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Abstract

Recently compiled datasets for hillforts and corn-drying kilns in the west of Britain, when subject to chronological analysis using Kernel Density Estimation, show a sharp and lasting fall-off in activity in the later 6th and 7th centuries. We investigate this through the regional and broader evidence for three major paradigms of change at this time: the Justinianic plague, climate change and the growth of Christianity, the last manifested in transfers of land to churches and in an ascetism which affects assembly practices. The resultant analysis provides archaeologically-derived insights into social changes of this period, and raises questions about the applicability of dominant narratives framed in other regions.

Pandemics, climate change and religion form influential paradigms of change for early medieval studies, in the form of the 6th- and 7th-century *mortalitas magna* or Justinianic plague, so-called because it first becomes apparent c 541 during the reign of the Emperor Justinian (Little 2007); the contemporaneous climate changes of the early medieval climatic anomaly or Late Antique Little Ice Age (Büntgen et al 2016); and the growth of Christianity (Wood 2022). Although highly topical and commanding a large amount of research attention, they have received little attention as paradigms of change in recent work on western Britain, unlike such classic explanations as trade and the end of Roman control which have been considered at length in a number of publications (e.g. Dark 2014). This paper accordingly considers their relevance, when examined In their regional context, to two groups of sites in western Britain – hillforts and corn-drying kilns – which can be considered as barometers of socio-political and economic change because their use relates to practices that were engrained in patterns of power and social reproduction.

Datasets for these sites, compiled by the authors and subject to chronological analysis using Kernel Density Analysis, show a lasting fall-off in activity during the later 6th and 7th centuries (Fig 1). This finding is of particular note since early medieval western

Britain is an area where a number of factors — a striking material poverty, aceramic, non-urban and un-monetized traditions, acid soils and limited written sources — pose significant difficulties in identifying sites, understanding social development and interpreting temporal patterns. Radiocarbon dating is now aiding the identification of sites belonging to this period, but usually it is not until long after the conclusion of an excavation that this method identifies early medieval activity, of which it is often the sole indicator at sites in our study area. The pattern shown in our datasets is therefore doubly striking, and its provenance and relationship to contemporary events, notably the striking coincidence of changes in archaeologically-attested activity, disease and climate downturn, form the subject of this paper. Correlation does not, of course, imply causation. We argue that while the impact of climate change on our data is inconclusive, plague may play a role in the decline, albeit perhaps indirectly and in interaction with other factors, notably the development of Christianity as a personal and proprietorial force, which we suggest as a significant force for change. In particular, we identify indications that the drop-off in corn-drying kiln activity may reflect a reduction in bulk malt-making, and consequently the large-scale brewing of ale. We attribute this, and the reduced activity at hillforts, to a cessation of some assembly practices that may be linked to developments in Christianity.

THE CORN-DRYING KILN AND HILLFORT DATA

To introduce our sources of data: corn-drying kilns, alternatively referred to as 'ovens' rather than 'kilns' in England, are structures for crop-processing whose interpretation is much discussed; a review of research is provided in Comeau and Burrow's 2021 overview and a summary is given below. They are generally short-lived features whose radiocarbon dates are, where possible, obtained from carbonised grains derived from their use, such dates usually providing a high level of chronological resolution. The corn-drying kiln dataset used here, published in 2021 (Comeau and Burrow 2021; data including gazetteer with locational details available at <*doi.org/10.5284/1085018*>), represents all archaeologically-identifiable kilns in Wales from late prehistory to c 1600 which had been reported by 2020, and comprises 143 kilns distributed between 71 sites, some sites having multiple kilns which are sometimes of different dates. 46 of these kilns have usable radiocarbon dates, 34 of which are from short-life samples like grain, while 68 are dated by pottery, artefacts, context or typology and 29 are undated. Since the use of pottery and

other artefacts to determine dating raises issues of residuality, our analysis (for hillforts as well as corn-drying kilns) focusses primarily on radiocarbon-dated examples, with those that have been dated by other means examined as a context for this. Sites specifically mentioned in this paper are listed in Figure 2, and descriptions will be found in the online gazetteer.

The hillfort evidence is more complex - our use of the term is considered below - but here we note that our dataset comprises a broader group of high status enclosed sites than reoccupied Iron Age hillforts. Few sites have been extensively excavated, most only have a small number of dates, and we can be less certain that those dates provide a comprehensive picture of their occupation and abandonment. Nevertheless, assessment of the samples and their relative stratigraphic positions within site sequences suggests that as a whole the corpus of dates is sensitive to changing patterns of use. The dataset comprises 30 sites, of which 14 have useable radiocarbon dates from stratified, short life samples. All of the remainder (as well as some of the radiocarbon-dated sites) have artefacts, particularly imported pottery and glass, that provide chronological information. Sites mentioned in the text are shown in Figure 3.

The significance of these datasets lies in the fact that individual poorly evidenced sites with isolated radiocarbon dates are difficult to assess when viewed on their own, particularly kilns whose radiocarbon dates reflect the last occasion of use. Our analysis therefore compiles these individual sites into comprehensive whole-region datasets and looks at overall chronological dating patterns, and at the characteristics of sites that make up pivotal points in these patterns. Comparative research provides reference markers.

Crossover between the two datasets is minimal, with just one corn-drying kiln being located at a hillfort. Their coverage, however, is slightly different, with the corn-drying kiln dataset covering Wales only, whereas the hillfort dataset also includes south-west England. Current indications are that kiln data for the south-west does not contradict the Welsh dataset. However it would not be statistically valid to include kiln sites from the southwest in our analysis until a comprehensive assessment equivalent to the Welsh survey has been undertaken, which is beyond the scope of the current paper.

The radiocarbon dates for these sites and features were analysed using Kernel Density Estimation (KDE) following Rowan McLaughlin's method (McLaughlin 2019). This is a non-parametric approach to calculating the changing probability density of the radiocarbon

dates that we have gathered for the period of interest. Uncertainty in the process of combining the probability density of multiple dates is handled by repeatedly randomly ('Monte Carlo') sampling from the probability density of each calibrated radiocarbon date and bootstrapping the resulting models. KDE has been opted for here over comparable methods such as Summed Probability Distribution (SPD) in part because it has been argued to better handle fluctuations in the shape of the underlying calibration curve (Bronk Ramsey 2017), but also because it enables clear comparison with recent Irish research on similar processes in our period of interest, which were carried out using the same method (Hannah and McLaughlin 2019; Hannah 2021).

Analyses were carried out in the statistical programming language R (version 4.0.0; R Core Team 2020) with all dates calibrated using the IntCal20 calibration curve (Reimer et al 2020). For the kilns dataset, each kiln was treated as a separate site, while the hillforts were divided into site-phases reflecting their differing histories of occupation. The dataset was thinned to avoid over-representation of any well-dated sites, with no more than two dates per site (kilns) or site-phase (hillforts) being incorporated into the chronological models. Where possible these selected dates were AMS-dated single entity, short-life samples. The KDE results in Fig 1 are shown as a shaded envelope with a mean central line indicated. This central line indicates the mean result when the given sample of radiocarbon determinations (which take the form of complex probability distributions) is combined; i.e. it is an averaged expression of the range of probabilities for the date of multiple sites.

CORN-DRYING KILNS

Corn-drying kilns, also known as crop or grain dryers and as parching or drying ovens, are crop processing structures that consist essentially of a drying chamber and an adjacent fire (Fig 4). Their charred grain contents provide a wealth of dateable environmental evidence which is discussed in Comeau and Burrow's 2021 published survey; the current paper focusses on the implications of the new KDE modelling. They are commonly associated with early medieval estate centres that consist of polyfocal scatters of separate sites, and indicate a scale of crop processing beyond that of a single farmstead (Comeau 2021). Early medieval examples are rarely found in close association with domestic structures, possibly because of fire risks, the notable exception being the 7th- to 9th-century kilns at South Hook (Pembrokeshire) (Comeau and Burrow 2021, 128).

While Figure 1 presents an analysis of the changing prevalence of the 46 radiocarbon-dated corn-drying kilns noted in the 2021 survey, the full dataset, as noted above, includes many which are dated using typological or contextual methods only. To explore the date distribution of the full dataset, including sites without scientific dates, a second assessment was carried out using a combination of probabilistic binning and aoristic analysis. For sites with radiocarbon dates, these were calibrated and the probability was calculated that each date falls into each 100-year period from AD 200–1200, with the total probability for each site summing to p=1.0. For sites without radiocarbon dates, or where contextual dating was judged to be more reliable, aoristic analysis was used to achieve the same result (Crema 2012; Bevan et al 2013). We have applied the aoristic approach here by distributing equally the total probability of each date (p=1.0) over all possible time blocks. For example, if a site is dated by 3rd–4th century pottery we split the probability equally over these two centuries: 0.5 probability in the 3rd century and 0.5 in the 4th. Using this approach we create a bar plot of the summed probability that the sites fall within each century, using a single date per site (ie each site is represented by 1.0 but this may be spread over multiple bars). Figure 5 presents the result of this assessment showing the changing prevalence of all corn-drying kilns with any dating evidence. It demonstrates that kilns dating to the first four centuries AD are under-represented in the KDE model due to a reliance on typological dating in the Romano-British period. However, the pattern for the focal period of this study — a 6th-century peak followed by a rapid decline in the 7th century — is maintained (see also Comeau and Burrow 2021 fig 3 for a non-apportioned approach). The 'long 8th century', although a time of increased agricultural production in Anglo-Saxon areas, is represented in this data by only the slightest of upturns at what otherwise is a low point in the overall record.

A broadly similar pattern is seen in the larger Irish dataset for corn-drying kilns, albeit with some Irish work showing a degree of 8th-century intensification (Monk and Power 2012, 38–9; McCormick et al 2014, 27–9; cf Hannah and McLaughlin 2019, fig 2, which shows modelling for grain rather than kilns). It should be noted that indications for 8th-century agricultural intensification in Wales are limited: although pollen data shows possible increases in arable activity (Davies 2019, 185), there is no archaeological evidence for watermills or clear evidence for heavy plough use at this time.

To understand this activity pattern, we need to consider the applications of these features. Corn-drying kilns are multifunctional structures, used principally for processed (threshed, cleaned) grain, either for drying it prior to bulk storage, to loosen barley and oats husks prior to milling, or for preparing malt for ale-making by roasting sprouted grains (Van der Veen 1989, 303–4; 2016, 5; Comeau and Burrow 2021). The common assumption that their primary purpose was to dry wet grain after damp harvests is not supported either by historical records or by archaeobotanical evidence, and early modern records show that wet harvests were usually dealt with by stooking techniques (Comeau and Burrow 2021, 114). Their estate centre associations are of particular note (Kinsella 2008, 106; Comeau 2021; McKerracher 2021). In Wales all the 5th- to 7th-century corn-drying kilns are at locations distinctive for central place ('focal zone') characteristics and/or assembly site associations (cf Comeau 2020, 25), which include proximity to recognised assembly sites (Bayvil; Dolbenmaen); Roman forts and/ or early medieval estate centres (Bayvil; Brynwgan; Felindre; Maes y Llan; Parc Cybi and Penrhos at Holyhead); Iron Age hillforts (Bayvil; Caerau); prehistoric ritual or funerary complexes (Parc Cybi; Sarn y Bryn Caled); and cross-roads or fording places in combination with Bronze Age or natural mounds (Buttington Cross; Dolbenmaen; Pentre Farm) (Fig 2).

Twenty-six kilns at 11 sites are attributed to the 5th to 7th centuries, 15 of them through short-life dates with at least 98% of probability within this period. They account for about two-thirds of all Wales' early medieval kilns (Comeau and Burrow 2021, 121–2). The most likely explanation for them would appear to be activity supporting the local provision of food and ale to large numbers of people, particularly given the post-Roman collapse in long-distance grain trade (Gleeson 2018, 107; Comeau 2021, 66; McKerracher 2021, 69–70). Such provision was probably only required periodically, for festivals and/or the visits of rulers and their retinues to estate centres. The supply of bread and ale as a food rent was an obligation of agricultural communities, recorded in charters of the 7th century onwards in south Wales (Charles-Edwards 2013, 274–82; Comeau 2020, 114, 219–26). It is likely that some of the hillforts with evidence for post-Roman activity were used in this way, and indeed, one of the corn-drying kilns of 5th- to 7th-century date is within the hillfort at Caerau (Comeau and Burrow 2021, 141; Seaman forthcoming). Wider evidence for

contemporary occupation here is currently lacking, and it is likely that post-Roman activity was associated with its use as an assembly site.

HILLFORTS

Interpretation of data patterns and choice of interpretative models needs to be equally cautious for hillforts, a term that, following Alcock (1988, 22), is deployed within the context of this article as a loose umbrella label for a heterogeneous group of apparently high status enclosed sites. These include hilltop sites with natural and/or artificial embankments, tidal islands, and earthwork enclosures that occupy hillslope locations. Although not true hillforts, we also consider a small number of lower-lying enclosures including 'rounds' where these have produced substantial assemblages of imported pottery and can reasonably be interpreted to be of broadly comparable status to the hilltop sites. Activity at this broad range of sites has long been identified as a defining feature of the archaeology of post-Roman western Britain with at least 30 showing some level of activity (Fig 3; Seaman forthcoming). Important examples include Cadbury Castle (Somerset), Dinas Powys (Vale of Glamorgan), High Peak (Devon), and Tintagel (Cornwall) (Alcock 1971). These sites often have visually impressive settings, sometimes in inhospitable locations, with commanding views of their landscapes. The reoccupation of ancient sites was undoubtedly seen as significant and hillforts are generally understood as elite residences and power centres. Artefact assemblages are commonly small, but frequently include ceramics and glass imported from production centres in the eastern Mediterranean and western France (Campbell 2007). Evidence for feasting and drinking and the production of fine metalwork is frequently encountered, and it is thought that many hillforts were associated with the collection and redistribution (often via gift-giving) of traded goods and render (Alcock 1971; Seaman 2016). Evidence for hunting/warfare and record-keeping is also encountered, and ritual activity, including burial and animal sacrifice, is attested. Some sites, such as Dinas Powys, have impressive multivallate defences, but at others, such as Coygan Camp (Carmarthenshire) and Kilibury (Cornwall), activity took place within dilapidated Iron Age ramparts that were not refurbished. Evidence for houses is rare and the small, often unstratified, artefact assemblages from many sites are difficult to reconcile with sustained domestic occupation. Thus, despite their frequent characterisation as 'defended

settlements', not all appear to have been primarily residential or defensive in function. We can instead see hillforts as foci for the negotiation of patron-client relationships and suggest they were also used as assembly sites and ceremonial centres (Seaman forthcoming). It is difficult to ascribe a status to individual sites, but we may envisage that hillforts were associated with rulers of differing degrees of power, from locally-based nobles to kings of large regions.

Dating evidence is primarily provided by artefacts, but a corpus of radiocarbon dates can also be assembled (Campbell 2007; Seaman forthcoming). Late Roman amphorae and red slipwares of Mediterranean origin are dated to the later 5th and 6th centuries AD, but it is noticeable that 7th-century material, including 'E ware' from western France, has been found on comparatively few hillforts and is notably scarce in south-west England where international connections appear to have been the strongest in the 6th century. Sites including Cadbury Congresbury (Somerset), Dinas Emrys (Gwynedd), Coygan Camp, New Pieces (Powys), and Cadbury Castle display very little evidence for occupation extending far into the 7th century (Fig 1). Indeed, the excavators of Cadbury Castle and Cadbury Congresbury both envisioned abandonment around or before AD 600 (Rahtz et al 1992, 223; Alcock 1995, 152). It is evident that some hillforts did continue into the 7th century, particularly in south Wales where E ware has been recovered from Dinas Powys, Hen Gastell (Neath Port Talbot), and Carew Castle (Pembrokeshire). The terminal date for E ware is often cited as c 700, but there is little evidence to support this and it is noticeable that radiocarbon dates from stratigraphically late deposits containing E ware at Dinas Powys do not extend beyond the middle of the 7th century. The radiocarbon dataset is comparatively small, but provides supporting evidence and suggests that this significant drop in activity at hillforts can be dated to the first decades of the 7th century. It therefore reveals a slightly later, but still striking similarity to that seen in the corn-drying kilns (Fig 1).

Any analysis of these changing patterns does of course need to carefully consider the nature of the activity that the data represents. There are a small number of outlier dates that extend into the 8th century, whilst Viking Age activity is also attested by artefacts at Hen Gastell (Wilkinson 1995). 8th- and 9th-century activity is attested on the southern terrace site at Tintagel, but the excavator argues for a 100–200 year gap following occupation in the 5th and 6th centuries (pers comm Jacky Nowakowski). Moreover, we

must also be conscious that the drop-off in Fig 1 represents only a decline in the types of activity that create material that we can radiocarbon date. At some hillforts, despite a lack of excavated indications of occupation for the later part of the early medieval period, there are indications of continuing significance which are provided by written sources and place-names. For example, the *Annales Cambriae* record that *Arx Decantorum* (usually identified as Degannwy (Conwy), a prominent double summit surmounted by a castle, under which evidence of significant post-Roman activity has been identified) was burnt by lightning (AD 812) and destroyed by the English (AD 822) (Morris 1980, 47–8). This may indicate a change in the use of these sites rather than outright abandonment. It is possible that further excavation and radiocarbon dating of hillforts could reveal evidence for post-7th century activity (as is the case in Scotland), but the data as they stand are consistent. Thus, the evidence points to a significant shift in activity beginning in the late 6th century to early/mid-7th century, but the reasons for this remain a question. The abandonment of some hillforts in the east has been associated with Anglo-Saxon incursion in the late 6th century (Rahtz et al 1992, 251), but this interpretation cannot be applied to the large areas that remained under British control. Plague has also been seen as an important factor (Campbell 2007, 132), and the evidence for this will be considered presently.

DISCUSSION

The decline in hillfort activity slightly post-dates the decline in corn-drying kiln activity (Fig 1) but we should not read too much into this, since it may change as more data becomes available, for instance for less well-dated hillforts. In addition, because some sites within our broad hillfort categories may have had a stronger residential focus, a greater degree of later continuity is to be expected. The important thing is that both kilns and hillforts show a marked decline within the same broad period, with a similar decline also visible in Ireland (Hannah and McLaughlin 2019).

This decline is sharp and lasting, and its interpretation is provocative since (as noted earlier) it coincides with events — the arrival of the Justinianic plague and the early medieval climate anomaly — that, together with population decline, are identified as agents of 6th-century change across Europe and Asia in a number of influential discussions. Relevance to a particular area cannot however be assumed, and we set out below the regional evidence for these and other factors — changes in social and religious attitudes —

that could also be implicated. As will be seen, in some cases, little or no actual relationship between our datasets and a particular paradigm can be seen, beyond the coincidence of timing.

THE JUSTINIANIC PLAGUE

There is no documented or scientific evidence for plague at any of the corn-drying kiln or hillfort sites, and specific evidence for it elsewhere in the study area is slender, although there is no question of its 6th- and 7th-century presence in Britain and Ireland. The substantial body of research that examines the Justinianic plague (*Yersinia pestis*) has largely focussed on the Mediterranean area where it first appears c 541. Records show that, having arrived in Ireland by 545 (Charles-Edwards 2006, 97), it recurs periodically across Europe over the following two centuries, with a major resurgence in Britain and Ireland in the later 7th century (Little 2007; Maddicott 2007). It occurs in bubonic, pneumonic and septicaemic forms, and much of the work on it examines its medical identification, mode of transmission, scale and severity of impact, with the presence of some additional epidemics like smallpox suspected (Grace 2018; Eisenberg and Mordechai 2019 for summary). Research has also considered its social and religious impact, notably in the work of Meier (2016), and it is linked in varying degrees to social changes of the 6th and 7th centuries, although it receives little mention in some key discussions of the period (Sarris 2021, 7–9; cf Wickham 2005 and Carver 2019).

Information for Britain and Ireland derives largely from texts, significantly supplemented by a recent bioarchaeological investigation of 6th-century burials at Edex Hill in Cambridgeshire (Keller et al 2019). There are two main sets of written sources, the annals of early medieval Ireland and Wales which provide brief records of the presence of plague and other epidemics, and the late 7th- and early 8th-century narratives of the ecclesiasts Bede (673–735) and Adomnán (624–704) which focus substantially on their north Britain areas of activity (HE; LCol; LCuth; Morris 1980; Charles-Edwards 2006). Gildas, writing in the 530s to 540s, also makes an undated reference to a plague or pestilence (*lues*) so savage that 'the living could not bury all the dead', but the chronological context of the text places it as an event of the 5th century (DEB §22, 25; Dumville 1984a, 83; Woods 2010, 227)[1].

[1] Scholarly consensus is lacking on the historicity and social and economic impact of 5th-century outbreaks of plague in Britain (Todd 1977; Wacher 1974, 414–22). Scientific and written evidence indicate that *Yersinia*

References to plague or pestilence at this time are also found in later sources, notably the 9th-century *Historia Brittonum* which appears to draw on the same sources as the *Annales Cambriae* (Charles-Edwards 2013, 346–59), and (for Wales) there is also a reference to an undated early medieval epidemic in *Cognatio Brychan*, a 13th-century text of possible 10th-century origin (Thomas 1994, 139; Petts 2007, 167).

Overviews of this evidence for Anglo-Saxon areas are provided by John Maddicott (2007) and for Ireland by Ann Dooley (2007). The presence of plague in Wales and the west of Britain has attracted little scholarly enquiry, and we therefore set out here such evidence as is available and present it within the larger picture for Britain and Ireland. We must start by noting that the use of the Irish and Welsh annals is complicated by the recognition that their 6th-, 7th- and early 8th-century sections were all compiled retrospectively from the same early, lost source, the pre-740 version of the Iona Chronicle which was incorporated after 740 in the Chronicle of Ireland, the parent version of the surviving Irish annals (Charles-Edwards 2006, 7–9; Flechner 2013, 425; McCarthy 2018, 152, 155). The Iona Chronicle provided a record of contemporary events from c 563, with earlier events entered retrospectively. In the discussion that follows we will refer to the reconstructed common text of the Chronicle of Ireland (Charles-Edwards 2006), and to the earliest, 10th-century, version of *Annales Cambriae* (Hughes 1980, 67–8; Morris 1980).

The presence of multiple retrospectively-created records that all draw on the same source affects the utility of some earlier scholarship on the plague (eg Bonser 1944), and is particularly problematic for Wales where no locally-based account exists before *Annales Cambriae'*s contemporary accounts begin in the late 8th century (Guy 2015, 26–7, 55). These Welsh annals were expanded retrospectively in the 10th century, drawing heavily on the Chronicle of Ireland for earlier sections and, for much of the 7th- and 8th-century content, on a lost North Britain chronicle that is also used by *Historia Brittonum* (Evans 2011, 28–38; Charles-Edwards 2013, 355–59; Guy 2015, 30, 44). This retrospectively-constructed framework incorporates some references to Welsh events drawn from other

Pestis was probably endemic in Europe and Asia by Late Antiquity; Greek and Roman authors also refer to other non-plague epidemics (Eisenberg and Mordechai 2019, 176–77; Little 2007, 4). The reference to the 'plague' or pestilence in chapter 22 of *De Excidio* appears alongside other forewarnings, including raids by the Picts and Scots and the arrival of the Saxons, which were used by Gildas to construct a didactic prophetic narrative (Perkins 2010, 100–1). Thus, whilst notionally set in the 5th century, it is likely that these events had parallels in Gildas' own time (cf Sims-Williams 1983, 19).

uncertain sources, notably the only specific reference to the 6th-century plague in Wales, the *Annales Cambriae* record for 547 (549 in the original chronologically-biased text) of the death from the *mortalitas magna* of Maelgwn, king of Gwynedd (Hughes 1980, 90–1; Morris 1980, 45; Charles-Edwards 2013, 352–53). This entry appears to have reworked the Chronicle of Ireland's entry for a plague outbreak in 549, substituting Maelgwn's details, and cannot be taken as a genuine record of the plague in Wales, however likely it is that Wales was, like Ireland, affected at this time (Dumville 1984b, 53–4; Charles-Edwards 2006, 99). There is also an earlier entry for the year 537 that John Morris (1980) translates as 'and there was plague in Britain and Ireland', although this may refer to a well-attested famine at this time given the use of the term *mortalitas* (death) rather *mortalitas magna*[2].

The Irish annals provide a more certain but sparse 6th-century record of events, with the Justinianic plague probably underlying the references to the *mortalitas magna*, *blefed* and the *crom/buidhe chonaill* in 545 and 549; there is also a reference to a pestilence called *samthrose*, possibly smallpox, in 554, and a reference to *scintilla leprae* in 576, thought to be not leprosy but some other infectious scaly skin condition (Charles-Edwards 2006, 97, 99, 101; Dooley 2007, 215, 217–19; Grace 2018).

Information about the 7th-century pandemic is clearer, with detailed accounts from Bede and Adomnán that largely relate to Anglo-Saxon areas but provide a comparative perspective on the more limited Irish and Welsh annals. Two significant waves are identified, the first between 664 and c 666 (somewhat longer in Ireland), and the second between 684 and 687 (Maddicott 2007, 177–78). The first of these, which Bede's account clearly identifies as bubonic plague, begins with a record of its appearance in Ireland on 1 August 664 (Charles-Edwards 2006, 154; Dooley 2007, 218–19; Maddicott 2007, 183). This date may be significant since August 1st was, in Ireland, a time of large gatherings for the Lugnasad festival, of which the fair of Tailtiu, presided over by the high kings of Tara, was one of the most important (Swift 2000). The deaths of the joint kings of Tara in the subsequent epidemic, and also of a number of the kings and nobles of their subject peoples, are probably linked to their presence at this gathering whose wide attendance, very likely

[2] This entry, unlike the 547 entry, is one of a small number that do not appear to derive from the Irish chronicles (Hughes 1980, 91). It may relate to the widespread evidence for famine and crop failure in 536 and 537 that is linked to dust-veils caused by the volcanic eruption of 536 (Moreland 2018; cf Charles-Edwards 2006, 94).

including overseas merchants, may have made it a superspreading event (Dooley 2007, 220).

In the following year plague is present across Ireland and England, with many deaths of Irish bishops, abbots, kings and others, and estimated mortality rates for English monasteries of 25–50% (HE 3:23, 149; 3:27, 161–62; Maddicott 2007, 175–78, 190). In Ireland this outbreak lasted for some five years, with the Chronicle of Ireland mentioning outbreaks of the plague in 664, 665, 667 and 668 (Charles-Edwards 2006, 155, 156, 157). After an outbreak of *bolgach*, probably smallpox, in Ireland in 680, the epidemic returned again in force in 684 and, Bede says, affected many of the kingdoms of Britain *(*HE 4:14, 195; Charles-Edwards 2006, 163; Maddicott 2007, 176–77). Adomnán notes that 'everywhere' in Britain and Ireland was affected apart from the peoples of Pictland and 'the Irish who lived in Britain'- possibly the inhabitants of Dalriada, though he does not use that term (LCol 2:46, 203). In Northumbria he describes seeing whole townships stricken, and Bede notes that on previously crowded Northumbrian estates 'only a small and scattered remnant, and sometimes none at all, remained' (LCuth 33, 259–61; LCol 2:46, 203; dating from Maddicott 2007, 177).

One of the individuals affected was a Welsh king whose death is mentioned in an *Annales Cambriae* entry for 682 that is not an obvious borrowing from the Chronicle of Ireland. This entry, the only specific mention of the 7th-century plague in Wales, records the death from the *mortalitas magna* of Cadwaladr king of Gwynedd, a death which *Historia Brittonum* attributes to the 664 outbreak (Morris 1980, 46). Scholarly opinion supports the 682 date, but the discrepancy highlights the problems of the material (Charles-Edwards 2013, 355–56).

To illuminate these fragmentary and discontinuous references, we can turn to the Cambridgeshire excavation at Edix Hill where ancient DNA analysis (Keller et al 2019) provides crucial confirmation of the presence of plague in 6th- (or possibly 5th-) century England, a time and place for which no contemporary records of plague exist. This identifies, for the first time in Britain or Ireland, the presence of the plague bacterium *Yersinia pestis*. It was found in four individuals in the cemetery of a small community of some 50–65 people (Keller et al 2019, Appendix SI, 9–10), dated by artefacts of the first half of the 6th century AD and by a radiocarbon date for one burial of 474–637 cal AD (1497±24 BP, MAMS38612);

the possibility of a pre-Justinianic date is not incompatible with evidence elsewhere for the presence of plague from prehistory onwards (see footnote 1, above). The presence of plague in 18% of the sample of burials (4 positive from a total sample of 22; the whole cemetery comprised 149 individuals) attests to the severe consequences of an outbreak for rural communities.

It is possible that the impact of similar outbreaks in Wales and the west of Britain may, in various ways, have been equally profound. Ewan Campbell (2007, 132) has suggested that the outbreak of the Justinianic plague in the 540s may have impacted on the trading systems that brought to Britain the imported material that we find in hillforts, and he observes that 'it may have been that the Byzantine merchants killed off their clients, especially the nobility at sites such as Tintagel'. If rulers were not actually killed by the plague, the disruption of international trade could have undermined their economic supremacy, whilst failure to protect their realm from natural disasters could affect ideological authority (Jaski 2000, 58). The resulting political instability may very possibly have brought about the abandonment of some hillforts but some sites would be expected to continue later. Moreover, the historical and archaeological evidence does not support complete collapse of elite power, and hence more nuanced models must be considered.

CLIMATE CHANGE

Climate change is frequently offered as an explanation for early medieval social and economic change (eg Cheyette 2008; McCormick et al 2012; Büntgen et al 2016), but information about it at individual sites in our databases is, like evidence for plague, lacking. As will be seen, data for other sites in the study region show only limited indications of a climate downturn, and agricultural indicators that show pastoralism being favoured rather than arable production are thought to be primarily influenced by economic adjustments rather than climate change. Most significantly, the pollen data, considered below, shows no correlation between activity levels in the landscape and at hillforts and corn-drying kilns, with reduced 5th- and 6th-century agricultural indicators when activity at hillforts and corn-drying kilns is peaking, and an increase in arable production in the 7th and 8th centuries when hillfort and corn-drying kiln activity is declining. In brief, climate change does not seem to explain the lasting fall-off in corn-drying kiln and hillfort activity.

This conclusion arises from an assessment of the evidence for climate change in the study area, which - like social structures and agricultural regimes - shows regional variability. Unquestionably, a range of climate proxy data shows that, across Europe, the middle of the 6th century was marked by a worsening of the climate, with a shift to wetter and cooler conditions that is variously termed the 'early medieval climatic anomaly' (the term that is used here), the 'Late Antique Little Ice Age' and the 'Dark Age Climatic Deterioration' (Blackford and Chambers 1991; Hoffmann 2014, 67–71; Coyle McClung and Plunkett 2020, 13–15). Recent work on tree ring data from the Alps and Altai Mountains dates this cold phase to AD 536 until approximately AD 660 and links its onset to large volcanic eruptions in 536, 540 and 547 which triggered an 'abrupt summer cooling' that was sustained by oceanic feedback mechanisms (Büntgen et al 2016, 232; cf Fig 6). The Old World Drought Atlas shows wet phases in Europe from the mid-6th to the late 7th centuries, and from the mid-8th to the mid-9th centuries (Coyle McClung and Plunkett 2020, 15, quoting Cook et al 2015). The onset of this period of cooling — the AD 536/7 volcanic eruption and resulting dust veil and harvest failure — has been proposed as a trigger for the initial spread of *Yersinia Pestis* that sets the scene for the Justinianic pandemic (Newfield 2016), and there are suggestions, noted below, that the ensuing climate anomaly may have added to the societal impact of the pandemic.

In Britain, indications of this 6th-century climate downturn are somewhat muted, with peatland wetness records for northern Britain showing relatively stable conditions in the 6th century, and only modest increases in wetness compared, for instance, to the 4th and 8th centuries (Fig 6; Rippon and Fyfe 2018). For Wales, the pollen record suggests a wetter phase in the 5th and 6th centuries AD, although this is a picture largely derived from upland cores with few absolute dates, wide sampling intervals and a consequent lack of chronological precision (Davies 2019, 176, 179, 184, figs 10.2a–b). In Ireland, a substantial body of climate proxy data shows wetter (albeit apparently not cooler) conditions from the mid-6th century until c 800, and growth downturns in the Belfast Oak tree-ring data at AD 536 and AD 541 (Swindles et al 2013; Coyle McClung and Plunkett 2020, 12–15).

Wetter but not necessarily cooler conditions for 6th-century western Britain therefore seem likely, but the impact of this on agriculture and other human activity is a separate question. Different social and agricultural regimes, variations between different

European climate zones and the problems of interpreting historical sources mean that research in one region may not readily transpose to another (Hoffman 2014, 26–7, 43; Degroot et al 2021). Causative models posited on environmental determinism risk overlooking human factors, while 'catastrophism' ignores longer, more subtle processes of change (Wickham 2005, 13, 548–49; Moreland 2018, 105–6; cf Mordechai et al 2019, 25553). It is notable, therefore, that British and Irish evidence, reviewed below, provides only limited support for arguments that link the early medieval climatic anomaly to the transformation of agriculture and settlement in the post-Roman Mediterranean landscape (Cheyette 2008) and to major societal transformations in the Mediterranean area, the Middle and Far East, and Central Asia (Eisenberg and Mordechai 2019, 171–73 for summary; eg Büntgen et al 2016).

In south-west England, pollen data from both upland and lowland sites shows an open, pastoral 5th- to 7th-century landscape that, with its small-scale cereal cultivation, is substantially unchanged from the Iron Age apart from some high altitude scrub regeneration (Rippon and Fyfe 2018). Here, as in Wales, a system of mixed agriculture allowed a 5th-century downshift to self-sufficiency with more emphasis on pastoralism when urban markets and Roman military demands disappeared. The significant period of change for this landscape comes in the 7th to 9th centuries, when dramatic increases in cereal pollen mark the appearance of convertible husbandry with its flexible integration of pastoral and arable agriculture (Rippon, Fyfe and Brown 2006; Rippon and Gould 2021, 104–13, tab 4.1). A largely open, pastoral landscape is also seen in the Welsh upland pollen data, albeit with the 5th and 6th centuries showing both arable and pastoral contraction. In the 7th and 8th centuries, when hillfort and corn-drying kiln activity in the region are declining, pastoral activity in Wales is stable, and there are clear indications of increased arable activity (Davies 2019, 180–87, fig 10.3a-b).

The overall impression is that pastoral activity in post-Roman Britain continued largely unabated from earlier periods, with recent overviews seeing the early medieval decline in arable production as an economic adjustment that pre-dates the climate anomaly (Rippon and Fyfe 2018; Rippon 2019, 21–2; cf Faith 2009). Similar observations — identifying changes in agricultural practice as primarily socially driven — are offered in recent Irish work, albeit with the observation that the mid-1st millennium climate change

may have encouraged a 'shift in emphasis' to pastoral farming and cattle ownership as a measure of wealth (Coyle McClung and Plunkett 2020). Further arguments against the early medieval climate anomaly as a major determinant of human activity are provided by a detailed palaeoenvironmental investigation of the agricultural landscape around Rhynie (Aberdeenshire), which is unique for its comprehensive examination of the milieu of two hillforts and an enclosed settlement complex with 3rd- to 7th-century occupation evidence (Jones et al 2021, 908–9). The abandonment of these sites in the 6th century AD is not reflected in the environmental data, other than in a short-lived decline in cereal-type pollen, indicating that the area's agricultural land continued to be actively used despite the cessation in local elite activity (Jones et al 2021, 905, 908, 910). This evidence, in combination with the pollen evidence for Wales and south-west England, suggests that the abandonment of hillforts cannot be assumed to signal periods of agricultural contraction, which in turn show (at most) an uncertain relationship with climate change.

CORN-DRYING KILNS AND CLIMATE CHANGE

Comparison of the corn-drying kiln and climate change evidence certainly shows that we cannot assume simplistic causal connections. The archaeobotanical evidence, showing use of the kilns mainly in the later stages of grain processing, suggests that it is unlikely that the 6th-century peak is attributable to drying damp harvests during the early medieval climatic anomaly. The fact that the Irish increase in corn-drying kiln use begins during a notably dry period in the 3rd to 5th centuries AD also discourages this conclusion (Timpany et al 2011, 80; Monk and Power 2012, 39; Coyle McClung and Plunkett 2020, 12–13). Another possible interpretation, that their declining incidence marks a climate-related reduction in crop-growing activity, is contradicted by the pollen evidence for increased arable activity in the 7th and 8th centuries. We do of course have to be alert to the possibility that low numbers of excavations may distort the Welsh picture here: in Ireland, where many more excavations have taken place, there are some signs of an intensification of corn-dryer kiln activity in the 8th century, before a pronounced activity decline after AD 800 (McCormick et al 2014, 27, fig 27).

There is also the question of whether the changing numbers of kilns reflect an adaptation to wetter climate conditions via changes in the grains being grown. Their assemblages are dominated by wheat (mainly spelt) in the Romano-British period, by barley

in the 5th to 6th centuries, and then — from the 7th century onwards, when kiln numbers reduce — by oats (Fig 7; Comeau and Burrows 2021, 128–30, fig 9A). Both barley and oats are well-adapted to the damp cool conditions of western Britain, and benefit from kiln-drying before milling and (in the case of oats) before storage (Wiliam 1977, 15; Monk and Power 2012, 40), so it is difficult to attribute the drop in corn-drying kiln activity to climate-related changes in grain cultivation.

The reason for the change in grain assemblage composition must lie elsewhere, and the most likely reason may be a reduction in a particular pattern of kiln usage that is not related to climate. Barley was the malting grain of choice for many medieval brewers, while spelt — on the evidence of archaeobotanical records — was commonly used for malt-making in the Roman period (Lodwick 2017, 64; Comeau and Burrow 2021, 116). The changing contents of corn-drying kilns, combined with the drop in kiln numbers, may indicate less malt-making (and consequently brewing) activity after the 6th century AD. The most likely reason for this would be a reduction in the scale or incidence of feasting activities, which can be viewed in the context of, perhaps, a lessening in use of some hillforts as assembly sites and ceremonial centres, together with the ceramic evidence for their abandonment at around the same time as corn-drying kiln activity declines.

POPULATION DECLINE

There is of course the possibility, noted earlier, that a drop in population lies behind this activity fall-off. In Ireland population decline is suggested as one possible reason for marked changes in radiocarbon datasets for a number of different types of archaeological activity (Hannah and McLaughlin 2019; Hannah 2021). These show that activity in the landscape reaches its maximum at c 680–700, declining thereafter to only half of its maximum level by the time of the Vikings. A general population decline in late and post-Roman northern Europe is supported by recent research (van Lanen and Groenewoudt 2019; cf Wickham 2005, 312), although the demographic impact of plague and its effect on social and economic activity are contended (Mordechai et al 2019; Sarris 2021, 27–8). Recent big-data palaeoecological research supports these concerns and reveals considerable variation in the impact of plague across Europe in the 14th-century Black Death pandemic (Izdebski et al 2022).

It is against these qualifications that we must view the question of whether a general population decline might account for the fall in hillfort and corn-drying kiln activity in Wales and western Britain, either on its own or via a reduction in assembly or ceremonial activity. Although no contemporary sources here provide specific descriptions of the impact of the plague, it is clear from Bede's and Adomnán's accounts of England and southern Scotland and from references in the Irish Annals that ecclesiastical communities, royal courts and rural hamlets all suffered in the late 7th-century plague, while the presence of plague in undocumented 6th-century rural communities is shown by the *Yersinia pestis* genomes identified at Edix Hill. However, although widespread, the plague was not, from Adomnán's account, present everywhere, with northern Scotland apparently escaping the 7th-century outbreak (LCol 2:46, 203). Interestingly, there is considerably more evidence for post-7th century activity at hillforts in northern Scotland (Noble 2016, 30–1), and (as already noted) the palaeoenvironmental evidence for Rhynie shows no sign of a 7th-century lessening in agricultural intensity, apart from a short-lived 6th-century reduction in the arable pollen signature.

For Wales, a lack of detailed lowland pollen work restricts understand of the agricultural contraction seen in the largely upland 5th- to 6th-century Welsh pollen record. If there was some depopulation, its impact on the settlement archaeology may have been localised and short term (cf Beresford 1983, 158–67; Sarris 2021, 26; Izdebski et al 2022). In south-west England, as at Rhynie, the abandonment of many smaller early medieval rural settlements around the 7th century is not reflected in a reduction in pollen indicators of agricultural activity (Rippon and Gould 2021, 105–6, tab 4.1). Assessments of landscape activity are however complicated by the poor chronological resolution of some pollen studies, which may fail to pick up slight changes, and by the possibility that landlord and food tribute pressures to maintain agricultural production may mask localised population declines. Nonetheless it is noteworthy that the existing data for Wales displays no correlation between activity levels in the landscape and at hillforts and corn-drying kilns, with the pollen record showing reduced 5th- and 6th-century landscape activity that coincides with the peak period for activity at hillforts and corn-drying kilns, and a revival in landscape activity in the 7th and 8th centuries that coincides with the decline in hillfort and corn-drying kiln activity.

SOCIAL CHANGE

The context for the decline in hillfort and corn-drying kiln activity may therefore be more complex than population decline exacerbated by a climate downturn, though there may have been some localised short-term instances of this. A potentially relevant perspective is offered by discussions that point to the possible effect of plague on social and religious attitudes (Little 2007, 26–8; Stoclet 2007; Meier 2016). Considering primarily the Mediterranean area, these suggest that a 6th-century intensification of religious fervour in the face of plague may have contributed to the rise in the cult of the Virgin Mary, the veneration of religious icons, the sacralization of the emperor and the embedding of religion in all aspects of social life. In Ireland, prayers of this period show that plague was feared as much as war (Dooley 2007), while 7th-century sources in Britain describe contrasting responses: for some there is a reversion to pre-Christian practices (HE 3:30, 167; 4:27, 223), while for others there is increased Christian piety and renewed evangelical fervour in the face of apostasy (LCuth 33, 261). The climate event of AD 536–7 may have had similar impacts on the psyche, and David Woods (2010, 232) has suggested that Gildas was inspired to publish his diatribe on the sinfulness of his contemporaries by a 'dense cloud and black night' that may be interpreted as a dust veil or fog produced by a volcanic eruption.

Christianity reached western Britain in the late Roman period and the monastic movement was growing significantly in the 6th and 7th centuries (Dumville 1997; Lewis et al 2022) . Here, we might tentatively identify two manifestations of increased piety that — arguably — might have been intensified by plague and the AD 536 event: the foundation of monasteries and donations of land to churches, and the suppression of festivals of pre-Christian origin. Burial practices in the study area, which are unfurnished, do not change at this time (Lewis et al 2022, 29–30). The period is marked, here and elsewhere in Europe, by the development of churches into large landowners (Davies 1978; Wood 2022), and the royal land-gifts that signal the growth of ecclesiastical estates in south Wales begin, in the view of a recent reappraisal, in the 7th century (Sims-Williams 2019, 54, 59). One might therefore ask whether some hillforts went out of use on monastic land because they were no longer part of the seasonal circuits (including hunts) of rulers and their entourages. Such consolidation, of course, does not imply that land went out of cultivation: the Rhynie evidence shows how land exploitation can be unaffected when local elite central places fall

out of use. It is these local elite centres, with their gatherings and feasts, that the hillforts and corn-drying kilns in our study represent.

Similar effects, of course, might have resulted from the consolidation of secular territories, with bigger territories producing a reduction in the number of focal places that were visited on circuit. Wendy Davies (1978, 93–4) argued for political consolidation in south-east Wales from the later 7th century, and this has been posited as a factor in the abandonment of Dinas Powys (Seaman and Lane 2019, 130). Comparable political consolidation cannot be seen across the whole of the west however, and some sites may have continued in use. There was also probably intensified exploitation of upland pasture by monastic houses whose granges were, from the evidence of later records, sources of hospitality for visiting royal hunts and circuits (Smith 1998, 220–21).

Transfers of estates to churches may also have affected corn-drying kiln activity via a subsequent reduction in the ale component of their food rents, if malt-making activity declined in areas where ascetic ecclesiasts eschewed alcohol. The bread and water diet of some 6th-century British monks is noted by Gildas (LL 3, 80), while the late 7th-century *First Life of Samson of Dol* (see below) has an account of the saint's time in south Wales that extols the virtues of abstinence and the perils of intoxication (Taylor 1925, 22, 39). These references are localised and it is actual practice (not just normative) that is referred to. There was however variability: while the monks of St David and St Teilo were teetotal, the 7th- and 8th-century Llancarfan and Llandaff renders include ale (Sharpe and Davies 2007, 113, 127, 143; Charles-Edwards 2013, 246, 273, 277, 281–82).

The other manifestation of increased Christian focus at this time is the suppression of previously-tolerated festivals of pre-Christian origin (Blair 2005, 10; Knight 1999, 120; cf Petts 2011, 38–9). The association of pre-Christian religious sites with hilltops and hillforts is well-attested (Woodward 1992, 17–19, 22–6; Semple 2013, 70–1). Indeed, it is likely that post-Roman activity at some hillforts included cultic practices associated with kingship and inauguration (Noble and Evans 2019, 78–80). The evidence for this is strongest in Ireland and Scotland at sites such as Tara and Lagore (Co. Meath), Rhynie, and Dunadd (Argyll & Bute), but has been argued for in a Brittonic context at Trusty's Hill (Dumfries & Galloway) and may also be evidenced by the ceremonial axe-hammer from Cadbury Castle (which is similar to that carried by 'Rhynie man') and evidence for cremation at Tintagel (Alcock 1995,

75; Barrowman et al 2007, 43; Toolis and Bowles 2017, 135–49). We may suggest that such activity became anathematic in the heightened Christian environment of the 7th century and hastened the move away from hillforts. It is noteworthy that the defences of several hillforts, including Dinas Powys, Gunwalloe (Cornwall), Raddon (Devon), and Glanfred (Ceredigion), appear to have been deliberately backfilled at the time of their abandonment and we may speculate whether this was associated with the formal 'closing' of these sites.

Written sources that attest to these processes include the late 7th-century *First Life of St Samson of Dol* (Olson 2017, 15–16), which describes how the 6th-century saint challenged and suppressed a hilltop ancestral celebration in Cornwall that involved horse races around a standing stone, and brought an end to longstanding New Year celebrations in the Channel Islands (Taylor 1925, 49, 75; Flobert 1997). Another encounter with a pagan festival, this time in northern France, appears in the 6th-century *Vita Sancti Paterni* whose narrative structure is followed by the Samson *Life*, though the events differ in detail (Brett 2017). Whether or not these events are rooted in actual events, as shared topoi they reflect the concerns about lingering attachments to pre-Christian practices that are expressed by the Council of Tours (567) and the Diocesan Council of Auxerre (560–605), with the former noting that 'Some still hold fast the old error, that they should honour the 1st of January. Others, on the festival of the See of Peter, present meat offerings to the dead, and partake of meats which have been offered to demons. Others reverence certain rocks, or trees, or fountains, etc. The priests should root out these heathenish superstitions' (Hefele 1895, 393, 410; de Clerq 1963, 175-199, 264-272; Knight 2007, 122).

Processes of sanctification of prehistoric sites may be indicated by Samson-names attached to standing stones, wells, mounds and chambered tombs in south-west Wales (Comeau 2020, 144). The date of Samson's festival, July 28th, hints at a religious refocusing of the August 1st festivals of Wales that survived in a shadowy form into the 19th century as a day for upland shepherds' festivals and riotous hilltop gatherings where temporary festival houses were burned (Comeau 2020, 22–3). In Cornwall, a tradition of August 1st assemblies persisted in the parish abutting Chun Castle hillfort where post-Roman activity most likely associated with assembly is attested (MacNeill 1962, 381–5; Alcock 1971, 209–12). Medieval Welsh legal sources indicate that August 1st was, with February 1st, May 1st, and November 1st, one of four key points in the pre-Norman year, manifested in a clustering of key legal,

agricultural, hunting and food rent events (Comeau 2020, 74–7). These are the cross-quarter days, the times of gatherings that are known as Imbolc, Beltane, Lugnasad (celebrated at Tailtiu) and Samhain in Ireland. The Irish Lugnasad August 1st assemblies are explicitly associated with the pre-Christian sun-god Lugh, and associated with hilltop celebrations which were often refocused as festivals of St James (Gleeson 2012, 22; MacNeill 1962, 19–20, 385–87, 418).

The possible Christian appropriation of these festivals in Wales is shown by patterns of rural church dedications that, for early medieval British saints, show strong clustering around these cross-quarter gathering times (Comeau 2020, 153). These are saints said to have been active in the 5th to 6th centuries, like Gildas whose own feast day is on January 29th, strikingly close to the February 1st cross-quarter day[3]. These associations are also evident for the 5th- to 7th-century corn-drying kilns (Fig 2), with 8 of the 11 kilns lying within 4 km of recorded early medieval ecclesiastical estates or churches (Nevern, Llandeilo, Llandough, Caergybi/Holyhead (2 sites), Llangyfelach, Llanddowror; Llandeilo Talybont), all but one of which are linked to early British saints with cross-quarter day festivals. Two of the sites with no recorded early medieval ecclesiastical associations are in the area of a later medieval church with a cross-quarter dedication.

Lack of records makes it difficult to identify when these saints' festivals were established, but the coherence of the overall pattern makes a date close to the establishment of their cults more likely than a later date. This process might, at some places, have had little effect on site activity, with gatherings continuing under a Christian rebranding, a process that is explicitly recommended in Pope Gregory's letter to Mellitus of AD 601 (HE 1:30, 57). However, although in Ireland Christianity clearly adapts itself to the 'indigenous iconographic repertoire' (Gleeson 2012, 24; cf Gleeson 2020), in western Britain there may sometimes have been more outright opposition, judging from Samson's reaction to the festivities in Cornwall and the Channel Islands. This reflects, perhaps, a mood of 'increasing ascetism' in the late 6th-century western churches, to which Gildas' writings were central (Sharpe 1984, 199).

[3] We are grateful to Alex Woolf for this observation.

Such attitudes may also have had a marked effect on use of upland hillforts. These, given inhospitable winter conditions and the timing of hunting and transhumant activities, were more likely to have been frequented in summer than in winter, notably for August 1st gatherings. We might also reflect on the possibility that the observed coincidence of a traditional festival with a plague outbreak (as at Tailtiu) could have been interpreted as a sign of divine disapproval.

CONCLUSION

Is there, then, a connection between declining activity at hillforts and corn-drying kilns on the one hand, and plague and climate change on the other? As grand narratives, both plague and early medieval climate change raise questions, not least about their relevance to an area like western Britain that is distant from the Mediterranean region where these narratives were initially framed. There is also limited consensus on their overall impact, even within the core Mediterranean zone. We need to be careful, accordingly, about how we apply such arguments. Covid-19 and 21st-century climate change show a variable geographical impact and remind us that we cannot assume that models drawn from one area will also apply to another area. Certainly, the early medieval evidence for western Britain is less than clear cut. Contemporary documentary records of plague are vanishingly rare, and no bioarchaeological markers of its presence are shown here at present. The landscape evidence (provided largely by upland pollen) offers little explanation for the abandonment of hillforts and the reduction in activity at corn-drying kilns, with the peak period of hillfort activity coinciding with the period of maximum potential disruption from plague, and the reduction in kiln use coinciding with increasing arable production. In Britain, neither climate change nor any decline in population following plague seems to have had a lasting effect on activity in the landscape that matches what we see for hillforts and corn-drying kilns. The changes that we see in the prevalence of these sites could, we suggest, instead be attributable to a reduction in feasting activity that is linked either to a decommissioning of festival sites with pagan associations, or to local elite central places going out of use through consolidation of political units or land transfers to churches.

The time frame for these changes is given by sources which indicate, from the mid-6th century, ascetism among British monks; from the later 6th century, a rooting out of ‘heathenish superstitions’ that included some communal celebrations; the 6th-7th century

growth of the monastic movement; and the 7th-century start of land transfers to the church in Wales. We can also observe the 5th-6th century floruit of the saints whose festivals eventually colonise the pre-Christian festival times of Wales. From this it is clear that some forms of assembly activity had become anathemic to Christians by the later 6th century, with practices regarded as unchristian being targeted in France by the 560s. Into this framework we can place increasing activity, probably assembly-related, at corn-drying kilns and hillforts in the post-Roman period which shows a sharp drop-off in the later 6th and 7th centuries, and also the Justinianic plague which from 545 onwards must – at the very least – have affected the outlook of those who lived through it, and the (possibly mild) climate deterioration that sets in after 536. There is, given the nature of the sources, some inevitable vagueness in dating of some of these events and processes, but this is not, in context, a major issue, with the time period of the less well-dated written sources falling within the range of probability of the KDE-analysed radiocarbon dates and the loosely dated pollen samples.

Significantly, the changes in hillfort activity and corn-drying kiln use antedate the changes of the long 8th century, and the corn-drying kiln dataset discussed here does not support a narrative that sees them as evidence of one of these changes, increased agricultural production. Instead, the decline in corn-drying kiln activity seen in the later 6th to 7th centuries, together with the reduction in activities at hillforts, may signal the beginning of another driver of long 8th-century social change — the growth of Christianity as a social and economic force. It is possible that the impact of plague on the popular mentalité and on the manifestation of the intensity of Christian belief may have had at least as much effect on social and economic activity (shown in corn-drying kiln activity and hillfort occupation) as the direct effects of disease mortality; and almost certainly more impact, in the medium to long term, than climate change. This should not be a surprise. Rural communities in western Britain practiced adaptable systems of extensive, mixed agriculture that were more focused on food security than the production of large surpluses, and would have been resilient to the effects of climate change. Moreover, current attitudes towards Covid show that individual responses to crises can be highly variable and often influenced by ideologies and reassessments of personal priorities. Such factors, like the locally-variable impact of disease and climate change, can be overlooked in all-encompassing grand

narratives. The datasets presented here provide new and coherent indicators that, we suggest, attest to the complex interaction of such agencies of change in the past, and reflect not a systemic adaptation to material conditions but a shift in social attitudes that ushers in the medieval world.

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Abbreviations

DEB *De excidio Britanniae*

HE *Historia Ecclesiastica*

LCol *Life of St Columba*

LCuth *Life of St Cuthbert*

LL *Lost Letters*

LIST OF FIGURE CAPTIONS

FIG 1

Non-normalised KDE models for A) corn-drying kilns in Wales and B) hillforts in western Britain. Gaussian kernel, 30–year bandwidth, 1000 iterations. Note that B starts from zero density at AD 200 due to the chronological bounds of data collected.

FIG 2

Corn-drying kilns in Wales: sites mentioned in text are numbered. Details of sites are given at <doi.org/10.5284/1085018>.

FIG 3

Hillforts in south-west western Britain with pre-9th century dating evidence; sites mentioned in the text are numbered.

FIG 4

A 5th-6th century corn-drying kiln at Bayvil, Pembrokeshire. *Photograph by Mike Parker Pearson*. *Plan from Comeau and Burrow 2021, fig 1.*

FIG 5

Dating evidence for all kilns in Wales.

FIG 6

Compiled palaeoclimatic proxies for the 1st millennium AD, showing early-medieval climatic anomaly. *Base figure from Rippon 2019, fig 2.3.*

FIG 7

Grain dominance in archaeobotanical assemblages from corn-drying kilns in Wales.