A process of elimination? Reviewing the fragmented settlement record of eastern Pictland and its implications for future research

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Abstract

The evidence for early medieval settlement across Scotland's eastern mainland is varied and whilst we continue to gain sites through new research and developer-led projects, our interpretation of the record is not advancing at an equal rate. Structural remains and robust floor deposits have proven particularly elusive, and our understanding of the role of different settlements and the relationship between sites remains limited. Preservation has played a major part in impeding interpretations and though contributing factors are routinely identified at the site-level, efforts to assess their prevalence or wider impact on the settlement record have been virtually non-existent. Through a review of excavation literature that complements the results published in Reid and Milek (2021), this paper collates evidence for the major factors impacting the identification of early medieval settlement remains and considers how such factors have influenced our interpretation of the archaeological record to date. The study then looks at the future of these sites in the wake of climate change and considers what techniques and strategies we may use to try and overcome the current theoretical and methodological hurdles.

Introduction

Investigation into Scotland's early medieval past has accelerated dramatically in recent decades. The period, roughly defined as AD 300–900, has advanced from having an almost exclusively fortified record to a much broader range of site types spread across a variety of environmental settings. As with much of early medieval Britain, documentary sources are rare, with few native accounts or historical records that pre-date the twelfth century (Noble et al. 2013: 1136; Evans 2019). Archaeology has therefore proven essential in developing our understanding of the period and continues to be the key tool in the identification and analysis of early medieval settlement.

Yet despite a series of new discoveries, the size and number of settlement excavations remains relatively slight in comparison with other periods. Unenclosed settlement, and structures in general, have proven particularly elusive, meaning that trends and relationships between site types are difficult to determine and our understanding of the broader economic, social and political spheres in which these sites operated is still very limited. This is particularly pronounced across eastern Scotland, an area that principally lies between the Moray Firth in the north and the Firth of Forth in the south (Walker et al. 1982: 1). Many researchers have argued that this area encompasses core Pictish territories, and the majority of new settlement evidence has been identified in this region (Woolf 2006; Carver 2019: 27) (**Figure 1**). However, the type and nature of remains varies widely, producing a complex and

often muddied record that continues to suffer from a lack of robust structural or dating evidence.

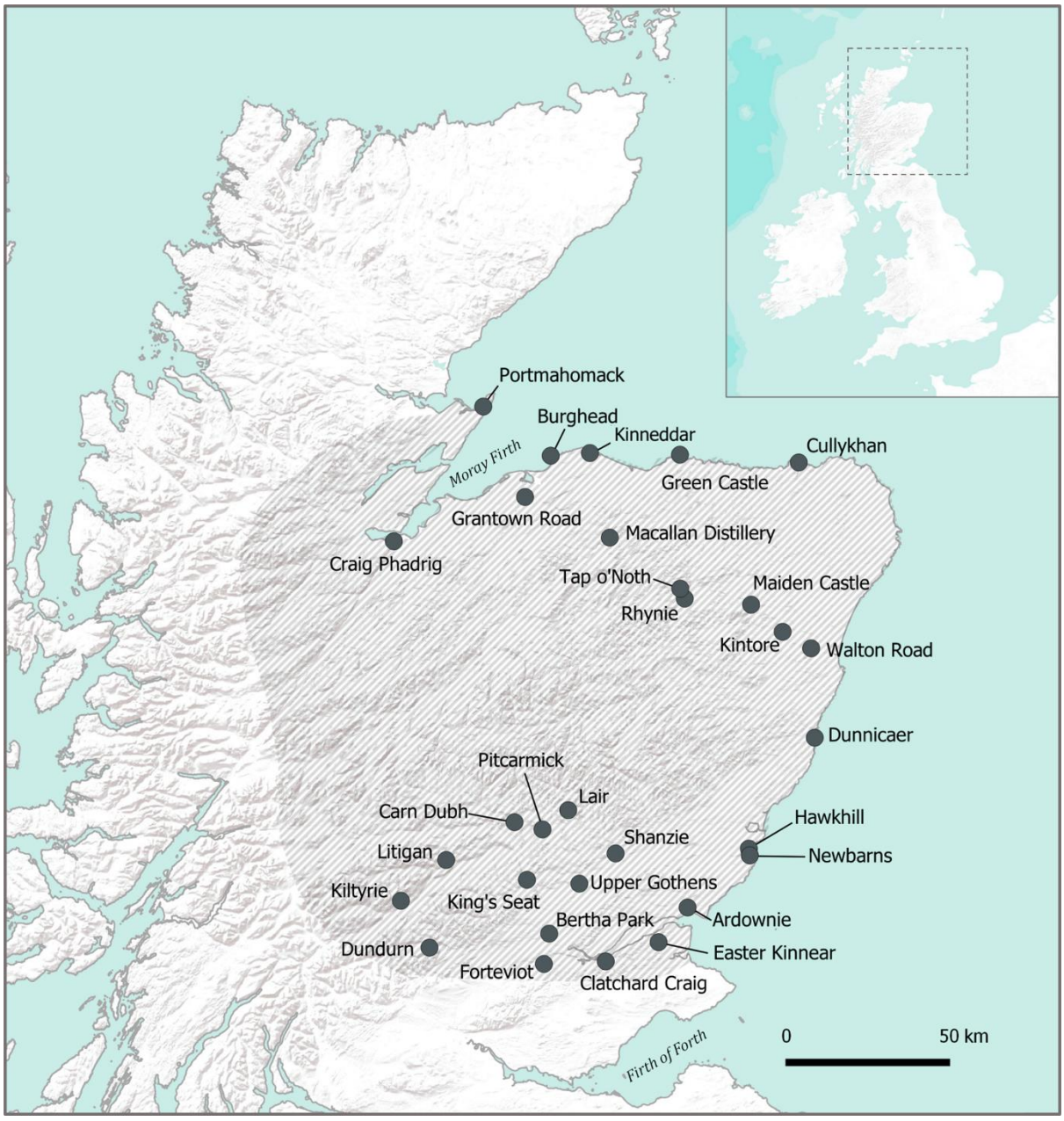

Figure 1. Eastern Pictland (shaded) in relation to UK, with location of key settlement sites mentioned in-text. Base map: ESRI 2020.

A key issue has been the preservation of settlement remains. The stone-built tradition that has resulted in the survival of upstanding structures on the Western and Northern Isles is not typically found across the mainland. Instead, buildings appear to have been constructed from more organic materials, such as turf, earth or timber wattle, with few earthfast elements, and it is likely that much of the evidence of construction has survived very poorly in the ground (Dunwell and Ralston 2008a: 140; Noble et al. 2020: 320). Post-depositional events (such as human reuse, animal activity and landscape changes resulting from agriculture, forestry and urbanisation) have further served to disturb remains, often resulting in heavily truncated sites

with few artefacts and little to no stratigraphic detail. Although these issues are widely acknowledged, detailed site-based characterisations or broader assessments of the impact of post-depositional factors on the Pictish settlement record have yet to be undertaken. As such, interpretations of the evidence often rely on assumptions about the preservation environment, and there is an uncomfortable trend in which we are gaining an increasing number of sites but little development in our understanding of their formation, role or depositional histories. The result is that significant aspects of the settlement record, in particular domestic dwellings and unenclosed sites, continue to be left out of important syntheses (for example, Blackwell 2019; Noble and Evans 2019). If early medieval Scotland is to continue its meaningful contribution to wider British and European narratives, such issues require addressing.

Scope and Methodology

Reliable interpretations depend on a clear understanding of the processes that have affected formation and influence the preservation of archaeological sites (Schiffer 1983, 1985, 1987; Shahack-Gross 2017). By reviewing both published excavation reports and grey literature pertaining to thirty sites with structural evidence of early medieval settlement, this paper synthesises the impacts that major preservation factors have had on the survival of early medieval remains and considers their influence on our interpretation of the Pictish record. It complements analysis conducted in Reid and Milek (2021) that characterises the type of post-depositional processes most likely to affect eastern Scotland's early medieval record and the frequency with which they are identified on-site.

The sites mentioned in this study (**Figure 1**) comprise the major settlement evidence for eastern Pictland and cover a range of different environmental contexts, providing a strong representation of the impacts most likely to occur at site-level. However, owing to some restrictions on the accessibility of grey literature, the study is non-exhaustive and the relatively small number of identified sites (in comparison to other periods) means that we may be missing crucial examples of preservation impacts. Similarly, it should be noted that the factors mentioned in this study are not the exclusive determinants of the destruction or survival of archaeological material. Their inclusion is based on what has been identified during archaeological inquiry, which is the product of a number of methodological biases that include the scale and nature of an investigation and the techniques of analysis used. For example, there was no exploration of deposit redox potential in the site literature, despite its role in determining the destruction of organic remains. There is also an overwhelming bias in favour of modern rural settings, as almost no early medieval structural evidence has been found in urban contexts. As such, the impact of urban development on the survival of the Pictish record almost certainly merits further consideration but is currently outwith the scope of this paper. Nevertheless, efforts to connect major issues affecting the survival and quality of the early medieval record have been virtually non-existent and this paper provides a much-needed synthesis that should encourage further research. In initiating this process, the study looks toward the future of these sites and considers what techniques and strategies we may use to try and overcome the current stalemate.

Factors influencing preservation

Reuse

The reuse of a structure, either for habitation or other purposes, can result in the formation of new deposits and the truncation, removal or reworking of existing ones (Schiffer 1985; Rothschild et al. 1993; LaMotta and Schiffer 1999). Several mainland sites, such as Portmahomack monastery and the 'scooped' structures at Easter Kinnear, show significant episodes of redevelopment within the early medieval period that have simultaneously provided key insights into settlement activity and restricted more detailed interpretations. For example, occupation at Dunnicaer promontory fort is defined by multiple successive hearths and postholes across very small areas, suggesting that buildings were frequently constructed, reworked, demolished and rebuilt (Noble et al. 2020: 320). However, this intense activity, coupled with additional truncating processes such as agriculture and stone-robbing, means that establishing whether the buildings functioned as residences, workshops or more specialised buildings (or had indeed changed throughout their lifecycles) has so far proved impossible (Noble et al. 2020: 320).

A number of sites also attest to the reuse of Pictish settlement in later periods (e.g. Kiltyrie, Kinneddar and Pitcarmick), introducing questions over the longevity of structures and to what extent they may have persisted in a habitable or reworkable state. A common assumption is that the organic building materials used across mainland sites would have quickly degenerated or been undermined by animal burrowing (Dunwell and Trout 1999; Walker 2006). Yet, the medieval reuse at Pitcarmick occurred up to 300 years after initial construction, suggesting that structures could have survived in some measure for 200-300 years (Carver et al. 2012: 186). However, patterns in this reuse, and the longevity of Scotland's early medieval settlement in general, are still largely unclear due to a relatively small dataset and incomplete dating evidence.

The fact that we still have no clear definition of what constitutes a Pictish house, and little understanding over the reuse or lifecycle of structures, means that recognising evidence of Pictish settlement in the east continues to prove a challenge. It is increasingly likely that evidence of early medieval occupation has been missed during the survey and excavation of other settlement sites, where secondary or tertiary occupation events are 'masking' or have removed structural indicators of Pictish activity. It is also a distinct possibility that, even when early medieval dates have been reported, they have not been fully explored or have been dismissed on account of suspected contamination, for example in structural forms that are seemingly atypical of the period. This has been the case in Moray, where late first millennium AD dates from two separate groups of roundhouse structures have been heavily questioned on account of having no obvious parallels (see Cook 2016 and Dunbar 2017 for further discussion).

However, the reuse of pre-existing settlement *by* early medieval people also has significant implications for our interpretation of the record. Across the western and northern parts of the country, patterns of reoccupation and redevelopment have been considered a key element of transition and are likely to hold vital information as to the varied structures across the Firthland regions and for the shift from round to rectangular house forms in general (Carver 2019: 187–188). There is certainly widespread evidence for the reuse of Iron Age hillforts and the more ephemeral reuse of Iron Age souterrains (see Harding 2009: 184 for discussion on the relationship between souterrains and 'scooped' structures in Pictland), and in areas where aspects of the early medieval record continue to elude researchers, the re-evaluation of Iron Age sites should be an important consideration. Recent excavations at Tap o'Noth in Aberdeenshire – a vitrified Iron Age fort with a dense concentration of over 800 supposed Bronze or Iron Age hut platforms – have highlighted the potential of this approach. Though investigation of the inner fort failed to produce any evidence of early medieval reuse, excavation of the outer fort (including two of the hut platforms) unexpectedly returned 3rd to 6th century AD dates (O'Driscoll 2020). Pictish period dwellings in Aberdeenshire are very rare and if future investigation supports these findings, the site would stand as the one of the largest forts and native settlements across Britain and northwest Europe, completely rewriting the narrative of early medieval settlement in Scotland (O'Driscoll 2020).

It is also important to look beyond the direct adaption or reoccupation of existing structures when attempting to locate and understand the settlement record. It has been recognised that early medieval royal sites across northern Britain and Ireland are commonly associated with prehistoric ritual landscapes, and this would certainly seem to be the case with high-status Pictish sites such as Rhynie and Forteviot (Foster 2014: 59–60). However, as new surveys and radiocarbon dates contribute to the narrative, it has become increasingly apparent that we should extend our awareness of this trend to more 'low status' sites. The best preserved early medieval buildings on the mainland – farmstead structures in the unenclosed settlements of upland Perthshire – were only discovered during the intensive survey of multi-period landscapes (RCAHMS 1990). It may therefore be the case that the 'masking' of settlement amongst more prominent remains has contributed to the relatively low number of unenclosed sites in other parts of the country. Given that we cannot rely on a single architectural form to direct our identification of settlement, exploring the wider landscape setting may prove to be a fruitful endeavour.

Agriculture

Numerous surveys and experimental work have recognised agriculture to be the most significant threat to the UK's archaeological record. The study by Reid and Milek (2021: 736) found that over 80% of early medieval sites in eastern Scotland had been affected by agricultural practices, with impacts ranging from the truncation and scarring of archaeological deposits to the physical fragmentation and chemical deterioration of artefacts (see **Table 1**).

Where it is identified on Pictish sites, the most severe cases of truncation typically result from repeated episodes of modern ploughing and thus predominantly affect sites in the arable lowlands. At Newbarns in Angus, excavation of an unenclosed rectilinear structure revealed that the average surviving depth of excavated features was around 0.2 m, with some deposits as shallow as 0.02 m (McGill 2004). Given that repeated ploughing can truncate sites by 0.07–0.1 m over a 30-year period (Oxford Archaeology 2010: 17–18), it is unsurprising that obliteration as a result of modern ploughing is one of the theories put forward for the general lack of early medieval settlement observed across mainland Scotland (see Dunwell and Ralston 2008a).

However, the rate at which sites truncation occurs is dependent on a multitude of factors that include the depth and frequency of cultivation, crop type, and environmental conditions such as soil type, drainage and topography. Processes that remove soil from agricultural land (e.g. windborne or waterborne erosion) or compact the soil (e.g. heavy machinery and livestock) effectively bring buried archaeology closure to the zone of erasure and accelerate this process. Yet the extent to which this threatens, or has already affected, Scotland's archaeology is almost unknown. Very few studies have attempted to identify compaction or erosion in relation to archaeological sites (see Dunwell and Ralston 2008b), and much of what we know more generally about erosion rates on agricultural land in Scotland comes from just a handful of individual studies (Lilley et al. 2018). It is clear that further investigation is required.

Nevertheless, ploughing has had a very obvious impact across eastern Scotland's early medieval record and remains a possible explanation for the limited recovery of internal or occupation deposits in extant structures (Cook 2016; Dunbar 2017). Yet a number of cases challenge the scale at which we can apply this assumption and the reality may be more nuanced. Sites in upland environments that lie above the altitudinal limits of intensive cultivation (e.g. Carn Dubh and Lair) also present with a lack of robust stratigraphy, as well as lowland structures with a 'scooped' component that lies considerably beneath the ploughzone (e.g. Easter Kinnear). In these cases, potential reasons for the lack of internal deposits could include the reworking of deposits by soil biota (see *Bioturbation* below*)* or anthropogenic factors, such as maintenance practices or the use of floor coverings (see Gé et al. 1993: 155–156; Boivin 2000; Macphail and Goldberg 2010: 598–599, 2018: 226–234).

Bioturbation

The disruption of sedimentary deposits by roots, invertebrates and animals has been widely identified across early medieval sites but to date has prompted little supplementary investigation. The majority of known cases relate to the truncation of features or the blurring of stratigraphic boundaries by plants and mammals, likely due to the ease at which their roots and burrows can be identified during excavation. Where it has been conducted, bulk analysis has also been successful in identifying the contamination of deposits with external material

such as insect eggs, insect remains, and plant roots and seeds (e.g. Carn Dubh, Macallan Distillery). Combined, the activity of these organisms can result in a heavily disturbed record

Table 1: Major preservation impacts identified during excavation of Pictish settlement, with examples of the affected sites in eastern Scotland

Factors Affecting Preservation	Recognised Impacts across Pictish Sites	Examples of Affected Sites
Reuse	Reuse of Pictish settlements · Loss of structural form via alteration of structures (inc. reuse of building materials and stone-robbing events) · Truncation, removal and/or reworking of internal deposits · Formation of new deposits · 'Masking' evidence of early medieval activity, via: – the greater prominence of medieval (or later) structures in the landscape – more intense reuse in medieval period (or later)	Burghead, Carn Dubh, Craig Phadrig, Dunnicaer Easter Kinnear, Kiltyrie, King's Seat, Kinneddar, Litigan, Maiden Castle, Pitcarmick, Portmahomack
	Reuse of pre-existing settlement during Pictish period · Alteration of structures (inc. reuse of building materials) · Reworking and commingling of deposits · Incorporation of new settlement into prehistoric landscapes · 'Masking' evidence of early medieval activity, via: – the greater prominence of prehistoric stone structures in the landscape – assumptions over dates of sites based on structural form – more ephemeral reuse in early medieval period	Ardownie, Bertha Park, Carn Dubh, Craig Phadrig, Cullykhan, Hawkhill, Lair, Shanzie, Tap o'Noth, Walton Road
Agricultural attrition	Ploughing (medieval, post-medieval and modern) · Destruction, truncation and scarring of archaeology · Reworking of deposits and loss of stratigraphic boundaries · Horizontal and/or vertical displacement of artefacts · Physical and chemical degradation of artefacts · Compaction of soil (over time results in the effective deepening of cultivation) · Increased susceptibility of exposed archaeological deposits to wind-borne erosion	Ardownie, Dunnicaer, Easter Kinnear, Grantown Road, Hawkhill, Kiltyrie, King's Seat, Kinneddar, Kintore, Lair, Macallan Distillery, Newbarns, Portmahomack, Rhynie, Walton Road

Agricultural attrition	<u>Ancillary activities (e.g. subsoiling, insertion of field drains etc.)</u> · Truncation of archaeology · Compaction of soils via vehicles and heavy machinery	Maiden Castle, Pitcarmick, Upper Gothens
	<u>Animal stocking</u> · Erosion of sites through trampling · Compaction of soil (increases the susceptibility of underlying archaeology to damage and removal if the site then comes under ploughing) · Damage to artefacts/structures · Vertical and/or horizontal displacement of soil and artefacts	Lair, Rhynie
Bioturbation (via roots, invertebrates, mammals)	· Vertical and/or horizontal displacement of sediments and artefacts · Permanent disruption of stratigraphic boundaries · Loss of structural integrity · Damage and fragmentation of artefacts and ecofacts · Contamination of deposits with exogenous material	Carn Dubh, Craig Phadrig, Dunnicaer, Easter Kinnear, Hawkhill, King's Seat, Kintore, Macallan Distillery, Newbarns, Rhynie, Shanzie, Walton Road
Soil acidity	· Chemical degradation and/or destruction of artefacts and ecofacts (e.g. bone, teeth, shell, iron) · Loss of environmental evidence and organic material (e.g. wood, insect remains, soft tissues) · Potential influence in pedogenic processes, resulting in the movement of fine material and homogenisation of deposits	Dundurn, Dunnicaer, Easter Kinnear, Litigan, Macallan Distillery, Pitcarmick
Coastal erosion	· Loss and truncation of archaeological deposits, features and structures · Exposure of archaeological deposits and structures resulting in increased susceptibility to physical and chemical deterioration by the elements	Burghead, Dunnicaer, Green Castle (Portknockie)

that limits the availability of secure dating evidence, making interpretations about individual structural form or settlement history problematic.

In looking for an explanation as to the general lack of interior stratigraphy found across eastern sites, bioturbation merits further consideration. Soft building materials such as turf and earthworks are highly susceptible to intrusion by burrowing mammals and introduce an abundance of organic material that, in the right soil environments, can be quickly turned over by soil biota (Dunwell and Trout 1999). Root and animal activity could therefore result in the mixing of collapsed roof, wall and floor deposits into what are seemingly homogenous layers, particularly in sites that have degenerated upstanding remains or are located on soils that have a looser, more easily penetrated structure (e.g. sandy subsoils). This was certainly the case at Kintore where, in a structure with limited floor layers, micromorphology identified bioturbation to be the most significant factor in destroying the internal fabric, alongside weathering and compaction (Ellis 2008).

However, the detailed investigation of soil processes on Pictish settlement sites is rare and there are many contexts where such analysis has not been conducted. Upland settlement, for example, has had no published micromorphological analysis to confirm or deny the impact of bioturbation on internal deposits, despite agriculture and reuse providing inadequate explanations for this occurrence. There has also been virtually no application in sites with limited or suspect dating evidence (e.g. Grantown Road and Macallan Distillery), which is surprising given that the impact of primary bioturbators, such as earthworms, is largely recognised through thin-section analysis and may be missed if such techniques are not routinely employed (Stein 1983; Taylor 2019).

Perhaps of greater significance has been the identification that, in the medieval burials and platform at Hawkhill in Angus, bioturbation occurred relatively recently and may have still been taking place at the time of excavation (Guttman 2009). Where stratigraphy is not observable to the naked eye, it may still be detectable in thin-section but the opportunity to access this information is waning. In areas where ploughsoil thinning, excavation or erosion are making sites more susceptible to intrusion, this imposes a significant time pressure and the potential loss of valuable deposits if adequate steps are not taken to recover information (Church 2009: 45).

Soil acidity

The vast majority of Scotland's soils are naturally acidic and are considered to be the primary reason for the lack of organic materials and artefacts recovered from Pictish settlement sites (Taylor 1990: 38; Noble et al. 2020: 302). Bone, teeth and shell degrade (and are eventually destroyed) most rapidly in environments where the soil water is acidic and unsaturated, for example in soils that are wet, free-draining and formed on sands or acidic parent materials (Kibblewhite et al. 2015: 250). These conditions dominate eastern Scotland's arable lowlands and, when coupled with the physical fragmentation and disturbance that results from

cultivation, it is unsurprising that very few artefacts survive in these contexts. The microbial activity that degrades organic matter, such as plant material, fungal spores and insects, is similarly accelerated by tillage disturbance, resulting in the extremely poor recovery of environmental evidence at sites such as Upper Gothens, which reported just a single, badly preserved cereal grain (Barclay 2001: 43; Kibblewhite et al. 2015: 250). The organic-rich peaty soils of the uplands typically have acidic pH values below 5, often below 4, and equally return limited quantities of bones, teeth and organic material (Paterson 2011: 15).

Metal artefacts, and the associated evidence of metalworking (e.g. slag and moulds), have fared somewhat better and provide the majority of our knowledge of manufacturing and settlement activity. The most significant evidence comes from hoards such as Gaulcross and Norrie's Law, but these have been found in isolation and contextualised examples are almost exclusively limited to enclosed, high-status sites such as Rhynie, Clatchard Craig, King's Seat and Dundurn (Blackwell and Goldberg 2019). More ephemeral evidence in the form of slag and revetted platforms have been identified in unenclosed settings (e.g. Hawkhill in Angus) but again there is little accompanying context and our understanding of manufacturing within the Pictish period remains heavily skewed towards concepts of status and/or ritual. In general, the artefact record from unenclosed sites is scant, with just a handful of heavily corroded iron and decaying stone objects recovered from sites such as Lair and Easter Kinnear.

It is important to note that this absence of material in unenclosed sites does not necessarily reflect an impoverished lifestyle – in fact, excavators are often careful to avoid such an interpretation (see Atkinson 2016: 77). The most common domestic artefacts are likely to have been made of wood and thus their destruction in the acidic soils of eastern Scotland is expected (Laing 2006: 76). However, as with bioturbation, very few studies have actually engaged with pH assessments at the site level, meaning interpretations regarding the presence or absence of particular artefact types are often based on assumptions about the preservation environment, rather than confirmed findings. Being unable to account for these processes at the site level means we may be missing important information over the reuse of objects, the types of materials used, or the function of settlement in general.

Soil pH is also known to influence soil-forming processes and may be linked to the seemingly homogenous deposits reported across Pictish settlement sites. Acidic conditions promote the dispersion of fine organo-mineral material from archaeological sediments and underlying soils, which is carried down the soil profile by rainwater. In a study of archaeological deposits at the Viking Age settlement of Kaupang in Norway, Milek and French (2007) identified this as one of the post-depositional processes responsible for the generally poor preservation of artefacts, bones and sediments, alongside leaching, bioturbation and the redistribution of iron. Combined, these had a cumulative effect in which the chemistry, structure and colour of the original occupation deposits were altered to such an extent that the sediments were rendered almost uniform in appearance and composition (Milek and French 2007: 324–325). Given the lack of stratigraphy observed across Pictish

settlement, examination of these processes in conjunction with pH analysis is likely to offer much needed detail.

Coastal erosion

The destructive nature of coastal erosion is well known and has impacted (and continues to impact) key sites across eastern Pictland. A dramatic example can be found at Dunnicaer promontory fort, where erosion has caused the headland to become detached from the mainland and resulted in the partial and total loss of structural elements (Noble et al. 2020; **Figure 2**). Estimating the total area lost has proven difficult, however a footprint of eroded rock indicates that the site was likely to have been at least 60 m longer and up to 25 m wider than its current extent (although additional estimations have been more generous – Noble et al. 2020: 309). Where the loss of a site has been so extensive, considering the potential role coastal erosion has played throughout the site's history is vital to the interpretation of its archaeological remains. The intense rebuilding activity identified within the surviving portion of Dunnicaer fort (see *Reuse* above) has been interpreted as a response to rapid expansion within a limited space that was possibly exacerbated by the effects of contemporary coastal erosion (Noble and MacIver 2017: 32). This is an important reminder that destructive agents do not exclusively occur following abandonment.

Figure 2. Erosion at Dunnicaer (top left – aerial view showing erosion foot at right side of stack; bottom left – mainland-side erosion face; right – proximity of surviving hearth to erosion edge in lower terrace). Top left created with Google Earth 2021 / photographs author's own.

As at Dunnicaer, erosion at Burghead promontory fort in Moray is ongoing with approximately 7.9 m of erosion having occurred on the north-west side of the site since 1904 (of which over 2.5 m occurred between 1976 and 2011 alone – Noble et al. 2018: 34). Land

loss is clearly accelerating and recent excavations demonstrated that the best-preserved stretches of rampart are those most under threat, with some areas surviving just one metre from a major erosion face (Noble et al. 2018: 34). It is therefore clear that coastal promontory forts face severe threat from erosion. However, the majority of these site types in eastern Scotland remain undated, meaning that the extent to which this process has impacted the early medieval settlement record as a whole remains uncertain.

The threat of climate change

What links these processes, aside from their negative impact on the survival of the archaeological record, are predictions that their rate of destruction will increase in the coming decades and centuries. Climate change in Scotland has been characterised by increasing temperatures, altered patterns of precipitation, and more frequent extreme weather events that have already had dramatic effects on our natural and cultural environment (Harkin et al. 2017: 4). Though the impact on coastal heritage has long been long acknowledged, recent years have seen a more focused awareness that this threat extends to all heritage assets, including inland and buried remains (Harkin et al. 2017; Harkin et al. 2019).

In agricultural zones, waterborne erosion and soil compaction (which effectively brings archaeology closer to the plough and can require deep and invasive remedial operations such as subsoiling or pan-busting) are major concerns (Oxford Archaeology 2002: 6–7). These factors are exacerbated by wet conditions and are likely to become a more significant problem as Scotland is subjected to wetter autumns/winters, and more erratic and extreme rainfall events (Troldborg et al. 2013; Lilly et al. 2018: 13). This threat is furthered by the fact that eastern Scotland accounts for over 65% of the country's potato crops, a type of cultivation that already requires deep ploughing and more intensive soil preparation (Oxford Archaeology 2002: 13). Current trends also indicate that the extent of planted agricultural land is set to increase further in coming years (RESAS 2019).

Changes to soil chemistry are expected to arise from increased temperatures and episodes of prolonged rainfall, altering the preservation potential of sites and buried remains (Harkin et al. 2019). Increased concentrations of atmospheric carbon dioxide have already been linked to greater microbial activity, whilst extreme dry spells have the potential to desiccate the very few examples of waterlogged deposits that have been identified at sites such as Portmahomack and Dundurn hillfort (Alcock et al. 1989; Spall 2007; EEA 2012: 150; Harkin et al. 2019: 32–34). Rates of bioturbation are also expected to increase due to longer growing seasons that encourage the spread of new and invasive species, and deeper and more penetrative root growth (Harkin et al. 2019: 33). Combined, these processes will result in the increased truncation of archaeological sites and the accelerated decay of artefacts and environmental evidence, further diminishing an already limited resource (Harkin et al. 2019: 34).

Moving forward

Rather than lamenting this potential loss, recognition of these processes should encourage a review of the techniques and methods we use to investigate Pictish settlement sites. There is an increasing awareness that preservation *in situ* may not always be the most suitable strategy of care and, in situations where negative conditions cannot be halted or significantly impeded, excavation is now being promoted as an active management plan (Harkin et al. 2019).

The first step in ensuring this approach is successful is to develop a baseline understanding of the current factors affecting preservation. This paper has outlined a number of major impacts but has also highlighted the need for more detailed site-based characterisations of the preservation environment and the post-depositional processes that have contributed to its current state. To address these gaps, archaeological analysis would benefit from a wider integration of techniques that are specifically designed to answer these questions. This could include geoarchaeological methods such as micromorphology, which is able to identify processes such as leaching, bioturbation and maintenance practices, and has consistently proved itself to have the greatest interpretative power of any single technique (Milek and Roberts 2013: 1845). Analysis of soil pH will also be useful in confirming the presence/absence of material types at the site-level, whilst multi-element analysis and magnetic susceptibility (an indication of burning and minerogenic variability) could offer new insight into activity areas and the spatial organisation of structures.

Results from these types of investigation will undoubtedly be beneficial for the reconstruction of individual site histories but also have the potential to inform much broader research agendas and management strategies if compared across a range of site types and environmental settings. Understanding how site location and different building materials influence the preservation of early medieval settlement is essential in identifying sites most at risk of destruction or, alternatively, targeting those that have the best examples of preservation. Similarly, it encourages an examination of the relationship between archaeology, land use, animal activity and soil properties, which will benefit our interpretation of the archaeological record far beyond eastern Pictland.

Integration of these methodologies and results in government and planning policy will be the key to meaningful action across the archaeological landscape. On agricultural land, scheduled monuments are currently protected through the Ancient Monuments (Class Consents) (Scotland) Order 1996, which limits damaging land use strategies but cannot control agricultural practices if they are shown to have occurred on the land within the previous ten years (UK Government 1996). This means that ploughing can occur at a consistent depth even when ploughsoil thinning is observed. Winter cover crops (which are planted to cover soil rather than be harvested) can help to limit waterborne erosion from bare soil in winter storms and heavy rain, and reduce snow compaction of topsoil horizons, essentially acting as soil armour for buried sites (Acuña and Villamil 2014). Many farmers have been put off the practice due to the expense and extra effort involved in establishing cover crops, however the

threat of climate change has encouraged a review of its benefits, with trials in eastern Scotland looking to using cover crops to build soil structure and mitigate the effects of extreme weather events (FFBC 2020). Should the benefits to archaeological sites be included in such trials, these practices could be written into new policy or recommended in cases where known archaeological sites are situated on regularly worked agricultural land.

Another strategy would be to embed dedicated geoarchaeological work and assessments of the preservation environment into developer-funded investigation. This type of excavation offers a prime opportunity to gain comparative empirical data across a wide range of sites, which can be used to inform broader heritage management strategies. Currently, there is no system in place to initiate this process, as Scotland lacks both the equivalent of Historic England's Science Advisors (who provide support and advice to local authorities determining planning applications) and any national guidelines on the application of geoarchaeology.

Conclusions

By reviewing the site-based evidence held in excavation reports, this study has identified a number of major factors that have affected the preservation of early medieval remains in eastern Scotland and influenced their interpretation. Widespread agricultural attrition, bioturbation, aggressive soil conditions and coastal erosion have resulted in a heavily truncated record that restricts our access to more detailed assessments of settlement form and function. The reuse of structures, both during early medieval occupation and following its abandonment, has also caused interpretational issues but may offer a new avenue of investigation when considering the potential location of settlement activity. Perhaps most significantly, this study has highlighted important gaps in our knowledge which can be addressed if we approach these sites with specific questions about the preservation environment, rather than attempting to address them following excavation. Finally, the threat posed by each of these processes cannot be understated and as climate change is set to accelerate their rate of destruction, the way we approach the archaeological record becomes vitally important.

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