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AD536 – Back to Nature?

Abstract

A spate of archaeological, historical and scientific publications have recently argued that the dust veil from a volcanic eruption (or series of eruptions) caused climatic change which 'forced' significant historical transformations in the middle of the sixth century AD. In this paper, I situate this phenomenon within a more general return to environmental determinism in archaeological explanation, a return which itself needs to be understood in the context of contemporary fears about the devastation to be unleashed by the climatic change we have made, and of the rise of precise measurement in environmental and archaeological science. I don't doubt the reality of the climatic change reconstructed for 536/546 but, given the coarseness of the dating of the historical transformations, I do question the causal connections drawn between the former and the latter. I suggest that for many archaeologists, the 536 event (and similar phenomena) functions much as written texts once did – as both the framework for analysis and as the explanation of historical process.

It is now clear that a 'climatological' event of European, perhaps global, significance took place just before the middle of the sixth century AD. It is not surprising that Klavs Randsborg, with his interest in the historical forces that made European history on a grand scale, was one of the first to incorporate it into archaeological narratives of change and transformation. In his The First Millennium AD in Europe and the Mediterranean (1991), Randsborg had already made connections (not common at a time when (as we will see) the

role of such 'impersonal' forces was eschewed in favour of the idea that Man makes History), between rising temperatures (and drought) in south-eastern Russia and adjacent parts of Central Asia, the 'warlike raiding and migrations' of the Visigoths and Huns into the late Roman empire, and profound 'military, political, and economic development' (1991, 29; also Cook 2013). Randsborg later focussed in on the role of the

> dramatic environmental "events", with severe effects on nature and subsistence (widespread famine) … [that] took place in 536AD and the following decades. … It is likely that the events were also responsible for the so-called "Justinianic plague". Furthermore, "536/546AD" is very close to the current date of the major archaeological change from the Post-Roman or Migration period to the "Merovingian" one in Northern Europe (including changes in animal art styles) and is reasonably close to the beginning of the significant transition from the early to the late Merovingian phase in Central Europe (1997, 198).

Randsborg's attempt to situate the '536-event' in its historical context,(1) to understand the part it played in the historical processes of the time, anticipates much subsequent commentary and debate about it. As we will see, the connections he drew between 536, the Justinianic Plague, 'Dark Age' migrations, and the great cultural/regime changes of Late Antiquity and the early Middle Ages would strengthen as more evidence (both archaeological and environmental) was generated, and as concerns about our own climatic predicament grew.

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1 '536-event' is in scare quotes to signal uncertainty about its status as an event, a single happening. As we will see, there is now strong evidence that it encompasses a series of events. It is also worth noting at this stage that the event recorded in 536 may have had its origins in 535 (see below, p. xx). Having made these points, from here on I will omit the distancing marks but continue to refer to the 536 event.

For Randsborg, environmental factors were only one among many, and never determined social, economic or political developments. For him, such dramatic environmental events existed alongside and (in terms of causation/explanation) were probably subservient to the impact of Scandinavia's changing relationship with the Roman world to the south (Randsborg 1997, 198; also Randsborg 1994; 2015, 132-39; also below, p. xx). As we will see in the pages that follow, in recent times, and despite the protestations of some of those concerned, this has changed, and many discussions of the 536 event (and not just in the popular press/journals) seem to have elevated 'the environment' to a determining role in human affairs. The question at the heart of my enquiry, one (as we shall see) which resonates far beyond studies of European Late Antiquity, is why has this event, or (as Randsborg wisely noted) series of events, acquired such prodigious explanatory power? Is it simply a product of the fact that 'science', through precise measurement, has provided us with a firmer grasp on past reality; that it has dispelled the delusion we have harboured that we (humans) are the agents of our own destiny, and has put us back in our place – within Nature? Does it, perhaps, say as much about the way we construct our narratives about the past, and about our fears forF the future, as it does about what really happened in the skies above Europe, and to the peoples of Europe, in the middle of the sixth century? To address these questions, we must first outline what we think we know about the 'dramatic environmental events' of 536, and consider what transformative power has been ascribed to them – at the local, regional and global scales.

WHAT HAPPENED?

The story of the discovery of what became known as the '536 dust veil' begins in 1983 with a paper by two NASA scientists in the Journal of Geophysical Research. Working through

the classical sources, Richard Stothers and Michael Rampino found, on five occasions (217BC, 44BC, AD472, AD536, and AD626), references to the 'atmospheric veiling and cooling' which they believed were a product of, and markers for, major eruptions of northern hemisphere volcanoes. They went on to stress the significance of the 536 event – suggesting that if it 'was a very distant one (Rabaul, New Britain?),(2) it may have been one of the most explosive in recorded history' (1983, 6357) – and spoke of the unparalleled atmospheric disturbance it produced (1983, 6369). Contemporaries certainly noticed, and recorded, the dust veil. The Byzantine historian Procopius tells us that

> it came about during this year [AD 536-37] that a most dread portent took place. For the sun gave forth its light without brightness, like the moon, during this whole year, and it seemed exceedingly like the sun in eclipse, for the beams it shed were not clear nor such as it is accustomed to shed (History of the Wars IV, 14, 5-6);

while the late Roman senator Cassiodorus lamented its impact -

> We have had a winter without storms, spring without mildness, summer without heat. Whence can we hope for mild weather, when the months that once ripened the crops have been deadly sick under the northern blasts? For what will give fertility, if the soil does not grow warm in summer? What will open the bud, if the parent tree does not absorb the rain? (Variae XII, 25; see also Arjava 2005, 78).(3)

2 See also Baillie 1991, 15. Stothers later argued that the 536 event was probably 'a northern eruption' (1999, 717).

3 Textual records of 'atmospheric disturbances' in the aftermath of the 939/40 eruption of Eldgjá, Iceland, include the following, 'plausibly dated to mid-July 939CE', from the Abbey of Monte Cassino, Italy – 'We looked at the sun, it did not have any strength, neither light nor heat. But we saw the sky and the colour [or

Stothers and Rampino found further evidence of this impact (and of other recorded 'dry fogs') in the presence of acid layers in Greenland ice cores at c.260±30BC, 201±30BC, 50±30BC, AD 540±10, and AD623±3 (1983, 6369; also Stothers 1999; Baillie 1999, 54-55).

By 1999 Stothers had begun to work through in detail the possible impact of these volcanic dust veils noting, for example, that in the first winter after a large eruption continents may actually be warmer before cooling sets in (1999, 713, 716),(4) and that stratospheric 'ash' clouds from tropical eruptions can cover the whole globe, and could therefore leave their 'acid' mark in both the Greenland and the Antarctic cores (1999, 716). More importantly, perhaps, he amplified the destructive force of the 536 event, its role as a driver of the historical process, by linking it not just to famine, but also to plague – the so-called Justinianic Plague which first appears in our sources in 541 (Little 2006; also Harper 2017). At that point (1999) the causal link was vague, nothing more than an assumed increased prevalence of the 'moderately chilly and wet weather associated with plague', the delay in the onset (between 536 and 541) of the second of these linked-cataclysms being regarded as a product of the time it took for plague to spread from either central Asia or north Africa (Stothers 1999, 720; also below, p. xx).(5)

In the same (millennial) year, Richard Keys published Catastrophe in which he presented the 'incontrovertible' case for 'a mid-sixth century climatic catastrophe' (1999, viii). For him too,

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'appearance'] of it changed, as though viscous. And others said that they saw the sun as though half' (cited in Oppenheimer et al. 2018, 375).

4 Sigl et al. found that

> strong post-volcanic cooling was not restricted to tropical eruptions; it also followed Northern Hemisphere eruptions, with maximum cooling in the year of volcanic-sulphate deposition. In contrast to the average of the 19 largest CE tropical eruptions, however, the Northern-Hemisphere-only eruptions did not give rise to any noticeable long-term cooling effect (2015, 5)

5 More recent biological modelling based on early 20th-century plague cases in Kazakhstan has resulted in the argument 'that periods of high plague activity should have a degree of correlation with increased precipitation', and to the suggestion that 'the first (Justinian) pandemic started during a period of higher than median plague activity in wild rodents' (Kausrud et al. 2010, 7; also Harper 2017, 219; McMichael 2010).

a massive volcanic eruption (at Krakatoa, no less) was the culprit. This super-eruption injected vast quantities of super-fine hydro-volcanic ash and sulphur into the stratosphere. The ash soon fell back to earth, but the sulphur dioxide interacted with the atmosphere to form sulphuric acid which

> condenses spontaneously under stratospheric conditions to form particles. These particles then grow from a few millionths of a millimetre across to less than one thousandth of a millimetre across but their enduring small size enables them to stay aloft in the stratosphere for months (Oppenheimer 2011, 58; Stothers 1999, 714; Keys 1999, 293; Baillie 1999, 49).

Carried on the earth's weather systems, these volcanic aerosols had a potentially world-wide geographic reach, and a longer-term impact on climate - they reflected and scattered incoming solar radiation, potentially leading to dramatic cooling (Ferris et al. 2011).

Also in 1999 (surely no coincidence!), Mike Baillie, a dendrochronologist from Queen's University, Belfast, published his Exodus to Arthur, in which he revealed the impact of such cooling on tree-growth in Ireland, across Europe and in north America. The European oak master chronology demonstrated that 'there was very little lead-in to the start of the AD536 event', when oak growth, on average was only c.85% of normal. Importantly, Baillie pointed to note an apparent recovery in the next two years, 'with the real "crash" taking place in 540-1' (1999, 6). Baillie did not doubt that this reduced growth was caused by a dust veil, but he had very different ideas about the 'trigger'. Focussing on some uncertainties about the dating of the 536 event in the Greenland ice cores (1999, 86-88), he went on to cast doubt on the existence of a sulphate layer at that point - and so on the volcanic source proposed by Stothers, Keys and others. The (then) apparent absence of similar layers in the ice cores from the Antarctic fuelled his argument that an equatorial volcano could not have triggered the climatic changes recorded in the tree-rings (above, p. xx). Rather, he

suggested that, sometime around 540, the Earth had 'some interaction' with a comet or its debris, producing the dust veil recorded in the Mediterranean sources (1999, 13).

The scientific evidence has proliferated in the last 20 years, and both the dating of the ice cores and the measurement of sulphur deposits has become much more refined (Sigl et al. 2015, 4). Although one research team claims to have found traces of small extra-terrestrial ferrules in polar ice-cores, and evidence for a comet impact site in the Gulf of Carpentaria (northern Australia) (Abbott et al. 2014), the evidence has moved decisively in favour of a volcanic trigger – or rather triggers. In 2008 L. B. Larsen and colleagues found evidence of sulphate deposits in both Greenland and Antarctic ice cores, suggesting a global atmospheric veil, at AD 533±2 years, the product, they argue, of a 'large explosive, near equatorial volcanic eruption', and the cause both of the dust veil lamented by Cassiodorus in 536 and of the reduced growth in tree-rings across the world (Larsen et al. 2008, 1). While they don't name their 'suspect' for this eruption, they do locate it in the tropics, and suggest that it was of 'unparalleled magnitude in the last two millennia' (2008, 3). Intriguingly, they point out that, in the Greenland cores, the 533±2 sulphate deposit was preceded by an even larger one dated to 529±2 – and suggest that this was the fallout from an eruption of Haruna in Japan (2008, 3). However, in their efforts to link their work to the accounts of 536 provided in the written classical texts, they rather ignore this earlier eruption.

Mike Baillie brought it back into sharp focus with his argument, based on comparisons with precisely-dated frost rings in bristlecone pines (see Salzer and Hughes 2007, 58), that the ice core evidence for this part of the sixth century has been misdated by seven years (Baillie 2008). Introducing a correction of this order would bring that evidence into line with the tree-ring data, with the initial ('northern') eruption (as evidenced by the sulphate deposits) now being in 535/6, with 'a second reinforcing eruption close to the equator in 540-41'

(2008, 4; also Baillie and McAneney 2015). With this reconciliation in the dating of the relevant section of the Greenland ice-core, and the accepted presence of sulphate signals in those from Antarctica (Traufetter et al. 2004; Ferris et al. 2011), Baillie effectively withdrew the comet argument – as he put it, this new dating removes the need for a 'specific extra-terrestrial vector which was only invoked because of the former total lack of an acid signal in the vicinity of 536-545' (2008, 4).(6)

Baillie's corrected dates were later confirmed by Michael Sigl and colleagues who used chemical anomalies and dated tephra layers to synchronise the sulphate deposits in the Greenland and Antarctic ice cores, and linked them to the tree-ring sequences (Sigl et al. 2015; also Büntgen et al. 2016; Harper 2017, 253; Toohey et al. 2016, 402). They also discovered that climate 'anomalies' produced by major tropical eruptions may have lasted longer than commonly assumed, and suggested that following the 536 event European summer temperatures dropped by between 1.6 and 2.5°C, and again by 1.4 and 2.7°C following the 541 eruption (Sigl et al. 2015, 547-48; Toohey et al. 2016, 406-07; see also Oppenheimer 2018 for the longer periods of summer cooling produced by eruptions of tropical volcanoes). In 2016, Ulf Büntgen and colleagues pointed to the impact of another, 'smaller but still substantial eruption' in 547, and suggested that, together with those in 536 and 541 (an example of what Clive Oppenheimer calls 'machine-gun volcanism'), it brought about an extended cold phase which they labelled the 'Late Antique Little Ice Age' [LALIA] and which lasted from 536 to c. 660 (Büntgen et al. 2016, 1; Harper 2017, 253-54; Oppenheimer 2011, 264).

6 Though in the end he does leave the door slightly ajar – 'if the European ice core workers can prove the 536 dating for their 533–534±2 acidity, in contradiction of the re-dating proposed here, that would leave open the question of what caused the second stage (540–541) of the two stage environmental downturn; an extra-terrestrial vector might not be out of the question' (2008, 4).

WHAT WERE THE CONSEQUENCES?

Some regard the 536 event as, literally, a world-changer. For them, it 'confirms' the collapse of civilisations across the world, supplies a date for this catastrophe, and provides an explanation. It tells them when, and how, world-systems disintegrated, and local societies perished. The Daily Mail reacted to Michael Sigl's 2015 paper by proclaiming that volcano-induced famine and disease pushed the Byzantine Empire to the brink of collapse, paving the way for the rise and dominance of Islam (Mail Online, 9th July 2015). This kind of catastrophism was not confined to the populist press. In 2008, and in response to the apparent discovery of comet impact sites in the Gulf of Carpentaria (Australia) and in the North Sea off Norway, The Atlantic told us that 'The Sky is Falling' and asked why NASA wasn't doing more to prevent a similar catastrophe. New Scientist's summary - 'multiple comet impacts … triggered a "dry fog" that plunged half the world into famine' - was just as apocalyptic (The Atlantic, June 2008; Abbott et al. 2014; Than 2008, 9). In 2010 National Geographic asserted that 'giant meteorites slammed Earth around AD 500' –

> material thrown high into the atmosphere by the Carpentaria strike probably triggered … [an episode of global] cooling, which has been pinpointed in tree-ring data from Asia and Europe. What's more, around the same time the Roman Empire was falling apart in Europe, Aborigines in Australia may have witnessed and recorded the double impact (National Geographic, 3rd February 2010).

Nature preferred volcanoes, telling us that sixth-century famine, cultural conflict and plague, caused by volcanically-driven global cooling, explain why 'They Really Were the Dark Ages' (Nature, 11th March 2008).

Perhaps the ultimate statement of the catastrophist position came, appropriately, at the turn of the millennium, when (as we have seen) David Keys argued that the eruption of a proto-Krakatoa was the driving force in 'bringing the ancient world to a close, and helping to lay the geo-political foundations of our modern one' (1999, viii). For Keys, the 535 eruption was an historical force of unparalleled significance.(7) The climatic disaster it precipitated

> half-destroyed the Roman Empire by unleashing hordes of central Asian barbarians against the Empire's northern borders, by triggering geo-political processes which created Arab pressures on its southern flank, and by causing a series of killer epidemics which drastically reduced its population (1999, 2).

More broadly(!), he links these Dark Age 'horsemen of the apocalypse' (volcano, barbarian invasion, plague) to the rise of Islam, the collapse of civilisations in China, northern, central, and south America, the rise of the Anglo-Saxons and ('because Anglo-Saxon expansion never really stopped' (1999, 130)) to the modern British and American Empires. 536 had, he argued, the effect of 'literally resynchronising world history' (1999, 295).

Recognising the dangers and weaknesses of such deterministic, mono-causal arguments, the authors of some of the serious scientific papers on 536 warn of the dangers of drawing too hasty conclusions about global catastrophe – and then go on to do so (if sometimes in an

7 Note Keys' point that the dust veil witnessed by Procopius and Cassiodorus in 536 was produced by an eruption of Krakatoa that took place in 535. Mike Baillie's argument that 'there was not a shred of realistic evidence for this suggestion [i.e. that Krakatoa was the culprit]' (2006, 62) seems to have been ignored by some (for example Hirschfeld 2006, 25-26), but it is certainly possible that the cause of the phenomena recorded in the classical sources took place in 535 (see also Sigl et al. 2015, 547).

attenuated form). Thus, Ulf Büntgen and colleagues remind us that 'any hypothesis of a causal nexus between the volcanic-induced sixth-century unprecedented thermal shock and subsequent plague outbreaks, rising and falling empires, human migrations, and political upheaval requires caution' (Büntgen et al. 2016, 5), but nevertheless conclude that their newly discovered 'Late Antique Little Ice Age' was an 'additional' environmental factor in driving a range of historical transformations almost as broad as those listed by Keys – 'the establishment of the Justinian plague, transformation of the eastern Roman Empire and collapse of the Sasanian Empire, movements out of the Asian steppe and Arabian Peninsula, spread of Slavic-speaking peoples, and political upheavals in China' (Büntgen et al. 2016, 1).(8)

Büntgen and colleagues go on to present their argument in graphic form, plotting reconstructed summer temperatures and the coldest decades of the Late Antique Little Ice Age (AD 536-c.660) against 'major plague outbreaks, rising and falling empires, large-scale human migrations, and political turmoil' (Büntgen 2016, 4, figure 4 – see Figure 1). The effect is to remove whatever caveats and nuances the written argument may have contained, and to confirm its deterministic nature – if in an 'unspoken', because graphic, manner.

Others have not been so reticent. Michael Sigl and colleagues tell us that volcanic eruptions are 'primary drivers of natural climate variability', and go on to suggest that scientists' refined ability to detect and date fallout from them doesn't just provide an environmental context for 'widespread famine and the great Justinian Plague of 541–543 CE', but supports

8 Similarly, Birgit Arrhenius starts out by noting Ulf Näsman's arguments that 'one should be cautious using catastrophes as explanations for historical developments', and then goes on to do just that (Arrhenius 2013, 1; Näsman 2012).

the idea that they may have been 'causally associated with volcanically induced climatic extremes' (Sigl et al. 2015, 548, emphasis added).

As we shall see, it seems that archaeologists and historians are increasingly drawing on the arguments in these (and similar) papers to 'explain' historical developments, at every level – from the kind of world-wide systems collapse promoted (for example) by Sigl and Keys, through regional transformations, to individual events (even mythical ones). However, it seems to me that the 536 event has most frequently been called upon to explain systemic change at a regional level.

In 2012, for example, David Löwenborg argued that the archaeological and palaeobotanical evidence from southern Sweden (the abandonment of settlements, the termination of burial grounds, and the decline of cereal pollen in pollen cores) points to a demographic crisis – a consequence, he argues, of the 'cosmic event of AD536-7' (2012, 7). He believes that this crisis resulted in widespread land abandonment and, inspired by Milton Friedman's assertion that 'only a crisis – actual or perceived – produces real change' (2012, 3), he argued that elites seized the opportunity to enhance their holdings and their power – and constructed large burial mounds as a physical manifestation of these claims (2012, 9). Southern Swedish society thus emerged from the catastrophe as more highly stratified, with more land concentrated in the hands of emerging aristocracies – and the basis of their power was more firmly located in their control over, their ownership of, land. Some have suggested that the transformation went deeper still and that the post-catastrophe late Iron Age was also characterised by a different belief system.

Morten Axboe pointed out that any dimming of the sun, moon, and stars precipitated by the 536 event might well have been taken by southern Scandinavians as a worrying omen; the subsequent devastation of crops brought about by summer frosts would have made it clear

that disaster really was to follow this 'dreadful portent'. This, Axboe suggests, would have called for 'sacrifice of every sort, including the most precious objects of gold available, to revive the dying sun and ward off the apparently imminent end of the world' (1999, 187; Tvauri 2012, 297). Although Axboe is explicit that he is not here arguing that 536 brought about the end of Migration Period religion (2001, 131; also 1999, 188), and is rather attempting to explain an intensification of pre-existing patterns of behaviour (the sacrifice of gold),(9) some have linked his observations to other manifestations of change in the ritual sphere to make exactly that argument. Neil Price and Bo Gräslund, for example, have suggested that the 536 event brought about a fundamental change in the imagery displayed on Gotland's picture-stones of (the central 'sun-symbol' disappeared) and have argued that, along with the increase in hoarding, this points to a 'major ideological transformation' in southern Scandinavian society (Price & Gräslund 2015, 121). 'After two millennia of continuous tradition', they tell us, 'the use of the sun symbol in Scandinavia comes to an end in the sixth century' (2015, 120; also Gräslund & Price 2012). In their argument the 536 event brought about, 'quite literally, the "twilight of the gods"' (Price & Gräslund 2015, 127) - the old symbols disappeared, tradition was broken, and new practices/representations emerged. Set this alongside the proposed demographic decline, settlement abandonment, and agricultural retreat, and you have dramatic transformations that reached the heart (and soul) of southern Scandinavian societies (see also Tvauri 2014, 30 for an equally catastrophic assessment of the impact of 536 in Estonia).

Narrowing our focus (from the region to the site), Birgit Arrhenius has suggested that the 536 dust-veil caused fundamental changes to the layout and function of the settlement at Helgö, in southern Sweden (Arrhenius 2013). She argues that an open-air ritual area, in use

9 'The fifth-century hoards show that sacrificing gold was a well-established Scandinavian religious custom' (Axboe 1999, 188, emphasis added).

from the later Roman Iron Age, was abandoned at around this time, with cult activities now performed indoors in a large hall constructed in 'the Late Migration Period' (2013, 5, 7) – she wonders if this 'change from outdoor sacrifices to rituals performed indoors was an act caused by the dusty weather' (2013, 11).(10) In addition, cemeteries appear on the site for the first time in 'the Late Migration Period', suggesting that, before this the site was visited only 'on special occasions at sacral events' (2013, 7). She also argues that it is possible that 'two large gold treasures found on the island' were deposited at this time (2013, 12). The explanation for the end of bronze casting, around 530 (the date of the last moulds), in Building Group 3, also invokes the direct impact of the 'cloud'. The character of these buildings, Arrhenius suggests, is typical of areas east of the Baltic, leading her to conclude that the bronze workers came from eastern Europe, and that 'the dust veil may have caused them to quickly return home, leaving all raw materials behind' (Arrhenius 2013, 4). I will return to the significance of this kind of argument at the end, but for the moment we should also note Arrhenius' conclusion that, despite the transformations just recounted, settlement continuity at Helgö was 'never broken', and subsequent developments on the site suggest that recovery from the effects of the cloud was 'rather rapid' (2013, 13). As we have seen, however, some have argued for deeper and more wide-ranging transformations.

At the narrower end of the analytical scale, Andrew Breeze has recently argued that 'a cloud of volcanic ash' from a 535 eruption caused the 'great and calamitous hunger' recorded under the year 537 in the Annales Cambriae. Critically (for him) the account also contains a reference to (the death of) Arthur - 'Gueith Camlann in qua Arthur et Medraut corruere; et mortalitas in Brittania et in Hibernia fuit' (Breeze 2016, 162). He reads this 'mortalitas' as a dust-veil-induced famine which sparked off the series of cattle raids which

10 This is a clear misunderstanding of the nature of 'dust-cloud'. As Neil Price pointed out, 'even at its worst the solar darkness would have simply resembled a tough winter' (2013, 18).

he regards as the basis of 'the battles of Arthur' listed in the ninth-century Historia Brittonum (2016, 158, 171). For Breeze, the 'climatological records show it [the 537 entry and the 'reality' of Arthur] as trustworthy' (2016, 168).(11)

However, even if we accept that this particular famine (if that is what it was) was caused by a volcanic dust veil, this does not create a link with, or establish the veracity of, the part of the entry about the death of Arthur and Medraut.(12) In addition, Breeze's argument that 'the Battles of Arthur' were really cattle raids arising from what were clearly exceptional circumstances is undermined by the fact that there was nothing unusual about cattle-raiding in early Irish and northern British society - it did not need a comet strike, volcanic eruption or atmospheric dust veil to spark them off. The point here is not to deny that a volcanic dust veil in 536 affected crop-growth in Ireland and northern Britain (as we have already seen, it clearly affected the trees), nor is it to minimise the impact of subsequent food-shortages. It is rather, to highlight the use of 536 as a fixed point (and explanation) from which tenuous links are spun in an attempt to turn myth into history. This focus on (almost the need for) 536 as a fixed point is, in fact, symptomatic of the way it has been marshalled in the writing of histories of Late Antiquity – from those of the mythic individual to those recounting global systems collapse. I will return to consider this point further below.

11 We might also note the way Breeze tries to reinforce his argument by introducing Procopius as an eye-witness - 'for with his own eyes Procopius saw the 'dust' (2016, 166).

12 By way of comparison we might note David Woods' comments on the entry in the Annales Cambriae recording the death of Maelgywn in 547 –

> This entry is of doubtful value, and may well represent the educated guess of a tenth-century chronicler who combined a Welsh tradition that Maelgywn had died of plague with an Irish annal recording a plague c. 547 to deduce that this was the plague that had killed Maelgywn (2010, 227).

WHY NOW?

The recent deployment of volcanic eruptions (and other natural phenomena) as driving forces in global (and local) historical processes has not been confined to telling us why the Dark Ages really were dark. Mats Widgren has noted the proliferation of publications, drawing upon high-resolution data from 'climate proxies', which adopt an overtly deterministic approach to understanding social, cultural and political change in past societies (Widgren 2013. For examples, see, among many others, Bampton et al. 2017; Biehl & Nieuwenhuyse eds. 2016; Büntgen & Di Cosmo 2016; deMenocal 2001; Drake 2012; Dull, Southon and Sheets 2001; Harper 2017; Haug et al. 2003; Manning et al. 2017; Oppenheimer et al. 2018; Sivertsen 2009; Stothers 2000; Toohey et al. 2016).(13)

Widgren argues that the deterministic tone of such publications can be partially explained by the fact that they are 'written by natural scientists lacking any demonstrated knowledge of social dynamics' (2013). While there may be an element of truth in this, the (implied) inability of scientists to be more nuanced in their understanding of the impact of the phenomena they study on social and cultural change cannot be the dominant factor in this return to determinism (see below) since increasingly it seems to be the case that archaeologists and/or historians appear with natural scientists as co-authors (and sometimes as the main author) of publications on the impact of the 536 event. Thus, Michael McCormick suggests that the environmental evidence for climate change 'probably help[s]

13 In modern times, the link between climate and social change has perhaps been most tightly drawn by David Zhang and colleagues in their study of early modern Europe. They conclude that 'climate change was the ultimate cause, and climate-driven economic downturn was the direct cause, of large-scale human crises in pre-industrial Europe and the Northern Hemisphere' (2011, 17296).

Mike Baillie was early in explicitly welcoming this return of 'environmental determinism' - 'for more than a century … the idea of environmental determinism has been more or less summarily dismissed. … Historians and archaeologists tend not to think in terms of environmental causes for events, even though common sense tells us that there must have been environmental causes in most cases' (1999, 30, emphasis added).

to explain… the early expansion of the Roman Empire and the later success of the eastern Roman Empire while its western counterpart declined … [as well as] the migration of the Huns and Avars that brought turmoil to the Roman Empire', and went on to stress the particular significance of 'the cooling event of 536 AD' (McCormick et al. 2012, 202-203, emphasis added).(14)

Despite the usual (but here muted) caveats about the complexity of historical processes and the need to avoid simplistic causal connections,(15) it seems that even when archaeologists and historians take the lead, imperial expansion and contraction is explained ('probably') by specific climatic circumstances. It may be that we have to look elsewhere to understand this clear return to determinism.

Firstly, we should not doubt that it does constitute a return. We have been here before, several times. Within British archaeology, the environment has for long been seen as a force driving historical transformation. For Gordon Childe, the domestication of animals, one of the great pre-modern revolutions in human development, and the core of what was then regarded as the Neolithic Revolution, was a product of 'climate crises'. The post-glacial 'northward shift in the normal path of the rain-bearing depressions from the Atlantic' caused desiccation in the Near East, forcing humans and animals into closer proximity around oases. As animals were increasingly focussed on these water sources, 'men might

14 Michael McCormick is Professor of Medieval History at Harvard. He is the first-named author on this paper. His co-authors include Ulf Büntgen, Professor of Environmental Systems Analysis at Cambridge. McCormick is one of the authors in Büntgen et al. 2011 and Büntgen et al. 2016.

Note that while Widgren doubted scientists' ability to apply their findings to historical processes, McCormick worried about the fact that 'historians and archaeologists … struggle with evaluating highly technical scientific analyses and methods, sometimes failing to understand them at an elementary level' (McCormick et al. 2012, 170).

15 'The present state of knowledge does not favour a simplistic unravelling of the complex interactions of environmental, economic, political, and cultural developments' (McCormick et al. 2012, 173)

study their habits and, instead of killing them offhand, might tame them' (Childe1942, 56; 2003, 77; also Wright 1993, 467).

The domestication of plants and animals caused by this climatic shift had, Childe argued, revolutionary implications for the whole species, the consequences of which we are about to reap the whirlwind – 'throughout the vast eras of the Ice Ages man had made no fundamental change in his attitude to external Nature. … [With climate-driven domestication] man has begun to control Nature or has at least succeeded in controlling her by cooperating with her' (2003, 66). In other words, climate change 'forced' the domestication which is central to Man's domination of Nature. The irony of the fact that climate change was at the roots of 'the new aggressive attitude to the environment' which has (ultimately) caused the spiralling climatic instability that threatens our world cannot be lost on us.

Childe's interest in, and understanding of, the role of the environment in directing human affairs is paralleled in the work of other British archaeologists and historians (Trigger 2006, 315-319). Mortimer Wheeler suggested that urbanism, that other great pre-modern revolution, might have been the product of his (similar) 'oasis theory of civilisation' (1956, 136; see also Childe 1950), while J.N.L. Myres echoed Childe in his assertion that

> until the Anglo-Saxon invasions, the pattern of human habitation in this country had been largely determined by the forces of nature … Five centuries later the distribution of Domesday vills shows that man for the first time has mastered his environment (Collingwood & Myres 1937, 325; emphasis added).

Similarly, Rhys Carpenter's Discontinuity in Greek Civilisation (1966) is built on the proposition that major changes in Greek history were the product of climate change. Like Childe, he saw real explanatory power in a climate-change-driven weakening of the high

pressure polar front forcing 'the trade wind's operation northward into the temperate zone' and resulting in nearly eight months of 'well-nigh continuous drought' every year for southern Greece. In this context, the Ionian migration from the Greek to the Asiatic mainland, like the Mycenaean migrations, becomes 'nothing more mysterious than a flight from a drought-ridden to a better-watered land' (1966, 61-64). Both are but instances in the story of 'the great climate cycle by which the career of European civilisation has been controlled' (1966, 15).(16)

The significance of the environment as a driver of historical transformation continued within the more doctrinaire articulations of the New Archaeology in the 1970s and 1980s (for example, Binford 1983, 47; 1989, 48). As I have noted elsewhere, some British processual archaeologists in fact downplayed Nature's part in driving the historical process and transferred that agency to what they called 'the multiplier effect' – a phenomenon which emerges out of interaction between society's subsystems, and which generates change by overcoming the 'innate conservative homeostasis of culture' (Hodges 1982, 153; Moreland 2017, 217). Here change comes about <u>despite</u> the system, and where humans do enter the equation they tend to be 'Great Men' – kings, merchants and missionaries (Hodges 1989, 4; also Symonds 2017, 11-12).

More recently, and certainly since the late 1980s, many archaeologists and historians have looked elsewhere for the main drivers of the historical process. As Daniel Löwenborg notes, the events and processes in sixth-century southern Scandinavia which he attributes to 'climate shock' were earlier explained by 'theories that focus more on a shift in agricultural methods, land rights aggregated to large farms and a gradual and deliberate change that

16 Clearly, this is not just a British phenomenon. Ulf Näsman has written that reviewing Löwenborg's (2012) paper on climate shock in southern Sweden 'was a déjà vu of my days as an archaeology student at the University of Uppsala in the 1960-70s' where 'the late Bertil Almgren, lectured with enthusiasm and from conviction about changes of climate as a general explanation of cultural change' (2012, 5).

tones down the catastrophic elements and sees man as in control' (2012, 7; Löwenborg & Eriksson 2015, 258, 268; also Widgren 2013, 126). Here he is referring to histories in which human action and decision-making generate structural change/stability; histories where the forces for change lie in the economy, in ideology, or in culture (ultimately in humanity itself), and where change tends to be incremental (the result of internal factors) rather than catastrophic (the product of deus ex machina disasters) (Wickham 2005, 13, 831). This willingness (or is it a desire?) to see Man as 'in control', as the maker of her own destiny, probably reached its apogee in the agency-centred perspectives of the last couple of decades – which were themselves a reaction to the dehumanising propensities of a New Archaeology in which people acted in response to Nature (above; Moreland 2017, 217-220).

In this sense, the move back to a preference for 'natural causes' as overarching historical forces, for the version of environmental determinism inherent in 'climate shock', might be seen as simply another swing of the academic pendulum, as the kind of action/reaction that often characterises the changing generations. However, we might also consider Kenan Malik's suggestion that the oscillation between explanations which put either Nature or Man at the heart of the historical process track, more-or-less faithfully, changes in our sense of optimism (or otherwise) about humanity and our place in the world (Malik 2000, 13; also Moreland 2010, 2-3). What many of the publications on 536 demonstrate all too clearly is that, with volcanically-induced climate change now seen by many as the great historical actor of late Antiquity, the focus is no longer on human creativity and action - we have been placed firmly back within Nature. Kyle Harper perhaps puts this most explicitly with his argument that the combined power of 536 and 541 (the dust veil and the Justinianic Plague)

constituted Nature's hubristic response to the Roman belief that they had 'tamed the forces of wild nature' (2017, 4).[17]

I would, however, argue that two other factors have contributed to this tendency towards climate determinism. Firstly (and most obviously), there is the real and pressing concern about the (already for some) devastating impact of climate change on our daily lives, and its likely catastrophic impact on all our, and our children's, futures. There is much to be gloomy about here, to add to Malik's more general sense of pessimism about the human condition, not least the lack of political will in some quarters to tackle the root of the problem, and the denial by others that it even exists. Just as, during the Cold Wars, fears about the devastating potential of nuclear weapons led to an enhanced interest in the possibility that previous mass extinctions had been caused by meteor or comet strikes (Nield 2011, 129-159), so the cataclysm appearing over our horizon has served to rehabilitate catastrophes as historical forces.(18)

I don't think that there can be much doubt that our current concern about climate change, and the desire to understand its prehistory, history, and current impact, has helped propel it to the top of many Research Councils' lists for priority funding (see, for example, Plunkett

[17] This captures the arguments, with a little more detail –

> At scales that the Romans themselves could not have understood and scarcely imagined – from the microscopic to the global – the fall of their empire was the triumph of nature over human ambitions. … Only in recent years have we come into possession of the scientific tools that allow us to glimpse, often fleetingly, the grand drama of environmental change in which the Romans were unwitting actors (Harper 2017, 4-5, emphasis added).

18 As Ted Nield notes, the rise of uniformitarianism, 'the idea that the past was not really so different from the present, and that the natural processes operating today have always operated', led to the rejection (at the very end of the 18th century) of the original catastrophism, of a 'geological thinking that had been dominated by grand theories of the Earth that often invoked global catastrophes, great deluges and massive, sudden upheavals' (2011, 91). At the moment it seems that a neo-catastrophism is overwhelming more human-focussed, incremental perspectives.

Nield also notes that

> After a new phenomenon is discovered and becomes established, it is rarely long before people start seeing it everywhere …. Perhaps this is all part of the phenomenon of having to believe in something before it becomes visible (2011, 137).

Here he is speaking about suggestion that there are cycles of mass extinction, but the observation might also apply to the 536 event.

et al. 2013, 17). And it seems clear that many of those who devise and conduct such research do so, at least partly, with a view to using their findings to press for political action in the present. Ulf Büntgen and colleagues, for example, express the hope that their work will 'provide a basis for questioning the recent political and fiscal reluctance to mitigate projected global climate change' (2011, 582; Widgren 2013, 3).

The second factor, and clearly linked to this burgeoning research on past climates, is the rise in precise measurement – both in terms of chronology and chemistry.(19) To take just one example, Michael Sigl and colleagues cite their enhanced ability to detect small quantities of sulphates and beryllium-10 (^{10}Be - an isotope used as a proxy for solar output), and to produce more refined ice-core chronologies ('using highly resolved, multi-parameter aerosol concentration records') as underpinning their confidence not just in the dating of volcanic eruptions, but in measuring their impact as well (Sigl et al. 2015, 544; Harper 2017, 44). Using increasingly refined measurement as a metaphor for homing in on the truth, this and similar natural science reports give the appearance of providing us with objectivity-through-precision,(20) with confidence that the events measured happened at that particular moment, with that predicable result. Timing and causation are tightly (intimately) linked, and the increasingly refined chronological measurement of chemical variations in ice cores, for example, might pave the way for 'the more precise discussion of the role of climate in social change' (Widgren 2013, 2). But this, the discussion of the demographic, economic and

19 Working against the grain of respect for the precision of science, Kenan Malik argues that 'the triumph of mechanistic explanations of human nature is as much the consequence of our culture's loss of nerve as it is of scientific advance' (Malik 2000, 13-14).

20 In many ways, of course, this objectivity and precision are more apparent than real. In every case here, we are observing, detecting and measuring not the thing itself, but a proxy for it – whether that be tree rings, sulphate deposits or beryllium-10. As such, some degree of interpretation is involved. Further, new methods, techniques, insights and contexts can undermine/refine what were once thought to be firmly fixed dates/events – as we have seen, for example, with the Mike Baillie's re-dating of the critical (for us) section of the Greenland ice cores.

cultural impacts of climate change, is where we might start to worry or, at the very least, where we need to be more careful.

WHAT'S WRONG?

While there is an obvious connection between chronology and causation (above), it is (or, at least, it should) also be obvious that a coincidence in time does not necessarily mean that there is a causal connection (Buckland, Dugmore & Edwards 1997, 581) - and this general principle must apply more forcefully when the chronological resolution broadens. In an early assessment of the role of written records in detecting and reconstructing past climate change, David Herlihy stressed that all 'individual observations must be accurately datable … the time resolution of the series must be high' (1980, 713). He went on to point out that while that condition could be met for many written sources, which can often be 'exactly dated, by day and month as well as by year' (1980, 714),(21) this was not true for what he called 'field data' where even a dating of plus or minus fifty years, while very precise on the scale of geological time, is too coarse to satisfy the needs of most historians (1980, 713). He emphasised that we cannot be confident that a (more or less) precisely dated phenomenon explains an event or process for which the chronological resolution is much coarser. When Herlihy wrote his paper in 1980 the former applied to 'historical' data, the latter to field data such as tree-rings, pollen sequences etc.. It might be argued that, for archaeological evidence at least, the situation has been reversed. As we have just seen, much of what Herlihy called 'field data' now has very tight 'time-resolution', while this remains much less true of the archaeological information. Bringing together sets of data with differing 'time

21 Admittedly, this is not always possible for our period.

resolution' leads, Herlihy points out, to the possibility of 'false associations …, which may offer specious conformation to mistaken judgements' (1980, 714; also Armit et al. 2014, 17047; Squatriti 2010, 808-809). I think that some versions of the 536 scenario run the risk (at least) of creating just such false associations – and thereby reinforcing determinist positions. Our present desire to prioritise climate change as an historical force might help explain why we have ignored the dangers pointed out by Herlihy (and others) and have been prepared to overlook the implications of the (comparative) coarseness of most archaeological chronology.

I will develop this issue in a moment by looking again at some of the evidence presented for the impact of 'climate shock' in southern Scandinavia in the sixth century. However, before I do that I need to acknowledge that those scholars whose work I will draw upon are aware of the dangers and limitations of environmental determinism (Price 2013, 2; Price & Gräslund 2015, 118). We need, Daniel Löwenborg argues, to combine such eco-deterministic approaches with others wherein 'cultural and economic changes depended on ideology' in an acknowledgement that while climate will always have an impact on all living organisms, 'what makes humans unique is our possibility to adopt changes in different ways' (Löwenborg & Eriksson 2015, 265, 271). He also accepts that the impact of 536 would have varied across the region, being greatest in marginal areas with dire consequences if ecological thresholds were crossed (Löwenborg 2012, 19). Further, he admits that some of the transformations which are, for him, proof of the impact of 536 on south Scandinavian society had their origins long before (see also below. p. xx). Thus he accepts that the move towards increased social stratification and land accumulation began in the Roman Iron Age ('after the fall of the Roman Empire, they [the elite] lost much of the network needed to maintain their status, and turned their interest to land instead'), but maintains that the possibilities for change would have been enhanced among a 'population … shocked and

traumatised by the crisis', which thus became the catalyst for enhanced stratification (2012, 19, emphasis added; also below, p. xx).

Obviously, as in all but the most determinist positions, there are matters of 'degree and emphasis' here (Price 2013, 1), questions of the explanatory weight to be placed on the multiple factors involved in historical transformation. There are also elements of counter-factuality. As we will see, other scholars put much greater emphasis on the significance of the end of the relationship with the Roman empire in transforming the social, political and economic structures of southern Scandinavia (see below, p. xx). In the Löwenborg scenario set out at the end of the last paragraph, the end of that relationship, and the end of the flow of resources which it entailed, led elites to turn their attention to land as a basis for power – and the 536 event provided them with further opportunity to acquire both land and power, and so reinforce their social position. So, the question is, which of these factors (the end of Rome or the volcanic dust-veil) should carry the greater explanatory weight? And the counter-factuality comes in when we consider (as we must if we are questioning the emphasis placed on 536) whether the move towards land accumulation and social stratification would have continued even without 536?

Clearly, we are not in a position to answer this last question, but we can suggest that, given that the impact of the end of Rome does not appear again in his argument, Löwenborg assigns greater historical efficacy to climate catastrophe.(22) This is confirmed, and the value of his earlier caveats reduced, by the suggestion that, in terms of understanding what happened in southern Scandinavia in the sixth century, all we have so far lacked is a 'reasonable explanation for an extensive population decline'. With the 'discovery' of the 536

22 In his 2015 paper with Thomas Eriksson, the 'break' with Rome appears as one of the earlier explanations replaced by the impact of the 'severe climatic event' – 'The decline, or crisis, in the sixth century is … sometimes referred to as "Migration Period crisis' and considered in relation to the turmoil on continental Europe following the decline of the Roman empire' (2015, 268; also Löwenborg 2012, 6).

event, however, 'a smoking gun is now presented' (Löwenborg 2012, 24). As seems often to be the case in dealing with 536, and with other climatic/environmental phenomena, caution induced by the need to avoid the excesses of earlier versions of environmental determinism (of the Ellsworth Huntington variety), dissipates when the historical narrative is actually constructed. So, while Neil Price and Bo Gräslund are right to say that 'very few researchers are actually putting forward the notion of a climate event as total explanatory factor' (Price & Gräslund 2015, 118, emphasis in the original; also Price 2013, 2), it seems to me that many are actually presenting the 536 event as the forcing agent, as the driver of mid-sixth century historical processes. Here we have to return to the evidence for the processes it is said to explain.

As we saw earlier, Daniel Löwenborg argued that the 536 event caused a 'climate shock' which resulted in a demographic crisis, with elites (anticipating Milton Friedman) taking advantage of the resultant land abandonment to accumulate more of it to themselves, and marking their new territorial claims through the construction of large burial mounds (2012, 9; Löwenborg & Eriksson 2015, 270). In a parallel argument, Neil Price and Bo Gräslund argued that the 'lengthy' catastrophe brought about by 536 cast doubt on the efficacy of existing ritual structures in securing control over the natural world, and so resulted in fundamental changes in the ideological sphere (Gräslund & Price 2012; Price & Gräslund 2015, and above). These 536-driven transformations are evidenced, Löwenborg argues, by fundamental changes in the archaeological, toponymic, and palaeo-environmental records, and by what Gräslund and Price call 'the archaeology of the Fimbulwinter' (2012, 431, and below). Returning to the issue raised by David Herlihy of 'false associations … and specious conformation to mistaken judgements' (1980, 714), the problem here is that these transformations are never dated tightly enough to make a causal connection with the (precisely dated, through both eye-witnesses and modern science) 536 event. The best we

get is by the century, usually it is by archaeological 'period' (Price & Gräslund 2015, 117; also Toohey et al. 2016, 408). Further (as we have seen), there are signs that some of the processes pre-date 536; and there are always contrary indicators (i.e. signs of 'continuity').

To take just a few (select) examples of the archaeological evidence for the Migration Period crisis, we are told that there are indications of a dramatic 'societal, economical, ecological as well as demographic downturn … between the Early and Late Iron Age' (Löwenborg 2012, 5). The abandonment of settlements, and the 'deposition of several hoards of gold' on Öland and Gotland have been taken as indication of war and conflict 'around the end of the fifth or early sixth century' (2012, 6; Price & Gräslund 2015, 116; also Widgren & Pedersen 2011, 60). In Hälsingland, there is a 'drastic decline in pollen of cereals' around AD 500, and 'in the sixth century many settlements seem to have been completely abandoned' (2012, 6; Price & Gräslund 2015, 116). In 'eastern central Sweden during the AD500s, the majority of villages were abandoned' (Gräslund & Price 2012, 431-32). In Östergötland and Västergötland 'archaeological remains and environmental data have been combined to suggest a decline in the fifth century' or in the 'middle of the first millennium' (2012, 6, 14). On the same theme, but broadening the canvas for a moment, 'large areas of agricultural land in northern and central Europe returned to forest during the middle and later sixth century' (Gräslund & Price 2012, 431; Price & Gräslund 2015, 115). There is a toponymic shift from the early Iron Age, where we find names referring to the territory of a 'people', to the late Iron Age with names which might imply individual ownership of land (2012, 8). In Västmanland, there is a shift in the location of burials, from higher to lower ground, between the Early and Late Iron Age – 'it seems like a clear majority of sites were abandoned around the middle of the first millennium' (2012, 11, also p. 13; Gräslund & Price 2012, 432; Price & Gräslund 2015, 115). Löwenborg also notes a significant shift in burial practice between the Early and Late Iron Ages; 'children are generally missing in the latter

case' (2012, 13). To make it clear, I am not questioning the evidence presented, and I accept that those who deploy it are aware of, and accept, the coarseness of its chronological resolution. The problem emerges when we place these broadly-dated processes alongside a precisely-dated event and argue that the latter caused the former.

The uncertainties around causation are enhanced by the fact that there are some (admittedly equally poorly-dated) contrary indicators. A pollen core from Kräggesta does not suggest a break in continuity (Löwenborg 2012, 15), while excavations in advance of the construction of the E4 around Uppsala provided 'no indication of a general abandonment of burial grounds during the Migration Period' (2012, 14). More generally, there are 'indications of expansion' in cultivation in central Uppland and Ångermanland, with some abandonment of marginal areas in the late Iron Age (2012, 15; Pedersen & Widgren 2011, 61).(23) It is possible that these signs of 'continuity' in the midst of apparent regression and abandonment are a product (and sign) of regional and sub-regional variability in the impact of 536. I will return to consider the possible causes of that variability in a moment.

And the uncertainty about the causes of the broad patterns that emerge from the archaeological and environmental evidence is further increased by the fact that some of the processes presented as a product of 'climate shock' might actually predate the event held responsible for that shock. We have already seen that Daniel Löwenborg accepts that southern Scandinavian society was already becoming more highly stratified from the Roman Iron Age (2012, 19; above p. xx). Ulf Näsman has pointed out that individual ownership of land and farms was already possible in the late Roman Iron Age, meaning that it was

23 Note that there are indicators that some of the phenomena that are said to bespeak catastrophe seem in fact to be associated with/the product of longer term changes – whether this be the changes to cult and ritual that have become focussed on the disappearance of the 'sun' from Gotland's picture stones, or the climatic indicators which might actually be part of a longer-term trend, perhaps driven by the solar cycle (Harper 2017, 254-55; Manning 2013, 120-35). It might be, as Mike Baillie cautions for an earlier 'event' that 'we end up explaining a long climatic downturn as a short, catastrophic, environmental event', thereby obscuring highly important natural climatic variation (1991, 15).

possible, 'long before AD 536', for the powerful to accumulate significant landholdings (Näsman 2012, 10). Further, the toponymic shift which records that process might, Löwenborg admits, have already started in southern Scandinavia in the third and fourth centuries (2012, 9). There is some suggestion that, rather than being abandoned, some settlements 'simply' shifted location (Löwenborg 2012, 6, 14), and Näsman points out that such mobility has a deep history in Scandinavian societies, and 'is not concentrated in the transition between the Migration and Merovingian periods' (2012, 8). Broadening the geographical scale, Helena Hamerow has argued that it was characteristic of the early Middle Ages 'across much of northern and western Europe' (Hamerow 2002, 104). In an important sub-regional study of Funen and surrounding islands, Jesper Hansen has shown that a decline in recorded settlements actually 'predates 536/46 by about a century', and that while there was a fundamental change in settlement patterns 'in the decades around AD600' it was a product of 'a change of land organisation and the rights and obligations bound to it' (Hansen pers. comm., 9th January 2018; also Hansen 2015, 311).

As we will see later, a strong argument can be made that some of changes in the ideological sphere attributed to 536 have much deeper roots, and similar concerns emerge when we adopt a broader geographical, rather than chronological, perspective. Thus, Anders Andrén points out that climate change cannot have been solely responsible for the demise of the sun in the symbolic repertoire of southern Scandinavians – after all, he points out, 'the sun remained a central mythological figure in the Baltic and Samí religions, although these … must have been as much affected as Scandinavia by the darkened sun' (2014, 185; 2012, 53-55).(24)

24 Andrén continues - 'Instead the clouds in front of the sun must have hit specific aspects of Old Norse religion, above all its eschatological and political basis' (2014, 185).

So, while it seems that the archaeological and environmental records do not unequivocally speak of catastrophe, the main points here are that the processes that created those records are imprecisely dated, and some of them pre-date the cataclysmic event said to have driven change. Ulf Näsman summarises the situation very well –

> the Migration period cannot be characterised as a short acute crisis in the social development. But neither is it reasonable to dismiss the concept 'crisis' completely when trying to understand the character of the period. All speaks in favour of the Migration period as a period of fundamental social change. Certainly, some changes began already during the Late Roman Iron Age [third to fourth centuries]; others took place in the following Vendel/Merovingian period [late sixth to eighth centuries]. Thus, the crisis has to be understood as a long process in which the Migration period is a transition period between an Early Iron Age and a Late Iron Age (2012, 6)

Neil Price and Bo Gräslund accept this extended chronology for social transformation ('it is surely obvious that … [it] followed a long trajectory that began a considerable time before 536 and continued thereafter'), but continue to emphasise the 'fundamentally catalytic role' of the dust veil (2015, 119). It is a matter of 'degree and emphasis' too when we consider the geographical variability of the evidence – with apparent abandonment and regression in some areas and expansion in others (see above). As we saw earlier, for Löwenborg this is a product of the 536 dust veil acting on the variegated landscape of southern Scandinavia, with the impact greatest in marginal areas (Löwenborg 2012, 19; see also Haldon 2016, 191; Toohey et al. 2016, 408). Ellen Anne Pedersen and Mats Widgren, on the other hand, argue that this variability might owe something to longer-term regional histories. They thus read the abundant archaeological evidence on Öland and Gotland, and along the southern part of

the Norrland coast, in the first half of the first millennium, as the product of their intensive exploitation, especially through the specialised rearing of cattle and sheep, to meet the demands of the Imperial Roman system to the south (2011, 61). Their conclusion deserves to be cited in full as it provides the basis for continuing to assert a human role in making history at a time when some have come to see us as 'unwitting actors' (Harper 2017, 5).

> These areas – on the outer fringes of Roman influence – were probably drawn into international exchange systems, and part of their agrarian expansion may have been connected to the surplus production of wool and hides. … It was in those areas that had previously seen the greatest expansion and had become centres of political and economic development that the decline was most sharp: Öland, Gotland, Östergötland, and Hälsingland. The most probable explanation for the symptoms of crisis and regional restructuring in the middle of the first millennium AD is that they represent shifts in the balance of power within the Scandinavian area that in turn influenced surplus production and settlement density (Pedersen and Widgren 2011, 61-62, emphasis added).

Here the emphasis is on situating the mid-sixth century evidence in the context of the long-term history of settlement and subsistence. The cause is systemic and structural, rather than cosmic – precisely the kind of human-centred explanation which is meant to fall, or fade in significance, with the return of environmental determinism. Southern Scandinavia's relationship with Rome led to settlement intensification and agrarian reorganisation to create a system capable of feeding both Imperial need and local ambition. The end of that relationship threw the regional system into crisis, and those areas most tightly bound to Rome suffered most when that demand disappeared. In this long-term perspective, illustrations taken to show a dramatic sixth-century decline in eastern central Sweden can

be read alternatively, much as I read similar graphs of settlement numbers in late Antiquity in the Sabine Hills, Italy, as a return to something approaching 'normality' after the aberration of the Roman interlude (Figures 2 and 3). In this reading it is not (or not just) the Migration Period pattern that needs to be considered, but the truly exceptional nature of the system that preceded it (Moreland 2010, 153).

It is also important to note that in situations, in other times and places, where we do have a series of precise dates for archaeological sequences, climatic determinist theories have been rejected. Unprecedented economic development in Ireland between 1995 and 2008 resulted in a dramatic increase in the number of developer-led excavations – and in the availability of vast quantities of new data, 'including ^{14}C dates from a broad range of landforms and environments' (Armit et al. 2014, 17045). These dates provide the kind of very tight time resolution demanded by Herlihy, and have been used to demonstrate that an assumed population decline (marked by the disappearance of evidence for settlement and craft-production) at the end of the Bronze Age was not caused by climate change as had previously been argued. Ian Armit and his colleagues demonstrated that a sudden shift to wetter conditions can be dated to c. 750BC -

> Comparison of the archaeological and palaeoclimatic data demonstrates that the decline in population at the end of the Bronze Age began more than a century before the climatic downturn of the mid-eighth century BC. Therefore the decline can be categorically disassociated with the climate downturn. To explain the end of the Bronze Age we must instead look towards socioeconomic factors (2014, 17046-47; see also Plunkett et al. 2013, 27).

Echoing Herlihy, they conclude that, while in the current social, political and academic climate it is easy to assume that cultural change is driven by climate change, such

assumptions must be 'critically assessed using high-precision chronologies to guard against misleading correlations between unrelated events' (Armit et al. 2014, 17047).

NATURAL ARCHIVES?

Throughout this paper I have highlighted the way that 536, an event rendered apparently more objective through the precision of science, has been deployed as a fixed point to which causal links are fixed and from which explanatory webs are spun. As such it is a manifestation of a set of chronological issues which Mike Baillie has characterised as 'suck in and smear' (1991). This is the tendency, on the one hand, for us to 'allow' precisely-dated phenomena to suck towards themselves, and thus to explain, more broadly-dated archaeological, historical and environmental information, and on the other, for us to smear the actual, precise, date of a feature or event across a broad time range by applying to it dating techniques which are themselves incapable (in almost all cases) of arriving at that degree of precision (Baillie 1991, 12, 15).

As we have seen above, at every analytical level, and despite the imprecise nature of much of the dating, events and processes from across two centuries have been sucked in, and explained, by the 536 event.[25] And if we focus on, if we remain true to, the details provided by the analysis of objects and texts, we can frequently challenge such explanations. At the broadest scale, David Keys' catch-all catastrophe is undermined not just by the attenuated nature of its links with, for example, the 'modern British and American empires' (1999, 130), but also by the details of regional-level archaeology. It is clear, for example, that the end of the Roman empire in Britain long predated 536, and that there was, nevertheless, continuity

[25] Of course, the events themselves do no such thing. Rather, it is us who make this happen; we direct the more broadly dated events and processes towards these chronological fixed points.

in landuse across the supposed catastrophe (Moreland 2010, 116-58). Extending the geographical range, while there are indicators of population decline in Italy, at the heart of the Roman empire, these emerge in the fifth century, not the sixth (Näsman 2012, 14; Wickham 2005, 548-550). More significantly, perhaps, Antii Arjava, at the end of his comprehensive review of the impact of 'the mystery cloud' of 536 on the lands around the Mediterranean, concludes that there is nothing in the evidence to suggest that 536 was a pivotal moment in world of late Antiquity – 'whatever happened around 536, its historical implications remained limited, at least in the Mediterranean area' (2005, 92-93. See also, for example, Izdebski et al. 2016; Fuks et al. 2017; and Toohey et al. 2016, 410).

Narrowing the geographical focus, we saw earlier that Birgit Arrhenius argued that 536 caused a shift from outdoor to indoor ritual practice (2013, 13). However, the actual dating of that shift at Helgö is not clear; the final date for the abandonment of the open air offering site is provided by a triangular stone setting created 'at the beginning of the Viking Age' (2013, 7, emphasis added). Further, Arrhenius accepts that, already in the pre-Roman period, there is evidence for indoor ritual practice at Uppåkra in Scania, and that the small temple there coexisted with outdoor rituals for a long time (2013, 13; also Andrén 2005, 112). In some places, therefore, the construction of 'temples' and the 'move indoors' predated 536. Importantly, and paralleling the arguments of Ellen Anne Pedersen and Mats Widgren regarding settlement and subsistence (above), Anders Andrén believes that these cult houses had 'clear Roman models', that they contain 'echoes of the early Christian churches' (2005, 130). This means, as he says, that Scandinavian religion was influenced by Christianity long before the missionary era and the official conversion (2005, 127). What is also means, however, is that if we don't allow these various phenomena to be sucked towards 536, if we don't push them in that direction, we might come to see that the transformation in cult was not quite as sudden as some have argued, and that the

explanation for it might lie more in the North's changing relationship with the Roman Empire than in the dust veil brought to our attention by Roman chroniclers.

In many ways, the apparent certainty and objectivity of dates/events like 536 seems to be acting much as written sources once did for many archaeologists (and for some still do) (Moreland 2001). Like texts, these dates provide the frame within which the archaeological and environmental evidence is situated, and through which it is explained. It is significant that ice-cores, tree-ring series etc. are now often referred to as 'natural archives' whose authority derives partly from the fact that, like 'natural images' in the Middle Ages, they are unsullied by human artifice (Mitchell 2012), partly from associations with the idea of the truthfulness of the written text, and partly from the fact that they are read through the technology of modern science (Harper 2017, 13; Manning 2013, 116; Roberts 2011, 30; Sigl et al. 2015, 543). As we have seen, the allure of the natural archive has been felt at all levels of archaeological analysis, but we perhaps see it most obviously in Andrew Breeze's attenuated attempt to use the 536 event to 'prove' the existence of Arthur, and in Birgit Arrhenius' *ad hominem* explanations for the end of bronze casting and for changes in cult at Helgö. Here the dependence on, the clutching at, the 536 event takes me back to Mortimer Wheeler's characterisation of the 'Dark Ages' at the beginning of his book on London and the Saxons -

> For the archaeologist at least, a real difficulty of the Dark Ages is that they are not dark enough. They are illuminated by fitful will-o'-the-wisps which tempt him perpetually from the narrow path of scientific inference into the morasses of pseudo-historical conjecture (Wheeler 1935, 3).

As archaeologists, we have come a long way since then – and natural scientists have helped us get here. What a shame then if, having liberated ourselves from 'the text', we now

surrender to the attractions of the 'natural archive' and, at the same time, fall back into the arms of Nature (in the shape of environmental determinism).

As I have stressed throughout, our understanding of causation, of what made history happen in the sixth century, is a matter of 'degree and emphasis' (Price 2013, 1). There were, undoubtedly, a range of factors at work, some natural, some human. Neil Price and Bo Gräslund may be right to complain that, in his Framing the Early Middle Ages, Chris Wickham 'reduced the entire impact of the dust veil … literally to a footnote' (2015, 118; Wickham 2005, 549, note 50), but Wickham is equally right to resist the 'catastrophism' of those who always seek to explain historical transformations by invoking 'plague, volcanic eruption, or the old mantra of war and destruction' (2005, 13). Social change, Wickham maintains, 'is overwhelmingly the result of internal factors, not external influences' (2005, 831).(26) Overwhelmingly, but not always. Catastrophes, as we see almost every day, are real, and we must not doubt their historical efficacy, but they need to be discovered and their real impact established - not generated from our chronological imprecision, our respect for science and archives, or from our contemporary concerns about the perilous state of Nature and the fate of our world (Sherratt 1995, 7; Brown 2013, xxx-xxxii).

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26 Wickham refers to the 536 dust veil as 'the latest Great Disaster theory to reach the academic community' (2005, 549). For him, as Price and Gräslund lament, 'the use of the title case says it all: the dust veil as nothing more than a passing scholarly fad' (2015, 118).

read drafts of this, and/or of the conference paper on which it is based – the level, tone and rigour of the argument have been significantly enhanced by their insight and comments. Thanks too to Neil Price and Paul Sinclair for stimulating discussion in Copenhagen. I dedicate this paper to my mother, Cathleen Moreland, who died on the 7th February 2018 – as my dad said, 'the brightest of us all', robbed of her mind, memory and old age by dementia.

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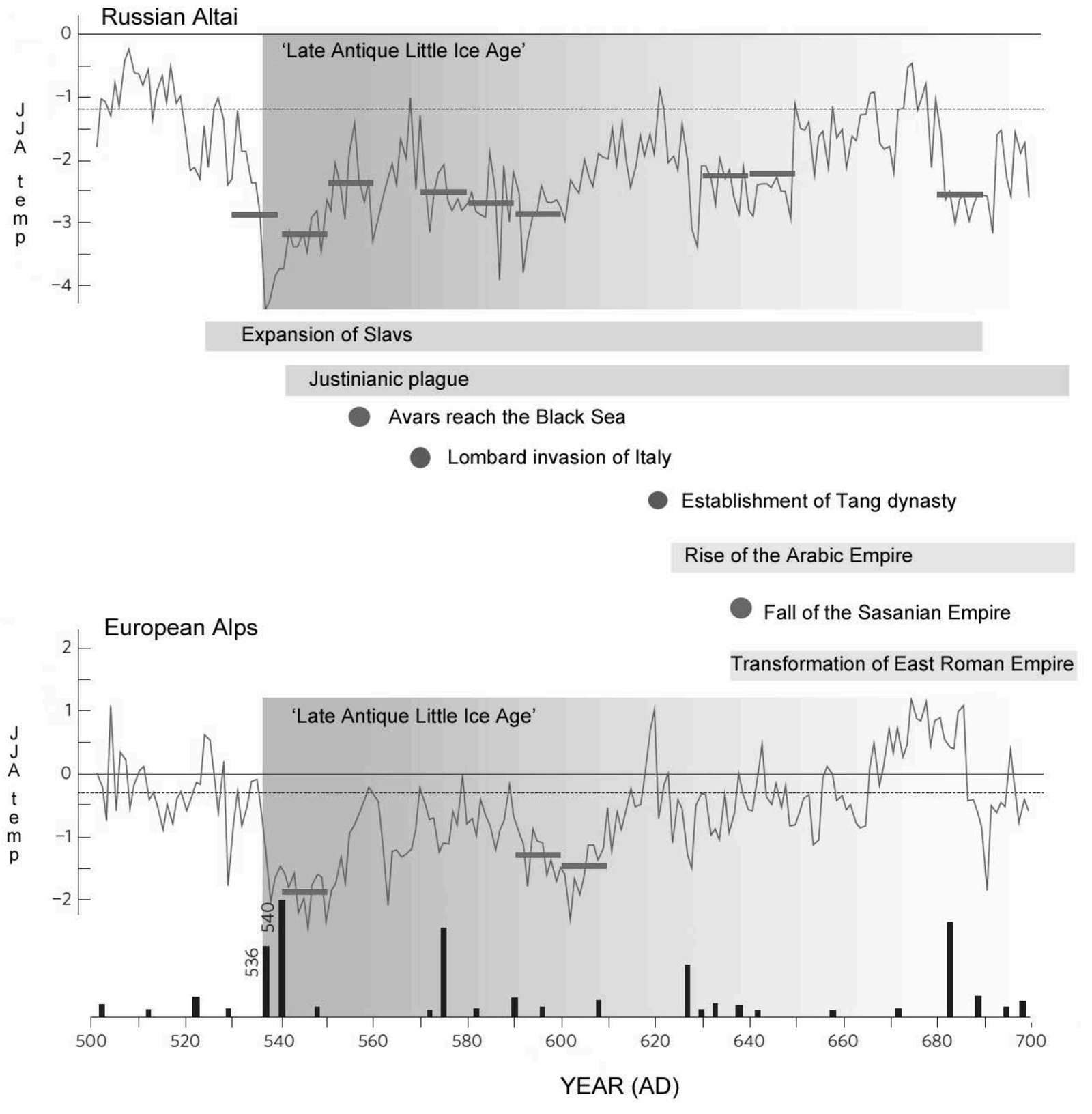
CAPTIONS OF ILLUSTRATIONS

Figure 1 – Determinism in graphic form, AD500-700. Reconstructed summer temperatures, coldest decades (horizontal bars), major volcanic eruptions (vertical bars) - plotted against plague, migrations, and rising and falling empires (text boxes and bullet points) (after Büntgen et al. 2016, Figure 4).

Figure 2 – Chronology of excavated 'prehistoric' settlements in Uppland province, east central Sweden (after Price and Gräslund 2015, 115). Note the abnormally high number of settlements in the Roman period.

Figure 3 – The aberration of empire – and return to 'normality'. Site numbers from the Farfa survey (Sabine Hills, Italy) – third century BC to seventh century AD.


Russian Altai
'Late Antique Little Ice Age'
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Expansion of Slavs
Justinianic plague
Avars reach the Black Sea
Lombard invasion of Italy
Establishment of Tang dynasty
Rise of the Arabic Empire
Fall of the Sasanian Empire
Transformation of East Roman Empire
European Alps
'Late Antique Little Ice Age'
JJA temp
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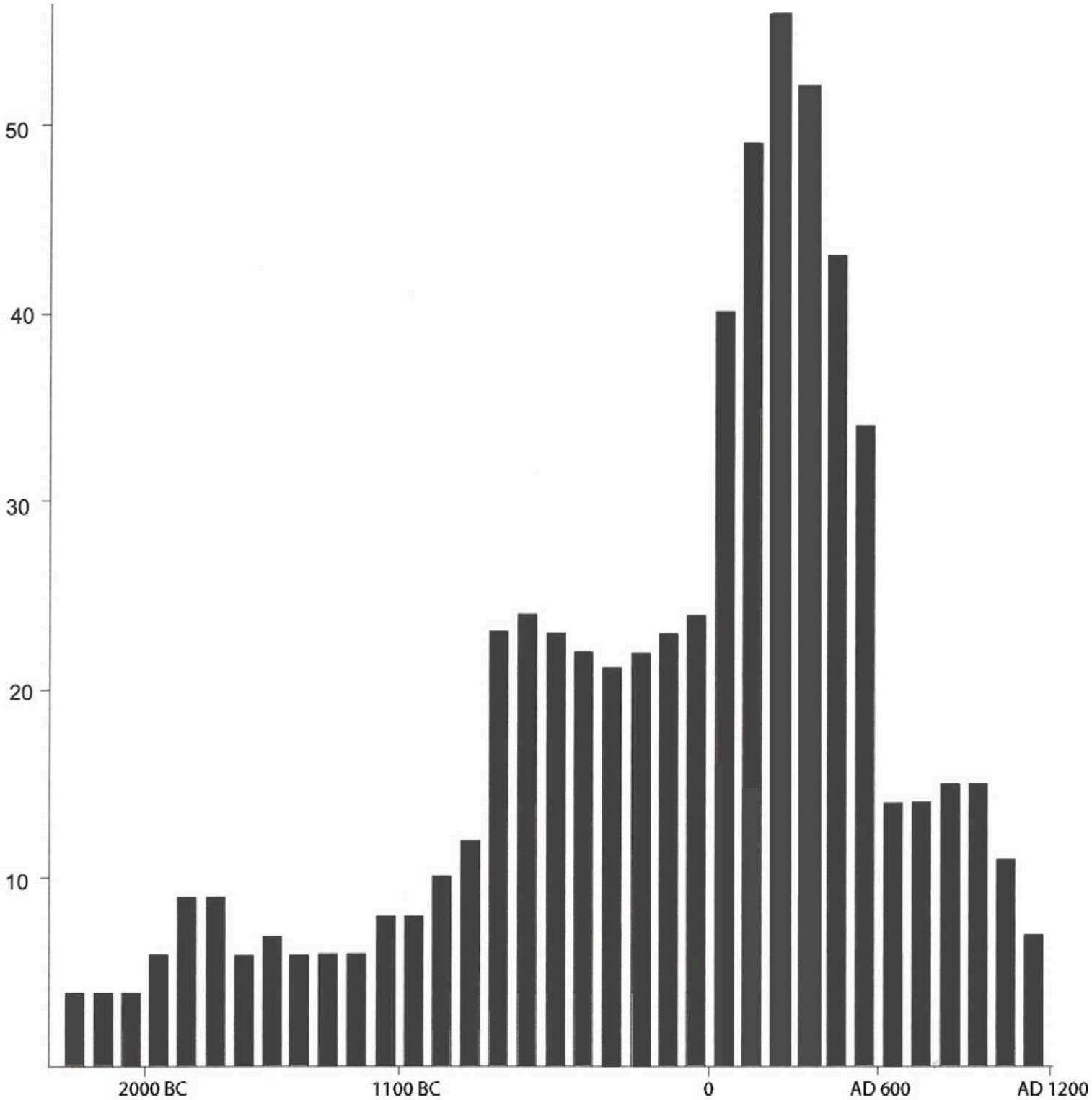
700
YEAR (AD)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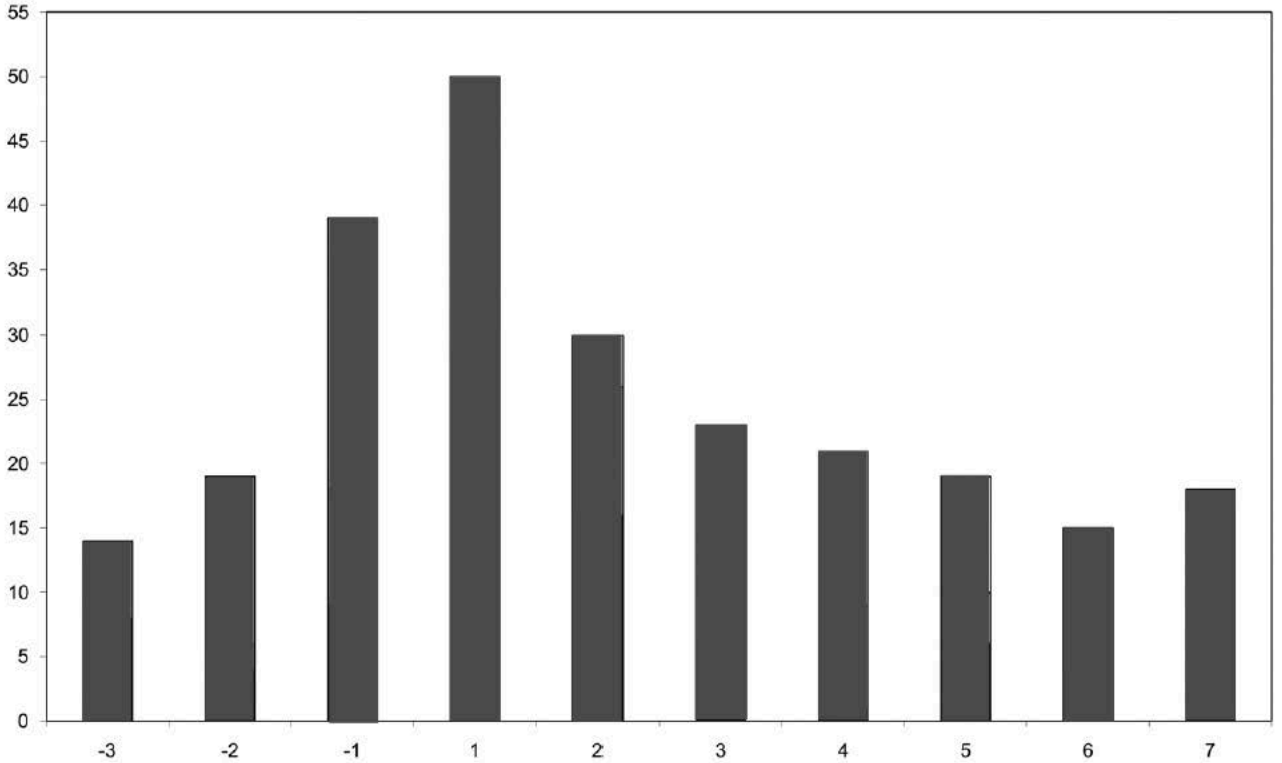
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