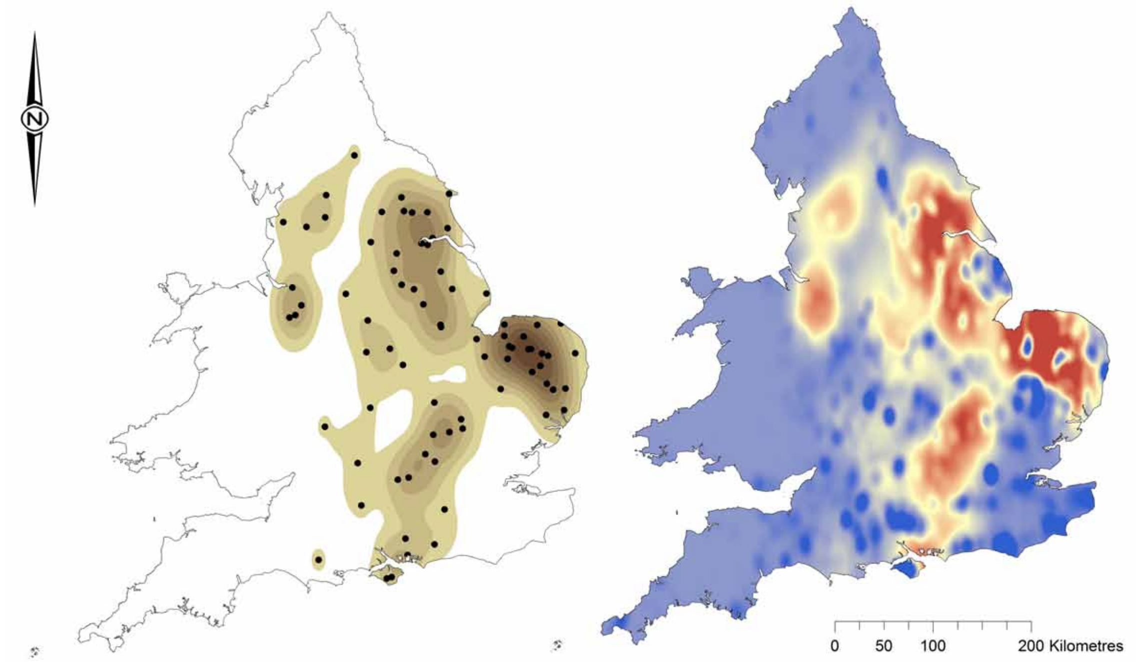

Figure 5.28: Left: Distribution map of artefacts in the PAS database bearing six-pointed star motifs as of 01/10/2016. Right: A comparison of the distribution shown to the left with the wider distribution of all medieval period finds in the PAS database. Areas in red correspond to higher densities relative to the PAS database as a whole while areas in blue denote areas which are under-represented relative to the PAS database. Created by the author.

the parishioners of New Romney found themselves standing during Church services—and other interpretations of the motivation behind its inscription are possible. For any coastal community such as New Romney, in which fishing and ocean-going trade represented important contributions to the local economy, protection from the dangers of the sea would have been important and such inscriptions could relate to a more general desire for protection rather than an explicit response to the storms of the 13th century. The concentration of graffiti on D2 may also relate to the fact that during the medieval period a shrine to St George was situated against the south wall opposite the pillar. The cult of St George was relatively popular throughout medieval Kent and, as with all saintly shrines, the intercessory power of the saint would have been believed to offer extra protection (Good 2009: 97, 161) which would have enhanced the efficacy of these ritual symbols. As always with medieval graffiti, dating is extremely difficult and in this case it is not possible to say at what time during the medieval period these symbols were carved into the pillars. One possible interpretation, however, is that the memory of the flood led the parishioners to seek protection from a recurrence of such a disaster through the inscription of protective marks inside the parish church to ward off evil spirits that might bring a future tempest to their town. Parallels for this graffiti can be found in nearby churches. At Winchelsea St Thomas, East Sussex, for example, a corpus of 11 graffiti depictions of ships on pillars opposite the site of a chapel of St Nicholas have been recorded (Dhoop 2016: 158-164; see fig. 5.29). These graffiti ships are loosely dated by the construction of the church and the style of the ships depicted to *c.*1290-*c.*1530 (Dhoop 2016: 164).

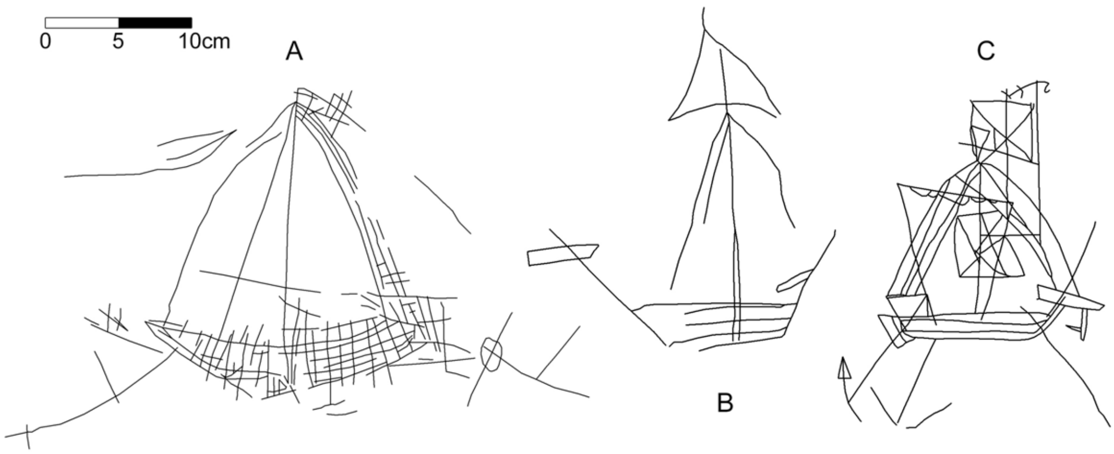

Figure 5.29: Three examples of medieval ship graffiti. A: The ship graffito from the south wall of the church at Broomhill, East Sussex. B and C: Two of the graffiti ships from Winchlesea St Thomas, East Sussex. Redrawn by the author after Gardiner (1988: 123, fig. 10.9) and Dhoop (2016: 160, fig. 64, ST5 and ST1).

Another graffiti ship was uncovered on the south wall by the doorway during the excavation of the church at Broomhill, East Sussex, (see fig. 5.29) which Gardiner (1988: 122-125, fig. 10.9) suggests was rebuilt after the loss of an earlier church in the 1287/88 storms. In common with the graffiti in New Romney, these graffiti depictions of ships may relate to accruing protection from the sea, which given the occurrence of the 1287/88 storms and other storms of the 13th and 14th centuries, would have had particular poignancy for the medieval populations of both Winchelsea (Dhoop 2016: 223) and Broomhill—just as they would have across a wider area for the inhabitants of Romney Marsh and neighbouring coastal areas.

5.11 Summary

From the different strands of material evidence discussed above it is clear that, throughout the medieval period, an extremely diverse web of methods were believed to provide protection from nature's extremes. For many of these it is extremely difficult to quantify the extent to which they were relied upon: a high proportion of saintly relics were lost at the Reformation, images of the Saints in churches have been lost or obscured through campaigns of iconoclasm and later renovations, medieval church bells are rare survivals and graffiti is invariably almost impossible to date beyond very broad periods. For some categories of evidence, the PAS does allow some measure of quantification, although there are inherent biases within the data. Some trends suggested by the different categories of evidence are the preponderance for deposits and graffiti to be focussed around liminal areas or boundaries such as doorways and windows. Particularly in churches, the north wall, which was associated with the Devil, was also seen as requiring special protection. With more portable forms of protection, such as pilgrim badges, *ampullae*, folded coins and material culture relating to the cult of the Saints, there does appear to have been a rise in material culture during the 14th and 15th centuries associated with protection. This was a time associated with major changes, most notably the Black Death, the aftermath and memory of which, in concert with the punctuated return of plague during the centuries which followed and the continued climatic upheaval caused by the transition to the Little Ice Age, may have created a milieu in which society as a whole accepted superstitious explanations and subscribed to apotropaic protective practices more readily. Certainly, Bailey (2001: 986-987) identifies a key change in patterns of beliefs related to magic and witchcraft after *c.*1350 and witch hunts across Europe demonstrably increased in frequency and vehemence during this time (Behringer 1999). Other than the three saintly cults explored above, a number of others can be demonstrated to have markedly grown in popularity shortly after the mid-14th century, for example the cult of the holy name of Jesus (Blake *et al.* 2003: 177).

Chapter 6

Memories of disaster

The preceding chapters have explored how natural hazards, and the disasters they engendered, were perceived, their short-medium term impacts and the steps which medieval society took to secure protection against them. A further important aspect to the 'experience' of disaster during the Middle Ages is the role of memory in preserving and transmitting knowledge of past events to future generations and in turn increasing preparedness and resilience in the face of future hazards. To what extent the occurrence of disasters feeds into a positive feedback loop, or 'adaptive cycle' (Forlin & Gerrard 2017), of this kind; in which each event provides new knowledge and experience from which successive generations can positively enhance collective social resilience, is a question of current relevance in studies of disasters, as well as change in complex systems more generally (Gunderson 2010; Angeler *et al.* 2015). Some have questioned whether any such loop exists at all—according to Uekötter (2004) the impact of natural disasters on the wider arc of history is akin to the behaviour of aggressive bees: "they sting and then they die";[1] the idea being that although their short-term, acute impact can be painful, this is rapidly overcome and forgotten. While this is perhaps true over the *longue durée*, especially in the case of low frequency events with a high return period,[2] on the time-scale of decades and centuries, focussing on events with a return period under 100 years, this approach seems to ignore longer-term reverberations which disasters can trigger across society.

When considering long-term social memory of hazards, it is important to recall that the short-term impacts of hazards—the destruction of a town's harbour facilities by storm surge flooding or widespread flooding throughout a city centre, for example—frequently force human decisions which have long-term implications for settlement, infrastructure and the re-orientation of established economic trends. In addition to such secondary impacts, certain types of hazard generate highly protracted direct physical impacts. Droughts and famines, for example, have direct impacts which last for considerable periods of time. In the case of famine, malnutrition can leave a lasting negative effect—unborn children and infants who grew up under famine conditions in the

[1] "Sie stechen, und dann sterben sie".

[2] Even in the case of absolutely catastrophic events such as the 8200 BP Storegga Slide tsunami, which Weninger *et al.* (2008: 16) estimate affected up to 3000 individuals during the relatively low population densities of the Mesolithic, the event has left no identifiable trace in communal memory; it has been effectively forgotten and is now known only through its 're-discovery' by modern scientific enquiry.

20th century were marked out in adulthood as shorter in stature, less economically successful and in some cases less healthy than those who grew up under normal conditions (Huang *et al.* 2010). In some cases, such a life history can be inferred through analysis of archaeological skeletal remains (Annis *et al.* 2018: 136). Flooding too leaves a long term imprint, both on the environment and on those who experience it, with appreciable negative impacts on the mental health of those affected (Fernandez *et al.* 2015). Clearly, in addition to tangible impacts, the experience of disaster also has a profound long-term impact on the psyche of those who live through such events.

While such long-term impacts are apparent today, it is doubtful whether they were readily appreciated during the medieval period. Long-term memory of extreme natural phenomena, however, may have been preserved in other ways or with different agendas in mind. Modern memorials to disasters often serve multiple purposes; these may encompass assisting survivors in coming to terms with loss, acting as reminders to avert similar future occurrences or for political and/or religious motives. In this chapter the different categories of evidence for disaster memorialisation during the medieval period are discussed. In doing so, the role that any preservation and transmission of memory played in bolstering resilience from recurrent disasters, if any, will be investigated. Particularly, any evidence for the existence of positive feedback loops or 'adaptive cycles' in amplifying medieval resilience to natural hazards will be assessed.

6.1 Memory in the past

Natural disasters can have profound impacts: on the lives of individuals who experience them, the trajectories of settlement development as well as wider economic and demographic trends. As a result, their occurrence was usually highly memorable; forming distinct moments crystallised in the memories of those who lived through them. Over time, as these memories were transmitted to offspring, these would presumably have become looser familial and communal anecdotes as they were passed down to subsequent generations. As oral traditions are repeatedly retold they eventually lose detail, are forgotten or mythologised losing the ability to connect them with the historical event they recall, as conceptualised in figure 6.1. An example may be provided by the belief, retold by Geoffrey of Monmouth (1999: 133-136), that Stonehenge was constructed as a war memorial, reusing stones transported from an earlier structure located on the legendary mountain of Killaraus in Ireland—a story which has been interpreted as a partial, yet mythologised and confused, account of the transportation of the blue stones from the west (in actual fact from Wales) during the Bronze Age (Piggott 1941). Work on oral history in traditional societies suggests that it is possible for memories to be accurately passed down for a maximum of *c.*200 years (Bradley 2002: 14). After this, as in the Stonehenge example, events become mythologised and exaggerated with precise details forgotten. Warren (2015: 214) has demonstrated with the example of hurricanes in the Philippines that, in this context, extreme storms are often forgotten after only *c.*100 years.

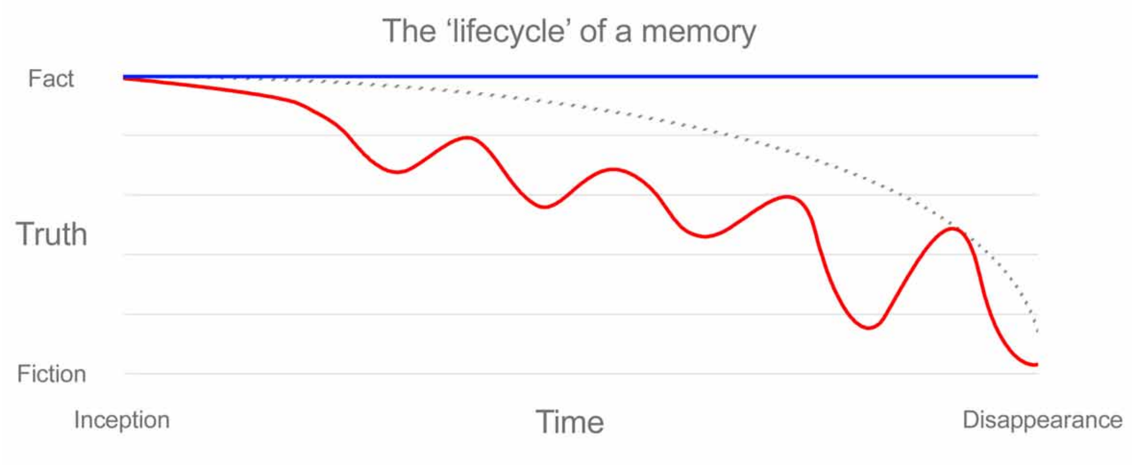

Figure 6.1: The 'lifecycle' of a memory. The blue line indicates an idealised transmission of a memory over time in which the memory is perfectly transmitted to future generations without loss of knowledge or the introduction of incorrect or fictional elements. The red line presents a more realistic model in which the memory slowly deteriorates from a factual representation of real events to an account which, as a result of inaccuracies introduced over time, has become more and more mythologised and is eventually more or less a fictional account. The dotted line indicates the trend line. One problem with this model is that memories are not in fact absolute truth at their inception, as they are influenced by the viewpoint, biases and beliefs of the witness to the events they recall. Created by the author.

Of course, hurricanes are a common occurrence in the Philippines and this perhaps explains why even the highest magnitude events do not persist in the popular memory for longer, as more recent events surpass the stories of the past, in relevance and immediacy if not necessarily magnitude. It is therefore plausible that in any given society, individual incidences of hazards which are relatively routine and well-known will be forgotten more rapidly than events which sit beyond what is considered normal or is at least known within living memory. Although it should be noted that while the occurrence of a specific disaster might have been forgotten, this does not necessarily imply that important ancestral wisdom concerning how to cope with that type of hazard also ceased to be remembered.

Natural hazards directly affect a limited number of people and statistically, during the medieval period, these were most likely to be peasants, a group affected both by poor literacy and the low survival of any documentary evidence they did create. In institutional and official records, which survive in far greater numbers, while the occurrence of natural disasters themselves was often recorded, although usually in low detail or for very specific reasons, the way in which these events were remembered by affected individuals in the years that followed was almost never a subject which merited documentation. As a result, exactly how memories of natural hazards were created, maintained and transmitted during the medieval period is a difficult subject to approach from documentary sources.

In some respects, the medieval period has been conceptualised as a time when memory and the past were relatively unimportant, at least compared to those periods which preceded and followed. Borg (1990: 1-3), for example, has noted the lack of obvious war memorials from the medieval period compared to Roman antecedents and the equestrian statues which rapidly appeared following the Renaissance.[3] Similarly, Hinton (2005: 223) has interpreted medieval material culture as signifying little interest in old things while, according to Gerrard (2007a: 170), evidence for medieval interaction with artefacts from earlier periods displayed "a rejection or suspicion of material links with the past"—new, therefore, seems generally to have been preferred to old. That memories and the past were important to medieval people, however, is demonstrated by various strands of evidence including the curation of old objects, probably often family heirlooms, in archaeological assemblages (Gilchrist 2012: 237-242), the foundation of churches and ecclesiastical institutions to commemorate past events (Borg 1990: 4-6) as well as the popularity of the cult of the saints which purported, and was widely believed, to commemorate historical events—the past mattered.

That natural disasters were communally remembered during the medieval period also occasionally finds confirmation in the documentary record. Edward Hall, an early 16th century chronicler, for example, was well able to recount the devastating 1483 flood on the Severn, near Gloucester, which occurred 65 years before the publication of his chronicle, 14 years before his birth, and was apparently well known amongst the local community (Hall 1809: 394; Rhodes 2006: 33). Understandably, high magnitude events appear to have provided particular cause for comment and subsequent memorialisation. Such events, which transcended accepted norms, were frequently described with the adjective 'great'[4]—as indeed has been the case in many more recent natural disasters.[5] The extreme drought of 1540, for example, was described as a 'great drought' by English contemporaries (Fabyan 1811: 701; Bailey 1853: 411) while the use of the word 'great' as a descriptor in a Papal letter written in 1410, describing the storm which inflicted damage to the chapel of St Martin-le-Grand, London, (Bliss & Twemlow 1904a: 208) led Conybeare (1910: 248) to conclude that the chapel must have been a victim of the storm of 1362; which certainly caused severe damage in London and would undoubtedly have still been remembered 50 years later.[6] The 15th century historian of the Abbey of Westminster, John Flete,[7] included a description of this storm, and the long period of repairs in its aftermath, in his history of the Abbey's estates (Armitage Robinson 1909: 135). Although Flete himself was not an eyewitness, he no doubt grew up hearing stories from the more senior monks of the ferocity of the 1362 storm. That laymen held similar recollections of that storm may be suggested by the inclusion of the St Maur's Day storm in a calendar of saints' days and historical events at the beginning of an early 15th century Bible thought to have been

[3] Although note that some medieval battles did attract memorials such as the cross erected after the Battle of Neville's Cross, Durham, in 1346 (Holland 1835: 176-177) and the 'Battle Stone' which marked the site of the 1388 battlefield at Otterburn, Northumberland (Tyson 1992: 77).

[4] Or Latin '*magna*'.

[5] Examples include the 'Great' blizzard which affected the Atlantic coasts of the US in March 1888, the 31st January/1st February flood of 1953 which is commonly remembered as 'The Great Flood' in England (and the events of that night are thoroughly documented in Hilda Grieve's 1959 book 'The Great Tide: The Story of the 1953 flood disaster in Essex') as well as the 'Great Storm' of 1987 in England (Burt & Mansfield 1988).

[6] More detail on the storm is provided in Chapter 3.3.

[7] b. *c.*1398 d. 1466.

produced for a lay Londoner (Solopova 2016: 211, 214). Furthermore, notes in the margins, or on otherwise blank pages, of ecclesiastical books from the 15th century commonly referenced the St Maur's Day storm,[8] highlighting its recollection, at least by monks in the *scriptorium* if not by the wider populace.

Documents which describe natural hazards quite tangentially also occasionally hint at the persistence of memory. In describing the flood of 1338 in Marshland, for example, the historical material gathered by Dugdale records that "within the compasse of *Lx.* years then past, one Parish Church, with the Parsonage, was by the breaking in of the Sea, ruined: and within *xxx* years, a Mannour house. . . with an hundred acres of Land, utterly lost for ever" (Dugdale 1662: 255). Another example comes from a Papal letter dated to 1404 or 1405 which mentions how a parish church "had been founded of old" near Newton, Cambridgeshire, at a place called "Saltmarsh" and "through storms of the sea and flooding tides . . . been devastated and abandoned and transferred to a place more remote from the sea" (Bliss & Twemlow 1904a: 24-25). In both cases, exactly when the old parish church was abandoned is unknown but candidate events for the marine flooding include the storms of 1287/88, which affected a number of towns nearby (Pawley 1984: 74; see tables A.1-A.3). In the latter case, the marine inundation of 1338, which reportedly swept away the church of Walpole St Peter, Norfolk, (Pevsner 1962: 745; see Chapter 4), situated less than 8km from Newton, is another candidate which would fit well with the devastation described and would equate to the survival of memory of the event for some 67 years. These cases, as well as those presented above, make it apparent that relatively precise memories of disasters and information relating to the occurrence of hazards easily endured for 50 years and sometimes more.

In other cases it appears that oral traditions recounting the occurrence of disasters could survive for considerably longer. Considering the 1345 Gauldalen landslide,[9] for example, local oral traditions of the event, some of which were contradictory, persisted at least to the 1770s, over 400 years from the event, when they were first recorded by the historian Gerhard Schøning (Helland & Steen 1895). Although in this case, a near contemporary written account of the disaster does survive[10] in the form of the Icelandic *Skålholt Annals* (Storm 1888: 211-212), the oral tradition includes some details that are not mentioned in the documentary account, most notably the fact that the disaster was preceded by the disappearance of a lake known as Hagevatnet, a fact which Rokoengen *et al.* (2001) interpret as key to the unfolding of the entire disaster. A similar survival of an oral tradition is provided by Morris (1907: 6), writing in the early 20th century, who was able to report a local tradition that, during the besanding of the medieval town of Kenfig by aeolian sand, some houses were engulfed so rapidly by sand that the inhabitants had to be dug out of their homes to be

[8] See for example: DUL MS Cosin V.iii.19 f. 19r; HL HM 37539 f. 154; HL HM 28174 f. 143v.

[9] This event is discussed in more detail in Chapter 3.4.4.

[10] Perhaps as a result of this 'external storage of memory' the survival of the local oral tradition was assisted in a way that would not have been the case in completely non literate societies.

rescued.[11] The oral record of the storms of 1287/88 provides another case of a possible survival over the long-term. Knowledge of the storm certainly existed into the early 19th century as the remains of a medieval ship, unearthed in a stretch of the River Rother, were initially interpreted as a wreck damaged and sunk during the storms of the late 13th century (Wallis 1823: 84-85).[12] Equally a local legend of unknown antiquity reported by Scott (1965: 29) purports that an outcrop of holly trees near Lydd, Kent, are the only remains of trees planted by a Frenchman named Stepvans, the majority of which were buried by shingle on the night of a storm in 1287. Whether an oral tradition of these storm events persisted uninterrupted from the 13th century until the recent past or was 're-kindled' by a more recent discovery of documentary evidence is difficult to gauge. All of these examples indicate the possibility that oral traditions recording medieval disasters may have survived for several hundred years transmitting information which, theoretically, could have assisted future generations dealing with the same type of hazards. In the case of the Gauldalen landslide, if the disaster did unfold according to the model proposed by Rokoengen *et al.* (2001), knowledge of the oral tradition could conceivably help interpret the disappearance of another lake under similar circumstances, to understand what might happen next and plan accordingly. In the case of the sand inundation at Kenfig, the knowledge that sand could envelop human habitation in this way might encourage active preventative measures and provide an example of how to act if such unfortunate circumstances did arise while the tradition related to the 1287/88 storms contributed to a more general awareness of the risk from storm events in the local area.

When particularly severe events struck, it was common to compare them to those that could be remembered occurring in the past. This provides another rare glimpse into how memories of disasters were, or were not, preserved. A specific detail mentioned by the anonymous chronicler from the Abbey of Melk regarding the high magnitude flooding which occurred along the Danube in 1501 bears this out as they report that: "within 100 years hardly anyone could remember such a high flood as a 107 year old woman . . . testified" (Rohr 2007: 95). Although less specific, this can also be seen in chroniclers' descriptions of the 1362 gale which include descriptions of the storm as like nothing "seen or heard before . . . in England" (Scott-Stokes & Given-Wilson 2008: 119) or "it was thought [nothing similar] had been seen in earlier times" (Martin 1995: 185). The inscription documenting the 1342 flood at Würzburg, meanwhile, describes how during that event water "reached as high as never before" (Dotterweich *et al.* 2003: 148, fig. 7) and the conditions experienced during the drought of 1540, by some estimates the driest summer across Europe in the last 1300 years (Büntgen *et al.* 2006; Wetter & Pfister 2013), "had scarcely ever been known in the kingdom" (Bailey 1853: 411). Although most of these events were verifiably unprecedented—well explaining such claims—these comments must be regarded critically. As Favier

[11]Although note that in this case it is unclear precisely when the sand movement that the memory relates to occurred as although problems with sand occurred at the site from the early 14th century, these were ongoing into the post-medieval period (Wessex Archaeology 2012b: 3).

[12]This vessel is now thought to date to a significantly later date, *c.*1500 (Fenwick 1978: 258-260).

and Granet-Abisset (2012: 120-121) rightfully point out, such claims are routinely made today in the modern media's reporting of natural catastrophes, even when the events themselves are both routine and well precedented. As the occurrence of natural disasters was frequently exploited by medieval populations to petition for concessions in taxation, or other dues owed,[13] and the description of the event as completely beyond human experience can only have helped their case. In some cases therefore, such descriptions may have been exaggerated to amplify the potential to renegotiate existing obligations afforded by the disaster.

While, clearly, medieval memories of natural disasters were made, transmitted and preserved, they remain a complex topic. Memories which exist only in human consciousness are in some regards like ripples in a pond, beginning as quite pronounced disturbances, over time giving way to more gentle movements before fading out altogether. At the same time, however, at any given point along a memory's life-cycle it may, quite suddenly, change its character or absorb new aspects as the memory is retransmitted and internalised through iterative retelling. Through each oral retransmission a memory must pass through two 'filters', conceptualised in fig. 6.2—what the teller chooses, consciously or not, to include and exclude from the transmission and what the listener chooses to hear and remember. Of course, in a complex, literate society as existed across medieval Europe, there were many additional ways to encode and transmit memories which, to some extent, bypassed this 'filtration' system. The remainder of this chapter, therefore, considers a number of different ways in which society created and preserved memories relating to natural disasters during the medieval period.

6.2 Popular verse

The transmission of popular verse was an important method of spreading and communicating news of events. In an age without newspapers, radio or modern digital media, news from the wider world was relayed largely by word of mouth. Poetry played an important role in this process, presumably from an early date, not only enlivening news from far and wide but also packaging it in a form that could easily be remembered and passed on to family, friends and neighbours. The occurrence of natural disasters, as in modern news reporting, was a topic which readily excited popular interest and was therefore commonly encoded in this way. In medieval Welsh poetry, for example, extreme weather events such as floods and anomalously cold seasons were frequent subjects (Griffiths *et al.* 2017). Verse continued to be a key way in which memories were preserved into the post-medieval period, with a significantly larger corpus of surviving source material as the invention of printing facilitated the spread of such material (Pfister 2011: 8). Ballads were also an important method by which news of disasters, including the occurrence of environmental hazards, as well as criminal executions, was disseminated in post-medieval England (McIlvenna 2016). Medieval poetry operated

[13] As was the case following the Fenland floods of 1338; see Chapter 4.

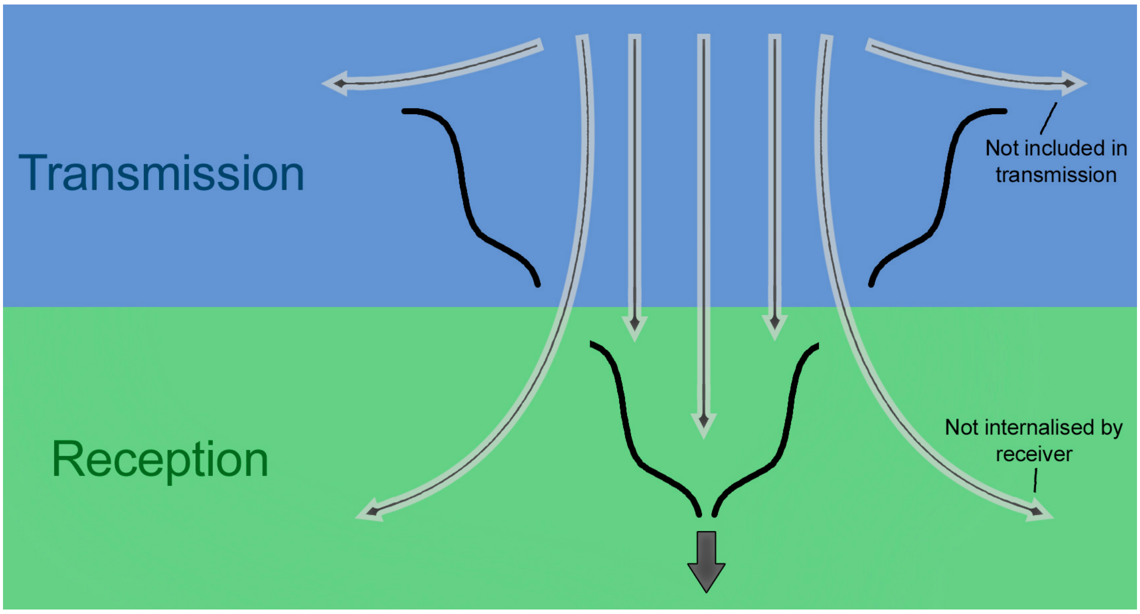

Figure 6.2: The transmission and reception of memories. Where memories are transmitted orally they are 'filtered' iteratively at each retelling. As a result details are lost as certain pieces of information fail to be transmitted while, of the data that is transmitted, some fails to be properly received. Each transmitter and receiver may also introduce their own embellishments which were not present in the version of the memory which they originally received. Created by the author.

in much the same way providing a source of news that did not require literacy and could easily be remembered and recounted and, as with early modern ballad performance (McIlvenna 2016: 290-291), musical accompaniment enhanced the popularity and, therefore, the longevity of these works.[14] As a medium for transmitting and encoding the occurrence of events, verse operated in a complex way. As outlined by Griffiths *et al.* (2017), for poetry to pass from the mind of the poet into wider society—and survive into the present—it first had to be pondered on and composed by the poet and then performed in front of multiple audiences. At some point the poem had to be written down or taught orally to others in order for it to spread. Where textual copies survived these were, over time, collected, read and examined by scholars and interested parties. In some cases, poems may have been completely forgotten in the oral tradition only to be rediscovered in manuscript form. In this way, knowledge of the events discussed in a poem would have "waxed and waned across the centuries" and would be "recalled and recycled at particular times depending on access and interest" (Griffiths *et al.* 2017: 104-106).

Popular verse relating to natural disasters presumably flourished, and reached a large audience, only when hazards affected a sufficiently high number of people across a wide enough area, allowing the promulgation of verses that were meaningful to a large number of people. The storm of 1362 fits into this category as it affected the whole of southern England and as such the majority of

[14]Examples which seem to date from the medieval period include *Sir Patrick Spens*, which Walter Scott (1807: 295-298) interpreted as a mythologised memory of a voyage undertaken in the late 13th century, and *The Battle of Otterbourne*, which preserves memory of the English defeat to the Scots at Otterburn, Northumberland in 1388 (Scott 1807: 345-353)

the population could find interest in recalling an experience that many had directly experienced and all knew something about. Regional and local disasters on the other hand, affected a much smaller number of people and as such, although verses may have been composed and known locally, it was less likely that these would survive over a number of years or be recorded by contemporary chroniclers.

A rare glimpse into the memorialisation of a natural disaster through poetical verse can be found in the case of the St Maur's Day storm of 1362. As has already been described above, a number of different strands of evidence attest to the fact that this event was widely remembered, at least in literate circles well into the mid-15th century. To this can be added a poetical verse included in John Harding's *Chronicle of England*, composed no earlier than 1436, which seems to have been an original composition made at least 70 years after the storm's occurrence. The verse recalls the magnitude of the wind and the high degree of damage caused across England but also, interestingly, introduces a falsehood—that the storm was accompanied by an earthquake. This fact goes unmentioned in any contemporary source with the idea probably stemming from the Aristotelian belief, transmitted to medieval European scholars through texts such as Isidore of Seville's *De rerum natura*, that earthquakes were caused by subterranean winds and eruptions released these winds into the air causing storms (Kendall & Wallis 2016: 173). The inclusion of this detail in the verse can therefore only be a later embroidery to the memory of the storm.

Verse documenting the 1362 storm from John Harding's *Chronicle of England*

In that same yere was on sainct Maury's day,
The greate winde and earth quake' meruelous,
That greatly gan the people all affraye,
So dreadfull was it then and perelous,
Specially the wind was so boistous,
The stone walles, steples, houses, and trees,
Were blow doune in diuerse ferre coũtrees.

(Ellis 1812: 330)

In addition to this later poetical verse, evidence also survives of a number of near contemporary verses related to the 1362 storm. Perhaps most famously, the St Maur's Day storm appears in the allegorical poem *Piers Plowman* (V: 14); its inclusion in which provides a *terminus post quem* for the composition of the poem—which probably occurred within a decade of the storm (Bloomfield 1962: 114). *Piers Plowman* went on to become a highly influential and popular work in late medieval England (Hudson 1988) so the inclusion of the storm in the poem would have done much to perpetuate and spread knowledge of the event.

Two other contemporary verses, which seem to have gained popularity in the area affected by the storm, were written down by the anonymous chronicler who continued Adam Murimeth's chronicle following his death. It appears that from 1359 this chronicler was a contemporary of the events they describe (Hog 1846: xviii), meaning that they were presumably directly aware of these verses being recited among communities that had lived through the storm and were later able to remember them when they came to compose their account of the storm. The two verses documented are given below:

Contemporary verses documenting the 1362 Storm

Latin Original

C. ter erant mille decies sex unus et ille
Luce tua, Maure, vehemens fuit impetus auræ
(Hog 1846: 196)

Ecce flat hoc anno Maurus in orbe tonans
(Hog 1846: 196)

English Translation

One Thousand, three hundred, sixty and one
Your light, Maur, vehemently attacks the air
(Translated by the author)

Behold! in this year, Maurus thunders in the world
(Translated by the author)

These two short phrases, it can easily be imagined, became widely known and were frequently repeated by people across England, especially in the area affected by the storm, providing a way of commemorating an unprecedented event that probably touched nearly everyone in some way. The widespread popularity of at least the latter of these phrases is confirmed by the fact that it was engraved at the base of the tower of the church of St Mary, Ashwell, Hertfordshire (fig. 6.3). The last line of this graffito, transcribed below, excluding the first two words, and first letter of the third word, is almost a perfect match for the verse given in the continuation of the Chronicle of Adam Murimeth (Hog 1846: 196). This not only provides material evidence for the wide circulation of these verses; it also suggests something of their authorship. In relation to memorials, including popular verses, which recalled the famine of 1315-1322, Jordan (1996: 183) notes that these were most commonly penned by those below the upper echelons of society; by people who were literate but in touch with the common lay population such as friars, University masters or parish clergy. At St Mary's, Ashwell, the evidence suggests that the creator of the inscription was most likely a literate mason. Timbers from the tower post-date the storm of 1362 (Miles *et al.* 2003: 110-111) and the inscription is at least 2m above ground level suggesting that scaffolding may have been in place when it was inscribed—as it would have been both difficult and unnatural to engrave it at this height from the current floor level. This advances the possibility that the tower itself was damaged in the storm and that one of the workmen employed to repair the damage, a literate stone mason, decided to commemorate the event by carving an inscription into the wall of the tower where he was working. That the masons working on the tower had no qualms about marking the walls is suggested by a double column of figures carved nearby which has been interpreted as the masons' wage sheet (Champion 2015a: 209).

This particular verse documenting the storm is both concise and low in detail, conveying only the fact that a storm occurred in a particular year. However, if the church itself was indeed damaged in this storm, as the evidence suggests, we can surmise that this well known verse would have had particular relevance for the local community. As such, its presence as an inscription within the church itself would have bolstered the survival of local oral traditions preserving knowledge of the storm.

The inscription at St Mary's Church, Ashwell, documenting the 1362 storm

Latin Original

[mccc]xlix
pestilencia
M C T Xpenta miseranda ferox violenta

mcccl
Supest plebs pessima testis in fine que ventus validus

[h]oc anno maurus in orbe tonat mccclxi

(see fig. 6.3)

English Translation

[13]49
There was a plague
One thousand, three times one hundred, five times ten, miserable, wild and violent
1350
The dregs of the populace survive to witness, In the end a strong wind

Behold! in this year, Maurus thunders in the world 1361
(Translated by the author)

6.3 Inscriptions

Although not all were metrical in their composition, inscriptions which commemorated the occurrence of extreme natural events were a relatively common method of creating a lasting memorial. Another in an ecclesiastical setting can be found at the church of Saint Katherine, Oppenheim, Germany, where the famine of 1315-1322 was commemorated in 1317 by an inscription and carving which sought to remind future church goers of the high-price of bread during this time of dearth (Jordan 1996: 184). This carving dates the construction of the church to 1317 and in this case, as with the inscription in St Mary's, Ashwell, it seems almost certain that it was inscribed by one of the masons working on the church. This is absolutely certain in the case of an inscription which originally

Figure 6.3: The graffito at St Mary's, Ashwell, Hertfordshire, engraved at the base of the tower. The text, highlighted, describes the outbreak of plague in 1361 and goes on to mention the storm of St Maur's Day 1362. The last line is nearly identical to a popular verse given by a contemporary chronicler. Photograph by the author. Inscription artificially highlighted.

occupied the wall of a house in Würzberg, Bavaria, which records the flood of 1342, the damage it wrought to the town as well as the name of the mason who built the house (Campbell 2016b: 283, note 64). Whether masons acted independently in the creation of these memorials or were compelled to do so by their clients is unknown although some inscriptions, such as the one in Würzberg, display an attention to detail that suggests they are unlikely to have been haphazard unplanned additions—a scenario which is much more likely in the case of a relatively untidy *graffito* such as that in St Mary's, Ashwell.

Examples of inscriptions can be found which recall the occurrence of many different types of hazard. As already described, examples are known commemorating storms and famine while comparable inscriptions are also a common feature in ecclesiastical settings memorialising repairs and restoration necessitated by earthquake damage—as in medieval Italy. One such example, at the church of San Mauro of Costozza in Vincenza, is a 14^{th} century inscription recording the earthquakes of 1117, 1222 and 1348 (Forlin & Gerrard 2017: 104-105). Commemorative inscriptions were also widely created to recall destructive floods. The 1342 flood in central Europe provoked the creation of a number of inscriptions, in addition to the one from Würzberg mentioned above, which typically detailed the ferocity of the inundation and the extent of flooding.[15]

The St Elizabeth's Day flood of 1421, which devastated settlements in South Holland, is another example memorialised by a number of inscriptions, in this case found in Dordrecht, South Holland. One such inscription, transcribed below, comes from inside the city's Grote Kirk, from the south

[15] See for example DI 66, Lkr. Göttingen, Nr. 9 [Online] http://www.inschriften.net/landkreis-goettingen/inschrift/nr/di066-0009.html [Accessed 16/08/2018].

wall by a door underneath the organ.[16] Another was installed above the Spuipoort, one of the city gates. Whilst the former appears to have been installed shortly after the event it recalls, the latter inscription only appeared in 1609, almost 200 years after the event it commemorated (Balen 1677: 770). Clearly, memory of the event in the town survived for a long period although as other strands of evidence make clear this was not without fictional embroidery of the historical facts. The flood destroyed a number of villages located in the Grote Ward and Dordrecht was one of the towns to which the survivors relocated—a fact which must have meant that memory of this event was particularly strong in Dordrecht. The survival of local memory was reinforced by the fact that, at least into the early 16th century, the remains of the inundated villages could still be seen when sailing in the area (Junius 1588: 182-183). Local folklore surrounding the flood, however, soon developed as Pollman (2017) has explored. One tale, frequently retold centuries later, concerned a baby who had apparently been found during the flood floating in a basket accompanied only by a black cat. This story must have surfaced relatively soon after the flood's occurrence as it is depicted on the left panel of the St Elizabeth's Flood Altarpiece (see fig. 6.4), which was painted in the early 1490s to commemorate the flood. For centuries after the flood certain families in Dordrecht claimed descent from this child, who was either male or female depending on who was asked. The number of villages destroyed by the flood also swelled over time to 72, an auspicious number in Christian theology, and this inaccurate detail was included in both of the inscriptions recording the flood in Dordrecht. Clearly, in this case, the memory of the event was embroidered relatively quickly after the event's occurrence and perpetuated through these inscriptions. As medieval inscriptions of this type are usually concise, while they ensure the preservation of some knowledge of the event, they fail to prevent the embroidery and fabrication inherent in the long-term oral transmission of memories. Where such invented and mythologised elements are included in the inscription they can even perpetuate the survival of inaccurate information.

[16] This information comes from the website of the Regional Archief Dordrecht, inventory number: 551_30149. Available at: http://beeldbank.regionaalarchiefdordrecht.nl/. [Accessed 02/03/2018].

Inscription commemorating the flood of 1421 in the Grote Kirk, Dordrecht, South Holland

Latin Original

A[NNO] XP̄I: 1421 NOVĒḂ 18 SV[BMERSAE]
MĀ[N]SERV̄[N]T 72 VILLE C[ON]TINVE
[DORDRACO]
(van Gijn 1908: 197)

English Translation

In the year of Christ: 1421 November 18 72 towns
were permanently submerged around Dordrecht

(Translated by the author)

Inscription commemorating the flood of 1421 originally installed above the Spuipoort, Dordrecht, South Holland

Dutch Original

T Landt en Water dat men hier siet ware[n] 72 proch[y]en na chronicx bediet
geinundeert devrt water crachtich int iaer 1421 waer achtich
(Balen 1677: 770)

English Translation

On the land and water seen here, 72 parishes, as the chronicle says,
were inundated by the force of the water in the year 1421
(Pollman 2017: 124)

6.3.1 Flood levels

In addition to merely documenting qualitatively the impacts of particular inundations, in the case of floods, and more rarely droughts (Macdonald 2007: 136), inscriptions presented a method of preserving memory of the height reached by floodwaters in a given event at a particular location. The height reached by floodwaters is an important piece of information which both reflects the severity of the inundation and assists future measures to prevent such an event recurring through future planning; erecting flood defences or zoning (re)construction away from areas which are commonly flooded. Evidence that this information was frequently noted and remembered can at times be discerned from other forms of evidence. John of Oxnead, for example, recorded that the flooding caused by the December 1287 storm reached more than a foot above the high altar of the parish church at Hickling, Norfolk (Ellis 1859: 270-271) while in New Romney, Kent, oral memory persisted that the pillars of the church of St Nicholas were stained at the level reached by storm tides during the floods of the same season (Grimson 1978: 34; visible in fig. 5.26). While such documented or orally transmitted memories of the levels reached by floodwaters were useful, flood marks, also called Noah's marks, represent a permanent material memorialisation of this information which were relatively commonly erected in towns exposed to flooding, although not in all areas (Griffiths *et al.* 2017: 103). An example can be found at Hannoversch Münden, Lower Saxony, (Hoffman 2014: 325-326) where an inscription on the parish church was set at the level reached by the floodwaters during the high magnitude flood of 1342. A later example comes from Krems, Austria, where a number of inscriptions were affixed around the town, including to the city gates, recording the level reached by flooding as a result of ice[17] on the Danube in 1573 (Rohr 2013: 137-138). Some cities, which were continually affected by flooding, such as Rome, are littered widely with inscribed river level markers dating to the medieval period (Aldrete 2007: 55-56). A rare documentary reference to such marks is found in a 1341 confirmation of land relating to the town of Saint-Émilion, in the English possession of Gascony, in which the boundaries of the town's jurisdiction are described in reference to local landmarks including two flood marks (Maxwell Lyte 1900b: 161).

Flood marks provide a valuable means of preserving knowledge of the levels reached along particular catchments during past flood events—extraordinarily useful information for increasing resilience in the face of flooding. Such data can inform future decisions and enhance efforts to protect areas already exposed to flood risk. However, one major problem with flood marks is their impermanence. Most frequently, flood marks were inscribed on bridges or walls close to river banks—areas which were especially vulnerable to damage from the hazard they memorialised (Macdonald 2007: 138). Many medieval flood marks, it can therefore be assumed, have been lost while, of those examples which have survived, it is rare that their present location can confidently be assumed to be where they were originally erected or inscribed. As relocation might raise or lower the flood mark from its proper, intended, position, many medieval examples can therefore not be trusted as reliable indicators of the flood levels they purport to represent. Even so, the presence of inscribed flood levels, in their original location or not, would have served as continuous reminders of the possibility of high magnitude flooding and the omnipresent need to guard against it to protect local populations in areas commonly placed at risk.

[17] Floes of ice created a dam across the river causing flooding at Krems which affected two thirds of the town.

6.4 Commemorative activities, material culture and other manifestations of memories

6.4.1 Commemorative events

In the modern world, anniversaries provide opportunities for reflection and remembrance and this is particularly the case with regards to natural disasters (for example see Blanchard-Boehm & Cook 2004). Some modern studies have even demonstrated the existence of 'anniversary reactions' in which people who have experienced highly stressful situations, such as a natural disaster or a wartime experience, are particularly affected emotionally and mentally at or around the anniversary of the event they experienced (Assanangkornchai *et al.* 2007). Anniversaries were of great importance during the medieval period—the majority of Church festivals were anniversaries of some kind; Saints' days were usually the date of martyrdom or another important moment in a particular saint's life and the major festivals of Easter and Christmas commemorated dates of particular events in the life of Christ. The annual custom of rogation processions, observed throughout medieval Europe to bless crops, fields and the parish, arose out of commemorative activities reported to have been instigated by Pope Gregory I to combat natural disasters that had afflicted the city of Rome in the 6th century (Latham 2015).

While anniversaries commemorating events known through scripture were of paramount importance to the medieval Church, it is also evident that, in a number of cases, the anniversaries of more recent events were cause for commemoration. An example from the Mediterranean reveals that following the severe flood of 1330 in Nicosia, Cyprus, a procession was conducted on the anniversary of the flood to commemorate those who had lost their lives and preserve memory of the event. That this may have contributed to ensuring that memory of the flood survived may be indicated by the fact that travellers to the area were aware of the risk from the river into the 15th century (Charalambous *et al.* 2016: 196). Another example of a commemorative anniversary event occurred in 1341 when Pope Benedict XII issued an indulgence to encourage attendance at a memorial for victims of famine, presumed to relate to the agrarian crisis of 1315-22, although the documentary evidence is not specific to a particular famine (Lucas 1930: 362).

The lack of obvious forms of disaster commemoration in the medieval period may be misleading. Although perhaps not restricted to anniversaries of the event, it seems likely that commemoration of disasters would have been included in regular church processions, such as those of Rogation, in which, while carrying out blessings for the future prosperity of the town or parish, negative past occurrences, such as natural disasters—and how they could be prevented in the future—must have also been brought to mind. In this vain, Standley (*forthcoming*) alludes to the possibility that a medieval crucifix, discovered through archaeological excavations in New Romney, Kent, along a known procession route in the town, was buried to protect the town against destructive flooding at some point after the storms of the late 13th century.[18] If this was the true intention, such an act, while seeking protection in the future, must have simultaneously commemorated the disasters of the past.

6.4.2 Individual commemoration

In addition to the anniversaries of disasters, in the present, memory is also preserved in relation to individuals who lost their lives as a result of a disaster. In the present, memorials are often inscribed with the names of the dead, commemorative messages are often written in 'books of remembrance' and informal 'shrines' are created at the site of the disaster (Brennan 2008; Maynor 2016). Commemoration of individuals, in the modern sense, does not appear to have been common in the medieval world. A rare exception may be the grave of a chaplain named Ralph who was killed when he was struck by a beam blown down into the interior of the chapel of St Pancras at St Augustine's Abbey, Canterbury, during the 1362 St Maur's Day storm (Davis 1934: 564). Afterwards, we are told that his body was buried inside the chapel beneath a marble gravestone. Archaeological excavations did uncover 14th century burials in the chancel (Blockley 2000: 68) but later interventions had removed the medieval floor surface (Blockley 2000: 60-61) along with any grave slabs, although a slab of Bethersden 'marble'[19] was recorded in a doorway along with 15th century stonework (Routledge 1882: 104). Graves in the nave and entranceway thought to be medieval in date were covered with slabs of Portland limestone (Blockley 2000: 59). Whether any of these inhumations or grave slabs relates to the burial of Ralph the chaplain, however, is impossible to confirm.

Grave markers or commemorative plaques, with or without inscribed names of victims, as would be common today at the site of a disaster, were the exception rather than the rule. It seems unlikely, however, that memories of those no longer present—either those who had been killed as a direct result of a catastrophe or those forced to relocate and move out of an affected area—did not persist. An example comes from the Great Famine in Germany which seems to have driven many inland dwellers from their homes to the coast in search of food. Documentary evidence suggests that memory of this mass migration from the countryside to the coast was remembered at least up until the Reformation (Diemar 1909: 238). A rare example of a memorial to an individual who became a casualty of a natural disaster, on the other hand, comes from Göttingen, Lower Saxony, where a commemorative plaque attached to the base of a crucifix records the unfortunate death of one Hermen Goltsmet who drowned during the "great flood of Saint Margaret's Day [20th July]" in 1342 (Arnold 1980).[20] The reasons for the scarcity of overt individual commemoration are likely twofold: firstly, that low literacy rates reduced the value of erecting commemorative markers in this

[18] Discussed fully in Chapter 3.

[19] This is in fact a type of limestone although this distinction was probably not made in the Middle Ages.

[20] Although the plaque and crucifix are now affixed at the top of the tower of Göttingen's St Albani Kirche this is unlikely to have been their original intended location.

way, a point which is reinforced by the fact that individual grave markers bearing the names of the deceased only became common from the 18th century (Renshaw & Powers 2016: 160), and that, secondly, individuals were remembered in other ways; primarily through oral memory as well as friends' and family members' thoughts and prayers—which have left little, if any, material evidence. One rare manifestation may be the belfry of the Augustinian friary at Clare, Suffolk. As already recounted in Chapter 4, this friary received a large donation in 1363 to fund the construction of a new bell-tower, likely necessitated by storm damage the preceding January. The sizeable donation however, led to the appointment of priests to pray for the souls of the benefactor, his family and "any to which he is obliged". Such prayers, although more often from family rather than Augustinian friars, were probably the primary way through which individuals were remembered after death.

6.4.3 Commemorative material culture

In some cases, memories became intertwined with objects. For example, in 1315, during the Great Famine, the pressure placed on the Cistercian abbey of Aduard in Groningen, by those seeking alms, led Abbot Eylard to order a huge cauldron to be made in order to prepare enough food for the needy. After the famine, the enormous cauldron was displayed to visitors to the abbey even until the 18th century, with its size and the embroidered memory of its provision for the hungry affording it comparable status to a holy relic (Jordan 1996: 110, 230). Somewhat analogous was the wine produced from grapes which matured during the 'mega-drought' of 1540. The long summer drought caused the grapes on the vines to become raisin-like and delayed the grape harvest until rains arrived in late August of that year. The delayed harvest resulted in a particularly prized, sweet sherry-like vintage as a result of the grapes' extra sugar content. Reserved for special occasions, this wine was preserved for many years and was still well known in 1631 when invading Swedish soldiers searched Würzburg for barrels containing the 1540 vintage, although they were unsuccessful in locating them (Glaser *et al.* 1999: 192). Similarly, up until the late 18th century handfuls of (durum) wheat were preserved in Zürich from the 1540 harvest as a reminder of the terrible drought of that year (Pfister 2017: 185). In both cases, relatively everyday objects; a cauldron in the case of the Great Famine, and wine and wheat in the case of the 1540 drought, became imbued with special significance as a result of their relationship with anomalous natural events. As a result, they became vehicles which both visually (the great size of Abbot Eylard's cauldron, or the notably parched nature of the sheaves of wheat preserved in Zürich) and through oral tradition transferred memory of these events down to future generations.

It is possible that certain types of material artefact may have served to propagate memories related to disaster in ways that will always allude the archaeologist. The occurrence of heirlooms in medieval domestic settings, for example, may be one of these, which has been explored by Gerrard (2007a: 179) and Gilchrist (2012: 237-242). The archaeological record attests to the continued use of a wide variety of objects, including ceramic vessels, dress accessories and other miscellaneous artefacts, for two or three generations and sometimes longer. Heirlooms were kept either for their intrinsic or practical value as objects or because of their personal associations. Gilchrist (2012: 248-249) explores a wide variety of heirlooms associated with typical life course rituals, including objects related to birth and baptism, which "constructed family biographies". Although no medieval examples are known, it is easy to imagine how objects which had been saved from a home in the face of an impending natural hazard, as was the case as the floodwaters arrived in the Grote Ward in November 1421 (Kleinhans *et al.* 2010: 70), might have garnered particular significance, "gaining new meaning and status" (Gerrard 2007a: 179), in the memories of survivors and subsequent generations. Certainly, in the case of town fires in medieval Bergen, Hansen (2015: 169) interprets the lack of ironwork among the archaeological assemblage as evidence that ironwork was salvaged from structures damaged or destroyed by fire. A more recent example comes from the devastating explosion of a ship in the centre of Leiden, The Netherlands, in 1807 which resulted in over 150 fatalities and caused thousands of injuries. After the disaster, however, the wooden and metal debris from the ship were collected and curated by survivors and passed down to future generations (Reitsma & Ponsen 2007: 7). Such objects, through their connection to a family member who had survived, and come through, great danger accumulated a distinct object biography (Gosden & Marshall 1999) and might have been perceived as having luck-giving or protective powers. Of course, such sentimental and metaphysical importance attached to heirlooms can only have persisted as long as memory of their connection to the event and family member was maintained. As Gilchrist (2012: 241) notes "their social currency as heirlooms ... diminished as oral memory of ancestors faded". Heirlooms associated with disasters cannot have been common and are unlikely to be identifiable archaeologically but their existence is perhaps less fanciful than it may at first seem and must therefore be considered.

6.4.4 Ex votos

The ex voto is a category of commemoration which fulfils a vow by thanking a saint, saints or other holy intercessor for their help in the past. These can take the form of paintings, other types of artistic depictions or votive artefacts[21] and are found throughout post-medieval Europe (Pfister 2011: 10) but were similarly common during the Middle Ages. They are most frequently found in church settings as the shrine of the saint to which one made the vow was the most appropriate place to leave the ex voto. While most ex votos were cleared away at the Reformation, some examples have survived such as the assemblage of wax effigies discovered at Exeter cathedral[22] following air raid damage during the Second World War. These are interpreted as ex voto offerings which were originally hung by the tomb of Bishop Edmund Lacey who, although uncanonised, attracted pilgrims

[21] As discussed in relation to folded coins in Chapter 5.
[22] Discussed more fully in Chapter 5.

after his death and was held responsible for a number of miracles (Radford 1949). Although an ex voto might be created for a wide variety of reasons; safely coming through childbirth or recovering from illness for example, they frequently memorialise and commemorate disasters and, in doing so, preserve memory in a physical form which would have been both visible and meaningful to future generations. Ex votos are particularly common in relation to sailors, with ex votos dedicated to Saint Nicholas, a known protector of sailors, especially common. Votive ships, often found engraved on church walls (see fig. 5.29), are a similar category which sought protection for particular vessels from saintly intercessors, or gave thanks after the fact. Graffiti depictions of ships are found across medieval Europe including from buildings in Spain (Gerrard 2003: 336-340), Britain (Champion 2015b) and Scandinavia (Westerdahl 2013). Their function has been debated and while in some cases they seem to be depictions commemorating real life events, such as battles at sea, others seem to be related to seeking protection either before or after a journey. In such cases, the engraved ships were material manifestations of prayers for protection and as such commemorated the hazards of the sea they were instigated to guard against.

One of the most impressive examples of an ex voto related to a disaster comes from Dordrecht, the Netherlands, where in the aftermath of the Saint Elizabeth's Day Flood of 19th November 1421,[23] the survivors commissioned an altarpiece to thank Saint Elizabeth for their survival. The altarpiece is composed of two panels which depict the flooded landscape around Wieldrecht (see fig. 6.4). These panels acted as doors to the altar and when opened revealed images from the life of St Elizabeth. The town of Wieldrecht was lost in the flood and its surviving residents relocated to Dordrecht where, in 1438 the churchwardens provided an altar for their use which they furnished with the St Elizabeth altarpiece commemorating the disaster which must have swept away their homes, friends and families (Helmus 1991: 139). They were clearly grateful for their own survival which they attributed to the intervention of Saint Elizabeth on their behalf. As a result, memorialization of the event was probably intimately connected to protection from any re-occurrence in the future.

Another method of fulfilling a vow to a Saint was the foundation of chapels or religious houses as thanks for survival during a hazard. Such foundations became memorials to the event as well as the Saint who had provided their protection. These dedications were, by necessity, made by those with means who could afford to fund the establishment of religious houses. Some royal dedications such as the Abbeys of Hailes (Page 1907: 96) and Vale Royal (Denton 1992: 124) provide examples of houses founded as thanks for their rich patrons surviving[24] natural hazards—in this case storms at sea. Comparably, local folklore from Fingal, Ireland,[25] holds that a chapel dedicated to St Maur

[23]This event is discussed above in relation to the later folklore which grew up around the flood.

[24]Although note that in the case of Vale Royal, which legend suggests was founded as a result of a vow made by Edward I during a storm on his return from the Holy Land, there is evidence that the Abbey was founded prior to the storm suggesting that the Abbey's foundation may have been intended to provide protection rather than as thanks for survival.

[25]See: National Folklore Collection, UCD: The School's Collection, Volume 0786, pp. 56; 130-131. Accessible at: https://www.duchas.ie/en/cbes [Accessed 26/01/2018].

Figure 6.4: The left and right panels of the St Elizabeth's Day Flood Altarpiece. Originally these formed the doors to an altar which, when opened, revealed scenes of the life of St Elizabeth. Rijksmuseum. Object numbers: SK-A-3147-A and SK-A-3147-B. Public Domain.

at Rush was founded by knights caught at sea during a storm in thanks for their safety. Given the dedication, it is tempting to connect this foundation with the 1362 St Maur's Day storm but the architecture of the chapel and the fact that the local legend specifies that the knights were crusaders seems to favour an earlier date. Although in Italian towns many late medieval churches and chapels were founded as ex voto dedications in return for protection from plague (Avery 1966), the practice does not seem to have been common in northern Europe during the same period although monuments, especially monumental crosses and columns, commemorating later post-medieval plagues, especially in the 17th century, are relatively common across Europe.

While dedications usually gave thanks to a saint for survivors' safety in an event's aftermath, in one case the occurrence of disaster has been blamed for the desertion and abandonment of a church due to its connection to a particular saint. Returning to New Romney, Kent, which prospered economically, due to its favourable coastal location and status as one of the Cinque Ports, until the adjustment in the drainage pattern of the River Rother led to the gradual siltation of the town's harbour, removing its access to ocean-going trade. Before these changes, the town had three parish churches (Robertson 1880: 237), dedicated to St Martin, St Nicholas and St Laurence. In the aftermath of the 13th century storms it appears the town's diminished population did not require and could not afford the upkeep of so many churches. As a result two fell into ruin with only one, the church of St Nicholas, surviving the Reformation, while the churches of St Laurence and St Martin were allowed to become ruinous and were eventually pulled down. Robertson (1880: 241) theorized that the reason for the decline of St Martin's church may have been linked to the occurrence of the storms of the 13th century as the first one to be documented occurred in 1236 around the feast of St Martin and would have caused "Men of Romney [to] associate St Martin, and his Festival, with the ruin of their port". It does seem to be the case that the church of St Nicholas gained prominence over the earlier foundation of St Martin by the mid-13th century (Robertson 1880: 241). However, the assertion that storms were the reason behind the abandonment of St Martin's Church cannot be proved and is not wholly convincing. In other cases of disaster, for example the 1421 St Elizabeth's Day Flood in the Netherlands, the saint on whose day the event occurred was honoured for their role in protecting the survivors rather than shunned as a bringer of ill luck. Additionally, although the newer church of St Nicholas seems to have been preferred by the inhabitants of New Romney shortly after the storm of 1236, the church of St Martin continued to exist until 1549, 313 years after the storm, which surely demonstrates that if there was any public fear or ill-will felt towards St Martin, this was either short lived or held by only a relatively small sector of society. Furthermore, the storm of 1236, while a disastrous event as described by the chronicler Matthew Paris (Luard 1876: 379; Luard 1890: 219), was not the event that spelled the end of New Romney's fortunes as the available evidence suggests this change in the Rother's drainage regime had occurred by the 12th century (Rippon 2000b: 191). Therefore, while the occurrence of the 1236 event close to the festival of St Martin possibly led to the preference of the church of St Nicholas over the church of St Martin, this is unlikely to have been the primary reason to demolish the church in the 16th century.

Ex votos—including pictorial representations, votive figures and dedications—did not generally preserve particularly useful information for future populations in how to deal with natural hazards in a practical sense. However, within the medieval world view, they served a very important purpose. By providing a lasting manifestation of prayers and vows to the Saints for protection, old ex votos, which were visible in local parish churches, exemplified a method to guard against the danger posed by natural hazards which had seemingly been successful in the past. As such, although from a modern scientific viewpoint vows to the Saints and ex voto inscriptions or paintings are powerless, to medieval populations they provided a powerful means to protect against worldly dangers. Ex voto ship inscriptions and altarpiece paintings, therefore, provided subsequent generations with demonstrations of the efficacy of such prayers and vows in the face of disaster.

6.4.5 Memory and structural repairs

Repairs to structures offer another alley down which memories must have been focused. Buildings and infrastructure damaged by extreme events must have found a prominent place within the communal memory. Structural damage inflicted as a result of a natural disaster caused a sudden disjuncture which was often visible in the fabric of the building long after the subsequent repair work had been completed, which in the case of large buildings such as Cathedrals could be ongoing for over a decade. The new repairs and additions usually differed stylistically from what had previously existed (as in the case of the church of St Nicholas, New Romney, repaired after the storms of 1287/88 or the church of Walpole St Peter, Norfolk, repaired after damage from flooding in 1338), meaning that the structure, although repaired, was fundamentally altered as a result of the natural hazard. Repairs themselves then must have become points by which memories of extreme events were repeatedly retold, preserving and reinforcing communal memory of the event. This was often manifested simply by the addition of the prefix 'new'[26] to the name of the settlement or structure; for example New Winchelsea, relocated after Winchelsea was lost to sea floods, or the 'new' tower built at Stowmarket after 1362. The communal memory attached to repairs can be seen in the wake of an extreme event following the 1356 earthquake in Basel, Switzerland. Repairs necessitated by this event could still be identified and commented upon by visitors and local antiquaries even into the 16th century (Hoffman 2014: 307) illustrating how well known the story of their damage and subsequent repair had become. Another example comes from Ullensaker Church, Akershus County, Norway, the original stone structure of which was destroyed by a landslide in the late 15th century. In the aftermath, however, a new wooden church was constructed which incorporated structural elements, most notably a large door, as well as fittings such as the stone font and a bell, from the original church.[27] In this case, especially as it relates to a holy building, it is hard to imagine that the reuse of structural fragments from the earlier church would not have afforded frequent opportunities for remembering the antecedent structure and the event which had swept it away. At Bergen the continued reuse of structural timber after multiple town fires is attested through dendrochronology which demonstrates that high volumes of timber were reused in the rebuilding of structures razed by fire—creating tangible links with the structures that had previously stood in their place (Hansen 2015: 165-166). These examples demonstrate that repairs and the structural alterations necessitated by hazards, were themselves cause for the creation and propagation of memory.

In some respects, the memory of what had been damaged and required repair in the past could increase future resilience. O'Neill (*forthcoming*) has argued, in the case of earthquakes in medieval Cyprus, that by taking note of what structural features withstood seismic damage and which elements failed, medieval cathedral builders were able to move toward more resilient designs. More earthquakes provided more opportunities to learn and improve designs so that they were less likely to collapse. Over time, Cypriot churches, therefore, became better adapted to earthquake damage more and more including features such as smaller windows and doorways, reduced vertical height, more massive buttresses and increased symmetry—which all served to reduce the chance of collapse in an earthquake. The same process can also assumed to have been applied against other hazards. Windstorms slowly led to designs becoming more aerodynamic; pyramidal spires gave way to conical forms which experienced reduced wind loads, and the development of lead roofing

[26] Although note that the prefix 'new' did not necessarily imply a natural catastrophe had occurred.
[27] This information comes from http://www.norgeskirker.no/wiki/Ullensaker_kirke. [Accessed 14/09/2017].

provided a stronger roofing material (Baker 2007). Comparable developments took place in bridge design, as discussed in Chapter 4. All of these structural developments required the preservation of memory of what had been damaged and what had survived during previous disasters—something which could be deduced from standing structures and visible patterns of repair which local oral memory linked to a particular event.

6.5 Summary

The memorialisation of disasters is clearly a complex topic which has many facets. At one end of the spectrum it relates to highly personal experiences which have the power to shape or destroy lives while at the other it relates to informing public policy and ways to mitigate the impact of future hazards. As such, during the medieval period and at any time, disasters were memorialised in many different ways, not all of which, and in fact the minority, persist in either the material or documentary records. Since the early modern period, and especially the advent of computing, our ability to collate data with the aim of forecasting the future has increased. For us in the present, this means that maintaining detailed and accurate information concerning past occurrences of natural hazards is vital to how we conceptualise mitigating their impact in the future. For a number of reasons, this was less important during the medieval period. Firstly, due to the lack of scientific and technological understanding, the type of data that is today useful—such as precise measurements of wind speed, precipitation or wave height—were not of particular interest or efficacy, even if they could be measured, during the Middle Ages. The exception were flood levels which were either inscribed onto structures or communally remembered in relation to a well known and permanent local feature. Secondly, because such high resolution information served little purpose, it was unnecessary to maintain communal memory of extreme events in high detail; it was enough for a coastal community to know that the sea had flooded their town before, and no doubt the particular streets and buildings that had been damaged or affected would have been remembered, without knowing the detailed characteristics of the storm that caused the flooding. No sweeping generalisations can be made about the length of time over which memories survived or how accurately they were transmitted. In some cases, such as the Gauldalen example in Norway, relatively accurate information seems to have been conveyed over hundreds of years while in others, such as the 1421 St Elizabeth's Flood, inaccuracies seem to have crept in almost immediately after the event. Communal memory seems to have operated on a case by case basis making it hard to predict what would survive and what would fall by the wayside.

Most of the categories of evidence described above commemorating disasters do not provide much information which would have been practically useful to subsequent generations. The majority simply act as a reminder that at some point in the past, perhaps with a precise date, a particular hazard occurred in a particular area. Some such as ex voto ship carvings do not even convey this level of information. As such, turning to the concept of an adaptive cycle, it seems initially that most of these methods of encoding and transmitting memories cannot have had much positive impact on any adaptive cycle. Two of the most obvious exceptions are flood marks and structural repairs. The former readily communicated the levels reached by floodwaters to future generations, providing the information necessary to mitigate the impact of flooding of that magnitude in the future.[28] In the case of the latter, visible structural repairs, and sometimes accompanying inscriptions, informed what could withstand natural forces and what could not, helping to build more resilient structures through a process of trial and error over time.

Although the other categories of evidence examined above do not appear to have actively contributed to increasing resilience through an adaptive cycle, this is not wholly true. One of the most fundamental steps to improving resilience against hazards is first accepting that their occurrence is both possible and presents a risk to society. By attesting to the past occurrence of a hazard, even in a low detail way, this is exactly what the majority of the types of memorial considered here did, either within kin groups (through oral memory, perhaps of ancestors, and the biographies of heirlooms) or wider society (as in the case of poetical verses, inscriptions, commemorative events and structural repairs). Additionally, some types of commemoration contributed to a peculiarly medieval adaptive cycle. Ex votos provided a material manifestation of a prayer to a holy intercessor for help, often against hazards, which had been believed to be effective in the past. In so doing, they provided an exemplar to future generations of a method to deal with worldly dangers that could be relied upon—and the evidence suggests that, in turn, many did.

[28] Although note that it is unclear to what extent the information provided by flood marks was actually heeded.

Chapter 7

Discussion

The preceding chapters have presented a wide array of evidence related to the occurrence and impact of disasters over the short- and long- terms. The evidence presented in Chapter 3 provides high-resolution reconstructions of a number of catastrophic disasters which impacted northern European populations during the medieval period. This has allowed knowledge of these events to be refined and clarified. Chapters 4 and 5, on the other hand, illustrate the dichotomy between two seemingly opposing strategies of response. On the one hand, practical and physical responses, which provided tangible protection from the impact of a future recurrence of a natural hazard, or relief in its aftermath, while on the other, religious and superstitious responses which were widely held to provide efficacious protection against these unpredictable natural events—either in isolation or in concert with other practical measures. This chapter draws these strands of evidence together, setting them in a wider geographical and historical context. This provides a renewed understanding of the occurrence and impacts of the disasters considered in Chapter 3 and, in so doing, conclusions may be drawn regarding the implications of these events—and disasters more generally—for medieval society. Additionally, the nature of the surviving evidence, both documentary and material, and how this might inform future research, is explored.

7.1 The causes of disaster

Natural hazards are, of course, the primary catalysts behind any natural disaster but, as discussed in Chapter 1, human decisions—such as the siting of settlement in hazardous locations (low lying wetlands being one example)—are of equal importance in transforming the occurrence of these hazards into true disasters. Over the *longue durée*, human populations at a given location become familiar with the natural rhythm of their environment including what natural hazards can reasonably be expected to occur and what measures are appropriate to guard against this risk (as discussed in Chapter 2.1). As explored in Chapter 6, medieval society actively perpetuated communal memory of these events, although generally only preserving relatively low resolution information about natural hazards, through a diverse range of methods. A change from accepted norms in the occurrence of natural hazards at a given location, or the occurrence of an unprecedented hazard, for which no collective memory exists, however, can have severe implications for human populations unprepared for these sudden changes. Medieval populations were, therefore, more likely to be afflicted by disasters when natural hazards occurred outwith patterns established over meaningful timescales to human society.[1]

7.1.1 Climate

Different types of hazard are the result of different natural processes but meteorological hazards are all influenced by climate—the long-term average weather experienced at a specific location. A change from an established climatic regime, therefore, especially one that has persisted for some time, can result in new and, for human populations, unknown weather patterns. Such a picture is gleaned from climatic reconstructions based on environmental proxies for northern European climate over the medieval period (Mann *et al.* 2009; Büntgen *et al.* 2011: 580-581). At the heart of the matter is the shift from the the so-called 'Medieval Climate Anomaly', characterised by generally warm and stable conditions from *c.*900-*c.*1300, to the 'Little Ice Age', which is thought to have typically consisted of colder and drier conditions between *c.*1300-*c.*1900 (Dawson *et al.* 2007). Focussed on the 14th century, the transition between these two climatic epochs appears to have been marked by pronounced climatic instability with heightened storm activity (Trouet *et al.* 2012) evidenced by proxies such as cliff top storm deposits from Shetland (Hansom & Hall 2009: 49) and sediment cores from the North Sea (Christian Hass 1996: 139). The evidence obtained from palaeoenvironmental proxies, therefore, supports the occurrence of meteorological hazards of a higher magnitude and/or greater frequency than had typically been seen in preceding centuries—a conclusion which is readily supported by the historical evidence (see for example Bailey 1991).

In concert with these climatic fluctuations, contemporary human society experienced particular challenges. Until the late 13th century, while climatic conditions were generally favourable, economic activity and population generally expanded whilst population density remained insufficient to pose demographic problems. From the late 13th century, but especially in the early 14th century, population expansion combined with the universal desire to hold land meant that, at least in England, the average size of land parcels for tenure gradually decreased, squeezing the ability of tenants to support themselves. Such a situation reduced living standards, increased inequality and, when crises forced some to sell their land, pushed many into poverty (Campbell 2016b: 193-196). From the late 13th century, therefore, society "found itself living in seriously reduced living conditions" and becoming "ever more prone to crises of subsistence" (Campbell 2005: 4). By the early 14th century, interactions between this increasingly vulnerable population and the deteriorating climate resulted in acute crises such as the Agrarian Crisis of 1315-22—the catalyst for which were rains of unprecedented intensity. Not only did the fluctuating climate of the late 13th and 14th centuries favour the occurrence of hazards such as windstorms, heavy rains and consequent

[1] As discussed in Chapter 6, this was generally not more than *c.*200 years.

flooding but society had also reached a point which made it peculiarly vulnerable to the impacts of these hazards.

The global changes in atmospheric circulation during this period also played a key role in enabling the occurrence of the greatest disaster of the period—the Black Death. Plague (*Yersinia pestis*) naturally occurs among central Asian rodent populations and, under favourable environmental conditions—notably warm springs and wet summers—the prevalence of plague in these populations drastically increases (Stenseth *et al.* 2006). Positive climatic anomalies which resulted in conditions conducive to rodent population expansion in central Asia during the medieval period, therefore, would have caused natural reservoirs of plague to expand while subsequent negative climatic fluctuations caused these plague-bearing populations to collapse. Such a collapse would drive the fleas, which spread the disease within these populations, to search for alternative hosts, including livestock, beasts of burden and humans (Schmid *et al.* 2015). Swings in climate in central Asia, therefore, promoted booming populations of plague-bearing rodents from which, during climatic swings in the opposite direction, the disease could make the transition to other hosts—who carried the pathogen to Europe along the 'silk roads'—the end result of which was perhaps the most decisive event of the Middle Ages.

Archaeological evidence, both direct and indirect, for the impacts of these climatic changes on contemporary European society can be found widely throughout the literature. An obvious indicator comes from the increased number of coastal sites affected by wind-blown sand inundation from *c.*1300, presumed to be a result of increased storm activity mobilising bodies of sand (*eg.* Brown 2015). The extent to which climatic fluctuations played a role in social changes at this time, however, is significantly more debatable[2] although evidence from a number of sites across northern Europe have been interpreted in this light. According to Buckland *et al.* (1996: 94-95), for example, the climatic decline of the mid 14th century was a contributing factor to the abandonment of the Norse colonies in Greenland—as a run of anomalously cold years could have made continued settlement untenable. In the Hebrides too, climatic decline may have prompted a shift in settlement. On South Uist, during the 14th and 15th centuries, the medieval population relocated from the coastal grassy dune plains, known as machair, to rocky outcrops to the east—perhaps as a result of anomalous weather patterns which caused instability of the machair environment (Sharples 2005: 195-196). Furthermore, archaeological evidence points to a dramatic decline in the availability and consumption of marine fish in the area during the 14th century (Serjeantson 2013: 78-9). Although this has traditionally been interpreted as a result of regional political turmoil, the sharp decline likely relates to fluctuations in sea temperatures, which altered where fish stocks could be found, and increased storminess, which made fishing a more hazardous pursuit (Oram 2014: 232). In this vein, Dhoop (2016: 208-209) has proposed that medieval ship builders made their vessels more

[2] As discussed in Chapter 1.3.

sturdy and robust in response to the climatic downturn during the transition into the Little Ice Age. In Sweden, pollen sequences from upland medieval settlements indicate that the mid 14th century coincided with a drop in cereal crop coverage of close to 50% (Lagerås *et al.* 2016: 43). While this is primarily interpreted as a product of farmers' migration to more productive southerly farmland driven by plague mortality, the spread of the disease, as discussed above, held a significant climatic component, and poor growing conditions during the years of the pandemic itself have been argued to have exacerbated the crisis (Campbell 2010b: 300-303). A similar interpretation has been advanced for cultivation in upland areas of Britain as a result of the climatic changes of the medieval period (Parry 1975: 11), although more recently this picture has been significantly qualified (Tipping 2002: 21). At the moated site at Cedars Field, Stowmarket, Suffolk, Anderson (2004: 28) has suggested that the raising of the height of the moat platform in the early 14th century was a response to the increased incidence of flooding caused by the contemporary climatic fluctuations and the evidence for pastoralism at nearby Cedars Park has also been suggested as a switch away from arable agriculture influenced by the difficulties of working clay soils under unfavourable climatic conditions (Woolhouse 2016: 122).[3] In medieval settlement archaeology a narrative of decline over the course of the 14th and 15th centuries is nearly ubiquitous (Dyer 1990: 115-116; Rippon 2001: 16-17; Gerrard 2007b: 987; Everett & Boulter 2010: 59; Hindmarch & Oram 2012: 283-293; Dyer 2018: 204; Young *forthcoming*) and is supported by systematic test-pitting across a wide area (Lewis 2016; Lewis *forthcoming*). Importantly, however, there are many plausible factors which may explain the contraction of settlements during this period and, notably, contraction and decline was neither synchronous nor universal—the onset of decline at many sites did not obviously occur until the 15th century while the majority of settlements were continually occupied—and some even experienced expansion,[4]—throughout the centuries of demographic decline and stagnation (Silvester 2010: 142-151). Many of these indicators of decline are likely to have been affected by a climatic component but, equally, a wide array of social and economic push and pull factors exerted a significant influence in shaping the dynamics of population, settlement and economic activity. Undeniably, significant disruption coincided with the climatic fluctuations of the 14th century but there is no linear relationship between climatic change and human society—climate did not determine what people did but it affected the viability of possible options.

The climatic fluctuations centred on the 14th century clearly played a significant role in the causation of many of the disasters which characterised this period. The case studies considered in this thesis mostly occurred during this period of climatic transition in the 13th and 14th centuries.

[3]In this case, although, as with the other examples given here, climatic change is likely to have played a role, social and economic factors are more likely to have been decisive in the shift from arable to pastoral agriculture. As with the criticism attracted by a similar interpretation applied to the desertion of the medieval villages at Barton Blount and Goltho in the 1970s (Beresford & Hurst 1971: 21), while climatic fluctuations may have made arable agriculture a less attractive proposition, the catalyst for the switch to pastoralism is more likely to have been a reflection of changing market demands and the reduced labour requirements of pasture compared to arable agriculture (Rippon 2001: 31-33).

[4]Dendrochronological dating of timbers from standing buildings, for example, suggests that a renewed phase of rebuilding occurred in the late 14th and early 15th centuries (Dyer 2013).

Although they were primarily selected based on the availability of source material, rather than their chronological clustering, the occurrence of disasters for which particularly large quantities of source material survive during these centuries might be more than simple coincidence. As meteorological hazards demonstrably occurred with greater severity and a variety of considerations may have reduced society's ability to cope with environmental shocks during this period, it is reasonable to suggest that high-impact disasters—those more likely to leave a significant trace in the historical and archaeological records—were also more likely to occur. In the case of any individual hazard, however, it is exceedingly difficult to identify any specific contribution climatic change may have played in the occurrence and magnitude of the event. Taking the storms of 1287/88 and 1362 as case studies, climatic proxies provide only uncertain indicators that wider climatic trends exerted an appreciable influence on the occurrence of these storm events.

7.1.2 The late 1280s

The series of storms that affected south eastern England and the North Sea coasts of continental Europe in the late 1280s were certainly anomalous. To what extent these were random weather events or representations of wider climatic trends is difficult to judge—and, in fact, it is currently impossible to provide a definitive assessment. Through contextualising the situation in reference to climatic proxies, however, it may be possible to infer to what degree a relationship may have existed. Summer temperatures in Europe cooled dramatically from 1286 to 1287 with only gradual warming over 1288 and 1289 (Luterbacher *et al.* 2016: 1-12; see fig. 7.1). This period of cooling coincides with a spike in volcanic sulfates detected in Arctic and Antarctic ice cores in 1286 (Sigl *et al.* 2015: [See supplementary data 5]; see fig. 7.2). The volcano responsible for the output of these sulfates in 1286 is currently unknown but must have been either a large southern hemisphere, low latitude, eruption or at least two simultaneous eruptions in both hemispheres (Zhou *et al.* 2006: 2779). The cooling produced by this event can be traced widely, for example in the tree ring growth patterns of Siberian juniper and larch (Hantemirov *et al.* 2004: 161). In addition to the atmospheric sulfates generated by the 1286 eruption, the late 13th century also happened to co-incide with volcanic sulfate levels in the atmosphere which were between 2 and 10 times greater than at any other time in the last millennium (Gao *et al.* 2008). To this abnormal level of volcanic forcing can be added the effects of sunspot activity and overall solar irradiance which also entered a depression during the late 13th century, in what is now known as the Wolf Minimum[5] (see fig. 7.2). From the above evidence, it is apparent that manifold factors were influencing global climatic circulation during the 1280s, bringing about significant cooling in Europe and the North Atlantic. Such cooling could have enhanced the meridional temperature gradient leading to storms of greater intensity than might have been expected without the presence of abnormal cooling (Trouet *et al.* 2012: 53). In

[5] Named after the noted sunspot researcher Rudolf Wolf, b. 1816 d. 1893.

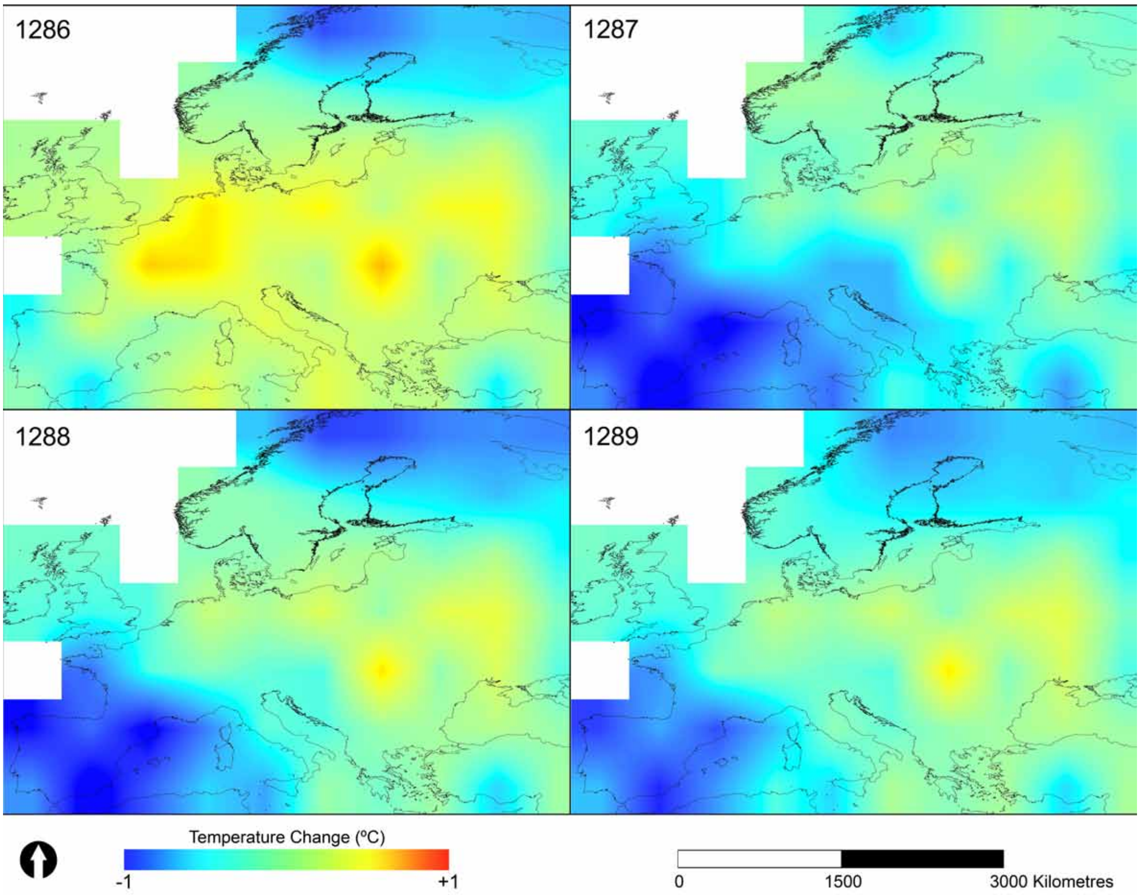

Figure 7.1: Temperature variance reconstructed from proxy evidence across the European continent in the summers of 1286 (top left), 1287 (top right), 1288 (bottom left) and 1289 (bottom right). Compared to 1286, the following summers exhibited pronounced cooling. Created by the author using data from Luterbacher *et al.* (2016).

turn, this may have theoretically increased the intensity of the storms of 1287/88 and their ability to cause the kind of damage attested by the archaeological record across New Romney.[6]

7.1.3 1361/1362

In the case of the storm of 1362, the climatic and meteorological conditions prior to the storm's occurrence can be reconstructed in vague terms from historical descriptions of the weather over the preceding months. For the second half of 1361 the evidence suggests that, following a summer of drought in England (Brandon 1971: 3, Ogilvie & Farmer 1997: 127), sea ice was present in Iceland during the autumn (Storm 1888: 359) and, by Christmas time, fruit trees were in bloom near Paris[7] (Birdshall & Newhall 1953: 108) which enjoyed a mild, if wet, winter (Kiss 2016: 44).

[6]As discussed in Chapter 3.1.3.

[7]A strikingly similar description of a mild winter in northern France followed the 1257 Samalas 'mega-eruption'. Such winter warming in the northern hemisphere is a documented result of high-sulphur volcanism in the tropics (Lavigne *et al.* 2013). No comparable eruption is known for the 1360s; Mount Yakeyama, Niigata Prefecture, Japan, erupted in 1361 (Hayatsu 1994) but this was a relatively low magnitude eruption which does not register in Arctic or Antarctic ice cores (Sigl *et al.* 2015: See supplementary data 5) and is therefore unlikely to have exerted a decisive influence on European climate. More locally, another possibility is the 1362 Icelandic eruption of Öræfajökull although the evidence suggests it only began erupting in June 1362 (Thorarinsson 1958: 29), after the occurrence of the St Maur's Day windstorm. Furthermore its ejection of only ~1.7 Mt of sulphate aerosol into the atmosphere would be insufficient to generate a significant climatic impact (Sharma *et al.* 2008: 736).

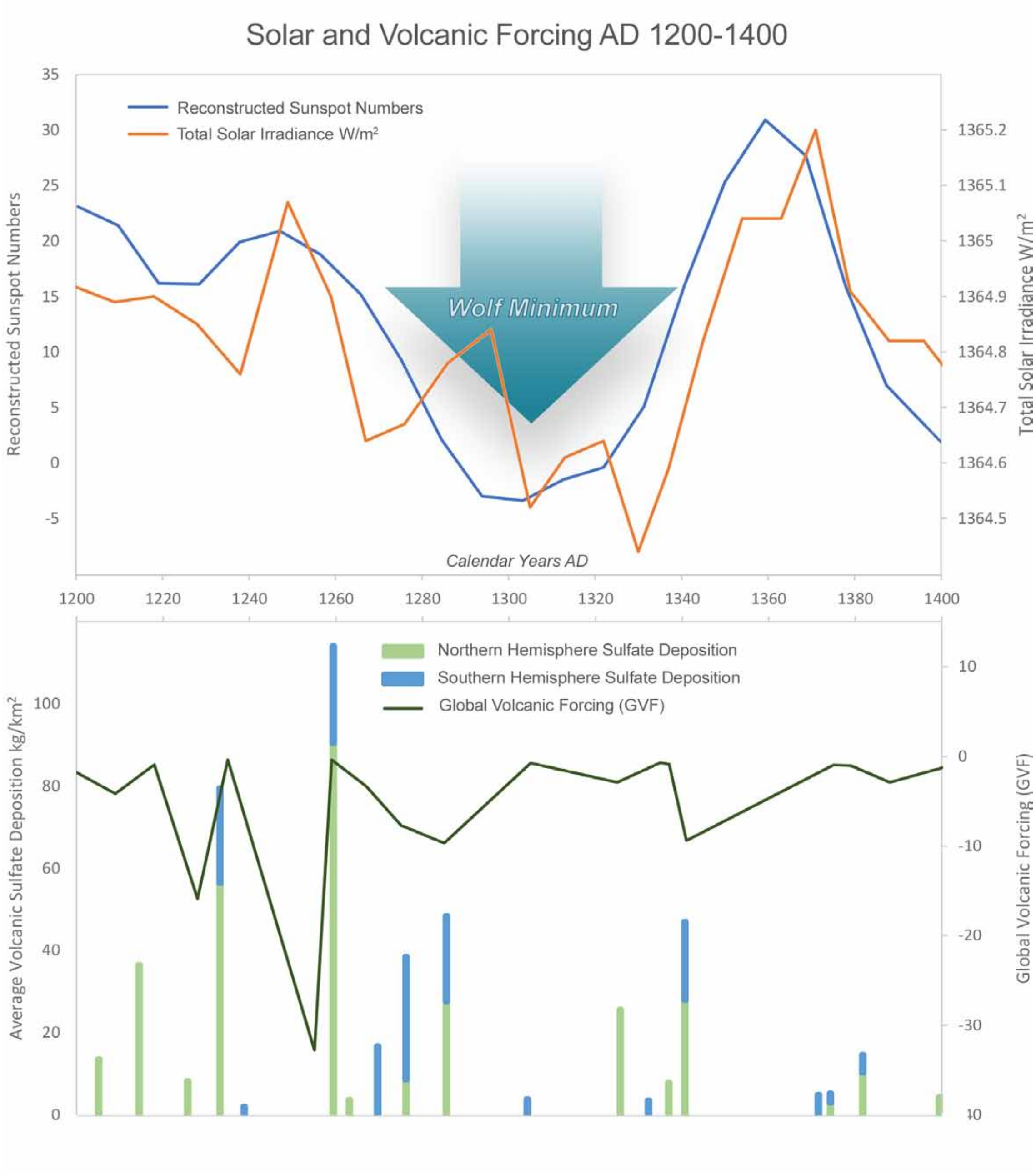

Figure 7.2: Indicators of solar and volcanic climatic forcing between AD 1200 and 1400. Created by the author combining sunspot data from Solanki *et al.* (2005), solar irradiance data from Delaygue and Bard (2010: See supplementary data) and volcanic sulfate and volcanic forcing data from Sigl *et al.* (2015: See supplementary data 5).

The winter in Germany and northern Austria, meanwhile, was reported as being harsh, although little snow fell in the latter and there was more rain than snow in Bavaria (Kiss 2016: 44). The presence of sea ice suggests cold conditions in the Arctic while flowering trees indicate an unusually warm winter in northern France. The winter was followed by a 'great' drought in Croatia in spring 1362 (Kiss & Nikolić 2015: 13-14). This patchy and uncertain picture can be augmented with the addition of climatic proxy evidence for the early 1360s. These indicate a low-level spike in sea surface temperatures during the early 1360s which was sharply followed by cooling (Dawson *et al.* 2007: 431) and a peak in sea ice coverage in 1364 (Massé *et al.* 2008: 567). This picture is echoed by reconstructed European summer temperatures with 1361 and 1362 standing out as relatively temperate years against the extreme cold of 1360 and the onset of renewed cooling in 1363 (Luterbacher *et al.* 2016: 1-12; see fig. 7.3), with anomalously cold summers in Slovakia during both years (Büntgen *et al.* 2013)[8] Meanwhile the phase of the North Atlantic Oscillation appears to have favoured higher magnitude storms at this time (Trouet *et al.* 2012: 53). These proxies provide quantitative proof of the dramatic fluctuations in global atmospheric circulation which characterized the period from the late 13th century through to the end of the 14th century, with the late 1350s and early 1360s registering as one of the peaks of environmental instability between 1300 and 1500 (Campbell 2016b: 339; see fig. 7.4). As this climatic variability is unlikely to have been caused by volcanic forcing[7] the most likely explanation is increased sunspot activity and solar irradiance which peaked sharply between 1355 and 1375 (Solanki *et al.* 2005; Delaygue & Bard 2010: see supplementary data; see fig. 7.2). Again, the increased thermal energy input into Earth's atmosphere at this time could have played an element in the genesis of a particularly high magnitude extratropical cyclone.

7.1.4 Summary

Although both the storms of 1287/88 and 1362 appear to have occurred during years of abnormal climatic variation, it is important to emphasise that there are great difficulties in attributing single events to climatic change. Windstorms are a particularly problematic phenomena in this regard meaning that any estimates as to the climatic contribution behind these events are extremely uncertain (National Academies of Sciences 2016: 111-114). That being the case, the cooling which characterised the North Atlantic and western Europe in the late 1280s may well have heightened the intensity of the winter storms which struck England and the Low Countries in 1287 and 1288. Equally, the storm of January 1362 demonstrably occurred during a period of heightened climatic instability when the North Atlantic Oscillation favoured storms of increased magnitude. Such linkages may also have played a part in the other disasters discussed in Chapter 3. Although the information concerning the occurrence of the landslides discussed in Chapter 3.4 is scarce, it is

[8] Data available at: http://www.ncdc.noaa.gov/paleo/treering.html [Accessed 31/08/2016].

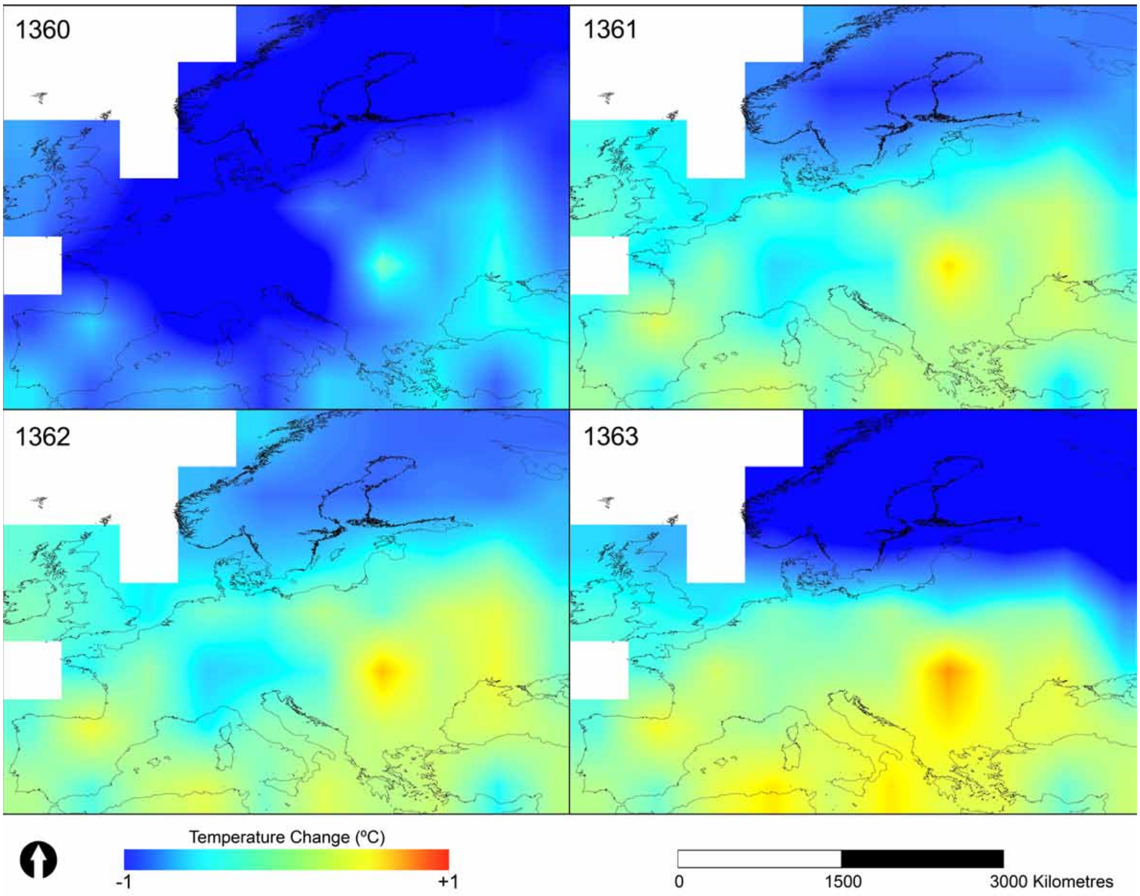

Figure 7.3: Temperature variance reconstructed from proxy evidence across the European continent in the summers of 1360 (top left), 1361 (top right), 1362 (bottom left) and 1363 (bottom right). Note that 1361 and 1362 were summers of relatively stable warmth bookended by summers of greater extremes. Created by the author using data from Luterbacher *et al.* (2016).

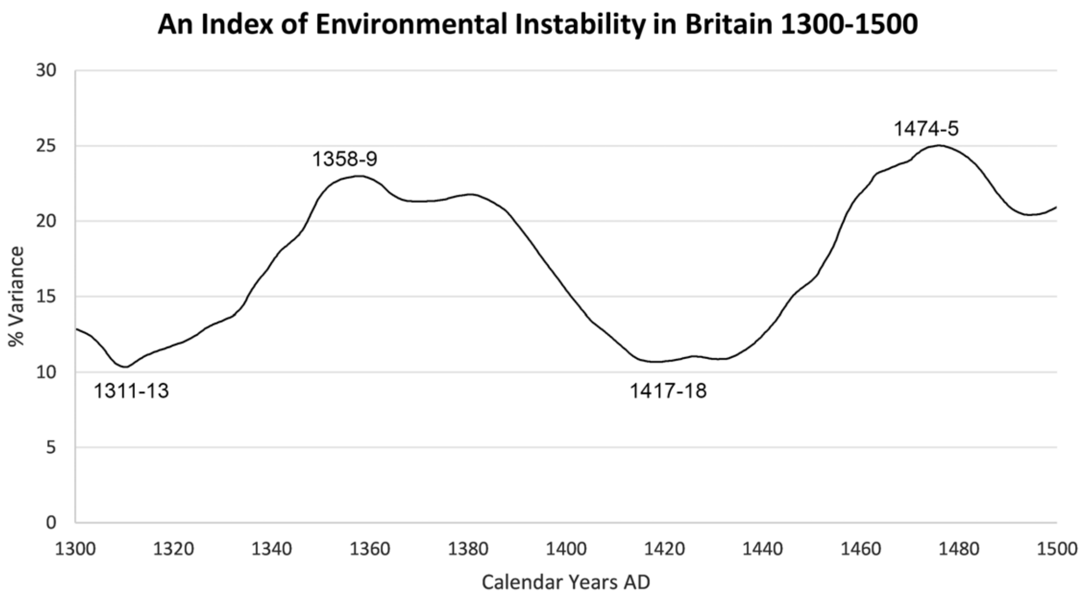

Figure 7.4: An index of environmental instability in Britain 1300-1500. Redrawn after Campbell (2016b: 339) by the author.

notable, for example, that Norway's most damaging landslide event occurred during a period of heightened climatic instability (Campbell 2016b: 277-289) reflected by historical evidence at a global level—only three years prior, the highest magnitude flood known to have affected central Europe occurred (Dotterweich *et al.* 2003), while, as far away as Yuan China, floods, epidemics, drought and famine characterise the early 1340s (Brook 2010: 72). While it is difficult to make any unqualified statements, it is likely that the global climatic shifts taking place when the hazards discussed above occurred affected their magnitude and, therefore, the severity with which they impacted contemporary human society.

7.1.5 Other factors

While climate was certainly an important consideration in the multitude of weather-related disasters which occurred over the 13th and 14th centuries, other factors affected the impact that these hazards had on contemporary society. In the case of the 1287/88 storms, the occurrence of earlier storms in the mid 13th century and the ongoing alterations to the drainage of Romney Marsh during this period (Rippon 2002b: 90-96), which made New Romney a less attractive port and eventually removed its access to the sea altogether, must have exacerbated the economic downturn which this series of storms initiated (see Chapters 3.1.3 and 4.7).

Turning to the flooding in the Fens in 1338, a number of factors likely exacerbated the effect of this disaster. Widespread poverty among the communities affected by flooding, reported in the documentary sources (Maxwell Lyte 1915: 62)—which would have increased the vulnerability of populations to the floods when they struck—may have been linked to increased tax demands placed on England as a result of the outbreak of war with France in 1337. According to Ormrod (1991: 183), the level of taxation levied on the laity in 1337 and 1338 was significantly higher than the populace might have expected given recent precedents and an indicator that this caused hardship and a degree of civil unrest amongst the peasantry elsewhere in East Anglia comes from the relative spike in trespass on the Lord's demesne reported to the manorial court at Walsham-le-Willows, Suffolk (Kilby 2015: 77). As well as heavy taxation, the widespread failure of the harvest the following year must have made the situation in Marshland particularly challenging (Campbell 2016b: 269-270). The Fens were also particularly densely populated at this time (Campbell & Barry 2014: 65, fig. 2.2), meaning that scarcity would have been amplified and the local people would have been especially vulnerable to the impacts of harvest failure and famine. Earlier disasters could have still been exerting an influence too—the panzootic of the late 1310s and early 1320s resulted in a sharp decline in livestock herds in England, although the fact that agriculture in Norfolk was less reliant on oxen for ploughing than neighbouring counties (Slavin 2009: 20-22) and that sheep seem to have been preferred over cattle in Marshland (Silvester 1988: 165) may have reduced local exposure to the panzootic and its after effects. Elsewhere, even by the late 1330s, herd numbers and prices had not fully returned to their pre-panzootic norms (Slavin 2009: 50, 57-58; Campbell 2016b: 214).

In both of the episodes of flooding referenced above, the storms of 1287/88 and the inundation of 1338, a further consideration may have been the transformation of coastal wetlands by human exploitation. A direct result of agricultural expansion into reclaimed marshland environments, especially those in which peat was present, was soil compaction and peat shrinkage (Soens 2013: 211). As a result, by *c.*1300, agricultural land in reclaimed marshlands around the North Sea littoral was topographically lower and thus at an increased risk of flooding. By the late 13th and early 14th centuries these environments, all around the coasts of the North Sea basin, had grown increasingly vulnerable as an unintended consequence of human activity. Although in these cases, the worst of the demographic decline was yet to come, Rippon (2001: 18) also points out that reduced population levels would have suppressed landowners rental returns and left the maintenance of the flood defence infrastructure to a diminished pool of manpower. At the same time, the increased occurrence of storms and flooding as a result of climatic fluctuations increased the risks to coastal wetland landscapes as well as the costs of protecting them through maintaining dikes and drainage infrastructure.

The impact of the storm of 1362 was similarly exacerbated by contemporary conditions. The windstorm came in the midst of a renewed outbreak of plague which had arrived in England in 1361 (Horrox 1994: 85-88), a fact bemoaned by the graffito at Ashwell St Mary (see fig. 6.3). Campbell (2016b: 314-315) regards this outbreak as "probably. . . the second greatest mortality crisis of the later Middle Ages" which, in wiping out many of the children born in the decade after the Black Death, prevented any demographic recovery from the earlier bout of plague. These circumstances undoubtedly made the destruction caused by the windstorm more difficult to deal with, as workers and labourers were scarce and the sums they could demand, in spite of official price fixing, were high (see Chapter 4.1). Society was also likely still experiencing a 'hangover' from the demographic crash of the Black Death—which had struck only a decade prior and triggered significant adjustments in the established labour model. The resulting shortage of labour meant that labour intensive tasks were increasingly abandoned or put on hold in the post-Black Death era (Campbell 2012: 124). This not only impacted the ability of landowners to restore the effects of natural hazards when these struck their estates but, in some cases, it also meant that maintenance and repairs were less likely to be performed which may have increased the vulnerability of communities to various types of hazard throughout this period.

The discussion of the issues presented above makes it clear that natural disasters do not occur in isolation. The most severe disasters arise when natural hazards are exacerbated by existing and ongoing factors. These include both the environment, with climatic fluctuations affecting the occurrence and magnitude of natural hazards, as well as endogenous considerations, such as wealth inequality, the distribution and availability of resources and the ongoing repercussions of earlier disasters. Climate was certainly not the only factor which governed the occurrence of disasters, therefore, but subtle changes could affect their occurrence. This is where Braudel's overlapping layers of historical time (1972: 20-21), encompassing gradual environmental changes, fluctuations in human society at the macro scale and the short-term agency of individuals, offers an effective model to conceive of the factors which caused disasters to arise and their consequences over the short- and long- terms. While changes in the environment, including climatic fluctuations, did not on their own determine when or where natural disasters occurred, they did influence, to a lesser or greater degree, the locations and periods during which natural hazards were more likely to occur. This, combined with social and economic forces and individual agency, expanded or constrained the risk to which medieval populations inhabiting a given location were exposed. Wider trends in both the environment and human society, therefore, played a considerable role in influencing to what extent disasters affected human society and how deeply their impacts were felt—as we shall see in the following section.

7.2 The impact of disasters and the responses of society

The direct and long-term impacts of the disasters discussed in Chapter 3 have been discussed in detail in the preceding chapters. A number of aspects, however, warrant further consideration and comparison. These include the economic impacts of disasters; while the damage and destruction across a large area commonly caused by disasters provides obvious evidence for the economically damaging effects brought about by disasters, there is evidence to suggest that these events may also be positive economic stimuli. Related to this theme is the way in which contemporary authorities managed the disruption and trauma caused by disasters and to what extent, if at all, disaster management strategies adopted by authorities developed and evolved over time. In addition, it is worth considering the intangible impacts of disasters. Through comparison with the impacts of natural hazards on modern populations, it is clear that disasters generate short- and long- term psychological and mental-health effects on individuals and populations. It can be assumed that such effects were similarly felt by medieval populations but there is a near complete absence of contemporary evidence—either historical or archaeological. This is concluded by a holistic review of the responses and mitigation strategies adopted by medieval populations in the face of the case studies considered in Chapter 3.

7.2.1 Economic impacts

In both the storms of 1287/88 and the storm of 1362, commodities, their production and distribution, were affected by the occurrence of natural hazards. In the case of the storms of 1287/88 the evidence suggests pottery production, and/or distribution, was negatively affected by the occurrence of the storms. Specifically, the occurrence of the storms coincides with the sudden replacement of sand and shell tempered wares, which had been common in the Romney Marsh area in preceding periods, by wares tempered only with sand (Barber 2008: 172; Canterbury Archaeological Trust 2010: appendix 5). Possible explanations for this change in the ceramics produced and consumed in New Romney, therefore, are that a coastal pottery production industry was taken out of operation, either through direct destruction or, perhaps more likely, the disruption of supply and distribution networks by the occurrence of the storms. The precise location of the pre-storm kiln responsible for the production of the sand and shell-tempered wares which fade away after the time of the storms is unknown. However, in the aftermath pottery production seems to have shifted to the kiln identified *c.*18 km away at Ashford Potters Corner (Grove & Warhurst 1952; Canterbury Archaeological Trust 2010: Appendix 5). While such a change would have presumably hit the former producers of the sand and shell-tempered wares hard, potters in Ashford presumably saw a proportionate surge in business. Similarly, Bailey (1991: 207) suggests that the damage that such flood events caused—particularly the repairs to the flood defences—may have provided an important source of employment for those on the edge of poverty in the affected regions. Notably, in this case, however, quite outside the impact of natural hazards, the entire region experienced population decline in the centuries which followed as a result of a combination of environmental conditions—the siltation of previously important watercourses and outbreaks of plague among the populace—political concerns—war with France which had formerly been an important trading partner—and market forces—which shifted demand from labour intensive grain to meat and wool (Rippon 2001: 31-33). In this case, therefore, while the storms may have exacerbated decline, the overall trajectory of human activity in the affected locale appears to have been governed by other factors.

Following the January storm in 1362, roofing materials, most notably tiles but also the labour of roofers and thatchers, were affected. The storm precipitated a spike in demand which, despite official regulation, sparked price rises. As a result, although a vast number were ill-affected when the storm caused damage to structures across England, for those with the skills and necessary resources (timber, roof tiles *etc.*) to mend the damage, the storm was good for business. The scale of demand is demonstrated by the high volume of tiles purchased; 123,500 tiles were bought from a tiler in King's Langley, Hertfordshire, (Page 1914: 265), as well as the fact that, around the years of the storm, labourers' wages in London jumped to an all time high (Keene 2011: 49, fig. 3.1). In addition, the storm seems to have had an impact on the availability and value of land and property. Not only can this be seen in the administration of the estates of the Black Prince—the prince's Keeper of Fees in the county of Suffolk, Thomas de Stanydelf, proposed to sell houses at Icklingham, Suffolk, in the storm's aftermath (Dawes 1933: 426; see Appendix G), perhaps to raise funds for other repairs[9]—but also in the activities of the Archbishop of Canterbury, Simon Islip.[10] His acquisition of land in the centre of Oxford in the aftermath of the storm, for the foundation of Canterbury

[9] Although note that the Black Prince ultimately ordered against this proposed sale.
[10] d. 1366.

Hall, a new college of the University, seems to have been motivated either by the availability of the land or the current owner's eagerness to sell as a result of the storm's impact (Wharton 1691: 415). Such transactions suggest that, while some needed to liquidate assets, others were keen to capitalise on the opportunity presented by the storm to acquire assets below their market rate.

As awareness of natural disasters grows, so analogies for the types of activities discussed above are emerging elsewhere in Europe. Another case of a disjuncture in ceramic production, akin to the aftermath of the 1287/88 storms, can be seen at Villa Franca do Campo, Azores, Portugal, following the 1522 earthquake and landslide which buried the town. This event appears to have ignited the local economy, forcing the instigation of a local ceramic industry to meet the sharp spike in demand. Previously, the ceramics in use across the town appear to have been entirely imported from the Portuguese mainland (Forlin & Gerrard 2017: 104). Exploiting disasters opportunistically, as the Archbishop of Canterbury seems to have done after the 1362 storm also finds numerous comparisons. In the North Sea basin for example, it was frequently enshrined in local law codes that, if a landowner was unable to afford the maintenance costs of the flood defences protecting their lands, which were required to safely protect them, their ownership of the land was void and could be claimed by other parties. While initially intended to protect the integrity of communal flood defence systems, elites were often able to exploit these regulations to take control of large areas of land where the owner had failed in some way to abide by local maintenance regulations (Soens 2013: 228-229). Costs would have been highest, and poor maintenance most obvious, in the immediate aftermath of a flood or storm event meaning that the occurrence of these hazards could actively assist the seizure and consolidation of land by wealthy elites at the expense of local landowners. Another example can be found in the case of the flash flood which destroyed the village of San Romano in Asturias, north-west Spain, in the 14th century. In this case, devastation of the village led to its re-foundation with the new name of Villanueva[11] on the opposite side of the River Trubia (Fernández *et al.* 2017: 9). However, the site of the destroyed village on the other side of the river, covered over by alluvial soils, seems to have quickly been acquired by local landowning elites (Fernández *et al.* 2017: 10), with the area roughly corresponding to the zone affected by the flash-flood still owned by their descendants until the 1960s. Clearly, wealthy parties with sufficient financial capital were frequently able to exploit the situations generated by natural disasters to acquire land which would, normally, have been either unavailable or significantly more expensive. This accords with Klein's (2007) concept of disaster capitalism in which modern day disasters, both man-made and natural, are exploited for financial gain, usually by governments and corporations. The general picture obtained from this discussion is that while disasters generated short-term economic crises they rarely had much impact on longer term trends. This being the case however, they did facilitate transactions which shaped affairs at the local level over long timespans—as in

[11]In English this translates as: New Settlement.

the case of the village of San Romano, Asturias.

The precise economic impact of a given historical disaster is difficult to gauge. While detailed economic data for the period is, in some cases, available, untangling the specific contribution to regional prices, wages or profits, either positive or negative, made by a particular natural disaster is an extremely challenging task. From the examples considered above, it appears that rapid-onset disasters, while acting as short-term stimuli, were quickly overtaken by macro-scale economic trends to shape longer-term trajectories of change—as is exemplified by the population decline seen on Romney Marsh discussed above. With reference to the occurrence of the Black Death and its impact on the economy of Holland, van Bavel and van Zanden (2004: 526-529) suggest a similar conclusion. They argue that the existing social and economic make-up of Holland was uniquely well placed to thrive under the new conditions brought about by the decisive changes of the Black Death. While the results of its occurrence, therefore, were fundamental in creating the right circumstances for a boom in the Holland economy to occur, it was the existing underlying qualities of the economy—weak feudal control and weak influence of guilds, the strength of the middle classes and relative freedom of the peasantry—which allowed it to take advantage of these new circumstances. Perhaps the most significant impact of disasters, therefore, was causing changes that otherwise may not have occurred. In the case studies considered in this thesis these included the transfer of land and property between different groups as well as alterations in industries and production, as seen in the pottery industry on Romney Marsh after 1287/88. These changes, although not significant enough to alter overall economic trends at the regional scale, did exert an influence on the future of the local areas they affected. The occurrence of such events, therefore, created winners and losers with some able to capitalise on opportunities at the expense of the difficulties experienced by others. Clearly, Klein's concept of disaster capitalism (Klein 2007) has a longer history within society which is readily reflected in the medieval evidence.

7.2.2 The management of disasters

One of the criteria by which previous scholars have compared the responses of past societies to natural disasters are the involvement of a society's power structures in the management and co-ordination of responses in the aftermath (see for example White 1974: 5; Chester *et al.* 2012). In the modern world, government is widely expected to plan for, and implement, disaster mitigation strategies as well as facilitate the deployment of rapid-response emergency services to save lives and protect the public during the emergency phase. As Schenk (2017: 142-143) has examined in the case of flooding in 14^{th} century Florence, such a role for authorities was certainly not an entirely alien concept to medieval Europeans and this can be seen in the case studies examined in Chapter 3 to a varying degree. White (1974: 5) proposed a tripartite categorisation, pre-industrial, industrial and post-industrial (summarised in Table 7.1), of the ways in which different types of society respond to disaster—including the nature of social organisation and power structures involved. This assumes that pre-industrial societies are relatively harmonised with nature, do not invest heavily in defence against natural hazards, are highly flexible and spatially variable in their strategies and do not organise themselves far beyond the level of small groups. When applied to the medieval evidence there are some notable discrepancies between this model and the evidence presented throughout this thesis. It could certainly be argued that flood defence infrastructure sought to control nature while the investment needed to construct and maintain these defences was often high. Both these structural responses and the spiritual and cultural responses to disaster were also widely applicable across Christian Europe—geographic variation was, therefore, low.[12] The organisation of responses to disaster during the medieval period, also frequently transcended the individual and local spheres—as this section explores. Based on White's classification, therefore, the medieval response to disaster leans significantly more toward the industrial category than the pre-industrial.

	Folk or Pre-industrial	Modern or Industrial	Comprehensive or Post-Industrial
Relationship with Nature	In harmony	Control over	Harmonised control
Capital Investment	Low	High	High and Low
Flexibility	High	Low	Medium
Geographic Variation	High	Low	Medium
Social Organisation	Individual or small groups	Interlocking and interdependent social structures	Combination

Table 7.1: The tripartite categorisation of responses to disaster by societies at different stages of 'development'. Reformulated by the author after White (1974: 5).

In the case of the 1287/88 floods, authorities only seem to have involved themselves in quite minor ways. The most major state involvement can be seen in the case of one of the worst hit towns, Winchelsea, which appears to have been all but erased by the storms. To remedy this situation, the state organised the re-location of the town, which had been suffering degradation from the sea at least since an earlier series of floods in the 1250s, to a new hilltop site that would be safe from coastal flooding (Martin & Martin 2004: 4-6). This re-foundation of Winchelsea was an impressive undertaking; land had to be purchased, streets laid out and plots for housing organised. However, as this relocation was planned from at least 1280 it can hardly be viewed as a state reaction to the storms and floods of 1287/88—but a protracted response to the storms of the 1250s and ongoing problems since then. The occurrence of the 1287/88 storm series, however, could have expedited the relocation plans as the transfer of land to the townspeople took place the following summer in July 1288 (Martin & Martin 2004: 5). Although the planned relocation of Old Winchelsea speaks

[12] Although, of course there were important differences—compared to England and the Low Countries, for example, where authorities managed the maintenance of flood defence infrastructure, flood defence on the French Atlantic coast was managed by individual landowners or communities without overarching institutional power structures (Athimon & Maanan 2018: 1493).

to the medieval English state's ability to carry out such large scale projects, it must be viewed in the wider context of the reign of Edward I which saw the foundation of many other new towns, where no natural disasters had occurred, as part of a concerted policy (Lilley 2014). The King's involvement in such matters was, therefore, key and the evidence in the aftermath of the 1287/88 floods of the imposition of bridge tolls at Bastwick suggests his absence from England at this time[13] may have allowed local landowners and religious orders greater latitude to manage their own affairs when recovering from the floods, with little state intervention or regulation.

The only other instance of state involvement in the recovery process following the 1287/88 storms was the instigation of a royal commission *de wallis et fossatis* to investigate the extent of flooding and how best to remedy the damage caused (Anon 1726: 155-163; Maxwell Lyte 1893: 309). Such commissions, however, usually empowered local landowners and officials to investigate the state of the flood defence system and order works to be carried out where necessary (Bankoff 2013: 30). In co-ordinating a practical response to the problems created by the storm, therefore, the primary responsibility fell to local elites and communities. The meeting at Snargate in 1287, for example, to agree on how best to repair the flood defences at Holewest, is probably illustrative of how such issues were typically resolved by local landowners and officials, although this was especially true in areas such as Romney Marsh and Marshland where specific regulations governed the flood defence and drainage infrastructure. The initiatives instigated by Canterbury Cathedral Priory (Gross & Butcher 1995: 108-109) and Christ Church Priory (Rippon 2001: 22-26) in the aftermath of the storms reveals the lengths to which landowners with sufficient capital were willing to go to make their lands profitable and secure in the aftermath of these disasters.

Following the occurrence of the floods of 1338 in the Fens, the administration of Edward III responded to petitions from the Marshland dwellers (as described in Chapter 4). Since 1337, a new tax based on the value of movable goods had been imposed across England to help fund the war with France. As the flood had damaged or destroyed many of the goods on which this tax was assessed, it followed that the tax burden for the area affected by the flood required re-assessment. The royal administration accented to the request to re-assess the tax of those who had been afflicted by flooding in Marshland although there appear to have been administrative errors which meant that, some years later, the tax rate reverted to the pre-flood assessment—provoking renewed petitioning and a second re-assessment.

To the central administration of the medieval state, these two flood episodes may have only registered as local problems which did not warrant any specific response from the state level. In the aftermath of the 1362 storm, however, which, at least initially, was perceived as a universal hazard,[14] the medieval state took a more active role in the management of the disarray created by

[13] From 1286 to 1289 Edward I was in Gascony.

[14] This is revealed by the fact that Edward III's regulation of the prices and wages that tilers and roofers could demand (Maxwell Lyte 1909a: 238-239) was issued to Sheriffs throughout England—not just those who administered areas affected by the storm.

the disaster. While, in common with the floods in the 1280s and 1330s, repairs seem to have been left entirely to individual landowners and tenants to organise at their own expense—as is made clear by the administration of the Black Prince's estates and the court case of the London burler Henry Maynburgh (see Appendix G; Thomas 1929: 61-62; see Chapter 4.1)—royal administration seems to have regarded the regulation of markets as an arena which did warrant state intervention. This is evident in the legislation to fix the prices of labour and roofing materials in the aftermath of the storm (Maxwell Lyte 1909a: 238) issued throughout England. Such a regulation perhaps stemmed from the medieval theological concept of the 'just price' championed by Aquinas which posited that "if . . . one man [may] derive a great advantage by becoming possessed of the other man's property, and the seller be not at a loss through being without that thing, the latter ought not to raise the price" (Aquinas 1947: 1513-1514). That the regulation was not wholly successful, however, can be judged by the numbers of people falling foul of the regulations (as discussed in Chapter 4) as well as the fact that, rather than suppressing wages or at least keeping them steady, wages of craftsmen in the building trade in London rose to unprecedented levels—and this only increased in subsequent decades (Keene 2011: 49, fig. 3.1).

Although not entirely effective, Such provisions in the wake of crises had slowly developed over the course of the 14th century. In attempting to bring an end to the Great Famine, the administration of Edward II introduced price controls on livestock, attempted to limit meat consumption among the peasantry and tried to stimulate the grain market—coaxing those with a surplus to bring it to market and offering favourable circumstances to merchants who might bring extra grain to England (Braid 2010: 348-349). In the aftermath of the Black Death, Edward III went a step further. The plunge in the available number of workers had allowed the survivors to demand excessively high wages—at least by pre-plague standards. To remedy this, Edward III introduced the *Ordinance of Labourers* and subsequently the *Statute of Labourers* which sought to restore prices and wages to pre-plague levels and limit the ability of workers to refuse work (Braid 2010: 359-360). Set in the context of these earlier attempts to manage the economic shocks of disasters, the ordinances imposed after the storm of 1362 clearly followed a comparable pattern which had slowly developed since Edward II's response to the Great Famine, but was especially similar to the ordinances introduced after the Black Death a decade earlier.

Turning to the landslide events considered in Chapter 3, there is little evidence for state involvement in the aftermath of these events. The grant of rights to hold markets and fairs to Cleeve Abbey following the destruction of the chapel of St Mary the Virgin (Maxwell Lyte 1897: 527), by a slope failure at some point before 1455, demonstrates the recognition that such events did exert an economic strain on the affected communities. That this grant seems to have came more than 10 years after the cliff collapse occurred, however, illustrates that such assistance was not generally immediately forthcoming. Regarding the Norwegian examples, the lack of evidence for state involvement may be an issue of the survival and availability of documentary evidence. The highest magnitude disaster, the Gauldalen landslide, for example, is attested by a single narrative source which does not comment on how the disaster was managed by authorities in its aftermath. Another possible explanation for the lack of evidence is the scale of such events. Compared to floods and storms, landslides generally affected a more limited area—often only affecting a single landowner or tenant—and as such may not have generally been viewed as events which warranted intervention at the state level.

From the available evidence it appears that, at the state level, medieval authorities seldom played an active role in the practical management of the conditions created by disasters. Royal authority did, however, exert control over financial matters, such as the taxation of the inhabitants of Marshland in 1338, and the regulation of market forces, as occurred with respect to tiles and labourer's wages after the 1362 storm. Landowners and local communities, on the other hand, were the most important actors when it came to responding practically to the challenges imposed by the occurrence of a natural hazard—repairing damage and redesigning or rebuilding structures and defences to withstand such events in the future. Damage to property was invariably the responsibility of landowners or their tenants to repair although occasionally indirect aid came through remission of rent or tax commitments or, in some cases, charity (see Chapter 4.6). One exception, where royal authority did become involved at the local scale were royal commissions *de wallis et fossatis* which, although imbued with royal authority, were carried out at the local level by landowners, officials and royal agents (Galloway 2009: 178). In some communities, where these hazards occurred repeatedly and threatened the existing economic system, such measures were overseen by local power structures such as Marshland's dike reeves or the 'Lords of the Level' of Romney Marsh (Bankoff 2013: 30-31). This picture is mirrored by the findings of Athimon and Maanan (2018: 1493-1494) who argue that, in relation to storms along the French Atlantic coast, royal administration rarely became involved in the management of disasters beyond financial concerns before the post-medieval period, while local landowners and communities were typically the ones who managed the practical measures necessitated by the occurrence of natural hazards.

7.2.3 The intangible impacts of disasters

Returning to the local impact of disasters, as events with extremely complex repercussions, touching many aspects of life, documentary and material records cannot be expected to preserve evidence for absolutely all the impacts that disasters unleashed on contemporary populations. As explored in Chapter 5, the risk posed by disasters, and medieval beliefs surrounding them, provoked a wide variety of spiritual and superstitious responses, some of which are reflected in the material record. While these offer an insight into medieval thoughts and prayers relating to how people sought to protect themselves, disasters must have affected the people who lived through them in ways which leave little or no trace in the surviving archaeological or documentary records. Their effects over the longer term on the mental health and psychology of the populations who experienced them, for example, goes virtually unmentioned by contemporary sources—although we may speculate as to the mental state of certain individuals, such as the anonymous inscriber of the bewailing graffito at Ashwell St Mary (see fig. 6.3). Nonspecific stressors, including psychological factors, which affect individuals during pre-adult development, can manifest themselves physically through abnormalities in growth and development such as reduced stature, vertebrae development and reduced life expectancy (Watts 2011). As it is rarely possible to identify the direct causes for these stresses, however, it would be exceedingly challenging to disentangle the contribution made by a specific stressor, such as a natural disaster, toward any developmental abnormalities in a specific individual. The silence on the issue of mental health and psychology in the historical sources, meanwhile, can largely be explained by the fact that the concept of post-traumatic stress disorder (PTSD) is modern, first defined in the 1950s although with 19th century origins (Andreasen 2010: 67-68), and was not recognised as such in the historical past. Instead, in medieval Europe, such conditions were usually classed as 'mania', with the 13th century English physician Gilbertus Anglicus describing the condition as follows: "those that have this sickness of melancholy,... have much sorrow, and dread much of thing[s] that is not to dread, and think on thing[s] that is not to think on", ascribing the condition to an imbalance of the bodily humours (Getz 1991: 13-14). Of course, not all those with conditions matching Gilbertus' description were PTSD sufferers, but his description would certainly encompass such cases. Although it is impossible to make entirely certain 'palaeo-diagnoses', suggested PTSD sufferers from the medieval period include crusaders, affected by the traumatic experience of war (Heebøll-Holm 2016), as well as those who lived through plague epidemics such as the Black Death (Boccaccio 1825: 15-16). Although explicit examples are lacking, another category must have been survivors of traumatic natural disasters.

Based on modern studies of individual and community responses and reactions to natural disasters, however, it is unimaginable that the occurrence of these events during the medieval period did not impact the psyche of those who lived through them. In the case of severe flooding, modern studies demonstrate that affected individuals commonly exhibit pronounced psychological effects in the aftermath of an event. Such findings have been robustly demonstrated across different cultural and demographic populations, in some cases incorporating control populations (see for example Canino *et al.* 1990), unaffected by flooding, to isolate the contribution of the flood event. The most commonly reported conditions in relation to flood victims are PTSD, depression and anxiety (Alderman *et al.* 2012; Stanke *et al.* 2012) but the extent to which individuals in a given population develop such mental health conditions is highly variable between studies—ranging from 8.6% to 53% (Lamond *et al.* 2015). Such a discrepancy is unsurprising as no two floods are alike and many variables affect how they impact human communities. Studies consistently point to the fact that different demographics (for example defined by age, gender or socio-economic status) are affected by post-event conditions to different degrees, although the specific outcomes are variable between studies. Some, for example, suggest that women affected by disasters face a greater risk of PTSD than men (Bonanno *et al.* 2007: 672, 678) while others have failed to identify appreciable differences (Fernandez *et al.* 2015). In the case of victims of the 2009 L'Aquilla earthquake, the type of behaviours exhibited by individuals was split along gender lines; females were more likely to experience sleeping disorders, including nightmares, avoidance of external reminders of the event and a generally negative emotional state while males were more likely to adopt 'mal-adaptive behaviour' such as smoking or alcohol consumption (Carmassi *et al.* 2014: 59), with the latter also seen in studies of flood victims (Fernandez *et al.* 2015). A specific individual's experience of a disastrous event has also been linked to the extent to which they are affected by post-event mental health conditions. In one case, for example, loss of loved ones and/or possessions was associated with an increased occurrence of post-event trauma (Assanangkornchai *et al.* 2004: 87) while in another those who experienced more severe flooding during the event were more likely to develop PTSD afterwards (Feng *et al.* 2007). A limited number of modern studies have also investigated the timeframes over which flood victims are affected by mental health conditions. One study demonstrated a correlation between flood exposure and mental health conditions which remained apparent five years after the occurrence of a flood (Fernandez *et al.* 2015) while in another, the severity of emotional distress, after a gradual downward trend, increased around the anniversary of the flood event (Assanangkornchai *et al.* 2007). How these conditions affect populations exposed to flooding over longer, decadal, timescales, however, is a topic which requires further study.

To what extent modern populations' psychological and emotional responses to flood events provide an appropriate analogue for those experienced by medieval populations is of course debatable. There are many fundamental differences between contemporary and medieval societies which could impact the extent to which mental health issues affected those who experienced natural disasters. Some of these differences may have made medieval society more resilient to a deterioration in mental health. For example, familial bonds may have been stronger in medieval society than in many modern settings—although family groups could still become scattered as economic migrants sought out better living conditions. The pervasive and institutionalised nature of the Church in medieval Europe also shaped perceptions of why specific disasters had occurred as well as the proper course of action to adopt in their aftermath. Both of these factors may have provided support networks, in the form of family groupings and the local congregation which, compared to many modern populations, may have ameliorated the development of mental health issues. Indeed, modern studies frequently cite social support and community assistance as factors which reduce the prevalence of mental health issues (Feng *et al.* 2007; Fernandez *et al.* 2015).

On the other hand, specific realities of the medieval world may have negatively impacted the mental health of medieval populations beset by disasters. The widespread belief that extreme weather events, rather than explainable natural occurrences, were signs of divine displeasure, for example, could have fuelled panic and worry in a population schooled by the Church in the importance of pleasing God in order to secure salvation in the hereafter. Through such a worldview, it is easy to imagine how the local occurrence of a disaster could trigger anxiety and fear for the future. In addition, the socio-economic balance of medieval society likely exacerbated the situation. Studies of modern communities have found that lower income groups face a greater risk of deterioration in mental health in the aftermath of flooding (Lamond *et al.* 2015). The high levels of poverty in the medieval world, therefore, would likely have compounded mental health problems arising from such disasters.

Familiarity with the hazard and preparedness for its onset may also have been important factors. Medieval lowland populations were certainly no strangers to flooding and, as such, they have been characterised as a 'risk culture' which was well adapted to dealing with the risks posed by flooding (Bankoff 2013). In Romney Marsh, for example, legal measures enshrined in the so-called 'Marsh Law', which sought to ensure co-operation between landowners to guarantee flood defences were maintained, had been in place since at least 1250 (Bankoff 2013: 30). It is unclear, however, whether such familiarity would have increased or reduced the chance of experiencing mental health issues in the aftermath of a flood. Modern studies analysing repeat flood victims point to varying conclusions—while some exhibited improved resilience from conditions such as PTSD, others displayed increased susceptibility (Lamond *et al.* 2015: 192). An important consideration must be the extent to which a disaster is expected as preparedness, both mentally and physically, guard against a subsequent deterioration in mental health (Assanangkornchai *et al.* 2004: 87). Without accurate weather forecasting there was no way that specific events could be pre-empted. Routine hazards, therefore, such as seasonal flooding were probably much less likely to cause mental health issues than disasters which were unprecedented by communal memory—be it the type of hazard, its magnitude or temporal occurrence.

Without historical evidence, people's thoughts and mental processes in the wake of specific historical disasters can never be reconstructed beyond doubt. Trusting modern analogues, however, it must be assumed that affected populations experienced a spike in mental health conditions such as PTSD, depression and anxiety after the occurrence of the types of hazards considered in Chapter 3. These conditions would have particularly acutely affected those who were poor and/or those who directly experienced the disasters. Through the worldview of medieval Christianity, the sudden occurrence of such events would also have provoked fear and anxiety although such spiritual concerns may have been quelled to some degree by Church ceremonies and festivals such as communal processions which purported to provide spiritual protection.

7.2.4 Summary

The impact of specific disasters has been enumerated at length—both above and in Chapter 3. Typically when high-magnitude natural hazards affected medieval populations the emergency phase of the disaster cycle (Alexander 2002: 6; see fig. 1.1) was characterised by widespread and severe damage and destruction and often, if contemporary chroniclers are to be believed, accompanied by high numbers of casualties. During this phase, effective responses were quite limited—where possible medieval people could flee from hazards or try to endure through them in locations thought to be safe from the hazard, such as strong buildings or high ground beyond the reach of floodwaters. In the aftermath of the event, however, the available options expanded significantly and practical solutions to the problems created by hazards became viable. It was at this stage that local authorities, and in some circumstances the Crown, became involved to mediate a return to normality. During this recovery phase, debris could be cleared, broken dikes could be restored and repairs to damaged structures could be organised. Doubtless, such activities provided a positive focus, which brought people together, for communities and individuals who, as well as coming to terms with their newly altered physical circumstances, may have been pondering the troubling eschatological implications that the Church often attached to the occurrence of natural disasters.

Over the longer-term, continued memory of such events—maintained in a wide variety of forms both material and intangible (as discussed in Chapter 6)—drove some level of adaptation. During the mitigation phase, therefore, structures were occasionally reinforced against the recurrence of future hazards—structural interventions after 1362, for example, including the repairs to the spire at Salisbury Cathedral (Miles *et al.* 2004: 20-22), the buttresses added to the church tower at Hitchin (Parker 1904: 38) and the secondary arch inserted beneath the spire at Austin Friars, London, (I'Anson 1866: 71) may be examples of such adaptive strategies within structures. In reclaimed wetlands, the continuity of dike maintenance was doubtless driven by the memory of what happened when the flood protection infrastructure failed and this, at times, led to high investment in improving such systems—as can be seen in the approach adopted by ecclesiastical landowners after the storms of 1287/88 (Gross & Butcher 1995: 108-109; Rippon 2001: 22-26). Such precautions and mitigation strategies provided a degree of protection from recurrent hazards—which was both tangible and also provided visible reassurance that necessary precautions had been taken to protect against the hazard(s).[15] This was important because, during the pre-impact phase, once again, there was little that medieval populations could practicably do to prevent the catastrophic impact of hazards. Where storms were foreshadowed by the weather, there may have been an opportunity to herd livestock to safety and move goods out of the way of floodwaters but even this was often not possible. A 1524 municipal regulation from the town of Krems, Austria, for example, gave permission for citizens to move their wine to a safe place, away from the banks of the Danube when threatened by flooding, as many of the town's wine cellars were at risk when the river flooded its banks. In the case of the disastrous flood of 1573, however, the fact that the

[15] Although note that such reassurance could be misleading. Reser (2007: 374) describes the 'levee effect'—a complacent outlook common among residents in flood-prone locales that assumes, once a flood defence is in place, that security is guaranteed whether or not defences are sufficient to protect against future flooding.

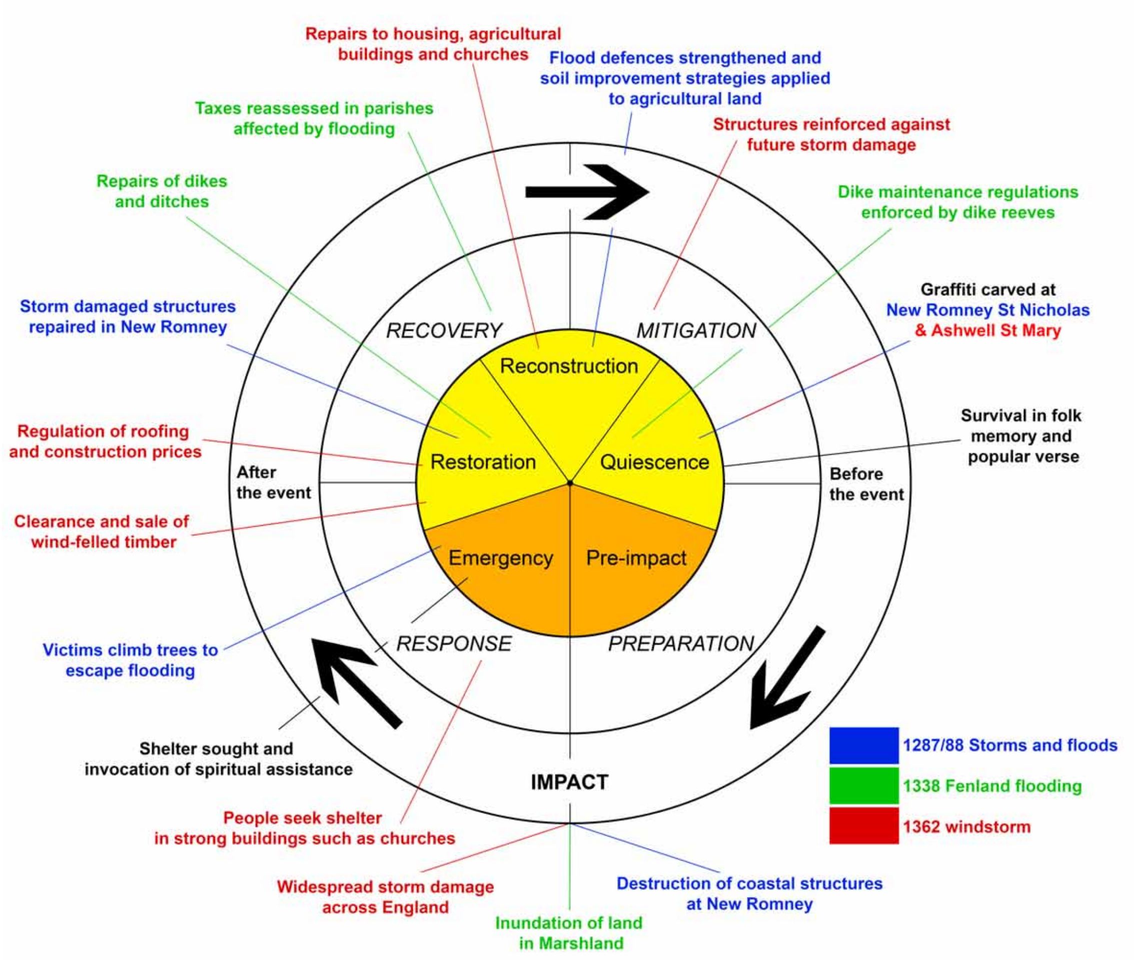

Figure 7.5: The disaster cycle applied to the disasters considered in Chapter 3. Each of the three most significant events considered in Chapter 3, the storms and floods of 1287/88 (blue), the Fenland flood of 1338 (green) and the 1362 windstorm (red), are shown in reference to each of the stages in this conceptual framework. Annotations in black can be assumed to have taken place in all disasters, although evidence may not survive. Notably, while the impacts of disasters were often severe, during the restoration, reconstruction and quiescence phases (highlighted in yellow), there were generally practical steps which could be taken to improve the situation. This was far less the case, though, during the pre-impact and emergency phases (highlighted in orange) when effective responses were extremely limited. Redrawn and annotated by the author after Alexander 2002: 6).

inundation was sudden and unexpected, and that it occurred at night, meant that there was not sufficient time to get the wine out of harm's way—resulting in devastating losses throughout the town (Rohr 2013: 138). While, in most cases, storms and floods gave some form of warning of their impending occurrence, landslides can occur after a significant period of time has passed since the triggering mechanism, either meteorological or seismic, has occurred.[16] For medieval populations, with no way of monitoring the physical properties of landslide-prone slopes, such unexpected and inexplicable occurrences would have made any preventative measures impossible and must have stoked interpretations of these disasters as the result of divine intervention.

This overview of the disaster cycle in reference to the case studies considered in Chapter 3

[16]It has been suggested that the occurrence of landslides increased in the 5 years following the Taiwan Chi-Chi earthquake in 1999, while weather-induced landslides frequently occur up to 5 days from the event thought to be the primary trigger (Tatard *et al.* 2010: 16).

is conceptualised in figure 7.5. The medieval capacity to react to the different challenges in each phase, reveals some interesting conclusions. Clearly, the practical responses adopted by medieval communities were most applicable to the restoration, reconstruction and quiescence phases, during which meaningful steps could be taken to restore conditions to their pre-event norms. In some cases, it was also possible to provide a degree of increased security in the event of a future recurrence of the hazard through structural responses. During the pre-impact and emergency phases, on the other hand, medieval responses were incredibly limited and this, combined with a poor understanding of the physical mechanisms behind most natural hazards, created a gap in medieval populations' physical understanding and ability to respond to natural hazards during these phases. According to Reser (2007: 382) "the search for causes and explanation... is a very common... psychological phenomenon typical of natural disasters". Where medieval populations were unable to explain disasters through physical means, therefore, it was natural, for those of the Christian faith, to turn to an explanation that was reinforced by the Church through a wide variety of media—divine intervention. It naturally follows that, against divine causes, disasters could be mitigated through divine measures. This explains the recourse to religious and superstitious practices, discussed in Chapter 5. While practical measures proved insufficient in providing protection in the moment of disaster, religious practices, most notably prayer but also practices manifest through material culture such as folded coins or *ampullae*, promised immediate deliverance at the utterance of specific words, the bending of a coin or at the dispersal of sanctified material. Far from being "blinded with profound stupidity that they believe[d] these things could happen" (Lewis 2001),[17] medieval peoples' reliance on spiritual and superstitious practices—the efficaciousness of which was no doubt vouched for and reinforced by members of the community—was, in fact, a logical response which 'plugged the gaps' in the available physical responses that were constrained by the limited scientific understanding of the age.

7.3 Physical signatures and material culture

The disasters considered in this thesis are evidenced by numerous physical indicators which can be linked to their occurrence. Certain types of hazard, left a physical signature in the moment of disaster itself—as the storm deposits linked to the 1287/88 storms detected across New Romney attest. Where this did not occur, the pattern of destruction and the subsequent repairs these engendered are the most obvious trace that can be linked to these historical disasters—as in the case of the breaches in dikes in Marshland and the widespread structural damage in buildings damaged by the storm of 1362. These repairs not only sought to repair the damage but, in some cases, also to improve resilience from the occurrence of hazards in the future. Other strands of evidence attest

[17] As the 9th century bishop, Agobard of Lyon, described those who believed in the magical genesis of hail and thunder (Lewis 2001).

to responses and social actions taken due to the occurrence of disasters. As discussed in Chapter 4, for instance, the burial of humans and livestock in unusual ways—such as mass graves—may relate to disastrous circumstances while inscriptions attest to the magnitude and occurrence of hazards—in the case of inscribed flood marks—as well as the fears of ordinary people and their desire to gain protection against any possible recurrence—as in the case of apotropaic graffiti. Such fears are also reflected in the artefactual evidence discussed in Chapter 5, the beliefs associated with which formed an integral component of medieval responses to natural hazards.

7.3.1 Disasters as 'watersheds'

The acute impacts of hazards, across a wide area of effect, have the potential to spur material and social change. In the case of low magnitude events, for example a fierce but routine storm which threatens structures but does not actually cause any material damage, this may be at such a low level that, from an archaeological perspective, it is imperceptible. As discussed above, however, more extreme events—those most likely to register as disasters to contemporary populations—may be expected to leave more recognisable signatures. In his assessment of the adaptations to seismic risk in medieval Cypriot ecclesiastical architecture, for example, O'Neill (*forthcoming*) posits that the devastating earthquake of 1350 led to a swarm of repair and redesign of churches across Cyprus attested by the standing building evidence. This wave of activity following at the heels of the earthquake, comprising clearance of debris, demolition and reconstruction, structural repairs as well as more ephemeral social interactions and indirect repercussions, could be conceptualized as a 'watershed'.

Running with the concept of high magnitude disasters as 'watersheds', some of the case studies considered above may accord with this concept. The storm series of 1287/88, for example, could be viewed as a watershed along the affected coastlines; covering much of eastern England as well as the Low Countries, with an area of effect roughly delineated by the evidence presented in Figures 3.1, 3.2 and 3.3. While the archaeological evidence from New Romney demonstrates the preservation of *in situ* remains connected to the storm series, these were the exception rather than the rule. Therefore, in the affected areas while evidence for late 13th century coastal flooding is likely to be connected to these events, less direct evidence is more likely to be encountered. This might include settlement contraction, altered settlement layouts, reorganisation of seafront and harbour facilities and/or renewed sea defences. Notably the dislocation in pottery manufacture identified by Barber (2008: 172) in the aftermath of the storms, manifest by the disappearance of shell and sand tempered wares, is another kind of watershed. On a regional scale this may assist in identifying pre- and post-storm contexts, elucidating human activity impacted by the occurrence of the storms.

In a similar vein, the storm of 1362 in England provides another example. Due to the uncertainty in identifying storm damage where it is not explicitly listed in the historical record, it is not possible to make a definite statement on this issue but the 1362 windstorm may serve as a watershed in architectural terms across the area of effect, and especially in eastern England. The vast number of churches damaged by the storm, attested by both contemporary chronicles and the standing evidence recounted above (see Chapter 3.3), with a high number showing evidence for post-storm repair, makes it worth considering how far reaching its impact may have been. Certainly, tower repairs and/or the modification of buttresses supporting tall structures, as at Hitchin, Hertfordshire, which date to the late 14^{th} century in southern and especially eastern England should be re-evaluated in light of the 1362 storm. While no far reaching claims are possible at this stage, it is certainly conceivable that a large number of such cases owe either to direct damage from the storm, and the subsequent phases of repair, or to adaptation in the design of such structures motivated by the damage experienced in 1362. Even if no damage was caused at a particular location, therefore, the storm's occurrence may have affected architectural decisions in new structures—especially churches and tall buildings—which were, themselves, unaffected in 1362.

In common with the picture gleaned from considering the economic impact of disasters, viewing disasters as 'watersheds' emphasises their role in bringing about change in human societies over the short-term—during their occurrence and in the immediate aftermath. This finds an analogy with a theoretical framework from the biological sciences, the concept of 'punctuated equilibrium' (Eldredge & Gould 1972). This posits that evolution does not occur at a constant rate but suddenly, as long periods of stasis are broken by rapid, bursts of change. Although, disasters are certainly not the sole instigators of cultural change, they do ignite a level of activity in certain spheres of human activity not seen in the preceding periods of quiescence which validates this comparison. Immediately, after the occurrence of a sudden-onset hazard, repairs must be organised, along with relief efforts and necessary provisions for circumstances created or altered by the calamity. Whether this frenzy of activity could be conceptualized as 'evolution', however, is a different question. Societal 'learning' is a potential product of this post-event phase, as explored in Chapters 4 and 6, but this may be more appropriately termed adaptation rather than evolution. Certainly, medieval populations' ability to adapt to new conditions created by disasters was key to coping with the challenges they engendered. Indeed, in their investigation of the varying trajectories of rural settlements in medieval Norway and Sweden, Svensson *et al.* (2012: 101) found that at those settlements where occupation was uninterrupted by the crises of the 14^{th} century, the unifying explanation for the continuity of settlement, based on the archaeological evidence, was adaptation—a population's ability to alter the way of doing things in light of the new reality in which they found themselves. While adaptation helped societies deal with disasters after their occurrence, there was no guarantee that these same adaptations would help them deal with future disasters—as every event is unique and may affect different geographic areas or spheres of life. The ability to adapt, however, would always have allowed communities a good chance of coping with the challenges created by disasters.

7.3.2 Signatures of disaster

As the changes which disasters stimulate within society appear to be manifest most obviously in the immediate aftermath of the moment of disaster, it is rare to be able to trace far-reaching changes in material culture to any specific disaster. Devastating calamities at the population level, however, may have more readily sparked shifts in society and its material culture which can be detected. Platt (2012), for example, has pointed to the social upheaval created by the Agrian Crisis of 1315-22, particularly the need for security, as the driving force behind the construction of moated homesteads across England during the early 14th century. Equally, in the aftermath of the Black Death analysis of tree-ring dates from timber structures across much of England points to a surge in the construction of non-aristocratic timber framed buildings (Dyer 2013). The improved living conditions in which the survivors found themselves as a result of the demographic collapse precipitated by plague appears to have allowed many to rebuild their homes with structures which may have been better suited to the new climatic conditions of the Little Ice Age (Campbell 2016b: 383). At the same time many other changes, which are manifest in late medieval material culture, took place. Standley (*forthcoming*) makes the case that the human suffering patently visible to medieval European populaces during the 14th century brought on the emotional involvement and affective piety which characterised lay devotion during the period. Funerary practices became less ostentatious affairs (Woolgar 2011: 18), although in some cases grave goods which may have held apotropaic significance appear to have become more common (Gilchrist 2008: 130-131)—perhaps a reflection of peoples' heightened concerns for the hereafter. An evolution also occurred in the culture of gift giving, affecting provision for feeding the poor and a general replacement of foodstuffs as gifts by their cash value (Woolgar 2011: 15, 18).

While it is easy to view these types of developments solely through the lens of plague, broader changes took place in the 14th century—Bruce Campbell's (2016b) 'great transition'—which hinged on the shift in climate from the generally favourable conditions of the Medieval Climate Anomaly to the colder, more hostile climatic regime of the Little Ice Age. These climatic oscillations created an environment in which natural hazards occurred with greater frequency and ferocity, as discussed above in Section 7.1.1,—a fact which is well illustrated by the litany of events spanning this period; the storms of 1287/88 and the other sea floods which continued throughout the period, the destruction of crops by unprecedented rains in 1315, 1316 and 1317 (sparking harvest failure and bringing on the Great Famine), the highest magnitude flood to have affected central Europe in 1342 (Dotterweich *et al.* 2003), the most deadly landslide in Norwegian history in 1345 and the unprecedented high-magnitude windstorm of 1362. As well as an age of plague, therefore, the transition from the Medieval Climate Anomaly to the Little Ice Age was also an age of disasters.

Changes in the material record which occurred during this pivotal period may be interpreted as 'teleconnections' between the dramatic fluctuations in the interrelated spheres of climate, disease,

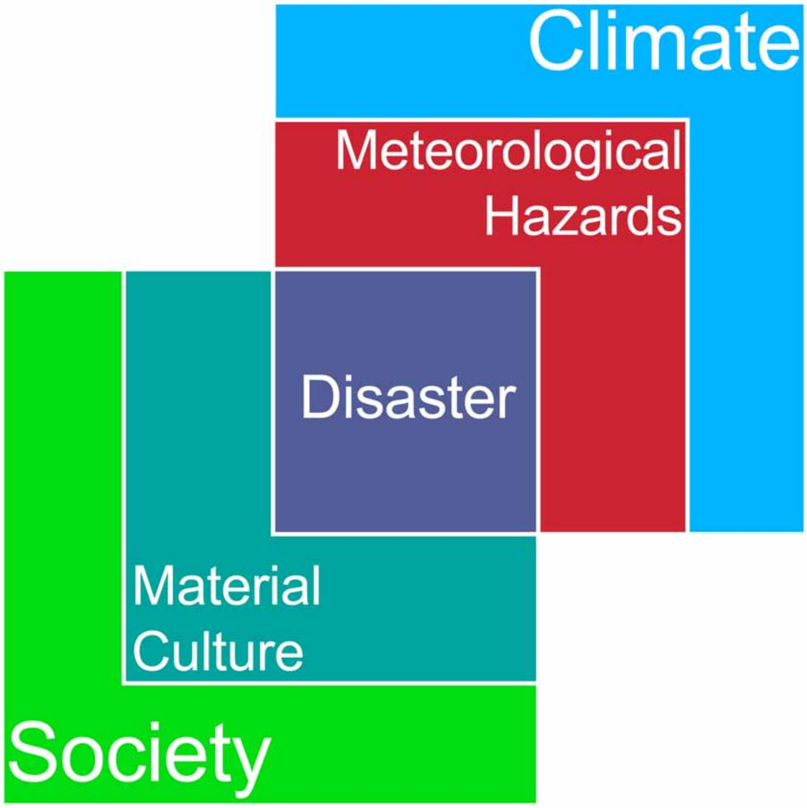

Figure 7.6: Disasters as the intersection of climate and society. Climatic processes cause meteorological hazards which spawn disasters when they interact with human society. Disasters both affect and are mediated by a societies material culture. Created by the author. Inspired by Campbell (2016b: 22; fig. 1.2).

population and society (see fig. 7.6). Material culture is the most visible way in which human society mediated the challenges imposed by deteriorating climatic conditions and the increased incidence of meteorological hazards this brought. In addition to the structural responses considered throughout this thesis, this may also be reflected in the types of protective artefact considered in Chapter 5 and, in some cases, a relationship between their circulation and wider affairs may be posited. The chronologies of *ampullae*, pilgrim badges, saintly relics and evidence relating to the cults of St Barbara, St Christopher and the Magi, when compared, display a pronounced divergence from the previous trend hinging on the mid 14th century and continuing throughout the 15th century. This is displayed in Figure 7.7, which uses 25-point moving averages in order, to some degree, to correct for the artificial jumps in the graphs which result from the use of broad periodisations to assign a date to each artefact as part of the PAS recording process. Alongside this data, Figure 7.7 also presents estimates of medieval English population after Broadberry *et al.* (2015: 20). The demographic collapse, for which the Black Death was the catalyst, of the mid 14th century registers as a major disjuncture between the period of sustained ascension, characterising the preceding period from the 11th to the mid 14th century, followed by stagnation until the early 16th century. Although the precise linkages are highly debatable, at the very least this 'before and after' pattern is similarly discernible in the temporal distribution of artefacts related to ritual protection considered in Chapter 5. A possible interpretation, therefore, is that, at a population level, the trauma of the

14^{th} century—spearheaded by the Black Death but also as a result of the numerous and recurrent disasters of the period—bolstered peoples' desire to protect themselves from the environmental dangers that defined the age. In reference to the calamities of the 14^{th} century, Jost (2016: 199) argues that "society underwent a psychological need for... protection in the face of such adversity" and this combined with lay populations' increased participation in religious practices (Jost 2016: 236) offers a compelling explanation for the rise in material culture linked to protection in the aftermath of a protracted period of crisis punctuated by high-magnitude disasters and a sudden drop in population. Adding a degree of credence to this interpretation is the fact that in systematic test-pitting across a wide area of eastern England, the prevalence of medieval ceramics dropped on average by *c.*45% in the post-Black Death era (Lewis 2016). If this represents a reliable proxy for material culture more generally, then clearly the protective artefacts considered in Chapter 5 significantly bucked the trend for material culture at this time. Certainly, the manifold disasters of the period created "the need for the utmost power to protect against misfortune and disaster" (Standley *forthcoming*).

Folded coins and *bullae* were not included in these comparisons as the circulation of both categories of artefact were dependant on other factors—the wider availability of coinage, in the case of folded coins, and documents from the Papal curia, in the case of *bullae*. As such, although the evidence certainly suggests they were relied upon for spiritual protection during the Middle Ages, it follows that their chronology closely tracks that of their 'raw materials'; *ie.* coin folding as a practice increased when more coins were in circulation and ritualised re-use of *bullae* increased when more *bullae* were available more generally. This is supported by the finds from the PAS database (see figs. 5.23 and 5.17). This being the case, one of the greatest divergences evident between folded coins and the availability of coinage more generally occurred during the mid-14^{th} century—when we might assume that individuals and society's requirement for spiritual intervention was at its greatest. *Bullae* with evidence for ritualised re-use make up only a small percentage of *bullae* finds overall so, in this case, such divergences may not be meaningful.

7.4 Summary

This thesis has sought to reconstruct the occurrence of a number of historical disasters using archaeological and historical approaches and to evaluate and contextualise their impact and what the occurrence of these types of event meant for contemporary society. A number of conclusions stand out. Disastrous circumstances arose as a result of the intersection of meteorological hazards with human society. As such, climatic factors which increased the incidence or intensity of these hazards played a role in the onset of many of the disasters which characterised the transition from the Medieval Climate Anomaly to the Little Ice Age. At the same time, however, endogenous economic and social conditions exacerbated the vulnerability of contemporary society and, correspondingly,

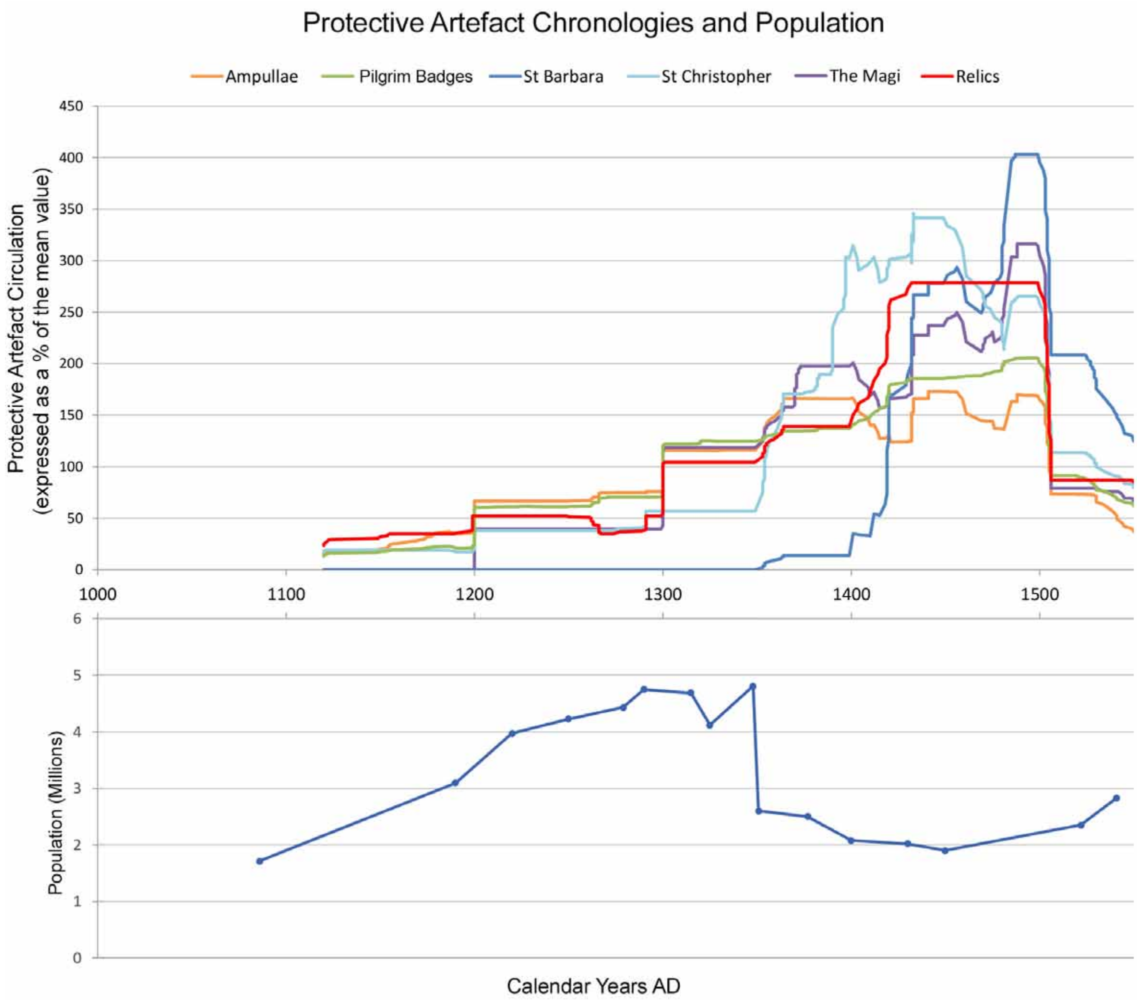

Figure 7.7: Protective artefact chronologies from the categories examined in Chapter 5 and population. 25-point moving averages of the chronologies of *ampullae*, pilgrim badges, material culture relating to the cults of St Barbara, St Christopher, the Magi and Saintly Relics, recorded by the PAS database. Data described in more detail in Chapter 5. Values for the cult of St Barbara have been divided by 2 to allow for easier comparison. Created by the author. Population estimates after Broadberry *et al.* (2015: 20)

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their impact. In general, medieval society was relatively well adapted to deal with disaster in the aftermath through the organisation of repairs, the re-construction of flood defences and their continued maintenance. These practical responses were largely organised and undertaken at the local level although, typically, the Crown did become involved when disasters occurred at a national scale and to regulate markets and financial considerations. Especially where disasters were unprecedented and/or arose without warning, medieval society was relatively unprepared to cope with disasters during the pre-impact and emergency phases. Modern psychological studies suggest that unexpected disasters are especially troubling and this must have particularly been the case when the natural mechanisms which caused disasters were poorly understood. At these times, however, spiritual protection invoked through prayer and specific types of artefact thought to provide protection provided a response which, to medieval people, seemed a logical recourse. The evidence obtained from the finds reported to the PAS, suggests that the uptake and reliance on these spiritual routes to protection experienced a pronounced expansion of use in the era following the Black Death and the climatic fluctuations of the 14th century. This suggests that, at a population level, the numerous disasters of the 14th century brought about a change in the beliefs of medieval society based on their psychological requirement for security.

Chapter 8

An endless chain of catastrophes?

The filmmaker and documentarian Werner Herzog describes existence as "an endless chain of catastrophes".[1] Indeed, as this thesis has explored, the existence of medieval communities in northern Europe was punctuated by the occurrence of natural hazards which, under the right circumstances, generated human disasters. The jump from hazard to disaster is ill-defined and varies between cultures (Bankoff 2004) but relates to both the characteristics of the hazard(s)—such as the recurrence interval[2] and magnitude—as well as factors endogenous to the affected societies—including the vulnerability, resilience and capacity for adaptation of the communities in the path of the hazard. These considerations differentiated the 'everyday risks' from the 'disasters' (Rohr 2013: 144-145) and are evident in all of the disasters considered in Chapter 3. The storms of 1287/88 had an acute impact along the coasts of south-eastern England exacerbated by their high magnitude and close temporal clustering. The archaeological evidence for structural damage and the deposition of sediments by storm action at New Romney demonstrates the severe implications that these events had for the contemporary inhabitants. The worst floods in Marshland over the 13th and 14th centuries, although a part of life in the Fens, came at a time when society was particularly vulnerable as a result of increased taxation, high demographic pressure and perhaps the delayed impact of earlier disasters such as the Agrarian Crisis of 1315-1322. The St Maur's Day storm of 1362, on the other hand—which damaged churches, other structures and blew down trees across much of England—came amidst a renewed outbreak of plague and was likely an unprecedented hazard for the contemporary population. High magnitude landslides, on the other hand, were rarely, if ever, events which medieval communities anticipated and, as such, when they affected human concerns their impacts were invariably regarded as disasters—although their typically limited area of effect and the low detail of much of the surviving historical evidence makes investigating these events a challenge.

This thesis has refined existing knowledge of the occurrence of the case studies described above through a consideration of a wide variety of different forms of evidence. In many cases, this has

[1] Encounters at the End of the World (2007) Directed by Werner Herzog. Discovery Films, USA.

[2] Events perceived as disasters were most likely to have either very long recurrence intervals, beyond the period of time that memory of the disaster could easily be transmitted, or shorter yet variable intervals which could result in the clustering of hazards over a short span of time—as occurred in the 1287/88 floods.

permitted reconstructions of the areas of effect and types of damage unleashed by natural hazards on medieval society (as in 1287/88 at New Romney, see fig. 3.4; in Marshland between 1287-1349, see fig. 3.12; and across England in the storm of 1362, see fig. 3.25). The historical and archaeological data, when used in concert, often allow a relatively clear picture of the short-term impact of these events to be established. Where archaeological evidence relating to the 'moment of disaster' survives, this often reveals tantalising evidence; crystallising a window of time in which the interplay between natural hazards and human societies created disastrous consequences. In the case of the 1287/88 storms, this is reflected in the structures damaged by storm flooding in New Romney—mainly in the plots along the town's medieval coastline—while the damage pattern traced through structures across the British Isles attests to the damage wrought by the storm on 15th January 1362.[3] Such material evidence is, however, the exception rather than the rule and it is, therefore, complemented by the surviving historical record which allows a more comprehensive picture of the occurrence of disasters to be established. Unifying data from the two disciplines provides the most holistic understanding of disasters but this frequently proves problematic due to the, sometimes significant, chronological uncertainties inherent in interpreting the archaeological evidence. This problem will hopefully be mediated in the future by the refinement and increased adoption of scientific dating techniques, such as luminescence dating, which have the potential to provide substantially greater chronological resolution than dating based on ceramic typologies—upon which the dating of the majority of contexts considered in this thesis are based.

During the tantalising 'moment of disaster', medieval populations were relatively helpless—finding themselves at the mercy of nautre's extremes. During the aftermath, however, a wide variety of options and possible pathways to recovery opened up. First and foremost, the costs of the catastrophe had to be counted, debris had to be cleared and the worst of the damage had to be repaired. This phase is widely reflected in the historical record—with the repairs to roofing by tilers and thatchers after the 1362 windstorm an obvious example—but can also be seen in the clearance of building debris in sites damaged by the 1287/88 storms in New Romney. The repairs to breaches visible in the Marshland sea wall were probably also fairly rapid repairs in the short-medium term after their appearance as a subsequent flood could have arisen at any time—and existing breaches would have let the water come through unhindered, perhaps causing further damage to the sea wall and inundating an even larger area. As an agrarian society, the success of the harvest, agricultural yields and the survival of livestock were of foremost significance and where disasters had destroyed crops or decimated herds a period of re-adjustment followed in which new strategies were introduced in an attempt to mitigate any losses —flooding, for example, frequently promoted the cultivation of beans, which were more resilient to saline soils and helped restore soil

[3] Coincidentally, another weather pattern from this year is fossilised through the tephra cloud generated by the Icelandic Öræfajökull eruption in June 1362, which has been detected in Greenland, Scandinavia and Ireland (Wastegård & Davies 2009: 505-506).

fertility, or a switch to pastoralism. In order to prevent disasters pushing medieval populations to a ‘tipping point’, landowners, higher authorities or the Crown often took seriously difficulties faced by individuals and communities in meeting their financial responsibilities. This can be seen in the aftermath of the damaging floods of 1338, when Edward III consented to a reassessment of the tax owed by the affected communities in Marshland, Norfolk. In such cases, authorities seem to have judged pragmatically that by overlooking a portion of rent or tax in the short-term the recovery process could be accelerated allowing normal payments to be resumed as quickly as possible. Charity too played a role during this phase although, as this was largely motivated by spiritual and eschatological concerns rather than outright philanthropy, the Church was one of the primary beneficiaries of such charitable giving and the extent to which donations and alms were dispersed to genuine disaster victims is unclear.

Once the most pressing issues created by the occurrence of disaster had been addressed, society had a chance to reflect on what had brought about the disaster and how protection from a similar future event might be gained. This was often approached in a surprisingly pragmatic manner—the high investment in sea defences by the monastic landowners on Romney Marsh in the wake of the 1287/88 storms, for example, demonstrates an acceptance that storms and floods were an expected reality against which practical precautions were necessary. The archaeological evidence demonstrates that in the aftermath of floods, dikes were sometimes heightened beyond their pre-flood dimensions—clearly recognising that what had stood before had been insufficient—and, in structures exposed to flooding, floor levels were sometimes raised above the height reached by floodwaters. As a class of structure, bridges, which were frequently damaged by torrents of water in times of flood, saw particular experimentation in methods and materials of construction as well as design, to some extent becoming stronger and more resilient over the course of the Middle Ages with the development of innovations such as cutwaters and enlarged flood arches as well as the general switch from timber to more resilient masonry or brick construction. Similarly, in ecclesiastical structures, the occurrence of storms provoked structural interventions which aimed to make the structure strong enough to withstand the forces of a future storm. Such modifications included the insertion or strengthening of buttresses, the use of stronger roofing materials or supporting internal scaffolds. Evidently, the need for such structural adaptations in light of the perceived risk from natural hazards outweighed the cost of carrying out such structural interventions. As discussed in Chapter 6, the transmittance and continued survival of memories relating to disastrous occurrences allowed knowledge relating to these hazards to be passed on to subsequent generations. In most cases this amounted only to relatively low resolution information—as in the case of flood levels—but even this was important in ensuring society grasped the importance of, for example, ensuring flood defences were properly maintained. This was particularly pertinent in reclaimed wetlands where—as well as being especially vulnerable should the flood defences fail—such works were usually mandated by local regulations and overseen by specially appointed officials. These areas were amongst those exposed to the most recurrent hazards and as such, the need for such institutional oversight of the flood defence system is perhaps unsurprising. From an entirely practical standpoint, therefore, such a system demonstrates a high acceptance of the risk posed by flooding which was met with correspondingly high investment to mitigate this risk. In this regard, a parallel can be drawn with traditional societies in the present day, which, according to Bankoff (2004: 32), "historically developed sophisticated strategies and complex institutions to reduce the constant insecurity of their lives". This was also very much the case in medieval northern Europe. The general picture, therefore, is that medieval populations were well equipped to respond against disasters in the aftermath and over the long term. During the restoration, reconstruction and quiescence phases of the disaster cycle there were a wide variety of practical steps which could be taken to improve the situation and bring about a return to normality while, over longer timespans, medieval communities both recognised the requirement to improve the ability of their buildings, infrastructure and settlements to withstand the forces of natural hazards and, as far as possible, acted to ensure this was the case.

The suite of options available to medieval communities in the aftermath of disaster must have had a positive psychological effect as they could clearly see that, through their own agency, they were usually able to restore conditions to pre-disaster norms and could take pro-active steps to prevent such conditions re-occurring. This contrasts starkly with their experience during the pre-impact and emergency phases, however, when, especially at the 'moment of disaster', their options were extremely limited. They could choose to flee but even this was not always a valid option—floodwaters might make escape impossible, as occurred when the unfortunates described by John of Oxnead were forced to climb trees in 1287 (Ellis 1859: 270-271). Equally, there was no escape against a high magnitude windstorm—contemporaries must have been forced to 'hunker down' and wait out the 1362 storm in structures which creaked from the force of the wind outside. In such circumstances, it is easy to see why religious and superstitious practices—which offered some hope of guaranteeing the safety of the participants and brining such frightening circumstances to a close—were popular throughout pre-modern Europe. It was impossible to disprove the efficacy of such strategies—storms and floods always subsided eventually and this was invariably seen as confirmation that such practices were effective. The need for additional spiritual protection also permeated into some of the, otherwise practical, physical responses taken against hazards. For instance, the deposition of cauldrons within the fabric of dikes in the Netherlands demonstrates that the dikes, on their own, were often not perceived to provide sufficient protection, or that an extra 'insurance policy' was desirable. This may relate to the lack of technological understanding of both the causative mechanisms behind hazards and the physical response of structures to the forces unleashed by these hazards. As a result, medieval builders were left somewhat in the dark, unable to know whether what they had built could withstand the forces of the natural hazards it was likely to face. Over time, therefore, the impression could have developed that strong buildings alone were insufficient and only in tandem with spiritual protection could they be expected to survive against nature's extremes.

The evidence obtained from the material culture considered in Chapter 5 suggests that, during the medieval period, and hinging on the 14th century, the extent to which these spiritual practices were relied upon underwent a significant change. While one might conclude this was solely a product of the Black Death, in fact, the 14th century was plagued by other significant disasters—the Agrarian Crisis of 1315-1322, central Europe's worst flood in 1342, Norway's most damaging landslide in 1345, the recurrence of plague in the early 1360s and the ferocious windstorm of 1362, together with the flooding it caused along the Frisian coast.[4] It is a valuable exercise to consider the unfortunate life history of an individual born in *c.*1280 in England who would have experienced the near universal trauma of the 1315-1322 Agrarian Crisis during their late 30s and the Black Death during their 70s—and, if they had been especially unlucky may also have witnessed one or two of the disasters considered in Chapter 3.[5] It is hard to imagine that being witness to such disastrous circumstances could not have had a profound psychological impact on the psyche of this generation and their descendants. Indeed, this pronounced period of disasters, appears to have triggered a response at the population level—causing people to seek protection from the dangers posed by natural hazards to a greater extent than had been the case in the past. Based on the medieval Christian worldview and the commonly accepted explanation of the causation of natural disasters, such a response was logical—without a scientific understanding of the factors behind hazards and the response of structures to their effects, more practical solutions were not necessarily obvious. While this thesis has provided evidence for one way in which people responded to the challenges of the 14th century, there is much about this time that remains uncertain. Our understanding of the impact of this tumultuous time on contemporary belief could be refined in the future by the consideration of additional categories of material culture to those considered in Chapter 5, artefacts which are not included within the PAS database—such as museum collections and excavation archives as well as evidence from neighbouring geographic regions.

Returning to the aims of this thesis stated in Chapter 1, it has been largely possible to address these although further work in the future will allow more detailed knowledge and clarification in certain areas. The first of these, to reconstruct a number of detailed case studies, was the product of Chapter 3, which investigated a range of types of hazard through different sources of evidence, permitting a particularly wide-ranging analysis of disasters as a broad category. The second aim was to characterise medieval responses to these events. Chapters 4 and 5 tackled this topic identifying many areas in which responses to disaster during the medieval period can be traced. Although beyond the scope of this thesis, many of these areas would benefit from further consideration—such as the specific agricultural strategies adopted in the aftermath of disasters

[4]Where it became known as the "*Grote Mandrenke*" or Great Drowning of Men.

[5]It is perhaps also worth considering whether living through such traumatic times would leave any signatures in such an individuals bones that scientific analysis might reveal.

and the structural adaptations necessitated by disasters in bridges and ecclesiastical architecture. Importantly, a seemingly incongruous relationship between physical and structural responses and superstitious and religious responses was identified which are reconciled when interpreted in light of the level of understanding and technological abilities of medieval society in reference to the different stages of the disaster cycle. The third aim was to assess the extent to which exposure to disaster affected the resilience of medieval society in the face of disasters. This was mainly considered by Chapter 6 which found that, although only relatively low resolution information concerning disasters was transmitted to subsequent generations, this could have played an important role in improving preparedness against hazards—particularly those which recurred relatively frequently. For those hazards which recurred over timescales too long to be meaningful for humans, however, it was unlikely that memory of the event would survive from one occurrence of the disaster to the next—meaning that resilience would be unlikely to be affected. Finally, the fourth aim was to examine the role of disasters as drivers of cultural change. This has been accomplished in a variety of ways including a consideration of the long-term trajectories of settlements affected by disasters. This topic, however, would benefit from a more detailed consideration as the myriad of factors which affect the pathways taken by settlements struck by disasters, and the many factors which play into what form this takes, require a large dataset to provide meaningful answers. The material culture considered in Chapter 5 provides another avenue to investigate cultural change influenced by disaster and it is suggested here that the experience of multiple disasters over the 14^{th} century, in aggregate, caused a sea-change in belief patterns at the population level.

Despite the fatalistic interpretation of natural disasters as events orchestrated from heaven conveyed in many of the documentary sources, medieval populations clearly had a sophisticated understanding of natural hazards, the threats they posed and what steps might be taken to protect and mitigate against their occurrence. In a number of ways, however, they were constrained in what could practically be accomplished by the limits of scientific and technological understanding of the age. These gaps in understanding created a psychological requirement for alternative explanations which, to medieval Christians, were logically filled by the agency of God—ushering in the power of prayers, protective amulets and ritual deposits as logical and efficacious responses against disaster. Although, therefore, in many cases medieval peoples' first response to disaster was prayer for divine intercession, in the aftermath they almost always responded to the new reality in which they found themselves practically—adapting to changed circumstances by repairing what had been damaged, and, in some cases, improving what had stood before so that it might better withstand hazards in the future. In a variety of ways, therefore, medieval populations adapted to the challenges of disaster and were thus able to, at least temporarily, uncouple Herzog's 'endless chain'.

Appendices

Appendix A

Locations affected in the storms of 1287/88

January 1287			
Location	County	UK Grid Reference	References
Essex	Essex	-	(Luard 1869: 308)
Boston	Lincolnshire	TF327440	(Luard 1869: 308)
Holland	Lincolnshire	-	(Owen 1986: 61-62)
Lincolnshire	Lincolnshire	-	(Luard 1869: 308)
Lindsey	Lincolnshire	-	(Owen 1986: 61-62)
Great Yarmouth	Norfolk	TG525065	(Ellis 1859:268; Luard 1866: 338; Luard 1869: 493
Kirkhale	Northumberland?	?	(Luard 1859: 167)
Bury St Edmunds	Suffolk	TL849648	(Ellis 1859: 268)
Dunwich	Suffolk	TM478705	(Ellis 1859: 268)
Ipswich	Suffolk	TM159445	(Ellis 1859: 268)

Table A.1: Historical references to specific regions and locations affected by storms and flooding in January 1287. Compiled by the author.

December 1287			
Location	County	UK Grid Reference	References
Abbey of St Benet at Holme	Norfolk	TG381157	(Ellis 1859: 270-271)
Great Yarmouth	Norfolk	TG525065	(Luard 1859: 168; Luard 1866: 338; Luard 1890: 68)
Hickling	Norfolk	TG413243	(Ellis 1859: 270; Luard 1859: 168; Luard 1890: 68)
Horseye	Norfolk	TG456226	(Luard 1859: 168; Luard 1890: 68)
Martham	Norfolk	TG452181	(Luard 1890: 68; Luard 1859: 168)
Waxham	Norfolk	TG441262	(Luard 1859: 168)
Frisia	Frisia	The Netherlands & Germany	(Pertz 1874: 565)

Table A.2: Historical references to specific regions and locations affected by storms and flooding in December 1287. (Created by the author).

February 1288			
Location	County	UK Grid Reference	References
Barnwell Priory	Cambridgeshire	TL479584	(Luard 1866: 340; Luard 1869: 495; Stubbs 1880: 293)
Appledore	Kent	TQ956296	(Stubbs 1880: 293)
Romney	Kent	TR065247	(Stubbs 1880: 293)
Thanet	Kent	-	(Stubbs 1880: 293)
Winchelsea	Kent	TQ950176	(Stubbs 1880: 293)
Mablethorpe	Lincolnshire	TF506850	(Owen 1986: 61-62)
Maltby-le-Marsh	Lincolnshire	TF466815	(Owen 1986: 61-62)
Spalding	Lincolnshire	TF246230	(Luard 1869: 313-314)
London	City of London	TQ302802	(Luard 1869: 311-312)
Great Yarmouth	Norfolk	TG525065	(Luard 1869: 313-314, 495)
King's Lynn	Norfolk	TF622198	(Luard 1869: 495)
Bury St Edmunds	Suffolk	TL849648	(Arnold 1896: 35)
Gulpher	Suffolk	TM326377	(Bailey 1991: 199)
Hohenhack	Alsace	France	(Pertz 1861: 215)
Flanders	Flanders	Belgium	(Pertz 1861: 215)
Frisia	Frisia	The Netherlands & Germany	(Grundmann & Heimpel 1949: 74)
Holland	Holland	The Netherlands	(Grundmann & Heimpel 1949: 74)
Zeeland	Zeeland	The Netherlands	(Grundmann & Heimpel 1949: 74)

Table A.3: Historical references to specific regions and locations affected by storms and flooding in February 1288. (Created by the author).

Appendix B

Documentary evidence for the storms of 1287/88

B.1 *Chronica Johanis de Oxenedes*

"Anno gratiae Mcclxxxvij, nocte Circumcisionis Dominicae tam venti vehementia quam maris violentia apud Gernemutam, Donewycum, Gypeswycum et alia diversa loca Angliae, aliarumque regionum mari contiguarum, prostrata sunt aedificia, et praecipue in illa parte Angliae quae Merslandia vocatur tota fere patria in stagna aquarum conversa, hominum multitudo intollerabilis aquis interceptra est et necata.

In crastino octacarum Epiphaniae ante auroram subitae coruscationes apud Sanctum Aedmundum apparentes videntes non modicum terruerunt. In eadem tempestate iterum mare erupit omnia, replens sibi finitima." (Ellis 1859: 268).

"Eodem anno mense Decembri cyclo decennovenali xv., septimo kaldendas Januarii, luna viiij, mare tam ventorum vehementia quam importuna et tumida ejusdem violentia, coepit densa caligine perturbari et perturbatum fines solitos per littora plana cum ingenti impetu erumpere, occupans villas, agros et caetera loca suis terminis adjacentia, necnon partes inundans quas nulla aetas seculis retroactis se meminit praevidisse aquis marinis irrigatas. Nam circa mediam noctem in suo accessu egrediens viros et mulieres in stratis suis cum lactentibus in cunabulis dormientes, genera etiam omnia jumentorum et pisces aquarum dulcium suffocavit vel submersit, domos cum universis suis contentis a fundamentis radicitus evulsas cum damno irrecuperabili asportatas in mare projecit. Multi aquis circumvallati quaerebant locum refugii et dum ascenderent arbores frigore dissoluti in villa de Hyckelingge novies viginti diversi sexus et aetatis aquis praedictis interire. In prioratu canonicorum ejusdem villae praedicta inundatio magnum altare eorum altitudine unius pedis et amplius est supergressa. Cononici omnes duobus tantum ibi relictis navigio confugerunt, qui dup equos ac res alias quas ab aquis rapere poterant, in eorum dormitorio quod est in volta salvaverunt. Et non solum in praedicta villa verum etiam in caeteris villis mari contiguis damnosa fit hominum periclitatio, cum praedicta inundation in profunda noctis obscuritate accidit advenisees.

Abbatia vero sancti Benedicti de Hulmo veluti punctus in magna circumferentia flumine stetit circumvallata, de qua dici posset illa Prophetia, "Abissus vallavit me et pelagus operuit caput meum:" nam omnes officinas in eadem abbatia, sive domos inferius sitas, praedictus fluvius marinus impleverat in tanta profunditate ut naviculae per medium earum ducerentur nec furnire potuerunt ibidem vel braciare. Fit illo in tempore urgente necessitate sancti Benedicti ecclesia stabulum equorum. Ista miserrima pestilentia non solum accidit in Norfolcia sed per plura Angliae loca." (Ellis 1859: 270-271).

"Anno gratiae Mcclxxxviij, pridie nonas Februarii, luna xxviij., mare iterum venti borealis austeritate perturbatum circa solis ortum in suo accessu erupit ad prioris fluvii terminos modico deficiente attigens. Quod a primo remanserat per istud funditus est annihilatum.

Eadem tempestate perdurante, in crepusculo noctis praecedentis, subito et ex inopinato, apud Santum Aedmundum, nullis penitus signis praembulatis, sub uno et eodem momento apparuit coruscatio, cum non dico tonitruo sed fragore quodam terribili foetoreque subsequente intollerabili. Comitabantur, etiam dictam tempestatem scintillae ignis manifestae, oculos videntium horribiliter concutientes. Hujus siquidem tempestatis vehementia turri ecclesiae de Bernewelle succensa, aliisque damnis conventui loci ejusdem illatis: terria fere pars ipsius villae illo igne consumpta est. Eodem igne fulgurante refectorio Sancti Aedmundi aliquantulum adhaesit; sed celerrime a monachis est subventum." (Ellis 1859: 271).

B.2 *Annales de Dunstaplia*

"Eodem anno in hyme fuit maxima inundatio pluviarum, et mare septentrionale ab el Humbre usque ad Geremue consentum alveum pertransibat, et in latitudine alicubi per tres leucas, alicubi per quatuor, quicquid reperit submersit. De hominibus vero, ovibus, et jumentis, maxima multitudo est necata" (Luard 1866: 338).

B.3 *Chronicon de Thomas Wykes*

B.3.1 *Innundatio Holandie.*

"In festo Circumcisionis Dominicae, ingruente vento fortissimo flante de partibus Orientis, qui et Eurus dicitur, et fluxu maris super provinciam Hollandiae terribiliter invalescente, praevaluerunt aquae maris, adeo ut fossata, quae terram ipsam et mare disterminant, inopinatius quam credi poterant transgrederentur, posuitque terram fructiferam in salsuginem tam repentinus maris impetus; cui per indigenas nullatenus poterat obviari: et maxima pars villae Sancti Botulfi submersa, hominumque et pecudum inaestimabilis periit multitudo. Consimilis inundatio facta est in Essexia, et in multis aliis provinciis quae pelago contiguantur, in planis litoribus ex parte Orientali; nec est visa tam horrenda maris alluvio in partibus illis a triginta retro annis et amplius." (Luard 1869: 308).

B.3.2 *Quod mare uno eodemque die bis fluxit et refluxit.*

"Mense januarii, una dierum inter Conversionem Sancti Pauli et Purificationem beate Virginis, accidit mirabile prodigium, fortasse alicujus eventus secuturi praesagium. Quippe maris inundatio tam vehementer invaluit, ut una die et nocte contra consuetum ordinem et cursum naturae quatuor vicibus fluere et refluere videretur; quinetiam cadia Londoniarum super ripam fluvii Tamensis adjacentia, quae maris impetum cohibere consueverant, superundait, et domos civitatis ultra terminos consuetos longe amplius quam ullus unquam mortalium viderat, fluctibus aequoreis inopinate cooperuit; villas quoque et agros quamplures partibus maritimis adjacentes absorbuit, homines innumerabiles et jumenta pariter infinita submersit."(Luard 1869: 311-312).

B.3.3 *De diversis incendiis contingentibus in Anglia cum inundatione maris.*

"Sane prater inauditas maris alluviones quas supra commemoravimus, per diversas regni provincias effraenis pelagi vesania deploranda nimis dispendia parturivit. Quippe impetuosa vorago monasterium monachorum de Spaldinges fluctibus operiendo non mediocriter damnificavit; habitationem quoque fratrum Praedicatorum Gernemuthae, quae mari contiguatur, fluctibus cooperuit inopinis; nec pepercit oppido Gernemuthae, cominus adjacenti, verum etiam nonnulla burgi ipsius aedificia submergendo delevit. Huic insuper accessit incommodo variis in locis ignis immoderata desolatio; ignis quoque fulmineus ex concussione tonitrui generatus campanarium monasterii de Bernewelle juxta Cantebrigiam, magnamque partem aedificiorum suorum indiscreto devoravit incendio; ignis etiam fotuitus vehementer accensus monasterium Persorae cum burgo paene redegit in cineres; sicque factum est ut quasi damnificando regnum nostrum elementa contraria concertarent." (Luard 1869: 313-314).

B.4 *Flores Historiarum*

"Eodem anno facta est inundatio maris magna in magna Gernemuta et in villis adjacentibus, ut in villis de Martham, de Hikelinge, de Horsethe, et ita crevit flumen apud Gernemutam magnam, quod ultra magnum altare in ecclesia ejusdem villae transcendebat.

Eodem anno mense Decembris, xviii. kal. Januarii, mare tam ventorum vehementia quam trebida violentia terminos solitos egrediens et omnia loca sibi contigua occupans ac partes litoreas, quas nunquam se meminit aliquis praevidisse, transivit, viros et mulieres cum lactentibus in cunabulis intercipiendo submersit." (Luard 1890: 68).

B.5 *Annales de Wigornia*

B.5.1 1286

"Kalendis Januarii mare subvertit Minorem Gernemue cum castello, et plusquam duo milia hominum submersit, et terram canonicorum de Castellacra et horrea dissipavit." (Luard 1869: 493)

B.5.2 1287

"Juxta Gernemue et Len mare praeter consuetudinem transivit terminos consuetos, unde contigit multos homines submergi et villas deleri. Ecclesia de Bernwelle ictu fulguris cremabatur." (Luard 1869: 495).

B.6 Gervase of Canterbury

"Pridie nonas Februarii mare ita erexit se in Thaneto, et juxta, et in marisco de Romenal et omnibus locis adjacentibus, quod omnes wallias dirupit, et fere omnes terras operuit a magna wallia de Apuldre usque Winchelese versus austrum et versus occidentem. Eodem die tantum fulgur visum est quale non fuit ex quo gentes esse coeperunt. Monasterium vero de Bernewelle Eliensis diocesis per hujus fulgur combustum est." (Stubbs 1880: 293).

B.7 Bartholomæi de Cotton

B.7.1 1286

"Anno Domini MCCLXXXVI. in vigilia Circumcisionis Domini, circa mediam noctem vehemens ventus subito auditus est, ex cujus flatu horribili facta est inundatio maris magna, ita quod per inundationem clxxx. naves numero apud Kirkele una cum nautis periclitabantur; sed pauci, Dei misericordia opitulante, miraculose ad portum salutis venerunt." (Luard 1859: 167).

B.7.2 1287

"Anno gratiae MCCLXXXVII. die Dominica proxima ante festum Sancti Thomae apostoli in Novembri, circa mediam noctem audita sunt tonitrua, et die Mercurii proximo sequente facta est inundatio maris magna. In cujus inundatione seu immensa tempestate in villis de Horseye, Waxtonesham, Marcham, Hikelinge et in villis adjacentibus cc. homines submersi sunt. In villa vero de Gernemuta centum homines sunt submersi. In magna vero Gernemuta prostratus est murus lapideus cimiterii per inundationem maris spatio lx. pedum. Et prostratus est murus prioris pronus in terram, et ita flumen accrevit quod ultra magnum altare in dicta ecclesia transcendebat." (Luard 1859: 168).

B.8 Hagnaby Abbey Chronicle

The Hagnaby Abbey Chronicle is unpublished. Presented here are English translations of the relevant passages from Owen (1986: 61-62).

B.8.1 1287

At Circumcision (1st January) the sea on the east crossed its bounds and caused great damage in Holland and Lindsey near the sea. Likewise on St Hilary's Day (13th January) the sea opened and enlarged its bounds, over running the whole of maritime Holland and Lindsey, destroying towns and drowning men, so that in one town almost fourscore were found dead. And in the church of St. Peter of Mablethorpe was wholly destroyed, the chalice and pyx, in which the body of Christ was served, being found crushed under a heap of stones (Et ecclesia sancti Petri de Malbertorp omnino destructa scilicet calxe et pixis in quo servabatur corpus Christi sub magno acervo lapidum inventi sunt illesi).

B.8.2 1288

On that day (the morrow of St Blaise, 1288, *ie.* 4th February) there was a flood of the sea throughout all maritime England, and it reached as far as Maltby field and totally destroyed the church of St Peter of Mablethorpe (et transivit usque ad campum de Malteby et destruxit radiciter ecclesiam sancti Petri de Malbetorp), and that day perished many men, uncounted sheep, and an unknown number of cattle ... Also on the eve of the Assumption (14th August) the sea caused very great damage in the territory of Mablethorpe.

B.9 *Chronicon Abbatie de Parco Lude*

"Millesimo CClxxxvij. Et ...[1] ejusdem ecclesie morbo paralysis percussus est. Dirupta est ecclesia Sancti Petri de Mablerthorp fluctibus maris.

Millesimo CClxxxviij. Sexto Idus Julii cecidit ingens grando super terram." (Venables 1891: 19-20).

B.10 *Chronica Buriensis*

"Sequenti quoque anno, iii nones februarii, in crepusculo noctis, subito et ex inopinato apud Sanctum Edmundum apparuit coruscatio, cum non modico tonitruo, sed fragore quodam terribili, fetoreque subsequente intolerabili. Comitabantur etiam dictam tempestatem scintillae ignis manifestae, oculos

[1] Word left blank in original Manuscript.

videntium horribiliter concutientes. Ignis quoque antedictus refectorio sancti Edmundi aliquantulum adhaesit, sed celerrime a monachis est subventum." (Arnold 1896: 35).

B.11 *Continuatio Chronici Florentii Wigorniensis*

"Nocte Dominicae Circumcisionis, tam venti vehementia quam maris violentia multa apud Gernemutham, Dunewich et Gypwicum, sed et per alia diversa loca Angliae aliarumque regionum mari contiguarum, prostrata sunt aedificia; et praecipue in illa parte Angliae, quae Merislandia dicitur, tota fere pro vincia in stagna aquarum conversa, hominum multitudo intolerabilis aquis intercepta est et necata. In crastino octav. Epiphaniae, parum ante aurorum, subitae coruscationes apud Sanctum Eadmundum apparentes, videntes non modicum terruerunt." (Thorpe 1849: 237-239).

B.12 *Menkonis Chronicon*

"Anno gratiae 1287. decima quarta die Decembris factum est diluvium in partibus Frisiae periculosum in homines, iumenta et res et propter hoc famosum in tempus futurum. Aquis vero sic coadunatis et commotis, inter conticinum noctis et gallicinium libere aggeres transeunt, et omne genus hominum, quod in locis humilibus mansionem habuerat, cum iumentis, domibus, frumento, feno gurges aquarum miserabiliter funditus evertens ad Silvas deportabat. Domus lapideae quam plures corruerunt. In Silvis etiam agri ab ymo evulsi aquis ferebantur. In locis humilibus sine obstaculo impetus aquarum paludes transivit. Nec fuit mirum, quia a tempore cuius non extat memoria in partibus istis tam infinita populi multitudo periit submersa. In occidente, ut sacerdotes et decani coniecerant, a Stauria usque ad Laycam triginta millia hominum submersa. A Lacia usque ad Emesam viginti millia perierunt. Orientales, ut sunt Riustingi, Astingi et Herlingi, a plaga praedicta immunes fuerunt. Agri etiam eorum sationales et pascuales fructum dederunt competentem; sed in locis humilibus, ut est in Sunedeswolda et Sconamora, agri quam plurimum fuerunt destructi. Res mira: vir unus, lupus unus et canis et lepus in baculo ad Silvas venerunt vivi. Multi etiam qui rabiem aquarem miserabiliter evaserunt. Et plerique pauperes, recedente aqua, paludes ascerdunt, construentes ibidem casas, in quibus frumentum quod ibi ab aquis fuerat proiectum triturabant.

...

Sequenti anno circa assumptionem Mariae, etiam circa exaltationem sanctae crucis, oceanus turbine ventorum commovetur ita ut pene omnes naves, quae se alto pelago commiserant, periclitarent, et submersi sunt centum gubernatores; in reliqua populi multitudine et divitiis et praecipue frumento non minor plaga fuit navibus annumerata, quam illa quae hyeme saevierat per inundationem salsi maris." (Pertz 1874: 565).

B.13 *Annales de Floreffe*

"Hoc anno tanta aquarum inundatio fuit in Zelandia, Frisia et Holandia, quam que nunquam audita fuerat, unde multi perierunt; que aqua dicta fuit eiusdem virgulti undique defossi cespitem plus quam duo miliaria devexisse integraliter, cum porco qui in eo pascebat, et ibi reliquisse summa tranquillitate." (Pertz 1859: 628).

B.14 *Annales Colmarienses Majores*

"In vigilia Agate fulgura micuerunt."

"Circa purificationem Virginis venit ventus, qui magnam sylvam sub Hohinnac radicitus devastavit."

"Circa festum purificationis venit ventus magnus, qui in Flandria oceanum de alveo suo ad tria magna miliaria inundare fecit, et plus quam quinquaginta milia hominum interfecit." (Pertz 1861: 215).

B.15 Alexander von Roes

"Ecce enim ninc in hoc anno preterito dominus suscitavit ventum aquilonis, qui mare Frisie ultra terminos et limites suos eiciens maximam partem Selandie, Hollandie et Frisie submersit in profundum abyssi." (Grundmann & Heimpel 1949: 72-74).

B.16 *Rijmkroniek van Melis Stoke*

"Dat op de zestiende kalende

Van Loument God doe sende

Ene vleet also groot,

Daer vele volx in bleef doot.

Te hant darna sinte Achten daghe

Sende God tote ere plaghe

Echter ene grote vloet.

Dese twee waren, als ic verstoet,

In enen winter int jaer ons heren,

Als ons de scrifturen leren,

xii hondert ende seven ende dachtich.

Dese twe vloede waren so crachtich,

Dat si ghingehen over al tlant,

Dat leghet an des sewes cant,

Beide oester ende wester Vresen;

Ende Hollant moste oec verliesen:

Suuthollant verdranc oec mede,

Ende ic ne weet gehne stede

Bider zee, en ghinc al onder

Tfolc verdranc, dat meer dan wonder

Te segghene es; des bleef so vele,

Dat het ghinc al uten spele.

Al Zeelant verdranc sekerlike,

Sonder Walchren ende Wolfaertsdike."

(Brill 1885: 233-234).

Appendix C

Grey literature survey of archaeological evidence for the storms of the late 13th century in New Romney, Kent

Report Reference No.	Trench No.	Classification	Report Reference No.	Trench No.	Classification
47707.1	1	6	47707.1	2	6
47707.1	3	6	47707.1	4	6
47707.1	5	5	47707.1	6	5
47707.1	7	2	47707.1	8	5
47707.1	9	6	47707.1	10	6
47707.1	11	6	47707.1	12	6
47707.1	13	6	47707.1	14	6
47707.1	15	6	47707.1	16	2
47707.1	17	6	47707.1	18	6
47707.1	19	5	47707.1	20	6
1996-162	80	6	1996-162	100	6
1996-162	150	1	1996-162	200	1
1996-162	250	1	1996-162	300	1
1996-162	350	1	1996-162	400	6
1996-162	450	6	1996-162	500	6
1996-162	550	6	1996-162	600	6
1996-162	650	6	2000-52	1	5
2000-52	2	6	2000-52	3	6
2000-52	4	6	2000-52	5	6
2000-52	6	6	2000-52	7	6
2000-52	8	6	2000-52	9	6
2000-52	10	6	2000-52	11	6
2000-52	12	6	2000-52	13	6
2000-52	14	6	2000-52	15	6
2000-314	1	6	2001-29	1	4
2001-53	1	2	2001-53	2	2
2001-53	3	2	2001-235	1	5
2001-235	2	5	2001-235	3	1
2001-235	4	1	2001-235	5	1
2001-242	1	3	2002-33	1	4
2002-33	2	4	2002-33	3	4
2002-33	1	4	2002-33	2	4

2002-34	1	6	2002-34	1	4
2002-34	2	4	2002-34	2	4
2002-34	3	6	2002-34	4	4
2002-34	5	4	2002-34	6	6
2002-108	1	6	2002-123	1	1
2002-218	1	2	2002-218	2	2
2002-218	3	2	2002-218	4	2
2002-218	5	2	2002-218	6	2
2002-383	1	1	2002-383	1	5
2002-383	2	5	2002-383	3	5
2002-383	4	5	2002-383	5	5
2002-383	6	5	2002-383	7	6
2002-383	9	6	2003-248	1	5
2003-248	2	6	2003-248	3	5
2003-248	4	5	2003-248	5	6
2003-248	6	6	2003-248	7	6
2004-140	1	3	2005-202	1	2
2005-202	2	2	2005-202	3	2
2005-202	4	2	2006-26	1	6
2006-26	2	6	2006-26	3	6
2006-26	4	6	2006-26	5	6
2006-26	6	6	2006-26	7	6
2006-26	8	6	2006-26	9	6
2006-26	10	6	2006-26	11	6
2006-26	12	6	2006-26	13	6
2006-26	14	6	2006-26	15	6
2006-26	16	6	2006-26	17	6
2006-26	18	6	2006-26	19	6
2006-26	20	6	2006-26	21	6
2006-26	22	6	2006-26	23	6
2006-26	24	6	2006-26	25	6
2006-26	26	6	2006-26	27	6
2006-26	28	6	2006-26	29	6
2006-26	30	6	2006-26	31	6
2006-26	32	6	2006-26	33	6
2006-26	34	5	2006-26	35	6
2006-26	36	6	2006-26	37	6
2006-26	38	6	2006-26	39	6
2006-26	40	6	2006-26	41	6
2006-26	42	6	2006-26	43	6
2006-26	44	6	2006-26	45	6
2006-26	46	6	2006-26	47	6
2006-26	48	6	2006-26	49	6
2006-26	50	6	2006-26	51	5
2006-26	52	5	2006-26	53	5
2006-26	54	6	2006-26	55	6
2006-26	56	1	2006-26	57	6
2006-26	58	6	2006-26	59	6
2006-26	60	6	2006-26	61	6
2006-26	62	6	2006-26	63	6
2006-26	64	6	2006-26	65	6
2006-26	66	6	2006-26	67	6
2006-26	68	6	2006-26	69	6
2006-26	70	6	2006-26	71	6
2006-26	72	6	2006-26	73	6
2006-26	74	6	2006-26	75	6
2006-26	76	6	2006-26	77	6

2006-26	78	6	2006-26	79	6
2006-26	80	6	2006-26	81	1
2006-26	82	6	2006-26	83	6
2006-26	84	6	2006-26	85	6
2006-26	86	6	2006-26	87	6
2006-26	TP1	6	2006-26	TP4	6
2006-26	TP6	5	2006-26	TP11	5
2006-35	1	6	2006-35	2	5
2006-48	1	6	2006-48	2	5
2006-87	1	5	2006-87	1	5
2006-87	2	5	2006-87	2	5
2006-87	3	5	2006-283	1	3
2006-283	2	3	2006-283	4	3
2006-283	6	3	2006-283	5	3
2006-283	6	3	2006-283	7	5
2007-74	1	6	2007-74	1	6
2007-74	2	2	2007-74	4	6
2007-74	5	6	2009-135	1	5
2009-135	2	5	2009-135	3	5
2009-141	1	5	2009-141	2	5
2009-141	3	6	2009-141	4	6
2009-141	5	5	2009-220	P03-23A	4
2009-220	P8-100A	4	2009-220	P10	4
2009-220	P24-F143A	4	2009-220	P19-20	4
2009-220	P26	4	2009-220	P9	4
2009-220	P12	4	2009-220	P15	4
2009-220	P13	4	2009-220	P16	4
2009-220	Compound	4	2009-220	1	6
2009-220	2	6	2009-220	2	6
2009-220	3	6	2009-220	3	6
2009-220	4	6	2009-220	4	6
2009-220	5	6	2009-220	5	6
2009-220	6	6	2009-220	6	6
2009-220	7	6	2009-220	7	6
2009-220	8	6	2009-220	8	6
2009-220	9	6	2009-220	9	6
2009-220	10	6	2009-220	10	6
2009-220	11	6	2009-220	12	6
2009-220	13	6	2009-220	14	6
2009-220	15	6	2009-220	16	6
2009-220	17	6	2009-220	18	6
2009-220	19	6	2009-220	20	6
2009-220	21	6	2009-220	22	6
2009-220	2624	4	2009-332	1	6
2009-473	1	3	2010-24	1	5
2010-24	2	5	2010-24	3	6
2010-128	1	5	2010-128	2	5
2010-128	3	1	2010-128	4	5
2010-128	5	6	2010-128	6	7
2010-128	7	3	2010-128	8	5
2010-128	9	3	2010-128	10	6
2010-128	11	6	2010-128	12	5
2010-128	13	3	2010-128	14	6
2010-128	15	5	2010-128	16	5
2010-128	17	5	2010-128	18	5
2010-128	19	5	2010-128	20	6
2010-128	21	5	2010-128	22	5

2010-128	23	5	2010-128	24	5
2010-128	25	5	2010-128	26	5
2010-128	27	3	2010-128	28	6
2010-128	29	5	2010-128	30	6
2010-128	31	6	2010-131	Eval 1	5
2010-131	1	5	2010-131	2	5
2010-132	1	5	2010-346	1	6
2010-368	1	6	2010-368	2	5
2010-368	3	6	2010-368	4	6
2010-368	5	6	2010-368	6	6
2010-368	10	6	2010-368	11	6
2010-368	12	6	2011-51	1	6
2011-51	2	2	2011-51	3	6
2011-51	4	5	2011-51	5	2
2011-51	6	5	2011-51	7	6
2011-51	8	3	2011-51	8	6
2011-117	1	3	2011-252	2	4
2011-252	3	4	2011-252	4	4
2011-252	1	4	2012-137	5	4
2012-137	6	4	2012-137	7	4
2012-137	8	4	2012-137	9	4
2012-137	10	2	2012-140	1	2
2012-140	2	2	2012-140	3	1
2013-247	1	5	2013-247	2	5
2013-247	3	5	2013-247	4	5
2013-247	5	5	2013-247	6	5
2013-247	7	6	2013-247	8	5
2013-247	9	5	2014-259	1	6
2014-728	1	4	2014-728	2	4
2016-68	N/A	5			

Table C.1: Survey of the grey literature documenting developer funded archaeological interventions in New Romney, Kent, from 1993-2016 for evidence relating to the impact of the late 13th century storms on the medieval town. The sites and locations in New Romney associated with each Report Reference Number are given in Appendix C.2. The classification system is detailed in Chapter 3.1.3. Created by the author.

Report Reference No.	Report Title/Site Name
47707.1	Derville Site, Southlands School
1996-162	An archaeological watching brief on a new gas main
2000-52	Land at Church Road
2000-314	13 Mabledon Close
2001-29	Southlands School, Station Road
2001-53	Land to the rear of Prospect House, Fairfield Road
2001-235	Land to the rear of the Old School House, Church Road
2001-242	Land to the rear of Prospect House, Fairfield Road
2002-33	Southlands School, Station Road
2002-34	Southlands School, Station Road
2002-108	13 Mabledon Close
2002-123	A plot of land at Church Road

2002-218	Southlands School, Dymchurch Road
2002-383	Southlands School, Fairfield Road
2003-248	Demolition of a garage at Sussex Road
2004-140	Extension to the rear of 'Sylvanden', Church Road
2005-202	Land north of Sainsbury's and fronting Fairfield Road
2006-26	New Romney Sewer Scheme
2006-35	The Elms, Dymchurch Road
2006-48	Church Villa, Church Close
2006-87	Churchyard of St Nicholas Church
2006-283	Former Sussex Road Garage
2007-74	The Elms, Dymchurch Road
2009-135	Land Adjacent to 77 Rolfe Lane
2009-141	Land to the rear of 60-76 High Street
2009-220	Churchlands Estate
2009-332	95 Rolfe Lane
2009-473	Land adjoining 'Dormers', Church Lane
2010-24	High House, High Street
2010-128	The New Romney and Greatstone First Time Sewerage Scheme Pipeline
2010-131	The New Romney and Greatstone First Time Sewerage Scheme Pipeline, Pumping Station 3, Church Road
2010-132	The New Romney and Greatstone First Time Sewerage Scheme Pipeline, St Martin's Field
2010-346	St Johns, St Johns Road
2010-368	Land adjoining 'Craythornes'
2011-51	Land at Rolfe Lane
2011-117	St Nicholas' Church, Church Road
2011-252	Southlands School, Dymchurch Road
2012-137	Inclusion and Family Centre, The Marsh Academy, Station Road
2012-140	16 High Street
2013-247	Land Adjoining 'Craythornes', Fairfield Road
2014-259	71 High Street
2014-728	The Allotments, Church Lane
2016-68	St Martin's Church

Table C.2: Archaeological Sites in New Romney by Grey Literature Report Reference Number. The classification of the archaeological deposits uncovered by these interventions is given in Appendix C.1. Reports are held by Kent County Council. Compiled by the author.

Appendix D

Documentary evidence for the Fenland floods of 1338

D.1 Wiggenhall

"in and after the xi th year of the then King, there were destroyed and drowned by the raging of the Sea, ten messuages and C. acres of Land in Wigenhale, belonging to divers persons; and that several other Lands were there dayly overflowed, and in danger likewise of being lost. And that the Lands and Tenements of the Inhabitants of the said Town, did lye on both sides that arm of the Sea, which ran through the midst of the said Town. And they said, that the men of that Town, by reason of the beforementioned arm, did yearly repair and maintain two Banks; the one containing six miles in length, and the other three, the chardge whereof amounted to Cxx l. per annum, and more; as by estimation they were given to understand. And they likewise said, that the before specified Inhabitants, did yearly repair and maintain one Bank called Pokediche, containing two miles in length, for their defence against the fresh waters, the charge whereof came to Cs. per annum, and more."
(Dugdale 1662: 258).

D.2 Walpole

"in that same xi th year and afterwards, there were by the said inundation, Cxl. Acres of Land in Walpole, drowned, and for ever lost. And that the Inhabitants of that Town, did yearly repair and maintain a Sea-bank, containing three miles in length, which extendeth it self Northwest, from the Town of Tyrington, unto a certain Floud-gate of Waltone, called Nobeche gote; for the repair & ma • n • enance wherof, the Inhabitants of the same Town did yearly expend Cxij l. And that h • y did repair and maintain a certain Ditch, called Pokediche, containing a mile in length, for their defence from the fresh waters; the charge whereof came to more than x l. per annum: besides other new works about those Banks, which yearly rose to xl l."
(Dugdale 1662: 258).

D.3 Walsoken

"in the same xi th year, and afterwards, two Gutters, which had been then lately made at Walsokne, for avoidance of the fresh waters of that Town, towards the Sea, were wholly filled up by the raising of silt, and utterly destroyed; by reason whereof CC. Acres of Land, belonging to several men there, were every year overflowed, in Winter time, to the damage of ten pounds to the Inhabitants. And they said, that the before-specified Inhabitants of that Town did repair and maintain, for every acre of land within the same, four foot of the Sea-bank, for defence of their lands against the Ocean. And likewise, for every acre of land in the same Town, one foot of the Bank of Pokedike, for keeping off the fresh waters; the charges of both which was more than xxx l. per annum. And that they did likewise yearly repair and maintain one Sewer, containing five miles in length; viz. from the Town of Walsokne to Wigenhale, which stood them in more than ten pounds per annum."
(Dugdale 1662: 258).

D.4 Tilney

in the same xi th year, and afterwards, seven messuages, and ten acres of land, belonging to divers men in the Town of Tilney, were by the like outragiousnesse of the Sea, drowned and for ever lost; and that divers lands of the Inhabitants there, were dayly overflowed. And they farther said, that the said Inhabitants of that Town, did yearly repair certain Sea-banks, towards the River, called Wigenhale Ee, viz. from Catysbac-gole to King's gole, which contain xxiiij furlongs in length; whereof xviij do extend from a certain place called the Hope, to Edeyenesgole, and were often subverted by the Sea-tides, so that the men of that Town did thereby lose a great part of their land yearly. And they said, that the before-specified Inhabitants were at the yearly charge of three pounds, for repair of six furlongs of the said Ditch, and for every furlong, besides, ten Marks. And they said moreover, that there was a certain Gutter, called Scales gole, but lately made, for safeguard of the lands of those Inhabitants; which was then destroyed by the Sea-tides; by reason whereof, a great part of the said Town was drowned and made yearly much worse, to the annual damage of xx l. so that, for the better defence of their Lands, and Bank, they were constrained to make two Scores, the charge whereof came to C. Marks, which Scores were also, by the raging of the Sea, over•hrown and spoiled, to the losse of that Town C l. And they likewise said, that the before-specified Inhabitants did every year expend xx l. in the repair of two Banks, viz. Pokediche and Blakediche, for def•nce of their lands against the fresh waters: and that they were at the yearly charge of xx l. more, for other common works; and likewise x l. for maintenance of their Gutters and Sewers.
(Dugdale 1662: 258-259).

D.5 Terrington

"in the same xi th year and afterwards, a thousand Acres of land, belonging to the Town of Tirington, were yearly overflowed by inundation of the fresh waters, in regard that the Sluse called Scales gole, being destroyed and spoiled by the Sea-Tides, as abovesaid, did occasion the breach and ruine of another Sluse, called Oxhowe, by which the said fresh waters passed to Scales gole; the damage whereof was Lx l. yearly to the said Town. And they also said, that CC. Acres of Marsh, belonging to the same Town, viz. in Rushemershe and Newemershe, were overflowed by the said tides, to the damage of the said Inha • itants, more t • a • six Marks yearly. And that the said • own, for repairing of the Sea-b • nk, containing two miles and an half in l • ngth, and of the Bank of Pokedich • , containing one mile in length, was at the yearly chardge of xxxix. and upwards."
(Dugdale 1662: 259).

D.6 West Walton

"in the before-s • • cified year, and afterwards, sixscore a • res of land belonging to the inhabi • • nt • of West Walton, were overflowed by the Sea-tides, to the yearly dam • ge of xl • . by reason that the Sea-banks were, with such fearfull tempests, so broken as aforesaid; and that the charge in repair of them came to more than Lx. per annum. And that they did yearly repair, for every acre of land lying in the said Town, six foot and two inches of the said Seabanks: and likewise for every acre, one foot of the said Bank called Pokediche, the charge whereof amounted unto xl • . yearly, and more. And that they also spent x l. per annum, in repairing of Gutters and Sewers, for draining of their land. And they said, that fiftie three messuages, and three hundred acres of land in that Town, were drowned and utterly lost for ever, by the inundation of the Sea."
(Dugdale 1662: 259).

D.7 Emneth

"in the year aforesaid, and afterwards, ten messuages, and an hundred acres of land, belo • ging to several persons, within the Hamlet of Enemeth, were utterly destroyed and drowned by the same inundation of the Sea. And that the Inhabitants of that Hamlet were at the yearly charge of xxx l. and more, in repairing of the Bank called Pokediche, for the safeguard of their Land."
(Dugdale 1662: 259).

Appendix E

Locations affected by the storm of 15^{th} January, 1362

Locations affected by the 15^{th} January 1362 storm			
Location	County	UK Grid Reference	References
Bristol Castle	Bristol	ST592731	(Maxwell Lyte 1912: 156)
St Stephen's Abbey, Calvados, Caen	Normandy	France	(Maxwell Lyte 1912: 260)
Longstanton	Cambridgeshire	TL399664	(TNA: JUST 2/18/58)
Torpel	Cambridgeshire	TF111054	(Dawes 1933: 431)
Cloyn	Cork	Ireland	(Bliss 1896: 414)
Chapel of the Trinity, Lostwithiel	Cornwall	SX107613	(Dawes 1931: 194)
Liskeard	Cornwall	SX252645	(Dawes 1931: 193-4)
Plymouth	Devon	SX484538	(Hardy 1869: 420; TNA: SC 8/247/12320)
Fordington	Dorset	SY698905	(Dawes 1933: 429)
Shaftesbury Abbey	Dorset	ST862229	(Page 1908a: 77)
Cottingham	East Yorkshire	TA051324	(Dawes 1933: 420)
Hatfield Broad Oak	Essex	TL548555	(Tyers *et al.* 2003: 101)
Lamarsh	Essex	TL891356	(Dawes 1933: 432)
St John's Abbey, Colchester	Essex	TL998246	(Bliss 1896: 444)
St Mary's, Great Henny	Essex	TL867378	(Dawes 1933: 432)
Thaxted	Essex	TL612309	(Newton 1960: 25-26)
Frampton Priory	Gloucestershire	SO750084	(Maxwell Lyte 1912: 260)
St Briavel's Castle	Gloucestershire	SO559046	(Stamp 1937: 185-186)
Froxfield	Hampshire	SU704255	(Haddon-Reece & Miles 1992: 48)
Portchester Castle	Hampshire	SU625046	(Page 1908b: 156)
Somerly	Hampshire	SU132093	(Maxwell Lyte 1923: 341)
Berkhamsted	Hertfordshire	SP996083	(Dawes 1933: 417, 423, 431)
Gaddesden	Hertfordshire	SP992136	(Dawes 1933: 431)
Harpendbury	Hertfordshire	TL110139	(Stern 2000: 95)
Kings Langley	Hertfordshire	TL073025	(Page 1914: 265)
St Albans Abbey, St Albans	Hertfordshire	TL144071	(Riley 1869: 387)
St Mary's Church, Ashwell	Hertfordshire	TL267398	(Pritchard 1967: 182)
Rochester Castle	Kent	TQ741686	(Stamp 1937: 282)
South Frith	Kent	TQ583448	(Maxwell Lyte 1912: 180)
St Austin's Abbey, Canterbury	Kent	TR154578	(Davis 1934: 564)

Stone	Kent	TQ561740	(Bliss 1896: 421-422)
Dublin	Leinster	Ireland	(Gilbert 1884: 396)
Louth Park Abbey	Lincolnshire	TF355886	(Venables 1891: 40-41)
Austin Friars, London	City of London	TQ329813	(Galbraith 1927: 50)
St Lawrence Lane, London	City of London	TQ327809	(Thomas 1929: 61-62)
Westminster Abbey	City of London	TQ301795	(Maxwell Lyte 1912: 195)
Whitechapel	City of London	TQ340814	(Bliss 1896: 468)
Eaton	Norfolk	TG202059	(Pribyl 2017: 241; BLO, MS Rolls Norfolk 30)
Fransiscan Friary, King's Lynn	Norfolk	TF620194	(Gransden 1957: 275)
Norwich Cathedral	Norfolk	TG234088	(Wharton 1691: 415; Galbraith 1927: 50)
Kirbymoorside	North Yorkshire	SE697865	(Dawes 1933: 420)
Exeter College, Oxford	Oxfordshire	SP515064	(RCHM 1874: 128)
St Mary's, Long Wittenham	Oxfordshire	SU549940	(RCHM 1874: 128)
Steventon	Oxfordshire	SU472192	(Miles & Bridge 2010: 109)
Wallingford Castle, Wallingford	Oxfordshire	SU609897	(Dawes 1933: 426)
Calais	Pas-de-Calais	France	(Dawes 1933: 423)
Bury St Edmunds	Suffolk	TL857641	(Galbraith 1927: 50)
Icklingham	Suffolk	TL776726	(Dawes 1933: 426)
St Peter & St Mary's, Stowmarket	Suffolk	TM049587	(Howard *et al.* 1994: 38)
Byfleet	Surrey	TQ065610	(Dawes 1933: 416)
Ashdown	Sussex	TQ432323	(Maxwell Lyte 1912: 156)
St Andrew's, Ford	Sussex	TQ002104	(Bridge 2000: 88)
Alveston	Warwickshire	SP234566	(WCL: E20; Chris Dyer pers. comm.)
Blackwell	Warwickshire	SP242434	(WCL: E20; Chris Dyer pers. comm.)
Clarendon	Wiltshire	SU182302	(Maxwell Lyte 1912: 177)
Mere Castle	Wiltshire	ST810326	(Dawes 1933: 429)
Salisbury Cathedral	Wiltshire	SU143295	(Bliss 1896: 462-463; Bliss & Twemlow 1902: 89)
Sevenhampton	Wiltshire	SU206904	(Maxwell Lyte 1912: 156)
Vastern	Wiltshire	SU049815	(Maxwell Lyte 1912: 156)

Table E.1: Historical references and archaeological evidence relating to specific locations affected by the storm of 15th January 1362. For each location the county and UK grid reference are given except in cases where locations are outside the UK. In these cases the local region most closely corresponding to the county-level is given and the country is listed. Compiled by the author.

Appendix F

Documentary evidence for the storm of 15th January, 1362

F.1 *Chronicon Johannis de Reading*

"Anno gratiae MCCCLXII, domini papae Innocentii X et novissimo, regni regis Edwardi tertii Angliae xxxvi, hiemante eodem apud Wyndlesoram, xv die Januarii, ventus zephrus sive auster, affricus, pessimus campanilia, turres, arbores, aedificia, aliaque fortia postravit et contrivit in frustra, debilibus parcendo, et tam in terra quam in mari bona consumpsit irrecuperabilia; vix in suo curso domos aut arbores, quas prae montibus attingere poterat, aliquas reliquit integras. Nec quievit a flatu forti septem diebus ac noctibus contiguis. Per totum annum forte nequam spritus praevenerunt praeconizata hastiludia in Chepe, Londoniis, videlicet, septem mortalia in omnes occurrentes peccata. Sequebatur pluviae inundatio tempore feni et messis, quae opera campestria plurimum impedivit."
(Tait 1914: 150-151).

F.2 *Chronicon Angliae Petriburgense*

"A.D. 1362. Maximus ventus in vigilia sancti Mauri abbatis percussit terram, Londoniae sexdecim turres eclesiarum dejecit, domos et molendina innumera prostravit, arbores et integras silvas in multis locis a fundamentis evulsit."
(Giles 1845: 172).

F.3 *Annales de Wigornia*

"Anno Domini MCCCLXI. Iterata fuit pestilentia et magnates obierunt. Ventus adeo vehemens fuit ut cruces, arbores, campanilia, et molendina ad terram complanaret."
(Luard 1869: 562).

F.4 *Annales de Bermundeseia*

"Anno Domini MCCCLXI., et anno regni regis Edwardi tertii tricesimo sexto. Hoc anno in die Sancti Mauri abbatis accidit ventus vehemens et terribilis per totam Angliam, prosternens ecclesias, campanilia, et aedificia multa in partibus orientalibus Anglorum.
Unde versus:
Ecce flat hoc anno Maurus, in orbe tonat."
(Luard 1866: 477).

F.5 *Eulogium Historiarum*

"Hoc anno xv. die mensis Januarii, litera Dominicalis B., hora vespertina, prorupit ventus inauditus ab Meridie et Occidente proveniens, qui homines suffocavit, arbores eradicavit, domos, turres, monasteria, campanilia, pinnacula, pomeria, et silvas prostravit, et multa alia mala humani creaturae ingessit, unde creditur a nonnullis diram Dei fuisse flagellationem."
(Haydon 1863: 229).

F.6 *Chronicon Angliae*

"De magno vento.

Tenuit rex Natale apud Wyndeshore; et quinto-decimo die sequente ventus vehemens, Nothus, Auster, Affricus, tanta [vi] erupit, quod flatu suo domos altas, aedificia sublimia, turres et campanilia, arbores et alia quoque durabilia et fortia, violenter prostravit, pariter et impegit, in tantum quod residua quae modo exstant [sunt] hactenus infirmiora."
(Thompson 1874: 50-51).

F.7 *Polychronicon Ranulphi Higden Monachi Cestrensis*

"In festo Sancti Mauri maximus et inauditus venti impetus exitit, campanilia super presbyteria, ecclesiarum pinnacula, arbores, domos ultra modum prosternens, multaque alia mala fecit: inundationes aquarum protinus sequebantur."
(Lumby 1882: 360).

F.8 *Adami Murimuthensis Chronica*

"ANNO DOMINI M.CCC.LXII., et regis Anglorum Edwardi tertii XXXVI., XV. die Januarii, circa horam vesperarum, ventus vehemens notus australis Africus tanta rabie erupit, quod flatu suo domos altas, aedificia sublimia, turres, campanilia, arbores, alia quoque durabilia et fortia violenter prostravit, pariter et impegit; sic quod residua quae extant, sunt adhuc deteriora, de quo quidam metricus sic ait;

Versus:

'C. ter erant mille decies sex unus et ille
Luce tua, Maure, vehemens fuit impetus aurae.'
Alius sic;
'Ecce flat hoc anno Maurus in orbe tonans.'
Innuunt isti versus, quod anno DOMINI M.CCC.LXI. in festo sancti Mauri abbatis, contigit iste ventus."
(Hog 1846: 196-197).

F.9 The Chronicle of England by John Capgrave

"In the XXXVI. ȝere blew the grete wynd oute of the southwest fro evensong til mydnyte, that blewe down many a hous; of whech wynd these vers were mad:-

C.ter erant mille decies [sex] unus et ille
Luce tua Maure vehemens fuit impetus aure.
This is the Englisch:-
A thousand III. hundred sexti and too,
Was Maurus wynd whech blew soo."

(Hingeston 1858: 221).

F.10 The Chronicle of John Harding

"Of the seconde pestylence and the greate wynde and earthquake, the yere a thousande. CCC.lxi. . . .

In that same yere was on sainct Maurys day,
The greate winde and earth quake meruelous,
That greately gan the people all affraye,
So dredfull was it then and perelous,
Specially the wind was so boistous,
The stone walles, steples, houses, and trees, Were blow doune in diuerse ferre coutrees."
(Ellis 1812: 330).

F.11 *Chronicon Anonymi Cantvariensis*

F.11.1 *De hastiludiis in Chepe. De vento terribili, inaudito et magno.*

"Anno Domini millesimo trecentisimo sexagesimo primo, ex parte domini regis Anglie, post nupcias huiusmodi, facta ubilibet proclamacione publica de hastiludiis in Chepe London, per diabolum et matrem eius ac septem peccata mortalia figuratiue per infra, contra quoscumque uenientes per extra, die Lune septimo decimo die Ianuarii faciendis, diabolus magnus Sathanas per prenosticaciones malas angelos suos et signa sue malicie premittens, die Sabbati ante hastiludia huiusmodi, uidelicet in festo Sancti Mauri Abbatis, circa horam uesperarum dicti diei, inceperunt tempestates horribiles numquam alias uise uel audite et uentorum turbines in Anglia, adeo quod domus et edificia pro magna parte corruerunt ad terram, et quedam alia discooperta deformiter per flatum uentorum huiusmodi remanserunt, arboresque fructifere in gardinis et locis aliis, et arbores alie in nemoribus et alibi existentes, cum magno sonitu a terra readicitus euulse fuerunt, ac si dies iudicii adueniret, et inhabitantes terram Anglie timor ac tremor sic exterruit quod nullus sciuit ubi secure potuit laticare, nam ecclesiarum campanilia, molendina ad uentum ac mansiones multe ceciderunt ad terram absque magna corporum lesione. Sed multa in illis tempestatibus stupenda et prodigia contigisse dicuntur."
(Scott-Stokes & Given-Wilson 2008: 118).

F.11.2 *De fratre Augustini.*

"Et inter cetera sic fertur London' contigisse: nam quidam frater Iohannes de Suctoun ordinis heremitarum conuentus London', robustus corpore, uolens clausisse hostium eorum ibidem, uentus superuenit magnus et terribilis eleuans eum de terra et transuexit eum per medium unius fenestre usque in gardinum eorum, et ibidem per malum, ut creditur, spiritum est super quondam absque lesione dimissus, et multa alia stupenda tam London' quam alibi tunc casualiter euenisse dicuntur, mansionesque et edificia per dictum uentum sic diruta pro defectu operariorum irreperata deformiter remanserunt. Et ecce dictorum hastiludiorum signa pessima et malorum presagia futurorum."
(Scott-Stokes & Given-Wilson 2008: 118).

F.12 The Chronicle of Henry Knighton

"Ventus horribilis. Eodem anno .xvi. kalendas Februarii, scilicet in die et nocte Sancti Antonii, orta est horribilis et nimis ualida tempestas uentorum, qualem nunquam retroactis temporibus non creditur a plebe fuisse uisam. Nam ultra quam dici potest boscos, pomeria, et omne genus arborum prostrauit et multas ultra quam crederet cum radicibus euertit. Ecclesias, molendina, campanilia, muros, domos dilapidauit. Apud Londonias mala innumera de campanilibus et aliis domibus et ecclesiis exercuit."

(Martin 1995: 184).

F.13 The Anonimalle Chronicle

“Mesme celle an mille CCCLXI en la veyl de seint Maure abbe qe fuist par samady, sourdist une tresgraunt et treshoribile tempest de vent parmy le south pais et comensa avaunt sayre et endurra tanqe a la mynuyt, la quel tempeste fist grauntes damages a demesure et a terre abatist en plusours lieus esglises et clochers, mesons et mures, molyns, pountes et arbres en boys et en orchardes a graunt plente; entre quex a terre abatist les clochers de Bury et de Norwiche et le sutyl clocher de les frers Austines de Loundres et plusours autres clochers de Loundres et de Norwiche et en plusours autres villes du pais.”
(Galbraith 1927: 50).

F.14 *Chronicon Abbatie de Parco Lude*

“Anno Domini Millesimo CCClxj, fuit mortalitas hominum, sed maxime juvenum et puerorum, unde pestilentia puerorum communiter nuncupatur. Eodem anno, circa festum Sancti Mauri Abbatis, per unum diem et noctem fuit ventus pervalidus et magnus contra partem aquilonalem, ita quod violentia sua prosterneret arbores, molendina, domos, et plura campanilia.” (Venables 1891: 40-41).

F.15 *The Brut Chronicle*

“And in þe xxxvij ȝer of King Edward, the xv day of January, that is to sey, on Seynt Mauris day, about evesong tyme, þer aroos & blewe doun to ground hye houses, & oþer strong þynges; and al oþer strong werkes þat stoden still, were so yshake þerewith, þat þey ben ȝett, and shol be euermore, the febelere & weyker while þey stonde; & þis wynd lasted withoute eny cesyng vij. dayes continuels.”
(Brie 1906: 315).

F.16 Chartularies of St. Mary’s Abbey, Dublin

“Item, [in] festo Sancti Mauri, Abbiatis, fuit ventus vehemens, pinncaula, camina, et cetera eminentiora, arobres ultra numerum, et campanilia diversa et campanile Fratrum Predicatorum, Dublin, quassavit et ad terram projecit.”
(Gilbert 1884: 396).

Appendix G

Calendar of responses to storm damage across the estates of the Black Prince in 1362

Date	Description	Reference
15th Jan	Storm Damage	See Appendix F
8th Feb	Order from the Black Prince to the bailiff of Byfleet concerning repairs and maximising profits from felled wood.	(Dawes 1933: 416)
12th Feb	Order from the Black Prince to the steward of Berkhamsted to supply Dunstable Friary with wood felled by the storm.	(Dawes 1933: 417)
12th Feb	Order from the Black Prince to the steward of Cornwall to repair all of the prince's castles, manors and mills in Cornwall and Devonshire as quickly and profitably as possible.	(Dawes 1931: 188)
14th Feb	Order from the Black Prince to the steward of Cornwall to personally investigate the damage at each of the prince's estates and to use felled timber to repair the prince's castles, manors and mills, with the remainder to be used in repair of park enclosures and any unsuitable wood to be donated to the prince's tenants.	(Dawes 1931: 189)
15th Feb	Order from the Black Prince to the steward of Cottingham to generate as much profit as possible from wind felled trees in the prince's parks at Cottingham and Kirbymoorside.	(Dawes 1933: 420)
2nd Mar	Order from the Black Prince to the steward of Berkhamsted to supply the widow of a former yeoman with wood felled by the storm.	(Dawes 1933: 423)
21st Mar	Order from the Black Prince concerning the sale of houses in Icklingham, Suffolk which were damaged by the storm.	(Dawes 1933: 426)
23rd Mar	Order to the steward of Wallingford Castle, Oxon., to repair the damage caused by the storm.	(Dawes 1933: 426)
26th Mar	Order to the steward of Mere and Fordington to collect all the wind felled trees for the repair of houses within Mere Castle and sell any excess for profit.	(Dawes 1933: 429)
11th Apr	Order from the Black Prince to the receiver of Berkhamsted and steward of Gaddesden to sell all wood felled by the storm for the Prince's profit.	(Dawes 1933: 431)
12th Apr	Order from the Black Prince to the steward of Berkhamsted to calculate the amount of money which previous parkers had received per annum from the sale of wind-felled tress (an accepted perk of the position).	(Dawes 1933: 431)

13^{th} Apr	Order from the Black Prince to the reeve of Torpel to repair the windmill, to generate profit by selling hay and firing the lime kiln and to donate wood to the poor tenants towards the repair of their housing.	(Dawes 1933: 431)
16^{th} Apr	Order from the Black Prince to the steward of Lamarsh, Essex, to deliver wood felled by the storm to the church of Great Heney for repairs.	(Dawes 1933: 432)
10^{th} Aug	Order from the Black Prince to the prince's receiver of Berkhamsted that the parker is to receive a fixed fee (100s) rather than a percentage of the profits from wind felled trees (because so many trees had been felled on January 15^{th}).	(Dawes 1933: 464)

Table G.1: Orders and activities planned and carried out across the estates of the Black Prince in the aftermath of the 15^{th} January 1362 windstorm. All dates are in 1362 by modern reckoning. Compiled by the author.

Appendix H

Protective artefacts from the Portable Antiquities Scheme

H.1 Saintly relics

Number	Object ID	Date	Classification
001	KENT-860013	1400-1800	Cross
002	ESS-7AB096	1100-1500	Cross
003	ESS-CEC005	1275-1400	Cross
004	SWYOR-F1BAB7	1066-1500	Pendant
005	YORYM-6CE0B1	1350-1500	Pendant
006	NMGW-9E8024	1500-1550	Pendant
007	SWYOR-A50855	1400-1550	Cross
008	DENO-A1D5F6	1300-1500	Pendant
009	DEV-4EAD04	1400-1500	Cross
010	PUBLIC-AA3105	1300-1500	Cross
011	CAM-2136A3	1350-1500	Pendant
012	NMS-1B2781	1190-1250	Pendant
013	YORYM-96F498	1400-1500	Cross
014	YORYM-09903A	1300-1500	Pendant
015	SWYOR-73122C	1400-1600	Cross
016	PAS-5BA841	1400-1550	Pendant
017	PAS-56385F	1400-1500	Pendant
018	WMID-115B76	1400-1500	Cross
019	WMID-1006A0	1400-1500	Cross
020	IOW-E17811	1400-1500	Pendant

Table H.1: Saintly relics from the PAS database as of 23/01/2017. This data is discussed and analysed in Chapter 5.1. Compiled by the author.

H.2 Artefacts relating to the cult of St Christopher

Number	Object ID	Date	Classification
001	PAS-0FAF62	1400-1499	Finger Ring
002	NMGW-0D2593	1390-1410	Strap End
003	KENT-C44AA6	1300-1399	Strap End
004	LIN-FBA9E3	1480-1550	Buckle
005	GLO-ECFFB2	1400-1499	Pilgrim Badge

006	SWYOR-EA45E6	1400-1500	Mount
007	IOW-DD2E92	1390-1410	Strap End
008	SUR-8EB387	1390-1410	Strap End
009	SUR-767B02	1350-1450	Strap End
010	WMID-9672B4	1390-1410	Strap End
011	NMS-79B927	1350-1450	Strap End
012	DENO-E67DD7	1400-1500	Finger Ring
013	WILT-D27C27	1350-1450	Strap End
014	LVPL-306A66	1450-1550	Finger Ring
015	LVPL-610AF8	1000-1500	Pendant
016	LVPL-E3A6F3	1350-1450	Statue
017	SUR-330251	1400-1550	Strap End
018	BM-1906D1	1400-1550	Crucifix
019	NMS-825184	1400-1500	Pilgrim Badge
020	SUR-692A34Z	1400-1500	Finger Ring
021	LANCUM-C14292	1200-1300	Seal Matrix
022	NMS-8FC872	1375-1525	Strap End
023	NMS-B10D26	1350-1450	Strap End
024	NMS-BCCCFD	1275-1400	Seal Matrix
025	LIN-2F6F65	1400-1500	Finger Ring
026	GLO-1A143E	1390-1410	Buckle
027	LEIC-C75607	1350-1450	Strap End
028	SWYOR-0C6EA7	1400-1550	Finger Ring
029	NMS-3A2BB1	1350-1450	Strap End
030	CORN-11B3FB	1390-1420	Strap End

Table H.2: Artefacts relating to the cult of St Christopher from the PAS database as of 03/10/2016. This data is discussed and analysed in Chapter 5.2. Compiled by the author.

H.3 Artefacts relating to the cult of St Barbara

Number	Object ID	Date	Classification
001	NARC1177	1400-1500	Finger Ring
002	SUSS-72D0D5	1400-1600	Finger Ring
003	SOMDOR-FF50A2	1450-1530	Pilgrim Badge
004	NARC-B9F6E5	1450-1550	Pilgrim Badge
005	SUR-7865B6	1350-1500	Pilgrim Badge
006	GLO-D4BD11	1400-1500	Pilgrim Badge
007	IOW-2A0A40	1400-1500	Pilgrim Badge
008	SUR-959317	1475-1525	Mount
009	SOMDOR-9E68C2	1450-1540	Pilgrim Badge
010	NARC-B8C8E7	1400-1600	Mount
011	SUR-770542	1500-1650	Mount
012	SUSS-9E63B4	1400-1500	Finger Ring
013	IOW-871B11	1450-1525	Mount
014	IOW-249BA8	1400-1500	Mount
015	SWYOR-806713	1400-1500	Mount
016	YORYM-39B423	1400-1550	Finger Ring
017	IOW-B00471	1400-1500	Pilgrim Badge
018	SOM-862035	1450-1550	Pilgrim Badge
019	NMS-CCEC73	1400-1500	Finger Ring
020	NMS-0191E5	1400-1540	Mount
021	LON-51F502	1400-1500	Pilgrim Badge
022	IOW-FDFE06	1400-1500	Mount
023	SWYOR-A8D690	1400-1500	Pilgrim Badge

024	GLO-A3DF57	1400-1550	Finger Ring
025	WMID-C2E4D4	1475-1525	Button
026	SF-4949EE	1400-1500	Pilgrim Badge
027	CORN-632D6E	1400-1500	Finger Ring
028	SUR-25C4C1	1450-1550	Purse
029	NMGW-EB4B2C	1400-1550	Pilgrim Badge
030	DOR-D49DE2	1450-1540	Pilgrim Badge
031	LIN-2F6F65	1400-1500	Finger Ring

Table H.3: Artefacts relating to the cult of St Barbara from the PAS database as of 03/10/2016. This data is discussed and analysed in Chapter 5.2. Compiled by the author.

H.4 Artefacts relating to the cult of the Magi

Number	Object ID	Date	Classification
001	PAS-A33562	1400-1500	Finger Ring
002	GLO-75A2B8	1370-1500	Pendant
003	IOW-336352	1300-1400	Brooch
004	SF-79BDF7	1300-1500	Mount
005	NMS-EDFA64	1400-1500	Finger Ring
006	ESS-2C4836	1500-1550	Reliquary
007	PAS-27F660	1450-1550	Finger Ring
008	BH-33F406	1450-1550	Finger Ring
009	BERK-458106	1300-1400	Vessel
010	SUSS-FF86E6	1200-1400	Brooch
011	PAS-0FE696	1400-1499	Finger Ring
012	PAS-676FF6	Unknown	Brooch
013	LEIC-512D1F	1400-1500	Finger Ring
014	NMS-6FA0F0	1350-1500	Finger Ring

Table H.4: Artefacts relating to the cult of the Magi from the PAS database as of 03/10/2016. This data is discussed and analysed in Chapter 5.2. Compiled by the author.

H.5 Pilgrim badges

No.	Object ID	Date	No.	Object ID	Date
001	NLM-E6FC53	1200-1350	002	NMS-57DC41	1400-1500
003	LON-84FB80	1450-1550	004	LON-806D1C	1400-1550
005	CAM-A02FB5	Unknown	006	LON-4FC379	1450-1500
007	PUBLIC-14A4B4	1400-1450	008	DOR-D49DE2	1450-1540
009	DENO-C68426	1400-1500	010	BUC-309E0D	1350-1499
011	PUBLIC-F5F53C	Unknown	012	PUBLIC-F5ED3C	1450-1500
013	LVPL-8EEAAD	1200-1550	014	DENO-61D101	1300-1500
015	GLO-BD3800	1400-1550	016	LANCUM-BB7601	1200-1500
017	SWYOR-BB1F09	1150-1550	018	PUBLIC-A75501	Unknown
019	SF-27C240	1250-1600	020	PUBLIC-878B35	Unknown
021	NMGW-DB8D66	1400-1600	022	WILT-386146	1350-1450
023	PUBLIC-265E81	1300-1450	024	LANCUM-E4062C	Unknown
025	LANCUM-D20F1F	1200-1500	026	LIN-03323A	1400-1500
027	LANCUM-356D71	1350-1530	028	BUC-5F2639	1475-1525
029	PUBLIC-5C3912	1300-1500	030	PUBLIC-364487	1300-1500

031	SF-EAFF4E	1420-1500	032	PUBLIC-2E6AF6	1375-1425
033	LON-9E2604	1300-1350	034	WAW-25F123	1300-1500
035	LON-087127	Unknown	036	LON-0801CB	1300-1500
037	LON-B4E381	Unknown	038	SF-37F174	1471-1540
039	LIN-548AA9	1250-1500	040	ESS-0F4159	1300-1500
041	DENO-FB96AA	1300-1500	042	SUR-6DA5CB	1400-1550
043	NMS-FE3C03	1400-1500	044	LON-97445B	1300-1400
045	LON-973A97	1300-1400	046	LON-972159	1300-1400
047	LON-943E53	1400-1500	048	PUBLIC-341C2D	1400-1500
049	SF-739782	1400-1500	050	WILT-DB9FC9	1250-1550
051	LON-3C4F47	1400-1500	052	SUSS-D0D1C2	1400-1500
053	NLM-BDF6C3	1200-1500	054	NMS-97CF17	1300-1500
055	NMGW-EB4B2C	1400-1550	056	LIN-9506E8	1066-1500
057	YORYM-B5B146	1173-1400	058	SF-101E37	1471-1550
059	PUBLIC-13C304	1200-1500	060	NARC-3F12F2	Unknown
061	SWYOR-039EFF	1300-1550	062	LIN-FF8C5C	1300-1500
063	NLM-6D4FE6	1450-1550	064	ESS-1A3010	1450-1525
065	SWYOR-5DC01E	1200-1550	066	SF-60F30A	1300-1500
067	LON-366E73	1250-1400	068	LON-F5E1F1	1300-1400
069	CAM-F53E78	1200-1450	070	LON-EC95CF	1200-1400
071	LON-586718	1400-1500	072	LON-576A31	1450-1500
073	NMGW-C39755	1400-1500	074	SF-4949EE	1400-1500
075	NMGW-46D749	Unknown	076	NMGW-62E55B	1400-1600
077	LON-8EA7E5	1375-1425	078	LON-8E11BB	1450-1500
079	LANCUM-908F56	1200-1400	080	NARC-BED83F	1205-1230
081	LANCUM-6A194E	1200-1500	082	NMS-3C99D3	1400-1500
083	NLM-1BD58E	1250-1350	084	SUSS-06E5D8	1200-1400
085	YORYM-6FB2B1	1200-1500	086	BH-0A0557	1400-1530
087	YORYM-B8133E	1200-1500	088	NLM-9E194A	1400-1500
089	SWYOR-9D37B9	1300-1500	090	DUR-243854	1300-1500
091	YORYM-D245DA	1250-1550	092	LIN-404108	1314-1500
093	LIN-566EC1	1400-1500	094	LON-7F46D1	1400-1500
095	NARC-B0179D	Unknown	096	SWYOR-5B34C7	1450-1525
097	NARC-05A6C2	Unknown	098	NARC-056589	Unknown
099	NARC-04F736	1250-1500	100	GLO-5E944B	1400-1550
101	WMID-F483E9	1400-1525	102	SF-A3A885	1471-1550
103	NMS-0EECC3	1300-1539	104	LON-53A440	1485-1500
105	LON-DE0860	1350-1450	106	NMS-5BC850	1400-1500
107	KENT-CA3DC7	1066-1500	108	LVPL-4F20F1	1400-1500
109	LVPL-4E9DA4	1300-1500	110	CORN-01E2E5	1300-1500
111	WMID-8EB286	1400-1525	112	NMS-66BC25	1200-1325
113	LON-A918A5	1200-1400	114	LIN-2D4682	1200-1450
115	LON-027F55	1300-1350	116	BH-CC6103	1475-1525
117	LIN-4A9334	1200-1450	118	LANCUM-F68AD4	1175-1400
119	LON-CCE076	1400-1500	120	LON-0DB361	1350-1450
121	SF-91F1C3	1400-1600	122	SUR-8DD812	1250-1400
123	LON-7A0FC6	1450-1550	124	SWYOR-FE0533	1400-1600
125	BERK-C11095	1150-1450	126	PUBLIC-A15598	1270-1350
127	WILT-DBC381	1200-1500	128	WILT-6F99A5	1200-1500
129	LON-6FABC6	1400-1500	130	NMS-37A335	1300-1550
131	NMS-365ED6	1400-1500	132	LON-2318A3	Unknown
133	DUR-6479B6	Unknown	134	LON-F96AE8	1400-1500
135	LON-F96824	1400-1500	136	NLM-1650F4	1300-1400
137	CAM-1D0832	Unknown	138	LVPL-F39C08	1300-1600
139	LIN-DF90E7	1200-1450	140	YORYM-211290	1300-1500
141	SF-8D5D64	1350-1500	142	CORN-225F65	1350-1450
143	FAKL-53A6F1	1450-1530	144	LON-1C0853	1450-1500

145	LON-1BD9C3	1350-1530	146	LON-140B46	1350-1420
147	SUR-FFF175	1400-1550	148	LIN-FD4722	1200-1450
149	NARC-44C770	Unknown	150	CAM-C571E7	Unknown
151	WMID-ADB132	1350-1550	152	NMS-2DD916	1300-1500
153	NMS-2D4373	1300-1500	154	SUR-F0FF05	1400-1550
155	WILT-85E7A5	1400-1500	156	BERK-85DD65	1200-1400
157	LIN-7308C3	1300-1500	158	KENT-4878A5	1350-1400
159	LON-CA8654	1400-1500	160	SWYOR-506DB6	1200-1500
161	LIN-69FF01	1300-1500	162	KENT-EC8680	1400-1500
163	PUBLIC-C2EA11	Unknown	164	DOR-EE8A03	1400-1500
165	NLM-133FC0	1350-1500	166	SWYOR-A8D690	1400-1500
167	SWYOR-A4EC54	1400-1500	168	SUR-91DA17	1400-1550
169	NMS-794393	1200-1530	170	WAW-3A3515	1400-1550
171	LVPL-6B1F98	1400-1500	172	NLM-AF77C6	1200-1500
173	BH-199D37	1400-1530	174	DOR-9BC000	1400-1550
175	LON-7188A5	1450-1500	176	SWYOR-5C3563	1400-1550
177	LON-48E271	1471-1540	178	YORYM-BDC077	1300-1500
179	KENT-C4B627	1400-1600	180	YORYM-DB0F36	1400-1550
181	DUR-468A21	1300-1500	182	PAS-B1BD65	1300-1500
183	DENO-A249C6	1300-1500	184	SWYOR-39ACF3	1400-1500
185	NMS-0E5046	1300-1500	186	SWYOR-EB3223	1250-1450
187	DOR-D2A340	1400-1540	188	SF-2CD985	1200-1500
189	DUR-022964	1400-1500	190	SWYOR-B6B054	1300-1500
191	BH-B61A93	1400-1550	192	PUBLIC-9CD231	1375-1475
193	LON-7210B2	1300-1500	194	SOM-1F9376	1400-1535
195	SOM-0CDEF6	1350-1700	196	DUR-73F3F2	1400-1500
197	YORYM-6153F1	1200-1600	198	LIN-E52544	1300-1500
199	SUR-E42C11	1300-1500	200	LON-51F502	1400-1500
201	BM-91D1C5	Unknown	202	BM-91CDA2	Unknown
203	BM-91C888	Unknown	204	YORYM-3EF607	1400-1550
205	SWYOR-25C3E5	1450-1550	206	SOM-145085	1400-1535
207	NMS-825184	1400-1500	208	WMID-7D5A75	1400-1500
209	LVPL-D73EC7	1300-1400	210	NARC-7FB921	1300-1400
211	LON-6D69D7	1300-1500	212	NARC-DAC931	1100-1550
213	NARC-DA5944	1100-1550	214	LIN-C5CED2	1300-1400
215	LON-C52131	1400-1500	216	LIN-5CB267	1400-1500
217	PUBLIC-2C1470	1200-1500	218	LON-8D8E17	1250-1400
219	SWYOR-3CA6F3	1200-1500	220	LON-A337B5	Unknown
221	LANCUM-BCEBA6	1200-1500	222	NCL-AE4D13	1400-1450
223	WAW-AAFA95	1066-1500	224	ESS-940232	1450-1525
225	LON-912381	1400-1500	226	LON-90DA13	1471-1545
227	LON-9040C0	1404-1450	228	BUC-12F2B3	Unknown
229	LEIC-6DA8E6	1100-1500	230	HAMP-2B9852	1300-1400
231	LON-DCBEE1	1450-1500	232	LON-DB7794	1450-1500
233	LON-DAA254	1450-1500	234	LIN-749B14	1400-1500
235	NARC-51EAD1	1150-1500	236	NARC-7B3E17	1200-1500
237	LANCUM-619B37	1400-1525	238	BUC-B7B744	1066-1500
239	GLO-BECDA3	1400-1500	240	SWYOR-BB3B45	1200-1550
241	PUBLIC-A5C6B7	1400-1500	242	NLM-93AF41	1400-1500
243	NARC-EF8344	1400-1550	244	NLM-B20A92	1200-1500
245	SF-640C85	1420-1460	246	WILT-6305E7	1470-1520
247	BERK-CBB1B5	1250-1400	248	LANCUM-3829C6	Unknown
249	NMS-C541A1	Unknown	250	SOM-862035	1450-1550
251	SWYOR-58F730	1400-1550	252	LANCUM-4501B2	1400-1500
253	WMID-3585A7	1100-1400	254	LANCUM-0AB780	1150-1400
255	LON-D76D87	1400-1550	256	LON-D6B298	1300-1400
257	NLM-33A234	1200-1400	258	LON-52AD58	1450-1500

259	IOW-B00471	1400-1500	260	DENO-A3C195	1300-1540
261	BUC-504795	1300-1530	262	LIN-3A8FB1	1300-1500
263	LON-D49AE5	Unknown	264	BH-589BA2	1475-1525
265	NLM-D4A333	1200-1350	266	DUR-84E7D7	1400-1530
267	DENO-C5CB07	1400-1540	268	NMS-179624	Unknown
269	NLM-EF8F77	1200-1400	270	HESH-5631E3	1200-1400
271	BERK-459115	1300-1399	272	BUC-EE63A0	1066-1500
273	BUC-EE54A7	1066-1500	274	WAW-4DE1A2	1400-1525
275	SWYOR-E10FB3	1400-1500	276	BH-4D5FD5	1475-1550
277	SWYOR-B4C081	1470-1520	278	LON-4EAFC3	Unknown
279	BH-E6F815	1475-1550	280	BERK-29EB55	1300-1599
281	NARC-5D1753	1250-1400	282	BH-B5CE85	1350-1550
283	SF-089A28	1300-1500	284	NLM-6717B6	1300-1400
285	NLM-620217	1400-1500	286	DEV-2FD8C3	Unknown
287	LON-043B88	1400-1500	288	WILT-81DE97	1150-1450
289	LON-08A482	Unknown	290	LON-08A0F1	Unknown
291	LON-089E47	Unknown	292	LON-089A48	Unknown
293	LON-0897E7	Unknown	294	LON-F57121	Unknown
295	LON-F56337	Unknown	296	CAM-264206	Unknown
297	LON-502AE6	1400-1600	298	WILT-0618C8	1400-1500
299	BH-5B0682	1484-1540	300	NLM-F3F221	1300-1500
301	YORYM-22A0C6	1400-1600	302	WILT-7D60E8	1200-1300
303	NARC-EA4A22	1300-	304	LANCUM-E85957	1400-1500
305	LON-C17D54	1200-1400	306	NMS-C75C02	Unknown
307	NMS-2401D5	1375-1400	308	SF-7A5314	1300-1500
309	NMS-98B222	1200-1500	310	NMS-708F73	Unknown
311	SF-EED552	1200-1400	312	NMS-EE2DC3	1300-1500
313	GLO-88C926	1300-1600	314	BH-CB9BB7	1450-1500
315	LON-427331	1450-1550	316	LVPL-DCE433	1461-1550
317	NMS-1093F6	1350-1500	318	LON-7CBB31	Unknown
319	HAMP-19F241	1425-1525	320	BH-C4ED35	1400-1525
321	LON-08EBD0	1200-1400	322	NMS-F1D6E1	1066-1500
323	LON-C82858	1400-1500	324	LEIC-215FD5	1250-1500
325	NMS-5519B8	1400-1550	326	NMS-5506C6	1200-1300
327	SUSS-3C5F86	1475-1525	328	LON-19F1D6	1350-1400
329	NMS-64B512	1400-1500	330	LON-D191D7	Unknown
331	LEIC-52B215	1250-1500	332	NMS-82C754	1400-1500
333	LON-E00C23	1200-1550	334	LON-DFB0F8	1200-1300
335	NMS-B99FA5	1300-1350	336	NMS-B5B524	1066-1500
337	DENO-E8A882	1400-1550	338	BH-6EDFD6	1475-1525
339	BH-6E8184	1475-1525	340	LEIC-564CD0	1171-1500
341	LON-C638E2	1350-1450	342	NCL-617555	1450-1550
343	NMS-E40D22	1200-1400	344	NMS-30EE65	1400-1550
345	LON-70DD63	Unknown	346	LON-70D1C4	Unknown
347	SF-873640	1485-1550	348	NMS-5DD095	1400-1600
349	NLM-FACEC6	1450-1540	350	NMS-8A5044	1450-1550
351	SWYOR-0F3FC3	1066-1500	352	NMS-C36C83	1400-1500
353	SF-8723E6	1400-1500	354	NCL-838C03	1066-1500
355	LON-5FA634	Unknown	356	LON-5F82C5	Unknown
357	SOMDOR-2057A7	1320-1540	358	DENO-380432	1066-1500
359	LVPL-A7AA62	1400-1600	360	SF-461CD7	1485-1525
361	SOMDOR-9E68C2	1450-1540	362	SWYOR-2133C1	1400-1520
363	NMS-749FE6	1300-1500	364	ESS-57FB48	1350-1525
365	LIN-8A5633	1400-1520	366	IOW-2A0A40	1400-1500
367	NMS-B76D74	1066-1500	368	BH-B903E5	1475-1550
369	NCL-8D9943	Unknown	370	KENT-F04B93	1300-1500
371	ESS-80AFE7	Unknown	372	LON-45C0B4	1350-1450

373	LON-4581B6	1350-1800	374	BERK-186AD6	Unknown
375	LON-CD2C70	1300-1400	376	GLO-ECFFB2	1400-1499
377	NARC-C24577	1300-1500	378	LON-F5F957	1415-1550
379	SUR-B57856	1400-1550	380	SOMDOR-7514C8	1320-1540
381	LANCUM-52ECB3	1066-1540	382	CAM-28B7A7	1300-1500
383	GLO-D4BD11	1400-1500	384	SOMDOR-29F941	1300-1499
385	BH-048794	1400-1600	386	NMS-575F46	1066-1500
387	LEIC-E37A35	1300-1500	388	BERK-A95AE5	1200-1500
389	NARC-921961	1300-1500	390	NARC-91D456	1300-1500
391	NARC-424E60	1400-1500	392	NARC-01A643	1300-1500
393	NMS-552096	1066-1500	394	BH-19C0B6	1300-1500
395	SWYOR-C9A808	1320-1420	396	NARC-C48E70	1300-1500
397	SUR-7865B6	1350-1500	398	NARC-7D7AC7	1300-1500
399	NARC-7A4A72	1425-1525	400	NARC-3E4393	1300-1500
401	NARC-3DDFF3	1300-1500	402	NARC-3CFAC1	1300-1500
403	KENT-E18875	Unknown	404	LEIC-957D14	1100-1500
405	NARC-69D2A6	1320-1500	406	NMS-58AE57	1066-1500
407	NMS-1FC390	1400-1500	408	LON-B92301	1400-1500
409	NARC-B9F6E5	1450-1550	410	DENO-B7F1D4	1300-1500
411	NMS-E48254	1400-1550	412	LON-E75417	1400-1420
413	WILT-DD6D34	Unknown	414	LON-0DC910	1400-1500
415	LON-0E51B1	1450-1520	416	WMID-FB76D0	1500-1600
417	LON-CF5770	1300-1400	418	LON-D3A3E3	1300-1400
419	LON-69C4E5	1450-1520	420	LON-D7E724	1500-1600
421	LON-0C5BE6	1300-1600	422	LVPL-F6D514	1400-1520
423	SOMDOR-FF50A2	1450-1540	424	SF-BD55E3	1400-1500
425	LON-974287	Unknown	426	BUC-823A02	1066-1500
427	NMS-D0D287	1350-1530	428	YORYM-70D333	Unknown
429	NMS-5F9BB2	1300-1499	430	NLM-66F7F3	1450-1535
431	YORYM-C0C077	Unknown	432	SF-7FFFE7	1066-1540
433	LVPL-608E46	1300-1500	434	PAS-24DDF3	1400-1599
435	NMS906	1400-1700	436	NMS1453	1401-1500
437	NMS962	1066-1540	438	SF10740	1200-1300
439	KENT4898	1500-1600	440	NLM6640	1200-1600
441	HAMP2202	1400-1530	442	SF9179	1200-1500
443	WMID4380	1066-1540	444	SF8205	1200-1400
445	SF8047	1400-1500	446	NLM5728	1450-1530
447	NARC1754	1220-1540	448	KENT3618	1200-
449	SF6115	1066-1540	450	NARC866	1066-1540
451	SOMDOR905	1300-1540	452	NLM4718	1200-1540
453	NLM4494	1200-1530	454	SF2266	1300-1500
455	SF1834	1300-1500	456	YORYM1221	1200-1500
457	YORYM1075	1200-1500	458	NLM2903	1066-1540
459	NLM2914	1200-1540	460	SOMDOR148	1400-1500
461	SF3	1200-1399	462	YORYMM328	1066-1485
463	YORYM501	1300-1485	464	WMID286	1471-1530
465	YORYM347	1300-1485	466	KENT680	1450-1530
467	YORYMM80	1300-1400	468	NLM667	1200-1485
469	KENT345	1350-1450			

Table H.5: Pilgrim badges from the PAS database as of 12/12/2016. This data is discussed and analysed in Chapter 5.3. Compiled by the author.

H.6 *Ampullae*

No.	Object ID	Date	No.	Object ID	Date
0001	YORYM-1400B1	1350-1550	0002	NMS-12E1F1	1300-1539
0003	LON-078B54	Unkown	0004	PUBLIC-1959D9	Unkown
0005	BH-14DA6E	1350-1530	0006	NARC-ECD4BA	1330-1530
0007	LEIC-D922B7	1100-1500	0008	FAKL-061358	1350-1550
0009	NARC-EE2681	1350-1530	0010	NMS-DADF38	1350-1540
0011	CORN-B2E7C7	1350-1500	0012	WILT-9955E3	1350-1530
0013	WMID-1AEE41	1300-1500	0014	HESH-0B21B6	1200-1450
0015	BH-0951ED	1200-1400	0016	NMS-DF9ADA	1350-1530
0017	BH-C6371B	1100-1300	0018	WAW-870F49	1175-1500
0019	LANCUM-5F058B	1350-1550	0020	SUR-603171	1300-1500
0021	NMS-5043C9	1400-1540	0022	SOM-3A03F2	1150-1350
0023	SF-D09AC4	1150-1450	0024	WAW-CEA7B9	1175-1500
0025	NLM-A6181A	1350-1500	0026	LANCUM-A62259	1300-1500
0027	SUSS-95F98E	Unkown	0028	NMS-930036	1350-1530
0029	IOW-02FF28	1300-1500	0030	WAW-657D63	1275-1500
0031	SWYOR-2D1942	1300-1500	0032	NMS-04E348	1350-1530
0033	NMS-EC7192	1350-1530	0034	SF-6B935D	1150-1450
0035	SUR-480378	1300-1600	0036	WILT-44C5AD	1350-1530
0037	LANCUM-B03873	1300-1500	0038	LVPL-AEACEB	1300-1500
0039	SUSS-2EDA81	1400-1540	0040	WMID-B0C629	1200-1400
0041	SF-4BE3B8	1350-1550	0042	YORYM-44F62E	1330-1530
0043	YORYM-44C9BB	1330-1530	0044	YORYM-3652FE	1330-1530
0045	LVPL-1FDCFB	1300-1500	0046	WMID-077EFD	1200-1400
0047	DUR-9DE5C1	1200-1400	0048	LIN-F7F27E	1200-1400
0049	LEIC-7993AE	1100-1400	0050	ESS-61BA6D	1350-1550
0051	NMS-60646C	1350-1530	0052	SUR-395977	1350-1530
0053	PUBLIC-EC9493	1400-1500	0054	WAW-D7169E	1275-1500
0055	NLM-D19725	1350-1500	0056	PUBLIC-B7676C	1300-1500
0057	LVPL-51FF8F	1170-1300	0058	NMS-3F88C9	1350-1530
0059	DUR-279B62	1330-1530	0060	NMS-D202FB	1350-1530
0061	KENT-3DE3D8	1150-1500	0062	WMID-1C504A	1200-1500
0063	SF-13D919	1300-1500	0064	NMS-FECD3B	1350-1530
0065	SF-942DB2	1350-1550	0066	BUC-EB5D8E	1150-1500
0067	WILT-C18A0C	1350-1530	0068	NMS-C215BE	1350-1530
0069	WMID-7115B3	1200-1500	0070	NMS-30E442	1300-1400
0071	WMID-30CDFB	1200-1400	0072	DOR-EDD2D9	1250-1450
0073	NMS-EEAE21	1350-1530	0074	NMS-EDB29E	1350-1530
0075	LEIC-DD8D58	1350-1540	0076	LANCUM-B172F9	1250-1450
0077	WILT-748A26	1350-1530	0078	WILT-220C16	1350-1550
0079	CAM-0D6F81	1150-1550	0080	SF-F36BD4	1350-1550
0081	WILT-E16391	1350-1530	0082	NMS-E2229E	1350-1530
0083	NMS-E1FF05	1350-1530	0084	SOM-8E6714	1350-1530
0085	NLM-8DF096	1200-1500	0086	NMS-FA981A	1350-1539
0087	NMS-CF9AA1	1350-1530	0088	SOM-CD6F72	1350-1550
0089	NLM-BB4AA0	1200-1500	0090	NMS-B96D6B	1350-1539
0091	NMS-92674C	1350-1530	0092	GLO-790D0C	1350-1540
0093	LEIC-611B15	1350-1530	0094	DUR-393B00	1350-1550
0095	SUR-B809C6	1300-1500	0096	SUR-7F32FB	1300-1500
0097	DOR-2911E2	1250-1450	0098	BUC-25F109	1200-1500
0099	PUBLIC-0050C6	1350-1530	0100	PUBLIC-FF5A5A	1350-1530
0101	PUBLIC-8478E8	1300-1500	0102	LIN-6A4720	1250-1450
0103	LIN-6A10B1	1250-1450	0104	BUC-668607	1200-1500
0105	SF-05578C	1300-1500	0106	YORYM-862197	1350-1550
0107	NMS-810BCB	1400-1540	0108	LIN-C5FADF	1330-1530
0109	PUBLIC-630502	1350-1530	0110	PUBLIC-5BB9F0	1400-1500
0111	GLO-45C271	1350-1550	0112	GLO-4591C2	1350-1550

0113	YORYM-44BA91	1350-1550	0114	SOM-CAD173	1350-1530
0115	WILT-B10128	1350-1538	0116	SWYOR-8D69AB	1200-1500
0117	BUC-382DF9	1300-1500	0118	GLO-20004C	1350-1550
0119	PUBLIC-816356	1350-1530	0120	LIN-388A6B	1200-1400
0121	SUR-25D738	1300-1500	0122	NMS-BDDCDD	1350-1539
0123	LIN-A3CEB4	1200-1500	0124	PUBLIC-3B23AD	1300-1500
0125	KENT-2A925D	1200-1500	0126	LVPL-DEA190	1350-1530
0127	SUR-430612	1300-1500	0128	NMS-017EAF	1350-1530
0129	NMS-885B6B	1300-1539	0130	BH-33CD85	1350-1530
0131	BH-33C7F5	1350-1530	0132	LANCUM-32C00D	1300-1500
0133	NMS-DC58DB	1400-1550	0134	SUSS-C6166C	1100-1500
0135	SF-B2BEA5	1300-1500	0136	SF-B28208	1150-1350
0137	NMS-1D87A9	1350-1550	0138	BUC-BB4E7E	1200-1500
0139	NMS-B922DD	1350-1530	0140	NLM-75B182	1350-1500
0141	NMS-74F996	1350-1530	0142	PUBLIC-4A5439	1300-1550
0143	SUR-BB9F86	1300-1500	0144	PUBLIC-928336	Unkown
0145	BUC-7930F6	1066-1539	0146	BUC-760611	1200-1500
0147	BUC-75FA6F	1200-1500	0148	BUC-75E833	1200-1500
0149	NMS-E62DB2	1400-1540	0150	HESH-3D46B4	1200-1400
0151	NMS-D260F2	1300-1539	0152	DEV-AB89D9	1300-1500
0153	NLM-3F8F36	1350-1500	0154	BERK-12B3A7	1350-1500
0155	PUBLIC-7C2E0D	1300-1500	0156	SOM-6EB0B7	1150-1350
0157	YORYM-C8D05B	1350-1530	0158	SF-AD0EC5	1300-1500
0159	LEIC-342604	1200-1500	0160	ESS-330B91	1300-1500
0161	BERK-DD0EE1	1350-1530	0162	ESS-CB117B	1300-1500
0163	PUBLIC-8E0C41	1200-1500	0164	PUBLIC-39F8B1	1400-1500
0165	SF-A288A9	1350-1550	0166	PUBLIC-4D6B58	1200-1600
0167	YORYM-0EFA5A	1250-1500	0168	DENO-E48A0E	1200-1500
0169	SF-CFC657	1150-1350	0170	DOR-BC490C	1350-1530
0171	WMID-795444	1175-1500	0172	DENO-523A3C	1200-1400
0173	GLO-FDECF5	1350-1550	0174	DENO-E97530	1350-1530
0175	LEIC-67CB23	1100-1500	0176	NMS-4003EE	1350-1530
0177	LEIC-96A1C8	1100-1500	0178	SF-833238	1400-1500
0179	NLM-7FF66A	1350-1500	0180	WMID-2C2E0C	1200-1400
0181	SF-FEB4DB	1150-1350	0182	DENO-EA2FE8	1200-1450
0183	DOR-D3D673	1350-1530	0184	LIN-AB0BE4	1200-1500
0185	NMS-99AEC8	1350-1539	0186	NMS-59E842	1350-1530
0187	NMS-56D589	1350-1539	0188	GLO-170AF6	1350-1550
0189	LEIC-03BACC	1200-1500	0190	BH-DAD53E	1350-1530
0191	SF-8A0501	1300-1500	0192	SF-89E2A2	1300-1500
0193	SF-89B7C7	1300-1500	0194	SUR-1917EC	1300-1500
0195	NMS-EF9DB1	1350-1530	0196	HAMP-B62E17	1150-1500
0197	KENT-06C852	1350-1550	0198	LANCUM-9FFCB7	1200-1500
0199	PUBLIC-92ABD8	1300-1500	0200	LANCUM-8ABE43	1200-1500
0201	BUC-6803E7	1200-1400	0202	SWYOR-0BEAB0	1350-1550
0203	NMS-F924B7	1350-1530	0204	SOM-F6B526	1150-1350
0205	IOW-A1FF86	1300-1500	0206	NMS-79C3AE	1350-1539
0207	WILT-1128AE	1300-1500	0208	BERK-D132B2	1350-1530
0209	LANCUM-BB5FDA	1066-1539	0210	LANCUM-7E1849	1200-1500
0211	NLM-7C4337	1350-1500	0212	NMS-D58D52	1350-1539
0213	LEIC-AFABD4	1300-1500	0214	WILT-92A8C4	1300-1500
0215	NMS-17AAC9	1350-1530	0216	WMID-84363B	1175-1500
0217	NMS-717B55	1350-1539	0218	LVPL-5D28A3	1150-1250
0219	SF-59BEE6	1300-1500	0220	SF-437871	1300-1500
0221	SUR-C91212	1400-1520	0222	SOM-C60D70	1150-1350
0223	PUBLIC-A0702E	1300-1500	0224	LANCUM-2188F4	1350-1530
0225	NMS-E0B90F	1350-1530	0226	LEIC-DE8EAE	1300-1500

0227	HESH-CCB98D	1250-1450	0228	BERK-A04ADC	1350-1538
0229	SWYOR-8BAB64	1300-1500	0230	NMS-4FFA73	1350-1530
0231	DUR-35F51F	1300-1550	0232	SF-FA9293	1350-1550
0233	NMGW-66FDC8	1300-1600	0234	SF-64353C	1350-1550
0235	HESH-2859B0	1250-1500	0236	HESH-938DB4	1250-1500
0237	DUR-8F668E	1350-1550	0238	LANCUM-7B5EF9	1200-1400
0239	HESH-54D2DB	1250-1450	0240	HESH-5321FE	1250-1500
0241	LANCUM-5023B8	1200-1500	0242	WILT-3E6A66	1350-1530
0243	HAMP-3B2F82	1150-1500	0244	NMS-A6A57C	1350-1530
0245	NMS-6BB588	1350-1530	0246	NMS-6714B8	1350-1530
0247	BUC-94A6F8	Unkown	0248	WILT-81ED3E	1350-1550
0249	BUC-16FAA4	Unkown	0250	WILT-01E053	1350-1530
0251	NMS-004AA3	1350-1530	0252	SWYOR-F08F5D	1250-1500
0253	NMS-C2E915	1350-1530	0254	LON-579724	1400-1500
0255	LVPL-EF7FAF	1300-1500	0256	NMS-DCFDEA	1350-1530
0257	NMGW-C6092D	1400-1600	0258	NMGW-C59E9C	1300-1500
0259	BUC-5EF8DA	Unkown	0260	NMGW-5BCFFA	1300-1500
0261	NMS-4AE71C	1350-1539	0262	NMGW-364EE5	1300-1600
0263	NMGW-36323D	1300-1600	0264	GLO-F4DD97	1350-1540
0265	GLO-B49E88	1350-1540	0266	YORYM-34C76F	1150-1500
0267	YORYM-34A7D8	1150-1500	0268	NLM-8CB455	1350-1500
0269	WMID-7A174A	1200-1500	0270	NMS-77C033	1200-1400
0271	SUR-5E9136	1300-1500	0272	LEIC-1F7F1C	1300-1500
0273	PUBLIC-112F3A	1300-1500	0274	NLM-0AEA94	1350-1500
0275	NMGW-514FAB	1300-1600	0276	WAW-0EC49C	1175-1500
0277	SUSS-D3656C	1100-1500	0278	LIN-BD7AC2	1300-1500
0279	LIN-BA47C6	1300-1500	0280	KENT-A66D3B	1175-1499
0281	SUR-94F5D4	1400-1500	0282	NMS-7C9770	1300-1539
0283	NMS-7AC852	1300-1539	0284	NMS-7A1622	1300-1539
0285	IOW-6DD3DB	1300-1500	0286	LIN-54BE9D	1300-1500
0287	DUR-53BBE6	1300-1500	0288	SUR-1484C9	1400-1500
0289	HAMP-EC785A	1150-1500	0290	YORYM-EA7821	1200-1400
0291	WILT-D54B4B	1350-1530	0292	SF-BDDE57	1300-1500
0293	SWYOR-ACC45C	1300-1500	0294	SF-A89C8D	1300-1500
0295	NMS-2863F7	1350-1539	0296	NMS-151749	1350-1539
0297	NMS-011D52	1350-1530	0298	KENT-94657A	1200-1500
0299	LIN-0512A2	1300-1500	0300	LIN-DF877F	1300-1500
0301	NMS-49DDD9	1350-1539	0302	YORYM-B6F7D0	1250-1500
0303	DOR-B2B84A	1350-1530	0304	SF-A159B5	1300-1500
0305	BH-374BF6	1350-1530	0306	LANCUM-2103D8	1350-1530
0307	NLM-D35DD5	1350-1500	0308	LANCUM-D31A15	Unkown
0309	BUC-A41CEB	1066-1539	0310	NMS-D3CF5B	1475-1525
0311	SF-A5984D	1300-1500	0312	SWYOR-412877	1300-1500
0313	GLO-3E5FB1	1350-1540	0314	SF-C26D02	1350-1550
0315	NARC-736271	1100-1500	0316	NMS-5B488F	1350-1539
0317	NARC-F57593	1250-1350	0318	NARC-F5113E	1250-1350
0319	NARC-F4E810	1250-1350	0320	KENT-DDF611	1200-1500
0321	NARC-DE0C84	1100-1400	0322	KENT-D9D6B2	1100-1500
0323	SUR-B4BF19	1400-1500	0324	WMID-89AAA2	1200-1400
0325	NMS-60A597	1350-1539	0326	NMS-5CBF67	1350-1539
0327	NMS-5B6874	1350-1530	0328	NMS-5A4F56	1350-1539
0329	BH-07D894	1450-1500	0330	SF-E04FC9	1350-1550
0331	DENO-CB52E7	1300-1500	0332	DENO-C92FC4	1300-1500
0333	LANCUM-C7D198	1300-1500	0334	LIN-22F1F5	1250-1500
0335	DENO-0EE425	1300-1500	0336	NMS-CEB964	1350-1539
0337	NMS-CC5327	1350-1530	0338	LANCUM-C98044	1100-1500
0339	PUBLIC-739802	1350-1530	0340	SUR-3B8917	1300-1600

0341	YORYM-265444	1150-1500	0342	YORYM-260C03	1350-1530
0343	DEV-178CC5	Unkown	0344	DENO-0F2014	1300-1500
0345	NLM-7C1585	1350-1500	0346	LIN-FEF158	1300-1500
0347	NMS-FE7977	1350-1530	0348	SOM-3D32A7	1150-1350
0349	LIN-2B9927	1300-1500	0350	LANCUM-BD8E11	Unkown
0351	LANCUM-964157	1050-1150	0352	SOM-414D73	1150-1350
0353	LANCUM-058005	1200-1500	0354	BERK-0114A3	1250-1450
0355	NMS-0644C5	1350-1530	0356	ESS-0487F3	1300-1600
0357	SF-998512	1300-1500	0358	NMS-83F2B5	1350-1530
0359	GLO-753483	1350-1540	0360	LANCUM-452F70	1550-1650
0361	SF-DFFCD6	1300-1500	0362	LVPL-CBB905	1300-1500
0363	BH-4C71A2	1350-1530	0364	NMS-A41C73	1350-1530
0365	SF-22DE63	1300-1500	0366	HESH-11D113	1250-1450
0367	SF-A62822	1300-1500	0368	NMS-916E33	1350-1539
0369	NLM-8D6583	1350-1500	0370	SF-67AF33	1300-1500
0371	BH-25FB67	1350-1530	0372	LIN-E4E405	1350-1530
0373	SWYOR-D2E6B1	1350-1530	0374	NMS-7BA190	1350-1539
0375	NMS-7B6683	1350-1539	0376	NLM-6BCF48	1200-1350
0377	NMS-D1DBE4	1400-1530	0378	SF-808FF2	1300-1500
0379	SUR-3199B6	1400-1500	0380	NMS-9C1BD3	1350-1539
0381	NLM-C84AF1	1350-1500	0382	BERK-C7FA20	1350-1530
0383	SF-76AFD7	1350-1530	0384	LIN-718381	1300-1500
0385	KENT-5DDB94	1350-1530	0386	WILT-DE9E02	1300-1500
0387	WILT-CE8493	1300-1500	0388	NMS-A36C91	1350-1530
0389	NLM-365253	1350-1500	0390	BH-363A46	1350-1530
0391	SF-A48A86	1300-1500	0392	NMS-2794A2	1350-1530
0393	NMS-270AA4	1350-1530	0394	NMS-1488F6	1350-1538
0395	YORYM-12E385	1350-1530	0396	WILT-0F24A6	1350-1530
0397	SF-FCAB27	1350-1530	0398	NMS-E80966	1350-1530
0399	NMS-9200B1	1350-1530	0400	DUR-7F96A7	1350-1530
0401	IOW-FDF493	1350-1530	0402	LANCUM-FAD347	1350-1530
0403	NLM-689BF3	1350-1500	0404	NMS-1A0378	1400-1525
0405	SF-0258D1	1300-1500	0406	PUBLIC-A0C335	1200-1400
0407	WMID-6D02A1	1300-1500	0408	NLM-1C00F3	1350-1500
0409	NMS-E00DA6	1300-1539	0410	HAMP-A68CA4	1350-1530
0411	YORYM-7303C6	1150-1500	0412	SUR-7A4E47	1300-1500
0413	NMS-4CB4B7	1300-1536	0414	GLO-4BB9B0	1350-1540
0415	NMS-7CC3C1	1350-1430	0416	WMID-D1A484	1175-1500
0417	WAW-84C225	1175-1400	0418	DEV-51C1D2	1300-1500
0419	HAMP-B0D201	1150-1500	0420	NMS-AF96D4	1350-1530
0421	ESS-966F81	1300-1500	0422	SUR-6AD510	1300-1500
0423	NMS-3069A3	1400-1530	0424	SF-2F9032	1350-1550
0425	HESH-0C7C12	1200-1500	0426	NMS-0912D4	1350-1530
0427	NMS-066085	1200-1540	0428	NLM-1BAF45	1300-1500
0429	WILT-F07928	1250-1500	0430	WAW-E35522	1175-1500
0431	NMS-DC9096	1350-1530	0432	WAW-D01703	1175-1500
0433	NCL-C6BF81	1150-1500	0434	HESH-6542E6	1250-1500
0435	PUBLIC-35B667	Unkown	0436	YORYM-201A03	1150-1500
0437	YORYM-1FE834	1150-1500	0438	LANCUM-104E21	1175-1500
0439	DEV-A3BF32	1150-1500	0440	NMS-8F82A4	1350-1530
0441	SF-3DD594	1300-1500	0442	LIN-92CF15	1300-1500
0443	LIN-92C038	1300-1500	0444	LIN-67DEC6	1300-1500
0445	LIN-666996	1300-1500	0446	NARC-54EDF2	Unkown
0447	IOW-51B836	1300-1500	0448	DUR-513BA4	1350-1530
0449	LON-1C0F88	1300-1500	0450	NLM-100525	1350-1500
0451	NLM-011E21	1350-1500	0452	PUBLIC-EFB403	1300-1399
0453	DOR-F07DF3	1350-1500	0454	SF-41D223	1300-1500

0455	NMS-401A28	1350-1530	0456	LIN-282D11	1300-1500
0457	LIN-281B32	1300-1500	0458	BUC-BD7BA5	1300-1500
0459	SWYOR-1C8AE3	1350-1530	0460	NMS-01A2E3	1350-1530
0461	NMS-B32334	1300-1530	0462	NMS-AE1108	1300-1530
0463	HAMP-76F058	1150-1500	0464	WAW-2399B7	1175-1500
0465	SF-F1DB52	1300-1500	0466	NMS-DD3853	1300-1530
0467	NMS-9B3077	1300-1539	0468	IOW-7AF845	1300-1500
0469	SF-0D4B22	1300-1500	0470	BERK-09E6E3	1350-1500
0471	NMS-F72E08	1300-1538	0472	SF-DD6823	1300-1500
0473	HESH-637557	1250-1550	0474	LIN-52FC35	1400-1500
0475	SF-3E60A1	1300-1500	0476	NMS-25DCB6	1350-1430
0477	PUBLIC-0551C6	Unkown	0478	NMS-FF98D1	1350-1530
0479	LIN-F9BFA3	1400-1500	0480	CAM-F9BB24	1100-1500
0481	LIN-F9A751	1400-1500	0482	PUBLIC-F7D045	1100-1500
0483	NMS-BFAE25	1350-1530	0484	NMS-7CF507	1300-1525
0485	SWYOR-124514	1200-1530	0486	SWYOR-033707	1300-1500
0487	NMS-D53341	1300-1530	0488	SWYOR-570FD1	1300-1500
0489	PUBLIC-D84044	1350-1530	0490	SUR-2BBA56	1300-1500
0491	SUR-1B3751	1300-1500	0492	NMS-2EEBE4	1400-1600
0493	GLO-1D5592	1350-1540	0494	KENT-09A116	1350-1500
0495	SF-F380E8	1350-1550	0496	GLO-F55B93	1350-1540
0497	LIN-625C14	1300-1500	0498	SWYOR-616F31	1350-1500
0499	LIN-345231	1300-1500	0500	YORYM-FAF4B1	1150-1500
0501	BERK-E3A276	1200-1450	0502	PUBLIC-D52E17	1300-1500
0503	NMS-518862	1200-1500	0504	NLM-24E924	1400-1500
0505	LEIC-14FA42	Unkown	0506	SWYOR-0EAB85	1175-1400
0507	PUBLIC-B97C78	1100-1500	0508	LANCUM-3BC756	1300-1500
0509	HESH-804731	1250-1450	0510	LIN-6BCD08	1300-1500
0511	WAW-480644	1300-1500	0512	DEV-D95961	Unkown
0513	NMS-AFDA36	1350-1530	0514	SUR-1D9FD4	1300-1500
0515	NMS-1D8055	1350-1540	0516	NMS-179334	1300-1550
0517	NLM-C88656	1200-1500	0518	HAMP-AD49E7	1350-1530
0519	IOW-634084	1300-1500	0520	PUBLIC-FA6A46	1300-1500
0521	WAW-DB75A4	1175-1500	0522	SUR-73FC44	1300-1500
0523	IOW-62FE72	1300-1500	0524	SWYOR-F7C156	1350-1530
0525	HAMP-E29AA4	1350-1530	0526	LVPL-DE22B6	1150-1250
0527	HAMP-64B301	1350-1530	0528	PUBLIC-3FB8A6	1400-1500
0529	LIN-24E397	1200-1300	0530	DUR-21EC84	1350-1500
0531	DUR-8C1598	1175-1500	0532	NARC-254DE5	1350-1400
0533	WAW-13FF38	1350-1500	0534	SF-A3A173	1200-1500
0535	FAKL-65AA32	1400-1540	0536	WAW-5C29B0	1175-1500
0537	WAW-C921D2	1175-1500	0538	WAW-C8FEE3	1175-1500
0539	NARC-B19637	1250-1400	0540	NARC-B152C5	1250-1400
0541	NLM-43B353	1350-1500	0542	BH-9CB614	1300-1500
0543	LEIC-1AD9D8	1100-1500	0544	BERK-060465	1150-1538
0545	BERK-05C323	1300-1500	0546	BERK-059E60	1300-1500
0547	LEIC-059214	1100-1500	0548	BERK-058E04	1300-1500
0549	LEIC-F08BA1	1300-1500	0550	SF-A20845	1300-1500
0551	WILT-9E29B0	1150-1500	0552	NLM-210894	1350-1500
0553	NLM-20CEB6	1350-1500	0554	NLM-086DA2	1471-1500
0555	SUR-611C72	1300-1550	0556	NMS-493180	1400-1540
0557	SWYOR-33C866	1175-1350	0558	IOW-549CE8	1300-1500
0559	LEIC-2689C2	1200-1500	0560	SF-0EE923	1400-1500
0561	LIN-8DB253	1300-1500	0562	LIN-2766A2	1300-1500
0563	LIN-141A97	1300-1500	0564	SWYOR-92F615	1350-1500
0565	NMS-54F9B7	1400-1540	0566	NARC-40D112	1300-1500
0567	WILT-8445C7	1150-1500	0568	IOW-81D4E1	1300-1500

0569	LVPL-6DD7C3	1300-1500	0570	LVPL-43AD53	1150-1250
0571	LVPL-41B496	1100-1500	0572	WILT-D72744	1150-1500
0573	LEIC-B00583	1100-1500	0574	LEIC-AF22A6	1100-1500
0575	CPAT-1D35B5	Unkown	0576	BERK-180503	1200-1500
0577	WMID-024CC8	1200-1500	0578	SF-DEAD94	1400-1500
0579	SUSS-CC9670	1150-1350	0580	LANCUM-6456D6	1100-1400
0581	CORN-555115	1350-1500	0582	CORN-546138	1350-1500
0583	SUSS-4E25C2	1150-1350	0584	SWYOR-BBAA23	1300-1600
0585	LIN-BA8EB8	1350-1500	0586	YORYM-E744E4	1150-1500
0587	LEIC-9153A5	Unkown	0588	BERK-8FC005	1150-1400
0589	YORYM-53C757	1150-1500	0590	NLM-10A6D5	1200-1500
0591	DOR-0FB6C8	1350-1500	0592	NLM-FE9685	1200-1500
0593	LVPL-C015E2	1150-1250	0594	NLM-A94C21	1250-1500
0595	DUR-9604A2	1300-1500	0596	LVPL-94BAA3	1200-1400
0597	WAW-948175	1250-1500	0598	LIN-150015	1300-1500
0599	LIN-13E791	Unkown	0600	SOM-054544	1150-1350
0601	NLM-FC9C15	1200-1500	0602	YORYM-948500	1150-1500
0603	ESS-7D4650	1200-1500	0604	KENT-587CB3	1350-1550
0605	LVPL-43C254	1150-1250	0606	PUBLIC-F12FD1	1400-1500
0607	HAMP-DACBB1	1350-1530	0608	LIN-ACB0C4	1300-1500
0609	BUC-A94743	1066-1500	0610	LVPL-076916	1350-1530
0611	YORYM-9CBEB2	1150-1500	0612	SOM-8B8475	1150-1350
0613	SF-76EF77	1350-1550	0614	SOM-761DA2	1150-1350
0615	LANCUM-0B15B6	1200-1500	0616	PUBLIC-0A92D1	1250-1550
0617	LEIC-08D4A7	1100-1500	0618	SF-CD8C64	1350-1550
0619	NLM-4D7ED2	1250-1500	0620	NLM-4BA415	1250-1500
0621	PUBLIC-FE5E33	1150-1350	0622	LIN-F61578	1300-1500
0623	HAMP-A0D9F6	1350-1530	0624	GLO-25C516	1350-1540
0625	DENO-0E2C66	1300-1400	0626	DENO-D14B95	1300-1500
0627	LIN-91B356	1300-1500	0628	LIN-91A1B1	1300-1500
0629	NCL-851056	1400-1500	0630	NCL-51FDB6	1400-1500
0631	BUC-185265	1066-1500	0632	PUBLIC-6B2A84	1300-1550
0633	NLM-EDBE35	1200-1500	0634	DOR-C4AFD7	1300-1500
0635	LIN-8A5CC7	1350-1500	0636	LIN-F4BF14	1150-1500
0637	IOW-E31B47	1300-1500	0638	ESS-E249D1	1350-1500
0639	SWYOR-3934A7	1350-1500	0640	GLO-E36D81	1350-1540
0641	GLO-E34953	1350-1540	0642	LIN-A601A0	1400-1500
0643	WMID-8F9A75	1100-1500	0644	SWYOR-A704A8	1350-1500
0645	SWYOR-67C023	1350-1500	0646	DEV-54FBE5	1300-1530
0647	PUBLIC-2983D4	1350-1550	0648	PUBLIC-297F48	1350-1550
0649	PUBLIC-D79714	1300-1600	0650	FAKL-C6A291	1450-1538
0651	SUSS-985C17	Unkown	0652	NARC-575335	1350-1500
0653	NMS-452277	1400-1600	0654	PUBLIC-EDB8D1	1350-1500
0655	PUBLIC-EDE127	1300-1450	0656	SUR-0BB133	1300-1500
0657	NLM-873E03	1250-1500	0658	WILT-23E041	1150-1500
0659	WAW-0CF996	1250-1500	0660	PUBLIC-09B6D4	1300-1600
0661	HAMP-F5E251	1350-1530	0662	DUR-F52413	1350-1530
0663	WMID-F50C92	1350-1500	0664	SF-D493A7	1300-1500
0665	SF-141645	1300-1500	0666	YORYM-12B643	1150-1500
0667	LANCUM-D4D0C8	1200-1500	0668	NLM-D17A16	1350-1500
0669	BERK-921FB2	1350-1500	0670	SWYOR-7FEDC1	1350-1500
0671	SWYOR-00ABE8	1400-1500	0672	LANCUM-F18D92	1300-1500
0673	LEIC-8CBE87	Unkown	0674	NARC-128747	1350-1530
0675	NMGW-A4FF13	1300-1600	0676	NMGW-A301E4	1300-1600
0677	NLM-B8E9D1	1200-1500	0678	BH-68B136	1350-1530
0679	SWYOR-BA44D1	1250-1450	0680	LIN-29EE81	1350-1500
0681	WILT-C2FA11	1150-1500	0682	HESH-830492	1250-1450

0683	SF-6D9764	1400-1500	0684	SF-6D47B6	1200-1500
0685	HAMP-EE83C1	1350-1530	0686	PUBLIC-DBB374	1350-1530
0687	BH-ABC1C3	1350-1530	0688	WMID-442904	1175-1500
0689	NMS-0664E7	1300-1550	0690	SF-EF7C61	1300-1500
0691	NLM-D70B85	1200-1500	0692	WILT-B278F6	1150-1530
0693	PUBLIC-218E98	1400-1500	0694	PUBLIC-214F28	1400-1500
0695	WMID-78A292	1400-1500	0696	DENO-613DA0	1350-1530
0697	SF-FAC2E3	1300-1500	0698	KENT-F89AA3	1350-1530
0699	DUR-F5AF71	1350-1530	0700	LIN-E40661	1400-1500
0701	SWYOR-78FC28	1100-1400	0702	BERK-514F85	1350-1530
0703	SF-5057E7	1350-1500	0704	WMID-3EEF72	1200-1500
0705	NLM-B94891	1350-1500	0706	SWYOR-3C7580	1350-1450
0707	BUC-3BAF61	Unkown	0708	KENT-EA6112	1300-1499
0709	LIN-D68810	1400-1500	0710	DEV-C1A236	Unkown
0711	PUBLIC-ABDAF4	1400-1500	0712	WMID-ADF892	1200-1500
0713	NCL-696FD8	1450-1550	0714	WMID-EA38C7	1300-1500
0715	NARC-6DB423	1350-1530	0716	YORYM-DF4281	1350-1530
0717	LVPL-A14031	1100-1500	0718	WAW-1E9544	1275-1500
0719	LEIC-F84EE2	1200-1500	0720	LEIC-F780F6	1200-1500
0721	LEIC-F70E84	1200-1500	0722	WMID-7A35C1	1175-1500
0723	SF-795206	1200-1500	0724	SF-7925E5	1200-1500
0725	IOW-646142	1350-1500	0726	KENT-E3F883	1350-1540
0727	LANCUM-CEFEB1	1400-1500	0728	LIN-640284	1400-1500
0729	CAM-523563	1300-1500	0730	LIN-283DD6	1400-1500
0731	GLO-52C047	1350-1540	0732	DEV-5222D1	Unkown
0733	YORYM-013842	1350-1530	0734	ESS-C05071	1300-1500
0735	ESS-829B67	1300-1500	0736	LIN-2D9D81	1400-1500
0737	ESS-04D9E3	1175-1530	0738	NMS-005522	1300-1550
0739	LEIC-EB7AD6	1066-1500	0740	GLO-423700	1350-1540
0741	CPAT-D58704	Unkown	0742	WMID-B1BBA5	1200-1400
0743	SF-339226	1200-1500	0744	GLO-1F5FC0	1350-1540
0745	CAM-CA74B7	Unkown	0746	NMS-098302	1400-1550
0747	GLO-B7B566	1350-1540	0748	IOW-808577	1350-1500
0749	SWYOR-771FB3	1350-1530	0750	WILT-6476E5	1200-1300
0751	SUSS-26BC85	1200-1400	0752	SUSS-261F92	1200-1400
0753	SUSS-259E67	1200-1400	0754	ESS-E4A647	1350-1500
0755	NCL-E46354	1100-1500	0756	BERK-D48596	1250-1450
0757	LVPL-D06A93	1100-1500	0758	SWYOR-BA43F8	1200-1450
0759	WILT-A96506	1150-1500	0760	WMID-517736	1175-1500
0761	HAMP-7D5B90	1350-1530	0762	LANCUM-40B516	1300-1600
0763	CPAT-289524	1350-1550	0764	DOR-020E35	1350-1530
0765	WILT-AB6CE7	1150-1350	0766	GLO-5A0F34	1350-1550
0767	SUSS-6BE7E7	1350-1530	0768	IOW-5A88F2	1350-1530
0769	IOW-F7A962	1350-1530	0770	SF-F1F1B3	1350-1530
0771	LVPL-B1D2E1	1350-1530	0772	GLO-4B3044	1350-1540
0773	GLO-348793	1350-1540	0774	WAW-7CCF71	1350-1530
0775	HESH-796C64	1350-1530	0776	LEIC-669D46	1100-1500
0777	LEIC-6686D7	1100-1500	0778	LEIC-667383	1400-1500
0779	LEIC-663202	1300-1500	0780	BUC-6210E2	1066-1500
0781	SOM-51B658	1150-1350	0782	DENO-BDE6C5	1200-1500
0783	IOW-818B97	1150-1350	0784	LEIC-E95527	1100-1500
0785	SF-BDC136	1400-1500	0786	IOW-1B89A0	1200-1300
0787	SOM-179013	1150-1350	0788	NMS-8231E7	1300-1550
0789	LEIC-7FA112	1100-1500	0790	SWYOR-2FDE48	1350-1530
0791	LEIC-1ADD95	1100-1500	0792	SF-EF2151	1300-1500
0793	NARC-D8B540	1350-1500	0794	ESS-994BF6	1300-1500
0795	YORYM-DC8274	1350-1550	0796	YORYM-DC6E02	1350-1550

0797	LVPL-5EBF44	1200-1550	0798	BH-953095	1350-1530
0799	NARC-7FD996	1000-1250	0800	LIN-D470F2	1400-1500
0801	CAM-C03B92	1066-1500	0802	HESH-42B233	1250-1450
0803	YORYM-18C752	1300-1600	0804	SF-968760	1300-1500
0805	NLM-15B4E0	1300-1500	0806	HAMP-0803C4	1350-1530
0807	BH-5C1973	1350-1530	0808	GLO-1D7138	1350-1540
0809	LVPL-1B3F01	1350-1500	0810	LEIC-DCB077	1200-1500
0811	LIN-C4D635	1400-1500	0812	LIN-875DF3	1400-1500
0813	LIN-72E794	1400-1500	0814	SF-5CC8C2	1300-1500
0815	LIN-485B98	1400-1500	0816	DUR-2FA6F0	1350-1500
0817	NARC-B8E350	1170-1400	0818	LVPL-250EB7	1350-1400
0819	SF-F963F1	1300-1500	0820	HAMP-7DF3C6	1350-1530
0821	SWYOR-6AC122	1150-1400	0822	LIN-D66CD6	1350-1500
0823	LIN-D65E97	1350-1500	0824	LIN-AC8E24	1400-1500
0825	SF-19BCC4	1400-1500	0826	DUR-F1C193	1300-1600
0827	SF-D91AE5	1300-1500	0828	IOW-89B920	1350-1500
0829	NCL-F28173	Unkown	0830	DENO-CD2B63	1200-1500
0831	SUR-FDFCC4	1200-1500	0832	SUR-FDEB32	1200-1500
0833	DENO-FCA184	1066-1500	0834	HESH-8D8AA8	1250-1500
0835	NMS-26A376	Unkown	0836	NMS-241B03	1350-1530
0837	NMS-CD2CD0	1300-1525	0838	WMID-C16F92	1300-1500
0839	NMS-FBF374	1475-1525	0840	WMID-85A954	1350-1530
0841	WILT-580DB1	1300-1500	0842	NMS-3E7C91	1300-1525
0843	SWYOR-4439E2	1350-1550	0844	NMS-19F692	1300-1525
0845	LANCUM-9C6A35	1400-1500	0846	IOW-830261	1175-1400
0847	WMID-F39C45	1300-1500	0848	BH-D9D2B8	1350-1530
0849	NARC-8ED7D4	1450-	0850	CORN-2DE864	1200-1500
0851	SUSS-E63AF6	1350-1530	0852	DENO-E413A6	1250-1300
0853	SWYOR-680942	1150-1350	0854	HAMP-FFE386	1350-1530
0855	BERK-FB5D54	1200-1350	0856	SUR-A997C1	1300-1500
0857	LON-818856	Unkown	0858	WILT-1829F3	1275-1500
0859	LIN-988950	1400-1500	0860	SWYOR-02E4D5	1300-1500
0861	DENO-88F045	1250-1350	0862	LIN-874DF7	1300-1400
0863	YORYM-4A6D97	1350-1530	0864	NMS-47B818	1066-1500
0865	SOM-36CAC6	1150-1350	0866	LON-321022	Unkown
0867	SUR-A25584	1300-1500	0868	LIN-630B41	1400-1500
0869	LEIC-25B878	1100-1500	0870	LEIC-250230	1200-1500
0871	HAMP-FF5225	1350-1530	0872	YORYM-69D688	1350-1550
0873	YORYM-6699D3	1350-1530	0874	SWYOR-532266	1450-1530
0875	CAM-414868	1066-1500	0876	NMS-413FA4	1300-1550
0877	NMS-D642D2	1300-1550	0878	NMS-D3A1F3	1300-1550
0879	NLM-BE97D6	1250-1500	0880	SF-AAAA35	1400-1500
0881	NCL-AB3421	1100-1300	0882	LVPL-80F3D5	1100-1500
0883	IOW-051DD0	175-1400	0884	LANCUM-F1F5E7	1450-1540
0885	BERK-9E82A2	1200-1299	0886	SWYOR-DF18A2	1200-1500
0887	LIN-DBA585	1400-1500	0888	SWYOR-DB89E2	1200-1400
0889	NMS-A7S3	1450-1540	0890	NMS-33B072	1066-1500
0891	BERK-0CDC91	1200-1400	0892	DENO-F564D5	1300-1400
0893	LIN-A087D5	1350-1450	0894	GLO-4D0CD2	1350-1550
0895	HAMP-0DB910	1450-1540	0896	NMS-A21E76	1066-1500
0897	SOM-BA8888	1300-1499	0898	SOM-5255B7	1300-1499
0899	BUC-D75066	1066-1500	0900	HESH-BF9F55	1250-1450
0901	SUR-6ADFF5	1250-1450	0902	LVPL-E965E4	1200-1500
0903	SUSS-2B7DE2	1350-1550	0904	DENO-803667	1200-1299
0905	WILT-707726	1200-1300	0906	NLM-6EEC14	1200-1500
0907	NCL-44B0B5	Unkown	0908	WILT-F4C514	1170-1340
0909	WMID-B51B26	1350-1530	0910	LEIC-347FA1	1100-1500

0911	DENO-E25637	1250-1299	0912	NMS-A60121	1350-1600
0913	DENO-38D8B5	1250-1399	0914	YORYM-D1BD55	1350-1550
0915	SOM-943561	1300-1499	0916	LIN-7B68A7	1400-1500
0917	NMS-56ED55	1350-1530	0918	NMS-54DC34	1350-1530
0919	LVPL-528642	1300-1500	0920	LANCUM-EA9476	1350-1550
0921	LIN-C1EB16	1400-1500	0922	SWYOR-BF8201	1066-1500
0923	SWYOR-3F5237	1300-1600	0924	SWYOR-2F2C06	1300-1600
0925	LEIC-9820D4	1300-1500	0926	NMS-973D14	1066-1500
0927	SF-85BFB2	1350-1500	0928	BH-849293	1350-1530
0929	SWYOR-469121	1350-1500	0930	SWYOR-460952	1350-1500
0931	NMS-6E9026	1066-1500	0932	IOW-5CA156	1300-1500
0933	NMS-0406B7	1066-1500	0934	NMS-F6E2C7	1066-1500
0935	SUSS-DBB385	1175-1500	0936	SWYOR-DB4F87	1200-1400
0937	NCL-709434	1350-1500	0938	NMS-BAB702	1066-1500
0939	SOM-B73081	1300-1499	0940	SOM-B4C778	1450-1540
0941	LIN-389137	1400-1500	0942	WILT-134200	1350-1530
0943	NMGW-7F8E71	Unkown	0944	NLM-6BA294	1250-1500
0945	ESS-510418	1350-1500	0946	NMGW-505793	Unkown
0947	NMGW-504A65	Unkown	0948	NMGW-502AC2	Unkown
0949	NMGW-501A41	Unkown	0950	NMGW-500597	Unkown
0951	NMGW-4FEEE8	Unkown	0952	NMGW-4FD945	Unkown
0953	NMGW-4F99B2	Unkown	0954	NMGW-EBF6D5	Unkown
0955	NMGW-EBD632	Unkown	0956	NMGW-EBC790	Unkown
0957	NMGW-EBBC07	Unkown	0958	NMGW-EB98A3	Unkown
0959	NMGW-EB74A8	Unkown	0960	NMGW-EB6520	Unkown
0961	NMGW-EB5970	Unkown	0962	NMGW-EB4870	Unkown
0963	NMGW-EB2DC0	Unkown	0964	NMGW-EB21B4	Unkown
0965	NMGW-EB0F26	Unkown	0966	NMGW-EB0160	Unkown
0967	NMGW-EAE858	Unkown	0968	NMGW-EAB468	Unkown
0969	NMGW-E8F602	Unkown	0970	NMGW-E8EC17	Unkown
0971	NMGW-E8DEF1	Unkown	0972	NMGW-E8BA22	Unkown
0973	NMGW-E88641	Unkown	0974	NMGW-E7FCF7	Unkown
0975	NMGW-E7F224	Unkown	0976	NMGW-E7E452	Unkown
0977	NMGW-E7DB28	Unkown	0978	NMGW-E7B7F0	Unkown
0979	NARC-6A86B1	1300-1500	0980	PAS-5874A2	Unkown
0981	PAS-41BCB2	1200-1399	0982	SOM-C5A5F2	1300-1499
0983	SUSS-44A8A5	1350-1530	0984	NLM-1B3553	1250-1500
0985	HESH-C7DA55	1250-1500	0986	NMS-8533D0	1350-1530
0987	SWYOR-353D98	1150-1500	0988	NMS-2E4FC8	1066-1500
0989	HAMP-204F64	1350-1499	0990	LANCUM-0C8136	1300-1500
0991	NMS-F49461	1300-1550	0992	KENT-F08AB7	1100-1500
0993	NMGW-8622C1	Unkown	0994	SWYOR-0A1FF2	1150-1500
0995	SWYOR-0A0AE1	1100-1500	0996	SWYOR-09F6F1	1100-1500
0997	NMS-F1E207	1300-1550	0998	SF-36FED7	1400-1500
0999	YORYM-D0C6C5	1200-1500	1000	NMGW-B95955	Unkown
1001	NMGW-B92C74	Unkown	1002	BH-953435	1350-1550
1003	HAMP-7DDA88	1350-1499	1004	LVPL-7BE541	1350-1530
1005	LANCUM-57DB84	1350-15	1006	KENT-41DFB8	1200-1500
1007	NMGW-EAE6E6	Unkown	1008	YORYM-D48CC3	1300-1500
1009	BUC-C37C17	1350-1530	1010	BUC-C35EF3	1066-1500
1011	LEIC-82B296	1100-1400	1012	NMS-17A718	1300-1550
1013	BUC-EF1341	1066-1500	1014	SF-7211D2	1400-1500
1015	BH-1ED846	1350-1530	1016	LIN-CAE521	1300-1499
1017	LIN-CAB541	1300-1499	1018	LIN-CAAA55	1300-1499
1019	LIN-CA9E27	1300-1499	1020	NMS-5F3214	1066-1500
1021	NMS-49FEB2	1350-1550	1022	HESH-25CE42	1250-1400
1023	BERK-20BA75	1200-1500	1024	LIN-797325	1400-1500

1025	LIN-121A27	1300-1499	1026	SUSS-052844	1350-1550
1027	LIN-FA69F2	1250-1499	1028	IOW-ED2A21	1300-1500
1029	DENO-951331	1350-1500	1030	NARC-7F82E8	1275-1500
1031	LON-7B8E64	1270-1350	1032	SUSS-075DA2	1350-1550
1033	NMS-FE94D7	1066-1500	1034	BH-829115	1350-1530
1035	SUSS-564EE2	1350-1530	1036	NMS-42DA51	1350-1550
1037	NMS-424D24	1350-1530	1038	SUSS-AC9A84	1350-1530
1039	WAW-C23733	1175-1500	1040	YORYM-88D4F4	1350-1530
1041	DOR-8820B3	1400-1500	1042	YORYM-865F93	1350-1530
1043	NMS-714541	1066-1500	1044	NMS-70B775	1066-1500
1045	BUC-706D62	1066-1500	1046	NMS-1DF066	1066-1500
1047	NMS-1BA4A2	1350-1550	1048	NMS-1B93D2	1350-1530
1049	NMGW-5C2C35	1300-1500	1050	NMGW-5BF8D6	1300-1500
1051	NMS-4D9E61	1350-1530	1052	HESH-F929B7	1200-1450
1053	BERK-E3B315	1200-1500	1054	SF-B42A96	1400-1500
1055	SWYOR-4836F1	1150-1500	1056	LVPL-3A9295	1300-1500
1057	YORYM-E529B3	1350-1550	1058	BUC-CD3B10	1200-1500
1059	NMS-23FA41	1066-1500	1060	NMS-A593F1	1350-1550
1061	SUSS-7EEC28	1350-1530	1062	NMGW-FAEA63	1350-1530
1063	KENT-D90045	1175-1450	1064	HESH-D69A22	1250-1450
1065	SWYOR-6F2D07	1150-1500	1066	SF-412552	1400-1500
1067	ESS-1A7335	1350-1500	1068	ESS-1A2477	1350-1500
1069	NLM-AFEF86	1200-1540	1070	WAW-5CAB06	1175-1500
1071	WILT-085303	1350-1500	1072	GLO-63E7A2	1400-1540
1073	NCL-3356D3	1066-1500	1074	SUSS-247D18	1350-1550
1075	WAW-132F83	1175-1500	1076	DENO-CE7858	1350-1530
1077	NMS-B89266	1066-1500	1078	NLM-3C3FE7	1200-1450
1079	KENT-26B407	1200-1300	1080	SUR-7E33E2	1300-1500
1081	SF-037FC4	1400-1500	1082	HAMP-02DCB3	1350-1500
1083	NARC-C3CC70	1171-1400	1084	BH-C2DB17	1400-1500
1085	NARC-575934	1171-1500	1086	SUSS-3351E4	1350-1530
1087	NLM-840B25	1200-1540	1088	BUC-B4A1B6	1300-1500
1089	HESH-8D3721	1250-1500	1090	SUSS-8CE0A3	1350-1530
1091	LEIC-77ACB7	1100-1500	1092	HAMP-4DAE37	1480-1530
1093	BH-4D0473	1400-1500	1094	HAMP-4CDD17	1300-1500
1095	WAW-F7FC51	1175-1500	1096	SUR-F621B6	1300-1500
1097	DENO-B7C4E2	1300-1500	1098	WAW-73D796	1175-1500
1099	NCL-BDD6D3	Unkown	1100	KENT-162845	Unkown
1101	KENT-161F31	Unkown	1102	KENT-D6C005	1150-1500
1103	SOMDOR-D374E7	1300-1499	1104	KENT-854587	1150-1550
1105	LEIC-6A7997	1100-1500	1106	NMS-C2BBE8	1350-1550
1107	LEIC-ADC741	1100-1500	1108	DENO-708330	1200-1500
1109	SF-1E2EB1	1400-1500	1110	SOMDOR-C337D7	1300-1499
1111	YORYM-876173	Unkown	1112	DENO-4A4151	1200-1500
1113	NMS-F08A15	1066-1500	1114	HAMP-226553	1400-1500
1115	SUSS-F97323	1350-1530	1116	SF-F6C2A6	1400-1500
1117	LIN-E35C14	1300-1500	1118	BUC-A30706	1350-1530
1119	BUC-A2F655	1350-1550	1120	NMS-4CAD44	1066-1500
1121	NMS-E2B412	1350-1550	1122	SUR-CD05C1	1400-1530
1123	NMS-B62466	1350-1550	1124	ESS-A055C2	1350-1530
1125	LVPL-50FD62	1350-1530	1126	LEIC-3B92E2	1100-1500
1127	WAW-0F3BE1	1175-1500	1128	NMS-0DADC5	1066-1500
1129	BUC-B97945	1200-1500	1130	NMGW-A7C035	1350-1530
1131	SUSS-2AF2F2	1300-1550	1132	LIN-26E9B6	1300-1500
1133	LIN-26C422	1300-1500	1134	LIN-26B262	1300-1500
1135	LIN-2697E3	1300-1500	1136	LIN-2646A3	1300-1500
1137	LIN-25E422	1300-1500	1138	BUC-25F5F4	1250-1550

1139	LIN-259674	1300-1500	1140	LIN-14D021	1300-1500
1141	LIN-0FF5A7	1300-1500	1142	LIN-EAA7B3	1400-1500
1143	LIN-927093	1400-1500	1144	ESS-149EA1	1175-1499
1145	SF-ED2A50	1300-1400	1146	ESS-EB7913	1150-1499
1147	IOW-EADFC5	1200-1500	1148	SUSS-5A4997	1350-1550
1149	SWYOR-4543B1	1200-1500	1150	NCL-44A762	1300-1500
1151	KENT-CAEA33	1170-1220	1152	HESH-760485	1250-1500
1153	CAM-0B40F4	1300-1500	1154	IOW-083774	1200-1500
1155	NMS-5EBBB3	1066-1500	1156	WMID-0C7F72	1175-1500
1157	WMID-0C0184	1175-1500	1158	LANCUM-BDAD67	1300-1600
1159	LANCUM-AAF868	1400-1800	1160	GLO-AAEE37	1300-1500
1161	NMGW-A947E6	1350-1530	1162	NMGW-A91BE8	1350-1530
1163	NMGW-A7E456	1350-1530	1164	SUSS-9530E3	Unkown
1165	WMID-68B203	1175-1500	1166	WMID-16E7D5	1175-1500
1167	WMID-167180	1175-1500	1168	NMS-017846	1300-1550
1169	CAM-D86507	1300-1500	1170	NLM-70BFC3	1200-1540
1171	HESH-7053B0	1250-1500	1172	NMS-424521	1066-1500
1173	LIN-B42603	1400-1500	1174	SF-9D8E97	1400-1500
1175	SF-9D1C15	1400-1500	1176	NLM-9AE7A2	1200-1540
1177	NLM-9AC596	1200-1540	1178	NMS-B45943	1066-1500
1179	SF-9DE998	1300-1500	1180	SOMDOR-215424	1350-1530
1181	SF-CE4447	1400-1540	1182	LANCUM-521C00	1066-1400
1183	DENO-3D8D13	1350-1530	1184	NLM-2692F5	1200-1400
1185	LIN-102E85	1400-1500	1186	NMS-D0E9F8	1066-1500
1187	SWYOR-BFA7D4	1100-1350	1188	NMS-B9CA23	1300-1550
1189	NMS-A70646	1300-1550	1190	DENO-7DD1D4	1350-1530
1191	LIN-842861	1400-1500	1192	YORYM-8113B0	Unkown
1193	YORYM-7F2EF4	Unkown	1194	BH-6F0026	1350-1500
1195	LEIC-6EF922	Unkown	1196	LEIC-6EF117	Unkown
1197	YORYM-6D6705	1200-1540	1198	SOMDOR-6B0737	1100-1500
1199	WILT-1A5270	1350-1530	1200	NMS-EC4A36	1066-1500
1201	NLM-EA6F47	1300-1540	1202	NLM-EA65C3	1300-1540
1203	NLM-EA5EB7	1300-1540	1204	NLM-EA55A7	1300-1540
1205	IOW-DB65D5	1200-1400	1206	BH-859466	1350-1530
1207	BH-851BC4	1350-1530	1208	NMS-82B748	1350-1550
1209	LANCUM-9E0FD6	1100-1550	1210	NLM-9A75C3	1400-1540
1211	WAW-0982B5	1175-1500	1212	SWYOR-C751B2	1150-1350
1213	SWYOR-C62BF5	1150-1350	1214	NMS-C5C671	1066-1500
1215	LEIC-B23308	1100-1500	1216	NMS-884AA1	1066-1500
1217	LON-0ED648	1300-1500	1218	NMGW-087897	1300-1600
1219	LEIC-F6F746	1100-1500	1220	NMS-760297	1066-1500
1221	NMS-5F6D71	1066-1500	1222	NLM-BC2B68	1350-1540
1223	SF-BA8FA4	1400-1500	1224	NMS-794F65	1350-1550
1225	DENO-7FC562	Unkown	1226	NMS-69B5D8	1066-1500
1227	IOW-FED7F1	1200-1500	1228	LON-D4FEB4	1200-1500
1229	LIN-8127D7	1400-1499	1230	WMID-B19EE3	1175-1500
1231	NLM-6E07C5	1066-1540	1232	NLM-6D4691	1066-1540
1233	NLM-5E87F1	1066-1540	1234	NMGW-1C3607	1350-1550
1235	LIN-C69181	1400-1499	1236	NARC-9CC447	1350-1499
1237	IOW-9C2C21	1300-1500	1238	SF-A3CA33	1400-1500
1239	SF-A37D38	1400-1500	1240	WAW-910944	1175-1500
1241	LIN-647020	1200-1300	1242	NMS-CD63E3	1350-1539
1243	NMS-62E398	1066-1500	1244	IOW-53BC04	1300-1500
1245	NMS-4FE372	1350-1550	1246	CORN-DA8D03	1350-1530
1247	HAMP-A65581	1400-1500	1248	SUSS-0227B7	1350-1530
1249	HAMP-019246	1350-1500	1250	GLO-578611	1350-1540
1251	SF-568725	1400-1500	1252	LEIC-04B494	1066-1500

1253	LEIC-039F83	1200-1500	1254	LEIC-029A74	1066-1500
1255	WAW-C31F73	1175-1500	1256	NMS-830C66	1350-1550
1257	IOW-5950C0	1300-1500	1258	SWYOR-D9FF55	1200-1350
1259	LANCUM-31BC94	1300-1500	1260	LEIC-090157	1400-1550
1261	SOMDOR-8A04D6	1066-1499	1262	LEIC-73F788	1100-1500
1263	GLO-1DF542	1300-1540	1264	LEIC-090986	1100-1500
1265	SUSS-0C2E33	1350-1530	1266	LEIC-7D16C2	1100-1500
1267	LANCUM-681B77	1300-1500	1268	NLM-527DC5	1200-1540
1269	HAMP-39D6F5	1300-1500	1270	KENT-E6D444	Unkown
1271	KENT-E14241	Unkown	1272	SOMDOR-A3E787	1350-1500
1273	SOMDOR-8FAC65	1200-1350	1274	SUSS-BD7967	1350-1530
1275	HAMP-7F7073	1400-1500	1276	LON-2C9155	1175-1300
1277	SUSS-F02248	1350-1530	1278	LANCUM-EDD285	1200-1600
1279	LANCUM-ED91E5	1170-1500	1280	LANCUM-EB5EE4	1150-1600
1281	LANCUM-D99605	1150-1500	1282	NLM-D761B8	1400-1500
1283	IOW-876852	1300-1500	1284	LEIC-701CF3	1100-1500
1285	NMS-6ACA02	1066-1500	1286	LIN-5B2AD1	1200-1300
1287	LIN-5B05B7	1200-1300	1288	WILT-0213D2	1350-1530
1289	LEIC-0151D6	1300-1500	1290	LEIC-5A9435	1300-1500
1291	NMS-58D6A4	1066-1500	1292	DEV-F4E6A2	1175-1350
1293	NLM-B0DD13	1200-1540	1294	SUSS-870E82	1350-1530
1295	WILT-37CF54	1350-1530	1296	NARC-206E62	1275-1530
1297	WILT-B70554	1350-1530	1298	KENT-8FA683	Unkown
1299	LEIC-8DC851	1100-1500	1300	LANCUM-77A960	1175-1500
1301	KENT-A31326	Unkown	1302	SF-8D2343	1400-1500
1303	NARC-776605	1350-1499	1304	LON-BACC15	1400-1500
1305	DEV-C0ACB2	1150-1500	1306	YORYM-A90475	1200-1520
1307	YORYM-979D26	1300-1530	1308	IOW-9245D4	1300-1500
1309	YORYM-440A02	1100-1540	1310	DENO-184BC5	1350-1530
1311	LANCUM-17C691	1400-1500	1312	LEIC-881864	1480-1540
1313	LEIC-879027	1200-1400	1314	LEIC-5DA791	Unkown
1315	LANCUM-EFF135	1200-1600	1316	NMGW-C593F0	1300-1500
1317	BUC-485AB6	1350-1530	1318	NLM-211456	1200-1540
1319	KENT-F6E473	1200-1500	1320	NLM-B257F7	1200-1500
1321	LEIC-A31A63	Unkown	1322	DENO-8D03C4	1350-1530
1323	NMGW-2584C7	Unkown	1324	DEV-BB8A24	1175-1500
1325	HESH-8CE9E4	1250-1500	1326	DENO-0D9E28	1350-1530
1327	NMS-8FE191	1066-1500	1328	NLM-3B8AC5	1200-1540
1329	LIN-D6D1D8	1180-1299	1330	SUSS-ACCD76	1100-1300
1331	HAMP-3E52F3	1401-1500	1332	SF-96B344	1400-1500
1333	IOW-860857	1300-1500	1334	SUSS-181F85	1200-1500
1335	LVPL-59F655	Unkown	1336	LVPL-59F0D3	1200-1450
1337	DENO-A320D5	1350-1530	1338	DENO-A2F3C3	1350-1530
1339	SUSS-A1E4F6	1250-1500	1340	DENO-9F2156	1350-1500
1341	YORYM-3997C2	1200-1500	1342	SUSS-34E414	1300-1550
1343	IOW-E56B30	Unkown	1344	LIN-0E5D75	1250-1400
1345	LIN-0C9642	1150-1300	1346	NLM-CE0AB2	1200-1540
1347	NLM-CDE912	1200-1540	1348	IOW-A6C036	1200-1500
1349	IOW-3EA251	1200-1500	1350	DEV-D33CE3	Unkown
1351	KENT-C44455	Unkown	1352	SOMDOR-BFFA03	1400-1500
1353	SOMDOR-AF8766	1200-1499	1354	WMID-AEA8C1	1350-1530
1355	GLO-85CC25	1350-1530	1356	IOW-323522	1200-1400
1357	IOW-731D41	1200-1500	1358	SF-71BB96	1400-1500
1359	NLM-6D9955	1200-1540	1360	NLM-5DC8F7	1200-1540
1361	KENT-E011E4	1300-1500	1362	SF-5F26F2	1400-1500
1363	LEIC-1F2E46	Unkown	1364	SF-CA06D5	1400-1540
1365	SUSS-0FBAA5	1350-1530	1366	NLM-0C8FC3	1200-1540

1367	SF-7B7E74	1400-1500	1368	SF-7B3C20	1400-1500
1369	KENT-7B36E1	1400-1500	1370	SF-7AECF5	1400-1500
1371	LIN-5064D2	1300-1499	1372	LVPL-3D9A07	1200-1400
1373	HAMP-2AD9A6	1400-1500	1374	LANCUM-853952	1175-1500
1375	LANCUM-81BAD7	1200-1300	1376	SUR-703A18	1400-1550
1377	HESH-6B3BC5	1250-1500	1378	IOW-C564D5	Unkown
1379	NCL-85E868	Unkown	1380	SUSS-D9A312	1350-1530
1381	WAW-344706	1200-1500	1382	ESS-1F1385	1100-1500
1383	ESS-1EF171	1100-1500	1384	SWYOR-B5D122	1350-1530
1385	SOMDOR-B96640	1066-1500	1386	LEIC-11CD33	Unkown
1387	LEIC-11B636	Unkown	1388	IOW-FDD290	Unkown
1389	SOMDOR-EA22C5	Unkown	1390	LIN-51B5E5	1400-1500
1391	WMID-2A22A6	1300-1500	1392	NMS-9B5202	1066-1500
1393	IOW-867B27	Unkown	1394	SUR-6F43A2	1400-1599
1395	BH-88AF85	1175-1550	1396	FASW-7949D2	1400-1499
1397	NARC-A27DF4	1100-1500	1398	WAW-2218F8	1200-1540
1399	LANCUM-22E1F1	1400-1500	1400	NMGW-A82461	1200-1499
1401	LIN-C0F195	1400-1500	1402	IOW-92D996	Unkown
1403	LIN-425905	1400-1500	1404	BUC-833027	1300-1500
1405	ESS-4B7351	Unkown	1406	NMGW-E44284	1200-1499
1407	LEIC-B8AEA1	Unkown	1408	LIN-261961	1360-1380
1409	LIN-213D70	1200-1325	1410	LIN-20F3E3	1200-1325
1411	NMGW-FE9A76	1200-1499	1412	LIN-658011	1200-1499
1413	SF-EB70C0	1400-1500	1414	WMID-2FA7C4	1100-1400
1415	NMGW-731841	1200-1499	1416	NMGW-5A97B1	1200-1499
1417	NLM-F3CCB2	1500-1599	1418	LVPL-605FF3	1350-1530
1419	SF-F6CA77	1400-1500	1420	SF-BB1402	1400-1500
1421	NMGW-D20231	Unknown	1422	KENT-EE6373	1066-1540
1423	KENT-DBF602	1100-1540	1424	SF-D83E11	1400-1500
1425	LIN-5D8364	1200-1299	1426	LIN-CAB5F3	1200-1300
1427	LVPL-48AAE2	1400-1500	1428	NLM-CB1157	1300-1550
1429	NMS-10BD37	1300-1400	1430	HAMP3896	1066-1540
1431	SF-B98D86	1400-1500	1432	SF-2753B3	1400-1500
1433	HAMP3733	1300-1400	1434	NLM7234	1300-1500
1435	NMS652	1066-1540	1436	NMS482	1066-1540
1437	NMS483	1066-1540	1438	NMS1018	1066-1540
1439	NMS1037	1066-1540	1440	NMS919	1350-1530
1441	NMS1267	1066-1540	1442	NMS1868	1066-1540
1443	NMS2269	1066-1700	1444	NMS2394	1066-1540
1445	NMS2610	1066-1540	1446	NMS585	1066-1540
1447	NMS844	1301-1500	1448	NMS1852	1401-1540
1449	NMS777	1066-1540	1450	KENT5308	1175-1540
1451	NLM7134	1350-1540	1452	NLM7114	1400-1600
1453	NLM7087	1350-1540	1454	LVPL2427	1250-1400
1455	HAMP3088	1350-1530	1456	SF10438	1350-1530
1457	NLM6977	1300-1500	1458	NLM6958	1350-1500
1459	NLM6930	1300-1500	1460	NLM6931	1350-1600
1461	SF9852	1350-1530	1462	NLM6780	1300-1600
1463	NLM6683	1400-1600	1464	SF9448	1300-1530
1465	SF9404	1300-1530	1466	WMID5303	1300-1400
1467	SF9251	1300-1400	1468	KENT4666	1066-1540
1469	KENT4490	1300-1500	1470	HAMP1986	1200-1300
1471	NARC3074	1400-1540	1472	LVPL2179	1200-1400
1473	LVPL2112	1250-1400	1474	HAMP1810	1300-1500
1475	HAMP1711	1300-1500	1476	HAMP1712	1300-1500
1477	SOMDOR1484	1100-1400	1478	WMID4341	1066-1540
1479	LVPL1993	1250-1450	1480	WMID4108	1066-1540

1481	WMID4085	1066-1540	1482	NARC2717	1250-1540
1483	WMID4023	1175-1500	1484	WMID3981	1200-1400
1485	NMGW3355	1066-1540	1486	HAMP1537	1200-1400
1487	NLM6101	1300-1540	1488	NLM6032	1300-1500
1489	NLM5659	1300-1540	1490	NLM5537	1300-1540
1491	NMGW3320	1066-1540	1492	WMID3805	1066-1540
1493	KENT3744	1300-1400	1494	SF6618	1300-1400
1495	SF6132	1300-1400	1496	LVPL1782	1300-1500
1497	WMID3291	1066-1540	1498	SF5024	1180-1320
1499	KENT2782	1200-1540	1500	HAMP770	1300-1400
1501	LVPL1642	1300-1500	1502	SF4196	1066-1540
1503	KENT2233	1300-1499	1504	NLM4689	1200-1540
1505	NLM4690	1200-1540	1506	NLM4691	1200-1540
1507	NLM4692	1200-1540	1508	NLM4693	1200-1540
1509	NLM4698	1200-1540	1510	SOMDOR663	1066-1540
1511	NLM4579	1300-1540	1512	NLM4585	1200-1540
1513	NARC757	1066-1540	1514	NLM4391	1200-1400
1515	LVPL1506	1200-1400	1516	SF2449	1300-1400
1517	RAH1546	1300-1400	1518	RAH1547	1300-1400
1519	RAH1158	1200-1400	1520	YORYM1265	1400-1650
1521	SF1294	1400-1540	1522	YORYM1181	1250-1400
1523	YORYM1171	1250-1540	1524	YORYM1080	1200-1500
1525	YORYM1081	1200-1500	1526	YORYM984	1300-1540
1527	WMID1320	1175-1350	1528	YORYM800	1066-1540
1529	YORYM801	1066-1540	1530	YORYM802	1066-1540
1531	YORYM803	1066-1540	1532	YORYM806	1066-1540
1533	SF235	1300-1400	1534	YORYM2178	1200-1540
1535	YORYM2181	1200-1650	1536	YORYM2188	1200-1540
1537	YORYMB178	1200-1540	1538	YORYMB188	1200-1540
1539	YORYMB181	1200-1650	1540	NARC101	1066-1540
1541	KENT1836	1066-1540	1542	LVPL868	1250-1450
1543	WMID850	1066-1540	1544	LVPL817	1200-1540
1545	YORYMM560	1200-1500	1546	YORYMM406	1200-1550
1547	YORYMM382	1200-1550	1548	YORYMM385	1200-1550
1549	YORYM564	1250-1485	1550	WMID539	1175-1500
1551	KENT1359	1350-1530	1552	YORYMM252	1250-1485
1553	YORYM411	1250-1485	1554	LVPL489	1200-1500
1555	WMID270	1066-1485	1556	WMID208	1066-1485
1557	NLM641	1066-1485	1558	NLM660	1200-1485
1559	NLM475	1200-1485	1560	YORYMM59	1150-1500
1561	YORYMM60	1150-1485	1562	YORYMM61	1150-1485
1563	KENT289	1200-1550	1564	LVPL176	1200-1485
1565	LVPL75	1200-1400	1566	NLM204	1400-1530
1567	NLM175	1400-1530	1568	LVPL10	1200-1450

Table H.6: *Ampullae* from the PAS database as of 12/12/2016. This data is discussed and analysed in Chapter 5.4. Compiled by the author.

H.7 Papal *bullae*

Number	Object ID	Date	Amuletic Reuse
001	NARC-57F786	1362-1370	No
002	NMS-9B736A	1180-1300	No
003	YORYM-A73B69	1303-1304	No
004	LEIC-ACD7C2	1046-1352	No

005	YORYM-49D002	1288-1292	No
006	BUC-CB15D4	1227-1241	Yes
007	KENT-3A0DA1	1472-1482	No
008	BERK-FC3E14	1288-1292	No
009	HAMP-83D839	1243-1254	No
010	PUBLIC-BA7B82	1294-1303	No
011	LANCUM-B30A86	1378-1389	No
012	SF-F32D94	1100-1534	No
013	BERK-64F246	1243-1254	No
014	HAMP-00D11E	1370-1378	No
015	HAMP-F0628C	1362-1370	No
016	BH-8220F5	1294-1303	No
017	NLM-6FB3BD	1294-1303	No
018	BERK-D968D9	1200-1550	No
019	LEIC-B09ED4	1216-1227	No
020	WAW-DC5219	1277-1280	No
021	CORN-1E5C48	1471-1484	No
022	WMID-0BB42A	1159-1181	No
023	NLM-63B5CE	1276-1277	No
024	SUR-1557C3	1100-1200	No
025	LIN-E39DF1	1198-1216	Yes
026	SUR-91AB24	1410-1415	No
027	NMS-3C47A6	1216-1227	No
028	SF-9A84E7	1243-1254	No
029	PUBLIC-EE33DC	1305-1314	No
030	PUBLIC-EE11F1	1305-1314	No
031	WAW-F00198	1243-1254	No
032	WILT-CEA4DC	1159-1181	No
033	PUBLIC-3EA104	1046-1047	No
034	SUR-EAD927	1370-1378	No
035	SF-BFBFF5	1159-1181	No
036	PUBLIC-9A5DF5	1288-1292	No
037	KENT-686978	1046-1047	No
038	LEIC-6F5D71	1243-1254	No
039	WILT-5D31FF	1410-1415	No
040	LEIC-B1EFE3	1272-1276	Yes
041	SWYOR-0AABEF	1265-1268	No
042	SWYOR-0A26F9	1243-1254	No
043	LVPL-0CEABB	1342-1354	No
044	WILT-3C7505	1342-1354	No
045	WAW-EC960A	1243-1254	No
046	SWYOR-BDD5A2	1254-1261	No
047	BH-BD3C11	1227-1241	No
048	SWYOR-537317	1145-1447	No
049	LIN-10223D	1100-1159	No
050	HAMP-975133	1431-1447	Yes
051	PUBLIC-339DE2	1191-1198	No
052	NLM-CA0903	1342-1352	No
053	NMS-89F310	1198-1216	No
054	PUBLIC-1856A6	1523-1534	No
055	NMS-89515B	1185-1264	No
056	NMS-0D05B2	1513-1521	No
057	LANCUM-ACE105	1370-1378	No
058	KENT-BB4E20	1066-1500	No
059	LANCUM-2EBECB	1300-1500	No
060	YORYM-1C246C	1243-1254	No
061	NMS-F7A49E	1294-1303	No

062	BH-B9E555	1334-1342	No
063	SF-93DCDA	1198-1216	No
064	SF-FFB45B	1265-1268	No
065	SF-FFA894	1389-1404	No
066	SOM-82B474	1227-1241	No
067	KENT-01AD9F	795-816	No
068	NCL-DB4158	1159-1181	No
069	NCL-D83EED	1243-1254	No
070	NMS-B74F61	1389-1404	No
071	BERK-4E38B4	1271-1276	No
072	LANCUM-6610BF	1243-1254	No
073	KENT-693426	1100-1500	No
074	SUR-6949C9	1271-1276	No
075	GLO-05B402	1362-1370	No
076	NARC-F5CAD2	1271-1276	No
077	WMID-F5604E	1154-1159	No
078	WMID-C8CC52	1389-1404	No
079	YORYM-8C2118	1243-1254	No
080	CAM-7B6937	1159-1181	No
081	NMS-1588D5	1523-1534	No
082	YORYM-7B3582	1243-1254	No
083	PUBLIC-F00586	1281-1285	No
084	NMS-BEE056	1305-1314	No
085	SWYOR-AAEC45	1288-1292	No
086	SUR-44B066	1198-1216	No
087	NMS-02B197	1100-1261	No
088	YORYM-9B9252	1046-1047	Yes
089	NLM-85A3C0	1458-1464	No
090	BERK-710865	1277-1280	No
091	PUBLIC-1ECC63	1254-1261	No
092	PUBLIC-DFEB31	1378-1389	No
093	SOM-DB4323	1389-1404	Yes
094	SWYOR-B1CE34	1254-1261	No
095	SF-4D4510	1404-1406	No
096	BH-4C32B5	1198-1216	No
097	SOM-B5A674	1378-1389	No
098	NMS-204778	1389-1404	No
099	ESS-0B1767	1227-1241	No
100	WILT-E7B815	1404-1492	No
101	HESH-95DD46	1181-1185	No
102	SF-EFD976	1271-1276	No
103	BH-256B91	1277-1280	No
104	NMS-157467	1334-1342	No
105	NMS-155876	1227-1241	Yes
106	NMS-1529B3	1294-1303	No
107	NMS-14E927	1265-1268	No
108	SOM-FBA501	1464-1471	No
109	SF-54CDC6	1417-1431	No
110	NMS-539655	1265-1268	No
111	WILT-E7B381	1271-1276	No
112	NMS-54B104	1243-1254	No
113	SF-2CA476	1305-1314	No
114	SF-2C92A0	1305-1314	No
115	SOM-708304	1305-1314	No
116	WMID-562956	1305-1314	No
117	SUR-314586	1316-1334	No
118	WMID-82FF84	1294-1303	Yes

119	NMS-5E37A6	1175-1300	No
120	NCL-C60397	1198-1216	No
121	YORYM-1FC501	1265-1268	No
122	PUBLIC-CE1262	1389-1404	No
123	PUBLIC-BC0C74	1410-1415	No
124	WMID-5190D4	1277-1280	Yes
125	PUBLIC-C43967	1046-1676	No
126	BERK-AD72D4	1271-1276	No
127	HESH-4D57D4	1227-1241	No
128	BERK-784A24	1276-1492	Yes
129	PUBLIC-276AA1	1243-1254	No
130	PUBLIC-262D42	1352-1362	No
131	NMS-8C87F4	1040-1060	No
132	NARC-2D1842	1227-1241	No
133	LVPL-7CD555	1500-1600	No
134	NLM-EC0491	1216-1227	No
135	DUR-D05CC3	1227-1241	No
136	SOM-1688B3	1342-1352	Yes
137	BH-0B8EF7	1409-1410	No
138	KENT-F5B8E5	1471-1484	No
139	PUBLIC-526613	1471-1484	No
140	WAW-058B25	1410-1415	No
141	BUC-E67EA1	1187-1191	No
142	LIN-DAEF68	1243-1254	No
143	SF-DA81A5	1216-1227	No
144	IOW-87E365	1513-1521	No
145	HAMP-609EF4	1277-1280	No
146	KENT-D96077	1200-1500	No
147	SF-83C313	1159-1181	No
148	SWYOR-37BC90	1417-1431	No
149	NLM-55FE43	1198-1216	No
150	LIN-71C973	1227-1241	No
151	CORN-F4D163	1378-1389	No
152	DEV-658312	1159-1181	No
153	BH-4F9CF0	1316-1334	No
154	YORYM-3CD643	1300-1500	No
155	IOW-5C6967	1281-1285	No
156	SUSS-170A48	1285-1287	No
157	BUC-B23213	1389-1404	No
158	SWYOR-236B81	1227-1415	No
159	BH-795CC7	1431-1447	No
160	SWYOR-3B1E63	1243-1254	No
161	BERK-41B0E1	1492-1503	No
162	PUBLIC-2ED853	1277-1280	No
163	IOW-9E7824	1227-1241	No
164	LEIC-32B180	1316-1334	No
165	SWYOR-CD4B25	1277-1280	No
166	PUBLIC-935275	1447-1455	No
167	SUSS-9DDA50	1000-1500	Yes
168	DUR-5EAB65	1243-1254	No
169	BUC-A6C083	1254-1261	No
170	SUSS-283B56	1254-1261	No
171	SUSS-282956	1389-1404	No
172	CAM-C06BF8	1277-1280	No
173	LEIC-3F5267	1294-1303	No
174	SWYOR-006FF5	1277-1280	No
175	SUSS-08FBE1	1227-1241	No

176	WAW-3F4254	1243-1254	No
177	BH-8F07F3	1503-1512	No
178	SF-524394	1191-1198	No
179	SUSS-A83228	1000-1600	No
180	SWYOR-826B52	1277-1280	No
181	DUR-A82CF6	1119-1124	No
182	FAKL-5A9C75	1275-1277	No
183	SWYOR-3CDF00	1200-1300	No
184	DEV-C1FF48	1000-1600	No
185	DOR-FEB525	1362-1370	No
186	LVPL-C24C20	1254-1261	No
187	YORYM-45D1C8	1492-1503	No
188	SUR-A1C1A2	1227-1241	No
189	YORYM-D28BA5	1261-1264	No
190	LVPL-7FFE42	1294-1303	No
191	WAW-ECB526	1227-1241	Yes
192	DENO-AD5225	1378-1389	No
193	LIN-5C5408	1294-1404	No
194	SUSS-913262	1342-1352	No
195	SWYOR-28DC83	1316-1334	No
196	NCL-47CBF6	1410-1415	No
197	WAW-C8D175	1389-1404	No
198	SUR-3DE655	1198-1254	No
199	ESS-416838	1271-1276	No
200	NARC-1572E4	1316-1334	No
201	SWYOR-C39B45	1073-1241	Yes
202	SF-99DA25	1409-1410	No
203	LON-86C1C7	1216-1227	No
204	SWYOR-33A1C7	1254-1261	No
205	SWYOR-30D3F1	1198-1254	No
206	WILT-9B90B5	1243-1254	No
207	BUC-95FC07	1046-1500	Yes
208	YORYM-006C94	1227-1241	No
209	BUC-EBB454	1342-1352	No
210	LEIC-961952	1378-1389	No
211	LIN-47F911	1275-1277	No
212	LON-F32191	1130-1492	No
213	NARC-61E663	1370-1378	No
214	NARC-BAC673	1261-1264	No
215	SF-514565	1243-1254	No
216	SWYOR-F52016	1410-1415	Yes
217	DUR-B72736	1198-1216	No
218	SUR-118FB1	1276-1334	Yes
219	NCL-24BDF8	1276-1277	No
220	YORYM-D32692	1216-1227	No
221	LEIC-410880	1316-1334	No
222	GLO-885645	1271-1276	No
223	WMID-BD9914	1288-1292	No
224	WMID-6715A3	1145-1153	No
225	CPAT-469C64	1389-1404	No
226	BUC-27EAA2	1216-1227	No
227	LEIC-FC52D4	1159-1181	Yes
228	BH-6AA373	1227-1241	No
229	SF-C432B2	1159-1181	No
230	DENO-896813	1378-1389	No
231	NMS-49F084	1216-1227	No
232	WMID-AC0922	1185-1187	No

233	SUSS-581148	1185-1389	No
234	SF-52F263	1227-1241	No
235	IOW-AFE665	1285-1287	No
236	WMID-201654	1227-1241	No
237	SF-75C3F8	1198-1216	No
238	DOR-8E4A35	1200-1400	No
239	NMS-687254	1342-1352	No
240	HESH-1517A7	1352-1362	Yes
241	KENT-D78154	1243-1254	No
242	NLM-2D1B54	1159-1181	Yes
243	SUSS-B7ECA6	1523-1534	No
244	CAM-2701C1	1100-1530	No
245	SUR-FAD9E2	1216-1227	No
246	NMS-796865	1198-1216	No
247	LANCUM-9BA377	1216-1227	No
248	NMS-EFEA04	1198-1216	No
249	LVPL-60C0E3	1243-1254	No
250	HAMP-A295D7	1342-1352	No
251	LIN-3869A8	1378-1389	No
252	KENT-361C31	1277-1280	No
253	HESH-1020D7	1342-1352	No
254	HESH-853C64	1370-1378	No
255	HAMP-199727	1227-1241	No
256	LIN-9E7F84	1431-1447	No
257	KENT-A87334	1159-1181	No
258	NMGW-A2E253	1417-1431	No
259	DENO-938AE1	1389-1404	No
260	NMGW-59D1A8	1254-1261	No
261	SWYOR-F13DF5	1281-1285	No
262	NMS-E18AA0	1275-1277	No
263	NMS-493185	1513-1521	No
264	YORYM-F7E248	1276-1277	No
265	SUSS-2F1195	1389-1404	No
266	ESS-F31985	1227-1241	Yes
267	WILT-150C66	1216-1227	No
268	DOR-FB2634	1243-1254	No
269	CORN-B357D6	1342-1352	No
270	KENT-AF0145	1277-1280	No
271	CAM-1A7AF8	1285-1287	Yes
272	NARC-19EFC8	1261-1264	No
273	BH-F73906	1227-1241	No
274	HAMP-CDC9E0	1362-1370	No
275	NLM-3B50D0	1254-1261	No
276	WAW-29A963	1191-1198	No
277	LIN-2E2046	1277-1280	No
278	BUC-05E1A2	1159-1181	No
279	SOMDOR-9F8A90	1243-1254	No
280	IOW-8555E5	1254-1261	Yes
281	WAW-086D07	1125-1500	No
282	SUSS-B91BE0	1316-1334	No
283	LIN-664BC5	1243-1254	No
284	NMS-610D14	1378-1389	No
285	SUSS-E4F456	1100-1400	No
286	BH-011013	1389-1404	No
287	IOW-1EDF91	1159-1181	No
288	CORN-E71360	1471-1484	No
289	LANCUM-E35E83	1471-1484	No

290	SF-E323D0	1370-1378	No
291	LIN-CCD242	1277-1280	No
292	SOMDOR-764453	1294-1303	No
293	SUSS-63AE03	1227-1241	No
294	ESS-BB1D45	1185-1187	No
295	NMS-A6FE32	1227-1241	No
296	WMID-FC2E15	1334-1342	No
297	WAW-933DF5	1130-1400	No
298	ESS-812B33	1198-1216	No
299	BH-6C91A6	1066-1503	No
300	NMGW-DAA680	1431-1447	No
301	BERK-480137	1227-1241	No
302	BERK-47FAF2	1389-1404	No
303	BERK-47DE41	1281-1285	No
304	NMGW-2EC721	1294-1303	No
305	LVPL-B4B6A3	1243-1254	No
306	NMS-5E6D45	1281-1285	No
307	WMID-E68740	1243-1254	No
308	HESH-CF56A6	1200-1550	No
309	BUC-FE3EC3	1370-1378	No
310	WMID-13DB63	1243-1254	No
311	DENO-D420E1	1243-1254	No
312	LIN-544D81	1254-1261	No
313	BH-84C126	1271-1276	No
314	SF-1B1416	1447-1455	No
315	WILT-E551E3	1303-1304	No
316	WILT-E29224	1294-1303	No
317	LANCUM-72E6E6	1378-1389	No
318	WAW-DDED55	1285-1287	No
319	BUC-0A7377	1100-1500	No
320	SOMDOR-F6E585	1227-1241	No
321	NMGW-E5B826	1198-1216	No
322	NLM-DFB5D3	1471-1484	Yes
323	LIN-6EABA3	1277-1280	Yes
324	NLM-94FBA7	1073-1241	No
325	SOMDOR-411B75	1154-1523	No
326	WMID-B32586	1276-1277	No
327	LEIC-A1B0C4	1471-1484	No
328	HAMP-260FE2	1227-1241	No
329	LEIC-157FF0	1243-1254	No
330	WILT-1CCC24	1447-1453	No
331	LIN-631C65	1243-1254	No
332	NLM-522086	1271-1276	No
333	WMID-12FB07	1243-1254	No
334	NMGW-5945E3	1261-1264	No
335	HESH-F307A6	1389-1404	No
336	SF-BB0514	1277-1280	No
337	BUC-B82B06	1288-1292	No
338	DEV-BFF625	1100-1540	No
339	ESS-72B6D7	1227-1241	No
340	LANCUM-A09125	1179-1254	No
341	NLM-A30BC1	1243-1254	No
342	KENT-5CEF43	1316-1334	No
343	WMID-C81864	1185-1187	No
344	LEIC-C37596	1254-1261	No
345	SUSS-F5E022	1243-1254	Yes
346	DENO-533BB4	1281-1285	No

347	IOW-3B7DA4	1404-1406	No
348	DENO-2A3E61	1243-1254	No
349	KENT-FF5704	1281-1285	No
350	ESS-967553	1227-1241	No
351	SWYOR-1C7753	1342-1352	No
352	LEIC-DC5BC8	1243-1254	No
353	NCL-C6DB33	1285-1287	No
354	SF-35D9C8	1243-1254	No
355	SWYOR-E12A00	1261-1264	No
356	HAMP-2B2AA5	1261-1264	No
357	HESH-ADE183	817-824	No
358	SF-3463D6	1271-1276	No
359	SUSS-77BCA7	1305-1314	No
360	DENO-954E42	1216-1227	No
361	IOW-4F0FB1	1352-1362	No
362	KENT-CAFD76	1342-1352	Yes
363	SF-0CE2E5	1227-1241	No
364	SF-734650	1342-1352	No
365	LEIC-B73947	1243-1254	No
366	NLM-1F84E4	1294-1303	No
367	BUC-7C5304	1187-1241	No
368	SF-6A9605	1227-1241	No
369	SOMDOR-4EBCE6	1159-1181	No
370	SOMDOR-3D18F2	1684-1688	No
371	IOW-135D74	1271-1276	No
372	COOK-0C0D67	1198-1216	No
373	KENT-CAC782	1352-1362	No
374	NMS-6A1A61	1216-1227	No
375	NMS-DFB0B1	1342-1352	No
376	WAW-A1E234	1227-1241	No
377	LIN-D1C543	1352-1362	No
378	NMGW-3FD605	1265-1268	No
379	NMS1273	1281-1285	No
380	NMS1462	1342-1352	No
381	NMS1642	1254-1261	No
382	NMS546	1227-1241	Yes
383	NMS576	1216-1227	No
384	HAMP3331	1243-1254	No
385	WMID6006	1316-1334	No
386	NLM7019	1271-1276	No
387	HAMP3010	1265-1268	No
388	NLM6959	1066-1540	No
389	KENT5017	1378-1389	No
390	KENT4994	1409-1410	No
391	KENT4876	1243-1254	No
392	WMID5600	1271-1276	Yes
393	SF9433	1281-1285	No
394	HAMP2257	1227-1241	No
395	WMID4778	1316-1334	No
396	SF8299	1294-1303	No
397	SF8298	1281-1285	No
398	SOMDOR1381	1294-1303	No
399	KENT4060	1227-1241	No
400	KENT4046	1066-1540	Yes
401	KENT4035	1254-1261	No
402	KENT4000	1066-1540	No
403	WMID4003	1285-1287	Yes

404	SOMDOR1360	1294-1303	Yes
405	SF7252	1276-1277	No
406	NMGW3330	1243-1254	No
407	SF7021	1227-1241	No
408	NMGW3298	1159-1261	No
409	SF6390	1410-1415	No
410	HAMP1212	1281-1285	Yes
411	SF6182	1288-1292	No
412	WMID2396	1066-1540	No
413	RAH1277	1066-1540	No
414	YORYMB394	1181-1185	Yes
415	YORYM723	1288-1292	No
416	KENT827	1300-1500	No
417	KENT314	1066-1485	No
418	LVPL158	1186-1189	No

Table H.7: Papal *bullae* from the PAS database as of 14/12/2016. This data is discussed and analysed in Chapter 5.6. Compiled by the author.

H.8 Folded coins

Number	Object ID	Date	Classification
001	YORYM-835FE9	1180-1247	Slightly folded
002	WMID-1706AC	1180-1194	Other
003	LEIC-8C951E	1279-1307	Halved
004	IOW-365C68	1279-1307	Halved
005	YORYM-095073	1279-1489	Halved
006	LIN-074D15	1369-1377	Halved
007	LIN-07149D	1158-1180	Halved
008	PUBLIC-E95F15	1310-1314	Slightly folded
009	LEIC-16633E	1247-1272	Halved
010	HAMP-F16C5C	1300-1310	Halved
011	NLM-30AEA5	1306-1307	Halved
012	HESH-B73E78	1272-1278	Halved
013	SUSS-E2A9D6	1363-1369	Halved
014	NLM-E0D86D	1351-1361	Slightly folded
015	LVPL-8BDECE	1497-1516	Slightly folded
016	SF-2B503C	1279-1489	Halved
017	ESS-0063A6	1154-1199	Slightly folded
018	NLM-DF2883	1279-1281	Halved
019	SUR-8CC5A8	1247-1279	Halved
020	GLO-8A2FEA	1299-1301	Halved
021	YORYM-61BDEA	1180-1247	Other
022	SF-1FC211	1180-1189	Halved
023	GLO-AF1375	1280-1281	Halved
024	SF-8312CB	1276-1302	Halved
025	NLM-C1AD50	1299-1300	Halved
026	WMID-DB8FA6	1279-1301	Other
027	SUR-F288E2	1310-1327	Halved
028	SUR-2A4C51	1217-1242	Halved
029	PUBLIC-7A1B4A	1489-1509	Halved
030	WILT-511795	1327-1377	Other
031	NMS-7175A5	1248-1250	Halved
032	WMID-5C19F4	1301-1310	Halved
033	IOW-B9B2D1	1180-1185	Halved

034	LON-B187F6	1272-1509	Halved
035	IOW-3C5531	1207-1211	Halved
036	NMGW-34E40E	1248-1250	Halved
037	NMGW-254637	1205-1209	Halved
038	KENT-21F7B7	1354-1355	Halved
039	NMGW-FA6F96	1305-1306	Halved
040	WILT-24D675	1305-1309	Halved
041	NMGW-1223EC	1300-1315	Halved
042	NMGW-1123B3	1300-1310	Halved
043	YORYM-FC01CE	1422-1427	Other
044	NMGW-C0D828	1305-1306	Halved
045	NMGW-BFC101	1280-1289	Halved
046	NMS-932041	1205-1210	Halved
047	NLM-F163B0	1300-1310	Halved
048	SF-C728E4	1135-1154	Halved
049	NLM-72D8FB	1280-1310	Halved
050	FAJN-DCE22D	1363-1369	Halved
051	WMID-CB6132	1301-1310	Halved
052	WILT-A1AD72	1291-1343	Halved
053	WMID-624D3B	1461-1483	Slightly folded
054	WILT-8F1408	1471-1483	Slightly folded
055	WAW-39B7A1	1350-1352	Halved
056	YORYM-0C1DD3	1247-1278	Other
057	NMS-E5CC9E	1190-1204	Slightly folded
058	NMGW-A72C86	1299-1301	Halved
059	NMGW-8E308A	1180-1189	Halved
060	NMS-F895BD	1154-1158	Halved
061	NMS-D40F5C	1351-1377	Other
062	WMID-CE8A97	1311-1313	Halved
063	PUBLIC-A59A09	1351-1485	Halved
064	DUR-3F86AD	1279-1377	Halved
065	LIN-1AE005	1180-1247	Halved
066	WMID-024F20	1248-1250	Halved
067	BH-72D24D	1248-1250	Halved
068	NARC-E3B110	1327-1377	Halved
069	LVPL-4AF949	1327-1377	Halved
070	PUBLIC-07C449	1413-1422	Slightly folded
071	NARC-E211EB	1413-1422	Slightly folded
072	DUR-B58E17	1280-1281	Halved
073	PUBLIC-6D63E4	1504-1507	Halved
074	SOM-E1200A	1189-1217	Halved
075	BH-622C92	1279-1485	Halved
076	NMS-7BF5A3	1160-1180	Halved
077	PUBLIC-366A67	1303-1305	Halved
078	PUBLIC-8D7403	1250-1256	Other
079	WAW-D2FD92	1501-1506	Halved
080	YORYM-24D254	1351-1485	Halved
081	BH-BB5B71	1279-1282	Halved
082	YORYM-A70DB3	1280-1286	Halved
083	NMS-8EE0A5	1292-1296	Halved
084	NMS-668A10	1279-1309	Unknown
085	LEIC-65A1D0	1247-1279	Halved
086	LVPL-ED5EA8	1279-1489	Halved
087	LVPL-ED2A53	1279-1489	Halved
088	NLM-F26CE4	1307-1310	Slightly folded
089	BERK-331CD1	1204-1209	Halved
090	BERK-329C53	1217-1242	Halved

091	NMS-F49880	1180-1185	Unknown
092	NLM-101006	1180-1247	Halved
093	HESH-A2B6D2	1270-1450	Halved
094	PUBLIC-63EA82	1300-1310	Slightly folded
095	BH-E654B1	1092-1095	Halved
096	DENO-6E1CF3	1471-1483	Halved
097	SUR-AD98A3	1500-1504	Slightly folded
098	NLM-1B8910	1307-1310	Halved
099	LANCUM-5F1517	1309-1314	Halved
100	NARC-4B5808	1180-1272	Slightly folded
101	HAMP-21FAA8	1205-1210	Halved
102	BERK-7BC376	1377-1399	Halved
103	NCL-BE5426	1136-1145	Halved
104	WAW-A87C85	1461-1470	Halved
105	NMS-850D74	1180-1216	Halved
106	GLO-204FB7	1351-1352	Halved
107	IOW-0CAED6	1422-1427	Halved
108	NMS-DED0F6	1248-1250	Halved
109	NCL-C742D0	1467-1477	Halved
110	NARC-13FE77	1272-1307	Halved
111	NMS-58D862	1180-1247	Halved
112	BERK-DD6BA7	1461-1470	Slightly folded
113	IOW-1E4152	1200-1204	Halved
114	BERK-CD8722	1350-1450	Halved
115	NMS-BD0702	1213-1215	Halved
116	SF-7A0122	1250-1280	Slightly folded
117	KENT-6AB814	1100-1135	Halved
118	SF-012B23	1251-1272	Halved
119	NMS-9258F5	1279-1485	Unknown
120	WAW-E11918	1280-1307	Halved
121	WILT-4677C3	1300-1305	Halved
122	LIN-F0A925	1422-1427	Halved
123	SUR-4EDC02	1299-1300	Halved
124	LVPL-CCAD92	1272-1377	Halved
125	SF-64A711	1419-1467	Halved
126	NLM-383E23	1307-1310	Slightly folded
127	GLO-026D22	1280-1281	Halved
128	WMID-0057F2	1180-1247	Halved
129	LIN-6B0544	1194-1205	Halved
130	LIN-58E274	1282-1300	Halved
131	IOW-C32751	1248-1250	Halved
132	NLM-9AEE15	1279-1327	Halved
133	NMS-C45927	1248-1250	Halved
134	YORYM-4A0BD3	1195-1539	Other
135	NMS-479D22	1205-1207	Halved
136	SF-610AB5	1280-1286	Halved
137	NCL-B81DB2	1299-1300	Slightly folded
138	NLM-3CED01	1247-1279	Halved
139	SWYOR-FC78E5	1301-1310	Halved
140	SF-578658	1272-1307	Halved
141	SF-C0C2F2	1204-1209	Halved
142	WAW-101792	1422-1427	Unknown
143	FAKL-FE33F6	1350-1500	Halved
144	NARC-D1A5C4	1249-1286	Slightly folded
145	SF-67E884	1180-1247	Unknown
146	NMS-6F9083	1280-1281	Halved
147	SOM-F6CEE5	1363-1369	Halved

148	LIN-E28612	1363-1369	Halved
149	LANCUM-B68E97	1247-1272	Halved
150	BERK-E88C90	1501-1520	Slightly folded
151	BERK-8EE1A6	1280-1282	Halved
152	NLM-A93475	1248-1272	Halved
153	LON-11CA02	1422-1427	Slightly folded
154	BERK-EBFC95	1180-1247	Halved
155	SUR-EA9484	1180-1247	Halved
156	NARC-59B7E3	1279-1489	Halved
157	LON-5741C1	1337-1391	Halved
158	YORYM-EFF7B7	1351-1485	Halved
159	SWYOR-DAA6F2	1196-1205	Halved
160	IOW-AC32C5	1279-1280	Halved
161	BH-A01131	1280-1287	Halved
162	DENO-CF2175	1351-1470	Unknown
163	LON-361F32	1280-1281	Slightly folded
164	LIN-E1D165	1301-1307	Halved
165	LIN-35E215	1083-1086	Halved
166	LIN-42FB00	1363-1369	Slightly folded
167	SF-099272	1305-1307	Halved
168	HESH-07BCB7	1180-1247	Halved
169	LEIC-ACCA26	1361-1369	Halved
170	BH-F2CFF6	1158-1180	Halved
171	HAMP-A1A578	1248-1250	Halved
172	NLM-0B5683	1317-1319	Halved
173	BERK-0B0D46	1200-1299	Unknown
174	SUSS-CDCB22	1250-1275	Halved
175	ESS-E6B727	1280-1289	Slightly folded
176	NLM-0D5171	1400-1485	Slightly folded
177	NLM-D53176	1217-1242	Halved
178	SWYOR-458997	1279-1280	Halved
179	BH-8BDF17	1248-1250	Halved
180	SWYOR-8B9062	1251-1272	Halved
181	NLM-A23A26	1247-1272	Halved
182	IOW-3ADED1	1279-1280	Halved
183	SUR-2BA650	1288-1292	Halved
184	LIN-2E8BF4	1413-1422	Halved
185	IOW-424AB1	1180-1247	Halved
186	KENT-C78066	1327-1377	Other
187	NARC-C6BF53	1272-1307	Slightly folded
188	LIN-C28142	1301-1307	Halved
189	SUR-49F262	1299-1300	Halved
190	WILT-21E061	1335-1343	Halved
191	WILT-E64CD6	1466-1467	Halved
192	WILT-CFFE77	1158-1180	Unknown
193	PUBLIC-AA94C0	1100-1102	Halved
194	SUSS-14AB43	1077-1080	Halved
195	LIN-2BCE24	1199-1272	Halved
196	IOW-F23851	1272-1307	Halved
197	SUR-1C9D65	1272-1307	Halved
198	HESH-9EB261	1327-1377	Halved
199	LVPL-A8E090	1180-1247	Unknown
200	LVPL-94FEB6	1272-1377	Halved
201	SF-EFA533	1293-1294	Other
202	IOW-35DAB4	1302-1310	Halved
203	BUC-D90653	1282-1283	Other
204	IOW-C97774	1282-1289	Halved

205	NLM-887A86	1100-1150	Halved
206	NLM-870E62	1180-1189	Other
207	SF-0ADD51	1205-1242	Halved
208	DUR-791DC3	1279-1372	Halved
209	NARC-E7B052	1216-1272	Halved
210	IOW-BEF091	1205-1210	Halved
211	HAMP-15DDD5	1363-1369	Other
212	LIN-D1C783	1351-1361	Halved
213	IOW-0A1E93	1361-1363	Halved
214	IOW-03E283	1301-1310	Halved
215	SF-02B9D5	1279-1280	Halved
216	HESH-305910	1209-1217	Halved
217	SWYOR-30F2F2	1158-1180	Halved
218	SF-C8DE58	1301-1333	Halved
219	HESH-EB4141	1200-1247	Halved
220	SUR-6C5184	1495-1498	Halved
221	SUSS-022737	1413-1422	Halved
222	SUSS-D40F30	1310-1314	Other
223	DENO-C4B434	1422-1427	Halved
224	SUSS-989536	1377-1399	Halved
225	WILT-DA3F23	1363-1369	Halved
226	NARC-883560	1279-1509	Halved
227	LON-070A60	1272-1301	Halved
228	LVPL-33EE02	1301-1310	Unknown
229	DENO-554DB4	1272-1544	Unknown
230	IOW-C6F397	1194-1205	Halved
231	SWYOR-4F7776	1501-1507	Halved
232	SF-ABE6E6	1194-1210	Halved
233	CPAT-FE4E17	1247-1271	Halved
234	NLM-660AF3	1464-1485	Unknown
235	DOR-FA5FF5	1461-1483	Slightly folded
236	SF-5EA085	1251-1272	Unknown
237	SF-C98D13	1279-1333	Halved
238	SWYOR-6D2265	1216-1272	Halved
239	YORYM-C20AC1	1272-1307	Other
240	WAW-76AD85	1278-1509	Halved
241	BUC-8A14D7	1501-1521	Slightly folded
242	DENO-CB1394	1413-1422	Slightly folded
243	SUR-E93BE4	1180-1247	Slightly folded
244	BERK-7DAFD6	1216-1272	Halved
245	SUSS-E79DA2	1301-1310	Halved
246	SUR-FEB026	1180-1247	Halved
247	SWYOR-C107C5	1180-1205	Halved
248	SUR-423071	1272-1327	Halved
249	BH-CB5068	1400-1600	Slightly folded
250	DOR-479E06	1216-1218	Halved
251	SF-A50B70	1247-1279	Halved
252	SF-D47832	1272-1307	Halved
253	SF-B0A674	1280-1281	Halved
254	IOW-CB1B30	1310-1314	Halved
255	IOW-25EE66	1474-1504	Halved
256	SUSS-FA0337	1327-1413	Halved
257	SWYOR-B2CF51	1180-1247	Halved
258	SF-C423E3	1251-1272	Halved
259	WILT-9DEBA6	1248-1250	Halved
260	DOR-B43DB6	1204-1209	Halved
261	WAW-CAED83	1251-1272	Slightly folded

262	NLM-4EF492	1251-1272	Halved
263	SWYOR-6FA7C6	1205-1218	Unknown
264	WILT-A619C2	1335-1342	Halved
265	SUR-D75F86	1279-1307	Halved
266	CPAT-F0DF56	1272-1377	Halved
267	BUC-1F09D7	1279-1489	Slightly folded
268	WILT-509C13	1413-1422	Halved
269	BUC-E41502	1352-1377	Slightly folded
270	WILT-A3E028	1413-1422	Halved
271	WILT-D6AD68	1174-1180	Slightly folded
272	NLM-444F94	1427-1430	Unknown
273	WILT-B9F4B3	1422-1427	Halved
274	BUC-C629B1	1327-1377	Unknown
275	SF-E20383	1422-1460	Halved
276	SF-B89DF2	1282-1289	Halved
277	LIN-1D9D80	1327-1377	Halved
278	WAW-C6DB58	1272-1500	Halved
279	NLM-7626E2	1217-1242	Slightly folded
280	SF-F51EC1	1279-1333	Slightly folded
281	LEIC-3CE614	1247-1272	Halved
282	SF-6C7763	1189-1204	Halved
283	WAW-095ED8	1292-1317	Halved
284	WAW-07B563	1248-1272	Halved
285	HESH-8D4050	1251-1272	Halved
286	SF-A72881	1296-1344	Halved
287	NLM-8D4723	1247-1489	Halved
288	YORYM-105C87	1530-1544	Halved
289	LEIC-569622	1280-1286	Halved
290	SF-1DD171	1282-1289	Halved
291	IOW-1F4FE4	1279-1302	Halved
292	IOW-1C0353	1461-1483	Halved
293	WAW-9A9043	1427-1435	Slightly folded
294	SF-C90367	1305-1310	Unknown
295	SF-9EB285	1302-1314	Slightly folded
296	BUC-37A544	1272-1377	Halved
297	SUSS-9C77C4	1272-1377	Halved
298	SF-456C73	1327-1377	Halved
299	NLM-DBCA91	1377-1461	Slightly folded
300	SUSS-790C75	1135-1141	Halved
301	WAW-4D6925	1272-1489	Halved
302	NLM-AA2158	1216-1272	Halved
303	WAW-840592	1272-1509	Halved
304	WAW-8184B8	1272-1307	Halved
305	WILT-19CBB4	1363-1369	Halved
306	WAW-F0B6E6	1327-1377	Slightly folded
307	SF-28B160	1272-1307	Halved
308	WAW-FCFBE1	1161-1165	Slightly folded
309	WMID6049	1216-1272	Halved
310	WMID5857	1216-1272	Halved
311	WMID5669	1363-1369	Slightly folded
312	WMID5671	1272-1399	Halved
313	WMID1770	1413-1422	Unknown
314	WMID676	1272-1307	Halved
315	NARC-03B111	1464-1470	Halved

Table H.8: Folded coins from the PAS database as of 01/04/2016. This data is discussed and analysed in Chapter 5.9. The classification is detailed in Figure 5.21. Compiled by the author.

H.9 Six-pointed star bearing objects

Number	Object ID	Date	Classification
001	LEIC-293696	1100-1700	Spindle Whorl
002	YORYM-58C333	1200-1800	Spindle Whorl
003	LIN-F897E6	1200-1500	Srap Fitting
004	SUR-545AC5	1150-1250	Harness Pendant
005	SUR-54501B	1150-1250	Harness Pendant
006	NMS-1C81E5	1100-1220	Harness Mount
007	PUBLIC-8D1177	1200-1400	Harness Pendant
008	DUR-523394	1200-1550	Spindle Whorl
009	LIN-E41417	1300-1700	Mount
010	LEIC-CAB10C	1100-1700	Token
011	LVPL-9E5261	1100-1500	Spindle Whorl
012	LANCUM-5415C8	1000-1600	Weight
013	LVPL-7B0ECB	1100-1500	Spindle Whorl
014	SF-C0D294	1300-1500	Brooch
015	NLM-27E931	1350-1500	Calendar
016	BH-6C0ECB	1100-1250	Mount
017	WAW-FD541D	1250-1400	Brooch
018	YORYM-855442	1200-1800	Spindle Whorl
019	YORYM-99D8A8	1200-1800	Spindle Whorl
020	LVPL-EF7FAF	1300-1500	Ampulla
021	NMS-39EFD3	1300-1400	Harness Pendant
022	NMS-C3D56B	1400-1500	Finger Ring
023	SWYOR-A17938	1100-1600	Spindle Whorl
024	NMS-F086F2	1100-1200	Harness Mount
025	DOR-7030B1	1350-1550	Finger Ring
026	WMID-AFF2A1	Unknown	Spindle Whorl
027	SF-36FF90	1200-1500	Finger Ring
028	NMS-8EF7D0	1100-1200	Harness Pendant
029	NMS-4534D2	1100-1250	Harness Pendant
030	YORYM-FAFAB3	1250-1600	Spindle Whorl
031	SF-541B81	1300-1400	Harness Pendant
032	YORYM-3E5C23	1200-1300	Brooch
033	WILT-07A752	1100-1250	Harness Pendant
034	SF-779904	1200-1500	Finger Ring
035	LANCUM-DB9DC5	1100-1300	Spindle Whorl
036	SWYOR-61A626	1200-1500	Spindle Whorl
037	SUR-E525B7	1150-1250	Harness Pendant
038	HAMP-B94F13	1300-1400	Harness Pendant
039	SUSS-BEBB77	1250-1450	Harness Pendant
040	NMS-C30FB7	Unknown	Harness Pendant
041	NMS-BFD6E0	1100-1200	Harness Pendant
042	IOW-8C4E51	1200-1400	Harness Pendant
043	DENO-FF2C04	1100-1800	Spindle Whorl
044	IOW-779A94	1200-1400	Harness Pendant
045	DENO-6D1046	1200-1800	Weight
046	LVPL-799683	1066-1500	Spindle Whorl
047	SWYOR-E78E57	1300-1400	Brooch

048	DENO-CA6F02	1200-1800	Weight
049	YORYM-CFD143	1150-1300	Harness Pendant
050	BH-A5BA61	1250-1500	Mount
051	BH-AA32A7	1066-1500	Spindle Whorl
052	LIN-49E5D3	1250-1400	Mount
053	NMS-102341	1100-1200	Harness Pendant
054	NMS-1113B3	1100-1200	Harness Fitting
055	BH-349E13	1100-1400	Harness Pendant
056	BH-B36BD6	1100-1400	Harness Pendant
057	BUC-21CD17	1100-1200	Harness Pendant
058	LANCUM-118551	1400-1800	Weight
059	WAW-C35E23	1400-1450	Finger Ring
060	NMS-719836	1400-1500	Srap Fitting
061	LEIC-052555	1100-1500	Spindle Whorl
062	NMS-CDFFF1	1100-1200	Harness Pendant
063	NCL-E653D3	1000-1200	Mount
064	NMS-9A5316	1100-1200	Harness Fitting
065	LIN-4D7425	1150-1250	Harness Pendant
066	LIN-91EC30	1066-1499	Spindle Whorl
067	NMS-C76A27	1066-1500	Weight
068	NMS-F29433	1300-1400	Harness Fitting
069	YORYM-FFA8E1	Unknown	Spindle Whorl
070	WILT-EF49B8	1301-1499	Harness Pendant
071	NMS-7527E4	1100-1200	Harness Fitting
072	SUR-5C7510	1400-1550	Srap Fitting
073	SWYOR-4993C1	1200-1500	Spindle Whorl
074	SF-8CC388	1150-1250	Harness Pendant
075	LEIC-ECE133	1066-1500	Spindle Whorl
076	BUC-F90751	1066-1500	Token
077	SF-96D9B4	1300-1650	Nail
078	LVPL-519EB6	Unknown	Spindle Whorl
079	LEIC-F3B2D2	Unknown	Spindle Whorl
080	LVPL-4A2126	Unknown	Spindle Whorl
081	HAMP1980	1300-1500	Fixtures & Fittings
082	NLM5539	1300-1540	Unidentified Object
083	SF6760	1066-1540	Srap Fitting

Table H.9: Six-pointed star bearing objects from the PAS database as of 01/10/2016. This data is discussed and analysed in Chapter 5.10. Compiled by the author.

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