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# Constructing Lordship in North Atlantic Europe

the archaeology of masonry mortars in the medieval  
and later buildings of the Scottish North Atlantic.

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## DECLARATION

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## ABSTRACT

This thesis investigates the archaeological potential of masonry mortars throughout North Atlantic Europe, with a particular focus on the buildings and environments of medieval northern and western Scotland.

The results of an extensive non-intrusive survey of medieval and later buildings are presented, within which nine multiphase sites were subject to more comprehensive building, environment and materials analysis. The survey suggests that, in general, different mortar-making techniques had well-defined sub-regional distributions which are not simply a correlate of environmental availability, but developed in different ways over time. Moreover, all of the more comprehensively studied buildings contain evidence of striking material contrasts from phases to phase which has great potential in standing building analysis. Material contrasts in masonry evidence between building phases, between neighbouring buildings, between specific buildings and the regional corpus, and between the regions themselves, are then considered as evidence of changing cultural, chronological and environmental context. The relationship between secular and ecclesiastical buildings across the region is a particular concern.

Qualitative lab-based and on-site material interpretations made throughout the thesis are supported by a programme of comparative experimentation. This thesis includes the first comprehensive investigation of lime mortars made from marine shells, the first evidence of lime mortars made from coralline algae, results from the first programme of dating medieval buildings in Scotland through radiocarbon analysis of relict mortar fuel, and microstructural analysis of a large range of medieval mortars from Norway to the Isle of Man. Wider research considers the initial emergence of mortared masonry in North Atlantic Europe and the relationship between clay and lime mortars.

Ultimately, by placing the upstanding buildings archaeology at the centre of the medieval and later landscape this thesis will demonstrate that masonry mortars have significant potential to inform our understanding of the cultural and environmental context of lordship construction in the North Atlantic, providing a new focus for further interdisciplinary discourse.



## LAY SUMMARY

This thesis investigates how different building mortars were manufactured in north-west Europe by analysing their surviving remains. The research suggests that mortars were made in many different ways depending on the location, type and age of the building and studying these different materials allows us to understand how individual buildings and regional building practices changed over time. In some cases it has been possible to suggest a construction date from the mortar evidence and, together with further examination of the different materials which were gathered for the manufacture of masonry mortars, this can help us understand more about the wider environment of woodlands, beaches and stone outcrops which were available in the past.



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## CHAPTER 1 - INTRODUCTION

### 1.0 INTRODUCTION

Within living memory, house builders in the Outer Hebridean islands of Scotland manufactured their own building lime by burning cockle shells in a peat-fired heap at the construction site, and there is evidence to suggest that this technique has been employed here in some form since the 11<sup>th</sup> or 12<sup>th</sup>-century AD (Thacker 2011; 2015a). In early 20<sup>th</sup>-century Shetland, meanwhile, lime was being manufactured by specialist limeburners who roasted the local metamorphic limestones in small peat-fired kilns at the quarry site itself, as documentary evidence suggests succeeding generations of the same local families had done for hundreds of years and perhaps since the 17<sup>th</sup>-century (Shaw 1980).

This contrast may appear unremarkable as lime burning is generally interpreted in terms of timeless tradition and, unlike in the Outer Hebrides, limestone outcrops are widespread across Shetland. Yet there is archaeological evidence to suggest that during the medieval period Shetlanders had also manufactured their building lime mortars by burning marine shells (e.g. O'Dell 1959; see Miket and Roberts 1990 for similar evidence in Skye), whilst elsewhere in North Atlantic Europe a range of different techniques were being employed.

On the island of Selja (western Norway), for instance, the mortar used in the construction of a fashionable 12<sup>th</sup>-century Romanesque chapel was manufactured by roasting marble in wood-fired kilns, whilst in this same high medieval period there is evidence to suggest that a technique of heating coralline algae gravels was employed in Orkney, again despite limestone freely outcropping across the archipelago (see chapter 3). Perhaps most remarkably, communities living further west on the small islands of *Sceilig Mhichíl* (south-west Ireland) and North Rona (north-west Scotland) had neither limestone outcrops nor even a beach, but a way was found to manufacture shell-limes to bind and/or coat the medieval masonry churches in both locations (Pavia 2010; Thacker 2013a). Indeed, in similarly restricted circumstances on High Island (west Ireland), it has even been suggested that the sand used to temper the lime mortar evident in the surviving medieval chapel was manufactured by physically grinding schistose bedrock in the water-driven mill excavated on the site (White Marshall and Rourke 2000, 89).

Such has been the importance of lime mortar in various periods that these represent just a few of the strategies employed within North Atlantic communities as lime mortared masonry

increasingly came to be seen as a cultural necessity within almost all European Christian medieval societies.

This thesis documents a preliminary investigation of the archaeological potential of these masonry materials across North Atlantic Europe, and will focus on the high and later medieval (1000 to 1560AD) buildings of northern and western Scotland. The research develops earlier work which had examined the medieval church and chapel mortars of the Outer Hebrides through non-intrusive material characterization of upstanding rubble buildings, although in general the chronologies and cultural contexts of many of those structures remain only very broadly understood (Thacker 2011). Ultimately, therefore, it was hoped the encouraging results of that previous materials research would have some relevance for the interpretation of buildings across the wider North Atlantic region, and that consideration of a broader spectrum of archaeological, architectural and historical buildings evidence might provide a usefully inter-regional perspective on the Outer Hebridean corpus.

### 1.1 NORTH ATLANTIC EUROPE AND THE EMERGENCE OF LIME

‘North Atlantic Europe’ is not a rigidly defined concept within this thesis but is considered to be a region whose boundaries change over time (cf. Liddiard 2013). It includes much of the area to the north and west of various Roman ‘limes’ across Britain and Europe, the lands of Picts and Scots referred to by Bede, much of Scandinavia, and those areas variously colonised by populations from Denmark and Norway in the late first millennium AD.

That building lime has been used to mediate identities with respect to these changing boundaries is clear, and the underlying reasons for the appropriation of lime mortared masonry by different sections of European society in different periods relates to a complex and heady brew of physical, cultural, historical and political associations. In many parts of the world lime has deeply-rooted cultural meanings associated with its white colour, which in Europe came to have particularly strong associations with Christian concepts of purity, virginity, cleanliness, and above all liminality (cf. Darvill 2002, 74; Thacker 2011; 2012; 2015a). Moreover, as a visually striking anthropogenic material which is not encountered in the natural world, knowledge of the pyrotechnical processes by which lime can be produced has also often been used to mediate a power relationship between different cultural groups. This is an excellent example of what Alfred Gell had referred to as a ‘technology of enchantment’ (Gell 1992), as this early 20<sup>th</sup>-century missionary account from the South Sea Islands makes clear:

‘The chiefs and common people, men, women, and children, hurried to the spot; and, when the covering was removed, a sheet of beautifully white plastering was presented to their astonished view. All pressed forward to examine it; some smelling it, some scratching it, whilst others took stones and struck it, exclaiming, as they retired, "Wonderful, wonderful! The very stones in the sea, and the sand on the shore, become good property, in the hands of those who worship the true God." (Rev. John Williams 1907).

In the 18<sup>th</sup> and 19<sup>th</sup>-centuries the Improvement project extended its remit to encourage people around the world to abandon building practices predicated on ephemeral organic materials, and similar coercive measures to persuade communities to adopt lime-coated masonry were employed by landowning estates in the West Indies (Chapman 1991; Mills 2009; Handler and Bergman 2009), as in Argyll (Sansum 2004, 164), Skye (MacLeod 1925, 166) and Lewis (Wilkinson 2009). Indeed, similar reactions to those of the South Sea islanders was reported from the Isle of Man in 1642, when Governor Greenlaw attempted to teach crowds of Manx onlookers the ‘wonderful process’ of manufacturing lime from local limestone sources (Train 1845). This project was reported to have failed, however, either because of the islanders’ subsequent inability to distinguish limestone from non-calcareous rocks, or because (unlike the governor) the islanders had not ‘had intercourse with the fairies, by whose agency his minerals were converted into powder’ (*ibid*).

In various medieval contexts around the world the emergence of lime coated buildings has also often been interpreted within similar paradigms of colonialism and conquest (cf. Karkov and Howe 2006), driven by persistent associations between mortared masonry, status and power as well as more nuanced cultural-religious concepts such as civility and cycles of ecclesiastical Reform (cf. Gem 1983). Many of these associations have been subsumed into the term *Romanitas* which implies an appropriation of Roman symbolism particularly relevant to the Roman Christian Church, but which may have different meanings in different chronological, social and regional contexts (see especially Jones 1971). From a lowland British medieval perspective, for instance, the symbolic *Romanitas* of lime mortar will have had a unique resonance as the material had first appeared here during the Roman Iron Age (Williams 2004:4), and so surviving masonry monuments and their remarkable constituent materials subsequently came to have particular cultural currency (Bell 1998).

One of the primary concerns of this thesis is to investigate how these lime-burning, mortar-making and other masonry techniques may have been disseminated in various contexts; whether for the first time (as in Roman Britain or high medieval Orkney), or in subsequent

periods when pyrotechnical traditions may have been regained. It will be suggested that in general, unless the source materials are imported, this process often appears to be predicated on the interplay between the technical expertise of the craftsman and local knowledge of available resources (cf. Sahlén 2011), and an important study at Hadrian's Wall demonstrated how materials analysis can allow some insight into this negotiation.

Microscopic analysis of mortar samples from the secondary very narrow 'Severan phase' of the wall (at Peel Gap) indicated that the lime-burners had deliberately sought out a distant limestone source in preference to closer outcrops, and it has been suggested this decision was predicated on the material's superior performance (Crow 1991, 57). This interpretation may then describe the approach of experienced Roman lime-burners initially confronted by an unfamiliar environment, and suggests a process of experimentation may have taken place before this phase of the structure could be built. Remarkably, however, although the primary (and broader) Hadrianic phases of the wall were stone and earth-cored, these also appear to have been lime coated (*ibid.*). Despite the apparently unsophisticated nature of the underlying materials now betrayed by the degrading fabric, therefore, this structure had also previously presented a striking statement of Roman culture for which lime served as a very visible signifier.

In southern Scotland, significant Roman masonry building evidence survives in the Antonine forts of Cramond and Bearsden, but in the immediate post-Roman period the distribution of mortared masonry appears to contract south to urban centres in Gaul, where the architecture was maintained to varying extents by early medieval Frankish invaders as keen to appropriate this iconography as they were to adopt the Roman Christian religion of the native population (Blair 2005). The masonry evidence at Autun is a good example of how this appears to have been technically achieved, as the cathedral of St Nazaire was renovated and extended in pulses of renaissance during the 6<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> centuries, reusing ashlar masonry sourced from within the now largely ruined antique city (Balcon *et al.* 2003). Antique masonry techniques, however, were also employed: *grand appareil* laid in well coursed heavy masonry, *petit appareil* in 'imitation' of *opus vitatum*, and throughout all the use of lime mortar mixed with crushed tile (*ibid.*:200).

The homogeneity of the masonry evidence from Autun has further significance for our enquiry once it is recognised that, as well as being explicitly anthropogenic, lime mortar also cannot be reused in the same way as stone. It is this characteristic which underpins the Autun archaeologists interpretation that the mortar evidence in different phases at St. Nazaire is so

consistent that continuity of traditional Roman lime making technique is demonstrated, rather than its revival in some way (*ibid*). Indeed, this interpretation parallels those of other scholars confronted by consistent evidence in other examples of iconic Gallo-Roman material culture, such as epigraphy and ceramics, which also appear to indicate the uninterrupted dissemination of intangible Roman craft traditions across much of the Frankish world into the early medieval period (e.g. Marti 2005). That lime-making techniques are particularly culturally (and subsequently archaeologically) significant in this regard is one of the main conceptual paradigms upon which this thesis is built, and clear examples of both continuity and irreversible breaks in craft traditions were encountered in the research.

In north-west Europe, this close association between lime mortar and Roman culture is made more stark as the material appears never to have been adopted by Iron Age communities living outside Rome's Imperial borders (in modern day Ireland, northern and western Scotland and western Norway), and even very Romanised areas of southern and eastern Britain are usually considered to have completely lost lime-making techniques during colonization by a pagan Saxon culture which brought its own timber building traditions (Blair 2005). The apparent initial Saxon disinterest in the masonry relicts of Romano-British authority, with which the landscape was evidently littered, certainly describes a very different colonial process to that evidenced in Frankish Gaul, and has even been interpreted as a deliberate contrast (*ibid.*). Broadly contingent upon the eventual Roman-Christianisation of the Anglo-Saxon Church, however, is the re-emergence of mortared masonry in the archaeological and historical records of their ecclesiastical buildings, during a period of early medieval Reform. This process is clearly evident in the substantial remains of the monasteries at Hexham, Repton, and Wearmouth and Jarrow, and an examination of the masonry here appears to fully corroborate Bede's text [731] (Shirley-Price 1990) which relates how the 7<sup>th</sup>-century Abbot Benedict Biscop brought Merovingian masons from Gaul to construct these buildings (Cramp 2006). Many of the masonry techniques already noted at Autun are again in evidence here, as the Northumbrian Church attempted to physically regain its Roman past by reusing Roman stone, re-appropriating Roman sites, and consciously re-importing essentially Romano-Christian masonry technologies to build lime-mortared and arcuate minster churches (Gem 1983; Bell 1998). Materials analysis of contrasting phase-specific dressed stone sources at the site has recently been interpreted as a somewhat similar process of non-local masons becoming increasingly familiar with local materials (Turner *et al.* 2013, 195) although the extent of pre-existing native expertise is not clear here. Tile-included *opus signinum* mortar floors, however, were noted at Wearmouth

and similar techniques have been reported at Anglo-Saxon sites in Reculver, Canterbury and Glastonbury (Cramp 1976; 2006).

It is from this early medieval period that Anglo-Saxon missionary work began across the North Sea in Saxony (see especially Palmer 2009), but the subsequent conquest of the region by Charlemagne is probably more immediately significant for the buildings archaeology. Charlemagne's conquest enabled the foundation of bishoprics (apparently for the first time, as there were no antique *civitates*) and the concomitant construction of a series of 8<sup>th</sup>-9<sup>th</sup>-century masonry churches 'from the Lower Rhine to the Lower Elbe...and from the German low mountain range to the North Sea coast' (Müller-Wille 2003; Palmer 2009, 168). This conceptual link, between regional administration and masonry building is an important and recurring feature of the archaeological record of North Atlantic Europe, and the particular importance of the North Sea evidence to this thesis in terms of material use will become apparent below.

It has been suggested that it is in this same period, in the wake of the Whitby 'Easter debate' (Shirley-Price 1990; Barnwell *et al.* 2003), that mortared stone emerges into the medieval archaeological record of western Scotland and Ireland in a series of small 'shrine chapels', built to house the relics of important saints and once more symbolise *Romanitas* (Harbison 1982; Ó Carragáin 2003; 2010, 66-70). That our understanding of this evidence is problematic will be discussed in chapter 4, but more convincing physical evidence in Scotland does relate to this same early medieval period and to an excavated 8<sup>th</sup>-century context at the important ecclesiastical site of Whithorn in Galloway. This site can also be associated with the Northumbrian Church, however, as their authority extended across much of the area around the Solway in this period. Although the main church at Whithorn is likely to have been timber-built in the 8<sup>th</sup>-century, lime evidence deriving from a mortar coated stone-built enclosure wall was discovered which (as at Hadrian's Wall) had an earth and stone packed core (Hill 1997, 143). The excavator highlighted how extraordinary this evidence was in a Gallovidian context, especially given the lack of limestone within the locality (*ibid.*), but it may be significant that strong shell-lime making traditions are reported in later periods in Galloway and piles of shell were noted at this site.

For Bede, mortared masonry explicitly expressed Reform (Gem 1983), and it is within this paradigm that he framed the narrative of King Nechtan's request for masons to be sent from Jarrow to Pictland (Shirley-Price 1990). We might see the construction of the 8<sup>th</sup> church at Armagh in Ireland in similar terms (Ó Carragáin 2010) and these were great victories for the

Church in physically extending Roman Christianity beyond the borders of the former Roman Empire for the first time (cf. O’ Reilly 2009). Unfortunately, however, no convincing archaeological evidence for Nechtan’s putative Romano-Pictish church has been found, and most interpretations of early medieval Pictish or Dalriadan church buildings within Scotland are dominated by negative evidence and historical references to timber-built churches, like that suggested at Whithorn.

From a wider perspective on Bede’s reference to Scottish timber churches, however, three issues immediately emerge:

- Firstly, the 8<sup>th</sup>-century Anglo-Saxon ecclesiastical masonry buildings discussed above would have fundamentally contrasted with both the contemporary halls of the English secular elite (Cramp 2006, 54) and with the majority of later Anglo-Saxon proto-parochial chapels which were also generally composed of timber (Blair 2005).
- Secondly, even within England, this contrast would have persisted until the widespread construction of secular masonry buildings and chapels began in the 10<sup>th</sup> or more generally the 11<sup>th</sup>-century: However important masonry churches were ideologically to the 8<sup>th</sup>-century Anglo-Saxon Church (Turner *et al.* 2013), throughout much of the early medieval period they were rare landscape features at the centre of large rural ‘mother-parishes’ (Blair 2005).
- And thirdly, however much Bede wished to establish the Romano-Frankish credentials of his Church, from his rather restricted eastern English perspective (Brooks 2006) he did not have to confront the sophisticated monumental dry-stone masonry of the northern Picts in Atlantic Scotland, the corbelled dry-stone chapels of western Ireland and Scotland which are also often suggested to date from the 8<sup>th</sup>-century (White Marshall and Walsh 2005, 127; Ó Carragáin 2010, 50), or perhaps even the survival of lime-making traditions in western Britain (cf. Brooks 2006).

Again, however, there are problems with chronologies in the early medieval chapel corpus in Scotland. In boldly stating that any putative Early Christian chapels in Shetland are likely to be made of timber, for instance, the main publication to emerge from the Old Scatness excavation implicitly also ignores the dry-stone corbelled buildings at ecclesiastical sites in the Western Isles and Argyll (Turner 2010, 22-23; *contra.* Hamilton 1956). In a remarkable reversal of *Romanitas*, however, this statement also implicitly suggests that local Pictish communities inhabited monumental stone-built domestic houses but were worshipping in timber-built churches. This is an important check to a simple correlation between stone

(rather than mortar) and civilization in the North Atlantic, and the iconography of such complex ‘native’ masonry buildings has been problematic for Imperial ambitions in many contexts around the world (Fraser 1990).

All three of the above issues will be important for our interpretation of the later Scottish North Atlantic evidence and comparing apparently contemporary secular and ecclesiastical buildings is a fundamental concern. By the end of the 10<sup>th</sup>-century there is good evidence to suggest lime-mortared masonry church buildings are present at important sites in Belgium, Switzerland, Bohemia, England, Ireland and northern Germany (Müller-Wille 2003; Cramp 2006; Stelzle-Hueglin 2007; Profantová 2009; Ó Carragáin 2010), and in much of continental north-west Europe lime-bonded high status secular masonry buildings had a similar distribution by this period. But widespread comparable contemporary evidence in either social sphere remains elusive in the archaeological record of the north North Atlantic, and appears to be largely absent in Scotland, Denmark, Sweden, Norway and Iceland. In the north and west of Scotland, any continuity of Pictish domestic architectural traditions into the high medieval period appears to have been effectively severed by 9<sup>th</sup>-century Norse colonization (e.g. Dockrill *et al.* 2010, 362), and many descriptions of this process are not dissimilar to most interpretations of the Saxon colonisation of East Anglia noted above. A complete shift in excavated material culture at Old Scatness (Shetland) suggested invasion to archaeologists, and the development of ‘foreign’ and pagan Scandinavian traditions of longhouse architecture in almost complete disregard of the native monumental masonry techniques (*ibid*; *contra* Sharples and Parker Pearson 1999). Indeed, many previous reviews have suggested lime technology is not evident in the Scottish archaeological record until the 12<sup>th</sup> or even 13<sup>th</sup>-century, and this persistently cited watershed has often even been used to date individual masonry buildings (e.g. Graham and Collingwood 1923, 279; Lowe 1987; 1993, 323; Fisher 2005, 85).

Occasionally, however, lime-mortared masonry buildings within the Scottish North Atlantic have been ascribed much earlier (even first millennium) construction dates, although unfortunately on-site archaeological characterisations of the mortar evidence at these sites in terms of material analysis, stratigraphy and chronology have been problematic. A number of important surveys and/or excavations of putative early medieval buildings at St Ninian’s (Shetland), *Teampull Ronain* (North Rona), Newark (Orkney), St Columba’s Shrine (Iona) and the east end of the crypt at Portmahomack (Ross), have been unable to clearly characterise primary mortar materials on site (O’ Dell 1959; Nisbet and Gailey 1960; Carver

2008) and in some of these descriptions it is difficult to ascertain whether the fabric concerned displayed any mortar at all (e.g. Redknap 1977; Carver 2008; see chapter 5). There has been no lab-based mortar analysis of early mortar materials at any of these sites.

It is probably significant that in the Scottish North Atlantic as elsewhere these early mortared masonry structures are all ecclesiastical buildings, but the apparent lack of explicit material characterisation is obviously problematic when the introduction of mortared masonry is generally regarded as so culturally significant, and the range of materials and techniques from which mortars have been made in North Atlantic Europe is so broad. As excellent as the RCAHMS inventories are, even in later medieval ruined buildings where mortar materials are often very visible and clearly contrasting, descriptions rarely move beyond generic statements such as ‘bonded with a coarse lime mortar’. In this context then, a number of important questions often go unanswered:

- Is the mortar a clay, clay-lime, shell-lime, limestone-lime or maerl-lime?
- Is it shell-tempered, maerl-tempered or lithic-tempered, or a mixture of these materials?
- Are limestone and/or shell available locally?
- Is it wood-fired or peat-fired?
- Which mortar is primary?
- Is that primary mortar, secondary lime pointing and clay bedding and core, or primary lime coating and bedding and clay core?
- Do the external elevations evidence a degraded render, harl, primary slaister, sneck-harl, or pointing?
- What is the coating stratigraphy and how does this relate to the development of other constructional phases elsewhere in the building?
- Is the building dry-stone, or has the mortar core and/or bedding degraded and dissolved?
- Etc. etc. etc.

Characterising these material relationships is often challenging, but this thesis will demonstrate that the process has excellent archaeological potential in the Scottish North Atlantic, and this potential has increased dramatically in recent decades with more widespread application of geoscientific investigative procedures to mortar materials for the conservation industry.

## 1.2 MORTAR ANALYSIS IN MEDIEVAL BUILDINGS ARCHAEOLOGY

That mortar analysis has not yet become a commonly-applied method of archaeological enquiry, however, is evident in almost all survey and excavation monographs of Scottish medieval buildings (e.g. Driscoll and Yeoman 1997; Lewis and Pringle 2002; James and Yeoman 2008) as well as published reference works on archaeological science and materials analysis (e.g. Tite 1972; Goldberg *et al.* 2001; Goldberg and MacPhail 2006; Henderson 2000; Shortland *et al.* 2009). The very comprehensive ‘Science and archaeology of materials: an investigation of inorganic materials’, for instance, has excellent sections devoted to glass, ceramics, metals and stone, but contains no information on how to approach mortar analysis at all (Henderson 2000). Rather than relating to the archaeological potential of the material itself, this is largely the result of the ambiguous position in which the archaeology of upstanding buildings still often finds itself. It is no coincidence that those inorganic materials noted above which are deemed worthy of archaeometric analysis tend to be those excavated from below ground levels, whilst upstanding building surveys are often divorced from the wider material environment. The result is that the archaeometry of ceramics is a mature archaeological discourse with a long historiography, whilst mortar analysis is dominated by excellent lab-based analysts with strong ties to the building conservation industry (see for example Valek *et al.* 2010; Hughes 2013). Buildings archaeologists, it would appear, are more engaged with non-intrusive investigations around the sociology of movement, landscape and space.

These atomistic disciplinary boundaries are reflected in (and perhaps also a reflection of) the historiography of mortar analysis which, before the 1980’s was dominated by wet chemical analyses, which did indeed demonstrate very little archaeological potential. One of the simplest and most commonly-used of these methods is acid dissolution to release aggregate-temperers for the characterization of so-called binder-to-aggregate ratios (e.g. Miranda *et al.* 2012), and attempts to use this method as part of comparative archaeological investigations in British medieval buildings have met with very little success. At Kildrummy Castle (Aberdeenshire), for instance, the temperers from fourteen acid-dissolved mortar samples were assessed (Biek 1962) in an attempt to establish a relationship between different buildings on the site, but the results were considered ‘insufficiently consistent’ (Apted 1962, 218). The limitations of this method are many but include: an implicit reliance on representative assemblages which are generally unsustainable in historic mortars, the incidental dissolution of calcareous fractions from within the added-temper, and the potential dissolution of any

carbonate kiln-relicts which were not a fully integrated part of the so-called mortar ‘binder’ (see chapter 2). The extraordinarily ambitious sampling strategy which took 626 mortar samples from All Saints church in Brixworth (England) was ultimately analysed using four different versions of this same procedure, and the published discussion doesn’t evince any clear or convincing outcomes at all (Parsons and Sutherland 2013, especially 251-261). To have approached this remarkable Anglo-Saxon mortar assemblage with such a limited analytical procedure was unfortunate, but the lack of any clear attempt to characterise the multiphase mortar archaeology first, compounds the issue. The earlier analysis of a series of Anglo-Saxon and medieval mortars from the excavation of Jarrow and Monkwearmouth was much more coherent in this regard, as the investigation was initiated by apparent material contrasts noted on site and with salient research questions regarding material sources and technology transfer from Gaul (Cramp 2006). Although the material descriptions are slightly problematic this undergraduate study appears to have identified a number of phase-specific contrasts in lime-sources, tempers and fuels which should be interpreted more thoroughly in future work.

Mortar archaeology requires a reflexive approach, but a disciplinary disjuncture sometimes exists between the on-site and lab-based analysis which may be further highlighted by consideration of two important investigations of medieval buildings from within the Scottish North Atlantic, both of which have been re-examined to some extent during this thesis. The first study included a nuanced and sophisticated petrographic investigation of the microstructure of thin sectioned mortar samples from two upstanding medieval castles (Castles Sween and Lochy) in which the limestone provenance of the mortars were convincingly identified through the recognition of heated kiln-relict clasts with contrasting core/rim textures (Hughes and Cuthbert 2000); but the materials research was of limited archaeological value as the samples were collected from unsafe ex-situ contexts without any reference to the standing multiphase fabric. In a second study, the mortars of an important early chapel excavated from beneath St Ronan’s church on Iona were subject to surface examination only (Dixon 1994), and here thin section analysis was ‘eschewed’ with results which are extraordinary and may be problematic (cf. Stoltman 2001, 307-8; see appendix 15). In this case, however, at least some samples were collected from measured contexts and the investigator employed a programme of comparative analysis with a range of sands available in the local landscape which was an early inspiration to my own fieldwork methodologies (*ibid.*). This apparent contrast of approach between upstanding and excavated archaeology will be considered again in chapter 4, but it is worth noting here that combining

these two excellent studies to implement a more interdisciplinary or multidisciplinary methodology would probably have better served the archaeology in both cases.

Without disaggregating the mortar, it is the ability of microscopy to examine textural variation in kiln-relicts, and the relationships between these and temper arrays in thin or polished sections which is the crucial advance in mortar analytical procedures, and the widespread post-1980's adoption of geoscientific microscopic techniques for the study of mortars has transformed the capability of analysts to characterise material provenances (Elsen 2006; Hughes and Cuthbert 2000). These techniques are also now being employed in archaeological mortar studies in continental Europe, and here I would particularly like to highlight a recent project at the Castle of Ladirago near Pavia (Italy), during which the examination of a series of masonry phases displayed at this primarily 11<sup>th</sup>-century building included:

‘Textural and compositional analyses of plasters and mortars...to provide useful clues in showing the different construction periods, whereas new data will increase the knowledge on historical production and techniques, with particular attention to the evolution and the exchange of building practices.’ (Caro *et al.* 2008, 86).

In this study, plaster and bedding-mortar samples were collected from measured and characterised masonry phases and subjected to acid dissolution, light microscopy and electron microscopy with EDX, before comparing these results with aggregates sampled from local riverine sources (*ibid.*, 88-89). Although the material grades suggested the quick-lime had been sieved, and this appears to have precluded microscopic identification of carbonate kiln-relicts (prompting the unusual but interesting step of measuring magnesium levels by microprobe analysis), the investigation successfully met its aims in refining the buildings phasing and collecting more data for future comparative mortar research. Within a discourse still dominated by a concern to specify conservation repairs, the comprehensive and geoscientific approach implemented in the Ladirago project is one of a number of recent studies which have influenced the methodologies designed for this thesis.

It is, however, curious that even in projects where mortar microscopy has been employed, analysts often continue to stress that it is the characterisation of contrasting phase-specific aggregate-temper profiles which has the greatest archaeological potential in buildings studies (eg. Lugli *et al.* 2013). Certainly, characterising temper profiles is the dominant method of

classifying ceramics (Goldberg *et al.* 2001) and is of course a fundamental part of mortar analysis also, but that many investigators still rely on such a limited approach may suggest that the wide range of different temper, fuel and particularly lime sources evident in the medieval Scottish North Atlantic material is exceptional. The requirement to interpret kiln-relicts within the Scottish Atlantic corpus, which in some cases had never previously been comprehensively characterised or even recognised, may support this suggestion and certainly increased the archaeological potential of the material in this research. Moreover, notwithstanding the above criticism of methodologies limited to surface examination only, many of the upstanding medieval buildings surveyed for this thesis display such large volumes of relatively coarse and clearly contrasting mortar materials and (with experience) these can often be confidently characterised on-site through non-invasive in-situ surface examination (Thacker 2011; see chapter 2). Indeed, although limited in scope, to be able to at least broadly characterise mortar materials in-situ is a crucial first step in integrating mortar archaeology within building survey, and the potential of this approach was recently ably demonstrated in an important re-analysis of the 9<sup>th</sup>-century ‘porch’ at Deerhurst Church Gloucestershire (Hare 2009). In contrast, however, a number of regional studies attempting to refine medieval building chronologies within the North Atlantic by considering stone-emplacement techniques (Ó’ Carragáin 2005b; Caldwell and Ruckley 2005; Potter 2006; 2009) do not consider mortar characterisation at all. In their investigation of the interplay between local geologies and masonry technique, however, these are important parallel studies which will ultimately lead to a much more holistic approach.

The potential of post-excavation mortar analysis will be considered in chapter 3, but (where possible) in-situ characterisation has to be the first approach and was employed widely during this thesis research in a series of rapid regional surveys begun very early in the project. Assessing the likely efficacy of those interpretations, through subsequent microscopic materials analysis, was one of the primary research aims of this thesis and continued throughout the project and beyond.

### 1.3 MEDIEVAL BUILDINGS ARCHAEOLOGY IN THE SCOTTISH NORTH ATLANTIC

This thesis is primarily concerned with the investigation of high medieval buildings from the 11<sup>th</sup> to the 13<sup>th</sup>-centuries when a confluence of factors including: the Christianisation of Scandinavia, Iceland and Greenland; another wave of Church Reform across northern Europe including the proliferation of new Reforming monastic orders; the conquest of

England by the Danes and then the Normans; the partial conquest of Ireland by the Normans and the Normanisation of much of Scotland; and the incremental formation of territorially-fixed archdiocese, diocese and parishes are all apparent. Contingent with these processes is a marked increase in masonry church and castle construction across Northern Europe at many levels of society and in the North Atlantic widespread evidence for building lime emerges in the archaeological record for the first time.

Once again the iconography is clear and, although Armi (1990) has questioned whether chapels elsewhere in Europe were always lime-coated, the early medieval evidence already discussed at Jarrow (Cramp 2006) and Galloway (Hill 1997), is now joined by high medieval examples of lime coatings in 12<sup>th</sup>-century Wales (Gem 2009), Scotland (McDonald 1995, 187; Thacker 2011) and Greenland (Nyegaard 2009, 7). Where Coelfrid had likened the early medieval Northumbrian Church to the moon (Bede [731]; Shirley-Price 1990:315) and Carolingian Europe had been ‘adorned with churches as the heavens shine with stars’, high medieval Europe was now also ‘clothed in a white mantle’ (Hiscock 2003). These buildings were described as *candidam*, a word often simply translated as ‘shining white’, but which actually has much stronger spiritual associations in particular bible references to Christ’s garments during the transfiguration or the throne of god (Malone 2003, 170). That every single medieval building in the Scottish North Atlantic surveyed for this thesis, both churches and castles, was coated with lime mortar allows its metaphoric association with this transition to another place (Thacker 2015a).

As noted above regarding the Outer Hebridean corpus, however, various issues in accurately dating the earliest masonry buildings for which evidence does survive in the Scottish North Atlantic have precluded chronological refinement, and these structures often cannot be confidently dated even to within a particular century (*contra* O’ Keefe 2004, 6). The specific issues for each regional study will be further examined below, but in general terms relate to a lack of documentation, widespread use of rubble walling, conservative architectural styles, and graveyard contexts which have often continued to remain in use so precluding excavation (Crawford 1987, 183; Evans and Rutherford 1998; Raven 2005; Barrowman 2008b).

Undoubtedly, the inability of Scottish archaeology to place its medieval buildings onto a more refined chronological footing has stymied interdisciplinary and inter-regional discourse and, as recent research at North Rona has shown (Thacker 2013a; in prep), in many cases this has resulted in the assignation of a series of inappropriately early construction dates to

structures within the North Atlantic corpus (see chapter 5). The relatively late radiocarbon date to emerge from Church Island (Hayden 2013) and more convincing evidence for the continuing early medieval vitality of the monastery at Iona (Dumville 1997, 17; Jennings 1998; Clancy 2011) have enormous chronological implications for the previously accepted early medieval Scottish North Atlantic chapel typology, which now appears to have been so very tenuously constructed around these two terminuses. The preoccupation of 19<sup>th</sup> and 20<sup>th</sup>-century Scottish scholars with the North Atlantic may in part be predicated on the dearth of early medieval texts away from the west (Maldonado 2011), but archaeologically the underlying problem with these 19<sup>th</sup>-20<sup>th</sup>-century national ‘Early Christian’ typologies (in Scotland and Ireland) was largely due to a preoccupation with stone-built fabric, and the perceived gradual and isolated development of mortared masonry structures from the dry-stone buildings on the Atlantic coasts of both countries (Anderson 1881; Leask 1955). Within this context, the more recent shift in the national discourse away from the west and toward timber churches and halls might appear to pose clear problems for a thesis which includes both Scotland and Ireland and is investigating the archaeological potential of masonry fabric. But from a North Atlantic perspective, very little is changed by outside perceptions that the region’s medieval buildings no longer represent the roots of their respective national corpuses further east.

Although at first glance the nodal spread of mortared and arcuate masonry technologies from a distant continental European source, suggested by the brief narrative above, might appear to present a very different schema from those typologies previously predicated on native innovation of technique, these are not mutually exclusive paradigms. Technological innovation (native and otherwise) certainly requires initial engagement not isolation and the sub-regions of the Scottish North Atlantic were part of much larger North Atlantic and northern European medieval cultural networks within which a variety of masonry techniques were translated, disseminated, negotiated and developed. Subsequent technical developments may have taken place in different social, environmental and cultural contexts at various times, and so have multiple points of origin, although pursuit of this narrative in the medieval period is often precluded by a lack of chronological refinement in the archaeological record.

Within an interpretive framework therefore largely predicated on initial translation, broader historically-contingent scales of analysis are sometimes appropriate and a possible example of the relevance of this approach may be described by the apparently very localised

distributions of medieval corbelled dry-stone chapels in Kerry (SW Ireland) and Lewis (NW Scotland). Whilst continuity of technique between the early medieval and prehistoric dry-stone buildings in Ireland seems unlikely (White Marshall and Walsh 2005, 103-6; Ó Carragáin 2010, 50; *contra* O’Keefe 1998, 114), and continuity of technique between the early and later medieval dry-stone buildings of Scotland has not been demonstrated (Harding 2000; Thacker in prep), from a pan-North Atlantic perspective there is complete continuity which may have greater archaeological potential for both countries. An inter-regional model of craft dissemination may be required even when, like their Roman counterparts further south and east, impressive monuments from those earlier periods would have still been very salient in the high medieval landscape (Driscoll 1998b).

A more sophisticated model for the development of building technique in the high medieval period may be arrived at by further re-considering the evidence which suggests that clay-bonded masonry might occupy an intermediate stage between ‘dry-stone’ and fully lime-bonded masonry in some sites or regions (Hamlin 1976; Swift 1987). That the terminology around these buildings is problematic is discussed in chapter 5, but given the very strong structural correlation between lime mortar and arcuate masonry in the Scottish North Atlantic and localised distributions of contemporary clay and lime mortar use at various times (Thacker 2011), it would appear contemporary regionally-specific contrasting structural/architectural forms pertained in different periods as different newly emerging technologies and techniques were employed. Whilst underscoring their continuing utility, however, contemporary use of clay-bonded, earth-packed, shell-lime mortared and/or dry-stone masonry in different contexts until the very recent past, does not preclude an earlier chronological succession. Even in a period where inter-regional spheres of influence and rapid change can be demonstrated, at some sites smaller intra-regional scales of analysis may still be appropriate and to interpret particular sites with simple reference to when lime mortar was first used within a region is rarely appropriate. Given that many early buildings across the Scottish North Atlantic demonstrate at least some use of clay mortar, this evidence requires re-evaluation.

#### 1.4 SUB-REGIONALITY WITHIN NORTH ATLANTIC EUROPE.

Regionality is clearly important within a thesis predicated on the premise that building form was mediated by negotiation within various cultural and physical environments, although to what extent the communities concerned considered their own identities to be defined in

geographical terms is a salient question (cf. Hastrup 1984; Broun 1999; Woolf 2000, 102-108).

For instance, although early medieval Ireland ‘consisted of more than one hundred and fifty separate kingdoms’ (Downham 2007, 12), it has been suggested that the island is remarkably culturally consistent in large part because its generally lowland topography presents a lack of physical barriers to cultural exchange ‘while the highland periphery can provide only scattered and separate refuges for older traditions’ (De Paor and De Paor 1958, 19; Ó Carragáin 2005a). Moreover, this ‘cultural unity’ appears to have been emphasised when the island was under threat of colonisation, whether from the Vikings in the 9<sup>th</sup>-century or the Normans in the 12<sup>th</sup>, and a recent study defined by ‘social acceptance of an idea of common ethnic ancestry and an idea of geographic origins’ concluded that medieval Ireland did exist as a ‘nation’ (Finan 2004, 114; Da Paor and Da Paor 1958, 19). Indeed, this concept was implicit within an important study interpreting ‘regionalisms’ in the Irish pre-Romanesque church corpus, and it was on this basis that contrasts in building form were largely interpreted in terms of chronology rather than regional identity (Ó Carragáin 2005a).

Similar interpretative paradigms have often prevailed within the Scottish discourse, although a much more complex narrative has emerged from the country’s varied internal topography, central North Atlantic location, and history of sea-borne communication. In this regard, medieval buildings studies have emphasised cultural connections around the North Sea between eastern Scotland, eastern England, and Scandinavia (Walker 2001; Blair 2005; Heywood 1988; Bogdanski 2013; Liddiard 2013), whilst the *Druim Alban* mountain range (located close to the Scottish west coast) is widely regarded to have presented a physical and cultural barrier between this region and the west Highlands and islands since the early medieval period at least (Bede [731] Shirley-Price 1990; Skene 1837; Dunshea 2013). In turn, the Scottish western seaboard and Hebrides are often regarded as an ‘integral part of the Gaelic Irish world’ (Nicholls 1972, 3-4; Kingston 2004, 19-21) by recent scholars, although the historic Irish colonial paradigms of Dalriadan invasion have recently been questioned (Campbell 2001; Armit 2008), a cultural ‘frontier’ between western and eastern Scotland remains implicit in the medieval Scottish discourse.

Political division between northern and southern Pictish kingdoms was also reported by Bede [731] in the early medieval period (Shirley-Price 1990), and is widely regarded to have been predicated on the ‘Mounth’ range of the Grampian Mountains, whilst in the high medieval period Crawford has suggested the Sutherland uplands presented a similarly

topographical cultural barrier between high medieval Caithness and the rest of Scotland (1985). The medieval folklore of the Viking colonies of Britain, the Faeroes, Iceland and Greenland, however, is largely predicated on resistance to the late first millennium attempt by Harald Finehair to form a Norwegian state (Hastrup 1984), and so conceptions of long-standing cultural regionality are explicit in many discussions of medieval politics both in Norway (Woolf 2000) and the wider diaspora. The Faroese, for instance, are reported to have such a multitude of dialects and customs that a concept of national identity before the 19<sup>th</sup>-century is highly questionable (Østergaard 1992). Although, by contrast, Iceland is often considered in the same culturally unified terms as Ireland, colonial paradigms work in many ways (Bhaba 1994) and cultural concepts which emphasise either continuity or change must weigh the evidence carefully, even on an island which (after *landnam*) was never under threat of foreign invasion (Byock 1985).

Returning to the archaeology, an early attempt to broadly characterise the regionality evident in the Iron Age archaeology of Scotland on the basis of ‘geography, chronology and culture’ identified the area north and west of a line from the firth of Clyde to Inverness as a coastal region in which ‘monumental drystone buildings suggested a common heritage’ (Piggott 1966; Lamb 2008, 74). More recent studies have convincingly demonstrated further Iron Age regionalities within this ‘Scottish Atlantic Province’ (Armit 1991; Harding 2000; Hingley 1992), but given the apparent geo-cultural coincidence of sophisticated pre-medieval dry-stone architectural heritage and later concentration of Norse colonisation (Thacker 2011) this thesis will focus on the same broad area. Recognising a North Atlantic European regionality for the period concerned, however, for the purposes of this thesis that ‘Province’ is now re-defined as the ‘Scottish North Atlantic’.

Map 1.1.2 (see appendix 1) describes this Scottish North Atlantic region as defined by this thesis, and highlights three further survey sub-regions. These consist of: the South-West Region, which essentially covers the old county of Argyll as far north as Ardnamurchan; the North-East Region which includes the Northern Isles, Caithness, and western Sutherland and Ross as far south as Loch Ness; and the North-West Region which includes the Western Isles, Skye and the nearby mainland between Ardnamurchan and the Kyle of Tongue. Notwithstanding the above discussion, there are clearly complex dualities inherent in discussing societies which are both divided by and connected by their maritime geographies, and in broad terms these sub-regions do appear to display contrasting historical and archaeological evidence in different periods and these contrasts often appear very persistent.

Buildings, portable material culture and place-name evidence, for instance, suggests clear cultural contrasts pertained between the communities either side of Ardnamurchan point on the west coast, both before and after Norse colonization (Crawford 1987; Jennings and Kruse 2009; Thacker 2011), and with the *Druim Alban* to the east, this is the basis of the boundary between the two western sub-regions. The boundary between the two northern sub-regions is based on similarly contrasting evidence but from the later medieval period, as increasing Gaelicisation of the North-West Region appears to have drawn the clan Mackay into the cultural ambit of the Lordship of the Isles (Cheape 1993a, 56) whilst increasing ‘scottification’ of the North-East Region appears to create cultural contrasts which are not so clearly apparent in earlier periods (Wainright 1962, 188-194). Ultimately the thesis will demonstrate that the buildings evidence can refine our understanding about how these boundaries might have developed, and the cultural implications of this evidence for our understanding of the Scottish North Atlantic in the later medieval period are significant.

Recognizing that these South-West and North-East Regions are often seen through the high medieval histories of the MacSorley and Orcadian lordships, however, is also important for this research project, as most historical commentators emphasize our continuing lack of knowledge of the northern Hebrides in this same period. The upstanding buildings archaeology of this region is very rich, but without an historical narrative has often proven challenging to interpret. I will argue that the medieval buildings of the northern Hebrides can be interpreted within the same typological frameworks as the rest of the North Atlantic region, but that in different socio-political circumstances the evidence is displayed in a very particular way.

## 1.5 THE FIELDWORK METHODOLOGIES

Ultimately this research aspired to examine a representative number of medieval and later masonry buildings within each survey area through a widespread programme of rapid building surveys, which continued over the course of the project and beyond. These surveys were generally undertaken with minimal previous literature search and characterised the complete range of visible in-situ mortar materials within as many historic buildings as possible. Subsequent analysis of these survey results could then begin to evaluate a number of research questions:

1. How consistent was the mortar evidence within single phase buildings?
2. To what extent did the mortar evidence contrast with building phasing?

3. To what extent did the mortar evidence corroborate the accepted building phasing?
4. To what extent did the mortars of particular buildings correlate with locally available material sources?

And this could then lead on to wider questions such as:

5. How much mortar material variation was there within the locality or region?
6. Did the mortar evidence within the region vary depending on type of building or chronology?

As noted above, these survey criteria had developed from earlier fieldwork in the Outer Hebrides (Thacker 2011) and so I was particularly concerned to begin lab-based microscopic mortar investigation as quickly as possible, in order to examine the veracity of these on-site interpretations and inform future work. These began within six months, and included a number of loose mortar samples collected during the rapid survey programme, as well as fixed samples removed from the first identified case study of *Eaglais na h'Aoidhe* in the isle of Lewis (see chapter 2).

Ultimately, based on the information from the ongoing rapid survey programme, three case study sites from within each sub-region were selected for more comprehensive building survey, mortar sampling and lab-based analysis, often in order to answer a different specific research question. Research questions were often related to material use, but at least one secular and one ecclesiastical building from each region was sought, and almost all case study buildings had long multiphase medieval and later chronologies with visible and generally physically accessible surviving mortar materials.

Levels of previous survey varied quite widely. The first site to be sampled at *Eaglais na h'Aoidhe*, for instance, had only very recently been subject to comprehensive stone by stone archaeological survey (Knot and Thacker 2011), whilst St Peters Thurso (Slade and Watson 1989), Iona (RCAHMS 1982) and Fincharn (RCAHMS 1992) had also been subject to fairly recently published architectural survey. Tuquoy Hall had been excavated over a number of seasons in the 1980's (Owen 1993) and Howmore had been subject to comprehensive building and geophysical survey (Reynolds *et al.* 2005). The Mingary Castle fieldwork was completed over the same period as the building was being analysed and recorded by Addyman Archaeology (Edinburgh) as part of a much larger survey, excavation and conservation project, whilst Uyea chapel and Duntulm Castle had not been subject to any significant investigation for almost a century. Most case study and rapid survey buildings

were of limited height and could be evaluated from ground level, whilst ladders and stepladders were used at Iona and St Peter's Thurso and both *Eaglais na h'Aoidhe* and Mingary Castle had full scaffolding access.

Sampling strategies varied. I had permission from Heritage Management at Historic Scotland (later Historic Environment Scotland) to collect loose mortar samples from scheduled sites, and where these were available and could be matched to the in-situ mortars surviving in fixed masonry contexts (eg. Iona, St Peters Thurso and Duntulm) then these were taken for lab-based analysis. Where loose samples were unavailable, or where any radiocarbon analysis was intended, then sampling was subject to scheduled monument consent in the normal way. Neither scenario applied to the Tuquoy assemblage as this material had already been excavated and curated, but as this study was also subject to a small grant from Historic Scotland then as with all the sites for which scheduled consent was formally granted, all analyses had to be complete within 6-12 months of sampling.

The main physical criteria for the sampling strategy was an aspiration to analyse a minimum of one sample from each major phase and context, together with various carbonate, aggregate and fuel source material samples from the local and/or regional environment. Mortar sample contexts varied, and a mix of core, bedding and coating and/or successive layers of coating could sometimes be very profitably investigated for wider stratigraphic relationships, although deep wall-core samples were almost always privileged for the characterisation of particular phases. If access arrangements were constant, then sampling was generally undertaken on the last day of each site visit in order that the sampling strategy could be informed by the wider building and environment survey. Sample quantities were generally of the order of 10-20 samples per building, although as full access was available at the particularly large and complex building of Mingary Castle, this site was subject to an ambitious programme which involved the removal of over 50 building and environmental samples.

Most case study sites had complex multiphase stratigraphies, and repeat visits were often made. With good visibility, most sites could be interpreted with confidence, and where interpretations have remained ambiguous this is often the result of a lack of non-intrusive access. The Orcadian corpus, however, did also present particular material challenges and these will be discussed in chapter 3.

## 1.6 RESEARCH QUESTIONS AND THESIS CHAPTERS

This thesis seeks to investigate the archaeological potential of the medieval and later masonry mortars of the Scottish North Atlantic in seven chapters.

Chapter One has introduced the research context, as above.

Chapter Two will take my earlier research in the Outer Hebrides as its departure point and examine the medieval and later masonry buildings of the whole of the North-West Region, as well as the archaeology and archaeometry of shell-lime mortars more widely.

Chapter Three will examine the mortar evidence within the challenging North-East Region, as well as the archaeology and archaeometry of maerl-lime mortars.

Chapter Four will examine the very rich mortar evidence within the South-West Region, and the archaeology of limestone-limes and (more particularly) mortar fuel.

Chapter Five will consider the evidence for clay mortars within the whole North Atlantic, and its implications for our understanding of the initial emergence of lime mortar within the archaeological record.

Chapter Six will draw together the buildings evidence from all previous chapters in order to describe an inter-regional narrative for lordship construction across the Scottish North Atlantic, and discuss the implications of that evidence for our understanding of the North-West Region.

Chapter Seven will provide a summary conclusion and signpost future work.

## CHAPTER 2 – SHELL-LIMES AND A CONTINUING MORTAR ARCHAEOLOGY OF THE NORTH-WEST REGION.

### 2.0 INTRODUCTION

This chapter presents a comprehensive discussion of the archaeological evidence for North Atlantic building lime mortars made from calcined sea shells. This not only extends the field survey of Outer Hebridean medieval chapels began during my MA research (Thacker 2011) to include ecclesiastical and secular buildings in the whole of the northern Hebrides and nearby Scottish mainland, but also investigates the mineralogy of various shell-limes using a variety of geoscientific techniques. This dual approach was designed to allow a reflexivity to develop between lab-based interpretations and continuing on-site surveys, which were beginning to suggest that shell-limes formed a very significant proportion of surviving medieval and later mortars in all three Scottish survey regions.

This chapter will begin by discussing the earliest research undertaken for this thesis, with two case studies from Lewis and Skye which also introduce many of the investigative methodologies employed in later work.

### 2.1 CASE STUDY *EAGLAIS NA H'AOIDHE*

#### 2.1.1 CONTEXT

In contrast to most Outer Hebridean medieval settlement evidence which is generally located close to the more fertile west coast (Sharpley and Parker Pearson 1999; Parker Pearson and Smith 2012; Parker Pearson 2012, 33), the parish of *Aoidhe* is situated on the east side of the island of Lewis where good agricultural land and a deep sheltered harbour have emerged from the younger sedimentary geologies of the Stornoway basin (Johnstone and Mykura 1989, 22, 147; British Geological Survey 1992). This was also the location of the *caput* of the *Sìol Torcaill* branch of the clan MacLeod which controlled Lewis, parts of Skye and the nearby mainland in the later medieval period, and the site of that castle building is only a few miles from the *Aoidhe* parish church and burial ground.

Contemporary documentary evidence for the Lewis MacLeod lordship, however, is sparse, and we are generally reliant on oblique annalistic references, and retrospective chronicle, saga and clan history accounts for earlier periods (Raven 2005, 54-55). Both place-name and

archaeological evidence suggest Lewis was culturally very Norse from the late 9<sup>th</sup>-century (Nicholson 1969; Crawford 1987; 2005; Clarke and Heald 2002; Thacker 2011; see Chapter 6), but most historical interpretations of this period also emphasise that the island was an agriculturally marginal and politically underdeveloped society, perhaps comparable to the free state of Iceland or inland Sweden (Anderson 1922, 456-7; Ó Corráin 1998; Woolf 2007a, 212-213; 2007b). By the 11<sup>th</sup>-century, however, Lewis had been subsumed within a larger secular kingdom, and this included the Isle of Man and all the islands to the west of Scotland subject to Norwegian rule from 1098 (Power 2015). The diocese of Sodor was coextensive with this kingdom, and so after translation from York to the newly formed archdiocese of *Niðaros* in the mid-12<sup>th</sup>-century, both the secular and ecclesiastical organization was (at least formally) subject to Norwegian rule (Woolf 2003, 174).

Importantly for this thesis, however, in this same mid-12<sup>th</sup>-century period the secular kingdom appears to have been divided by Somerled's conquest of the southern Hebrides from his Argyll heartland (McDonald 2015). Although the details of that partition are not documented, by the beginning of the 13<sup>th</sup>-century contemporary accounts report that Lewis and Skye, at least, remained within the kingdom centred on Man (Anderson 1922, 456). After Norway's subsequent cession of the Hebrides to the kingdom of Scotland in 1266, the northern Hebrides were included within the Sheriffdom of Ross (University of St Andrews 2007-13), and the *Siol Torcaill* branch of the clan Macleod finally emerge into the historical record in the 14<sup>th</sup> and 15<sup>th</sup>-centuries (Matheson 1981).

Despite these early narratives of poverty and underdevelopment, however, by this late medieval period the parish of *Aoidhe* was reported to be one of the richest benefices in the Sodor diocese (Thomas 2008, 63) and Lewis was eagerly sought by the clan MacKenzie when the MacLeod's were forfeit in the early 17<sup>th</sup>-century (Matheson 1981). Indeed, in 1626 Lewis was described by the Bishop of the Isles as "...the best and gritest of the Hebrid ylandis" (Craven 1907, 49), and it was during this period that the incoming MacKenzie landlords built a new high-status residence and church in the emerging town of Stornoway (MacKenzie 1919, 146-7). It is likely *Eaglais na h'Aoidhe* lost its position as the main congregational centre of the parish in this same early post-Reformation period, and by the late 18<sup>th</sup>-century the building was being served by a peripatetic minister every fifth Sabbath only (MacKenzie 1791-99, 251).

The church did, however, retain its official parochial status within the re-configured post-Reformation parish of Stornoway until the late 18<sup>th</sup> century and, most significantly,

continued as the place of burial for both MacKenzie and MacLeod island elites until this date and beyond (Lawson 1991). It is upon this continued symbolic importance as the ancestral root of lordship in Lewis that much of the buildings continued post-medieval development appears to be predicated, even after the Mackenzies too were forfeit and the church was co-opted as a small congregational chapel prior to ruination in the mid-nineteenth century (Knott and Thacker 2011).

Some of this historical narrative may be supported by the medieval buildings evidence surviving elsewhere on Lewis and this thesis will turn to these structures to explore wider regional issues in chapter 6. In further contrast to reports from very high status sources, suggesting that Lewis was economically poor, however, it is worth noting that the concentration of 12<sup>th</sup>-13<sup>th</sup>-century masonry chapels surviving in the north-west of the island does appear to evidence a thriving Christian-Norse society at farm level (Barrowman 2005; Thacker 2015a), whilst material culture from excavations in neighbouring Uist may also suggest a greater level of personal wealth here than is evident in the Orkney Earldom (Sharples and Smith 2009). Given the apparent heterogeneity of the physical and political landscape of the North Atlantic I would suggest that this comparative approach may be very valuable and highlight that, unlike many other regions within North Atlantic Europe, no larger monumental medieval masonry buildings survive in the Outer Hebrides to indicate a conspicuously higher level of lordship here before the construction of the churches at Howmore (Uist), St Moluag's (Lewis) and the largest surviving phase of *Eaglais na h'Aoidhe* itself in the 13<sup>th</sup> and 14<sup>th</sup>-centuries.

### 2.1.2 ON-SITE SURVEY

The upstanding ruin of *Eaglais na h'Aoidhe* is dominated by two major constructional phases, including a large rectangular late medieval church with a smaller post-medieval chapel appended to the west (Muir 1861; MacKenzie 1919, 137; RCAHMS 1928 12-14). Although previous architectural interpretations of the monument were reasonably consistent with the historical emergence of clan and church in the 14<sup>th</sup> and 15<sup>th</sup> centuries, recent comprehensive archaeological survey has also identified a large section of earlier fabric of unknown date (Knott and Thacker 2011). Indeed, seven major constructional phases were recorded during this work, and the comprehensive characterisation of each context according to masonry style and mortar compositions enabled further stratigraphic relationships to be posited (*ibid*; Thacker 2011; 2012). The mortars of each phase were characterised *in-situ*

according to visible surface compositions, and included materials divided into two types depending on depositional history. These initially consisted of:

1. Added-temper – mixtures of lithic and shell materials whose compositions matched those from particular beach contexts near to the site; and
2. Kiln-relicts – other lithic and shell materials not found in local aggregate sources, and which often appeared to display altered colours or textures.

Applying these comparative criteria to buildings across the Outer Hebrides drew particular attention to two different kinds of kiln-relict materials, including mortars with fine-grained sedimentary inclusions not consistent with local metamorphic geologies or mortars with often high concentrations of discoloured marine shell fragments, and in almost every case these putative heated limestone and heated shell inclusions were mutually exclusive and phase-specific (Thacker 2011; 2015). These analytical criteria will be expanded upon during the course of this thesis to include fuel and vitreous reaction products, but this early separation of mortar inclusions into ‘kiln-relicts’ and ‘added-tempers’ remained a fundamental interpretative distinction throughout the research.

Applying this comparative approach to the church enabled a more nuanced stratigraphic interpretation of the buildings development, but also revealed the structure to be the repository of a remarkable series of mortar materials with contrasting limestone and shell kiln-relicts, and different aggregate tempers. These provided valuable evidence of how mortar-making techniques at one particular site had developed over more than 500 years.

PHASE (and possible date)	CARBONATE kiln-relic type	AGGREGATE Added temper	BINDER MATRIX
1 (C12 <sup>th</sup> /13 <sup>th</sup> )	Shell	3	Shell-lime
2 (C14 <sup>th</sup> /15 <sup>th</sup> )	Shell	3	Shell-lime
3 (C17 <sup>th</sup> )	Limestone	2	Limestone-lime
4 (C18 <sup>th</sup> )	Shell	1 and 2	Shell-lime
5 (C18 <sup>th</sup> /19 <sup>th</sup> )	Limestone	4	Limestone-lime
6 (C19 <sup>th</sup> )	Lime	1?	Limestone-lime
7 (19 <sup>th</sup> /20 <sup>th</sup> )	none	1,2,3 & 4	Cement

Table 1(from Thacker 2012): On-site mortar phasing of *Eaglais na h'Aoidhe*.

### 2.1.3 EARLY CHALLENGES TO ON-SITE INTERPRETATIONS

However, although the above in-situ material interpretations could be suggested with increasing confidence on-site in the particular geo-physical environment of the Western Isles, elsewhere in North Atlantic Europe it had been suggested that it was not possible to objectively distinguish tempers from shell-lime kiln relicts (Clemmenson 1911; Norlund 1930; cf. Goldberg *et al.* 2001, 301), and indeed a number of conceptual and methodological challenges remained. These included:

- a tacit assumption that current and past environmental compositions can be compared;
- the possibility that added-tempers were purposefully graded with shell material;
- rare evidence that unheated mollusc shells display discoloration in some natural environments (eg. Schnelder-Storz *et al.* 2008);
- evidence that some mortars display no visible kiln-relicts;
- contexts where comparative temper sources were not available;
- and speculative interpretations of particular limestone sources.

In essence, these challenges were predicated on the comparative basis of the evidence, and if mortar analysis was to inform buildings archaeology in the North Atlantic more widely (where limestone and shell materials may both be extant in temper arrays) then greater emphasis on the positive identification of heat-alteration in putative kiln-relicts was considered necessary. As outlined in the introduction to this thesis above, recent developments in mortar petrography were considered likely to inform this approach (Poole and Sims 2016) although, for similar reasons of control, the same limestone-free Western Isles environment which had initially enabled *in-situ* mortar interpretations was a good place to begin these investigations. A mortar sampling and analysis strategy was, therefore, designed for *Eaglais na h'Aoidhe*.

### 2.1.4 SAMPLING AND SECTIONING

Close scaffolded access to all elevations of the ruined building was enabled by correlating the mortar sampling with a programme of consolidation being undertaken by a masonry contractor. In total 26 mortar contexts were recorded by hand measurement from fixed building features such as window jambs, sills or wall faces and small mortar samples (50-200g) were removed from each with a mallet and chisel. This building generally exhibited

clearly visible phase-specific contrasts in mortar evidence and the mortar stratigraphy was already well-understood from the site survey. In order to preclude the slightest possibility of mis-identifying later repair materials or earlier mortars associated with stone reuse, samples were generally only removed from contexts where core, bedding and coating mortars were visibly consistent and contiguous. Samples were removed from a range of contexts within each recognised phase in order to interrogate in-situ interpretations, but some awareness of the scale of analysis (and that this process is inherently biased) must be maintained (Pearsall 2000, 12). As each mortar sample only constitutes a very small fraction of each phase, statistical representation is not relevant to this ‘judgemental process’ (cf. O’Connor and Evans 2005, 123).

As the first site to be sampled within the project, however, some of the limits of previous non-intrusive survey became immediately apparent as new and relatively un-weathered mortar surfaces were revealed. These included: soft and rounded lime inclusions within mortars previously noted to display high concentrations of rounded surface vesicles; and some very high concentrations of soft, black and very fragile carbonised inclusions, for which no surface evidence had been apparent at all. Visual and textural examination, however, had suggested this latter material was unconsumed (relict) peat fuel.

Once back at the lab in Edinburgh, these samples were re-examined, consolidated and sectioned. Like sampling, deciding where to cut each section is also a judgmental process in which previously unseen materials are revealed. Unlike in the sampling process, however, I was now able to effectively excavate for information by repeatedly sawing samples and polishing them down to display a wealth of compositional information which was not previously visible in hand sample (cf. Goldberg and MacPhail 2006, 354). However, as much of this important information will not be visible in the semi-transparent thin section either, I developed an original sample preparation technique which enabled the microscopic analysis of these newly revealed mortar surfaces in reflected light. For this process I prepared at least two (slide-mounted and polished) opaque ‘thick-sections’, of approximately 1mm thick, and scanned and analysed these in reflected light before deciding which to remount and reduce to a standard 30µm thin-section. This ensured that the scanned surface of the opaque thick section was the very same surface as the thin section, enabling direct comparison with its previously scanned opaque self and with the other thick-section retained from the same sample.

### 2.1.5 MORTAR ANALYSIS

In all nine of the main case studies presented in this thesis building survey is supported by the petrographic analysis of a range of thin-sectioned mortar samples in order to ascertain the lime, temper and fuel provenance. Given its perceived interpretational value, however, assessing lime-provenance by identifying carbonate kiln-relicts was initially considered the most crucial aspect of these investigations. The essential requirement of lime-provenancing is to recognise altered clasts which demonstrate a spectrum of variously heated mineralogies, structures and/or textures, and interpret their relationship with the mortar matrix which supports them (Hughes and Cuthbert 2000; Elsen 2006; Poole and Sims 2016).

The lime burn, however, is only one part of the biography of these lime-source kiln-relict clasts. Each of the materials gathered at the kiln will have already undergone a whole series of natural and anthropogenic processes (such as sedimentation, growth, transport, abrasion, fracture, weathering, biological or chemical attack, and ultimately selection) (cf. O'Connor and Evans 2005), and will undergo further anthropogenic post-kiln processing (such as slaking, sieving, mixing, emplacement and/or curing regimes) (e.g. Margalha *et al.* 2011). Moreover, post-deposition taphonomic pressures on the *in-situ* mortar in the ruined building (such as acidification, dissolution and re-precipitation) all have the potential to affect the evidence to a greater or lesser extent.

Any surviving evidence of the pyrotechnical process itself, however, is also the result of another particularly large range of interrelated factors including material size, heating rate, maximum temperature, moisture levels, redox pressures, time and most particularly pyrotechnique (Gosselain 1992; Livingstone Smith 2001). Whilst, on a larger scale, this evidence will be contingent upon a series of negotiations between the limeburner and various kiln/fuel/carbonate types, non- or pre-industrial lime kilns are generally considered to be very heterogeneous pyrotechnical environments which are likely to have influenced the development of each surviving thin-sectioned kiln-relict differently (*ibid*; see chapter 4). Indeed, it may be this heterogeneous environment on which we rely to betray something of that specific kiln/fuel/carbonate/burner negotiation in the material sample.

Single carbonate kiln-relict clasts, however, will only rarely display the whole range of changes associated with increased temperature, but each may display some part of that spectrum. Ultimately, our analysis will collate and conflate interpretations from different surviving contexts to infer an historic pyrotechnical process, but it is important to note that it

is not the firing process itself which is being seen under the microscope, but a spectrum of evidence from different kiln contexts. Accepting, for the moment, that fully calcined carbonate materials and/or completely consumed fuels are very difficult to identify petrographically, our research in this first case study is initially mostly concerned with identifying and describing surviving clasts which:

- 1, retain enough relict structure for their taxa or lithogy to be identified to some degree,
- 2, betray enough evidence of alteration that they can be distinguished from unheated added-temper materials, and,
- 3, display a spectrum of concomitant relationships with the general mortar matrix.

This is the basis of our carbonate kiln-relict identification process at all macro, meso and microscopic scales, and whether in limestone, shell or maerl-lime mortars.

Despite being widely distributed throughout the world, however, detailed microscopic investigations of shell-lime mortars are very rare. A short petrographic and XRD study of late modern shell-lime mortars from Brazil, however, usefully reported high concentrations of ‘large sea shell fragments [which] showed a distinctive...profile exhibiting carbonate in the inner part, [an] isotopic rim [and] extensive cracking’ (Müller and Kanan 2005, 739). How far these characteristics would be displayed in the Isle of Lewis materials will become evident below.

#### 2.1.6 *EAGLAIS NA H’AOIDHE* – THIN-SECTION INTERPRETATIONS

Fuller details of this lab-based investigation of the mortar samples from *Eaglais na h’Aoidhe* are included in appendix 7 (see volume 3), and a much shorter summary will be presented here.

##### 2.1.6.1 The shell-limes

Most importantly, microscopic analysis supported the on-site interpretations of each shell-lime mortar sample in the assemblage and the thin-sections displayed many petrographic features which would eventually come to be associated with this mortar type. In cross-polarised light these samples were all comprised of a very fine-textured cryptocrystalline pale brown carbonate matrix, included within which were fine bioclastic fragments to 2.5mm which displayed a range of altered characteristics. Although randomly oriented, many of

these fragments exhibited curving profiles, sub-square internal microstructure and ribbing and hinge structures which suggested a high concentration of *C. edule* (Cockle) shell valves was present. These often contained fine fractures, both at the grain/matrix boundary and internally. Many of these clasts, however, had clearly also lost much of their internal microstructure, and this appeared to have been replaced by a cryptocrystalline brown carbonate fabric of similar texture and birefringence to the general mortar matrix. Indeed, where this process of textural alteration is most advanced the replacement fabric of the shell and the general mortar matrix are in optical continuity. Where the grain/matrix boundary is less coherent, therefore, the distinction between bioclast and matrix becomes ambiguous. This was interpreted as clear positive evidence of a *C. edule* shell-lime mortar provenance, and in sections where this evidence was exhibited there was no evidence for geogenic carbonates.

Although other altered mollusc shells were evident in the *Eaglais na h'Aoidhe* samples, including some locally high concentrations of probable *Ensis arcuatus* (razor-shell), it was useful that the assemblage was dominated by *C. edule* fragments because the distinctive structure of this taxa's shell makes alteration very recognisable. Such clasts fulfil the initial criteria for carbonate provenancing in exhibiting:

- 1, enough relict structure to be taxonomically identified;
- 2, alteration which suggested heating; and
- 3, an intimate interrelationship with the supporting carbonate matrix.

Most of these clasts can be interpreted as having been maintained at a high enough temperature and low enough carbon pressure to induce fracturing, alteration and even partial dissociation/calcination, whilst simultaneously retaining enough structural coherence and carbonate mineralogy that re-crystallisation within the general carbonate matrix was (mostly) precluded. The extent of the textural alteration within the bioclasts of these shell-lime samples, and particularly within those from the medieval phases 1 and 2, is striking in comparison with pristine shell structures generally displayed elsewhere, and interpreted as unheated shell from within mixed shell/lithic added-temper arrays.

### 2.1.6.2 The limestone-limes

Thin-section analysis also supported the interpretations of those samples which had been characterised as ‘limestone-limes’, and petrographic analysis refined these interpretations further as the altered clasts of different sections contained limestones from different lithostratigraphic contexts. These included a possible marble in phase 6 (ENH.02), which clearly displays a relict core with surviving 60° cleavage and a substantially altered rim; an oolitic limestone clast in phase 5 (ENH.08); and a micritic limestone with some bioclastic inclusions in the important phase 3 construction of the western burial aisle. Contrary to earlier speculation therefore (Knott and Thacker 2011; Thacker 2011), none of these limestone sources appear to be related to Macleod/Mackenzie lands in dolomitic Assynt, and this was also confirmed by XRD analysis.

### 2.1.7 EAGLAIS NA H’AOIDHE - XRD ANALYSIS

Already in this thesis it is clear that the relationship between carbonate kiln-relicts and mortar matrices is often complex and intimate, and indeed this relationship is one of our provenancing criteria. Although the contrasting shell- and limestone-lime mortars were clearly distinct at all levels of analysis in the *Eaglais na h’Aoidhe* assemblage, the cryptocrystalline texture of the mortar matrices was generally much too fine to effectively examine petrographically. XRD analysis was therefore identified as a possible parallel technique with which to investigate the mineralogy of these materials.

#### 2.1.7.1 XRD Methodology

In order to attempt to effectively isolate the mortar matrix from the supported inclusions, the first eleven samples from *Eaglais na h’Aoidhe* were crushed in a single pass of a mechanical jaw crusher, and the resultant grades sieved down to 63 µm (cf. Miranda *et al.* 2012). This finest material (now considered inclusion-free) was then milled by hand in an agate mortar before either being mounted as a bulk dry powder or, if there was insufficient volume, suspending in acetone and slide mounted. Given the research materials, a standard sample of *Ostrea* calcite was also mounted and analysed as a control, and the diffractometer (Bruker D8 Advance) run in the 2 theta range; 2-60° with a step size of 0,025°, and a step time of 1.5 seconds.

Apart from the crushing and sieving process, which only applies to matrix analysis, the methodology and diffractometer specification described above was employed in all the XRD

work reported in this thesis, and all results should be considered as semi-quantitative whether illustrated as diffractogram plots or as text-based internally-calibrated compositional percentages measured through the 'Reitveld' programme.

#### 2.1.7.2 *Eaglais na h'Aoidhe* XRD Results

The resultant XRD plots of these eleven samples confirmed the mortar matrices were all calcite, without any evidence for dolomitic mineralogies, but further consideration of the results indicates there is greater complexity here. In the first place, it appeared curious that there were no apparent mineralogical differences between the shell-lime and limestone-lime mortar sample matrices from this site, even though clear differences in sample colour and matrix texture were apparent on site and at higher magnification. Indeed, when the fundamental differences in carbonate mineralogy between these contrasting source materials are also considered the results are even more striking.

Although geogenic carbonates are often very broadly characterised as either calcite or dolomite, as these end members of the Ca-Mg phase diagram are very stable over geologic time periods (Klein and Hurlbut 1993), biogenic carbonate structures may be formed of a variety of different carbonate polymorphs - including aragonite, vaterite, and low or high magnesium calcite in different monomineralic layers (Bathurst 1976, 2-3). Molluscan shells, however, are generally aragonite and/or calcite (Bøggild 1930; Claason 1998, 22) and the shells deposited by *C. edule* are reported to be almost completely composed of aragonite in the living organism (Majewski 1969, 56-61). That aragonite might not leave a mineralogical signature in the re-carbonated lime of a fully dissociated shell totally subsumed into the mortar matrix was expected, but that this very distinctive polymorph is not evident in the *Eaglais na h'Aoidhe* shell-limes (at all) is suspicious as these XRD results did contain a quartz peak which suggested not all mortar inclusions had been successfully removed. Given the complexity of the binder/relict structure visible in these same mortar samples in thin section, it therefore seems likely that some fraction of altered (but not fully dissociated) shell kiln-relicts were included here also - but was now calcite. This suggestion is significant in suggesting that a more complex process than the simple 'lime cycle' must pertain in these shell-lime mortars, and as one of the main concerns of the research is to characterise lime-sources by identification of heat-altered kiln-relicts, further knowledge of this process was required.

## 2.2 EXAMINING SHELL-LIME MINERALOGY THROUGH EXPERIMENTATION – *C. edule*.

A number of shell heating experiments published elsewhere for a wide variety of research concerns, did indeed suggest aragonite was ‘calcitised’ before dissociation and in some molluscan taxa this alteration was reported to take place at relatively low temperatures (Li *et al.* 2009; Rashidi *et al.* 2011; Mohamed *et al.* 2012; Nemliher *et al.* 2009). Archaeologists have also been experimenting with burning shell material for some time in order to better understand the wide range of burnt fauna encountered in archaeological assemblages from contexts such as middens (Lincke and Modreski 1983; Spennemann and Colley 1989; Classen 1998; and especially Villagran *et al.* 2011), although none of these projects had traced the complete ‘shell-lime-cycle’ process which the *Aoidhe* analyses suggested might pertain. Given that the *Aoidhe* kiln-relict evidence contained a high concentration of *C. edule* (cockle) shell, I began a number of furnace experiments on this shell type to investigate its alteration profile at different temperatures.

### 2.2.1 EXPERIMENTAL METHODOLOGY

A number of whole unfractured *C. edule* valves, with lived ages of between two and eleven years and little sign of abrasion were selected from an assemblage collected from the high tide line of *Traigh Mhor* (Barra). These were washed in tap water to remove any visible surface organic growth or beach aggregates, rinsed in distilled water, and left to air-dry in a warm lab for 24 hours. A large proportion of these shells were then shattered to fragments of 20mm or less with a small hammer and, together with the remaining whole valves, stored in sealed bags.

For each stage of this first round of experiments, a porcelain crucible 50 x 39 x 36mm high was filled with the shattered shell and one whole large (pre-weighed) valve was placed on top. This was then placed in a preheated electric muffle furnace and held at each given temperature for 24 hours, before being removed and allowed to cool for 30 minutes. The whole valve was then re-weighed and the shells described as quickly as possible before being placed in another sealed bag (in a dessicator jar) to await preparation for XRD analysis. In later experimental runs the shattered fraction would also be pre-weighed to a standard 30g for comparison with the heated material.

2.2.2 HAND SAMPLE DESCRIPTIONS (see 2.1.3 in appendix 2 for images)

**BWC.000.** Externally, the shells are all predominantly various shades of white, with a matt lustre, and no evidence for a periostracum. All valves display a distinct non-symmetry, typical *C. edule* ribbing and annual winter growth bands. There is no fracturing and very little rib abrasion. Internally, most valves display a highly lustrous white colouration, with a marked brown coloration along the posterior margin and adductor scar. This brown colouration is more marked on top of the ribs, internally, lending a striped effect. In oblique light the pallial line can just be seen, but is not recessed, and ventral to the pallial line the internal ribbing is much more pronounced, with only a very slight ribbing profile on the dorsal side.

**BWC.150.** After being heated to 150°C, the whole valve has remained intact without any sign of fracture visible to the unaided eye. Both the shattered fragments and whole valve now display a distinct yellow coloration, which is evenly distributed across the surface, apart from a very small (2.5mm<sup>2</sup>) darker yellow patch internally anterior to the umbo. The brown coloration displayed in BWC.000 along the internal posterior margin and posterior adductor scar has now completely disappeared, both adductor scars are now very faint and barely visible and the pallial line cannot be seen at all with the unaided eye. At x20, however, a shallow concentric mark is visible at the pallial line, together with a slightly ragged, very fine micro-crack, which cuts across the internal ribbing concentrically without coinciding with any growth lines. There is no evidence for any external fracturing and the shattered shell fragments display no fracturing at all.

**BWC.350.** After heating to 350°C, the whole valve has again remained complete without any fracturing visible to the unaided eye. Externally the shell displays an even grey/blue colouration. Internally the posterior margin of the shell also now displays a marked blue/grey colouration (where previously it was brown) and the surface is slightly powdery and laminating with very shallow concentric and radial micro-cracking, one of which extends across the anterior adductor scar. The anterior of this shell has a slight brown colouration and both adductor muscle scars display marked curving brown striations. All these brown areas have retained their shiny lustre, as has the ventral margin as far as the pallial line. At x20 very fine fracturing is quite general on the external shell surface, concentrically across the ribs and radially between and upon ribs. This micro-cracking is also very extensive in the

shattered shell, isolating most rib nodules, and in section penetrating no further than the ‘rib layer’ (or mesectostracum, see below). Internally, much more exfoliation is revealed.

**BWC.400.** After heating to 400°C, the whole valve has remained complete and has a dark blue/grey coloration. Externally this coloration has a concentrically stripped appearance and no cracking is evident. Internally the shell surface is even darker, and the posterior/anterior colour dichotomy has been lost. The colouration here is a reasonably homogenous grey, dorsally from the pallial line, whilst the ventral margin remains almost white. Both adductor scars are very dark grey, the darkest part of the shell, and the striations between light and dark grey remain visible. Some surface fragments of the shell have become detached, internally, and the white colouration beneath suggests the grey coloration may be a surface feature only. At x20 the shell is extensively cracked externally, particularly radially between the ribs but also concentrically across them. Externally the striped colouration is revealed as a much darker blue/grey in the early growth of each season, and lighter in the later seasonal growth. This appears to be reflected also across the life of the shell, as the shell grows older and growth slows, the growth bands become closer together and the shell has an almost uninterrupted darker coloration. This does not appear to be a symptom of the recessed topography at growth bands. Internally, radial micro-cracks are evident and radiating within the dorsal part of the shell, whilst a number of concentric cracks have appeared close to the pallial line.

**BWC.550.** After heating to 550°C, the whole valve remained complete, and is now at its darkest coloration. Externally, the shell is overwhelmingly homogenous very dark blue/grey, although fine radial lines of much lighter material are retained between the ribs. There is extensive and deep cracking both radially and concentrically. Internally, the shell is also very dark grey, with the adductor scars remaining the darkest areas, and this colouration is now matched around the umbo and in a concentric band ventral to the pallial line. Internally, the shell displays extensive crazing in apparently random patterns, and thin layers of material have become detached at the surface. The dark coloration seen externally now appears in cross-section also, rather than just at the surface, grading to a lighter internal colouration. At x20 the internal dark blue/grey colouration is revealed by some fragmentation and appears to be continuous throughout the depth of the shell. In concentric cross section the ribs are the darkest colour and they are distinctly fine grained. The lower layer (or endostracum, see below) is striated blue/grey and white, and is becoming detached from the upper ribbed (mesectostracum) layer.

**BWC.650.** After heating to 650°C, the whole valve has remained complete, although a large fracture runs through the thickness of the shell from the ventral margin, almost detaching a large section of the posterior side. Elsewhere the shell also displays extensive and deep fracturing and further shallow crazing, both internally and externally. Internally there is marked foliation and loss of thin layers of shell material from the dorsal to the internal ribs of the ventral margin. Internally the shell is completely white, whilst externally the shell is a uniform very light grey colour. At x20, examination in cross-section reveals that the external grey coloured layer is a surface, sub-mm feature of the ribbing only. Further, the rest of the shell no longer displays any layering or other structure at all, but is a homogenous coarse grained crystalline mass.

**BWC. 750.** After heating to 750°C, the whole valve has remained virtually complete, except for a discrete portion of outer shell ribbing near the umbo of 2mm x 3mm. This loss has revealed a homogenous crystalline texture without visible structural definition. Internally, the shell is crazed by radial and concentric cracks, including across individual ribs ventral to the pallial line. Centrally, there are some very small areas of delamination, revealing a smooth, underlying white layer beneath. The main fractures, however, appear much deeper than these delaminated areas perhaps suggesting differential stresses. The shell is now completely white.

**BWC.950.** After heating to 950°C the whole valve initially remained complete but displayed deep cracking, crazing and internal delamination. On cooling the shell quickly fissured and fragmented into multiple pieces, and eventually powder.

### 2.2.3 RECORDED WEIGHTS FOR EXPERIMENTALLY HEATED *C. EDULE* SHELL

<i>Cerastoderma edule</i> shell heating experiment.					
Sample	Temp/°C.	Weight before (whole shell)/ g	Weight after (whole shell)/ g	Weight after (shattered)/g	Weight retained/%.
BWC.000	000				100%
BWC.150	150	5.447500	5.393055		99.0
BWC.350	350	8.102275	7.954470		98.2
BWC.400	400	5.747530	5.632875	29.43	98.0/98.1
BWC.500	500	7.420400	7.195545	29.44	97.0/98.1

BWC.600	600	7.043695	4.891760	28.98	69.4/96.6
BWC.650	650	6.015690	3.349090	25.22	55.7/84.1
BWC.700	700	11.10996	6.152695	21.48	55.4/71.6
BWC.750	750	6.141735	3.402715		55.4.
BWC.950	950	2.792130	1.542480		55.2

 Table 2.4. (above) Mass changes in experimentally-heated *C. edule*.

## 2.2.4 XRD ANALYSIS OF EXPERIMENTALLY HEATED *C. EDULE* SHELL

XRD of all samples was undertaken 10 days after the first sample left the furnace.

	HMC	LMC	PERICLASE	PORT/LIME	ARAGONITE	BRUCITE	DOLOMITE
0	0	0	0	0	97	0	0
150	0	0	0	0	98	0	0
350	18	80	0	0	4	0	0
400	11	88	0	0	0	0	0
500	6	91	0	0	0	0	0
550	4	93	0	0	0	0	0
600	3	93	0	3	0	0	0
650	2	72	0	23	0	0	0
700	0	53	0	41	0	0	0
750	0	0	0	95	0	2	0
950	0	0	0	95	0	3	0

 Table 2.2. (above) Weight % mineral phases of experimentally heated *C. edule* shells

## 2.2.5 THIN SECTION ANALYSIS OF EXPERIMENTALLY HEATED *C. EDULE* SHELL

Mollusc shells display great microstructural variation, even at species level, but interpretation must also contend with structural variability within species, especially in *C. edule* (Cayeux in Bøggild 1930, 285; Bathurst 1976, 3). Variation in the nomenclature used to describe shell microstructure also differs across and between disciplines, but the descriptors used here will follow those of Majewski's (1969) discussion of *Arca spp.*, Bøggild's (1930) discussion of *Cardium edule*, and Mitchells (1935) investigation of *Cerastoderma corbis martyn* all of which are consistent and make useful reference to thin-section evidence.

All these authors agree their various *Cardiidae* shells are predominantly composed of three layers including an outer periostracum layer composed of conchiolin, and two predominantly carbonate shell layers composed of aragonite. These two aragonitic layers consist of an inner layer (referred to variously as the 'endostracum' or 'hypostracum'), and an outer layer ('mesectostracum' or 'ostracum') which may or may not be further divided into two

structurally-alike sub-layers (Bøggild 1930, 284 suggests the upper prismatic layer forms a continuation of the cross-lamellar; Majewski 1969, 56-61; Carter 1967, 243) .

However, as none of the *C. edule* shell samples used for the experiments or noted from historic samples displayed a surviving periostracum this will be discounted from our discussion which will concentrate on the carbonate-dominated endostracum and mesectostracum layers only. There is some further complexity within these to be aware of, as the pallial line (pallial myostracum) and adductor scar (adductor myostracum), both of which displayed such notable characteristic changes in our hand sample descriptions above, do indeed also display distinct structures and mineralogies in thin section, these features form only a small fraction of most *C. edule* shells and so will not be discussed further.

Both the endostracum and mesectostracum are themselves composed of finer laminae arranged parallel to the shell surface, and in the mesectostracum these gradually undulate until eventually paralleling the ribbing of the outer shell surface. Although the process by which polymorphic carbonate material is laid down by molluscs remains largely a matter of discussion rather than agreement, these ‘crossed lamellar’ do appear to ‘mark periods of deposition’ (Mitchell 1935, 215), and this is often apparent in their structural form in radial section at high magnification (see Farrow 1972). By contrast the endostracum has been interpreted as consisting of more ‘complex’ crossed lamellae, but in thin- section this much narrower layer has a generally more homogenous spherulitic form which, due to the process of shell deposition, is only evident on the dorsal side of the pallial line.

Although both *Cardiidae* shell layers are predominantly aragonitic, and the distinctions evident in thin section between the homogenous endostracum and layered mesectostracum result from their contrasting structural forms (Bathurst 1976), there may be a chemical correlate in contrasting protein concentrations which are more particularly associated with the crossed lamellar structure in the mesectostracum of some molluscs (cf. Moore 1969, n976-977; Dauphin and Denis 2000). If it is the breakdown of these conchiolin hydrocarbons which causes the discolouration in shell material during heating, then in *C. edule* we might speculate that high concentrations of these organic matrices are also associated with the distinctive discolouration of the pallial line and adductor scars noted above.

Reference should be made to 2.1.4 (appendix 2) for photomicrographs of some shells thin sectioned for this experiment. In thin section it should be noted that very little fracturing is visible in BWC.350 on either shell surface, although a fracture is apparent between the two

internal carbonate layers, and these are still clearly contrasting. The crossed lamellar structure of the mesosectracum is still generally evident although the very dark-coloured (probably organic) material often appears to have lost coherence. The spherulitic structure of the endostracum is apparent and the layer has retained a lustrous apparently highly birefringent texture which continues into the lower mesosectracum. In radial section, and especially at the hinge, these crossed lamellae are particularly clear, although the very fine red ‘cryptocrystalline’ material is also worthy of note (see chapter 3 for similar in maerl-lime kiln-relicts).

The higher temperatures to which the BWC.550 shell was subjected, however, has clearly resulted in major structural and mineralogical changes. Externally the shell is highly fractured, and crazing is visible throughout the whole structure. Much of the ribbing has been lost from the upper surface, whilst the inner surface also betrays some foliation, and (as described in hand sample) the endostracum has been completely lost from this clast. The internal laminae of the mesosectracum have almost completely disappeared, and this structure now appears to be dominated by a fine-grained mass. Much of the shell is now a homogenous dark grey and the lustrous high birefringence of BWC.350 is no longer apparent.

#### 2.2.6 CHARACTERISING HEATED *C. EDULE* SHELL IN FOUR STAGES

Collating the results and descriptions of this series of experiments suggests that the physico-mineralogical alterations *C. edule* shells undergo during heating can be usefully summarised in four stages, and associated with four shell types:

Type 1 *C. edule* shells will have retained their external shape and internal two-layer microstructure without fracture, and have remained aragonitic. Type 1 shells will have lost some weight, and the brown colouration of their pallial line and adductor scars will also have disappeared as a progressive change in general colouration from white to yellow is displayed. This Type 1 shell evidence suggests the material has been heated to between 0 and 250°C.

Type 2 *C. edule* shells will have retained their external shape but will display some fine external micro-cracking. The mineralogy of the shell will have been completely altered from aragonite to low and high magnesium calcite, so that, although the internal microstructure of the shell still appears largely unchanged, this should now be described as relict. This shell

will not have lost any more weight than a Type 1 shell, although the structure will now display an increasingly dark grey colouration, especially at the pallial line and adductor scars. This Type 2 evidence suggests the material has been heated to between 250 and 450°C.

Type 3 *C. edule* shells will have retained much of their external shape but may now be deeply fractured and internal shell microstructure will be increasingly indistinct. Most shell in this range will display a very dark grey discolouration, have lost little weight and be dominated by low-magnesium calcite. At the higher end of this temperature range, however, the discolouration will have begun to be lost, the shell will have begun to lose more significant amounts of weight as the calcite begins to dissociate, and some lime will be produced. This Type 3 evidence suggests the shell has been heated to between 450 and 650°C.

Type 4 *C. edule* shells may retain their external shape at lower temperatures, but this will often be deeply fractured and will generally turn to powder on contact with air. Externally, the shell will now be a uniform very bright white. Internally, the shell microstructure will have been completely destroyed, almost half of the mass will have been lost and the low magnesium calcite will increasingly have dissociated to form lime. This Type 4 evidence suggests the shell has been heated to between 650 and 950°C.

The broad thrust of these experimental results are useful because the changes in shell form, colour, mineralogy and microstructure over the full range of possible kiln temperatures are consistent and distinctive in hand sample, XRD and thin section. That poorly-heated shell fragments remain in shell-lime mortars is widely reported (Clemmenson 1911; Rosenthal 1989; Clancey *et al.* 1995, 337), and some commentators have noted that even when heated to dissociation, shells often remain intact (Mackinnon and May 1990, 200). It is remarkable that *C. edule* shells retain their external shape and some relict internal microstructure through mineralogical changes from Stage 1 (aragonite) to 2 (low & high magnesium calcite) to 3 (low magnesium calcite) to 4 (lime). The change in mineralogy associated with stages 1-2 is particularly notable as although the (CaCO<sub>3</sub>) chemical formula of the material remains unchanged, this alteration from aragonite to low and high magnesium calcite is fully ‘reconstructive polymorphism’ which requires the atomic bonds configuring the orthorhombic aragonite unit cell to be broken and reassembled into the newly configured trigonal calcite structure (Klein and Hurlbut 1993, 155). Ultimately, it is because this

irreversible restructuring of the biocarbonate crystallography has taken place as a solid state process that the internal microstructure of the shell has survived in relict form and enabled each of the four ‘stages’ of alteration to be characterised within quite fine temperature limits.

This experimental methodology was designed to remove the complex issue of temperature duration from the results, as it was considered that after 24 hours the heat would have fully penetrated the depth of the shell and this timescale is also consistent with some ethnographical shell-burning descriptions from later periods (e.g. MacIntyre 1993). It is reasonable to assume that any temperature-specific alterations have reached completion in these experiments and therefore these results provide evidence for a completed partial process. Given the heterogeneous environment reported in kiln studies elsewhere (Gosselain 1992; Livingstone Smith 2001) the product of each of these experiments may be conceptualised as representing a potential discrete kiln context, rather than a continuous chronological process.

At *Eaglais na h'aidhe* the large increase in altered but undissociated shell clasts in the later (phase 4) shell-lime mortar compared to the medieval phase 1 and 2 materials is salient and has been interpreted as a loss of expertise. In part this comparative approach assumes similar levels of post-kiln processing, and many shell-burning accounts explicitly report the recycling of conspicuously underburnt material for inclusion in subsequent kiln charges (e.g. Mackinnon and May 1990; Panda and Misra 2007; Thakuria 2012). In this scenario, therefore, some historic relict clasts (both carbonate and fuel) may have been subject to multiple heating episodes. Whatever the post-kiln refinement strategy employed, however, a range of variously altered clasts is clearly evident in the archaeological material examined both on site and in the lab and (in parallel with each kiln experiment) each of these clasts represents a different kiln context.

In addition to environmental variation, however, there is variation within each clast. These experimental results appear to present evidence for the gradual dissociation of shell between 600 and 750°C, and this may correlate with widespread thin section evidence, including from *Eaglais na h'Aoidhe*, where altered shell clasts appear to have lost some coherence as optical continuity with the binder increased. Given the experimental evidence for the maintenance of clast shape, understanding how the grain boundary breaks down during this process is crucial to interpretation but it is clear that all such highly altered shell-relicts will have been completely calcitised by this point. Indeed, this was suggested by the *Eaglais na h'Aoidhe* XRD results which prompted these experiments in the first place.

The 600-750°C temperature range for dissociation, however, is also much lower than the 900°C usually quoted for limestone dissociation (e.g. Moropoulou *et al.* 2001; see Válek *et al.* 2014) and the very much smaller dimensions of the shell material is also likely to be significant in allowing those alterations to take place relatively quickly.

Different redox environments within the kiln are likely to skew these characterisations (cf. Valverde and Medina 2015), and there does appear to be a close relationship between temperature, carbon pressure and alteration profile within this experimental evidence. Discolouration was much more marked in shell Types 2 to 3, after the seemingly rapid 350°C inversion of aragonite to high and low magnesium calcite, and this confirms shell discolouration is caused by the increased breakdown, diffusion and release of the hydrocarbon protein compounds which permeate the cell structure (Moore 1969, 74, 976-7). Within the Type 2 and 3 experiments, however, the shattered material beneath the surface of the crucible often displayed a much darker discolouration than the overlaying whole valve, and this striking contrast is also paralleled by the substantially higher percentage of retained mass in the shattered material - even at 700°C when the overlying whole valve had been fully calcined. This evidence indicates that dissociation had been relatively inhibited in the shattered shell, perhaps by a higher carbon partial pressure within the furnace crucible, which also inhibited expulsion of the discolouring protein-breakdown products. Elsewhere, carbon dioxide release associated with matrix pyrolysis has been reported in the bivalve *T. decussates* at temperatures of 200- 420°C (Nemliher *et al.* 2009, 29), and as CO<sub>2</sub> is heavier than air this may have contributed to greater carbon pressure within the furnace crucible. Unfortunately it was not possible to regulate or monitor oxygen levels in the furnace used here, but this effect may periodically be magnified many times over in some historic lime-kiln contexts (cf. Newell 1998-9). This is an issue to which this thesis shall return when the interrelationships between lime-burning technique and the regulation of kiln atmospheres with different fuels is considered (see also chapter 4).

Although not generally noted in the ecological literature, the blue-grey discolouration displayed in some living and post-mortem *C. edule* shells at ambient temperatures, also appears to be related to anoxic environments associated with some finer muddy habitats but this is not considered a significant factor in any of the mortar interpretations made here. The post-mortem fracturing of shell material can also take place in the littoral zone and it is probable that historic lime-burning shell collectors would not have been so selective in choosing shell as I was for the experiments above. Whilst it is probable that some

fragmented shell material went into historic kilns before firing, experience suggests that *C. edule* shells usually follow a distinct taphonomical pattern involving increased abrasion of the shell surface, followed by loss of ribbing profile and puncturing of the umbo, before loss of the ventral margin and more wholesale fragmentation (cf. Claason 1998, 55; Schneider-Storz *et al.* 2008, 472). Ultimately, this taphonomical trajectory should be easily recognisable, whether in in-situ survey, hand sample or microscopically, and contrasted with the results above. Again, however, this is not considered a significant issue in shell-lime mortar interpretation.

In summary, therefore, the results from these shell heating experiments would appear to allow for very refined interpretations of *C. edule* kiln-relicts in hand sample, XRD and thin-section. As briefly noted above, however, apparently similar changes in biocarbonate mineralogy are also associated with the formation of geogenic limestones or dolomites from metastable carbonates in a low temperature sedimentary process called diagenesis, and elsewhere it has even been suggested that shell heating ‘may provide a good tool for the modelling of fossilisation’ (Nemliher *et al.* 2009, 27). Further discussion of this process is therefore required if we are to distinguish our experimental anthropogenic evidence from the biogenic and geogenic processes taking place in the wider environment. Is diagenesis a factor in the analysis of either pre-depositional ‘quarry’ or post-depositional building contexts?

### 2.3 DIAGENESIS 1 – ARAGONITE ALTERATION, TAPHONOMY & SHELL HARVESTING.

Given the sometimes ambiguous terminology surrounding diagenesis, however, we need to be particularly careful to define our terms of reference. Diagenesis itself may be defined as:

“All physical, chemical and biological processes that occur in a sediment after deposition and before metamorphism during which sedimentary assemblages and their interstitial pore fluids react and attempt to reach equilibrium with their evolving geochemical environment” (Keary 2001,73).

It is the aqueous component of this process which is crucial to the replacement of metastable aragonite (or high magnesium-calcite) with low magnesium calcite in the diagenetic geological formation of limestones, as it relies on the relative solubilities of these different carbonate polymorphs in varying aquatic environments (James and Choquette 1984). Whilst submerged in saline water, however, aragonite and calcite are reported to be very stable and

only alter under certain ‘very specific’ circumstances, usually related to both burial (which may be associated with some increase in temperature) and saturation with calcite-rich fresh water in contexts such as phreatic zones (*ibid.*).

Where these environments do apply, then thin section evidence suggests diagenesis proceeds in two main ways: either the aragonite is ‘*neomorphosed*’ across a film boundary (Dickson 2003), in a closed system where the atomic reconstruction of the aragonite crystal structure is quite localised and many internal structural or proteinous shell features may be preserved (Chappell and Polach 1972); or, in a more open system, where a calcite ‘mould’ is formed around the aragonite shell which is then completely dissolved and the void may or may not be filled with calcite subsequently (*ibid.*; James and Choquette 1984). Although in this second scenario only the moulded outline shape of the shell remains to evidence its provenance, it would appear in both cases the newly formed calcite – whether neomorphosed or recrystallised – is relatively slow growing and therefore often sparitic (Tucker and Bathhurst 2009 refer to ‘neomorphosed calcitic spar’). Whilst care must be taken in thin section analysis where metastable grains or shells are coated with calcite which may be micritic in texture (Walbusser *et al.* 2011; James and Choquette 1984), it would otherwise appear that neomorphosed shell material textures should be readily identifiable. Moreover, from a palaeontological perspective, the lack of a fluid component to the experimental shell-heating reaction is not consistent with the definition of diagenesis, and this high temperature solid state process would be better characterised as ‘inversion’ (Tucker and Bathhurst 2009, vii).

Geobiologists report that where post-mortem *C. edule* shells have been deposited inland then taphonomy is mainly characterised by biological attack, whilst in the more ‘taphonomically active zone’ (TAZ) of the upper level of Recent ocean floors, bioturbation, hydro-transportation and (in estuarine contexts) high pH, have all been reported to cause high rates of post-mortem shell aragonite and calcite dissolution (Cherns *et al.* 2011; Walbusser *et al.* 2011; *contra* James and Choquette 1984). It is necessary, however, to remain aware of how variable even contemporary marine environments can be with respect to salinity, temperature and carbonate saturation, and that almost all of the literature on diagenetic processes (including those discussed and referenced above), are modelled in warm water carbonate-saturated environments very different from those of North Atlantic Europe. Indeed, important evidence from western Sweden and north Norway suggests that taphonomy in cool-water settings is generally characterised by microbial induced aragonite dissolution, and

that evidence for recrystallisation, precipitation or replacement carbonate material is not apparent (Alexandersson 1974; Freiwald 1995). In this environment, therefore, diagenesis cannot be driven (Cherns *et al.* 2008; 2011; see also Chapter 3).

18<sup>th</sup>-century reports of Scottish North Atlantic limeburners harvesting shell are available from Barra and Nigg, and in both cases stranded boats were filled with shell at low tide and sailed ashore at full tide (MacQueen 1791-99, 337; Matheson 1791-99, 196; see chapter 5; Thakuria 2012). Elsewhere, cycles of supra-littoral deposition may have been exploited, such as that reported within the loch adjacent to the church of *Eaglais na h'Aoidhe* in the 17<sup>th</sup> and 19<sup>th</sup> centuries:

‘... clams, oysters, cockles, mussels, limpets, whelks, spout-fish; of which last there is such a prodigious quantity cast up out of the sand of Loch Tua, that their noisome smell infects the air...and this they say happens most commonly once in seven years.’ (Martin [1695] 1999, 16). ‘The reporter has seen huge heaps thrown ashore, twice during that period, - which employed many carts and creels, for several days, in carrying them away for food and manure (Cameron 1833, 123).

Although dissolution may progress to some degree in these upper and supra-littoral zones, (particularly where meteoric waters are a significant local factor), it is probably not wholly appropriate to extend the TAZ concept completely to these generally more aerial environments. We should conceptualise post-mortem shell taphonomy as a triangulation of the geochemical forces; with diagenetic, preservational and dissolutional end members and, although time-averaged, radiocarbon dated, post-mortem shell assemblages in ‘near shore’ environments (<10m deep to the supra-littoral) have been estimated to range from tens of years to thousands of years (Kidwell and Boscense 1991, 174; Flessa *et al.* 1993; Flessa and Kowalewski 1994; Flessa 1998), evidence of fossilisation within active littoral-to-supralittoral zones is rarely reported. Indeed, in a project to measure the net movement of *post-mortem C. edule* shells on the East Frisian coast and Dogger Bank (North Sea), a large assemblage of individual shells radiocarbon dated to up to 10,000BP ‘were not any more battered or worn than younger shells or shells...recovered from the present-day habitat’ (Flessa 1998, 189).

Although preservation in the intertidal zone is likely to be a localised issue, in general it appears that pre-kiln diagenetic processes are unlikely to compromise our identification of shell kiln-relicts in the thin sections from the North Atlantic, and this is supported by the

experimental results reported above in which both Stage 1 *C. edule* shells were fully aragonitic.

The corollary to examining the pre-kiln depositional history or biography of mortar materials, in order to recognise their anthropogenic alteration, is the paleoenvironmental potential of the material and this issue will be explored in a number of ways throughout the thesis. For instance, many molluscs such as *C. edule* or *P. vulgata* are fast growing and short-lived, and the tidal biodeposition of their shell carbonates (Mahé *et al.* 2010) makes both species excellent repositories of isotopic information which can be used as proxy evidence for environmental conditions during growth and radiocarbon dated to a very high resolution (Surge and Barrett 2012; see chapter 4). As diagenetic neomorphism has been shown to recycle the same carbon in shell materials (Chappell and Polach 1972) it is possible that Type 1-3 inverted aragonite does not affect the isotopic composition of shell kiln-relicts. Again, however, a better understanding of depositional history is crucial to understanding that potential (Pearsall 2000) and widely reported evidence that post-mortem shells are not generally transported very far from their natural habitat (Flessa 1998), and that shell assemblages can include very wide age ranges (*ibid*; Kidwell and Boscense 1991; Flessa *et al.* 1993; Flessa and Kowalewski 1994), does appear to limit their potential at present. Where, as at *Eaglais na h'Aoidhe*, it is possible shell-lime assemblages are the result of seasonal deposits of live organisms, however, then that potential may be available and should at least be considered. In an Irish project, two radiocarbon dated shell samples from the mortar of the medieval church on Caher Island, Co Mayo returned consistent but older uncalibrated radiocarbon ages than cross-dated charcoal from the same phase, although the shell had such large  $2\sigma$  error ranges that the calibrated dates do (just about) correlate (Berger 1995, 169; see chapter 4).

It is accepted that much more work needs to be done to investigate these shell materials from a range of environmental and historic contexts, as well as considering the post-construction (or post mortar deposition) taphonomy of the mortars themselves. Indeed, within the masonry of the lime-bonded ruined building, mortar inclusions are now in a post-depositional burial environment where calcite-rich pore fluids may be a diagenetic issue (although see chapter 3 for some evidence that the mortar environment is diagenetically benign also).

## 2.4 INTERPRETING HEATED *C. EDULE* SHELLS IN NORTH ATLANTIC MORTARS.

Accepting that the thermal profile of the shell-heating experiments presented above (and particularly heating rate) will not strictly apply to historic mortars (Gosselain 1992, Livingstone-Smith 201), it is nevertheless suggested that comparative ‘equivalent firing temperatures’ (hereafter EFT; Tite 1969) are a much simpler concept to apply to limekiln-relicts than ceramics - in order to infer a very approximate maximum firing temperature for individual (and ranges of) clasts and so at least demonstrate provenance.

This section of the chapter will now return to the historic fabric within a number of putative shell-lime bonded buildings from across the region, to compare the material evidence with the experimental results and infer EFTs.

### 2.4.1 XRD ANALYSIS OF HISTORIC SHELL-LIME MORTARS

Four putative heated *C. edule* shell kiln-relicts were physically separated from their respective shell-lime mortars and subjected to XRD analysis. These relicts were initially examined in hand sample, and an EFT suggested from physical characteristics of colour and texture. These were then subject to XRD analysis for comparison.

ENH.23 - Eaglais na h'Aoidhe, Isle of Lewis; single *C. edule* fragment embedded in mortar sample ENH.23; white coloured with a very thin blue-grey external surface colouration; very soft and easily crushed; removed from mortar with a steel spatula. Pre-XRD interpretation: Type 2 shell-lime kiln relicts heated to an EFT of 400°C.

MHU.02 – St Mary’s, Howmore, South Uist; six dissolute loose *C. edule* shell fragments from NE corner of chapel; generally very dark blue-grey with some lighter grey at rim and on ribs; very soft and easily crushed; no lime mortar adhering. Pre-XRD interpretation: Type 2-3 shell-lime kiln relicts heated to an EFT of 4-500°C.

THH.12 - *Rubh an Teampull*, Harris; single *C. edule* shell fragment embedded in mortar sample taken from south wall wallhead; dark grey; very soft and easily crushed; lime mortar physically scraped from shell with steel spatula. Pre-XRD interpretation: Type 2 shell-lime kiln relicts heated to an EFT of 400°C.

TQ.8 - Tuquoy Hall, Westray; two *C. edule* shell inclusions dug out of the sawn face opposite thin section TWO.08; both were white and blue striped. These 3 samples were all

ground and suspended in acetone and mounted on a glass slide. Pre-XRD interpretation: shell-lime kiln relicts of unknown type.

A summary of the subsequent XRD results interpreted through the Reitveld programme is presented below:

Sample	HMC /%	LMC /%	Aragonite /%	Periclase /%	Portlandite /%	XRD Type EFT	Visual analysis
ENH.23	24.7	70.9	0.5	-	-	2 (300°C)	2 (400°C)
MHU.02	18.7	76.2	1.9	1.2	-	2 (400°C)	2-3 (4-500°C)
THH.12	13.5	83.6	-	-	-	3 (550°C)	2 (400°C)
TQ.8	31.8	59.3	1.2	-	-	2 (350°C)	-

Table 2 (above) – Mineral phases in *C.edule* shell mortar inclusions.

There is reasonable agreement between these results. The XRD evidence supports the visual analysis interpretations that these four clasts are heated shell kiln-relicts, although there is some slight disparity in both relict type and EFT. That two of the three visual interpretations were higher may indicate a more reducing kiln environment pertained in these mortars, but it is probably best not to over-interpret these results until more work has been done and more data is available. At present the most significant aspect is the broad equivalence.

#### 2.4.2 THIN SECTION ANALYSIS OF HISTORIC SHELL-LIME MORTARS

This section of the chapter will attempt to refine interpretation of a range of shell-lime mortars from across the North Atlantic according to the 4-stage criteria suggested above, by presenting a series of short studies.

#### 2.4.2.1 Rubh an Teampail (Harris)

This is a single phase late medieval unicameral chapel, with discoloured *C. edule* shells visible in the core mortar. Samples were subject to SEM, XRD, and thick-section and thin-section petrography (2015e). In situ, hand sample and thin section analysis suggested Type 2-4 kiln relicts were present and XRD data from one inclusion returned a mineral phase profile consistent with an upper Type 3 kiln-relict (EFT - 550°C). A number of vitreous kiln-relicts were also analysed (see appendix 2.3) whilst both in-situ, hand sample and thick and thin-section evidence, indicates the kiln was peat-fired.

#### 2.4.2.2 Howmore churches & chapels (South Uist)

This site contains a series of six upstanding medieval and later church and chapel buildings which have been re-phased as a thesis case study (see chapter 6; appendix 9). On site survey suggests all the pre-18<sup>th</sup>-century mortars are shell-limes which display very white matrices, and discoloured Type 2-4 *C. edule* shell kiln-relicts. This interpretation is supported by the apparently terrigenous lithic added-temper noted in thick and thin-sections from the site (Thacker 2011), thin-sections which display Type 2-4 shell-lime kiln-relicts and XRD analysis of one dissolute Type 2 *C. edule* kiln-relict as above. No shell-lime vitreous relicts were noted, but thin sections included evidence for probable peat-firing.

#### 2.4.2.3 Eaglais na h'Aoidhe (Lewis)

This medieval and later parish church site was re-phased by the candidate in a collaborative project (Knott and Thacker 2011), and lab-based analyses of mortar samples form a thesis case study (see appendix 7). In situ, hand sample and thin-sectioned samples contained Type 2 – 4 *C. edule* whilst probable heated *E. arcuatus* kiln-relicts were also present. These interpretations are supported by XRD of a *C. edule* shell inclusion which returned a mineral phase profile consistent with a Type 2 kiln-relict (300°C EFT).

#### 2.4.2.4 Teampull Ronain (North Rona) (see also chapter 5).

This chapel is one of the earliest upstanding Christian structures in Scotland, and was re-phased in 2012-13 (Thacker 2013a; see chapter 5). The building contains multiple shell-lime mortared phases with contrasting kiln-relict evidence of both shell and vitreous materials. One mortar type is characterised by high concentrations of Type 3- 4 shell relicts and well-developed vitreous inclusions, whilst another is characterised by high concentrations of Type

2-3 shell relicts and poorly-developed vitreous products. These mortars appear to indicate contrasting kiln temperatures in each phase.

#### 2.4.2.5 Iona churches and chapels

This predominantly medieval site is a thesis case study (see chapter 4; appendix 15) during which the nunnery/priory was re-phased. Site survey suggested all the earliest surviving high medieval mortars at this site are shell-limes, and this was supported by thin-section analysis, wherein Type 3-4 *C. edule* and *O. edulis* shell evidence was noted in different structures.

#### 2.4.2.6 Duntulm Castle (Skye)

This medieval and later castle informs a thesis case study in which the earliest medieval phases of the building complex all appeared to be constructed of shell-lime bonded masonry (appendix 8; see below). In situ, hand sample and thin section analysis suggested these mortars included Type 2-4 *C. edule* and *O. edulis* shell kiln-relicts.

#### 2.4.2.7 St Peters Thurso (Caithness)

This medieval and later church was analysed as a thesis case study site (appendix 11) during which extensive primary high medieval masonry fabric was identified on the basis of its mortar archaeology. Two possible late medieval and/or early modern shell-lime phases were also recorded and analysed in thick and thin-section. These included Type 3-4 *C. edule*, *O. edulis*, and *P. vulgata*, and some probable *E. arcuatus* kiln-relicts.

### 2.4.3 SUMMARY OF EAGLAIS NA H'AODHE EVIDENCE

In the context of this thesis the most significant aspect of the microstructural analysis of mortar samples from *Eaglais na h'Aoidhe* is that these support the on-site interpretations of their various limestone or shell lime-sources made during building survey. The study clearly positively identified altered limestone and shell clasts in different mortars at a microscopic level, and within the samples analysed (in this limestone-free environment) these altered clasts were mutually exclusive and phase-specific. The potential for microstructural analysis to recognise different limestone sources has also increased the archaeological potential of the surviving materials in demonstrating fundamental geological distinctions between different phases which had previously all been interpreted as limestone-limes and distinguished by their contrasting aggregate grades and stratigraphic context only (see table 1 above). In this

regard limestone-limes appear to have greater archaeological potential than shell-limes in that their different sources may be more specifically recognised, and perhaps located.

The more complex mineralogies presented by heated *C. edule* shells, however, appear to offer a more refined analytical tool for positively identifying heated clasts, so establishing mortar provenance and even ‘equivalent firing temperatures’. That these clasts have been radiocarbon dated elsewhere also suggests these materials may have greater archaeological potential than limestone-lime in some circumstances, although a preliminary investigation suggests that potential is difficult to evaluate and requires more work (chapter 4).

Returning to the building, microscopic analyses supported previous interpretations that there was a general progression at *Eaglais na h'Aoidhe* from shell-lime to limestone-lime mortars, and these are most strongly associated with the medieval and post medieval periods respectively. Given the association of the first limestone-lime mortared phase with such a clear architectural statement as the western burial aisle, this would appear to evidence a cultural change which here is probably associated with the new MacKenzie lordship. The use of finely dressed architectural features, such as the eaves corbels and arch *voussoirs*, is also salient and suggests an imported team of masons were employed, although that these were hewn from the very coarse local sandstone is notable when the mortar lime-source was imported. The later use of shell-lime in a localised context, when it is suggested supplies of limestone may have run low, indicates this is not a simple narrative, and the poor quality of that shell lime compared to the robust and thoroughly calcined mortars of the (native?) medieval phases is salient. This suggests either a loss of shell-lime mortar manufacturing expertise or the adoption of an unfamiliar material (whether as a result of relatively low firing temperatures and/or a relative lack of post-kiln processing) and in that regard these late phase 3-4 shell-limes are perhaps the most evocative of all.

This study of *Eaglais na h'Aoidhe* has now set the agenda for the rest of the thesis as we consider the potential of mortar archaeology to display changes in building phasing, provide links between the upstanding building remains and the local or non-local environment, and display evidence of cultural change. These issues will be considered in every case study, including the foregoing preliminary examination of the castle at Duntulm.

## 2.5 CASE STUDY - DUNTULM CASTLE

### 2.5.1 CONTEXT

Duntulm Castle is located at the very northern tip of the Isle of Skye, on the north-west coast of the Trotternish peninsula overlooking the northern and western approaches to the island from the Outer Hebrides (see appendix 8). The building complex itself has been constructed on a steep dolerite coastal promontory from which (on a fine day) the whole east coast of the Western Isles from Barra to Lewis and much of north-west Ross may be clearly seen.

Like the Outer Hebrides, northern Skye is exposed and treeless but with a vegetational history comparable to the mainland further north in Sutherland and Wester Ross, the Trotternish peninsula is well known for its high agricultural fertility (Birks 1993). More importantly for this study, the locality around Duntulm Castle is one of a series of west coast castle sites in which the igneous rocks which dominate much of the North Atlantic region have protected an underlying series of Mesozoic sediments which includes extensive limestone deposits (Richey *et al.* 1961, 42; Hesselbo *et al.* 1998; Thacker 2016a; 2016b; see chapter 4). The two main calcareous formations within this district (both of which are Jurassic) have been plotted onto the first edition Ordnance Survey 6-inch map (O.S. 1878), and during walkover survey a fossiliferous limestone pavement on the shore close to the castle site was noted and described (see appendix 8).

For the early and high medieval history of Skye we are dependent on the same rare annalistic, chronicle and saga sources as we were in Lewis, although there is perhaps more detail. In the early 13<sup>th</sup>-century Pál Bálkason is named as the *vicecomes* of Skye in the near contemporary chronicle of Man and the Isles, and it is on his death in 1231 that we see the emergence of the eponymous founder of the clan Macleod (Anderson 1922. 458; Sharpe 1977, 29). Leod carved out a lordship which stretched from Harris in the Outer Hebrides to Glenelg on the mainland (Grant 1959, 26; Dodgshon 1998), and although the very late clan history which had insisted he was the son of king Óláfr Guðrøðarson is unreliable, for what it's worth the document reports that he took Trotternish from the Norse *Clan Mhic Val* of Duntulm (Grant 1959, 27; Sharpe 1977). It is likely Leod was a descendent of a local Norse *sveitarhöfðingjar*, and the primary curtain wall phase of the MacLeod *caput* at Dunvegan Castle has been dated to this same 13<sup>th</sup>-century period (RCAHMS 1928).

The upstanding buildings of Duntulm Castle, however, are generally regarded to have been constructed much later in the medieval and early modern periods (RCAHMS 1928, 167-169; Miket and Roberts 1990). Like many Scottish castles there is no contemporary documentation relating to the lordship until the late 15<sup>th</sup>-century when (on the forfeiture of the Lordship of the Isles) Trotternish was ceded directly to the crown (*ibid.* 1990, 54). From this period until the early 17<sup>th</sup>-century the documentary evidence suggests the peninsula was controlled by different clans in a series of remarkably short-lived episodes, including Angus O<sup>g</sup> MacDonald, the MacLeods of Dunvegan, the MacLeods of Lewis, and the MacDonalds of Sleat, until the MacDonalds finally secured a crown charter in 1614 and made full compensation to the MacLeod's (*ibid.*). Although this remarkable series of grants has been interpreted as crown manipulation of local feuding politics, from the perspective of these various Hebridean clans this may also reflect the central position of this lordship within the geography of the region and the potential of this highly fertile peninsula to generate a surplus (Birks 1993). The site and buildings are first mentioned in a report of the late 16<sup>th</sup>-century (RCAHMS 1928, 168) from which time the symbolic and legal importance of the castle as the caput of that lordship is explicit in a number of charters which required the castle buildings to be occupied and in good repair (Miket and Roberts 1990, 57). 19<sup>th</sup>-century maps record a 'hill of pleas, formerly a justice seat' on the same site (O.S. 1878). Without much chronologically-specific architectural detail surviving in the buildings, however, this site has again been related to these historically-informed 15<sup>th</sup>-17<sup>th</sup>-century dates, with various concomitant speculative attempts to ascribed patronage (RCAHMS 1928; Gifford 1992, 526-7).

Duntulm Castle was identified as a potential case study for this thesis very early in the survey programme of the North-West Region for a number of reasons, including:

1. an accessible and apparently phase-specific range of contrasting mortars which preliminary survey suggested problematicised the accepted phasing;
2. The site was secular and so represented a contrast to the first regional case study at *Aoidhe*, but there was also some masonry at the site of the associated parish church from which to draw further comparison;
3. Some of the surviving upstanding castle structures appeared to display shell-lime mortars, and yet limestone was clearly outcropping very close by.

This site also provided the first indication of the remarkable quantity and quality of mortar evidence often available within the very thick walls of ruined medieval castle sites, and was

the first on-site thesis study to display evidence for the use of wood fuel. The archaeological potential of this fuel material will be explored in chapter 4, but it is pertinent here to highlight that together with the locally outcropping limestone the project was now encountering an increased range of material availability.

### 2.5.2 DUNTULM CASTLE AND KILMOLUAG CHURCH ON-SITE SURVEY

Fuller details of the survey and analysis of Duntulm Castle are contained in appendix 8, but a shorter summary and discussion of the evidence will be presented here.

Duntulm Castle now survives as a complex which includes a multi-period curtain wall, which also contains two corner towers and a sea-gate, the remains of a substantial south-west range with an appended stair tower, and a later ‘hall’ range at the western corner (RCAHMS 1928; Miket and Roberts 1990, 53-68). All of these buildings survive to a general height of 3 metres and the extent of ruination is such that both wall facing and deep wall cores are often clearly visible in collapsed sections and wallheads. As in previous work in the Outer Hebrides (Thacker 2011; 2012; 2015), contrasting shell and limestone inclusions interpreted as heated kiln-relicts were only noted in mutually exclusive contexts.

The crucial context for interpreting the general stratigraphy of the site is located at the west corner of the curtain wall where a large collapsed section of masonry has revealed a deep cross-section of walling in which the core rubble is bound with a coarse shell-rich mortar, whilst the wall face is bound with a very fine mortar containing a high concentration of probable limestone inclusions. This contrast in evidence appears to suggest the curtain wall has been re-faced, and this wall face is contiguous with a probable 16<sup>th</sup>-or early 17<sup>th</sup>-century west-angle tower above, which has been cut by the (also limestone-lime bonded) overlying west hall. Thus the masonry at this west corner of the site appears to display three superimposed phases of work, with a medieval shell-lime bonded curtain wall succeeded by two post-medieval limestone-lime masonry structures.

In contrast, the core rubble of all three conjoined ‘towers’ in the south-east of the site appeared to be bound with similar shell-rich lime mortars, and although various episodes of collapse, rebuild and overgrowth has obscured any direct stratigraphic relationship between the large south tower and the shell-rich core of the curtain wall to the west described above, it is very likely (and generally accepted) that these are the earliest upstanding structures surviving on the site. That the curtain wall may have been re-faced, however, does not

appear to have previously been suggested and the style of this secondary stonework appears similar to that displayed in the north-west, north and east curtain walls. Moreover, where these structures can be safely investigated, they are (including the sea-gate) bound with limestone-lime mortars.

These contrasting shell and limestone-rich mortar materials suggest a number of previous interpretations of the site development may be problematic as (accepting the shell-lime evidence in the west gable at *Eaglais na h'Aoidhe* as exceptional) it is generally very difficult to argue that physically unrelated structures with clearly contrasting mortars (such as the sea gate and south tower amongst others) are coeval. Moreover, although at that time still requiring lab-based analysis, it appeared salient that this site survey suggested a similar general progression from medieval shell-lime mortars to post-medieval limestone-lime mortar pertained at this site as had at *Eaglais na h'Aoidhe*.

The upstanding remains at the nearby medieval parish church site of Kilmoluag are fragmentary, but the west wall of an oriented building (presumed to be former church) still stands to wallhead height. Although this wall has been modified to support a late modern memorial, close examination suggests that the primary fabric is bound with a probable shell-lime mortar displaying a high concentration of heated *C. edule* shell fragments.

### 2.5.3 THE MICROSTRUCTURE OF THE DUNTULM CASTLE SAMPLES

41 thick-sections and 37 thin-sections were prepared from 14 loose mortar and limestone samples taken from the wider site of Duntulm Castle, and their microscopic analysis appears to both support the mortar characterisations previously made on site, and refined those interpretations further.

The added-temper fractions within the assemblage demonstrate a sequence which becomes increasingly fine with each successive phase and correlates with the lime-source evidence. The early materials interpreted as shell-limes are strongly associated well-sorted coarse gabbro gravels which indicate the thick-walled medieval curtain wall and south tower were effectively built with a shell-limecrete, whilst the much narrower walls of the post-medieval curtain wall battlements and west hall were built with limestone-limes which are only ever associated with a fine sharp monominerallic sand.

The lime sources within the Duntulm Castle assemblage were different to those previously encountered at *Eaglais na h'Aoidhe*, although once more inclusions interpreted as possible

shell and limestone kiln-relicts were evident in samples from mutually exclusive contexts and the *Ostrea edulis* (oyster) clasts these had been interpreted as heated kiln-relicts on the basis of a similar blue-black discolouration to that noted in Type 2-3 *C. edule* elsewhere. At higher magnification the laminated structural form of the *O. edulis* shell was clearly largely composed of bundles of fibres known as foliated structure which betrayed a spectrum of textural alteration including: progressive fracturing; loss of boundary coherence; loss of internal microstructure; and increasing optical continuity with the supporting carbonate matrix of which some were an almost indistinguishable part.

The composition of the geogenic carbonate kiln-relicts within the later limestone-limes of the castle, however, also contained very high bioclast concentrations, and these matched those of the bioclastic packstone sample collected from the shore at nearby *Cairidh Ghlumraig* very well. Indeed, as well as clearly suggesting this outcrop was quarried for lime manufacture in the post-medieval period, this limestone also displayed both of the main diagenetic relict bioclastic types discussed earlier in this chapter including shell moulds in which the aragonite had been replaced by sparry calcite and shells with well preserved foliated structure from the original mollusc shell microstructure. Remarkably, therefore, both shell-lime and limestone-lime mortars at the site contained similarly altered foliated-shell kiln-relicts, so offering the potential to examine the variety of textures exhibited in heated biogenic and geogenic carbonates at a single site in future investigations. That the foliated structure within the Jurassic shells had survived diagenesis, however, also suggested *O. edulis* was calcitic, and so likely to conform to a much simpler (limestone-like) lime-cycle when used as a building lime source than the aragonitic *C. edule* clasts discussed earlier in this chapter. As no published literature could be found which had investigated the mineralogical changes associated with heating *O. edulis*, another experimental programme was undertaken with the material and is presented in appendix 2.

#### 2.5.4 SUMMARY OF THE DUNTULM CASTLE EVIDENCE

In the context of this thesis there are a number of features of this preliminary investigation of Duntulm Castle which are very significant. Perhaps the most salient aspect for this chapter is the interpretation that shell-lime mortars are in evidence in early building phases when bioclastic limestones were clearly available close to the site, and that limestone even been used to manufacture lime for later constructional phases. This suggests that, unlike in the Outer Hebridean case study sites of *Eaglais na h'Aoidhe* and Howmore (see chapter 6;

appendix 7 and 9), our interpretation of these materials cannot be simply predicated on a lack of available geogenic carbonate materials, and some of these putative shell-lime mortared phases at Duntulm display limestone building stones which are also clearly very bioclastic. This interpretation supports Miket and Roberts (1990) thesis that shell-limes were evident in Skye even where limestones were available, although it is not yet clear where the shell materials evident in the earliest phases of this building may have been collected from, and given that both *O. edulis* and *C. edule* require sandy habitats it is possible that these were transported to the site from some distance away.

It is, therefore, perhaps even more significant that the limestone kiln-relicts evident within the later mortars of the building match the loose sample collected from the limestone ‘pavement’ on the shore of *Cairidh Ghlumaig* so closely, as the probable lime provenance of these later mortars can now be located very precisely through a remarkable confluence of historic, archaeological and geological evidence associated with this site. Indeed, an ‘abundance of limestone in Strath and Trotterness’ was reported in the 17<sup>th</sup>-century (Martin [1695]), and by the 18<sup>th</sup> ‘Some limestone of most excellent quality is found on the neighbouring shore, but [is] difficult to quarry, being a long continuation of a very flat rock, which is exposed to view, when the tide ebbs’ (Martin 1791-99, 554). This describes the sample context at *Cairidh Ghlumaig* very well and a location in which quarrying limestone was not too dissimilar to harvesting shells.

Moreover, it is also important that limestone-lime mortared phases have now been so securely identified at Duntulm Castle from a period when shell-limes appear to be in more general use in castle contexts elsewhere in Skye (Miket and Roberts 1990), including within another late MacDonald hall at Castle Camus (Thacker 2016).

Whether this indicates the same masons were using different lime mortars at different MacDonald sites requires more work as one of the most notable features of this survey is the contrast between the wide range of materials contained within this complex multiphase building and the short timeframe over which it has been suggested to have developed. Previous interpretations of this site have suggested the upstanding evidence can be constrained within two centuries (Gifford 1992), but this may better reflect the complex history of the site than its archaeology. In comparison with the castle evidence, the shell-lime bound fabric of the upstanding west wall of the church of Kilmoluag is likely to be substantially medieval, but no attempt has been made here to ascribe specific construction dates to these structures. It is hoped that research can continue at both of these sites: that the

early mortar material provenances and stratigraphy will be refined by improved access, the removal of fixed samples and further geoscientific analysis; and that from this some dating evidence may emerge (see Chapter 4).

## 2.6 SHELL-LIME MORTAR ARCHAEOLOGY IN CONTEXT

The various experiments and analyses detailed in this chapter appear to support the characterisations made of shell-lime mortars during site survey, and so we shall now return to those surveys in order to get a wider perspective on the geographical and chronological distribution of the technique.

### 2.6.1 THE SHELL-LIME MORTARS OF THE MEDIEVAL NWR

Appendix 1.2.1 collates all the information from the building surveys undertaken up to the completion of this thesis in the North-West Region (NWR).

Within this data, it is apparent that shell-limes are almost ubiquitous within the surviving medieval masonry of the North-West Region, in both secular and ecclesiastical contexts. The only ‘alternative’ binders apparent within the data consist of a very low number of clay-bonded buildings in the Isle of Lewis (*Tigh a’ Bheanneach*; and *Dun Eistean*), and a small concentration of limestone-lime or dolomite-lime bonded medieval castles in mainland Ross-shire and Lochaber (*Eilean Donnain*; *Strome*; *Ard Bhreac*; *Inverlochy*).

Shell-limes predominate to an even greater extent in NWR island contexts where the above two clay-bonded building and one possible late medieval limestone-lime at *Dun Scaith* at present appear to be the only contrasting materials. This is not a mutually exclusive mainland/island dichotomy, however, as shell-limes also survive in many mainland contexts (including *Castle Tioram*; *Dun Lagaidh*; *Castle Bharraich* and *Baile na Cille* church). The positions of the mainland sites of the NWR draw attention to the regional boundaries initially conceived for this thesis, and the early shell-lime masonry of the curtain wall at *Castle Tioram* is particularly striking when the neighbouring and apparently contemporary castle of *Mingary*, just over the border into the South-West Region, is limestone-lime bound.

This is not a mutually exclusive geological dichotomy either, as many of the castles of Skye and the Sutherland buildings of *Bharraich* and Balnakeil are sited very near to outcropping limestones used to make building limes in later periods. Conversely (accepting that Inverlochy Castle has local limestone outcrops), the limestone-lime masonry of Eilean Donnain is located on a lochside noted for its shellfish, but is not a locality in which limestone outcrops. The later medieval limestone-lime of *Dun Scaith* in the extreme south-east of Skye may foreshadow the post-medieval change in the masonry techniques to follow at Duntulm Castle and *Eaglais na h'Aoidhe*, but in many Skye contexts shell-limes continued to dominate the archaeological record into the 18<sup>th</sup>-century, including in the various MacKinnon buildings of Strath where limestone, marble and lime industries were located.

In the early modern period, when different techniques are evident in a locality then there may be a social aspect to the evidence and considerations of scale are important. Many of the later shell-limes of Skye, for instance, are within reasonably small 18<sup>th</sup>-century burial aisles such as the MacKinnon, MacLeod and MacLean aisles of Strath, Dunvegan and Duntulm respectively, and similar evidence was noted at Galson (Lewis). Each of these buildings overlays or is later than the limestone-lime of larger structures, such as churches, castles or houses, on the same site or within the wider locality. The general post-medieval change to limestone-lime masonry techniques noted in the case studies of this chapter, however, is also evident in the regional archaeological record and almost complete by the mid-20<sup>th</sup> century. The apparent relentless irreversibility of this evidence makes these chronologically and/or stratigraphically later shell-lime contexts all the more evocative.

### 2.6.2 THE SHELL-LIME MORTARS OF MEDIEVAL SWR

Appendix 1.2.2 summarises the survey results of building lime mortar evidence surviving in buildings of the South-West Region and it is clear shell-lime mortars are a prominent feature of the archaeological record here also. There is, however, an apparently clear geographical dichotomy from the earliest period when Kilchoan and Keills are the only possible shell-lime bonded mainland sites.

The earliest medieval masonry recorded in the islands of the SWR is more heterogeneous. Islay is dominated by shell-lime masonry in the high medieval period, including in the early

curtain wall of Dunyvaig Castle and the ‘Great Hall’ at Finlaggan. Mull, Iona and Lismore present a more complex picture, however, as (accepting there is a lime-stone phase in Lismore also) the mortars surviving in the churches and chapels of this period are shell-lime, whereas the Sound of Mull castles of Duart, Aros, Coeffin and Achadun like their mainland counterparts at Mingary and Ardtornish, are all primarily limestone-lime.

Once more, these contrasts cannot be completely explained by environmental availability at almost any scale. The islands of Islay and Lismore in particular contain significant outcrops of limestone which were used to produce building lime in later periods, and the mainland coast of Argyll contains excellent shell resources. There a social correlate here, however, as in the later medieval period a similar shell-lime/church and limestone-lime/castle contrast pertained at Kilnaughton/Dunyvaig (Islay), but nowhere in any of the regions surveyed was the reverse situation noted.

The use of shell-lime in the SWR decreases markedly over the medieval period. Once more the multiphase sites with deep chronologies, such as Dunyvaig, Finlaggan and Iona are good examples of this process at single sites where carbonate resources probably remained relatively constant. Again, however, within this regional/chronological context it is the sites which appear to buck the trend which are most evocative, and in this regard the shell-lime bound masonry of the substantial medieval north range at Mingary Castle stands out as extraordinary (see chapter 4). This structure is clearly on a different scale to the smaller shell-rich contexts seen in the later medieval masonry of Castle Sween and the adjacent chapel. Unlike in the northern regions, however, there was no surviving evidence in the SWR for the high status use of shell-lime plasters on constructionally limestone-lime medieval buildings such as the western hall of Duntulm.

### 2.6.3 THE SHELL-LIME MORTARS OF THE MEDIEVAL NER

Shell-lime mortars are also a very significant feature of the archaeological record of the North-East Region of this thesis and dominate the high medieval archaeological records of the surviving mainland and Shetland masonry buildings. Only in Orkney are they less common.

The use of shell-limes in the high medieval NER also seems to cut across all social contexts in this period, as it is found in the castles of Sutherland (Skelbo), Caithness (at Braal, Forse,

Old Wick and possibly Borge) and Shetland (Holm), the Cathedral and churches of Dornoch and Tain; and the much smaller proprietary chapels of Shetland. No constructional uses of shell-lime in Orkney were noted, but a number of medieval and later coatings are reported.

The later medieval period is more difficult to interpret in much of the NER, due to a lack of surviving buildings in many districts, but where survival is better, in the Firthlands of Ross-shire and Sutherland, then shell-lime mortars continued to form a significant proportion of the archaeological record, including at the Cathedral in Fortrose and the Bishop's Palace Dornoch.

The lack of upstanding late medieval building evidence in some districts, and particularly in Shetland, is probably significant as by the early modern period (when upstanding survival is once more extensive) the evidence for constructional shell-lime use has disappeared from the archaeological record. This apparent lack of continuity may be contrasted with the Firthlands where, as noted above, building survival is good throughout the late medieval period and shell-lime masonry continues to dominate the archaeological record of the district into the early 18<sup>th</sup> century. As in most other regions, excepting the Outer Hebrides and perhaps part of Islay, there is no evidence to suggest shell-lime use continued into the late modern period.

#### 2.6.4 THE SHELL-LIME MORTARS OF THE NORTH ATLANTIC

Elsewhere in the North Atlantic shell-limes mortars are frequently reported in medieval contexts. Before this thesis research shell-limes were the only medieval mortar reported in the Isle of Man (Train 1845), within the small *keeil* chapels (Marstrander 1937, 414; see chapter 5), 12<sup>th</sup>-century Castle Rushen (Rigby 1927; O. Neil 1951) and 13<sup>th</sup>-century St Michael's Malew (Lamplugh 1903, 566; Bruce 1968, 25, Qualtrough 2007, 16). Although the mortar archaeology of Galloway requires much more work, shell-limes have also been noted in medieval buildings here, and are probably in significant numbers (Brown 1791-99, 288; Maxwell-Irving 1993, 100).

In Ireland, shell-limes are reported in many coastal districts (O'Danachair 1957, 70; *contra* Boate 1652), and Pavia concluded that mortar samples from both phases of St Michael's church, *Sceilig Mhichíl* were shell-limes due to the 'presence of several instances of transformed shell...together with the occurrence of the remains of shell structures in lime lumps...' (Pavia 2010, 23). The mortars of the 11<sup>th</sup>-century churches on Caher Island, Co.

Mayo and High Island, Co. Galway, have both been described as displaying a high shell concentration and shell-limes might be suspected (Berger 1995, 169; White Marshall and Rourke 2000, 74).

Shell-limes are the only medieval masonry mortars reported from Greenland and the Faeroes (Clemmensen 1911; Norlund 1930; Dahl 1968), and peat-fired shell-lime masonry is reported in late medieval Holland (Davids 2008, 122; Rosenthal 1989), 12<sup>th</sup>-century medieval Denmark (Helms 1870, 9-10; Clemmenson 1911), 15<sup>th</sup>-century north Germany (Marinowitz *et al.* 2012, 16) and western Sweden (Jan Erik Lindqvist pers. Com).

Many of these districts report a continuation of shell-lime burning with peat into the modern period, including in 17<sup>th</sup>-century and 18<sup>th</sup>-century Orkney (Wallace 1684; Martin [1695], 212; Brand 1700); 17<sup>th</sup> and 18<sup>th</sup>-century Dumfries and Galloway (Symson 1684; Donnachie 1971) 18<sup>th</sup>-century Caithness (Morison 1791-99, 152); 18<sup>th</sup>- 20<sup>th</sup>-century Outer Hebrides (MacQueen 1791-99, 337; MacLean 1837, 187; McRae 1837, 167; MacIntyre 1993; Thacker 2011); and 17<sup>th</sup>- 19<sup>th</sup>-century western Denmark (Helms 1870; Feilberg 1922, 29-30).

## 2.7 CONCLUDING DISCUSSION

This chapter has characterised the archaeology and archaeometry of a number of medieval shell-lime mortars from North Atlantic Europe and found that evidence to be extensive from the earliest period. Indeed, the evidence from *Sceilig Mhichíl* in Ireland may even be first millennium, and from the high medieval period shell-limes dominated the archaeological record of west Denmark, Holland, northern Germany, Caithness and Shetland, the Faeroes, Greenland, the Western Isles, western Argyll, and the Isle of Man. By the 19<sup>th</sup> and 20<sup>th</sup>-century these techniques had almost completely disappeared from all three Scottish North Atlantic survey regions of this thesis, only remaining in the Uists and possibly north-west Islay.

Shell-limes almost completely dominate the medieval archaeological record of the North-West Region (see maps 1.1.6 and 1.1.7, appendix 1), including in the two cases-studies described in this chapter, at *Eaglais na h'Aoidhe* and Duntulm Castle, but as in the wider region both buildings were dominated by limestone-limes in the post medieval period. Both of these studies have demonstrated the excellent archaeological potential of mortar analysis

during archaeological survey of particular buildings, as mortar-making techniques changed from phase to phase.

Within a discourse in which shell-lime mortars are generally interpreted as a simple response to a lack of limestone, however, the most significant aspect to emerge from this work is that these contrasting shell- and limestone-lime mortar-making techniques are not a simple correlate of environmental availability, but are chronologically and culturally contingent. *Eaglais na h'Aoidhe* and Duntulm Castle appear to have similar mortar archaeologies even though limestone was freely available at Duntulm and unavailable at *Aoidhe*, and shell-lime mortars dominate the medieval mortar archaeological record in many other districts of this survey where limestone is widely available, including Islay, Skye, Sutherland, Caithness and Shetland. This phenomenon is most striking in shell-lime mortared structures where limestone is used as building stone and two of the earliest (probably 12<sup>th</sup>-century) castle buildings within the region, at Castle Holm (Shetland) and Rushen Castle (Isle of Man) also fit into this category. Although hundreds of miles apart at opposite ends of the survey region, that Holm and Rushen are both Late Norse buildings is significant.

In a previous desk-based survey, I had suggested landscape geography/topography might be the defining factor in mortar provenance (Thacker 2011), but this is also contradicted by these survey results, wherein Braal Castle (Caithness), *Coire-chatachan* (Skye), and the 'Great Hall' at Finlaggan (Islay) have all been characterised as shell-lime bonded buildings located miles inland and very close to significant limestone outcrops used in later periods for lime-burning. It is striking to see the lime mortars of these buildings packed with Type 3-4 *C. edule* and/or *O. edulis* shell kiln-relicts, so far from the sea.

Contrasts between the building evidence and the environment, and between different buildings, often highlight different cultural and political contexts. The Isle of Man provides another striking evidence of this process when the Cistercian Abbey at Rushen, which is located very close to the Late Norse castle, was founded by a community from Furness (England), these builders did not manufacture shell-limes, but burnt the local limestones instead (see chapter 3). By contrast, on current evidence it would appear shell-lime making techniques may have died out in Shetland during a late medieval lacuna in the masonry archaeological record, and limestone lime-making is firmly associated with the subsequent period of 'scottification' when new landlords and population plantation is reported (Fenton 1997; but see especially Strachan 2008; chapters 3 and 5). These Shetland and Manx

examples are two of many different mechanisms of cultural change associated with colonialism in contexts where it was possible for incoming populations to utilise local limestone outcrops. The corollary to this apparent contrast is that in these contexts the use of shell-lime may be associated with the now native Norse population somehow, in ways which this thesis will explore further in later chapters.

The wider decline in shell-lime mortar evidence across the region from its medieval *floruit*, however, is a process which appears so generally unrelenting across all three regions (see maps 1.1.6-1.1.9, appendix 1) that contexts in which significant shell-lime bonded pieces of architecture physically overlay limestone-lime fabric are quite rare. In this regard, the shell-lime phase abutting the western aisle at *Eaglais na h'Aoidhe* is particularly interesting because it appears to betray a vernacular informality or lack of expertise which is no longer firmly culturally-situated. As evocative as that is, however, the more conscious cultural contrast at this site is the political and architectural statement made with the initial MacKenzie construction of this fine post-Reformation limestone-lime masonry monument, and in this context masons from mainland Ross-shire were probably involved. Two case study buildings in which more significant shell-lime phases overbuild earlier limestone-lime work, however, are included within this thesis - at St Peters Thurso (see chapter 3 and appendix 11) and Mingary Castle (see chapter 4 and appendix 14) - and in both cases it will be suggested this may be evidence for cultural or political change.

Contrasting masonry evidence at single sites are more simply interpreted when the production techniques are coeval but of different social context, such as in a contemporary house and barn or castle and outbuilding for instance. It is then tempting to translate this comparative framework to structures from different periods, and as masonry construction itself becomes increasingly associated with patrons of lower social status so shell-lime mortar making techniques often appear to follow (see chapter 5 for more discussion with respect to clay mortars). In contrast to the poor-quality 18<sup>th</sup>-century shell-lime phase at *Aiodhe*, however, the mid 18<sup>th</sup>-century shell-lime masonry of the *Bhartasiag* MacLeod Aisle at St Mary's Dunvegan and the Mackinnon Aisle at Strath are two of a series of very formal classical burial aisles seen throughout Harris, Skye, Harris and Ross-shire in the same period, both of which appear to be shell-lime bound. Like the mortar stratigraphy at *Aoidhe* the shell-lime bound *Bhartasaig* aisle abuts a limestone-lime bonded phase of the church, but this later structure was evidently constructed by formally-trained masons operating within a

thriving post-medieval Hebridean ‘masonry culture’ which on Skye still clearly included widespread shell-lime manufacture and use. The putative late shell-lime mortar coating the western hall at Duntulm may relate to this culture but this evidence is also paralleled in other high status early modern buildings throughout the region, such as at Noltland Castle (Westray), the Earls Palace (Kirkwall) and Urquart Castle (Ross-shire), in a period in which shell-limes were considered particularly ‘fine’ and excellent for ‘plaistering’ (Harrison [1577]; Wallace 1684; Matheson 1791-99, 196; MacLean 1837, 187).

Constructional mortars, by contrast, are often referred to as ‘cements’ in medieval and later documentation (Bleazard 1998, 3) and ‘shell-lime cements’ had an excellent reputation when surveyed in later periods. Castle Rushen has ‘grey walls of hard limestone, cemented with shell mortar even harder than the stones it holds together’ (Rigby 1927), the shell-lime of St Michael’s Langness was ‘very enduring’ (Lamplugh 1903); *Teampall Chrìosd* (North Uist) was ‘bound together with the hardest lime’ (MacKinlay 1910, 53). In Ireland shell-lime was considered ‘superior’ to limestone-lime (Ó Danachair 1957, 70), and in Iona it was ‘so strong, that it was easier to break the stones than force them apart’ (Campbell 1843, 332; see chapter 3 for similar description of the mortar at Orphir in Orkney).

By way of postscript to this chapter, in 1513 masons constructing a bridge in Dunkeld specifically sought oyster shell-lime from a commercial kiln operating from Cramond (Edinburgh) (Myln 1893, 20), and this material was reportedly still being manufactured in the Firth of Forth region into the late 18<sup>th</sup>-century (Trotter 1791-99). I am only now beginning to record the Scottish shell-lime mortar evidence away from the north and west, but perhaps one of the most significant recent surveys was undertaken at St Andrews (Fife) where a massively ambitious 12<sup>th</sup>-13<sup>th</sup>-century cathedral (which was the centre of the medieval church in Scotland) was built of the finest dressed masonry bonded with a very shell-rich probable shell-lime mortar.

It is therefore possible that St Andrews Cathedral can now join a large group of fine high and late medieval North Atlantic and North Sea Cathedrals, including Fortrose, Dornoch, Iona, Skeabost, Ribe, Kirkjubour and Gardar, which were built with shell-lime mortars and I am sure that list will grow in future work. By the early 20<sup>th</sup>-century, North Atlantic shell-lime mortars may be most firmly associated with the domestic croft houses of the southern Outer Hebrides, but this material has a complex north-west European biography within a multitude of culturally-specific building contexts.

## CHAPTER 3 – MAERL-LIMES AND THE MORTAR ARCHAEOLOGY OF THE NORTH-EAST REGION

### 3.0 INTRODUCTION

This chapter will present an examination of the evidence for building lime mortars made from coralline algae (or *maerl*), within a wider investigation of the mortar and masonry archaeology of the North-East Region of this thesis (hereafter NER). The chapter will be framed around three broadly contemporary medieval and later case studies which present a range of masonry evidence:

- 1, The first NER case-study considers a number of curated mortar fragments from the excavation of a Late Norse/medieval secular site at Tuquoy, Westray (Orkney) (Owen 1993). This site doesn't conform to the chronologically-deep criteria on which most case studies in this thesis were selected, but its value was initially predicated on assessing the archaeological potential of post-excavation mortar analysis when a combined site survey and sampling strategy could not be implemented. Added significance was accorded to these materials, however, as some appeared to be maerl-limes similar to those recently identified on site in the castle and church on Wyre (Orkney), and so these important Late Norse and medieval buildings will now be discussed as a group. The comparative analysis of secular and ecclesiastical buildings at these sites will inform wider discussion in the thesis.
- 2, The second NER case study will present evidence from the very complex multi-phase church of St Peter's, Thurso (Caithness), and will resolve some of the issues of this sites contested phasing (RCAHMS 1911; Slade and Watson 1989; Fawcett 2002), as well as highlighting further problematic contexts. It is the extraordinary archaeology of this important 'Bishops church' which is of most significance to this chapter, however, as the materials and techniques displayed in the primary phase of this building are unusual for this region.
- 3, The third and final case study from the NER will consider a number of buildings located on island of Uyea (Shetland), as a more simply interpreted group which reflect the wider buildings archaeology of Shetland very well. This study will also, however, present convincing evidence for the development of the bicameral chapel on the island which further questions the relationship between secular and ecclesiastical buildings in the region.

### 3.1 CASE STUDY – TUQUOY & WYRE, ORKNEY

Although my previous work in the Outer Hebrides (see chapter 2) enabled most mortars of the NER to be interpreted on site with confidence, the medieval and later mortars of Orkney presented significant interpretational challenges. As in Caithness almost all the sedimentary lithologies outcropping in Orkney are calcareous to some extent (Sherriff 1814, 110; Mykura 1976, 9), and settlement here is inherently coastal, but many Orcadian lime mortars did not appear to display surviving evidence for heated shell or limestone kiln-relict inclusions. Finally, however, the first apparently clear relict evidence for the manufacture of building lime from a marine plant known as coralline algae (or ‘maerl’) was recognised in the medieval castle and church on Wyre (Orkney) (Thacker 2013b).

#### 3.1.1 CUBBIE ROO’S CASTLE AND CHAPEL, *IN-SITU*

The saga accounts dating Kolbein Hruga’s *steincastala* (‘Cubbie Roos Castle’) to before 1150 (Pálsson and Edwards 1978, 155) provide the earliest historically-documented reference to a masonry castle in Scotland, and it is now generally accepted that the primary phase of the monument surviving on Wyre is the building to which that account refers (Lamb 1982, 33). That this castle was built and coated with lime mortar of good quality has also been the subject of particular comment (e.g. Watson 1929-30; Clouston 1926, 295; 1931, 25; Lamb 1982, 33; RCAHMS 1946a, 237) although the extraordinary provenance of that material had not been previously recognised.

Also located on the island of Wyre, and only 110m east of Cubbie Roo’s Castle, is the bicameral (nave and chancel) chapel of St Mary’s. The discourse surrounding this building has also concentrated on foundation dates, in consideration of whether this structure was also built by Kolbein Hruga (Radford 1962, 186-7) or by his son who would be bishop of the Orkney diocese later in the 12<sup>th</sup>-century (RCAHMS 1946a, 235; Owen 2005, 201). Like many North Atlantic churches, the building fell into ruination sometime in the post-Reformation period, but a variously repaired masonry structure still stands to eaves level today (RCAHMS 1946a; Sharman *et al.* 2002, 87).

The church walls were built on a wide scarcement foundation and are almost completely composed of flat-laid and naturally-bedded well-bonded sandstone, with reasonable coursing but without strictly alternate quoining. Both the nave and chancel entrances are arch-headed

and of similarly narrow dimensions, although no east window is apparent and the nave doorway is in the centre of the west wall.

The wall faces of the ruin are complete and a secondary 19<sup>th</sup>-century coal-fired limestone-lime mortar is displayed in various shallow contexts (Thacker 2013b). A torch-light search indicated that the core rubble within the walls is very heavily voided, but the primary mortar of this building is still visible in some core (above the doorway arches), bedding and coating contexts up to 1m<sup>2</sup>. These large areas of surviving coating allowed mortar compositions to be examined in great detail, and this particular material was most remarkable in its display of branching, nodular fragments of coralline algae ranging up to 30mm long and displaying a wide spectrum of dark discolouration and textural alteration (*ibid*). Many of these characteristics are reminiscent of Type 2-4 shell-lime kiln-relicts described in chapter 2, and clearly contrasted with those unheated maerl clasts noted during various shore surveys and added-temperers in mortars elsewhere (see below). There was no limestone apparent in this maerl-rich primary mortar, and no maerl in the later limestone-lime mortar of the building. Moreover, subsequent preliminary survey of the adjacent Cubbie Roo's Castle revealed apparently similar coralline kiln-relicts in primary coat, bed and core materials here, which also contrasted with the *in-situ* mortars of later phases.

### 3.1.2 TUQUOY HALL

Although less well documented, the buildings of Tuquoy (Westray, Orkney) are often considered to have strong parallels with those on Wyre, and both are generally interpreted as broadly contemporary high-status 'Late Norse' sites (Owen 1993; Lamb 1993). The secular buildings at Tuquoy, however, are not upstanding. These were discovered when 'massive stone walls' began eroding out of a coastal cliff-section approximately 50m west of an upstanding bicameral parish church, and remarkably one of these walls was described as 'bearing the same shelly lime render as occurs on high status medieval buildings such as Cubbie Roo's Castle and The Wirk' (Lamb 1993, 82). Subsequent excavation revealed a series of masonry buildings including an externally lime-coated stone-built 'hall' from which a number of mortar samples were removed and curated (Owen 1993).

I made an initial non-intrusive examination of these curated mortar fragments (Thacker 2014) and suggested the assemblage was comprised of three different types of mortar, which were subsequently labelled A, B and C:

‘Mortar A’ dominated the assemblage, with single phase samples of distinct character and profile. These samples had large planar faces on one side and thin casts of narrow rubble joints on the other (see figures in appendix 12). This suggested Mortar A was a primary coating which had penetrated narrow masonry joints in the wall face to between 30 and 85mm. That these casts of the underlying wall joints were generally compact and rounded, however, also suggested that this coating had not been physically contiguous with the buildings ‘primary’ bedding or core mortar. In composition, Mortar A contained coralline algae inclusions which displayed a range of textures and colours; from coherent 1-3mm cross-sections to eroded nodular thalli-shaped longitudinal vesicles ranging up to 15mm. From memory, this appeared very similar to the maerl-lime evidence seen previously on Wyre, and so these mortars were also interpreted as possible maerl-limes in an interim report (Thacker 2014).

The curated Mortar B samples comprised a much smaller fraction of the assemblage. Although these fragments were also single phase mortar coatings with evidence for a planar face, they displayed particularly large coherent rubble casts which suggested the underlying wall had been much more irregular. Moreover, Mortar B clearly contrasted with Mortar A in colour, density and texture, and was interpreted as a very fine, white, soft, and particularly lime-rich shell-lime mortar, containing a fine lithic temper and a low to medium concentration of (Type 3-4) *C. edule* kiln-relicts.

The last mortar type (C) from the assemblage consisted of two small mortar fragments labelled as collected from the adjacent Crosskirk bicameral church. These were also coating samples, but with very thin (6-7mm) profiles, no protruding casts of the underlying wall, and without any clearly visible carbonate kiln-relicts. That these samples also contained a high possible fuel fraction further suggested that these were a different material to Mortars A and B.

### 3.1.3 TUQUOY IN THIN SECTION

Microscopic analysis of sections prepared from a selected range of these curated Tuquoy samples supported the previous interpretations, and confirmed that this assemblage was indeed comprised of three different mortar types:

The Mortar A sections (samples TWO.01, 02, 04, 06 and 07) display a carbonate matrix generally comprised of grain supporting, cryptocrystalline, brown fabric of variable

density which often resolves into biogenic clasts interpreted as maerl on the basis of their external shape and some surviving relict bio-structure. These maerl clasts also display a range of optical and physical evidence of alteration, including: complete discolouration (some were almost opaque in XPL and PPL); contrasting discoloured rims and lighter cores; surface fractures and/or internal crazing. A range of clast textures is also apparent from those with clear bio-structure and grain boundaries; to more micritic examples with no bio-structure, incoherent grain boundaries, and a general optical continuity with the surrounding carbonate matrix.

In thin section, the Mortar B sample (sample TWO.08) was clearly revealed to be a very different material from Mortar A. This sample contained a very large volume of highly-altered biogenic (mostly bivalve shell) kiln-relict clasts, almost all of which were in complete optical continuity with the general mortar matrix. There was only a very low concentration of added-temper apparent in this very lime-rich material.

In further contrast, the Mortar C coating sample from the Crosskirk was dominated by spinaflex calc-silica ‘gells’ and carbonate kiln-relicts which suggested it should be characterised as some form of geogenic (ie. ‘limestone’) lime mortar. It may be important for future research to note that although similar textures had also been noted in Mortar A, they had been interpreted as incidental lithic kiln-relicts as they were in much lower concentration.

In summary, therefore, thin-section analysis generally supported the hand sample characterisations, and significantly both suggested that three different mortar phases were in evidence. The loss of microstructure and increased micritisation of many of the Tuquoy maerl inclusions appeared to be convincing evidence for heat alteration, although other clasts within these sections appeared very coarsely textured, with equidimensional (even sparitic) textures which had not been evident in the shell-lime materials. Although the mortar matrices also often appeared more coarsely textured, as this particular characteristic had previously been suggested as one of our main criteria for distinguishing diagenetic processes within biogenic clasts (see chapter 2), this was a cause for concern. Moreover, and conversely, micritisation had been reported in some unheated maerl materials elsewhere (Wolf 1965; Milliman 1974, 61-62), and this clearly suggested further investigation was required.

### 3.2 EXAMINING MEARL-LIME MINERALOGY THROUGH EXPERIMENTATION

Mëarl is a Breton word now in common usage to describe various free-living non-jointed ‘corraline algae’, most of which are of the family *Corallinaceae* (Order: *Corralinales*) (Boscence 1991, 99). Although globally distributed quite widely (Adey and Adey 1973) in the context of this thesis it is relevant that maerl deposits are particularly extensive around the western coasts of Brittany, Britain, Ireland, western Sweden, Norway and Iceland, and evidence from the more sheltered Irish, North and Baltic Sea coasts is generally lacking (Birkett *et al.* 1998, 7). Many investigators of coralline algae have commented on the proliferation of descriptors used to describe organism morphology, and that massive interspecies variation makes taxonomic identification problematic (Woelkerling *et al.* 1993; Foster 2001, 660, Nash *et al.* 2011, 3337-3338). The white skeletal material with which this chapter is concerned is only revealed post-mortem, when the red-coloured living tissue coating dies, and as this research proceeds microscopic investigation of population-representative samples may be necessary to refine taxonomic identifications (Birkett *et al.* 1998, 33; Nash *et al.* 2011, 3337-3338). As the term ‘maerl’ refers more generally to a multispecies morphology of these skeletal sands and gravels, however, at this early stage in the research I found it a usefully accurate collective term (Hall-Spencer *et al.* 2010, 5.). ‘Maerl’ was therefore co-opted as an anglicised suffix to identify the gravels from which the lime for this putative mortar type had been manufactured – ie. ‘maerl-lime’.

In order to investigate the effects of heat on these skeletal materials, a similar series of furnace experiments as had previously been performed on various mollusc shells (see chapter 2) was undertaken on a sample of maerl gravel collected from the foreshore at *An Dorneil* (Skye). This material was rinsed in distilled water and left to air-dry for 24 hours before 30g fractions were weighed out into a ceramic crucible, with 2-3 of the largest fragments placed on top. The samples were then placed in a pre-heated muffle-furnace at given temperatures for 23 hours, removed and left to cool for 30 minutes before being re-weighed and photographed. The resultant clast morphologies were then examined with the unaided eye and x20 hand lens, both superficially and after fracturing to reveal a thalli cross-section.

### 3.2.1 HAND SAMPLE DESCRIPTIONS OF EXPERIMENTALLY-HEATED MAERL

**DVC.000.** Averaging 10-15 x 2-3.5mm, the maerl clasts all have a homogenous white colouration, both at the surface (which has a dull polished lustre) and internally (which is dull). Some are hollow and others exhibit bore holes which may be the result of biological attack, but in general the clasts are coherent and reasonably difficult to snap. In transverse section at x20 the material is fine-grained but a concentric layered structure is clearly visible, most particularly including a central ‘core’ and a distinct rim.

**DVC.350.** The maerl clasts have remained whole without fracture or spalling. There is a slight but distinct superficial grey discolouration. In cross-section a central core (of approximately a third of the diameter of the stem) is of lighter material than the rest of the specimen. At x20, a concentrically ringed bio-structure is plainly visible, with 4-5 fine layers surrounding a central core. No cracking or spalling is apparent.

**DVC.450.** The maerl clasts have remained whole, without fracture or spalling. In cross-section, the central core remains white although the outer layers display a much darker grey/blue discolouration. At x20, these clasts display a layered core/rim structure similar to DVC.350 (above).

**DVC.550.** The maerl clasts have remained whole without fracture or spalling. The colour is now very dark grey and this discolouration is uniform throughout the depth of the crucible. In cross-section, however, single specimens continue to display a lighter core. At x20 a much finer ring structure than previous examples is evident and this is evenly striated with alternate light and dark concentric layers.

**DVC.650.** The maerl clasts have remained whole without cracking or spalling. The discolouration noted at lower temperatures is much lighter (similar to DVC.350), and is uniform at all crucible depths and in fractured cross section. At x20, there is a localised faint (relict) layering, but elsewhere a localised sub-mm faceted crystalline texture is now also evident.

**DVC.750.** The maerl clasts have remained whole without fracture or spalling. The material is now yellow/white throughout the depth of the crucible, and in cross-section is composed entirely of sub-mm faceted crystals, with no evident bio-structure.

**DVC.850.** The maerl clasts have remained whole without fracture or spalling, and have a slight yellow/white discolouration. At x20, fractured cross sections display sub-mm faceted crystals, with no evident bio-structure.

### 3.2.2 WEIGHT CHANGES IN EXPERIMENTALLY-HEATED MAERL

SAMPLE CODE	TEMPERATURE/°C	WEIGHT/g	Weight Retention
DVC.000	000	30.00	100%
DVC.350	350	29.1	97%
DVC.450	450	28.7	96%
DVC.550	550	27.8	93%
DVC.650	650	26.5	88%
DVC.750	750	16.3	54%
DVC.850	850	17.1	57%

Table 3.3 (above) Mass changes in experimentally-heated maerl.

### 3.2.3 XRD ANALYSIS OF EXPERIMENTALLY-HEATED MAERL

A small quantity of heated maerl was selected from mid-depth in each experimental crucible, and prepared for XRD analysis as previously described (see chapter 2). A summary of the resultant mineral phases is presented below whilst a line graph of these results are presented in appendix 3 to enable interpolative comparison.

Sample	Temp /°C	Magnesian Calcite/%	Calcite /%	Periclase /%	Portlandite /%	Aragonite /%	Brucite /%	Trace /%
DVC.000*	000	78.2	18.8	-	-	-	-	3.0
DVC.350	350	80.5	15.9	-	-	-	-	3.6
DVC.450	450	83.3	13.8	0.4	-	-	-	2.5
DVC.550	550	60.1	34.7	2.7	-	-	-	2.5
DVC.650	650	23.9	68.2	4.1	-	-	-	2.3
DVC.750	750	-	-	8.0	90	-	-	2.0
DVC.850	850	-	-	8.0	90	-	-	2.0

Table 3.1 (above) Weight % mineral phases of experimentally heated Maerl.

#### 3.2.4 THIN SECTION ANALYSIS OF EXPERIMENTALLY HEATED MAERL

The porous radial structure of maerl skeletal material consists of a lattice of calcified algal cell walls structured such that ‘an inner layer of acicular calcite [oriented] parallel to the cell wall [is] succeeded by radial, inward-growing calcite crystals...’ (Blunden *et al.* 1997; Bosence 1991, 99; Wright 1985). At high magnification and in longitudinal section, this skeletal structure displays filaments of high optical birefringence (*contra* Milliman 1974) and these are surrounding darker lumen created by the loss of the enclosed vegetative cell (Baas-Becking and Galliher 1930). Elsewhere, the ratio of cell-wall to lumen volume (or density of cell wall calcification) has been shown to be inversely proportional to the seasonal temperature experienced by the living organism (Kamenos and Law 2010), and this gives rise to alternating annual growth bands wherein summer seasons are associated with wider bands, elongate lumen and finer cell walls, and winter growth by more heavily calcified narrower layers (McCoy and Kamenos 2015). The mechanics of biomineralisation have proven difficult to investigate experimentally (De Yoreo *et al.* 2013, 17), but microscopic observation in many organisms suggests taxa-specific organic matrices, situated within calcified cell walls, play a key role (Goffey *et al.* 1991, 1632, Nagasawa 2013).

Characteristic radial structure, annual growth banding and some sub-annual radial features are evident in the slightly oblique longitudinal section of rhodolith DVC.350, from the experimental programme, and this clast clearly displays a high birefringence. At higher magnification, the more heavily calcified growth of winter periods, radial orientation of wall filaments and clear elongate lumen are all apparent. Although not salient in the literature on algal structure, the central core of the maerl from sample DVC.350 also often appears to display a higher concentration of calcified material without cellular lumen or orientation.

Sample DVC.550, however, displays a much more pronounced discolouration and this is also more clearly associated with annual growth banding. The winter growth layers are dominated by a very fine dark material, and this appears to have diffused out across this part of the skeleton, obscuring examination of any possible underlying structural alterations. The summer growth is characterised by a combination of burst or carbonate-filled lumen such that the highly birefringent crystallinity appears more salient.

### 3.2.5 CHARACTERISING HEATED MAERL IN 4 TYPES

In comparing these various analytical results, the clast discolouration in samples heated between 350-650°C is once more interpreted as the partial oxidation and release of organic proteins from the biocarbonate structure (see chapter 2). In this case the source is very likely to be the aforementioned organic matrix. The contrast in birefringence between the growth bands noted in DVC.550 (in hand sample and thin-section), and the diffusion of a fine dark-coloured material about the winter growth, appears very similar to the contrast between the foliated and chalk layers reported in heated *O. edulis* in this same temperature range. This suggests that the organic matrix in these coralline algae is more concentrated in the heavily calcified winter growth layers of the skeleton. The bursting of interlumen filaments is a feature which has been reported in heated maerl elsewhere (Goffey *et al.* 1991), and in DVC.550 this appears to be associated more particularly with the thinner cell walls of the summer period.

The contrast between the darkly discoloured rim and lighter/white core noted in clasts heated to 350-550°C (again in hand sample and thin-section; see also Tuquoy sample TWO.01) suggests the heavily calcified core is more coarsely crystalline (again noted in hand sample at x20) and is not associated with an organic matrix. It is possible the coarse and sparitic textures of the relict bioclasts and binder, in the Tuquoy mortar thin-sections described above, may relate to this contrasting structure, or to the more generally distributed and increasingly coarse crystallinity noted from 650°C.

In comparison to the heated *C. edule* evidence (see chapter 2), the lack of any apparent crazing or fracturing in the experimental and *in-situ* Wyre maerl evidence is notable, but (more curiously) this is a characteristic which also contrasts with the Tuquoy thin section inclusions. The littoral zone surveys undertaken throughout Atlantic Scotland during this mortar research suggest that once maerl fragments reach gravel grades of 20-25mm and below, then they rarely display evidence of fracturing, perhaps suggesting that the concentrically layered maerl bio-structure is better able to dissipate both physical and heat-induced stresses and strains. This may be important in constraining fragmentation and transportation rates (see Bosence and Wilson (2003) for a preliminary review of maerl gravel accumulation rates).

Accepting the fracturing profiles in the archaeological material requires more work, the morphological similarities between experimental samples heated to very high temperatures

and the Tuquoy thin-sections are striking. That Portlandite, rather than lime, is evidenced in the experimental XRD results probably reflects the time it took to run the samples, and this evidence may have some interpretational value in offering another context for the more coarsely sparitic textures already noted – these may also have been poorly (or air) slaked.

In repeated XRD analyses, unheated maerl material from Orkney, Skye and Mull consistently displayed very high high-magnesium calcite (HMC) weight% levels, and these fractions were supported by XRF analysis and mass balance calculations. At increasing but still low temperatures (0-450°C), the decrease in mol% HMC-Mg associated with increasing HMC weight% suggests some Mg re-distribution, and this data corresponds almost exactly with the data from the shell-heating experiments reported in chapter 2. This suggests that weight% Mg may serve as a sensitive low-temperature geo-thermometer which can be applied to a variety of bio-carbonate materials. With increased temperature (450-650°C), however, a net replacement of this magnesium is apparent within the HMC structure, resulting in a continuing decrease in Mol% Mg. This is contingent with increased unit cell volumes and the formation of periclase in increasing fraction. By 650 - 850°C dissociation, the periclase fraction is at its highest level (8 wt%), and some dolomite is also present within the generally lime-dominated experimental product.

That there is no significant loss of weight up to 450°C suggests the low temperature changes in Mg/Ca ratios are solid-state alterations, and the more significant weight loss noted from 450°C is therefore probably associated with the formation of periclase rather than the early de-carbonation of the HMC. This may be important in terms of the low dissociation temperatures widely reported for dolomitic limes elsewhere, where early periclase formation has also been noted, particularly at higher carbon pressures (*Chever at al.* 2010; Poole and Sims 2016, 147-153; see Kudlacz 2013 for more discussion). More specifically here, however, the high magnesium levels within various mineral phases have enabled the demonstration of a direct relationship between temperature and maerl mineralogy. Once more, experimentally-heated clasts may now be characterised according to 4 'Types':

**Type 1 (0-250°C)** – small density loss; white-yellow colouration; white annually-layered concentric bio-structure; HMC and LMC present; high HMC wt%, increasing HMC/LMC wt% ratio, highest mol% HMC-Mg.

**Type 2 (250-450°C)** small density loss; increasing grey external discolouration; white annually-layered concentric bio-structure; HMC and LMC present; maximum HMC wt%, maximum HMC/LMC wt% ratio; decreasing mol% HMC-Mg; highly birefringent.

**Type 3 (450-650°C)** increased density loss; darkest grey/black surface discolouration but then decreasing; concentrically striated internal discoloration; HMC, LMC and periclase present; maximum LMC wt%; minimum HMC/LMC wt% ratio; lowest mol% HMC-Mg; relict internal bio-structure retained but decreasing; highly birefringent summer growth.

**Type 4 (650-850°C)** massive density loss; no surface or internal discolouration; no LMC or HMC; maximum periclase; lime and/or portlandite present; no internal bio-structure; high crystallinity.

### 3.3 DIAGENESIS 2 – HIGH MAGNESIUM CALCITE

Given the textural alterations reported elsewhere, however, further discussion of diagenesis at this point is of value in order to investigate wider environmental biocarbonate alterations with respect to High Magnesium Calcite (HMC) and to establish whether this might compromise archaeological and/or palaeoecological interpretations. As the research probes different levels of analysis, however, it is important to redefine the terms of reference.

Although ten different coralline species have been reported in North Atlantic Europe, four of these species are dominant, and each has sub-regionally specific distributions (Adey and Adey 1973; Hall-Spencer 2010). The form, size, colour and matt lustre of the experimental DVC samples suggest these are predominantly *Lithothamnion Glaciale* and that suggestion is consistent with their northern British and Scandinavian distribution (Adey and Adey 1973, 349; Irvine and Chamberlain 1994, 183-188; Birkett *et al.* 1998, 17). This more refined characterisation is now important because although maerl is often generally characterised as a ‘high-magnesium’ material (Blunden *et al.* 1997) compositions can vary quite widely. Moreover, the processes by which cation concentration is negotiated between different taxa and their environments has been the subject of much research.

In attempting to demonstrate a direct relationship with water temperature, Chave (1954) measured high-magnesium calcite levels by XRD in bulk samples of 193 living marine calcareous organisms worldwide. This study reported generally far higher Magnesium levels in the corallines than other, predominantly molluscan, taxonomies (for example, mol% levels in *Goniolithon sp.* (Florida) were at 28.75% and *Lithothamnion sp.* (Bermuda) were at

14.85%, reducing to 7.7% in Alaska). In designing lab-based experiments on *Amphiroa*, Stanley *et al.* accepted the broad thrust of Chave's work on temperature but demonstrated that corallines also built carbonate skeletons according to the changing Mg/Ca ratio of their marine environment (2002). In the context of more recent concerns around biotope conservation in the face of climate change, water temperature fluctuations and ocean acidification, the relevance of this research has recently re-emerged (Nash *et al.* 2011; 2013a) and more refined analysis methodologies and techniques have now convincingly demonstrated that each alternating summer/winter growth layer in Scottish *L. Glaciale* contains contrasting temperature (or perhaps growth-rate) dependant Mg/Ca ratios which can serve as an excellent proxy for palaeoenvironmental reconstruction (Kamenos 2010; Kamenos and Law 2010; McCoy and Kamenos 2015). Remarkably these have a fortnightly (tidal) resolution.

Of course, environmental factors are not only a significant factor in biomineralisation but they are the driving force of post-mortem taphonomy and/or diagenesis. Of most concern here are reports that post-mortem maerl thalli in the Sound of Iona ranged up to 4,000BP and recent estimates indicate some UK maerl beds may be up to 8,000 years old and 'might effectively consist of a living skin over a semi-fossil base...' (Birkett *et al.* 1998, 38, 78). Any secondary deposition of such 'semi-fossilised' material onto the beaches of the wider North Atlantic would be of great interest to this thesis for a variety of reasons, but again evidence of aging would probably not be evident in gross mineralogy (see chapter 2). Evidence from sublittoral-littoral sediments dominated by *L. Glaciale* in the *Skagerrak* (off west Sweden) suggests that whilst biogenic carbonate polymorphs undergo general postmortem dissolution at slightly different rates, this is not accompanied by carbonate precipitation of any kind even where biocarbonate structures have been subject to intense postmortem micro-boring (Alexandersson 1974). This Swedish evidence suggests that this North Atlantic marine environment must be undersaturated with respect to carbonate, and that the great variety of polymorphic carbonate structures and cements in *L. Glaciale* all originate within the biologically maintained micro-environment of that living, red, superficial tissue:

“...all observations indicate that when the life processes of the red algae cease, the processes of cementation also come to an end.” (Alexandersson 1974, 23).

XRD analysis of skeletal material from both living and non-living samples of *L. Coralloides* from Galway (Ireland) also suggested that no appreciable change in mineralogy or levels of organic material were associated with death and early deposition (O'Reilly *et al.* 2012, 22).

Moreover, recent research on *L. Glaciale* samples from Loch Sween, Argyll, describes how the Ca/Mg ratios in these corallines, from sedimentary levels dated to between AD1353 and 2006, fluctuate according to water temperature at the date of bio-manufacture without any appreciable post mortem/sedimentary mineralogical alteration (Kamenos 2010). This non-precipitative (and so non-recrystallising) sedimentary environment suggests that any maerl materials gathered for burning in the medieval and later periods are unlikely to have undergone any significant mineralogical changes. This interpretation is supported by the consistently high Mg levels from Orkney and Skye in the repeated XRD and XRF analyses reported in this thesis chapter, although admittedly these were not radiocarbon dated.

Like the bio-aragonite of *C. edule* discussed in chapter 2, the bio-HMC of *L. Glaciale* is a metastable carbonate polymorph, and the survival of relict bio-structure in Type 1-3 kiln-relicts of both organisms indicates that the heat-induced alterations of mineralogy took place within substantially localised closed systems. In both cases this combination of irreversible mineralogical change and structural survival offers excellent potential for the identification of heated kiln-relicts. Unlike *C.edule*, however, the potential of maerl to signpost kiln conditions is not predicated on the reconstructive inversion of an orthorhombic crystal structure (to a trigonal calcite one), because unlike aragonite HMC is already trigonal. The alteration trajectory of heated maerl appears to be initially predicated on the reorganisation of Mg and Ca cations only (in Type 1-2 relict-clasts), before the evident loss of mass and formation of periclase in Type 3 suggests the system is at least beginning to open up.

In summary, this largely theoretical section of the chapter allows us to continue our investigation relatively untroubled by pre-kiln diagenetic alterations. The experimental programme has demonstrated that coarsely crystalline carbonate textures do form in heated post-mortem maerl clasts, and that may offer useful interpretive comparanda in future work. We should remain aware of reports that some corallines deposit micritic cements within their carbonate skeletons, but these textures are unlikely to compromise the clearer evidence for the intimate relationship between highly altered clasts and the mortar matrix in thin section. Clast discolouration in hand sample and thin section also appears to offer clear comparative potential.

In the context of the above discussion on the refined paleoenvironmental research potential of coralline materials, the XRD analyses of bulk maerl compositions from mortar inclusions reported above are relatively crude, but this level of analysis is commensurate with the current research objectives. The variable mineralogical compositions discussed in this

section caution that particular care to identify local unaltered maerl-source material of similar taxa for comparative analysis may be necessary, and this issue will become more pertinent later in this chapter. Although requiring much more work, in the wider context of this thesis the above discussion suggests that where maerl has been heated to provide a lime-source, then concomitant changes in Mg/Ca levels may have compromised much of its palaeoenvironmental research potential. Moreover, at this stage in the research, the long life and post-mortem biographies of these materials would also appear to preclude any simple relationship with the construction date of the building.

### 3.4 INTERPRETING HEATED MAERL IN NORTH ATLANTIC MEDIEVAL MORTARS

Having removed many of the geogenic factors from the pre-kiln maerl biography, and characterised a number of kiln phases experimentally, this chapter will now return to the historic fabric to re-examine a number of archaeological mortar samples.

#### 3.4.1 XRD ANALYSIS OF HISTORIC MAERL-LIME MORTARS

In 2015 four maerl (bulk sample) mortar inclusions from various archaeological contexts were prepared for XRD analysis. These are described below, together with a pre-analysis characterisation predicated on hand sample examination:

1. DWH.002 - Camas Bàn House, Skye – a sample of loose maerl from a dissolute core mortar of the primary north wall which had been interpreted as a limestone-lime; multiple fragments to 6 x 4 x 2.5mm; all fragments display a white surface and x-section when fractured; very hard and difficult to crush.  
Pre-XRD interpretation: Type 0 unheated maerl added-temper.
2. SMW.004 - St Mary's chapel, Wyre, Orkney – a sample of loose dissolute maerl collected from the chapel floor at north-east of nave; the parent mortar was interpreted as maerl-lime; two fragments to 10 x 10 x 5mm diameter; one very dark grey/black, the other lighter grey on surface, but both very black when fractured; very hard and brittle, but these thalli readily collapsed to powder when ground.  
Pre XRD interpretation: Type 2 maerl-lime kiln relics heated to approx. 400°C.
3. IPA.012 – Priory Refectory, Iona – a sample of loose dissolute maerl from bed joint of refectory south wall; parent mortar tentatively interpreted as maerl-lime in thin section; multiple fragments to 7 x 4 x 3mm; all fragments white coloured on surface and in x-section when fractured; very hard and difficult to crush (*contra*. SMW).

Pre-XRD interpretation: Inconclusive.

4. TQ.2 – Tuquoy Hall, Westray – a sample composed of three maerl fragments dug out from the sawn face of mortar sample TWO.02. These inclusions were all very white and crushed very easily.

Pre-XRD interpretation: Type 2 maerl-lime kiln relicts heated to approximately 600°C.

In addition to these historic mortar inclusions, a sample of maerl of similar morphology was collected from littoral contexts close to each surveyed site. Although as Westray had not yet been visited no environmental sample for Tuquoy was available, multiple samples from nearby Wyre were included. All samples were then analysed with XRD, and the results are tabulated below:

Sample	Temp	Magnesia n Calcite/%	Calcit e /%	Periclas e /%	Portlandit e /%	Aragonit e /%	Brucit e /%	Trac e /%
DWH.002	unknow n	78.7	18.6	-	-	-	-	2.7
(DVC.000 3)	(ambien t)	(78.2)	(18.8)	-	-	-	-	(3.0)
SMW.004	unknow n	46.0	49.9	1.7 <sup>1</sup>	-	-	-	2.4
(WBO.00 0)	(ambien t)	(81.8)	(15.9)	-	-	-	-	(2.3)
IPA.012	unknow n	71.8	21.3	1.3 <sup>1</sup>	-	-	-	5.6
(IPA.000)	(ambien t)	(70)	(25)	-	-	-	-	(5.0)
TQ.2	unknow n	24.0	71.0	1.3 <sup>1</sup>	-	1.3	-	2.4

Table 3 (above) – Mineral phases in various maerl mortar inclusions and nearby beaches.

<sup>1</sup>Although less than 2% this periclase result is considered significant and much greater than 0.4 of DVC.450. The slightly different ratios here around 500°C may reflect different magnesium levels.

<sup>2</sup>Similar to note 1, although less than 2% and considered to probably represent contamination caused by the saw this figure is included here for transparency.

<sup>3</sup>The figures for DVC.000 are the average of results from two different samples which were in any case very close.

These results appear to represent a wide range of maerl types previously characterised by experimentation. The mineralogy of the sample DWH.002 matches the sample recently collected from the shore almost exactly, and this supports the *in situ* and hand sample interpretations which had suggested this maerl was an unheated added-temper. Moreover, this result also now serves as a very useful control as it suggests that this material had not undergone any alteration in the 200-300 years since the construction of this building. This is valuable (if still post-medieval) post-kiln taphonomical data which suggests that in this instance the mortar context was diagenetically benign.

The mineralogy of the maerl sample from St Mary's Wyre (SMW.004) also supports the previous on-site and hand sample interpretations which had suggested that this is a heated kiln-relict. That this XRD result includes decreased Mg/Ca ratios and a periclase fraction is convincing. These XRD results suggest that this was a higher temperature kiln-relict than its morphology had suggested in hand sample (Type 3 rather than Type 2), and this variation may reflect contrasting historical-experimental redox kiln environments (cf. Newell 1999; Toft 1998; see chapter 4).

The two samples discussed so far (DWH and SMW) represent the clearest evidence for either end of the alteration spectrum, and in both samples the in-situ, hand sample, XRD and thin section evidence is consistent.

The mineralogy of the sample from Iona nunnery (IPA.012), however, requires more explanation. That these clasts exhibit slight differences in Mg levels and morphology from the experimental Skye samples suggests this may represent a different coralline taxa mix and so we should be cautious in comparative interpretation. Moreover, this result highlights that the unheated Mg/Ca ratios appear again in the experimental data at Type 3, and so other corroborating evidence is required to distinguish between clast Types. As with WBO, however, the presence of periclase appears to provide clearer evidence for alteration, and suggests that this is a Type 3 kiln-relict heated to around 500°C. No typological

interpretation of this sample was made in hand sample, but this evidence for a relatively low temperature alteration is consistent with the textures exhibited by this mortar in thin section, which had suggested the kiln charge was only very lightly heated/calcined. This is extraordinary evidence also supports the *in-situ* interpretation of the mason responsible for maintenance at the site (Gordon Rutherford pers. com. HES; see appendix 15).

The mineralogy of the maerl sample from the Tuquoy excavation (TQ.2) appears to support the hand sample and thin-section interpretations which had suggested this was a highly altered Type 3 kiln-relict heated to around 600°C. The small aragonite peak, however, is anomalous, as this is a low temperature polymorph more generally associated with mollusc shell (see chapter 2). It is possible this represents contamination caused by sawing the samples from which this clast was removed, but this is speculation at present and the issue clearly requires further investigation and repeat analyses. The very high LMC calcite and periclase fractions, however, appear convincing and present a striking contrast with results from heated *C. edule* clasts from a different mortar (Mortar B) from this same site (see chapter 2 and appendix 10).

The mineralogy of the maerl samples from Iona/Mull, highlight the importance of comparative environmental sampling. These XRD results are more convincing, however, when it is considered that the sample data is taphonomically biased. The two (Iona and Wyre) maerl samples collected from loose contexts appear to have been released from a mortar matrix which had otherwise dissolved away, and any very highly-altered carbonate relicts are likely to have dissolved away also. These samples are therefore fractional products of dissolution, and both IPA.012 and SMW.004 probably represent evidence for some of the lowest kiln temperatures at their respective sites. By contrast, the sample from Tuquoy (TQ.2) was physically dug out of an already sawn mortar sample and so has not been taphonomically sorted in the same way and it is possible these particular Tuquoy clasts would not have survived on a weathered mortar surface.

This chapter section has reported very preliminary results from a very small sample assemblage and much more work is required to collect further environmental, experimental and archaeological data in future. These results are, however, consistent and enable maerl-lime mortars to be interpreted with increasing confidence.

### 3.4.2 THIN SECTION ANALYSIS OF HISTORIC MAERL-LIME MORTARS

Following on from the above results, this next section of the chapter will refine characterisations of maerl clasts previously examined in thin section, according to the 4-stage criteria suggested above, by presenting a series of very short studies.

#### 3.4.2.1 Cubbie Roo's Castle, Wyre

This multiphase medieval building displays classic Type 3-4 maerl-lime evidence in the primary 12<sup>th</sup> century phase and maerl/shell-lime mortar (also associated with clay mortar) in one secondary medieval phase. Loose samples of mortars of the both phases of this site were analysed in thick and thin-section where Type 2-4 heated maerl kiln-relicts were noted.

#### 3.4.2.2 St Mary's Chapel, Wyre

This building was subject to rapid survey and displays the clearest evidence for maerl-limes noted to date in extensive internal mortar coatings (Thacker 2013b). The primary mortar is a peat-fired maerl-lime with Type 3-4 heated maerl kiln-relicts noted in bed and coating mortars, and these interpretations are supported by analysis in thick and thin-section, XRD and SEM.

#### 3.4.2.3 Eynhallow Church.

This building was re-analysed during a four day on-site survey (Thacker 2015d; see chapter 5). Mortar survey allowed the primary and secondary medieval phases to be distinguished and a previously unrecognized primary chancel wall to be identified. On site, both medieval phases of this building were interpreted as maerl-limes on the basis of apparent in-situ Type 3-4 kiln-relicts and these characterisations were subsequently supported by thin-section analysis. During these analyses the first evidence for a maerl-lime lime-wash was also noted. The second medieval phase was fully lime-bonded and the maerl-lime contained a higher heated mollusc shell fraction.

#### 3.4.2.4 Orphir Church, Orkney.

Although heavily consolidated, significant mortar evidence survives at Orphir, in exposed core, bed and internal coating contexts of this iconic 12<sup>th</sup>-century building. Possible Type 3-4 maerl kiln-relicts were noted on site and this maerl-lime mortar interpretation was later supported by thin-section analysis of a number of loose coating samples. Some low

concentrations of heated shell were also noted. This monument now requires further survey work to establish the provenance of fragmentary primary core materials.

#### 3.4.2.5 Newark Chapel, Orkney.

The site was investigated on the basis of the characterisation of mortars between two contrasting phases of the site (Lowe 2000; Raey 2014). Whilst the later context displayed a probable limestone-lime, the earlier phase displayed a range of altered biogenic clasts including *C. edule* shell and maerl. Although these contrasts are convincing, there is clearly greater complexity here, and further examination with in-situ samples are required to fully understand the sites mortar stratigraphy (for more detail see chapter 5).

#### 3.4.2.6 St Catherine's, Linton

This single phase bicameral chapel retains only very fragmentary evidence of mortar within internal beds of the north nave and external chancel walls. Tentatively identified as a maerl/shell-lime on site on the basis of discoloured maerl and *C. edule* fragments, this was supported by thin section analysis where heated maerl-lime relicts were the dominant type.

#### 3.4.2.7 Tuquoy Hall, Westray.

Two of the buildings of this excavated multiphase site were initially described on the basis of hand-sample analysis of curated mortar samples (Thacker 2014). The primary mortar was interpreted as a maerl-lime and the secondary mortar as a shell-lime on the basis of their respective Type 3-4 maerl and shell inclusions. These interpretations were subsequently supported by thin-section analysis.

#### 3.4.2.8 St Magnus Cathedral, Kirkwall, Orkney.

This building was subject to a number of very brief on-site surveys and subsequent thin-section analysis of two loose mortar samples. The visible 12<sup>th</sup>-century work of the triforia and transepts (Cruden 1998; Fawcett 1998) were interpreted as biogenic possible maerl-limes on-site and this may be supported by thin-section analysis of a loose vaulting sample from the north transept which also included heated maerl and a low concentration of heated *bivalvia* shell including *O. edulis*. This contrasts markedly with the limestone-lime mortar noted in the late 15<sup>th</sup> or 16<sup>th</sup>-century west end (Fawcett 1998, 109). More significantly, however, thin-section analysis indicated that a sample of mortar associated with the remains

of a cross-wall beneath the nave floor, and which in hand sample appears to match visible mortars in various 13<sup>th</sup>-century contexts, was a limestone–lime with a probably local mudstone provenance. These earlier 12<sup>th</sup> and 13<sup>th</sup>-century interpretations are at very preliminary stage, but suggest further mortar archaeology has great potential at the site.

#### 3.4.2.9 Iona Priory Refectory and Bishop's House, Iona, Argyll.

These two broadly 15<sup>th</sup>-century buildings and other contemporary phases elsewhere on the site form part of a South-West Region case study and have been constructed with similar maerl-rich mortars (see chapter 4). These mortars are of very different character to the maerl-limes of the North-East Region, however, and their interpretation as maerl-limes was not initially made on the basis of on-site survey. This provenance was suggested by the site mason, however, and appears to be confirmed by petrographic and XRD evidence (see chapter 4 and appendix 15).

### 3.5 MAERL-LIME MORTAR ARCHAEOLOGY IN CONTEXT

Although much more work is required to refine our understanding of maerl and maerl-lime mortars, the various experiments and analyses presented in this chapter suggest that the characterisations made during site survey are generally sound. Therefore, we shall now return to those surveys in order to place our case studies within the wider context of the NER region and establish the geographical and chronological distribution of each technique.

#### 3.5.1 MAERL-LIME MORTARS OF THE NER

It appears clear from these summaries that maerl-limes have a distinct geographical and chronological range within the North-East Region, as none were recorded outside of Orkney and these mortars were only noted in medieval and most particularly 12<sup>th</sup>-13<sup>th</sup>-century contexts (see tables 1.2.1-1.2.3 in appendix 1). No very late medieval or post-medieval maerl-lime mortars were noted in the NER in any social context, and no evidence has yet been noted found for a maerl-lime equivalent of the high-status shell-lime plasters of the early modern period noted in chapter 2 or its later use in more vernacular contexts.

#### 3.5.2 MAERL-LIME MORTARS OF THE SWR

The only use of a possible building maerl-lime noted within the South-West Region during this research is in the late medieval buildings of Iona. This very maerl-rich material was

noted in a number of primary and secondary constructional contexts on the island and appears very similar to a number of other broadly contemporary mortars in the North-West Region. These Iona mortars, however, are very different to the maerl-lime mortars of the NER and the suggestion that they represent contrasting technical traditions is supported by their different chronological as well as spatial distributions.

The lack of discoloured Type 2-3 heated maerl relicts within the Ionan material is curious. This draws attention to the technique required to effectively roast maerl gravels, how that technique might have developed in the medieval period, and how that might inform our wider research concerns. Elsewhere in the South-West Region, maerl-lime burning had reportedly taken place in Bute at a site where a series of upstanding kilns survives to this day (Marshall 1935) and although some maerl was noted within the local environment, no clear evidence for maerl heating was noted.

### 3.5.3 MAERL-LIME MORTARS OF THE NWR

The Clan Ranald burial aisle at St Mary's Arisaig, and a secondary phase at Dun Scaith (Skye), were surveyed very early in this thesis research and also appeared to display mortars with no very clear evidence for heated shell or limestone. Moreover, like the mortars of 15<sup>th</sup>-century Iona these are extremely maerl-rich materials of probable very late medieval to early modern date, and these now require further work. A secondary phase at Strome Castle is somewhat similar.

High maerl concentrations have recently been reported in the sound of Arisaig (Hall-Spencer 2010, 9), and in the 19<sup>th</sup>-century there were banks ...'formed of small coral like pieces, having often several branches...[which] has been found to answer on being well-worked with a trowel, without any admixture, as a tolerable plaster for the dry stone cottages of the inhabitants. The chief deposit of this sand is an inexhaustible bank...in Arisaig, whence it is conveyed to the distance of fifty and sixty miles' (Clerk 1838, 131). The suggestion that even unheated maerl can form a material sufficiently plastic and adhesive to serve as a plaster is remarkable, and underscores the necessity of much more research into the physical properties of the material.

### 3.5.4 MAERL-LIME MORTARS OF THE NORTH ATLANTIC

As noted above, maerl has a wide geographic distribution through the North Atlantic, and particular concentrations have been reported in Western Ireland, Cornwall and Brittany (De

Grave and Whitaker 1999). Use of unheated maerl to provide agricultural lime is reported from late 17<sup>th</sup>-century Cornwall (Birkett *et al.* 1998, 57) but might not have been used in France in this way until the 19<sup>th</sup>-century (Blunden *et al.* 1997, 11). These reports may be associated with enclosure and Improvement, but I don't know of any reports of its use as a building lime source outside of the Scottish North Atlantic buildings described above.

### 3.5.5 INTERPRETING THE MORTAR ARCHAEOLOGY OF TUQUOY AND CUBBIE ROO'S

Given that the lab-based analyses generally supported the previous interpretations of the mortars from Tuquoy and Wyre the contrast between the evidence from these two sites requires discussion.

After these analyses had been completed, the island of Westray was visited as part of the continuing programme of rapid surveys in the region, and this included the church (see appendix 10). Like the Wyre chapel, the primary phase of Crosskirk Tuquoy is a bicameral church with a rectangular nave and smaller narrower chancel, and both are generally interpreted as 12<sup>th</sup>-century on that basis (RCAHMS 1946a 344-345; Lowe 1993). Significantly for this thesis, however, survey identified a limestone-lime core mortar within the building and this material interpretation is now supported by thin-section analysis. Although contrasting in some respects with the coating sample already analysed above, overall the evidence suggests the primary phase of this church was bonded and coated with a limestone-lime mortar.

This evidence from the church at Tuquoy is in clear contrast with the adjacent clay-bonded lime-coated secular hall. Although unknown at the time of analysis, very recent collaborative work on the excavation archive has now established the contexts from which the curated mortar samples were removed, and these match the interpretations made of the curated samples very well. It is now apparent that the samples interpreted as Mortar A were removed from both in-situ and ex-situ demolition contexts associated with the primary 'Late Norse hall', whilst the more lime-rich Mortar B samples were from ex-situ contexts associated with the secondary 'medieval' building. Moreover (as examination of the cast mortar profiles had suggested) the structure of the primary hall building was described as clay-bonded, whilst its mortar coating clearly underlay the secondary medieval building (Thacker 2014).

Although the broad width of the hall walls (at 1.0 - 1.4m thick) have previously been emphasised and interpreted as a symbol of high status (Lamb 1993; Owen 1993, 328),

evidence from previous survey elsewhere in the region would suggest these large dimensions can probably be associated with the use of clay as a bonding material (Thacker 2011). The importance of clay bonding in early masonry buildings in the region is discussed more specifically in chapter 5, but it is worth emphasising here also that there is no evidence that the lime mortar coating the external face of the primary hall at Tuquoy is from a substantially later period.

Importantly, later thin-section analysis of loose mortar samples from Cubbie Roo's Castle and the neighbouring St Mary's chapel (Wyre) demonstrates that the primary mortars associated with both buildings are remarkably similar – to the extent that it is difficult to tell them apart. That this mortar evidence is chronologically specific is supported by contrasts with biogenic-lime mortars associated with later (possible 13<sup>th</sup> and 14<sup>th</sup>-century) phases of the castle complex, and by the similarity in masonry styles between primary church and castle buildings. The primary phases of both the castle and church in Wyre are therefore fully lime-bonded with very similar mortars and this strongly suggests they are broadly coeval (*contra*. RCAHMS 1946a).

The consistency of the primary Wyre evidence, however, also highlights contrasts between the masonry of the church and hall at Tuquoy, and might suggest that these buildings were built in different periods, and perhaps by craftsmen from different masonry cultures. These Tuquoy mortars will be comprehensively re-evaluated for a forthcoming publication (Owen in prep.), but it is useful that recent excavation elsewhere on Westray (on the opposite side of the island from Tuquoy) has revealed another building from this broad high medieval period and House 1 at Quoygrew was described as of 'free-standing dry-stone construction, with some use of clay bonding and an internal skin of lime mortar made from burned shells' (Barrett and Gerrard 2012, 64-65). Shell assemblages from excavated middens at the site were dominated by *P. vulgata* (Surge and Barrett 2012, 237), and this would be an unusual shell-lime provenance, but given that: maerl-limes have also often previously been described as shelly (see below); later biogenic-limes also often have a higher shell fraction (as indeed at Tuquoy Hall); and environment is also important; this description of the lime provenance from Quoygrew requires further investigation. That this is a clay-bonded, biogenic-lime coated building dating to the decades around 1200 (Barrett and Gerrard 2012, 64-65), however, is clearly significant and provides more valuable comparanda from a context within the same masonry culture.

The evidence discussed so far might suggest the limestone-lime mortar materials and techniques displayed at Crosskirk Tuquoy are unusual within the masonry cultures of 12<sup>th</sup>-century Orkney, whilst the materials and techniques displayed at Tuquoy Hall, St Mary's Wyre and Cubbie Roo's Castle are much more typical. It may be significant, however, that the architecture of Crosskirk Tuquoy also contrasts with St Mary's Wyre, whilst, as we have seen, there is some similar mortar evidence at the Kirkwall Cathedral. The significant implications of these contrasts for our understanding of the region will be discussed in more detail below.

### 3.6 CASE STUDY – ST PETER'S CHURCH, THURSO, CAITHNESS.

The 'Old Kirk' of St Peter's is a large former parish church located close to the mouth of the Thurso River in a town of the same name on Scotland's north coast (see figures in appendix 11). The plan-form of the building is broadly cruciform, with a large rectangular nave from which north and south aisles, a small vaulted lower chancel and an adjacent tower can be accessed. The internally apsidal and vaulted 'enclosed' chancel has long been recognised as representing the older core of a more generally post-Reformation building, and was considered by the RCAHMS to have 'more affinity to a structure of the 12<sup>th</sup>-century, such as St. Margaret's chapel in Edinburgh Castle, than to a building of the 16<sup>th</sup> or 17<sup>th</sup> century to which period the nave and transepts belong' (1911, XXIX, 113; see also Dunbar 81, 39). A subsequent and much more thorough architectural study of the building, however, suggested the lower parts of the tower and at least the form of the nave were probably primary also and compared the building to other vaulted bicameral chapels in the Northern Isles to suggest St Peter's was founded as a 12<sup>th</sup> century proto-cathedral or 'bishop's church' (Slade and Watson 1989).

This historically-informed analysis, however, has probably not received as much attention as it should. The study was: ignored by Gifford (1992, 130) who seems to have largely repeated RCAHMS (1911) observations; briefly cited but tacitly ignored by Crawford in order to re-argue for the traditional prominence of Halkirk within the earldom (1993); and doubted by Fawcett, who questioned whether the tower at St Peter's should be interpreted as medieval at all (let alone 12<sup>th</sup> century) but without further discussion of the fabric (2002, 71).

### 3.6.1 ST PETERS THURSO – BUILDINGS ANALYSIS

I first visited St Peter's church during the rapid survey programme of the North-East Region, and the site was subsequently selected as a case study on the basis of a long multiphase chronology and clearly evident large assemblage of contrasting masonry mortars. Seven days were subsequently spent on site re-analysing the fabric of this complex building and investigating a number of material sources available in the immediate locality. The main focus of the survey was to characterise the primary masonry and establish the form of the early church, but subsequent alterations to the structure were also eventually investigated in order to compare and contrast materials throughout the building. Over the course of this survey 17 loose mortar samples, 3 sand and gravel samples from the nearby river and shore, and a single sample of stone from a nearby outcrop were collected and subject to microscopic analysis in reflected and polarised light.

A more detailed discussion of that evidence is presented in appendix 11 (see volume III), and only the main interpretive thrust of that study is presented here.

### 3.6.2. PRIMARY PHASE MASONRY AT ST PETERS

A distinctive suite of masonry techniques and materials is displayed in the lowest masonry courses of much of the building, and was first characterised in the apsidal chancel. This primary phase fabric has been constructed of regular square blocks and rectangular slabs of a hard crystalline blue-coloured sandstone, with sharp arrises, quartz-rich veins and parallel beds. This sandstone lithogy only appears to be found in the earliest masonry on the site and wider survey suggests the stone has probably been quarried from the cliffs around Thurso Bay. This sandstone is so regularly bedded that blocks could often probably have been used straight from the quarry, but concoidal tool-marks on some stones suggest that it was otherwise hammer-dressed to form quoins and other architectural features (see figures in appendix 11). The primary masonry was bonded and coated with two very consistent and equally distinctive lime mortars of different specification, both of which appeared to be limestone-limes tempered with fine lithic sands (labelled Mortar and Coating 1). Unusually for a Scottish North Atlantic medieval building, the internal and external rendered coatings of this phase had been brought to a very smooth highly-polished surface finish, fragments of which survive to this day.

Having characterised this very distinctive suite of masonry materials and techniques in the enclosed chancel, this masonry could be clearly recognised in the lower courses of all four walls of the large rectangular nave internally, and in all four walls and vaulting of the lower stages of the tower. Mortar 1 bound, well-bonded, hammer dressed and tightly-jointed blue sandstone masonry, coated with Coating 1, is the earliest fabric in each of these parts of the church.

Recognising the character of this work also allowed the identification of a number of surviving primary architectural features, including:

- fragments of north-east, south-west and west nave windows, two deep putlog in the south nave wall, and the lower section of a doorway between nave and upper chancel;
- a complete chancel arch, apsidal vault, most of the north window and a fragment of the east window in the lower chancel;
- and a complete nave doorway, substantially complete vaulted spiral stair, mid-chancel doorway, series of buttresses, and a series of slit windows in the lower and mid tower.

In order to examine the relationship between these structures more closely, seven loose mortar samples were collected from apparently primary lower chancel and tower contexts, and in thin section these materials proved to be equally consistent and distinctive – they are clearly the same material. This mortar had been manufactured from peat-fired, quartz-included calcareous mudstone and tempered with a well-sorted mixed lithic and shell sand, probably from Thurso Bay. Moreover, dissociation and recrystallisation of this mudstone lime-source has often produced a green-brown coloured matrix infused with complex hydraulic textures and crystallinities which have probably imparted a chemical set to the mortar. Certainly this would account for the material's hard and durable consistency and, with regard to the polished render coatings associated with this primary phase, material sources and masonry techniques appear to be complimentary.

The surviving masonry of this primary phase also hints at the former existence of a number of other primary features in contexts where the physical fabric has now been lost. It is, for instance, likely that: the high altar was located at the chord of the chancel apse (cf. Crook 2000, 232); that a side altar was located below the north-east nave window where the masonry has clearly been patched-up in a subsequent phase (cf. Bond 1916, 9-13; cf. Bacci 2009); that nave doorways were located in the south and north walls (Slade and Watson 1989); and that the font was located between these two (e.g. Bolvig 2004). The evidence is

more fragmentary in the mid- and upper-levels of the building, but the approximate 2.3m height difference between the two (now clearly primary) doorways into the higher chancel levels suggests that the chancel may have been a three storey structure (or a double height room from which a ladder gave access to the nave doorway and roof-space) opening up the possibility that the tower also included another north doorway at the higher upper chancel level. The doorway from the upper chancel to the nave must have opened onto a timber platform, perhaps for the display of relics to the congregation (cf. Hare 2009), and the well-worn sill of the doorway from the tower to the chancel certainly betrays high volumes of footfall.

The form of the primary windows in the lower chancel has been reconstructed from a number of surviving blocked fragments (see figures appendix 11), and although previously described as ‘small slits...without any check for glass’ (RCAHMS 1911, 110; Gifford 1992, 130) these are much wider than most medieval windows encountered in the region and were surely glazed. Assuming the west nave window was centrally placed, the surviving south jamb suggests this would have had a large internal width of approximately 1.7m.

No evidence for primary wall-paintings survive, but it is certain that externally the whole building was finished in a sharp, highly-polished and lime-washed render, and was a much more visibly striking building than the ruin we see before us today.

### 3.6.3 SECONDARY PHASES AT ST PETERS

The three main secondary structural phases surviving within the fabric of St Peter’s include the upper storey of the tower and the north and south aisles, and these were all previously recognised as secondary by Slade and Watson and ascribed to the 17<sup>th</sup> and 18<sup>th</sup>-centuries (1989). Examination of these structures for this thesis has demonstrated that each was also constructed using a distinct suite of masonry techniques and bound with a different mortar. Stratigraphically, however, the archaeology is more problematic as these structures are located in different parts of the church, and although each is clearly overlaying or abutting the primary masonry of the building there are no direct physical relationships between them. Slade and Watson’s (1989) suggestion that the north and south aisles are of different 17<sup>th</sup>-century phases, however, is reasonable and supported by this survey which has also recognised their association with contrasting limestone-lime mortars, rubble masonry styles and (cyma- or roll-) moulded details. More problematic, however, is a series of smaller

secondary contexts which includes the upper tower of the church, the two west nave doorways and the east window of the lower chancel.

The upper tower had previously been ascribed an 18<sup>th</sup>-century date on circumstantial evidence related to the location of a secondary sandstone memorial mount and the need to construct a hollow tower for the workings of the church clock, and it is not clear whether these authors envisage the tower was any higher than the lower primary levels before this period (Slade and Watson 1989, 317; Watson 2011, 19-20). From the evidence for Type 3-4 kiln-relicts in the core of the walls, however, it is clear that the upper levels of this tower were constructed with a shell-lime, and on present evidence this would be very unusual evidence for an 18<sup>th</sup>-century building in such a formal context (see distribution map 1.1.8 in appendix 1). The surviving masonry of the upper tower has been altered many times, but the change in mortar from the primary limestone-lime of the mid-tower to the distinctive red-coloured shell-lime of the upper structure is coincident with a clear change in masonry with large and often edge-laid fine-dressed blond sandstone window jambe, as well as two rows of deep floor-joist sockets and a wide external scarcement off-set.

Moreover, a somewhat similar red-coloured shell-rich mortar was also noted binding the north-west nave doorway which had previously been interpreted as medieval without recognition that both nave doors are also secondary (Slade and Watson 1989, 312). There is no fine-dressed sandstone associated with the primary phase masonry, but the secondary internal dressings of the south nave doorway are also abutted by external jambs of an even later phase which are stylistically (roll-moulded) and archaeologically (sandstone lithogy and comparative mortar Type) related to the 17<sup>th</sup>-century south aisle. This clearly provides a 17<sup>th</sup>-century upper terminus for the inner jambs of the south nave door as the underlying primary fabric provides a probable 12<sup>th</sup>-century lower terminus.

Also of clear significance to this debate are the very faint traces of a wall painting surviving on the walls of the lower chancel. When first revealed this appeared to depict a number of figures including a mitred bishop, and is generally considered to be medieval (Fawcett 2002, 323). Curiously, however, the very faint pigmented remains of this painting survive upon a coarse shell-rich probable shell-lime mortar, which also betrays tool-marks consistent with a plasterer's comb. A very similar 'scratch-coat', with an overlaying crisp lime-rich smooth coat, is also evident in the east of the chancel overlaying the secondary east chancel window which is clearly secondary and also appears to be bound with a slightly contrasting but closely related shell-lime material.

Subsequent thin section analysis of a number of loose samples supports these on-site shell-lime characterisations and although it is clear these contexts now require more work on site, the comparative evidence suggests their late modern interpretations should be questioned. The possibility that these are exceptional and important pieces of post-Reformation evidence should not be ruled out on the basis of a mortar typology tautology, but medieval dates for the chancel painting and Upper Tower would clearly conform more closely to the regional corpus and the possibility should be investigated further.

#### 3.6.4 LATER MEDIEVAL ST PETERS THURSO? – PAINTINGS AND TOWERS

The very white two-layer technique displayed by the secondary coating of the lower chancel is typical of ‘true fresco’ (Hiler 1934; Binski 1991, 62) but although some later medieval wall painting evidence in Ireland has been tentatively characterised on this basis (McGrath 1987, 104), it is more generally accepted that *secco* was a much more commonly used technique in Northern Europe (Hiler 1934, 274). A 12<sup>th</sup>-century description of this technique, probably written in Germany, instructs the painter first to sprinkle water on the dry wall:

‘until it is completely wet. All colours which are to be used on it are mixed with lime and applied to this wet surface so that, as they dry with the wall, they adhere to it’ (Theophilus *De Diversis Artibus* or ‘On the Various Crafts’, in Binski 1991).

This technique does not therefore necessarily require multiple plaster layers and so may better describe the Irish evidence where, although only very few medieval wall painting fragments survive, a wide range of plaster ‘grounds’ are in evidence (McGrath 1987). Scottish comparanda are almost non-existent, but over 800 medieval mural paintings are known to survive in the churches of Denmark (Bollingtøft 1993), and many of these also appear to have been applied using the *secco* method. Certainly this is suggested by the evidence reported from the 12<sup>th</sup>-century church of Gundsømagle, where a 12<sup>th</sup>-century wall painting of the apostles was found beneath post-Reformation whitewash in the chancel and suggested to have been composed of ‘pigments mixed with lime and painted on a hardened porous’ surface of mortar (Padfield *et al.* 1994). There are, however, also interesting phase- or period-specific technical contrasts as the nave at Gundsømagle revealed a later phase of 13<sup>th</sup>-century paintings which ‘had obviously been executed very quickly’ upon a much coarser lime-rich plaster, using a method ‘quite different from the laborious planning that is found in Romanesque painting’ (Bollingtøft 1993, 531).

These 12<sup>th</sup> and later 13<sup>th</sup>-century mortar coatings are remarkably similar to each coating layer within the chancel of St Peter's and the particular attention to detail in the 12<sup>th</sup>-century Romanesque mortar work is notable. It would appear likely that the pigments from the wall paintings in the north-west of the chancel at St Peters have soaked through any overlying plaster layer and, although the surviving pigment remains are now only very fragmentary, other paintings within the more recently ruined building were previously described in the mid-19<sup>th</sup>-century as:

'of the very rudest execution. One of these represented the offering of Isaac. Abraham was dressed in something like a kilt and hose with flowing surtout... while above appeared an angel...' (Calder 1861, 167).

Of the architectural form of the tower at St Peter's, consideration of wider comparanda is also instructive. Thirty-two bell towers surviving in Lincolnshire (eastern England) have been described as 'approximately square in plan...divided into two equal parts separated by...a set-off, giving a tall lower stage supporting a shorter bell chamber stage' [whilst] 'the great majority of the towers still retain a floor level at or near external string course level, dividing the bell chamber from the lower part of the tower... [This] clear distinction between the lower tower and the bell-chamber was [often] exploited in the later middle ages...when the bell-chamber section alone was replaced' (Stocker and Everson 2006, 7, 20-21).

These Lincolnshire towers are generally (like the late medieval towers of the Caithness churches of Canisbay and Dunnett; RCAHMS 1911, 7-8, 21-22) situated to the west of the nave, but the similarity of this description to the evidence at St Peters is striking and, given the quality of the primary masonry, a similar late medieval change in bell arrangement provides a reasonable context for rebuilding upper tower.

### 3.6.5 INTERPRETING ST PETER'S THURSO

The shell-lime evidence in the secondary masonry of the upper tower and chancel of St Peters Thurso is complex and introduces a new focus for future research at the building but should not distract us for too long from the much clearer archaeological evidence displayed within the building's primary phase, and a number of aspects of this primary building are apparently unusual:

- In plan-form, enclosed apses are otherwise only reported elsewhere within the chapels of very large 12<sup>th</sup>-century churches such as: St Etienne (Caen), Peterborough and Romsey; the cathedrals of Durham and Lincoln (Ferne 1986, 401; 2002, 248) and possibly within the first phase of St Magnus Cathedral, Kirkwall (Orkney) (Fawcett 1988, 89).
- In elevation, I know of no other three-storey chancels outside of a cathedral setting.
- In architectural detail, particularly wide window spans for this region suggest comparisons with the apsidal church (also dedicated to Peter) on the Brough of Birsay where evidence for glazing was found during excavation (Curle 1982, 121-2).
- In the buildings fabric, where use of hydraulic limestone limes are (apparently) unknown in the biogenic-lime dominated medieval masonry of Caithness and very rare in the wider North-East Region in the high medieval period (see map 1.1.6, appendix 1).
- Evidence for a highly polished external smooth render is also very unusual in the Scottish North Atlantic.

These last two very consistent pieces of mortar evidence, together with the other details of form and fabric, suggest a very particular suite of masonry techniques was brought to bear on this building, in order to fulfill a very particular architectural brief. Whether this supports Slade and Watson's contention that this building was a 'bishop's church or 'proto-cathedral' (1989) requires more work, but that the chancel wall painting previously depicted a mitred bishop seems remarkably appropriate. Davidson (1999, 75) has remarked that apses highlight the space around the altar and I wonder if in this context (as again at St Peter's Birsay and St Sunniva's, Selja) the apse might be particularly representative of a bishop whose position facing the congregation certainly continued in this region into the 12<sup>th</sup>-century (cf. Radford 1988, 23).

The coincidence of the Bishops Castle located less than one mile away must have some significance on this debate and it is unfortunate for the methodology adopted throughout this thesis research that the remains of this building are so fragmentary and confused. Again these require further work, but we shall now turn to a site elsewhere in the North-East Region, where the importance of continuing relationships between the secular and ecclesiastical archaeology is salient.

### 3.7 CASE STUDY – UYEA CHAPEL, SHETLAND

The last case study of this chapter considers a group of upstanding buildings located on the small (1.5 x 1 mile) island of Uyea, south of the larger island of Unst in north-east Shetland (see appendix 12). The study examines a small chapel/burial aisle complex standing within a sub-circular burial ground in the south-east of the island, and two 19<sup>th</sup>-century and later domestic buildings located elsewhere on the island.

The most significant of these buildings is clearly the much altered probable 12<sup>th</sup>-century chapel building which currently survives above ground as a two-celled structure. There is, however, no documented history of the island for the high medieval period, and previous descriptions and interpretations of these upstanding remains vary widely. Dryden visited the site in 1855 and described the structure as a bicameral nave and chancel church, but without realising the smaller cell was in the west (MacGibbon and Ross 1896, 149-151); the RCAHMS oriented the building correctly and also suggested this was a bicameral building, but noting that the western cell was a later addition suggested the previous ‘E. division has been ‘completely demolished’ (1946b, 143-5 ); the site was not visited by Lowe during his thesis fieldwork, but an assessment of previous descriptions led to speculation that the building was a sophisticated tri-cameral towered church (1987 vol. 2, 222-225); and finally the site was visited as part of the GUARD Shetland Chapel-Sites Project (Morris 2004; Brady and Johnson 2000, 31-36) which concluded that although the building ‘has been considered to be of nave-and-chancel form...there is no physical evidence of a chancel and little to suggest there ever was one’ (*ibid*, 32). Given the arched doorways surviving in both the west and east walls of the earliest phase of the building, however, this is a curious conclusion and the site was included in my earlier desk-based survey of bicameral chapel sites (Thacker 2011; 2015a). The most significant reported detail of the building noted during this previous study were consistent reports that these doorway arches were headed with ‘false’ lintel-headed arches, whilst other ambiguous and conflicting structural descriptions suggested mortar survey may be revealing.

#### 3.7.1 UYEA BUILDINGS ANALYSIS

Indeed, closer characterisation of the contrasting masonry styles and bonding materials surviving at this site is crucial to understanding its stratigraphy (cf. Brady and Johnson 2000, 35), as the building is essentially comprised of three main phases which are lime-bonded, clay-bonded and dry-stone respectively.

Moreover, the primary upstanding phase of the structure is a bicameral nave-and-chancel chapel of remarkable form; comprised of tightly jointed, sharp-arrised, flat-laid schistose blocks and slabs which have generally been laid quite level but with almost no lateral bonding between stones or between walls. This lack of lateral bonding is particularly notable internally and has resulted in large sections of walling comprised of vertical stacks of face stone with associated risbond joints either side. That this masonry is lime-bonded, however, is clear in the visibly contiguous and consistent core, bed and coating lime mortar which surrounds the primary stonework, and interpreted on site as a fine-tempered shell-lime with a high concentration of kiln-relict fragments, including *O. edulis* (see chapter 2 and appendix 2.2). This interpretation was subsequently supported by thin-section petrographic analysis of a loose mortar sample collected from the site, which also suggested this mortar was peat-fired (see appendix 12). Moreover, that this distinctive suite of masonry materials and techniques included the only lime mortar on the site facilitated clear interpretation of just how little of the primary chapel masonry actually survived, although significantly this included both corbel-arch-headed doorways (see appendix 6.1.3).

Interpretation of this primary chapel phase, however, was also aided by the equally distinctive masonry style of the two main overlaying phases. Repairs to the primary rectangular cell (which currently stood to a reasonably level wallhead height) had been noted by most previous visitors to the site, but more focused characterisation of the masonry allowed these episodes to be confidently ascribed to one of two main subsequent phases. These included: some clay-bonded masonry repairs to the primary west wall (and the blocking of the doorway) associated with the later clay-bonded cell, abutting from the west; and a later phase of repair to the remaining nave walls in very well-bonded dry-stone masonry. That this last dry-stone masonry phase included substantial repairs to the external face of the east wall of main upstanding structure is most significant, however, as two stones protruding from this wall at ground level and surrounded by shell-lime mortar-bonded primary masonry, are almost certainly the last remains of the chancel north wall. From this evidence a reasonable interpretation of the development of the upstanding building can be suggested.

### 3.7.2 UYEA BUILDINGS INTERPRETATION

The development of the buildings surveyed on Uyea is clear and includes:

1. a primary phase in which a shell-lime mortar bonded and coated nave-and-chancel bicameral chapel was constructed with tightly-jointed schistose stones but very little bonding in the walls. This chapel had a corbel-arched west entrance to the nave and a similarly constructed ‘doorway-like’ narrow chancel arch on inclined jambs. Assuming the chancel was centrally placed relative to the chancel arch and square in (external) plan, this small structure will have had internal dimensions of 2.36 x 2.36m (the newly discovered primary chancel at Eynhallow was 2.57 x 2.61 internally; *contra*. Radford 1962). This chapel is very likely to be a late 11<sup>th</sup> or 12<sup>th</sup>-century construction and that is supported by the form of the cruciform grave-markers to the north-east which have been noted elsewhere at Lundwick and North Rona.
2. a secondary phase in which a clay-bonded burial aisle was appended to the west wall of the former chapel. Repairs to the west wall of the primary building, including blocking the former nave entrance, suggest the chapel was ruinous by this date and the masonry style of the broken memorial within this cell suggests a 17<sup>th</sup>-century date is likely. This structure was extended to the south in a later phase with more slender masonry walls in some unknown period.
3. The Laird’s Hall is a very formally course and snecked limestone-lime bonded building with a fireplace inscription dated to 1818 in the name of Leisk. A last phase of the chapel building saw substantial dry-stone repairs to the former nave of the chapel which included rebuilding most of the external face of the east nave wall. This suggests that the chancel had already been removed, or was removed at this time, to allow access into the newly configured burial enclosure through the former chancel arch. This phase created a burial enclosure which probably did not support a roof. The masonry is of 19<sup>th</sup>-century style and this interpretation is supported by the 19<sup>th</sup>-century memorial which now dominates the space. The dedication to Thomas Leisk suggests the deceased was the former owner of Uyea Hall.

Examination of the masonry of the upstanding buildings on Uyea provides a simple archaeological study which appears to reflect the wider mortar archaeology of Shetland very well (see regional table 1.2.3 and maps 1.1.6-1.1.9, both in appendix 1). Shell-limes are also in evidence at the nearby 12<sup>th</sup>-century church of Lundawick (Unst) as well as St Ninian’s, Kirk o’Ness (Yell) and Castle Holm. The 17<sup>th</sup>-century clay-bonded burial aisle parallels similar materials surviving at the possible 17<sup>th</sup>-century buildings of Greenwell’s booth and Vöesgrind (both Unst), although judging by these building we should have expected the clay

mortar of this aisle to have once been coated in a limestone-lime mortar. This period on Uyea is probably associated with another domestic building, perhaps on the same site as the current farmhouse. Finally, the limestone-lime bonded buildings of the 19<sup>th</sup>-century and roofless burial enclosure both conform to the regional corpus. It would be interesting to analyse these coal-fired materials to ascertain if the local lime from Baliasta had been employed (Ingram and Ingram 1841, 45; Mykura 1976, 34; see appendix 12).

Although only a small island, the buildings evidence on Uyea appears to clearly display a number of cultural developments, and transitions from Norse to Scottish, from shell-lime to limestone-lime (via clay), and from peat-fired to coal-fired are all in evidence.

### 3.7.3 THE BICAMERAL CHAPEL AT UYEA

The primary chapel building on Uyea displays close parallels with the nearby church of Lundawick (Unst) in masonry style, shell-lime mortar, west entrance and corbel-arching, and both buildings are associated with cruciform gravemarkers of a style similar to those noted at the Norse chapel on North Rona (Nesbit and Gailey 1960; Thacker 2013a; in prep; see also chapter 5)). Indeed, most of the domestic buildings on Uyea appear to have strong monumental connections to the chapel and burial ground, and it is interesting to note how their relative forms change in different periods.

In this regard, it may be of further significance the similar church at Lundawick is also near to an excavated ‘type-site’ Norse longhouse which was previously suggested to be 10<sup>th</sup>-century (Small 1966) but has been recently re-ascribed to the 12<sup>th</sup> (Bond *et al.* 2007, 11; Bond 2013; see chapter 5). This is important in suggesting that these secular and ecclesiastical buildings may be contemporary, and it is entirely possible that the probable Norse longhouse footings recently recorded on Uyea (Smith 2005) are also contemporary with the bicameral chapel examined here.

Even though often constructed with significant volumes of masonry, these secular Norse buildings of Uyea and Unst are clearly very different both to the secular buildings of mortared masonry previously associated with the bicameral churches of Wyre and Tuquoy (*supra.*). Accepting that the longhouses, settlements and burial mounds of Uist, Orkney and Norway often appear to have been deliberately reconstructed in cycles of tell-like layers (Sharples 2005, 182; Harrison 2013), it is salient that the ephemeral building materials also often evident in their construction contrast so remarkably with the monumentality of the

contemporary lime-bonded and coated chapels (Thacker 2011; 2015) and this juxtaposition is fundamental to the meanings of these various materials however ‘informally’ this chapel may have been built. As noted in the introduction to this thesis, in most North-west European medieval societies lime-mortared masonry emerges into the archaeological record in ecclesiastical buildings first, creating repeated instances of material contrasts with secular buildings such as those noted in England in the 8<sup>th</sup>- and 11<sup>th</sup>-centuries (Blair 2005, 275, 411).

### 3.8 THE MORTAR ARCHAEOLOGY AND HISTORY OF THE NER

Appendix 1.2.3 collates all the information from the North-East Region building surveys undertaken up to the completion of this thesis, and this data exhibits the most diverse mortar archaeological record of the three survey regions with clay, maerl-lime, shell-lime and limestone-lime mortars are all well represented in different geographical and chronological contexts.

It seems clear that biogenic-limes are common in the surviving high-medieval mortar corpus within Orkney and can often also be associated with clay mortars in various configurations (see chapter 5). The only well-contexted instance of a different lime-source noted in this period was at Crosskirk Tuquoy, although that of 13<sup>th</sup>-century St Magnus Cathedral and perhaps the Bishop’s Palace appears likely. Moreover, outside of Orkney the high medieval archaeological record of the region appears to be dominated by shell-limes, and the only different lime-source noted in this period was at the case study site of St Peter’s Thurso.

The surviving high-medieval lime mortar corpus of the North-East Region as a whole is generally dominated by biogenic-limes of either shell or maerl. The production of either maerl or shell-lime mortars can probably be largely attributed to environmental availability within the region, whilst the evidence for use of biogenic-lime mortars (particularly in limestone-rich Shetland, see map 1.1.10) does not conform to the availability or otherwise of limestone. This suggestion is further supported by the evidence for varying amounts of heated shell within maerl-lime mortars and for an increase in these shell concentrations in some later Orcadian medieval contexts. This is notable both in the regional data and at a number of individual multiphase sites such as Eynhallow and Cubbie Roo’s Castle. These interpretations are supported by microscopic analysis and appear likely to reflect a change in the available littoral assemblages of Orkney, rather than any change in material sourcing or lime-burning strategy. Elsewhere, in a possible early high-medieval context, shell/maerl-lime hybrids were also recorded at Newark and this may reflect an historical environmental

spectrum on this coast close to the shell-lime mortar at the chapel on the Brough of Deerness. Large deposits of maerl were reported on the island of Graemsay in the 19<sup>th</sup>-century (Shirreff 1814, 112-3) and more reflexive work is required to establish how concentrations may have changed over time in various contexts.

Some previous commentators have noted the marine materiality of these mortar materials. These include Lamb's description of the coatings of Tuquoy, Cubbie Roo's and the Wirk as 'shelly' (1993), Cullen and Driscoll's description of the mortar at Strome Castle as 'shell' (1995, 17) and the RCAHMS noted a perceived high concentration of 'shell and coral' in the mortar of Orphir Church (1946a, 174). Moreover, as with the shell-limes of chapter 2, there are a number of particular references to the high quality of mortar materials here as in the seemingly challenging work of demolishing most of the round church at Orphir which was 'strongly cemented with lime' (Liddell 1791-99, 417), '...the mortar proving excellent Cement it did not answer to separate [the stones]' (Bishop Pococke 1760, in RCAHMS 1946a, 174).

By the later medieval period the regional record is much more heterogeneous, with limestone-lime noted in every district and in particular much more commonly recorded in Caithness and Shetland. Viewed in more detail, this appears to be a period of intense change as, although biogenic-limes are still in common use at the end of the 13<sup>th</sup> and into the 14<sup>th</sup>-centuries, by the end of the 16<sup>th</sup>-century there is no certain evidence for the constructional use of biogenic lime mortars in any of the northern districts of the North-East Region. By this period, the only surviving archaeological evidence noted during this survey was within a number of constructional contexts in the Firthlands (see also chapter 5) and as a high quality coating elsewhere across the region (see chapter 2). There is no known further evidence for maerl-lime mortars at all, although the coating stratigraphy at Orphir is yet to be systematically examined.

There is a lack of surviving late medieval buildings evidence in the Northern Isles (Owen 1993, 329) and this appears to coincide with a change in mortar-making and other masonry techniques. This lacuna may be reflected in the masonry development of St Magnus's Cathedral which had been complete except for a west end for approximately 150 years from the mid 13<sup>th</sup>-century (Fawcett 1998). Accepting that there is limestone-lime evidence elsewhere in the building, the 15<sup>th</sup>/16<sup>th</sup>-century masonry with which the west end was finally built conforms to the new limestone-lime techniques and presents a striking contrast at triforium level from the earlier masonry which it clearly abutts. High medieval/late medieval

biogenic/geogenic material contrasts in neighbouring buildings include Lundawick/Muness (Unst), Tuquoy Hall/Noltland (Westray), St Ninian's/Sumburgh House (Shetland) and Castle Holm/Scalloway (Shetland).

The association between clay and biogenic mortars in the high medieval period, was noted at Tuquoy and Eynhallow (both Orkney), and this changes to an association between clay and limestone-lime mortars in the early modern period, as noted at Greenwell's booth and Vöesgrind (both Unst). Limestone-limes are the only lime mortars for which surviving evidence was noted in the later modern period, and the modern use of clay and limestone-lime parallels that seen in the Isle of Lewis in this same period as Improvement gathered momentum across all social ranks into the 20<sup>th</sup> century. In contrast to Lewis, the limestone reserves of the North-East Region enabled some of this need to be met by locally manufactured peat-fired and coal-fired limestone-limes from places like Unst and Fladdabister (both Shetland; see also chapter 5), whilst increasingly economical transport links enabled more affordable imports also.

Despite the medieval archaeological evidence for limestone-lime of very probable local provenance reported in this chapter at the Orkney sites of St Magnus Cathedral and Tuquoy, documentary evidence suggests knowledge of its use had been lost by the early modern period and this may also evidence a cultural break. In the Northern Isles, the process by which the lime-making potential of local geogenic calcareous outcrops is realised once more appears quite clear in the documentation of the 17<sup>th</sup>-18<sup>th</sup> centuries. Indeed, the potential of lime production to facilitate Improvement is already salient in Orkney by the early 17<sup>th</sup>-century, as almost all of the parish reports of 1627 make an assessment of the lime-making potential of their district and each declares that 'lyme kills [or] lyme quarelles...there is nane' whilst the minister of Evie declares 'We have no lyme, neither can we have any other material whereby our industrie may in any reasonable degree be profitable unto us in comparison with lyme' (Peterkin 1820, 72-98). As noted in chapter 2, later 17<sup>th</sup>-century accounts of Orkney draw particular attention to the manufacture of shell-lime for 'Plaistering', and this is reported to be the only alternative to imports from 'the south' (Wallace 1684; Martin [1695], 212; Brand 1700). There is archaeological evidence for such high status shell-lime plaster in Orkney at Noltland Castle (Westray) and the Earl's Palace (Kirkwall), as well as further south in the North-East Region at Castle Urquart. There is a single report of probable shell-lime manufacture in 18<sup>th</sup>-century Canisbay (Caithness) (Morison 1791-99, 152) and, although the social context for this report is not clear and

notwithstanding the discussion of St Peter's above, most documentary references to shell-lime insist that the material was only ever used for building or tanning, rather than manure.

Imports to Orkney from 'the south', including from Peterhead and the Firth of Forth, continued into the 18<sup>th</sup>-century (Graemeshall accounts D5/84), but Brand's [1700] description of both Orkney and Shetland at the turn of the 17<sup>th</sup>-18<sup>th</sup>-centuries does appear to coincide very nicely with the development of lime production locally. In Shetland he reports that '[t]here is here much Lime-ftone (tho for ought I heard not to be found in Orkney) which in some places they have but lately come to the knowledge of as in Unft but about 4 years since; and in other places they know not yet how to use it' (Brand [1700], 80). This parallels the reported 17<sup>th</sup>-century re-introduction of limestone burning in the Isle of Man discussed in the thesis introduction, although the surveys undertaken in Shetland for this thesis demonstrate a much earlier use of limestone-lime than Brand's report might suggest. More work is needed on the provenance of these materials, but it is possible this evidences itinerant expertise imported for particular building projects and/or that Brand is concerned with the widespread manufacture of lime for manure and building simply not required by the general population. It is notable that the earliest evidence for limestone-lime in Shetland includes Sumburgh House and Munn Castle, both of which are buildings patronised by Scottish incomers and constructed in mainland Scottish styles (Wainwright 1962; Strachen 2008) and possible that the lime-burning traditions of Dunrossness in Shetland may also relate to the incoming population of the 17<sup>th</sup>-18<sup>th</sup>-century period (Brand [1700], 70; Fenton 1985, 88), and perhaps even to a single stonemason from Peterhead (see chapter 5).

By the later 18<sup>th</sup>-century, however, limestone-lime was being manufactured commercially on a number of Orcadian estates, including in Shapinsay from at least 1779 (Graemshall accounts D5/11/7; D3/136). It is notable that the farm at Linton (Shapinsay) was a limestone-lime burning site in this period (Shirreff 1814, 110) but that the high medieval bicameral chapel contains biogenic-lime mortar evidence. Elsewhere in Orkney the accounts of Breckness and Skail are interesting in this later 18<sup>th</sup>-century period, as in March of 1791 the local landowner is negotiating freight of lime by sloop from Shapinsay (Orkney archive D3/136) and yet already by 1797 the same estate are burning their own lime for building (Orkney archive D3/43) and this is described as 'excellent' in the contemporary statistical account (Clouston 1791-99, 420). In complete contrast to Brand's description of just over a century earlier, by the early 19<sup>th</sup>-century it was reported that there was 'much limestone in Orkney' (Sherriff 1824, 113). It would appear that in this transitional period Orcadian

building lime needs were being met from a number of different sources, including the burning of local shell, the burning of local geogenic calcareous outcrops and imports from further south and Shetland (Fenton 1997, 143-4).

### 3.9 CONCLUDING DISCUSSION

The high concentration of high medieval bicameral churches and chapels in the North-East is salient within the medieval archaeological record of the North Atlantic and given the history of the region it is no surprise that many commentators have highlighted architectural parallels with Scandinavia in this period. However, outside of the curious *Heimskringla* reference to two 9<sup>th</sup>-century Naumudal kings ‘raising a mound or tomb of stone and lime and of wood’ (Finlay and Faulkes 2011, 57) the earliest Norwegian churches are bicameral timber structures and all of the upstanding stone buildings appear to post-date 1100 (Christie 1966; Lidén 1969; 2007; Bauer 2008, 103-6; Gjerland and Keller 2009, 167). Moreover, limestone is well distributed throughout Norway (eg. Opalinski and Harland 1981; NGU 2005), and a core mortar sample collected from the important Romanesque bishops’ church on Selja (and kindly donated to this thesis research by Per Storemyr) had a local metamorphic limestone provenance. The evidence from Southern Scandinavia and north Germany may be more relevant as although the famous Danish Trelleborg sites are of earth, wood and turf up to the turn of the 12<sup>th</sup>-century (Roesdahl 1984; Randsborg 2003), a number of stone churches had emerged in the archaeological record here by the mid-eleventh (*ibid.* 72-73). In Orkney, the round church at Orphir may be reasonably dated to earl Hakons return from crusade in 1120, and this structure is clearly very similar to contemporary buildings in southern Scandinavia such as St Michael’s Schleswig (Pálsson and Edwards 1978, 97, 125; Fisher 1993). The round-towered church of St Magnus Egilsay is also usually dated to just before the foundation of St Magnus Cathedral (Ferne 1988, 144-5), and there are believed to have been other churches of this form at Tingwall and West Burra (both Shetland) for which strong 11<sup>th</sup>-12<sup>th</sup>-century Schleswig and Norfolk (England) architectural parallels pertain (Cant 1975, 21; Heywood 1988). The preliminary evidence for biogenic-limes at a number of early Orkney sites and the shell-lime evidence reported in many contemporary southern Scandinavian and north German buildings (Helms 1870, 9-10; Clemmensen 1911), might also suggest cross-cultural North Sea influence.

The strong links between the courts of England, Denmark and Germany during the 11<sup>th</sup>-century reign of Cnut have been more clearly highlighted by recent historical research (Hare

2000). There is ‘virtually no evidence’ for the rebuilding of minor churches in stone in eastern England before the Danish invasion (Blair 2005, 423), and architectural studies suggest these insular contacts with the Rhineland continued long after the Norman Conquest, even in major building projects (Potts and Potts 2002). According to Adam of Bremen, when Cnut sailed from Denmark to England he took three days to cross a sea which had ‘the Orkneys on the left, and touches Frisea on the right’ (Tschan 2002, 91), and although the competing claims of the Irish, Hamburg, Saxon, Bremen and Norman Churches on Norse society are well known it is also possible that these medieval ecclesiastical centres had a chronologically-contingent influence on the buildings archaeology of the region. In that regard, the oft-repeated emphasis on the relationships between St Magnus Kirkwall and Durham (eg. Cambridge 1988), and Niðaros and Lincoln/Southwell (Blindheim 1965; Cant 1988; Bogdanski 2013), may prefigure the elevation of Niðaros to Archepiscopal status and underscore a change in Orcadian focus from a late 11<sup>th</sup>- early 12<sup>th</sup>-century continental Danish/German influenced society, to one increasingly looking to Anglo-Norman France, England, Scotland and Norway (see also chapter 6).

Accepting that the maerl-lime of Orkney is a local variant, and that the contrast with limestone-lime mortar techniques is the more culturally-significant contrast, in general terms a distinct biogenic mortar-making masonry culture appears to have dominated both northern Regions of this thesis as it did elsewhere within the wider North Sea and much of the north North Atlantic Province in the high medieval period (see also chapter 2). The preliminary evidence from Newark suggests that in Orkney this may have been in place for some time whilst the secondary evidence at Eynhallow suggests these techniques continued at some contexts here into the 13<sup>th</sup> or 14<sup>th</sup>-century as shell-limes did elsewhere. This wide distribution and longevity suggests these biogenic masonry techniques had effectively become part of the local building culture, and this interpretation is supported its widespread use in limestone-rich Shetland and by its sudden disappearance from the archaeological record there, after a late medieval lacuna, which might be related to ‘scottification’ (cf. Wainwright 1962; Strachan 2008). That this evidence is socially contingent, however, may be evidenced by comparing the lack of limestone-lime in limestone-rich Shetland with the evidence for ‘limestone’-limes in apparently limestone-free Orkney and Caithness (see main limestone distribution map in appendix 1.1.10).

Against this wider regional narrative and the distributions emerging from the rapid survey programme can be set the main case studies of this chapter each of which also included high medieval bicameral churches in their primary phases. It is, however, clear that these churches were constructed in different social and/or chronological contexts and, looking beyond similarities in their plan-forms to the wider buildings corpus and the materials and techniques from which they have been constructed, two interrelated features of the evidence are salient: firstly, although all of these bicameral churches were constructed of local rubble, each includes a very wide range of different mortar materials, including shell-lime (Uyea), maerl-lime (Wyre), and limestone-lime (Thurso and Tuquoy); and secondly, each appears to be very closely related to nearby domestic and/or secular buildings which also display a range of constructional forms.

Exploring the relationships between secular and ecclesiastical buildings is fundamental to this thesis research, and the value of this approach is very evident from the Uyea survey, wherein variously constructed domestic buildings could be related to of successive phases in the islands chapel (see also Thacker 2015b for a similar approach to *Eaglais na h'Aoidhe*). As the Uyea longhouse is not upstanding and was probably not mortared it is not possible to compare this secular building with the same materials analysis approach which at Tuquoy appears to demonstrate such contrasts in technique and at Wyre suggested the secular and ecclesiastical primary materials and techniques are almost indistinguishable. Initially, therefore, the archaeological potential of this Uyea longhouse appears lower. This example does, however, highlight that whilst all of these churches are fully lime-bonded and coated there is a spectrum in the secular evidence from turf or earth-packed in the Unst longhouses (see chapter 5), to clay-bonded and lime-coated at Tuquoy, to fully lime-bonded at Wyre. To what extent this spectrum is predicated on chronological or social contrasts is an important question which requires careful consideration of both the secular and ecclesiastical corpus.

At the western aisle of *Eaglais na h'aoidhe* and the primary phase of Rushen Abbey (see chapter 2 for both), mortar material contrasts with the regional corpus appear to be examples of 'nodal colonization' – a phrase which will be used throughout this thesis and which combines O'Keefe's suggestion that colonisation often doesn't progress along linear 'frontiers', with Karkov and Howes's assertion that colonisation can also refer to the movement of 'texts, objects and social practices' (2006, XV). Without using this terminology, similar developmental models have been proposed elsewhere in 12<sup>th</sup>-century north-west Europe: in Munster, Ireland (De Paor 1967; O'Keefe 1994), Lincolnshire,

England (Stocker and Everson 2006); Gwynedd, Wales (Thurlby 2006); and Trondelag, Norway (Blindheim 1965; 1987; Bogdanski 2013). In each of these cases important Romanesque buildings such as Cormac's Chapel, and Lincoln, Bangor and Nidaros Cathedrals have been suggested to have spawned particular developments, and often fusions, in style and form, in the surrounding buildings of the district (see also Gem 1988; Stalley 2012). I know of no similar studies within the secular building corpus.

For possible influence on the ecclesiastical masonry of the North-East Region, however, it is reasonable to look to the construction of St Magnus Cathedral Kirkwall, whose 12<sup>th</sup>-century team of masons were probably brought to Kirkwall from the construction sites of Durham Cathedral and Dunfermline Abbey (RCAHMS 1946; Cambridge 1988). Indeed, again without using this terminology, Crawford has already implied that a regionally-nodal stonemasonry model pertains in Orkney by dating the bishop's churches of Egilsay and Birsay (St Magnus) to before and after the construction of St Magnus Cathedral on the respective absence and presence of dressed sandstone (2006, 105; 2013) and Simpson has used similar masonry evidence to argue for the contemporaneity of the Kirkwall Bishop's Palace (1961b). Moreover, reports that this same Point of Holland (Orkney) sandstone can be identified at the important Archdeaconry church of Shetland at Tingwall (Cant 1975, 21, 45) clearly suggest sea-going transport of stone was practiced, and if we simply accept this criteria (and Slade and Watson's contention that St Peter's Thurso is a particularly Norse bishop's church), then on similar grounds to Egilsay the lack of sandstone at St Peter's would suggest a construction date predating that of Kirkwall Cathedral.

North Atlantic masonry evidence, however, is often more complex than this. Although the masonry team constructing the western aisle at *Eaglais na h'Aoidhe* did indeed import limestone to make their mortars, they also appear to be the first to hew the local coarse Stornoway sandstone into dimensioned blocks (Knott and Thacker 2011). By contrast, the earlier phase 2 medieval builders at *Eaglais na h'Aoidhe* imported fine blond sandstone for dressings, but built the church with shell-lime mortars (*ibid.*). In another contrast, rather than build in the local shell-lime tradition or with imported limestone, the English lime-burners at Rushen Abbey roasted local limestones, perhaps for the first time, whilst architectural details in the building were hewn from both imported sandstone and local limestone (Butler 1988; 2002; Davey 2002, 84). In Iceland, although we don't know how the mortar was manufactured, the 14<sup>th</sup>-century reforming bishop Auðun brought a stonemason with him from his native Norway and 'south of the church in Rafta Slope he found a red rock, and this

he had broken up, brought home and hewn' to build a masonry altar (Hafliðason 1890, 64-65).

Each of these buildings presents various examples of how masons negotiated the construction of buildings with stone and mortar in different ways, with reference to their own expertise and apparent material availability, but without reference to any pre-existing masonry techniques which had already been negotiated. Most nodal models consider the development of indigenised hybrid masonry techniques to be a one-way process only, as local craftsmen selected which techniques to adopt from internationally-influenced masons working at the local major building project (see for example Blindheim 1987, 17; Gem 1988; Bogdanski 2013, 103; Turner *et al.* 2013, 195). Unlike in Iceland, however, St Magnus Cathedral was not the first lime-bonded masonry building to be constructed in Orkney, and the evidence suggesting the Northern Isles already had a strong masonry culture before 1137 is significant. Implicit in the above discussion of the wider regional influence of St Magnus's is an acceptance that this earlier culture was not dressing freestone, and this material technique is privileged in all the interpretations of the dissemination of architectural technique referenced above. In 12<sup>th</sup>-century Orkney, as in later Man and Lewis, lime mortars were already being made (see chapter 5).

It is unfortunate that the biogenic-rich lime mortar evidence examined for this research from St Magnus Cathedral was a loose sample as this may refute the bold statement made by the RCAHMS that there is nothing Norse about St Magnus Cathedral (1946a). Given the later (probable 13<sup>th</sup>-century) limestone-lime evidence within the building, however, it is more probable that the mortar and masonry evidence surviving at both St Peter's Thurso and Crosskirk Tuquoy are related to this wider influence. Both buildings are parish churches, both are bound with limestone-lime mortars and both have vaulted chancels. Moreover, perhaps the most convincing piece of evidence in support of this theory is the mortar technique displayed; as both sites display hard, fine-textured hydraulic mortar coatings of different specification to their respective more coarse core mortars, and this has been applied in a specialist constructionally-secondary process. This is unusual evidence in a Scottish North Atlantic context and, more than just substituting one material for another, suggests a fundamental difference in technical repertoire. It may be significant that a (latterly lost) sandstone 'gable mount' was also previously reported at Crosskirk Tuquoy (Lowe 1987), but this discussion clearly places more significance on future work at St Magnus's, and at the other vaulted parish churches of Orphir, Egilsay, Birsay and (although now lost) Skail in

Deerness. It is notable within an Orcadian context that the biogenic lime mortars of the chapels of Brough Deerness, Newark, probably Brough Birsay and Eynhallow are not parish churches, and this discussion will be picked up again in chapter 6.

Certainly the change in masonry associated with the shell-lime bound upper tower at St Peter's Thurso represents a cultural departure from the buildings primary phase. This evidence is contrary to developments in the regional corpus where by the later medieval period constructional use of shell-limes is no longer associated with the Northern Isles, but appears to have contracted south to the Firthlands. Whilst the cultural contrast between Scottish and Norse hegemonies in the North-East Region has been emphasised above with the development of limestone-lime masonry, it is notable that the 13<sup>th</sup>-century Scottish bishop to whom the construction of St Peters is traditionally ascribed (Gilbert of Moravia) would build his Cathedral in the Firthlands with *C. edule* shell-lime mortars. Moreover, he was descended from a family who had very recently arrived into Moray from Flemish Holland, whilst the bishop of Moray in this same period was one Richard of Lincoln (Lewis and Pringle 2020, 1; Taylor 2014, 102). Clearly these North Sea relationships are very close and towered and vaulted churches are such a very prominent feature of this much wider regional corpus (Kubach 1972) that it is difficult to see these buildings in isolation as reflecting a particularly Norse ethnicity.

In this regard, however, a number of interwoven metaphors from apparently different perspectives may be useful: firstly, from a buildings perspective, Blair conceives of the 'physical transformation' of the local church as 'a tide which rose in Eastern and southern England around 1000, rolled slowly but steadily westwards and northwards through the 11<sup>th</sup> century, but failed to spread far into the Highland zone until after our [1100] period' (2005, 420-421); and secondly, from an anthropological perspective Hastrup conceives of Icelandic identity in the high medieval period as a layered (almost concentric) construct which operates at various geographical and linguistic scales, including Icelandic, Norse, Scandinavian and European (1985; see also Woolf 2000). Buildings monumentalise their patrons and patrons personify their buildings, and it is notable that the geographical scale of the comparanda drawn on to interpret the churches within this chapter are proportional to the social level of the architecture - with intra Shetland comparisons at Uyea and continental European comparisons for St Peters Thurso.

In the North-East Region secular and ecclesiastical buildings were intimately linked in processes of cultural construction as settlement and graveyard mounds continued to grow

throughout the 12<sup>th</sup> and 13<sup>th</sup>-centuries. If chapter 2 demonstrated that the regionality of mortar-making technique was not a simple correlate of environment availability, then chapter 3 has demonstrated that masonry techniques in the North-East were culturally and socially contingent and negotiated at various scales.



## Chapter 4 - Limestone-limes, fuel and the mortar archaeology of the South-West Region

### 4.0 - INTRODUCTION

This chapter will present an examination of the evidence for limestone-lime mortars and mortar fuel within a wider investigation of the archaeology of the South-West Region of the thesis. Once more, three regional case studies – Castle Fincharn, Mingary Castle and Iona - will be considered, and increasing emphasis will be placed on relating the materials contained within these buildings to the wider environment. This chapter will detail research which led to the first directly radiocarbon dated medieval buildings in Scotland.

### 4.1 PREVIOUS APPROACHES

#### 4.1.1 DATING UPSTANDING BUILDINGS BY SURVEY AND EXCAVATION

Perhaps more than anywhere else in this thesis the archaeological potential of mortar fuel exposes the disparity of approach between materials excavated from below ground and the upstanding resource. This is most evident in survey and excavation projects published in monograph format which routinely detail specialist post-excavation analyses of a large range of materials, including lists of characterised timber or charcoal from hearths and middens, yet mortar is rarely investigated and before this present study not a single coherent example of the archaeobotanical study of relict mortar fuel had been published. The impression is often of archaeology performed around standing buildings whose investigation is left to specialists from other disciplines, and in this scenario physical fabric is essentially archaeologically dead, and often becoming increasingly so as consolidation proceeds.

This issue is particularly stark for Scottish North Atlantic medieval buildings for which an almost complete lack of contemporary documentation or closely datable architectural details is a widely recognised problem (Dunbar 1981, 44, 46; Crawford 1987, 183; Evans and Rutherford 1998, 73-74; Davey 2002, 81; Caldwell and Ruckley 2005; Raven 2005, 218, 266; Stell 2006, 14-18; Barrowman 2008b; Thacker 2011, 1; *contra* O’Keefe 2004, 6 for the Irish corpus). The issues for our interpretations of upstanding buildings are clear from a preliminary study which attempted to place western Scottish medieval castles and churches within broad chronological limits by characterisation of rubble ‘masonry styles’ and stone provenances, but whose typologies frequently span 200-300 years (Caldwell and Ruckley 2005, 99-106). The ascribed chronologies of some medieval castles in the region can be even

broader with, for instance, Dunyvaig in Islay dated to both the 13<sup>th</sup>-century (Millar and Kirkhope 1964, 6; Caldwell and Ruckley 2005, 114) and 16<sup>th</sup>-century (RCAHMS 1984), and a similar 400 year span had been suggested for the case study of Castle Fincharn in mid-Argyll, considered below.

Excavation of churches is often precluded as surrounding burial grounds commonly remain in use but even where large scale excavation of medieval castles has taken place, as for example at Smailholm Tower (Good and Tabraham 1988, 234), Duffus Castle (Cannel and Tabraham 1994; Tabraham 1997) and Spynie Palace (Lewis and Pringle 2002), then the construction dates of the upstanding buildings have often not been refined any further. Interpretations in these cases have then subsequently fallen back on limited architectural comparanda and indirect documentary references, even though at least two of these examples have high concentrations of visible mortar fuel.

The excavation at Castle Carrick highlights some of the issues as the site was excavated by a number of organizations over a ten year period ‘in tandem with repair and restoration of the building by its owner’ (Ewart and Baker 1998, 937). A long list of specialists contributed to an excellent and very comprehensive final publication which offered:

‘... a synthesis of all episodes of fieldwork, a wide range of post-excavation analyses of artifacts and environmental materials, and a historical appraisal of the castle as a strategic stronghold in the emergence of Campbell power in Argyll’ (*ibid*).

Not unusually, the castle does not appear in contemporary documentation until 1529 (Ewart and Baker 1998, 997, 1002), but the upstanding building had previously been dated to the 14th century by architectural typology (RCAHMS 1992). Much was subsequently made of a piece of Saintonge Ware discovered during these excavations which Tabraham suggested provided the first ‘archaeological dating’ of ‘hall-house’ construction in Scotland, indicating the building should now be ascribed to the later 13th century (Tabraham 2005, 31).

Unfortunately, however, the excavators themselves had concluded that:

‘the only find which can be dated confidently to the period before the castle's construction, are two conjoining sherds from a Saintonge polychrome jug...[which in Southampton]...were present in deposits dating only to the hundred years between the mid

13th and mid 14th century... [although here]...could have been in use for some time before it was deposited.’ (Franklin 1998, 960).

The chronology of the upstanding building is then much less secure and possibly much later than Tabraham would suggest, although I am in no doubt that (before consolidation) the mortar within the walls of Castle Carrick would also have contained a significant and datable relict-fuel assemblage.

#### 4.1.2 THE ANALYSIS OF EXCAVATED WOOD AND CHARCOAL

Meanwhile, excavated wood and timber materials in Scotland are now quite routinely subject to archaeobotanical analysis, to ascertain which tree taxa and morphologies are represented (Pearsall 2000). At Castle Carrick, for instance, 149 wooden fragments were divided into unworked ‘roundwood’ and ‘structural pieces’, before identification to species level and comparison with the standing woodland surviving in the local landscape today (Crone 1998, 977-982). At the excavation of the early medieval monastic mill at Nendrum (Northern Ireland), 1800 mostly structural pieces of wood were similarly categorised and described (Earwood 2007, 222-254), and charcoal from hearths has also been the subject of some large archaeobotanical studies.

Indeed, archaeobotanical analysis is generally regarded as essential for any excavated charcoal samples considered for radiocarbon dating, and all charcoal dated through Historic Environment Scotland’s funding scheme must comply with strict pre-submission protocols to establish sample taxonomy and morphology (Ashmore 1999). This is necessary because tree rings stop exchanging carbon with the atmosphere as soon as they are formed (Bowman 1990, 15), and so if possible young roundwood tissue (preferably with sap-wood and bark) and/or wood from short-lived tree taxa should be selected from the assemblage to minimise any ‘old wood effect’. Heartwood oak is generally considered particularly problematic in this regard, given the potential for this tree to live to a great age (Ashmore 1999).

There are further constraints implicit within this protocol, however, as in order to be characterised confidently each charcoal or wood sample must be of the order of 1cm<sup>3</sup> (Schweingruber 1990, 211; Pearsall 2000, 144-153), and this is much larger than that physically required for AMS radiocarbon dating.

This protocol is not common to all disciplines, however, and some research designs routinely require the dating of very small taxonomically-unidentified samples where charcoal relicts as small as 100µm are considered ‘macroscopic’ (Mooney and Tinner 2011). As with all dating methodologies, much depends on how much chronological refinement is required to frame the research. In archaeology there may be additional challenges relating to sample size, taphonomy and context, as charcoal is generally so resistant to degradation that turnover events can lead to problematic chronological relationships with the stratigraphic context concerned and erroneous results from mixed assemblages (Ashmore 1999). In response, recent protocols also now insist on ‘single entity’ sample submissions only, and the efficacy of that requirement may be further supported by recent research which suggests that microcharcoal returns different (often older) uncalibrated dates than macrocharcoal from the same context (Eckmeier *et al.* 2009).

In general, these protocols aspire to increase the accuracy and/or refinement of the results by improving our understanding of the depositional history of the sample (Pearsall 2000, 247), although they cannot militate against chronological issues relating to the post-mortem pre-pyrolysis depositional history of the sample such as wood survival, acquisition and seasoning strategies (Shackleton and Prins 1992; Marston 2009; Théry-Parisot *et al.* 2010). These, therefore, are interpretive challenges to which we shall return.

#### 4.1.3 DATING MORTARS AND THEIR RELICT FUELS

There have been attempts to radiocarbon date masonry mortars since the 1960’s, although these have met with mixed success for a variety of reasons. Dating methodologies have generally followed one of two approaches, although a third has also been attempted: The first method is predicated on the principle that because quicklime absorbs carbon dioxide from the atmosphere as it sets, so measurement of the radiocarbon content of the mortar ‘binder’ (released through acid digestion) should give an accurate estimate of the date of construction (Folk and Valastro 1976; Ambers 1987; Matthews 2001; Lindroos *et al.* 2007; Al-Bashaireh 2008; 2013; Pesce and Ball 2012; Pesce *et al.* 2013). As is very evident within the work of this thesis, however, the concept of a pure ‘binder’ is problematic and the ever-present challenge with this approach is the confidence with which potential contaminants such as heated carbonate kiln-relicts, calcareous aggregates or re-crystallised lime can be shown to have been removed (*contra.* Chu *et al.* 2008, 910). A number of methodologies have been designed to circumvent this issue, including the dating of ‘pure’

lime lumps rather than tempered mortar (Pesce and Ball 2012). The most commonly applied methodological refinement, however, relies on the greater resistance of most contaminants to decarbonation and so measures the first (or alternatively sequential) aliquots of released carbon dioxide only (Folk and Volastro 1976). Within north-west Europe, the pioneering work of a team from Scandinavia in this field, which successfully dated a group of medieval chapels in the Åland Archipelago to the 13<sup>th</sup>-century is notable (Lindroos *et al.* 2007), although elsewhere results have often been much less than convincing, including some with age ranges spanning more than 12,000 years (e.g. Matthews 2001). The issue then becomes one of confidence.

The second most commonly employed method is the dating of mortar charcoal fuel-relicts, and it is this approach with which this chapter will be mostly concerned, although with reference to the previous discussion on dating charcoal from excavated contexts there are clear issues with many previous approaches to this material. This discussion will begin with consideration of a significant project in Ireland undertaken by Rainer Berger.

#### 4.1.3.1 BERGER'S PROJECT

For decades, Rainer Berger's research had centred on developing original methods to carbon-date buildings and, having previously devised a methodology for dating historic timbers from medieval buildings in England and continental Europe (Berger 1970), his attention turned to a range of apparently early medieval Irish masonry buildings for which our understanding of construction dates was very broad (Berger 1992; 1995). Like the upstanding medieval buildings corpus in Scotland, many of these Irish structures lacked historically datable architectural details and contemporary documentation, and a similar dearth of surviving primary timbers forced Berger to explore the possibilities of dating the constructional mortar. Whilst, as above, his initial attempts to date the carbonate fraction of the lime binder failed on the inconsistencies inherent in interpreting the geological/historical carbon ratios, he noted how the acid digested remains of these mortar materials contained '...many charcoal particles...from the original fuel used to produce burned lime... [which had not been] ...totally consumed in the heating process' (Berger 1990, 881). The experimental focus was subsequently shifted to radiocarbon dating these charcoal fuel-relicts and, beginning with 'control' structures with well documented histories, the project ultimately suggested date ranges for a series of 25 undocumented medieval Irish ecclesiastical building contexts (*ibid*, 884).

Berger's  $^{14}\text{C}$  dates were obtained from an acid digested mortar residue which contained a 'mixture of charcoal particles and carbonate-free inorganics' (*ibid*, 882), and yet, although he very briefly mentions the possibility that the results could have been compromised had coal, peat or bog-wood been present, only in a later paper is the possibility of a distorting 'old-wood' effect briefly commented upon before being dismissed on the evidence of reported lime-burning fuel-use traditions (Berger 1995, 161). Remarkably here, not only was the wood taxonomy and morphology not characterised, but the charcoal does not even appear to have been physically separated from the dissolute aggregate fraction. Furthermore, both his initial recognition of the relict fuel within the digested residue, and his later concern to ensure that a 'good quantity' of mortar was collected, suggest that most of this relict fuel was of very small grades only and not very visible in-situ. It could also be argued that these uncharacterized micro-charcoals are not 'single entity' but are from a multitude of micro-contexts, and unpicking this last concern is important in order to understand how context characterisation affects both research design and results.

It is fundamental to the archaeological potential of this material that mortar samples from fixed core contexts relate directly to the building's construction. The challenges which have bedevilled relating the radiocarbon data of Iron Age material sampled from occupation levels to the construction of the buildings which surround them (Romankievitz 2011, 20) are not an issue for primary mortar samples, and lime mortars are not generally subject to turnover or multiple fire events which may cause mixed assemblages (Eckmeier *at al* 2009). The visible contrasts and phase-specific nature of the mortars described within the case study buildings of this thesis also aids identification, and we are probably entitled to presume Berger's samples were consistent single phase pieces of mortar.

The corollary to this presumption is that multiple dates from single samples in very close proximity are of questionable value in a scenario where taxa remain unidentified, as the charcoal could be from the same wood source. A more general concern, however, would be that a lack of multiple dates from more disparate contexts within the same putative phase denies the possibility of effectively identifying outliers or of statistically refining a combined date for the phase (e.g. Long and Rippeteau 1974; Shennan 1988; Bowman 1990, 58-60). Perhaps Berger did not have the opportunity to sample from multiple contexts, but it will become clear during the course of this chapter that consideration of contexts, quantities and taxonomy/morphologies of available fuel-relict samples are inseparably linked to the archaeological potential of the resultant data.

It should be emphasised here, however, that Berger's minimal methodological descriptions belie the importance of his work to Irish church archaeology, where his results have had significant influence on the discourse. It was Berger's results which first prompted Harbison to group together a number of particularly small 'tomb-chapels' (built to house the graves of important local saints) and suggest these were probably the first ecclesiastical mortared stone structures in Ireland (1990, 149-152). Indeed, Ó Carragáin (2003; 2010, 66-70) has subsequently added 'St Columba's Shrine' Iona to this grouping, but it is interesting to compare these more recent discussions of the Irish pre-Romanesque corpus with Harbison's (pre-Berger) elegant 4-part typology where 'the problem of their dating' largely relied on historical sources (1982, 618-620).

A number of challenges to Berger's results have subsequently emerged, however. With a more informed perspective on the historic sources, Manning (1997) was able to demonstrate that Clonmacnoise round tower was not 10<sup>th</sup>-century as had been previously suggested (Berger 1992), and that the upper end of Berger's (1995) 2-sigma error range provided a more accurate date. On this basis Ó Carragáin has suggested that these radiocarbon results should be treated with caution, and has highlighted the plateau in the calibration curve around this very early second millennium period (2010, 66, 116), but other more significant issues are flagged-up by this discussion, and by further consideration of the radiocarbon data from the tomb-chapel building at Inishmurray. Berger's radiocarbon result for this building was considered reasonable, and used to support Ó Carragáin's later 'shrine-chapel' typology (2003), and yet the context from which the mortar sample was removed is now thought to be secondary and the early radiocarbon result explained as a possible sample of primary mortar taken from a secondary position (O'Sullivan and Ó Carragáin 2008, 76).

Although Berger's contexts and lack of appreciation for building multiperiodicity has also been emphasised (Potter 2009, 175) this 'reuse' explanation is difficult to demonstrate and unconvincing. I would suggest a more likely source of bias might be found in a methodology which was 'assuming that there is no significant age-lapse [between the radiocarbon age of the charcoal and its date of deposition], i.e. that the normal procedure in the past was to use short-lived fuel' (Berger 1995, 161).

Indeed, it is probable that there is some level of old-wood effect in all of Berger's results. At Inishmurray, this may have been significant enough to cancel out the phase difference, whilst

at Clonmacnoise round tower it was not quite enough to move the result out of the 2-sigma range. Although it appears significant that Berger's Clonmacnoise sample calibrated to within such a refined documentary date, in this example the 2-sigma range from a single sample is so very broad that the coincidence may not be very meaningful. Remarkably, however, there doesn't appear to have been any consideration, in the published Irish archaeological literature studied for this thesis, that these radiocarbon dates are first and foremost a lower terminus and always likely to give an early date to which at least some additional offset must be applied.

Similar issues are apparent elsewhere. In a project to date grave structures within the catacombs of Rome, for instance, 'rare small bits of charcoal encased into the mortar', of unknown taxonomy or morphology were AMS radiocarbon dated to the 1<sup>st</sup>-century AD, and the monuments subsequently re-ascribed to this early date rather than the previously assumed 3<sup>rd</sup> to 4<sup>th</sup>-century (Rutgers *et al.* 2002, 545). The archaeologists here were 'assuming that four out of five dated charcoal fragments from the Villa Torlonia catacombs originated from short-lived vegetation [and therefore felt they could] argue that the measured <sup>14</sup>C dates are reasonably unaffected by 'old wood' biases' (*ibid.* 545).

Similar methodological approaches were apparent in all the mortar charcoal dating projects noted during this thesis research (see also for example Matthews 2001; Al-Bashaireh 2008; 2013). The only study in which dated mortar charcoal appears to have been characterised were two samples from the investigation of the Anglo-Saxon church of Brixworth, which were re-examined from within a larger charcoal assemblage otherwise removed from more conventionally excavated contexts such as post-holes and ditch-fills (Millard 2013, 276). In many projects where uncharacterised mortar micro-charcoals have been dated it is therefore difficult to evaluate how reasonable the results are, and it will be suggested below that the assumption that limeburners always used short-lived fuel can be problematic and that more rigour is required. This thesis has already clearly demonstrated that lime burning techniques are historically, culturally and environmentally contingent, and will now highlight that complex interrelated issues of technique, carbonate provenance, kiln design and fuel type also pertain which have significant implications for the archaeological potential of the surviving resource.

## 4.2 RELATING LIME-KILNS, FUELS AND MORTARS

In contrast, however, most commentaries on lime burning technology emphasise continuity in tradition over variously long periods since its introduction, and many trace that continuity back to the Roman period (e.g. Caroscio 2007, 112-114). Johnson, for instance, suggests the sow kiln described in 19<sup>th</sup>-century lowland Scotland was ‘presumably...the survivor of a long tradition’ (2008, 130), while Toft compares historical descriptions of coal-fired limeburning from 16<sup>th</sup>-century Wales with those of Cato to suggest ‘how little the sixteenth century operation had changed since the Roman times, except for the fuel used’ (1998, 76). This chapter section will suggest that contrasts in fuel use fundamentally affect limeburning technique and the mortar evidence which survives in archaeology today.

### 4.2.1 LIME-BURNING FUELS IN BRITAIN

The most oft-quoted Insular medieval evidence for lime burning fuel is found within the 13th century building accounts of Westminster and Windsor Palaces in England (see Colvin 1971), and the seemingly abrupt 1264 change in lime-burning fuel specification from wood to coal in the Westminster documents has been highlighted by a number of commentators to suggest that a more static craft tradition previously pertained (Brindlecomb 1975; 1976). Moreover, the limeburners’ apparent preference for sea-coal in this period (Galloway *et al.* 1996, 448) has prompted scholars to reflect on an earlier 13<sup>th</sup>-century passage in the Westminster accounts which is purported to describe an order for a boatload of ‘oak brushwood’ for lime-burning (Brindlecomb 2012:7), and as a consequence, an interpretation that ‘Traditionally lime was burnt with oak brushwood’ (*ibid*) appears to have become cemented within the literature (e.g. Johnson 2010b, 72).

Further scrutiny of these earlier accounts, however, casts doubt on this interpretation, as “*Ad calcem et ad prasternendum et carianum vetera robora*” (Colvin 1971, 345) should probably be more generally translated as ‘old pollard’ rather than ‘brushwood oak’ and related to dead or exhausted pollard stocks, now useless to commoners with woodcutting rights, which would have reverted back to the king (cf. Rackham 2003, 182; Bond 2007, 277). That ‘*Johanni Pollardi*’ was also paid in the same year of the Winchester accounts ‘*pro busca prosternenda et cariana a calcem faciendam*’ (Colvin 1971, 288) underscores this point. *Busca* might be translated here as ‘firewood’ and yet, although this much vaguer term did become more ubiquitous in Irish sources in the later medieval period (Slattery 2009, 72), this also does not appear to imply ‘brushwood’ which would surely have been more

specifically referenced from the resources of a well managed 13th century English underwood (Rackham 1982, 203; 2003; 2009, 168).

Indeed, a more informed reading of medieval building accounts from elsewhere in Britain and Ireland suggests that, even at a single site, a range of fuels, including different wood taxa and morphologies, might be employed in lime-burning (see also Bond 1981). An early 14<sup>th</sup>-century account from Blackburn (England), for example, details the collection of brushwood and purchase of coal to fire a limekiln, perhaps suggesting the brushwood was intended as kindling only (Johnson 2010b, 72). This evidence is underscored by the later 15th century building accounts of Tattershall Castle (England) where the range of very specifically referenced fuel types is remarkable, including: felled *focali* (wood fuel); *carbonum pro eadem* (charcoal); *carbonum maritimorum* (sea-coal); *turbarum* (peats); and *Ellerkides* (faggots made from elder) (Simpson (1960, 42, 61, 21-2,64,24, 67, 27). Significantly, however, only general descriptions of firewood and coal pertain for the lime-burning fuels here, whilst the fuel purchased for firing the brick kilns was very consistently described as *fagottorum* (faggots) from the *bosco* (wood) and *subbosco* (underwood) (*ibid.*). This suggests that where a type of ‘brushwood’ was specifically required (perhaps for its very hot short-lived flame) then it was also very specifically commissioned.

Elsewhere, however, short-lived brushwood was indeed used in variously documented lime-burning accounts, including in: 13<sup>th</sup>-century Shrewsbury (England) (Colvin 1963); 18<sup>th</sup>-century Languedoc (France) (Young 1794); 19<sup>th</sup>-century Spain (Morris 1815), Sussex (England) (Young 1813; Brayley and Britton 1814; Martin 1997) and Yorkshire (Johnson 2010a); and 20<sup>th</sup>-century Greece (Forbes 2002). In order to understand the reasons for this we should look at the lime-burning process more closely and, in particular, consider the evidence contained within different kilns.

#### 4.2.2 LIMEKILNS AND LIMEBURNING TECHNIQUE

Only a handful of limekiln excavations have examined the fuel evidence more thoroughly, and to a certain extent those which are documented appear to support the assumptions of previous commentators. The excavation of three late medieval to early modern limekilns in France, for instance, revealed small diameter wood, heavily dominated by various *quercus* (oak) species (Vaschalde *et al.* 2013); a 2<sup>nd</sup>-century AD lime kiln in Northants contained ‘twigs and branches up to 40 mm in original diameter’ of beech, poplar, oak, hawthorn,

hazel and field maple (Jackson et. al 1973, 136); whilst charcoal from a lime kiln close to the medieval church site of St Michaels in *Betws-yn-Rhos* (Wales) was identified as roundwood alder (Grant 2007; Clwyd-Powys Archaeological Trust 2008, 7).

This small list suggests that the use of small diameter wood to burn lime was chronologically and geographically widespread, encompassing high status Roman, medieval and low status modern sites, but the evidence is also curiously circumstantial – from kilns and documentary accounts rather than the mortars themselves. Moreover, although apparently disparate, each of these sites shares a crucial detail in common: each has been reported as a particular type of flare kiln where the carbonate charge is suspended above a fire which is continuously fed with fuel. It is this capability to continuously add more fuel which makes the use of fast burning small diameter wood so appropriate, and it is this separation of fuel from carbonate which predetermines that any fuel inclusions in the resultant mortar will be accidental and rare. The fuel, kiln, technique and mortar types are contingent upon each other.

This particular conjoined fuel/kiln/mortar evidence should not, however, be conflated with that for mixed-feed kilns (whether freestanding heap, pit or clamp; cf. Livingstone-Smith 2001) in which the fuel and carbonate are layered or heaped and subsequently allowed to burn through without significant further additions of fuel during the burn (*contra*. Henry and Stewart 2012, 29). There is clearly more obvious potential for relict fuel to be included in the lime product leaving this type of kiln, although this may or may not then be removed by subsequent processing associated with making the mortar (eg. MacIntyre 1993; Spence 1825). Importantly here, Johnson reports that all seven ‘modern’ historic clamp kilns he recently excavated in Yorkshire contained wood charcoal, including alder, ash, oak and willow (Johnson 2010b, 72), although the morphologies of this fuel are not reported and three also contained coal.

A more informed approach to the archaeology of lime-burning fuels requires that the evidence is considered in the round, and that the fuel evidence in the historic mortar is related to the type of fuel used to burn the lime, which is related the type of kiln, which is in turn related to the contemporary (physical and cultural) environment. This is a negotiation between the limeburners craft expertise, the required specification of the lime and material availability, and, as stated in the authoritative *Encyclopaedia Londinensis*:

‘Limekilns are built of different forms or shapes according to the manner in which they are to be wrought, and the kinds of fuels which are to be employed’ (1814).

In a mixed feed lime burn much depends on the limeburners ability to initially predict material behaviour as the kiln is loaded. When ‘...burning lime with peats [for instance] the size of the [sod-built clamp] kiln must be proportioned to the quantity of limestone intended to be burnt’ but because ‘both peats and limestone vary in quality, the proportions of the...layers must be modified by this circumstance’ (Radcliffe 1803, 160, 162). Once lit, the control of the air flow then becomes important in order that a balance is maintained between temperature, carbon pressure and burn duration, as ventilation is required to feed the fire and remove the carbon dioxide created by both fuel and lime-source. This control can be crucial with some fuels, although the lower calorific value of wood (compared to coal) means the material is generally very much less likely to cause over-burn, so air movement can be much higher and burn durations are substantially increased (Toft 1998, 80-83). Although in principle this high air flow appears likely to create a comparatively oxidizing kiln environment less conducive to fuel pyrolysis, the evidence for mortar-included wood charcoal recorded within this thesis suggests other factors have also affected the process. Whilst wood-fired flare kilns are characterised by cycles of oxidation and reduction concomitant with episodes of stoking and burning (Newell 1999, 124), mixed feed clamp kilns are much more likely to contain a reducing environment initially (which may pyrolyse some wood fuel), before increased ventilation burns the resultant charcoal (Toft 1998). Larger diameter wood may be more suitable for this slower burn (cf. Russell and Dahlin 2007, 410-13), although a balance is of course required which may have significant implications for any resultant archaeological resource. The hundreds of unenclosed lime-burning ‘heaps’ of Tanzania which are still being worked to this day, for instance, are likely to allow for a very oxidising environment, and are generally fuelled by ‘coconut poles of 15-25cm diameter and 1m in length’ (Muhegi and Schilderman 1995, 15). The surrounding physical environment may be very different. but clearly, depending on taxonomy, a 25cm diameter section of slow growing Scottish North Atlantic tree has the potential to contain a significant carbon time depth in life (Bowman 1990), and longer post-mortem standing wood survival times.

Although heterogeneous kiln temperatures reported in other fields should caution against making simplistic interpretations of the relationships between mortars and kiln environments

(Gosselain 1992), the generally relatively low calorific value of wood (compared to coal) which makes this a very forgiving fuel with respect to lime burning (Toft 1998) underpins a greater complexity. I would suggest that, at least in part, the use of ‘brushwood’ to burn lime is so widespread in the historical evidence derived from 18th to 19th century agricultural Improvers because its use was championed as an economically prudent example of holistic estate management: utilising an otherwise waste material from limited woodland resources to produce the lime which was so important to the Improvement cause (see for example Nisbet 1905, 49). Lime was the foot soldier of Improvement (Johnson 2010b) and the concomitant massive increase in its use, both within construction and agriculture during this late modern period, also resulted in its production in more vernacular building contexts (Tait 2012, 101) where in England this fuel was often more readily available. Thus a documentary and cultural bias may have emerged from a historically specific period of increased use and reporting by lowland authors.

In contrast, I would suggest a layered clamp type of kiln is much more likely to have pertained where peat or a mixture of wood morphologies were available, as was clearly reported at the stone-built peat-fired kilns of Fladabister Shetland (Fenton 1997). Mixed feed layering is also clearly apparent in the descriptions of the early 19<sup>th</sup>-century turf-built inverted-cone shaped kilns of Shapinsay Orkney (Shirreff 1814); the peat-fired shell-lime kilns of 19<sup>th</sup>-century western Denmark (Feilberg [1899]); and in 19<sup>th</sup> and 20<sup>th</sup>-century Uist and 17<sup>th</sup>-century Galloway where the peat-fired ‘kilns’ were constructed of the peats themselves in simple rick-like heaps (Symson 1684; MacIntyre 1993; Thacker 2011).

Without implying homogeneity, it may be that these last three examples provide a possible explanation for the lack of upstanding physical remains of medieval limekilns at North Atlantic building sites, although an alternative and perhaps more plausible possible model may also be suggested by the structure of a number of mixed feed pit-]kilns reported from 17<sup>th</sup>-century Ireland. Boate usefully describes how during this early post-medieval period limestone-lime kilns in Connaught and Munster were constructed by excavating a ‘great pit, round or square...[that]... doth by degrees grow narrower towards the bottom’ and was then filled with alternate layers of limestone and ‘wood, turf or comb...which being done, the kiln is set afire until all be burnt’ (Boate 1652, 86-87; Johnson 2008, 128). The 12<sup>th</sup>-century annals of Armagh (1145) and Derry (1163) both report the constructions of enormous lime kilns ‘sixty feet every way’ ([www.ucc.ie/celt](http://www.ucc.ie/celt)), so these are surely also mixed-feed kilns;

where (in some contrast to the upstanding heap) pyrolysis and reducing environments are very likely.

It has been suggested that an ‘evolutionary development of limekilns took place [in England] in the medieval period’ (Ellison *et al.* 1993, 223) but, although more evidence is becoming available, there are still not enough excavated examples to be confident about general trends. Each of the main case studies presented in this chapter from the South-West Region have associated limekiln evidence but, like almost all known upstanding kilns in the Scottish North Atlantic recorded during this thesis research, two of these are very late modern. Possible exceptions elsewhere include the vented structure at Dun Scaith (Skye) (Thacker 2011), and kilns at Dunstaffnage (Breen *et al.* 2010), but a very probable exception is the mixed-feed clamp kiln excavated at Iona which also contained charcoal evidence (see appendix 15). In the future this may be a very good opportunity to relate sources, kiln, building and historically documented limeburning traditions.

#### 4.2.3 ROMAN VS. MEDIEVAL?

Underlying the specifics of the above discussion, however, are broader contrasts in Insular historic lime evidence. As noted in the thesis introduction, much has been made of the symbolism of Bishop Biscop’s employment of immigrant Gaulish masons at Wearmouth and Jarrow, and the archaeological evidence for brick or tile tempered *opus signinum* type mortars within the Anglo Saxon phases at these monasteries does appear to support Bede’s rhetoric that this was a re-introduction of particularly *Roman* mortar making technologies and techniques. Similar evidence has been noted in near-contemporary work in Kent, Glastonbury and Winchester (Cramp 2006; 1976), but closer study of the later medieval phases at Wearmouth and Jarrow reveals how mortar-making techniques at these sites also changed in later periods with: Anglo-Saxon mortars containing coal and high concentrations of brick or tile; medieval mortars containing frequent wood charcoal inclusions and much less or no tile; and a return to coal in the post-medieval materials (Cramp 2006, 2-3). Moreover, these changes are again paralleled by the glass-making evidence, particularly at Wearmouth, where the early medieval glass also displays essentially Roman technique (*ibid.*, 56-60) which very obviously contrasts with the later medieval material, and a broad 10th to 12th-century watershed might be suggested in both materials.

Perhaps significantly, this evidence also appears to reflect very fundamental differences between Roman and later medieval mortars surviving across Britain more widely, which the *opus signinum* work of immigrant Continental masons to Anglo Saxon Bernicia and the remarkable evidence from the cosmati pavement in high medieval Westminster Abbey (London, England, see Siddall 2013) only serve to highlight. Cramp's early approaches to mortar archaeology, and her interpretations of the 'inventiveness' of monastic inmates in 'combining continental and insular traditions' (Cramp 1976, 241), are refreshing and insightful, but from at least the 10th to 12th centuries medieval mortars across Britain and Ireland are generally interpreted as simple non-hydraulic materials, without significantly engineered 'chemical set', or the inclusion of pozzolana or ceramics. Accepting that not all Roman Lime mortars are hydraulic, this serves to highlight how assumptions regarding the homogeneity of lime-burning and lime-making techniques are problematic, and much more work is required to refine this picture in different contexts.

### 4.3 FUEL IN THE SCOTTISH NORTH ATLANTIC

#### 4.3.1 FUEL AVAILABILITY

In the preliminary section of each of the case studies of this thesis, the known vegetational history of the local environment has been assessed for each site by a review of palynological studies, woodland reconstructions on wider evidence (MacVean and Ratcliffe 1962) and historical accounts. It is apparent from these studies that almost all regions of the survey had extensive woodland cover in the early to mid-Holocene and this has been eroded at different times in different places (*ibid*; MacVean 1964). Against this background, fuel availability and environmental change across the North Atlantic has been of increasing concern to scholars, with various apparently episodic events of substantial tree cover loss being emphasized: in prehistoric North Skye (Birks 1993a), South Uist (Bennett *et al.* 1990), and the Isle of Man (Chiverrell 2002); early medieval Iceland and Greenland (Amorosi *et al.* 1997); Anglo-Norman Ireland (Nicholls 1972, 5; Slattery 2009); and post-medieval Argyll (Samsom 2004).

Many of these more sudden clearance events have traditionally been related to colonisation episodes by different human populations, especially those areas subject to significant Norse colonisation which often present largely treeless landscapes today. More recent scholars, however, tend to emphasise how the woodland resource in various Norse colonial contexts was either: never significant, as in Caithness (Birks 1993b); already highly degraded, as in the Faroes (Lawson *et al.* 2005); highly regulated, as in Iceland (Simpson *et al.* 2003) and/or

carefully managed, as in Greenland (Schofield and Edwards 2011). In contrast, many Scottish North Atlantic contexts, such as mainland Argyll and Ross-shire in particular, contain evidence for much more extensive tree cover surviving into the medieval period. A very late 16<sup>th</sup>-century account from Loch Maree, for instance, describes the district as:

‘...compassed about with many fair and tall woods as any in all the west of Scotland, in some parts with Holly, in some places with fair and beautiful firs of 60, 70, 80 feet of good and serviceable timber for masts and raes, in other places are great plenty of excellent great oaks, where may be sawn out planks of 4 sometimes 5 feet broad. All their bounds...adorned with wood even to the brink of the loch for the most part.’ (Pont 1583-96).

That control of these valuable resources was a fundamental concern for Norse communities requiring timber has been highlighted by Crawford in the Firthlands (Crawford 1995; Crawford and Taylor 2003), and most island-based medieval lordships in the west also appear to have maintained control over wooded mainland estates in which many also built castles and churches.

Although the relationship between past processes of deforestation and peat formation is complex, almost all settlements in the North Atlantic contained peat and/or turf resources in the medieval period and many retained these into the late modern period (Edwards *et al.* 2008). In the Scottish North Atlantic late-18<sup>th</sup>-century Statistical accounts emphasis the use of peat as the general domestic fuel across the whole region, even in areas which retained extensive woodland cover (eg. Beith 1836, 129 among many), although many Orkney accounts report that peat resources were being exhausted in many parishes and that some families in the community were burning dung (Bethune 1791-9). Micromorphological midden studies have demonstrated mixed use of peat, turf and/or dung in Iron Age and medieval Orkney (Dickson 1998; Allen 1995) and medieval Iceland (Simpson *et al.* 2003). Wood fuel, however, also appears to been available to all farmsteads within the *Myvatnssveit* area of Iceland (as either scrub or driftwood) even up to the 18<sup>th</sup>-century, and comparative work suggests that access to peat fuel was retained by more elite farmsteads here from the earliest *landnam* period, and had a particular role in higher temperature industrial processes (Simpson *et al.* 2003).

This industrial use of peat contrasts with evidence for wood (particularly birch) charcoal production in southern Iceland in the early and high medieval periods (Church *et al.* 2007), although the possibility that peat may also have been initially pyrolised to peat-charcoal for industrial use in more northern districts was not considered in the published study. Certainly, quite widespread reports of semi-industrial peat-charcoal use are salient in modern Scottish accounts (eg. ‘scorched peat’ in Orkney; Low 1791-99, 331). Returning to Loch Marie, botanically-unidentified wood-charcoal production ‘scoops’ associated with an iron bloomery in this district were carbon-dated to the 15<sup>th</sup>-century, with other evidence suggested a 13<sup>th</sup>-century lower terminus for the site (Johnson *et al.* 2006), whilst oak-charcoal has dominated reports from early medieval Ireland (O’ Sullivan *et al.* 2010, 107). Wood-charcoal production on an industrially large scale is historically documented across Argyll at Lochaweside and Lochetiveside from the 18th century (Sansum 2004, 119-120, Campbell 1984, 33), and in Wester Ross, at LochMarie, from the early 17<sup>th</sup>-century, and evidence is found in the widely reported wood-charcoal platforms from both these areas (see Sansum 2004, 139-141).

Historical and archaeological reports of coal use within the Scottish North Atlantic are generally confined to the late modern period, although preliminary surveys south of the Clyde (outside of the survey area of this thesis) suggest future work may modify this picture.

#### 4.3.2 LIME-BURNING FUELS IN THE NORTH ATLANTIC

Out-with my previous work in the Western Isles (Thacker 2011), there have been no archaeological studies of the types of fuel used to fire historic building limes in Scotland, and archaeometric studies of lime mortars also often do not include relict-fuel within their descriptions. In almost all of the experimental lime burns I have undertaken to investigate past technologies, however, it is the acquisition of fuel which has been the delimiting factor in terms of scale, cost and preparation time. As has been noted above, fuel availability was variously contingent not only on the local physical environment but on historic and social context, and this complexity has various archaeological implications which are reflected in the evidence considered below. The sheer volume and cost of fuel for communities to burn sufficient lime for even the smallest chapel should always be a consideration in building survey of any given period, often underscoring important symbolic associations with land, wealth and status.

#### 4.3.2.1 Historical Evidence for Lime-burning fuels in the North Atlantic

Like all resource use, fuel was an important issue during 18th and 19<sup>th</sup>-century Improvement, and ‘Enlightened’ contributors to the Statistical Accounts often complained that although limestone or shell sources for lime manufacture were locally available, the general population could not afford the fuel to burn it in Glenelg, Ross-shire (Beith 1836, 129), Dornoch, Sutherland (Bethune 1791-9, 5), and Stromness, Orkney (Clouston 1791-9, 456). This 19<sup>th</sup>-century Glenelg account is of particular interest as, although the hills of the parish are described as very well-wooded, the general domestic fuel of the parish is peat, and shells are suggested to be used in place of limestone-lime because peat would not be able to effectively roast the local limestone (Beith 1836, 129). Why wood-fired kilns could not be employed is not reported and, as the reason for lime manufacture is not clear here, it is not certain if the shell in question is being burnt or not. That a functional relationship may exist between peat and shell in lime manufacture, however, is a pertinent question given the lower dissociation temperature and smaller dimensions of shell material, and the common association of biogenic-limes with largely treeless areas of the Atlantic and North Sea regions (see chapters 2 and 3). This is clearly not a simple functional dichotomy, however, as although 17<sup>th</sup> to 20<sup>th</sup>-century accounts of shell-burning ricks in Uist and Galloway were peat-fired (Symson [1684], 42-43, MacIntyre 1993; Thacker 2011; 2012; 2014; 2015), as described above, limestone was also burnt in peat-fired kilns in early 19<sup>th</sup>-century Orkney (Shirreff 1814) and Shetland (Fenton 1997), although in these examples the limestone was often reduced to very small sizes in compensation.

#### 4.3.2.2 Archaeological evidence for lime-burning fuels in the North Atlantic.

Despite extensive on-site searches, my earlier on-site survey of medieval chapels in the Western Isles failed to find any *in-situ* relict mortar-fuel evidence (Thacker 2011, 23), and no other comparative mortar surveys within the North Atlantic appear to have been published. Implicit within Berger’s (1992) radiocarbon project, however, is the suggestion that wood-fired lime mortars are very common in Irish medieval mortared buildings, and that he reported no examples without wood-charcoal (even at *Sceilig Mhichíl*) is remarkable. Again, given the wide distribution of limestone in Ireland a strong wood-limestone relationship may underlie this evidence and, although clearly at least some west-coast mortars are shell-limes (Pavia 2010; see chapter 2), I know of no archaeological evidence for Irish peat-fired lime in the medieval period. A remarkable series of late modern (possibly 19<sup>th</sup>-century) pit kilns in Co. Kerry contained wood charcoal and heated limestone (Cleary *et*

*al.* 2008, 47-49) and, although no archaeobotanical data was reported, it is worth considering how far we might reasonably conflate this evidence with Boate's 17<sup>th</sup>-century description of mixed-feed layered pit-kilns in the same region.

More positively, this thesis research identified wood-charcoal evidence in-situ, in hand sample and in thin section, and characterised a number of these mortar inclusions microscopically in reflected light using standard archaeobotanical procedure and reference material at magnifications up to x400 (Schweingruber 1990, 211; Pearsall 2000).

Recognition of wood-charcoal relicts in thin section is also based on the identification of wood microstructure in various planes, and patterns of porosity, vessel sizes and general morphology can sometimes constrain taxonomies (see Mingary case study below for example).

Peat fuel relicts were also identified in-situ and in thin section and, although in-situ examples were very rarely noted on the surface of mortars, and much more commonly encountered beneath the weathered surface during sampling (see chapter 2). At larger sizes these inclusions are often cubic and fibrous, leave a moist black and heavily carbonised stain on the hand and have a granular mineral texture to the touch. Where the identification of large peat inclusions was certain in hand sample and thick-section (as for example from BalnaBodach, Barra) then thin sections were prepared for comparative reference material. In thin section these inclusions are opaque, dense and generally very amorphously shaped with none of the porosity displayed by wood-charcoal fragments, but can be challenging to interpret where there is a high incidence of other opaque vitreous reaction products within the section. To date, with the possible exception of Borve Castle Benbecula (Thacker in prep.) on-site survey and microscopic evidence for wood, peat and coal fuel-relicts has been mutually exclusive.

All the mortar fuel types noted during this thesis research, including in-situ, hand sample and thin-section evidence is presented in Appendix 4 and discussed further below.

In the South-west Region, fuel evidence was noted in 28 medieval building sites and in all there was evidence for wood charcoal, with peat only noted late in the period at Iona. Wood charcoal is also reasonably common in post medieval building contexts although coal is also present from the 18<sup>th</sup>-century. Medieval wood-fired mortars in this region are associated with

both churches and chapels, in mainland and island locations, and with both limestone-lime and shell-lime mortar provenances.

In the North-West Region, fuel evidence was noted in 16 medieval buildings and of these 11 were interpreted as wood charcoal and 5 were interpreted as peat. Almost all of the medieval wood charcoal evidence is associated with castle buildings on the mainland and Skye, whilst the medieval peat fuel evidence is most strongly associated with the Outer Hebrides and with churches. The medieval wood-charcoal fuel evidence is associated with both shell-limes and limestone-limes.

In the North-East Region, fuel evidence was noted in 14 medieval building contexts only, and of these 8 were interpreted as peat and 5 as wood charcoal. All of the wood-charcoal contexts were associated with the extreme south of the region, whilst the Caithness and the Northern Isles evidence was all associated with evidence interpreted as peat fuel. Wood-charcoal evidence is clearly associated with both limestone-lime and shell-lime mortars, whilst the peat evidence is most strongly associated with biogenic lime mortars.

The greater concentration of *in-situ* fuel evidence in the South-West Region is partly a reflection of the greater density of upstanding accessible medieval masonry sites available to survey, but is also a reflection of the greater resilience of the wood-charcoal evidence on mortar surfaces. Indeed, the resilience of wood-charcoal is such that the mortar will often erode preferentially, so gently exposing the charcoal to closer examination. In contrast, as the lack of evidence from my previous Western Isles study suggested, relict peat fuel appears to degrade before the encasing mortar and so very rarely survives on a weathered mortar surface. Peat fuel evidence was, however, noted in very high concentrations beneath mortar surfaces at the medieval chapel sites of *Eaglais na h'Aoidhe* (Lewis) and *Rubh' an Teampull* (Harris), although it was not noted in either of these buildings before these mortars were cut. I also suspect that, given their physically fragile composition, peat relicts are also often lost in the abrasive cutting process with which sectioning begins, but even where they are successfully retained the variously fibrous or granular textures are often less clear at 30 microns.

*In-situ* relict peat-charcoal was noted in high concentration within the medieval mortars of Borge Castle (Benbecula), and in more recent contexts such as the croft house at 189 BalnaBodach (Barra), but these are very rare valuable exceptions. At the former of these sites this survival may relate to the late modern context, whilst the evidence at Borge

probably once more reflects the coarse unrefined nature of medieval castle mortars. In general there is a much higher density, as well as volume, of fuel evidence within the massive walls of castles than in houses, churches or chapels, suggesting that different lime burning, kiln environments and/or mortar making techniques may have pertained. This fuel evidence is also often paralleled by a higher density of other incidental kiln relicts such as heated limestone, or under-burnt shell inclusions, suggesting a much less refined firing and/or subsequent processing of the material pertained overall. It is possible kiln sizes sometimes struggled to effectively heat the massive volumes required to fill castle walls (which are often over 3.0m thick) and this interpretation may be underscored by the often more refined quality of church and chapel mortars with their thinner walls and often smaller more tightly fitting building stones. In this scenario, the much reduced volume of mortar generally required for later medieval church buildings whose overall dimensions are generally smaller and whose walls average only 0.8m thick, appears to have justified more quality control. Whether this is further evidence that different craftsmen were involved in castle construction is becoming an increasingly salient question, however, and this will be considered below.

That a greater concentration of castle buildings were surveyed in the wood-charcoal dominated South-West Region and Skye, and more churches and chapels in the NER and Outer Hebrides, has therefore also biased this survey data. Both of the biases suggest that a greater density of wood-fired mortars have been successfully identified and that as a consequence the fuel record for the SWR is more complete than in the two northern regions where more buildings are probably bound with peat-fired mortars than has been positively identified *in-situ*. Accepting this also suggests the dichotomy between the wood-fired SWR and the peat-fired NER north of the Firthlands (and Outer Hebrides) is even starker than these results would indicate.

Apparent idiosyncrasies in these results, such as Iona, Ross of Mull, Shiant and Duntulm may underlie evidence which suggests the charcoal fuel evidence is slightly more widely distributed than the environmental evidence for woodland distributions. Moreover, many sites also exhibit evidence for changing fuel materials. The wood-fired dolomite-limes of the medieval castle of *Ard Bhreac*, for instance, contrast with coal-fired material evident in the neighbouring post-medieval Calda House, whilst Iona appears to display evidence for a three

phase development from wood to peat to coal concomitant with changes in other mortar materials.

Although the apparently lower initial dissociation temperatures of biogenic lime-sources reported in chapter 2, and their smaller dimensions, may appear suited to the lower calorific value of many peat fuels, peat-fired examples of both biogenic and geogenic lime-sources were noted including at the high-status church of St Peters Thurso. Likewise examples of wood-fired limestone-lime and shell-limes are extant in these results, although no wood-fired maerl-limes have yet been noted.

Importantly, therefore, given the technical knowledge and inclination, all communities have been able to manufacture lime and no particular kinds of fuels are functionally necessary to convert geogenic or biogenic carbonate materials. That wood-fired mortar appears to be more widely distributed than woodland histories would suggest was available, may indicate that this was the preferred fuel although the possible reasons for that lack of correlation may be complex. No examples of peat-fired mortars were noted in areas of high woodland densities, even where peat was reported to be the general domestic fuel of the district. Certainly, peat formed a hugely significant part of the rural economy in many northern and western districts in medieval and later periods, and was commonly included with rent or service payments to landlords (e.g. 1595 *Rentale Orchadie*; Peterkin 1820).

Given the challenges to dating many medieval buildings in the Scottish North Atlantic, the high density of visible wood charcoal evidence within the castle buildings of the SWR and Skye may impart a particular significance to these materials which clearly requires further investigation. The preliminary rapid survey programme drew attention to the high concentrations of charcoal inclusions and heated limestone relicts within the mortars of the medieval castles of Fincharn (mid Argyll) (Thacker 2015f) and Mingary (Ardnamurchan) (Thacker 2015g), and so together with the ecclesiastical complex on Iona these are presented below as South-West Region case study sites.

#### 4.4 CASE STUDY - FINCHARN CASTLE, ARGYLL.

Castle Fincharn occupies the summit of a small promontory protruding from the southern shore of the large long freshwater loch of Loch Awe in mid Argyll (Thacker forthcoming). This position allows extensive views across the loch in all directions as well as inland to the

enclosed fields of the surrounding farm to the woodland plantations and rough grazing of the high hills beyond.

Approximately 1,000m to the west-south-west of the castle site is a burial ground containing the upstanding remains of the former parish church of Kilneuair, and both castle and church buildings are in a state of ruination which allows a very comprehensive investigation of constructional techniques. Fuller details of this investigation are presented in Appendix 13, but this section will briefly summarise the study and discuss the results further.

#### 4.4.1 BUILDING SURVEY

The surviving remains of Castle Fincham indicate this has been a small rectangular lime-bonded masonry building with a smaller enclosed level area surrounding the ground-floor entrance in the north end wall. Major episodes of collapse have reduced some wall sections to ground level, but elsewhere large sections of upstanding masonry survive to two full storeys and include a small ground-floor slit window, numerous first-floor joist sockets and the remains of a number of wider splayed arch-headed windows on the first storey. This mixture of coherent survival and complete collapse has revealed large volumes of core rubble and full wall cross-sections, thus enabling the mortar and stone-emplacement materials and techniques to be investigated very thoroughly. This evidence suggested the surviving fabric was essentially single phase.

The lime mortar of this building is consistent and contiguous in core, bed and coating contexts and displays a remarkably high concentration of kiln relicts including large heated limestone clasts with core/rim textural contrasts up to 60mm diameter, and cubic sections of wood charcoal relicts up to 30mm across. The stone emplacement technique is also consistent and quite formal, with large (sometimes edge-laid) meta-mafic blocks, pinned and levelled with smaller stones of mixed lithologies in regular level course heights of between 400-450mm (which pass right through both faces and the core of each wall). The west wall of the building has been built upon a levelling plinth, but no evidence of hammer-dressing or quarrying was noted in this stonework, and the very rounded arrises suggest the material has been sourced from superficial contexts, rather than quarried bedrock. Quoining is accomplished by a combination of techniques including the use of finely-dressed sandstone within the first-floor slit-window.

In contrast, the nearby ruined church of Kilneuair displayed two clear phases of remarkably contrasting masonry styles, although the primary phase to the east is clearly the most formal and, like the castle, is regularly coursed with large often edge-laid blocks surrounded by pinnings in course heights of 400-450mm. Within the east wall survives the south jamb of a tall window which is located so far to the south that a twin-lancet arrangement must be suspected, and in the south wall is a trefoil-headed piscine. Both are dressed from a coarse, red probably felsic stone with diagonal tool-marks, and the walls are bound with a coarse yellow-coloured limestone-lime mortar which also contains a high concentration of limekiln-relicts. The probable twin-lancet form of the east window suggests the church had probably been constructed in the mid-13<sup>th</sup>-century, and that is not unsupported by the form of the (primary) piscine.

The striking similarities in the masonry styles of these two buildings also suggested they might be closely related but at the time of survey the chronology of the castle could not be so easily independently interpreted from its architectural form. This two-storey rectangular building with ground-floor slit-windows and wider arch-headed first floor windows had been described as a ‘hall-house’ by the RCAHMS (1992), but a number of possible dates had been suggested by previous commentators, which ranged from the 13<sup>th</sup> to the 16<sup>th</sup>-century (see below; Thacker forthcoming). However, given the apparently simple single phase archaeology of the surviving mortar and masonry and the high concentration of visible wood-charcoal kiln-relicts in deep core contexts, this building appeared to offer good potential for a radiocarbon dating programme. Moreover, as research continued it soon became apparent this site was also associated with an unusually large volume of documentary evidence, and that an integrated mortar archaeological study could place the castle building at the centre of a much more comprehensive multidisciplinary study.

Therefore, with the goodwill of the owner, scheduled monument consent was approved for the removal of mortar samples from the castle building, and in the meantime the wider site was subject to walkover survey.

#### 4.4.2 ENVIRONMENT SURVEY

To inform the study’s investigation of possible limestone sources, British Geological Society collated information regarding interpretations of the bedrock and surface geology of the area

were studied through Edina Digimap (appendix 13) and two possible sources of metalimestone identified locally within a wider geology dominated by metamorphosed lava formations (see Borradaile 1970; Gower 1977). ‘Shira’ limestone is reported within the region’s Ardrishaig Phylites, and can be seen outcropping in quarries above the western shore of Loch Phearsain (Borradaile 1977), whilst ‘Tayvallich’ limestone is much more widely distributed and is reported much closer to our site. This very local metalimestone outcrop was therefore plotted onto the local Ordnance Survey First Edition Six inch to the mile map of the site (O.S. 1875a), and a walkover of the area was made starting from the farm at Fincharn. In fact, identifying the outcrop within the swarm of dykes was made much easier by the discovery of a previously unrecorded lime kiln, and so the kiln, quarry and coarse quartz-included limestone outcrop were described and loose samples collected. Locating possible local aggregate sources was more problematic as the mortar appeared to contain low volumes of rounded lithic materials but only insignificant volumes were available the loch and nearby river. This may explain the apparently low temper volumes within the castle mortar, and samples were collected from both contexts.

Within a locality largely dominated by grazing and softwood plantations, wider exploration drew attention to a conspicuous area of naturally regenerating woodland along the south-east bank of Loch Awe, just north and east from the castle site. A 2.8km section of this lochside woodland was then subject to walkover survey, during which all recognised tree taxa, their relative concentrations, and habits were noted, and from this study a woodland of very particular morphology emerged. This is mainly composed of standards of variously mature ash trees with minor populations of oak, and an underwood dominated by hazel with some localised concentrations of birch. It was, however, the habit of these plants which was most salient as whilst the ash displayed single tall straight trunks, of up to 800m diameter, the hazel population exhibited a shrub habit with large bunches of up to 50 multiple stems, each of which emerged from below ground. This is a natural (rather than anthropogenic) ‘self-coppice’ habit (cf. Rackham 1983, 495; cf. Coppins and Coppins 2010) which here included stems of a range of sizes up to 75mm diameter, and whose lichen encrusted bark suggested were also of a range of ages although there was very little standing dead wood. The possible significance of this description will be discussed below.

#### 4.4.3 DOCUMENTARY AND CARTOGRAPHIC EVIDENCE FOR CASTLE FINCHARN

The documentary evidence relating to Fincharn begins with Argyll’s earliest surviving royal charter in which:

'Alexander [II], King' of Scots, grants to Gillascop mac Gilcrist, for his homage and service in Argyll, the five penny lands of Fyncharne except the half penny land held by his brother Ewen, called Cragenywyr, the five penny lands of Glennane except the penny land called Penig Corthen held by the foresaid Ewen, and the other lands therein mentioned.' (MacPhail 1916, 114-5).

It is important to note here, however, that this document is a feudal land charter which does not refer to any buildings at all. Moreover, most later medieval documents associated with this district refer to a lordship and castle of 'Glassary' (or various spellings thereof) only, and the identity of this building has been contested. The earliest reference appears to be a 1297 memorandum from Alexander of the Isles which contends that a '...certain castle and barony by the name of Glasrog...' was held by the Stewarts (Stevenson 1870, 191), and although both Macphail (1916, 149) and RCAHMS (1992, 286) doubt this is referring to Glassary the association is accepted by a number of scholars (e.g. Barrow and Royan 1985, 168; Ewart and Baker 1998, 998). Otherwise, the first widely accepted reference to a castle in Glassary is contained within a Robert II charter of 1374 to 'Gilbert de Glascestre', confirming that his daughter Agnes and son in-law Alexander Scrymgeour would inherit the '...terras de Gascestre et castrum...' (MacPhail 1916, 148-9). Whether this is a reference to Fincharn or to another castle in this period is not known, however, as no documents explicitly identifying a building at Fincharn emerge until 1563 by which time an inquest into John Scrymgeour's effects declared '...the lands of the lordship and barony of Glasre...with the messuage or manor place of the said lordship named Nether Fincharn...' (*ibid*, 206; RCAHMS 1992).

This last reference would, on paper at least, appear categorical, but how far this 16<sup>th</sup>-century retour associating of Fincharn with Glassary holds true for earlier centuries requires more clarity. Indeed, further doubt around this association even emerges later in this same century, as in describing the geography of Glassary and that of neighbouring lordships and parishes the map-maker Timothy Pont identifies the "...castell in Glassrie [as] called Duntreoir...", a name subsequently translated within the text margin as 'Duntruynne' (1583-96, 83). At first sight this identification of Duntruynne Castle with Glassary (when this building clearly lies within the neighbouring lordship of Ardscothenish) would appear to be an obvious mistake by Pont in contradiction of the recent 1563 retour highlighted above, but further investigation is instructive. Although the RCAHMS (1992, 285) state that Fincharn Castle does not appear

on Pont's maps, this is not certain. Fortunately, the southern tip of Loch Awe and Glassary are covered in two overlapping sections of Pont's manuscripts (NLS maps Pont 14 and 15) and within Pont 14 a significant building on the south shores of Loch Awe, west of the settlements of Fincharn Mor and Beag, is clearly drawn. This does not appear to be one of Johnson's later additions to the document and clearly depicts a two storey building with an arched opening (see appendix 13). Although slightly inaccurately positioned I know of no other archaeological or historical contexts for this structure and suggest this may be tentatively identified as Fincharn Castle (as indeed has been suggested by James (2009, 136) although without further discussion). There is a smudged feature in the map manuscript right above this building, but we should also question why no roof structure has been drawn here. This is a missing feature which clearly contrasts with Pont's depictions of the other Loch Awe castles of ArdChonnell and Kilchurn from the same manuscript (Pont 14), both of which (unlike Fincharn) have clearly surviving 16<sup>th</sup>-century phases (RCAHMS 1992).

That Fincharn Castle is not redrawn on the overlapping section of Pont's map 15 (of Mid Argyll north of the Crinan Canal), may suggest further confusion around the building's status, but his identification of Duntrune as the castle of Castle of Glassary in 1583-96 may in fact better describe the reality on the ground in this period as (although once more cartographically apparently misplaced) in the text of the same document Pont (1583-96, 83) also describes Kilmichael (not Kilneuair) as the Parish church of Glassary. It is well known that at some unknown time around the Reformation the parish of Glassary was translated from the church of Kilneuair and, although the reasons for such a move have not previously been clearly understood (Innes 1854, 43), Kilmichael is situated more centrally in the south of the parish and is only a few miles east of the castle of Duntrune.

That the 1563 retour confirming Fincharn (as the manor of Glassary) to the Scrymgeour family also included '...the patronage of the Rectory and Vicarage of the Church of Killeneure' (Macphail 1916, 206), however, certainly allows a lower terminus for the translation of the church and possibly also a lower terminus for the ruination of Castle Fincharn. It is suggested here that Pont's maps, depictions and descriptions may also allow an upper terminus for both these events, and if this is accepted then it follows that the centre of the lordship, both church and castle, have been translated at sometime between 1563 and 1593.

Although now clearly labelled, by 1747-55 Castle Fincham is suggestively depicted on the Roy Map as a simple open square, again with no roof, and by the mid-19th century the ruination of Fincham Castle by arson had already passed into parish folklore at some distant unspecified date (Campbell 1844, 683). The final ruination of the castle by fire in the 16<sup>th</sup>-century, may provide a context for Pont's depiction of a roofless building (with an emerging smudge). The oral tradition that this was arson perpetrated against the lord by one of his angry vassals (*ibid*) is supported somewhat by a 1501 document in which James and John Scrymgeour (respectively rector and patron of the parish church of Kilneuir) petitioned the pope to excommunicate certain 'wild men' who at that time lived:

'even within the limits of this parish... especially at the side of the mountain of Lathyrewern', at the castle of Fynchaers and the lake of Lochquho, at the ford of the rivulet of Anygray...[and elsewhere and who] habitually carry out many homicides, thefts, robberies, burnings, oppressions, vulgarly called *lesornyng*, and other similar evils which it is impossible to prevent by judge or power...' (Fuller 1994, no. 493; Boardman 2006).

That this plea against oppression was petitioned by the Scrymgeours themselves suggests that in 1501 Castle Fincham was no longer held in any meaningful way by the titled lords of the manor and so the retour of 1563, the first documentary reference to Castle Fincham as the Scrymgeours lordly caput within the barony of Glassary, may (on the eve of the castle's ruination) evidence another truth entirely.

#### 4.4.4 DOCUMENTARY, CARTOGRAPHIC & PALYNOLOGICAL WOODLAND EVIDENCE

These complex and developing interrelationships between the documentary, cartographic and archaeological evidence for medieval lordship at this site can also be explored in the wider environment. Examination of the maps available for this area of Loch Awe indicate that within a largely treeless post-medieval environment there is a small unenclosed woodland reasonably close to Fincham, north-east of the castle site along the lochside. This woodland is consistently depicted on the 19<sup>th</sup>-century first edition Ordnance Survey (O.S. 1875a), Roy (1747-55) and Pont [1583-96] maps and corresponds to the same area around Rubha Cuilinn and Ardary recorded during walkover survey above.

Although sometimes apparently depicted as broadleaf, these maps do not allow a reliable indication of which trees were available or how they managed during this period, or in the

medieval centuries with which this thesis is primarily concerned. However, the mid-19th century Statistical Account for Glassary reports that although the parish ‘cannot by any means be said to be wooded... There is also a considerable portion of natural wood, as Oak, hazel, birch &c., along Lochaweside’ (Campbell 1844, 681). That ‘natural wood’ in this 19th century context usually implies naturally re-generating anthropogenic coppice, rather than ancient natural woodland, has been suggested by Sansum (2004, 129), although we may need to modify this definition slightly below.

Unusually, at Fincham, we can tentatively push this post-medieval documentary evidence back into the late medieval period as the 1501 Scrymgeour petition to the pope, already noted above, describes Kilneuair as being in ‘...quite *a wooded place* near the sea shore...’ (Fuller 1994, no. 493; my italics). That a slightly dubious geographical description and estimation of the local tree density should be offered in a petition seeking the excommunication of the current ‘wild’ residents of Castle Fincham is curious and suggests we should treat this apparently incidental reference carefully. But if the locality could at that time reasonably be described as a ‘wooded place’, then by late medieval standards this probably indicates quite extensive tree coverage, and is a description in direct contrast with the late modern evidence discussed above.

To investigate the woodland history around Fincham before this late medieval map and documentary evidence, however, we must return to the physical evidence which survives in the Argyll landscape today (cf. Newman *et al.* 2007), and to an important palynological study undertaken in Upper Loch Awe (Sansum 2004). This study suggested the pollen record of the upper loch should be divided into two main zones, including: 880 – 1240 AD where a generally ‘open woodland...of Oak, Alder and Hazel...[with an]... influx of birch ...[peaking in the 12th century]...mediated by grazing is described (Sansum 2004, 214); and 1240-1590AD where ‘pollen accumulation rates are appreciably lower... signify[ing] a long period when the woodland on the site became more open than that represented in the previous zone...and wetter’ (*ibid.*, 219). Sansum’s thesis subsequently drew most attention to later very radical anthropogenic impacts on local woodland populations, which the pollen stratigraphy suggested occurred in the woodlands of northern Loch Awe in the late 1500’s. It is important to recognise that this later medieval/early modern event now also appears to coincide with the translation of the Glassary lordship, but it is also clear that (at least in Upper Loch Awe) there were significant environmental changes in the high medieval period.

#### 4.4.5 MATERIALS SAMPLING AND ANALYSIS

With scheduled monument consent a total of fifteen fixed samples, including both fuel-relict and mortar fragments, were removed from deep wall-core contexts within all four walls and from both storeys of the castle ruin. A number of loose samples were added to this assemblage; including two limestone samples collected from different lithostratigraphic contexts within the locality, a heated limestone sample from the nearby modern kiln, and sand and gravel samples from the river and lochside.

The bound mortar materials were thick and thin sectioned in line with the methodologies outlined in chapter 2, for comparative analysis between each other and with the environmental materials. The details of these analyses are presented in appendix 13, but in summary petrographic analysis confirmed that the local Tayvallich limestone (rather than Shira) had been roasted to manufacture the lime, and the heated relicts displayed excellent concentric core-rim textural contrasts which will be discussed further below. That the limekiln had been wood-fired was also confirmed through recognition of diffuse porous charcoal fragments in thin section, whilst the resultant lime appears to have been tempered with subrounded gravels from the lochside. All of these analyses supported the on-site interpretation that the building was generally single phase and no contrasting materials were noted.

Twelve samples of relict-fuel were examined microscopically in reflected light by myself and Dr Mike Cressey (CFA Archaeology, Edinburgh), and the assemblage interpreted as 9 *Corylus* (Hazel), 2 *Quercus* (Oak), and 1 *Betula* (Birch). Furthermore, of the 12 samples: 3 were interpreted as heartwood of indeterminate morphologies (which included both *Quercus* samples), whilst six were interpreted as roundwood with variously high levels of curvature, including one of which was considered likely to be less than 10 years old. Five of these fuel-relict samples were selected for radiocarbon analysis based on criteria of short-lived taxa, roundwood morphologies, and widely distributed core building contexts.

Importantly, the results of these analyses returned uncalibrated radiocarbon ages within a very narrow range (between 744 and 808BP +/-36) and, according to both Chauvenet criteria (Long and Rippeteau 1974) and chi-square test (Shennan 1988, 104-126), it is therefore very

likely that this wood died in a single event. This interpretation of the data is significant for two main reasons:

- Firstly, this narrow range supports the above on-site and materials analysis interpretations which had suggested the castle remains were generally single phase;
- and secondly, this narrow range allows the dates of the whole assemblage to be statistically combined to suggest a likely calibrated date with increased accuracy and reduced error.

Indeed, combining the radiocarbon ages of the relict mortar fuel assemblage from Fincham Castle returned a very accurate and narrowly calibrated combined date of 1219-1269cal.AD at 95.4% probability.

#### 4.4.6 CONCLUDING DISCUSSION - A C13<sup>th</sup> BUILDINGS ENVIRONMENT STUDY.

1219-1269cal.AD is a very reasonable lower terminus for the surviving castle's construction: archaeologically (as the dates were within such a narrow range); architecturally (given close comparison with other early-mid 13<sup>th</sup>-century 2-storey masonry buildings; see chapter 6); and historically (given the 1240 royal charter). We should remind ourselves, however, that although some commentators had simply accepted this charter as evidence for the construction date of the ruined castle structure (Campbell, M. 1984, 33; RCAHMS 1992, 285; James 2009, 250), others had suggested the building was c.1300 (Historic Scotland 1971) whilst some insisted this 'must be a later castle' and that the ruins at nearby *Caol Chaorunn* are more suggestive of this early charter date (Campbell and Sandeman 1962, 86-87). Indeed, Coventry (1997, 179) describes Fincham as 'a strong but ruined 16<sup>th</sup>-century tower house and courtyard'.

As the first directly dated castle in Scotland a number of issues relating to this building can be discussed in greater depth and with greater assurance. The first concern was to investigate any possible relationship between the castle and a church building, already suggested to date to the mid-13<sup>th</sup>-century on architectural grounds, and which masonry survey suggested was constructed with very similar rubble masonry and mortar techniques. The masonry style at Fincham Castle had been described elsewhere as 'of early west Highland type' (Millar and Kirkhope 1964, 9), and clearly an early 13<sup>th</sup>-century lower terminus suggests castle and church were built in the same broad period.

The 1219 lower terminus for the castle's construction indicated by the radiocarbon dated mortar fuel correlates very nicely with the 1240 land charter. That the castle is not mentioned in the charter suggests 1240 is a reasonable historical lower terminus and that the lower end of the radiocarbon range is probably not appropriate. A mean date within the range of 1244, however, correlates with the charter date very well, and on balance the evidence may suggest the document is effectively a foundation charter and that the castle was then constructed shortly afterwards. The challenge then is to demonstrate how soon afterwards.

It has been suggested that the 1293 list of lordships included within the Sherriffdom of Lorn are co-extensive with their associated parishes (Boardman 2006, 12; University of St Andrews 2007-13), effectively therefore providing an historical upper terminus for the formation of both administrative units. The evidence for this process will be discussed much more fully in chapter 6 but it is the curiously northern location of these buildings within the parish which is salient here. Indeed, I would argue that since both castle and church were owned, patronized and served by the Scrymgeours in the later medieval period (and we can be sure that Kilneuir was the parish church; Innes 1854, 43), that this location, the proximity of the castle to it, and the apparently remarkably conjoined biographies of the buildings are most persuasive in indicating that Castle Fincham is indeed the 'castle of Glasrog' referred to by Alexander of the Isles in 1297 (Stevenson 1870). This interpretation is supported by the radiocarbon data, but also by the evidence discussed above which suggests that, although located at the northern tip of the parish and lordship, the physical and political link between castle and church was so strong that it persisted throughout the whole medieval period. Only when Castle Fincham was finally ruined in the 16<sup>th</sup>-century was the parish church translated to the more geographically convenient Kilmichael. Importantly, this allows a 1297 documentary upper terminus for the surviving fabric and a 1240 lower.

Returning to the mortar archaeology, the environment surveys undertaken during this Fincham case study investigated possible links between the woodland evidence and the standing building, and a number of aspects may be highlighted. The evidence for level courses running through the castle walls suggests all four walls of the building were constructed to the same height, and so the sample contexts are chronologically associated more by height than by aspect. The range of context heights, however, is still sufficient to be representative of the mid-way point in the build. The sampled assemblage suggests the kiln fuel was almost completely dominated by roundwood hazel. Although no bark was noted

within the relict assemblage (cf. Church *et al.* 2007b) (and we might question how often bark would survive post-kiln processes of slaking, mixing and deposition anyway), no post-mortem degradation such as bore holes (which might indicate the wood collected a long time after death) were noted either. Remarkably, elsewhere, subterranean hazel stools have been estimated to live up to 1,000 years, and so it is possible some of the local specimens examined during this survey were alive when Castle Fincharn was built. Pragmatically, however, it is probably more significant that the thin multi-stemmed hazel morphology within the local woodland matches the morphology of the relict-fuel assemblage, so suggesting that the fuel for the limekiln was harvested from similar ‘self-coppiced’ shrubs (cf. Rackham 1983, 495; cf. Coppins and Coppins 2010). The range of stem sizes and ages springing from individual plants noted during woodland survey represents a stem life-cycle which elsewhere has been estimated to be 30 to 50 years (Rackham 2003, 209) and such ephemerality is extremely useful for interpreting radiocarbon results. Indeed, hazel could be described as the perfect mortar fuel for radiocarbon dating buildings.

The origins of this extremely northern locus to the lordship are probably geo-historical. The Ford area of southwest Loch Awe would always have been a physical crossroads where the land and water routes down Loch Awe met the north-south routeway between Kintyre and Lorn, but Meredith Lobay (2009, 53) also speculates that this southern tip of Loch Awe may have marked the boundary between two septs of the cenél Loairn much earlier in the medieval period. That this suggestion may be supported by later evidence, however, was not discussed and is of significance here.

According to a much later Campbell account, by the later 12th century ‘a great man called Swineruo... was Thane of Knapdaill and Glassrie’ (Macphail 1916a: 82), and, following Sellars (1971) reasoning, Gillespie, Ewan, GilPatrick and (possibly) Dovenaldus MacGillechrist, are nephews who follow a generation later. This description of Suibhne as a ‘Thane’ is common in later clan genealogies and may be a later archaism of little meaning (Steve Boardman pers. Comm), but this does not negate the probability that Sween’s lordship did extend from below Tarbert (Loch Fyne) to Loch Awe, and so was in effect co-extensive with a similarly geographically constrained Dalradian sept. We need to be careful here of a tautology which follows the Campbell MacIver retrospective logic, but this territory does describe the lands occupied in the 13<sup>th</sup>-century by the MacSween, MacFerchar, and especially MacGillechrist cousins who are much more visible in contemporary records

by that time, and suggests this probably does represent a division of the larger 12<sup>th</sup>-century lordship.

Following this line of reasoning to its logical conclusion, it is therefore possible to tentatively suggest that Sween's lordship, as inherited from Dun Sleibhe, was a fossilization of the southernmost Dalradian sept of the cenél Loairn, and that into the 13<sup>th</sup>-century that *tuath* was divided into the MacGillechrist lordships of Knapdale, Ardscofnish and Glassary. This suggestion may also be supported by Dugald MacSween's 1263 grant of lands in Knapdale, Kintyre and Cowal to the Earl of Monteith (McDonald 1997, 143), as this appears to include the whole lordship except the MacGillechrist lordships of Glassary and Ardscofnish.

According to the list of lords within Balliol's 1293 Sheriffdom Act, however, by this late 13<sup>th</sup>-century period the MacGillechrists had lost Glassary (which now belonged to Ralph de Dundee) and although John MacGillechrist was still lord of Ardscofnish (University of St Andrews 2007-13) by 1346 he too was forfeit by the crown and his lands granted to 'Gilbert of Glasserie' (Macphail 1916, 118). As MacPhail indicated some time ago, this appears to suggest that, after 150 years, the former lands ('sub-tuath?') of Gilchrist himself was once more in the control of a single lord (*ibid*).

It does therefore seem likely that the deeply rooted Dun Sleibhe genealogy discussed by Sellar (1971) had been tamed by King Alexander's power into accepting their lands as feudal inferiors from the crown by the mid 13<sup>th</sup>-century, only to completely lose them all some 100 years later. At Fincharn, Gillespie MacGillechrist, perhaps like Sween before him, was caught between two much larger kingdoms; with Scotland to the east and Clan Sorley to the west. He was clearly a man of some education who was well capable of commissioning a very sophisticated twin-light masonry church and one of the earliest masonry castles in Scotland, but his negotiation with the crown's interest does not appear to have enabled his kindred to resist the movement of larger forces and ultimately their ancient 'celtic' lordship was lost. In this way the castles of Sween, Fincharn, Tarbert and Duntrune may represent a last brief masonry glimpse of this genealogy before they were snuffed out.

As an integral mechanism of their lordships, Gillespie and his cousins had also managed huge and largely wooded Argyll landholdings, as the 1240 Fincharn Charter states, "In bosco

et plano” (Macphail 1916:122). Although this was a standardized phrase, it is remarkable that Sansum’s (2004; 2005) thesis on the woodland ecology of Upper Loch Awe also hinges around this very same mid-13<sup>th</sup>-century (1240) date. Indeed, just when Fincham and Kilneuir and probably also the neighbouring castles and churches of Ardchnonnel, Fraoch Eilean and Inishail were being built:

‘there is decline, under stress, of tree cover...[involving]... elements of climate, grazing and depletion of the wood resource by an expanding human population’(Sansum 2004, 233).

Hazel will not thrive in shade and that the morphology of the mortar charcoal matches that in the surviving woodland does not necessarily indicate that taller standards were present in the 13<sup>th</sup>-century (*ibid.*). But it is suggestive. In discussion of the evidence from the excavation of nearby Castle Carrick, where structural timbers were exclusively made from oak, ash and pine, Crone speculated that ash might no longer be a component of the local woodland there because this taxa had been locally overexploited (1998, 981). This structural assemblage, however, also appears to prefigure 16<sup>th</sup>-century Baron court records forbidding the cutting of oak, ash and pine elsewhere in Argyll (see Watson 1997), and this probably also reflects the increasing importance of these taxa for the supply of structural timber. In the absence of excavation at Fincham and mortar archaeology at Carrick it is worth asking how reasonably we might conflate these two sites to suggest how the local woodland resources were being managed in the 13<sup>th</sup>-14<sup>th</sup>-centuries, with underwood and/or shrubs for fuel and standard trees for structure. Unlike Upper Loch Awe or Loch Goil, however, ash is much more likely to be better represented on the calcareous soils around Fincham (cf. McVean 1964) and such strong straight timber may have been a valuable exchange commodity (cf. Shackleton and Prins 1992).

It is no coincidence, however, that the woodlands of Upper loch Awe began to shrink from the mid-13<sup>th</sup>-century as the castles began to rise and the weather began to cool across the North Atlantic - living conditions were about to get much worse. A quickly deteriorating climate and political changes on a much larger scale highlight that although Gillescop MacGillechrist was a very powerful man within this mid-Argyll region, these were larger forces apparently out-with his control (Oram and Adderley 2008; Oram 2014; Oram forthcoming).

#### 4.5 CASE STUDY MINGARY CASTLE, ARDNAMURCHAN

The second case study from the South-West region presented here discusses the castle of Mingary, which is located at the most westerly point of mainland Scotland on the south coast of the Ardnamurchan peninsula (see appendix 14). Mingary Castle was the most comprehensively sampled site included within this thesis research, and where the single phase simplicity of Castle Finchain was a useful place to begin to explore the archaeological potential of relict mortar-fuel, this case study will re-introduce some complexity.

##### 4.5.1 BUILDING SURVEY

There is no documentation relating to Mingary until 1495 (Oram 2012), but the primary phase is usually dated to the 13<sup>th</sup>-century on the architectural style of dressed sandstone windows located within the curtain wall and a polygonal plan-form which may be compared to other buildings which also have no documentation (RCAHMS 1980). The first site visit to the building for this thesis research was undertaken during the programme of rapid building surveys, and the potential for mortar archaeology both here and in the neighbouring parish church of St Comgan's was immediately apparent in the contrasting shell- and limestone-rich phases visible in both buildings. In interim these materials were immediately interpreted as representing probable shell-lime and limestone-lime provenances.

I subsequently undertook a much more comprehensive mortar survey of Mingary castle as part of a wider (pre-conservation/renovation) excavation and survey project directed by Addyman Archaeology. Access to almost all areas of the castle was enabled by a full scaffold, and the unconsolidated fabric of the building was often visible in very deep core contexts. This was an amazing archaeological resource (about to be lost to conservation), and by the end of the on-site survey at least nineteen different mortared phases had been characterised at the castle site alone and over 50 mortar samples had been removed for further lab-based analysis. There is no space here to discuss that investigation in full, and much more detail is presented in appendix 14, but within that complexity the main phases of masonry construction were associated with very recognisable mortars. These included:

- A primary curtain wall which was bound with a very consistent, fine lithic-tempered wood-fired limestone-lime, with very little or no shell content.
- A secondary North Hall range which was bound with a bright white wood-fired shell-lime which a high concentration of heated *O. edulis* kiln relicts.

- A 16<sup>th</sup>-century bartizaned parapet which overlay the primary curtain in the south and south-east, and was bound with a distinctive coarse limestone-lime, with a high concentration of heated limestone relicts and a mixed lithic/shell temper.
- Various east and west internal ranges, which were multiphase, but appeared to display similar very finely textured green-coloured limestone-lime mortar materials.

Whilst these main phases were therefore clearly distinct from one another, as at St Peters Thurso (see chapter 3) most of the secondary structures had a direct relationship with the primary curtain wall only, and most were considered to belong to the same broad very late medieval or early modern period (Addyman and Oram 2012, 5.4.1). That these features were bound by contrasting shell- and/or limestone-rich lime mortars, however, clearly suggested multi-periodicity and it was hoped further interrelationships between contexts might be clarified by comparative microscopic characterisation.

In contrast, the mortar stratigraphy at St. Comgan's Church could be more simply interpreted as consisting of a shell-rich mortar bound primary phase (surviving mostly within the east and west walls) which had been overbuilt by limestone-lime bound masonry in the post-Reformation period. Interestingly here, however, a window associated with the underlying phase is of transitional 12<sup>th</sup>-13<sup>th</sup>-century character (RCAHMS 1980, 143), and yet this shell-rich mortar-bound masonry is very different to the limestone-lime bound masonry of the castle's primary curtain wall.

#### 4.5.2 ENVIRONMENTAL SURVEY

In previous discussion of west Highland castles, much has been made of the geographical location of Mingary Castle and its position overlooking the entrance to the sound of Mull is often interpreted in strategic terms associated with surveillance. An appreciation of the physical environment in which Mingary and St Comgan's are located, however, is very important to understanding these sites and their constructional history for quite different reasons.

Like Mull, Morvern and large parts of Skye, the Ardnamurchan peninsula is generally dominated by mafic lavas of the same North Atlantic igneous series which form an arc from north-east Ireland and Arran, across the Inner Hebrides, Faeroes, Iceland and onto Greenland (Richey *et al.* 1961, 42). As introduced in discussion of Duntulm Castle (see chapter 2), however, these flows have also protected a series of earlier underlying sedimentary

Mesozoic strata which now outcrop in a number of discrete contexts from Skye to south-eastern Mull and possibly Islay (*ibid*, 20; Hesselbo *et al.* 1998), and locating these outcrops is very important for our understanding of medieval buildings in the Sound of Mull. Part of this sedimentary series outcrops in south-west Ardnamurchan at Mingary/Kilchoan, and the calcareous geologies of the area (and neighbouring Swordle), together with a number of post-medieval lime kilns, have been plotted onto the 19<sup>th</sup>-century first edition Ordnance Survey maps (O.S.1875b; 1875c; see appendix 14).

With reference to this plotted map, it is salient that in south Ardnamurchan the largest Broadford/Pabbay calcareous outcrop underlies the arable crofts at Ormsaigmore/Ormsaigbeg very close to St Comgan's church and, although less extensive, a number of different Jurassic strata (including some altered by contact metamorphism; Agrell 1965) are also a significant feature of the underlying geology around Mingary Castle. These limestones are a very obvious feature of the shoreline immediately east of Mingary Castle and the RCAHMS (1980, 209) identified some evidence for quarrying within these outcrops and speculated that this was to provide building lime for the castle's construction at some period. That the Sound of Mull castles of Mingary, Ardtornish and to some extent Duart are located on or very close to these same rare Mesozoic outcrops is no coincidence.

As is often the case, a survey of the shoreline to both sides of the castle revealed literal cells with remarkably distinct and contrasting shell-rich or lithic-rich aggregate arrays and some of these were sampled for later comparison with the castle mortars. This shoreline is very exposed, however, and no shallow sandy littoral environments suitable for living *O. edulis* or *C. edule* communities or deposition of post mortem shells was noted, which might have supplied the shell-lime phases of the castle.

Consideration of the multiple phases of wood-fired mortars within this large castle building also highlights that today western Ardnamurchan is largely treeless, and a similar environment is evident in late 19<sup>th</sup>-century Ordnance Survey maps (1875b; 1875c). Moreover, this depiction is supported by the mid-19<sup>th</sup>-century statistical account for the large Post-Reformation parish of Ardnamurchan in which, except for the 'woods of oak, birch and hazel [in] the south...' beyond the low hills towards Loch Sunart, the peninsula is generally described as having 'little wood' (Clerk 1838, 118-119). There is also no woodland shown in Ardnamurchan on either the Blaeu or Roy maps of the 17<sup>th</sup> and 18<sup>th</sup>-centuries, although these depictions cannot be used as a reliable guide as even Moidart, an area which has been considered as one of 'few localities in the Highlands which contain such an extensive area of

native broadleaved woodland that has not been disturbed by development’ (Cheape 1993), is also largely treeless here.

However, whilst Ardnamurchan is always likely to have had a different vegetational history to the more sheltered environment of Moidart, in their seminal reconstruction of Holocene pre-clearance Scottish woodland MacVean and Ratcliffe (1962) did suggest that Ardnamurchan is likely to have been an area of almost continuous birch dominated woodland, and that the south coast, in particular, is likely to have been covered with continuous oak/birch or ash/birch woodland, depending on soil type. In some respects this interpretation may be supported by the mid-19<sup>th</sup>-century account above which describes a woodland community of mixed oak and birch on the south of the peninsula (Clerk 1838), whilst a palynological study undertaken at nearby Claish Moss suggested that mixed oak forest had developed early in the wider Ardnamurchan area, and both oak and birch pollen were persistent throughout the stratigraphy of their study (Moore 1977).

Unlike Cheape’s description of neighbouring Moidart, therefore, the evidence noted above suggests the woodland history of Ardnamurchan has undergone major changes in some late Holocene period and this may apply most particularly to the south coast. Examining the current landscape for possible evidence of that history, however, draws attention to the relatively extensive woodland at *Camas na Cloiche Mòire*, *Camas Choire Mhuilinn* and *Allt Choire Mhuilinn*, still surviving on the west facing slopes of Ben Hiant (approximately one mile from Mingary Castle) and clearly depicted on the 19<sup>th</sup>-century Ordnance survey map (1875d). That this may be a ‘semi-natural’ relict of a more extensive south Ardnamurchan Oak/birch or Ash/birch woodland was also suggested by MacVean and Ratcliffe (1962), and so the area was identified as requiring further survey.

#### 4.5.3 MATERIALS SAMPLING AND ANALYSIS

Given the comprehensive scale of the sampling and lab-based analysis strategy adopted for Mingary Castle there is no space here for detailed consideration of each sample, and for this the reader is directed to the full report appended to this thesis. Discussion of materials here will be restricted to the main issues of building stratigraphy and chronology, with particular emphasis on the character of various material sources and the analysis of mortar fuel-relicts from a number of specific contexts.

Each mortar sample was given a random code and thick- and thin-sectioned before being examined with a petrographic microscope in plane and cross-polarised light. Many distinct types of mortar could be immediately recognised, but each was characterised individually, before the resultant descriptions were arranged into groups of apparently similar materials. These groups were then re-examined, often with more than one section on the microscope stage, to check the veracity of the putative mortar type. Ultimately, 8 different mortar types emerged from this exercise and when correlated with the context information these were found to correspond very closely.

Once more, these microscopic and petrographic analyses supported the on-site characterisations of the castle mortars but also added greater refinement. This was most particularly effective with the various limestone-lime mortars, each of which could now be associated with a different temper source (with a distinct mineral and shell compositional profile) from different shoreline littoral cells, and, although all appear to have been manufactured from the local limestone, each type has a different texture which suggests a different sedimentary environment. It is possible that the compositional variation of these limestones may reflect different levels of quarrying in different historic periods, although more comparative sampling would be required to test this theory. Unfortunately, however, although microscopic analysis also supported the on-site interpretations of each shell-lime phase and a consistent group of characterisations emerged from the North Hall range samples, material variation within and between these samples and other shell-lime masonry contexts precluded the confident ascription of any interrelationships between these structures.

Relict mortar fuel samples were isolated from their various masonry contexts by a number of methods, including direct removal of larger fragments from the castle masonry and acid dissolution of finer fragments from mortar samples. Larger samples were then characterised microscopically in reflected light as in previous descriptions, and similar archaeobotanical criteria regarding porosity etc. could often be applied to relicts visible in thin-section. Other diagnostic characteristics allowed characterisation of this assemblage, however, because the assemblage was almost completely dominated by *Quercus* (oak) fragments, which is often very recognisable from the large blocky fibres. In summary, of the 16 fragments examined 13 were characterised as *Quercus* (oak), 2 were *Corylus* (hazel) and 1 was *Betula* (birch); of the 8 larger samples examined in reflected light, 6 were amorphous probable heartwoods, whilst 2 were round or branchwood.

Over the course of the investigation, ten mortar fuel-relict samples were submitted to SUERC for radiocarbon analysis and these were from three main contexts:

- Five samples were submitted from the primary curtain wall. Four of these were from deep core contexts in which the mortar had already been subject to lab-based analysis, and one was from a more superficial bedding context without associated lab-based characterisation. These returned uncalibrated radiocarbon ages of 753, 703, 745, 637 and 543BP +/- 34-36.
- Two were submitted from superficial bedding contexts of the Drum garderobe, which had been interpreted as secondary although its associated mortar could not be differentiated from the primary curtain. These returned uncalibrated radiocarbon ages of 604 and 544BP +/- 36.
- Two were submitted from core contexts of the North Hall range whose shell-lime mortar had been characterised, although the submitted fuel samples were made of multiple charcoal fragments handpicked under the microscope from two different acid digested core mortar samples. These returned dates of 640 and 575BP +/- 29.

#### 4.5.4 ARCHAEOBOTANY, STRATIGRAPHY AND CHRONOLOGY

Further scrutiny of these radiocarbon ages reveals an issue of interrelated stratigraphy and chronology. The samples removed from the drum garderobe and from the North Hall both pass chi-square tests, suggesting the relict-fuel of both sets of samples stopped exchanging carbon with the environment in single events, and so each set of data can be combined to calculate combined calibrated dates with reduced error. These calculate to:

1299-1401 cal.AD at 95.4% probability or 1299-1370cal.AD at 75.2% for the North Hall; and, 1305-1419 cal.AD at 95.4% probability or 1305 -1364cal.AD at 60.5% for the Drum Garderobe.

Although no direct stratigraphic relationship was noted between these structures, they are clearly of different phases, as the North Hall is bound with a shell-lime and displays a particular and massive masonry style whereas the drum garderobe is bound with a limestone lime indistinguishable from the primary curtain. These statistically-combined radiocarbon dates allow both structures a lower terminus in the 14<sup>th</sup>-century, but to understand these further we need to return to the archaeobotany and remember that the North Hall samples were (like those in Berger's Irish materials (1992; 1995) micro-charcoals recovered from

acid digested mortar samples, although in this case it was clear they were mostly oak. As a stand-alone result, therefore, we have very little idea how this lower terminus relates to the construction of the North Hall (ie. how much offset should be applied). In contrast, however, although one of the drum garderobe samples was also oak, the other was hazel and both were interpreted as roundwood/branchwood of less than 20 years old. Thus the lower terminus of the drum garderode is more meaningful, and a 14<sup>th</sup>-century date more reasonable.

The radiocarbon results from contexts interpreted as primary curtain wall, however, do not pass a chi-square test, and this initially appears to suggest that their radiocarbon ages do not represent a single event. There is one clear outlier within this data, relating to the sample collected from a bedding context in the north wall, and when only the deep core samples are considered then these do pass a chi-square test and so a combined calibrated date may be calculated. In this case that calculates to a very narrow range of 1266 -1296 cal.AD (@ 95.4% probability) - a combined date which accords very well with many previous interpretations of the construction date of the castle.

Returning to the archaeobotany of these samples, however, initially problematises that result. This is because these primary curtain core samples were oak with amorphous morphologies and so, once again, we do not initially know how much offset should be applied to this lower terminus. Unlike with the North Hall, however, in this case we can constrain the required offset somewhat, as the primary curtain appears to be abutted by the drum garderobe which has already been dated more securely to the 14<sup>th</sup>-century on roundwood relict-fuel samples. Moreover, the relative morphologies of these samples suggest these structures were constructed at dates much closer than their calibrated radiocarbon ages would suggest. Indeed, re-consideration of the outlier from the curtain wall questions this relationship even further as this (short-lived *Betula*) sample returned a radiocarbon age contemporary with the drum garderobe, and these are contexts which could not be separated on the character of the mortar. Even further, it was clear these bedding samples were contiguous constructional materials (rather than later pointing) and the RCAHMS (1980, 213) had even previously suggested that this drum garderobe and the curtain wall were coeval.

When the archaeobotany of the radiocarbon data is considered, rather than being an outlier the short lived bedding sample may provide a lower terminus much closer to the construction date of the primary curtain wall than the amorphous oak of the core samples, to which a

greater offset should be applied. In this scenario the drum garderobe may be constructionally secondary only, and of the same broad 14<sup>th</sup>-century date as the curtain wall.

This narrative neatly fits the radiocarbon data we have, but in my opinion at present puts too much strain on the single result from one bedding sample and, although they have similar mortars, doesn't take enough cognisance of the construction break between the garderobe and curtain wall. The fundamental problem with the data is that there are not enough demonstrably short-lived samples from the primary phase to calculate a combined date with the accuracy of Fincharn. At the present state of knowledge, therefore, the above debate around the development of Mingary Castle may be more nuanced than the data can sustain, and more comparative work from other sites is required to understand this evidence more fully. In interim it is reasonable to make a more general inference from the radiocarbon data that the curtain wall and drum garderobe were both constructed on or around 1300, with the North Hall constructed later in the same century, as this narrative also clearly differentiates the shell-lime bound North Hall from the 16<sup>th</sup>-century limestone-lime bound architecture of the south/south-east bartizaned parapet.

#### 4.5.5 INTERPRETING MINGARY - MASONRY CULTURES

That lab-based analysis supported the broad on-site lime-provenance interpretations of the various mortars of Mingary Castle, however, draws further attention to the massively-built shell-lime masonry of the North Hall range and, given the close proximity of the building to conspicuous limestone outcrops which had been used to construct the primary phase of the castle, this requires some discussion.

In chapter 2, an apparent contrast was noted between the masonry of the churches of the Sound of Mull, which rapid on-site survey suggested were bound with shell-lime mortars, and the limestone-lime bound masonry of the castles, and it was suggested that these might represent different masonry cultures which (in this case) reflected social contrasts. It may be significant, therefore, that although documentary evidence suggesting St Comgan's, Mingary was in lay patronage by the end of the 15<sup>th</sup>-century is convincing (Thomas 2014, 133), the adjacent estate was owned by Iona Abbey (RCAHMS 1982, 146-7) and the lower terminus for the castles construction (provided by the radiocarbon dated fuel) now suggests the primary phase curtain wall of the castle was constructed significantly later than the neighbouring parish church. Whilst these comparanda need more work (see chapters 6 and

7), unlike at Fincharn, the church and castle at Mingary appear to be chronologically and culturally distinct.

Without suggesting any direct relationship with the parish church, I would also suggest that a similar explanation applies to the shell-lime masonry of the castle's secondary North Hall, and that this structure is also of a different masonry culture to the primary curtain wall. For the North Hall I think we should be looking north, to the medieval shell-lime masonry traditions of the North-West Region of the Scottish North Atlantic and, even more directly, to the masonry culture of the shell-lime bonded Castle Tioram, where a similar hall range with a similarly massive masonry style was built (Evan's and Rutherford 1998; see appendix 14).

#### 4.6 CASE STUDY – IONA

This last case study from the South-West Region of the thesis will present a brief discussion of the masonry evidence from the ecclesiastical complex of Iona which is nevertheless crucial to our understanding of the masonry archaeology of the wider region and will figure repeatedly in foregoing chapters. Fuller details are also presented in Appendix 15, but as the constructional development of the site from its 13<sup>th</sup>-century re-launch is very well understood these details can be briefly summarised here to introduce the buildings, consider how they have technically changed over the medieval and later periods, and provide a very different perspective on the mortar archaeology of the South-West Region. The surviving upstanding buildings on Iona display a remarkable assemblage of different mortar materials, the investigation of which may allow a comprehensive study of how mortar materials have changed and developed here over the last 1,000 years.

##### 4.6.1 BUILDING SURVEY

On-site survey of the upstanding structures on Iona, complimented by a programme of lab-based analysis of loose samples, suggests a definite chronological progression of contrasting mortar materials pertains here in three broad phases.

Phase 1 includes the high quality shell-lime mortars displayed within all the probable 12<sup>th</sup>-13<sup>th</sup>-century buildings (such as the Abbey complex, St Oran's chapel, St Ronan's parish church, St Mary's chapel, the Nunnery complex, and neighbouring Kilvickeon Parish church on the neighbouring Ross estate) which also tend to display a high concentration of evidence for heated *O. edulis* (oyster) shell fragments. In a refinement of the accepted chronology of

the site, the west cloister walk would appear to be stratigraphically slightly later in date, and this suggestion is supported by the contrasting lime-provenance of its mortars, which display a very high concentration of heated *C. edule* (cockle) shell kiln-relicts. This structure, however, does conform to the general lithic-tempered shell-lime mortar production techniques displayed by the large group of earlier Phase 1 buildings, and both this cloister wall, St Mary's chapel and Kilvickeon church also displayed wood charcoal kiln-relicts.

In stark contrast to these materials, however, are the mortars ascribed here to Phase 2 which include the Nunnery refectory, secondary phases of the Nunnery Church and St Oran's chapel, and the primary construction of the 'Bishop's House'. All of these mortars are extremely maerl-rich, clearly distinct from earlier and later phases, and there is some petrographic and XRD analysis evidence to tentatively support a maerl-lime provenance interpretation (see chapter 3). Previous interpretations have dated the first two of these structures to the 15<sup>th</sup>-16<sup>th</sup>-century and that is now supported by the similar mortar within the secondary intramural tomb of St Oran's chapel, which architectural history would suggest is of this same period. Although there are no certain 17<sup>th</sup>-century mortars to provide an upper terminus, a similar logic questions the ascription of the Bishop's House to the 17<sup>th</sup>-century, and the 15<sup>th</sup>-century period (related to the earlier commendation of the site to the Sodor bishops) is preferred here (RCAHMS 1980, 252; appendix 15). This ascription is important as the Bishop's House mortar also contains a high concentration of peat fuel kiln-relicts.

The final phase of mortar development at the site is displayed in various post-Reformation repair phases, burial enclosures and domestic buildings, all of which contain coal-fired limestone-limes, many of which are likely to have been imported from Lismore.

#### 4.6.2 FURTHER DISCUSSION

The three phase clarity of the upstanding Iona evidence will be very useful in future discussion and suggests the site has excellent potential for future research. A number of issues are raised by this evidence, however, which are pertinent to this chapter and so will be briefly discussed here.

A particularly salient question surrounds the evidence that a number of Phase 1 mortars at the site appear to have been wood-fired, although palynological evidence would suggest Iona and much of southern Mull are likely to have been treeless from around 3-4000BP (Walker

and Lowe 1985; Bohncke 1981, 369-70). There is some evidence that the monastic community here had been exploiting resources from wider estates since the very early medieval period and this appears to have included ferried timber for constructional purposes (Swift 1987, 325). Perhaps significantly, however, the Phase 1 Iona mortar evidence presented here would appear to correspond with the pre-Romanesque mortars from *Sceilig Mhichil* and High Island (both off south-west Ireland), both of which have been interpreted elsewhere as probable shell-limes with some evidence for heated *O. edulis* (Pavia 2010; see chapter 2) and both of which contained charcoal which was successfully radiocarbon dated (Berger 1992, 884; 1995, 168). Whilst the possibility that driftwood and peat may have been used to fire these Ionan limekilns should not be ruled out before archaeobotanical analysis can take place, with concomitant effect on any radiocarbon interpretations.

This evidence has added significance for future work on the island because Irish church archaeologists (Ó Carragáin 2003; 2010) have recently suggested that the small building known as ‘St Columba’s Shrine’, located to the west of the main Abbey church on Iona, was related to a group of similarly diminutive saints burial chapels found across Ireland each of which was the earliest lime-bonded building at their respective sites (Harbison 1992). Indeed, the Ionan structure has been suggested to be the earliest of the group, and dated to before the mid-9<sup>th</sup>-century translation of Columba’s relics to Dunkeld and Ireland (Ó Carragáin 2003; 2010). There are, however, issues with this essentially historically-based chronological interpretation, the most salient of which is that (unlike some of the Irish comparanda) this building has never been radiocarbon dated and excavation failed to describe any bonding material at all (Redknap 1977). Perhaps there was no mortar to describe, although a series of mortars was identified in the upstanding building during this thesis research, including a shell-lime in some secondary contexts (see appendix 15).

Remarkably, the archaeological potential of this material may be increased by re-examination of another excavated feature, located to the north of the abbey, which was interpreted as a series of early medieval lime-burning clamps with evidence for vitreous kiln-relicts and charcoal (Reece 1981). It is unfortunate that this chronological interpretation is predicated on a single piece of pottery in a problematic overlaying context, but the suggestion that the adjacent pile of ‘white sand’ was the carbonate charge is intriguing given the well-stratified series of medieval biogenic lime mortars on the site. An early chronology should not yet be dismissed, therefore, and there is clearly now potential for a future

archaeobotanical study of medieval kiln and buildings to include a radiocarbon dating programme.

The reasons for the apparent later medieval shift in lime-making technique at Iona, and the evidence for another pre-Romanesque clay-bonded chapel on the island beneath St Ronan's church, will be discussed in the following chapter. It is, however, worth highlighting here that, at this interim stage, the changes in lime-making technique evident in the upstanding buildings on Iona do also appear to be associated with a change in fuel, and in future research it may be this evidence which has the potential to most convincingly demonstrate a radical change in lime-burning culture.

#### 4.7 LIMESTONE-LIME ARCHAEOLOGY IN CONTEXT

The lime-mortar provenances of the South-West Region examined for this thesis are listed in Appendix 1.2.2 and the now familiar process of initial high medieval variability developing into a region almost completely dominated by limestone-lime mortars is once more apparent. Within this region, however, limestone-limes dominate the corpus from the earliest period whilst biogenic and clay mortars have much more localised insular distributions. From its first general emergence in the high medieval period the manufacture of limestone-lime is the most densely distributed lime provenance in the region, with 30 limestone-lime building phases, compared to 15 of shell-lime. Moreover only 2 of these shell-lime bonded sites are noted in mainland locations, whilst 10 buildings within the islands (Bute and Mull) were interpreted as limestone-lime.

Far fewer buildings were examined from the later medieval period, but of these 16 were limestone-lime and again this included island sites in Mull and now Islay (such as Moy and Dunivaig Castle) also. Only 5 possible shell-lime mortar bonded sites were noted, however, and these include very small phases at Castle Sween and Kilmory Knap. The more significant shell-lime constructions include 2 churches in Islay and the North Hall at Mingary. By the post-medieval period limestone-lime bonded buildings almost completely dominate the data, with 53 recorded in both Modern periods (and there could obviously have been many more), only 4 possible shell-lime mortar phases noted (three of these are on Islay) and 2 of clay.

Once more this data does not simply correlate with environmental availability. Limestone-limes almost completely dominate the mainland and Bute buildings from the earliest period,

and yet, although limestone is widely available in mainland Argyll, these sites are often very coastal with extensive local post mortem shell and maerl assemblages apparent during this survey. The case study sites of Castle Fincham and the primary phase of Mingary are not untypical representatives for these buildings, whilst at Aros Castle, Mull (where geogenic carbonates are not immediately available) local marine shell populations were eschewed in favour of transporting limestone to the site (Thacker 2016). In direct contrast, the (possibly near contemporary) ‘Great Hall’ at Finlaggan is located some distance inland and very close to extensive limestone outcrops, and yet rapid survey suggests marine shells may have been transported into the site to manufacture a shell-lime masonry mortar which is reasonably widespread in Islay.

#### 4.8 CONCLUDING DISCUSSION

In discussion of the mortar archaeology of the South-West Region this chapter has been able to integrate the case study buildings still further within their local environments and associate the buildings with very particular contexts. This has been possible because the masonry culture of much of the region is predicated on wood-fired limestone-limes, and these mortar materials are generally sourced from reasonably fixed parts of the local landscape and form kiln-relicts with enough surviving microstructure for those specific sources to be traced. Thus it was possible to demonstrate that: Castle Fincham had been built with mortar made from Tayvallich not Shira limestone, whilst Mingary appears to have been sourced from a slightly different local lithostratigraphic context; and that the Fincham kiln had been fired with very short-lived fuel cut from local hazel shrubs, whilst the Mingary kiln had been fired with local oak wood with a greater range of morphologies.

It is clear that each of these different fuel sources affected the archaeological potential of the surviving material, but that heterogeneity also enables us to study how each building was constructed in negotiation with the local environment. The palaeoarchaeological potential of maerl was discussed in the previous chapter, and it is now increasingly evident that the medieval building is a collection of medieval materials each of which offers direct evidence of the wider medieval environment.

This research has allowed medieval buildings within Scotland to be directly and independently dated for the first time, and more informed archaeobotanical, archaeometric and straight forward archaeological interpretation of those results has refined them considerably. Two early castles of the Scottish west Highlands can now be related more

closely to the historical evidence surrounding the development of lordship in the region, and even to particular historical figures within that narrative.

The wider view of the mortar evidence presented here, however, once more draws attention to the great variety of mortar making evidence displayed in the medieval North Atlantic, and again indicates any interpretations based on simple ahistorical ‘traditions’ or asocial environments are often problematic and constrain what questions we might otherwise ask. Accepting that the Fincharn castle and church case study was useful as an almost ideal simply single phase site, the other two case studies from this region presented heterogeneous multiphase mortar evidence which I have ultimately suggested is the result of two different mechanisms of change. At Mingary Castle and church I have suggested that the contrasting shell and limestone mortars represent construction by masons from different masonry cultures and in some instances may even represent regime change; whereas at Iona there has essentially been continuity of medieval lordship, but a change in the surrounding political and perhaps physical environment has led to a change in lime making material sources, technique and probably personnel.

This discussion of Iona, however, has also taken us back, possibly to the very introduction of lime-mortared masonry techniques into the region. And it is to that initial emergence of masonry mortars into the archaeological record of North Atlantic Europe to which the next chapter will turn.



## Chapter 5 - Clay and lime mortar archaeology in the North Atlantic

### 5.0 Introduction

This chapter will investigate the use of clay/silt subsoils as masonry mortars in North Atlantic Europe. Although forming a relatively small proportion of the buildings surveyed for this thesis, clay mortared buildings have previously been characterised as representative of a number of very particular and significant contexts, including:

- As an intermediate stage in the medieval development of lime-bonded stone building techniques from their dry-stone predecessors (Radford 1950; Hamlin 1976; Swift 1987).
- As a signifier of native or vernacular craftsmanship (Ó Danachair 1957).
- As a signifier of economic poverty or ephemerality (Barrière 1992).
- As a geographically-constrained medieval technique (O' Sullivan 1994).
- And, perhaps encompassing all the above, as a particularly Norse masonry technique (Clouston 1926).

The underlying theoretical concern of this chapter will be the emergence of mortared masonry structures into the archaeological record of North Atlantic Europe, in different contexts at different times. It is significant that in many ways these are the same processes of technical and cultural development examined at phase, site or sub-regional scales in previous chapters, but in consideration of the early chronologies of both clay and lime mortar evidence a much wider geographical and chronological perspective will be required.

The historiography and anthropology of clay mortar interpretation in Scotland and Ireland will be discussed first, in order to introduce certain issues of typology and chronology, before masonry evidence from the Iron Age and early medieval periods, both within and without the Roman Empire, is considered. The chapter will then return to the North Atlantic to discuss a range of dry-stone, turf, earth-packed, clay-bonded and/or lime-bonded structures, and consider how this evidence might change as buildings develop and mortars degrade. The evidence reported within an apparently coherent group of pre-Romanesque chapel buildings from across the region will then be examined before briefly discussing 5 case studies to highlight the significant archaeological potential of a more informed approach to the survey of clay mortared structures.

This chapter will not be so concerned with lab-based materials analysis, but the discussion is wide-ranging and forms an interpretive and methodological pivot on which the research turns. As highlighted in the introduction to this thesis, there is a tension in many interpretations of the early to high medieval periods in the North Atlantic, between the regional and the universal and between native development and outside influence. It will be suggested below that consideration of the apparent regional and chronological variation in the use of clay mortars can inform our understanding of the way in which people negotiated within their various political, cultural and physical environments. Ultimately, however, it is the evidence for mortar, any mortar, which is of most fundamental importance to this research, and all of these various bonding materials are essentially regionally, socially, and historically-specific architectural responses to similar cultural pressures. This will provide the basis for the final chapter and thesis conclusion.

## 5.1 INTERPRETATIONS OF THE EARLY CHURCH IN THE NORTH ATLANTIC

### 5.1.1 ATLANTIC IRELAND

Until the mid 20<sup>th</sup>-century the early medieval building typologies of Ireland were predicated on a perceived chronological progression from the dry-stone chapels of the west coast, whose technical roots were seen to lie in distant prehistory, to the lime-bonded churches distributed more evenly throughout the whole country (Leask 1955). Within this narrative, the burning of church buildings during Viking raids was considered an important impetus to a process of increasing native sophistication which was already well underway, as the ‘use of mortar made it [increasingly] possible to construct corbelled roofs of straight sided form’ in these ‘descendents of the clochán[s]’ (*ibid.*, 28). In parallel with this indigenous scheme, Irish masonry and mortar-making techniques also gradually developed from ‘Dry-stone, mud and (possibly in later buildings) mortar, often burnt from sea-shells’ in ‘rude’ or ‘primitive’ buildings (Macalister 1935:248), which over time ‘improved in quality from the shell, sand and gravel of the Rubble period...to the fine lime of the Ashler’ (Phipps 1939:58).

The use of ashlar as a technological lower terminus has already noted in the 12<sup>th</sup>-century Northern Isles (chapter 3; see also chapter 6; Gem 1988), but a correlation between stone dressing and different mortar-making techniques has also been a commonly employed interpretive scheme for early medieval buildings where a spectrum of surviving structural forms was accepted as evidence for the incremental chronological development of native

techniques from which lime-bonded arcuate church buildings (in particular) would eventually emerge:

‘The transition from the dry wall and undressed masonry, to the cemented walls and dressed stones of the later buildings... took place in the sixth, seventh, and eighth centuries. The cement first used, especially in buildings on the sea-coast, was largely composed of shells and sea-sand, while, inland, a compound of mud and gravel was used. The walls were first dry built, the composition poured in a liquid state upon the top of the walls and allowed to filtrate downwards; later on, the wall was well built with two faces and a rubble core grouted in a similar manner; while, in the time of Cormac O' Cillen, circa 950, we have the stones well bedded in good mortar.’ (Stokes 1894, 44).

Although both this evolutionary process, and the chronologies on which it was based, have now been generally dismissed (Macalister 1935; Henry 1970, 149-50), it must be acknowledged that even in this 19<sup>th</sup> century drive to simplify and order on a national scale, Stokes had an awareness that these different structural forms probably had overlapping chronologies, and that the materials used had regional distributions.

From this perspective it is no coincidence that one of the last commentators to suggest that clay-bonded structures may occupy a chronologically transitional position in Irish pre-Romanesque church architecture, did so on the basis of a regional study wherein three of the seven pre-Romanesque churches of Northern Ireland were interpreted as clay-bonded (Hamlin 1976, 57-58). Indeed, of the six ‘early churches’ listed in the Archaeological Survey of County Down, four are described as bonded with clay (Government of Northern Ireland 1966), and although we might now ascribe Raholp to a later date on the altar and aumbry evidence (cf. Murray 2010; Biggar 1916), this is still a significant proportion of such a small early group.

More recent discussion in Ireland, however, has returned to a national perspective on regionality, to emphasise that most first millennium churches here (as elsewhere in Europe) are likely to have been constructed from timber, and that it is their direct replacement by fully lime-bonded buildings, rather than by any kind of transitional masonry structures, which is the more general narrative (Ó Carragáin 2010; Harbison 1982). Indeed, Ó Carragáin (2010, 311; *contra* Hamlin 1976), identifies Killelton (Co. Kerry) as the only known pre-Romanesque ‘earth-bonded’ church in Ireland, and has also sought to highlight the

(nationally) limited distribution of the corbelled drystone chapels of Ireland's west coast to suggest that these buildings are always likely to have been a very regionally-specific architectural expression. Moreover, speculation that these dry-stone buildings had also been constructed over a very long time period, even into the 12<sup>th</sup>-century (Harbison 1970; Hamlin 1985), has recently been supported by radiocarbon data from a previously-supposed very early 'type-site' medieval building at Church Island (Hayden 2013), and that this has fundamental implications for previously accepted North Atlantic typologies in both Scotland and Ireland will be discussed further below.

### 5.1.2 ATLANTIC SCOTLAND (INC. ISLE OF MAN)

The association of worked stone with fine cemented buildings, which early commentators had noted in Ireland, however, also had currency in the Isle of Man where the simplest surviving small stone chapels (or *keeils*) were initially interpreted as Early Christian in part because of the perceived technical excellence of Norse stone masonry:

'Nothing could be more natural; for it can scarcely be assumed that a people, able to create such important monuments of art as the ornamental crosses of Gaut and his school... would ever have built such primitive places of worship as the small keeils.' (Marstrander 1937, 16-17).

Moreover, regarding the spectrum of buildings evidence, a similar gradual progression from dry stone, through clay-bonded, to shell-lime and eventually limestone-lime was also suggested in Man, whereby the chapels '...were built of unhewn stones, slabs, earth and rubble, in ancient times, with no other kind of agglutinate than earth or clay, later shell mortar or cement' (Marstrander 1937, 414).

It is interesting that again here shell-lime as well as clay finds a particular place in the typological scheme, but recent investigation (including excavation) has found no convincing evidence for any surviving Early Christian masonry chapels in the Isle of Man, and some of the simplest buildings are demonstrably Norse (Megaw 1950, 172; Bruce 1968, 71; Cubbon 1982, 266-271, 275; 1983, 22; Morris 1983, 123). Indeed, not only does the supposed correlation between stone carving and chapel sophistication now appear unfounded, but by the 12<sup>th</sup>-13<sup>th</sup> centuries in Man, Anglesey (Wales) and Galloway (Scotland) lime-bonded masonry buildings largely replace the ornate 9<sup>th</sup> to 11<sup>th</sup> century free standing crosses as signifiers of sacred place (cf. Driscoll 1998), and in some districts the two are almost mutually exclusive. The structural contrasts in Manx chapel buildings noted by Marstrander,

and largely supported by subsequent excavations and surveys undertaken by Kermode (1908, 1910, 1911, 1915, [1918] 1935) and Bruce (1968), now need to be generally constrained within a much tighter pre-Romanesque chronology.

Moreover, the similarity of these early Manx *keels* to similarly diminutive chapels found in Islay (Scotland) and elsewhere in the north North Atlantic suggests a much broader Norse distribution pertains (e.g. Vebæk 1968, 41; Swift 1987). Within the Scottish part of this region it is now possible to establish a more regionally-informed buildings archaeology of this period by considering two important contemporary studies of early chapels in Man, Islay and the Northern Isles, both of which were undertaken at the University of Durham (Lowe 1987; Swift 1987).

With regard to the interpretation of clay mortared structures within these two works, however, it is remarkable that two contrasting frameworks pertain: Lowes thesis implicitly characterised both clay-bonded and lime-bonded bicameral buildings of the Northern Isles as ‘mortared’, and contrasted their structural forms with putative dry-stone buildings (Lowe 1987, 125); whilst Swift’s study initially explicitly re-classified as ‘dry-stone’ those early Islay chapels previously reported as clay-bonded because of a lack of visibly surviving mortar evidence, and contrasted their structural forms with ‘mortared’, ie. lime-bonded, buildings (Swift 1987, 178-9). It is crucial to the historiography of these materials to realise that a similar disparity of approach is not unusual within survey and excavation reports more generally as, even where clay mortar evidence is successfully identified within a building, then the terms ‘clay-bonded’ and ‘dry-built’ are often used interchangeably to characterise the same masonry context. In this instance, however, the contrast may actually reflect real differences in the regional corpus.

With the caveat that the evidence for dating dry stone chapels was slight, Swift ultimately concluded that a broad typological and chronological progression was evident in the Islay material, and then tentatively re-introduced clay-bonded buildings into a scheme which developed: from 8<sup>th</sup> and 9<sup>th</sup> Ionan sculpture; to small Manx-influenced drystone chapels; to larger drystone chapels with lateral doorways and roughly shaped building stone which may have been clay-bonded; to lime-mortared churches within larger cemeteries dated on architectural historical grounds to the 12<sup>th</sup> century (1987, 318). Again, this work suggests there is an association between the ‘shaping’ of stone and mortar use and, although the smallest Islay chapels were interpreted as somewhat later (Norse rather than ‘Celtic’), Swifts thesis is essentially based on the same sculpture/enclosure/building criteria as Marstrander

(1937) employed in the Isle of Man fifty years previously and a very similar typological progression of building forms subsequently emerged.

Meanwhile, in the Isle of Man, Lowe (1987) (following Kermode and Bruce) divided the Manx chapels into four structural types which included: internal stone-skinned earth or turf walls (rare); double-skinned stone with interstices packed with earth and rubble (common); Dry stone (common); and clay or lime. In this typology, therefore, the clay and lime evidence is conflated into a single structural type and a similar conflation was adopted in the Northern Isles where the 12<sup>th</sup> century date for the ‘introduction’ of lime mortar suggested by the RCAHMS was also simply accepted (Lowe 1987; 1993, 323). In this Northern Isles study, however, Lowe also highlighted that:

‘All of the non-unicameral structures...have been built with clay and/or lime mortared walls [and]...this could be expected on constructional grounds alone, since the building of arches would necessitate the use of mortared stonework’ (Lowe 1987, 125).

This functional interpretation is erroneous, however, as there is significant archaeological evidence for prehistoric mortar-less arcuate and vaulted masonry in the Mediterranean, which is also often associated with finely dressed stonework (see especially Boyd 1978), and drystone rubble arches continue to be built throughout the world today (eg. DSWA 2009). That these examples are historically and culturally-situated contexts, far removed from the high medieval North Atlantic, does not negate this point - it underscores that this is not a ‘functional’ issue, but is a cultural one.

The association of mortar with arcuate masonry is, however, another persistent theme in medieval building historiographies, and a previous desk-based survey of high medieval northern and western Scottish building did indeed suggest that these two types of evidence were related, but also highlighted that contrasts within the surviving corpus were regionally distributed (Thacker 2011; 2015a). In this study similarly-planned 12<sup>th</sup>-century bicameral chapels reported as dry-stone were also always reportedly relatively very thick-walled and trabeate (and there was a high concentration in Caithness), whilst those reported as lime-bonded were generally much thinner-walled, arcuate, and mortar-coated (and there was a high concentration within Orkney). Moreover, although bicameral church buildings which were reported as clay-bonded comprised only a small fraction of the survey, the data suggested that these buildings combined various aspects of these structural forms; again

perhaps suggesting that clay-bonded buildings occupied some kind of intermediate position in a structural (if not necessarily chronological) typology (*ibid.*).

The fieldwork undertaken for this current thesis research indicates there are some problems with the reported data on which this earlier study was based, but the survey did also usefully highlight a number of stratigraphically earlier unicameral chapels which will be considered in more detail later in this chapter. The most cited example of these early chapels, however, is probably the clay-bonded and lime-coated building discovered by excavation underlying St Ronan's parish church, Iona (O' Sullivan 1994), and given the wider discussion of clay-bonded regional comparanda within the published account some initial comment is required here.

Despite the ecclesiastical history of Iona, the remains of this underlying building were situated by the excavator within the building traditions of the south-west of Scotland rather than Ireland, as it was suggested that pre-Romanesque Irish buildings generally contained little reported evidence for either clay-bonding or lime-coating (O' Sullivan 1994). It is interesting that unlike later interpretations of Columba's Shrine there was no attempt to constrain the chronology of this building with reference to the 9<sup>th</sup>-century Viking raids on the island (see Ó Carragáin 2003, 136; 2010, 69 for example), but a very early lower terminus was ascribed here on the basis of Scottish comparanda whose structural details are contrasting and whose chronologies are themselves still ultimately based on misinterpreted Irish parallels. In brief summary, it was suggested that this clay-bonded lime-coated Ionan building may be as early as the 8<sup>th</sup>-century as its structure could be compared with the chapel of Ardwall Island (Galloway), even though (like St. Ninian's Bute) there is no evidence the Ardwall chapel was ever lime-coated (Thomas 1967; Aitken 1955; *contra* Foster 2011). Moreover, the original 8<sup>th</sup>-century interpretation of the clay-bonded building at Ardwall was itself dated on comparison with the corbelled dry-stone chapels of Gallerus, *Sceilig Mhichíl* and Church Island (Ireland), all of which are dry-stone. Whatever the justification for suggesting that the materiality of these buildings is a reasonable basis on which to compare them, in effect the clay-bonded lime-coated chapel on Iona was indirectly dated on comparison with corbelled dry-stone Irish churches, whilst one of those Irish buildings (Church Island) now has a radiocarbon dated lower terminus of the 10<sup>th</sup>-11<sup>th</sup>-century (Hayden 2013, 78).

### 5.1.3 – DISCUSSION

Although precise dating evidence for many of the individual early chapel and church buildings of the southern North Atlantic discussed above remains problematic, recent work in Ireland, Man and Islay has generally shifted the regional pre-Romanesque corpus into a much later, and chronologically tighter, period. This may be because previous commentators were grappling with hagiography-driven conceptions of a dry-stone monastic west coast Celtic Church (cf. Maldonado 2011) decimated by Viking raiders, which imposed a ‘pagan gap’ on the archaeological evidence, extended the chronology and allowed evolutionary models time to explain the spectrum of material evidence. Establishing whether that typological range has a chronological or social basis within that tighter time frame, however, remains a salient question.

### 5.2 AN ANTHROPOLOGY OF CLAY MORTAR & SHELL-LIME MANUFACTURE

As a constructional material which is not found ‘naturally’ within the environment, the manufacture of a lime mortar of any provenance might appear to have demanded a more complex technical scheme than that required to produce clay mortar (Radford 1950; cf. Maniatis 2009, 11), and it is perhaps for this reason that shell-lime mortared structures are often placed chronologically later than their clay-mortared counterparts (but before limestone-lime mortared buildings) within various evolutionary models.

The interpretations on which these typologies were initially built, however, draw their epistemological logic from deep-seated cultural biases which have valued materials according to a hierarchy contingent with other value-laden properties such as rarity, permanence, rigidity, colour and luminescence (see especially Fraser 1990, 25-27; Thacker 2011; 2015). On this basis, for many western Europeans, a greater intrinsic worth inheres in materials such as gold or marble than copper or sandstone, and this may be complemented by a concomitant technical hierarchy predicated on the perceived level of skill required to perform certain techniques. Those craftspeople people with the most developed skills are therefore associated with the most valuable materials (Fraser 1990, 25-27.) and this developmental scheme can be applied to both individuals and societies. Just as the manufacture of lime mortar appears to require greater expertise to produce than clay mortar, so the material is harder, has greater weather resistance, is more permanent and, most importantly, is white and shiny. With all these and many more powerful cultural attributes on

its side, as soon as lime mortar has been accepted into a community then other materials and the craftsmen who work with them tend to be viewed in a comparative way.

### 5.2.1 MORTAR AND THE CRAFTSPERSON

Writing in early 19<sup>th</sup> century Scotland, John Loudon, like many Improvers, had a clear and explicit conception of the relationship between materials, skill, durability and aesthetics when distinguishing between ‘labourers’ who built with undressed stone and ‘masons’ who built with quarried material (Loudon 1825:444). Although when ‘...clay is used like lime, and is meant to answer the same purpose...[and applied]... in the ordinary way, the result cannot be a durable one, when clay-bonded walls were lime coated then this would add greatly to both the durability and the beauty...[of the work. As long as]...the clay was properly tempered...[then the results]...have been known to last nearly as long as walls made entirely with stone and lime’ (*ibid*).

Given this reference to the tempering of clay mortars, it is worth recounting how clay mortars were very often prepared in this period, with a description from early 20<sup>th</sup> century Ireland:

‘Usually the prospective builders sought the advice of the local experts in selecting the clay... The top soil was cleared away and the clay laid bare. Then began the exacting work of “tempering”. The clay was dug up with spades, all lumps broken and stones picked out. Water was added and the mixture was kneaded to the consistency of dough by stirring with pitchforks and shovels...trampling with the bare feet, or driving cattle or sheep or riding horses or donkeys through the clay. For finer work (such as plastering) animal hair was added to the clay. In many districts lime was mixed into the clay; cow-dung was also used widely, while there are traditions that milk, buttermilk, ashes and animal blood were used to strengthen the clay. The clay mixture was left to ‘temper’ or ‘sour’ for several days, being turned over or re-kneaded occasionally. While the clay was ‘souring’ the site was prepared.’ (Ó Danachair 1957, 66).

Broadly similar production techniques are reported from 19<sup>th</sup>-century Scotland (e.g. Beaton 1993), although according to Ó Danachair clay mortar was everywhere in Ireland considered ‘inferior’ to lime-and-sand and (at least in this period) was only used when lime ‘could not be obtained’ (*ibid*, 70). It does appear from his description, however, that 19<sup>th</sup>-20<sup>th</sup> century

Irish builders used both clay and lime mortar, and this would also accord well with the evidence from rural Scotland at this time (see below).

Away from rural contexts, however, the documentation pertaining to the Scottish construction industry of this and some earlier periods seems to have made clear and explicit distinctions between various categories of builders in stone, the materials they might use, and the contexts they might work in. This included workers defined as ‘masons’ and ‘rowmasons’, but also ‘cowans’ such as John Shedden who in 1623 Glasgow was authorised ‘to work stone and mortar and to build mortar walls, but not above one ell in height, and without power to work or lay hewn work, or to build with sand and lime’, whilst in 1636 Canongate a cowan was permitted to do ‘any work with stone and clay alone, without lime’ (Knoop and Jones 1978). These documents make an important distinction between ‘mortar’ and ‘lime and sand’ to which we shall return, but the Schaw Statutes of 1598 and 1599 even prohibited masons from working alongside a cowan (*ibid.*). This supports the entries in both Jamieson’s dictionary of Scots and the O.E.D which define ‘cowan’ as a derogatory term for a man ‘who does the work of a mason but has not been regularly apprenticed or bred to the trade’ (Jamieson 1808, 324; especially Knoop and Jones 1978, 24; OED 2016).

These documented associations - between clay-mortar, unhewn-stone and the cowan on the one hand, and lime, hewn-stone and the mason on the other - appear straightforward but are clearly demanding of further interpretation. Elsewhere in the medieval period it has been shown that differently defined types of masons were accorded different rates of pay, but that the same persons would often move freely between these different categories of work (Knoop and Jones 1978), whilst the late 18<sup>th</sup>-century Statistical Accounts of Orkney and Shetland describe local builders in stone as masons who are ‘self-taught’ (Low 1791-99, 322; Mouat and Barclay 1791-99, 194). Moreover, these early modern texts describing a prohibition on cowans working with lime in certain contexts probably indicates that they often did, and this is not a rule which should simply be imposed upon the archaeology.

Simpson (1961) believed he could detect the stonework of these different categories of builders and their ethnicity on the perceived ‘quality’ of their work, and although all the so-called ‘hall-houses’ of Moray are lime-bonded (and display both dressed and rubble sandstone) he suggests that ‘[t]he masonry at Duffus is much superior to that at Rait: the latter is ‘cowan’s’ work, whereas the former is obviously due to a *maistre mafon de franche peer* of the highest standing. It could be that the Duffus master-mason supplied the dressed

work for Rait, while the general masonry work was executed by local craftsmen.’ (Simpson 1961, 13).

Elsewhere, and more recently, Caple and Davies (2005-8) have suggested that the almost constant changes in occupation back and forth between the local Welsh and Norman Lords is apparent in the masonry of the late 12<sup>th</sup> century phases of *Castell Nanhyfer* in Wales, as the clay-bonded slate masonry displays a more ‘distinctive architectural form’ wherein ‘local’ ‘welsh’ building techniques and ‘native building traditions’, (also apparently seen in the broadly contemporary masonry at *Dinas Emrys*, *Tomen-y-Castell* and *llys at Rhosyr*) contrast with the ‘accurately-faced’ square sandstone blocks of the Anglo-Norman ‘building tradition’ (Caple and Davies 2005-8); perhaps, according to Davies, because ‘Welsh masons were not so accomplished as their English counterparts and relied on their ‘traditional buildings skills’ (Davies 2007, 27).

Once more in this high medieval period there is an apparent correlation between the use of lime and dressed stone, and clay and undressed stone, although ‘traditional’ descriptors are used to interpret both sets of evidence in terms of ethnicity and technical ability in a colonial context. There is also a subtle (but striking) contrast between these interpretations of the secular medieval buildings evidence and the perhaps more nuanced interpretations current in medieval church archaeology in Wales, where the continuity of native stone carving technique from before the partial Norman conquest has also been emphasised (Thurlby 2006), but here is suggested to have resulted in a sophisticated ‘local form of the Romanesque’ (Edwards 2011, 74). Although I am not familiar enough with the Welsh evidence to judge how far these interpretive schemes are a reflection of differences in the archaeological evidence (rather than the separate discourses), the interesting implication again is that very different craftspeople are working in each of these social contexts.

The available documentary evidence regarding the manufacture of lime, however, indicates that people from a wide section of society have been involved in its production in various periods. A higher level of building craft specialisation might be suggested by a person’s occupational surname in some medieval contexts, such as Richard Mason (*Cementarius*) of 13<sup>th</sup>-century Aberdeen (Ewan 1993, 159), although that this needn’t preclude a multi-skill set is suggested by reference to a dual ‘plasterer’ and lime manufacturer at Holyrood House in 17<sup>th</sup>-century Edinburgh (Mylne 1893, 195). This may have been specialist ‘Plaiser lyme’ (*ibid*), but limeburners are often listed in medieval building accounts as a separate trade (e.g.

Colvin 1971). In 16<sup>th</sup>-century Ayreshire and 17<sup>th</sup>-century Edinburgh reference is made to the ‘lym man’ and ‘Lymeman’ respectively (Sanderson 1975, 92; Mylne 1893, 195), whilst medieval evidence elsewhere suggests this was also very often an itinerant occupation (e.g. Coulton 2010, 163) and one frequently associated with women (e.g. Colvin 1971; see also Jorge 2012, 506-7). Indeed, most medieval and later craft activities ‘generally involved the whole family’, including wives and children (Ewan 1993, 157) and were performed in combination with subsistence agriculture (Birrell 1969, 93). In contrast to many medieval accounts, post-medieval accounts (such as the Statistical Accounts of Scotland) will often describe that lime was being manufactured in a particular district or parish, but limeburners are never listed as a specific artisanal trade within Scottish North Atlantic parish lists, even where it is clear that lime was being manufactured commercially in the community concerned. The surviving evidence is more complex than a simple shift from the individual medieval craftsman to particular post-medieval locations, but this narrative is suggestive and may be significant. At Fladdabister in Shetland, for instance, the local metamorphic limestone was roasted in peat-fired kilns to produce building lime for distribution across Orkney and Shetland until the late-19<sup>th</sup> and early 20<sup>th</sup>-century (Fenton 1997), and although generations of the same limeburning families can be traced back to the 18<sup>th</sup>-century through census returns (Bayanne 2016), these craftspeople are not mentioned in the statistical account of the period.

Importantly for this thesis, however, a very good description of the social realities which may be implicit in some post-medieval lime-burning traditions emerged from the Firthlands of Easter Ross, where by the 18<sup>th</sup>-century the manufacture of shell-lime was a trade carried out most particularly on the sands at Nigg. In this location:

‘...an extensive level bed of shells, of diverse kinds... [is]... manufactured into lime by persons trained up to the business from their infancy. There are 20 men, with their wives and children, who are employed in this trade...[and the]...lime manufactured from these shells is reckoned an excellent cement for building, and is peculiarly adapted for plastering, and finished work’ (Matheson 1791-99, 196).

The potential for elderly or very young members of the community to collect shells for lime-burning is salient in a number of accounts (e.g. Thakuria 2012), and in 19<sup>th</sup>-century Barra children with ponies transported cockle shells across the island so that lime could be manufactured for the construction of a new church (Blundell 1917). At Iona, 16<sup>th</sup>-century documents suggest most of the Abbey’s tenants on the neighbouring estate of Ross had been paying their rent in lime for some time (Iona club 1847, 3), and although there has been

some speculation that this material was manufactured from Carsaig limestone there does not appear to be any clear medieval evidence for limestone-lime bound mortars within the buildings on the island (see chapter 4 and appendix 15). The possibility that this rental corresponds to the maerl-rich lime analysed from within various 15<sup>th</sup>-century building contexts is supported by the fact that only those farms with access to the sea paid their rent in this way (*ibid*; Campbell 1791-9, 206), whilst elsewhere in Europe the requirement for tenants of medieval monasteries to supply lime in payment of rent or services was well known from at least the 10<sup>th</sup>-century (Halkin and Roland 1909, 292; Hilton 2003, 66).

In spite of their different limestone, shell and maerl material sources, however, it is clear that each of the regional lime-producing centres of Fladabister, Nigg and the Ross of Mull had access to precious carbonate resources in periods when lime was required locally in large volumes and for an extended period. These are the necessary pre-conditions for the development and sustenance of regional expertise, and in this respect monasteries such as Iona had always been able to support specialist craft skills within their estates in ways which pre-figure the ‘Improved’ management of secular estates from the 17<sup>th</sup>-century onwards (Swift 1987, 325; Ryan 1988; Whyte 1979; Shepherd 2011). Given this long history of the wider management of monastic estate resources, it is possible that the tenantry on Ross were supplying lime or shells to Iona from before the early 13<sup>th</sup>-century re-foundation, but the very late medieval switch in lime-making technique to peat-fired, maerl-rich materials noted in the island’s buildings archaeology is a striking contrast which may also be associated with these rental payments somehow - perhaps with wider environmental changes in carbonate availability or the use of lime as manure on monastic estates.

Elsewhere, the post-medieval documentation appears to compliment the archaeology of these limeburning communities very well. Brand’s (1700) contention that there were large outcrops of limestone in Shetland but that nobody had been burning it until very recently, fits very well with the history of the lime-burning families of Fladabister, their continued trade into the 20<sup>th</sup>-century (Fenton 1997; Tait 2012) and broadly correlates with the disjunct from the medieval shell-burning culture apparent in these islands. At Nigg we know with some accuracy the early 19<sup>th</sup>-century date by which, in the face of growing limestone-lime imports, the shell-lime-burning families of Easter Kilmuir finally went out of business (Rose 1836, 20; Mathison 1838, 311). This also correlates well with the archaeology, although because shell-lime mortars have much deeper medieval roots in the archaeology of the Firthlands it is more difficult to conceptualise how the 18<sup>th</sup>-century expertise of these craftspeople might

relate to that earlier buildings evidence. Iona is remarkable in that regard as, accepting the major building programmes of the 13<sup>th</sup> and 15<sup>th</sup>-centuries, the masonry of the site appears initially to have emerged incrementally in two or three earlier and apparently discrete building projects, and these alone would not have been enough to support local expertise. Macnab's (1970, 133) suggestion that the 'monkish craftsmen' taught the tenants of Mull lime-burning techniques which persisted into the late modern period is not supported by field survey on Ross, but the original premise appears reasonable for before the later medieval and early modern periods when the familial models of training 'from their infancy' like those reported in Easter Ross, Shetland and 13<sup>th</sup>-century Aberdeen (Ewan 1993) could be sustained.

That the shell-lime burners of Nigg were also fishermen (Matheson 1791-99) should not exclude them from Birrell's (1969) definition of 'peasant craftsmen' whose commercial activity was usually practiced alongside subsistence agriculture (Hirth 2010), and none of these examples should be divorced from their socioeconomic context. Indeed, the lime-burning udallers of Shetland and the monastic tenants of the Ross of Mull fit even more clearly into this category, and building survey in these districts suggests that those lime-burning families were not living in lime-bonded masonry houses themselves, and historical evidence suggests they were probably not manuring their fields with lime either. Although this chapter has stressed the specialist knowledge required to successfully manufacture different mortars from different materials, lime-burning in these contexts was not a self-perpetuating 'traditional' or ahistorical cultural practice at the core of regional subsistence strategies (cf. Silverman 1983; eg. Armit 2008, 7), but was a parallel historically-situated economic activity with a beginning and an end.

It is possible that the widespread and rapid increase in the use of cement in 19<sup>th</sup>-20<sup>th</sup>-century (see Wright 2011 for discussion in survey area) may have given rise to recent perceptions that lime burning was previously an unchanging ahistoric technology, and this suggestion is supported by the common addition of the epithet 'traditional' to all lime mortar evidence - as if the knowledge and skills associated with this apparently homogenous material were the result of a single continuous and conservative process. Clearly, the range of materials encountered by this thesis research brings more complexity to this discourse, and as a result the concept of lime or clay mortar making 'traditions' are both problematicised and foregrounded. William's terse comment that 'it only takes two generations to make anything traditional' highlights how in its 14<sup>th</sup>-century emergence into English vocabulary 'tradition'

was a very active word, which described the ‘handing-over’ of knowledge and/or skills (1983, 318-320) by various processes of cultural transmission (Rowlands 1993). Craft traditions, however, ‘only endure within sustaining social contexts’ (Connerton 1989), and that lime burning is a ‘contingent craft’ (Hirth 2010) ensures that its production is also intimately related to a communities varying requirements for building in masonry or manuring at different scales in various periods.

Although by the time our North Atlantic studies emerge into the documentary record they are site-specific regional proto-industries (Tait 2012), and on the near-continent very large inter-regional centres of lime production may have already developed by the late medieval period in very well-resourced locations such as the cockle shell beds of the Wadden Sea (Thacker 2011), this is unlikely to have been the general rule for earlier periods away from very large building sites. Indeed, the largely single phase mid-13<sup>th</sup>-century fabric surviving in the the castle and church ruins at Fincharn, and the conjoined biographies of these buildings, demonstrates that at some sites a short burst of medieval construction activity can provide all the masonry buildings required at a site for centuries to come. Likewise, the changes in mortar compositions evident in many of the multiphase case studies investigated for this thesis also indicate a range of different lime and mortar making episodes often took place at various sites, rather than a single sustained and unchanging tradition. That this might be explained by a number of different mechanisms is fundamental to our interpretations of the surviving physical mortar archaeology of each site over different time scales, but the heterogeneity which is evident within the Scottish North Atlantic suggests different traditions are actively circulating simultaneously and may often inhere within single itinerant of craftspeople. This suggestion is not unsupported by the general use of very local materials as highly mobile teams of medieval masons and limeburners with multi-skill sets adjusted their techniques to suit local resources, but also does not preclude particular expertise amongst some in, for instance, shell-lime burning.

In his description of the shell-lime mortar displayed within 13<sup>th</sup> century gothic church of St. Magnus’s Kirkjubour (Faroese), however, Dahl describes a:

‘specifically Faroese mortar, known as *skilp*...[which]... was the islands’ substitute for the lime which cannot be obtained here...[Although]...we do not know if the church was built by native craftsmen or foreign masons, [the building is] completely within the mainstream of Christian European architecture, [with] the only specifically Faroese characteristic ... being the use by local craftsmen of *skilp*’ (Dahl 1968, 187-188).

Dahl's suggestion that we may be able to divide the origin or ethnicity of the mortar (produced by native 'craftsmen') from that of the builders (who may have been foreign 'masons') implies that some level of pre-existing indigenous masonry expertise pertained within the Faroes, and this may be supported by evidence that St Magnus's is not the earliest *skilp*-bonded masonry church on this site. This is an important concept which forces us to consider whether the Faroes could support a continuous living lime-burning tradition in an earlier period, and is an issue which requires further research. Without at this stage completely dismissing the possible significance of other complex pyrotechnical traditions (such as Iron smelting and smithing), within which relevant transferrable skills may have been locally sustained, it must be also accepted that these buildings are situated within a much wider and more complex North Atlantic masonry culture which probably does not allow a simple native-foreign dichotomy. Where craftspeople are itinerant in a maritime environment, then our understanding of traditions and/or cultures require fluid geographical scales.

It is within different historically-contingent socio-economic circumstances that materials and expertise acquire cultural meaning and the mortar archaeology of Iona offers a good example of this process. As the Ross tenants' role shifted - from manufacturing lime to pay their medieval rent to being supplied with lime by their landlord to coat their own post-medieval stone houses - so lime-making traditions died in one location, proto-industrial techniques were developed in another, and the masonry culture of the region changed.

There is of course 'no teleology into which all craftsmen in all places can be made easily to fit' (Cooper 2011, 4) but, as discussed in the thesis introduction, any prospective builder arriving at a new site requires some combination of previous craft expertise and knowledge of local resources, and to some extent the building will be a practical negotiation between these two. Within this interpretive framework shell-lime and clay mortars have much to offer the builder familiar with their use; whether a newly arrived itinerant expert or perhaps even a talented local craftsman with knowledge and transferrable skills. Without playing down the different techniques required to successfully manufacture lime from different biogenic carbonates and different fuels, shells can easily be gathered by non-experts in advance of construction (without quarrying skills or specific knowledge of local calcareous geology), secure in the knowledge that these materials will be useable. It is a great advantage of these materials that the negotiation with the environment is not dependent upon experimentation with unfamiliar geologies.

Returning to Iona, the wider connections of the monastery throughout the North Atlantic might suggest the earliest lime burner at the site is likely to have been itinerant although, given that one of the earliest masonry buildings here is likely to have been the chapel underlying St Ronan's church, it is also clear that this builder was familiar with both lime and clay mortared masonry techniques. The question we must continue to ask is where that expertise came from.

### 5.3 THE ORIGINS OF CLAY MORTAR

Informed by the above historical and anthropological perspectives, this chapter will now return to the archaeological evidence for the use of clay mortar; to investigate its suggested 'native', or 'traditional' roots. The following examples will be discussed in an attempt to review the early evidence for clay-mortars within the wider region, and begins with a number of Roman contexts from northern Britain, in a period when lime mortar is the more usually discussed newly emergent constructional material.

#### 5.3.1 ROMAN CLAY MORTARS

As noted in the introduction to this thesis, a project involving considerable survey and excavation of Roman contexts along Hadrian's wall in the 1980's confirmed earlier interpretations that the structure had been built in two main phases and suggested that, whilst the masonry of the later Severan phase displayed a fully lime-bonded core, beds and coating, within the earlier Hadrianic phase only the wall face was 'mortared' and the core consisted of 'soil and rubble' only (Crow 1991:57). Further, materials analysis of the extremely durable Severan lime mortar indicated a limestone provenance from a source 'a considerable distance from the Wall, while other [closer] limestone outcrops... were not exploited' (*ibid*).

Perhaps it is a reflection of the mortar taphonomy, but Crow's characterisation of the earlier Hadrianic wall facing here as 'mortared' is somewhat ambiguous. Moreover, although his suggestion that this constructional technique would have allowed work to proceed in the winter implies the surviving lime mortar evidence of this phase was a secondary coating, rather than primary bedding material, this appears to conflict with evidence apparent elsewhere along the wall at Newcastle (Grew *et al.* 1979, see below). Much clearer, however, is the suggestion that the particular limestone sourced for the later lime-bonded Severan phase was probably not available to earlier Roman builders whose 'experience of

the necessary building materials was limited... particularly in the selection of suitable limestones for mortar-making' (Crow 1991:57).

The implication of this interpretation must therefore be that these earlier Roman craftsmen were not ignorant of lime mortar-making technology or techniques but only of local limestone availability, and in Crow's view the decision to build with a soil and rubble core in such circumstances was a pragmatic logistical solution (*ibid*). We might speculate whether different constructional evidence might have emerged in this early phase had the wall been built in a district where the local population sustained living lime-making traditions, but evidence elsewhere suggests a spectrum of lime and clay mortar applications (in various combinations) could be employed in different Roman contexts. East along Hadrian's wall at Newcastle, the masonry was reported to display a 'clay-bonded core' with 'lime-bonded facing' (Grew *et al.* 1979:358); whilst further north the masonry walls of the Antonine bath house at Bearsden had been constructed of clay-bonded diamond-broached dressed masonry facings with a clay-bonded core, all plastered with *opus signinum* lime mortar coatings (Breeze 1984). This suggests a much more sophisticated context for Roman clay mortar use than is generally acknowledged.

Furthermore, in contrast to the Hadrianic evidence described above, at Cramond Fort (Lothian) both clay and lime masonry mortars were reported in various Antonine contexts, wherein the earliest masonry buildings excavated are lime-bonded whilst later repairs are often clay-bonded (Rae and Rae 1974). In sum, therefore, the evidence for both clay and lime-mortars in many excavated Romano-Scottish buildings indicates that both structural forms had general currency without suggesting a broader chronological development.

### 5.3.2 IRON AGE AND EARLY MED NORTH ATLANTIC

Out-with these shifting boundaries of the Roman empire, however, and despite archaeological interpretations of native masonry traditions, it is not at all clear that the use of clay mortars to bond masonry cores, beds or coatings was a widely applied Iron Age or early medieval Insular masonry technology at all. In contrast to the Roman evidence, descriptions of clay evidence within North Atlantic building masonry of this period are rare and fleeting, and interpretations are conflicting.

Although clay was reported in the excavated roundhouse masonry at Crosskirk (Caithness), both beneath the steps and in the core of the massive walls (Fairhurst 1984, 41-42), this

appears incidental to the huge quantities of earth generally reported here (*ibid; contra* Romankiewitz 2011, 99), and distinguishing between these two materials is a crucial issue. Elsewhere, Findlay (1984, 10) feels able to suggest that there are three examples of clay used as a ‘mortar’ in the wheelhouses of the Western Isles, although the ‘interstitial clay’ found within the facing stones of the piers and external walls of the wheelhouse at Baile Sair, North Uist (Rennel and McHardy 2009) was not so definitively characterised. Moreover, the clay discovered ‘on and between the stones’ of the recently excavated wheelhouse walls at Old Scatness was described as ‘unusual’ evidence and ‘not grouting or bonding for the walls, but a purely surface feature... [which]...appears to have formed an inner facing to the walls (Dockrill *et al.* 1997, 69-70). As described, this interpretation does sound like rare Iron Age evidence for a secondary clay ‘plaster’ coating of a dry-built wall.

Staying in the Northern Isles, evidence for early medieval constructional clay use was described by Morris (1995) during the excavation of a Pictish cellular building dating from 600-915cal.AD (on the Point of Buckquoy, Orkney), where a possibly corbel-roofed figure-of-eight masonry structure had been revetted into the natural subsoil of the site. Above these retaining walls an ‘encircling bank of clay with further walling form[ed] a rim’ (*ibid*, 293), but this does not appear to describe clay-bonded masonry *sensu stricto* - where clay is used as a mortar to separate and stabilize masonry beds. Like similar structures elsewhere in Atlantic Scotland, this structure should perhaps be characterised as a dry-stone retaining structure which in this case happens to be retaining a clay-based, rather than the usual sand, subsoil.

Clearly, it is not easy to review the evidence for the use of constructional clay mortars in Atlantic Scotland from these few excavation reports, when there are so few archaeological descriptions of clay contexts within the huge corpus of upstanding Iron Age dry-stone building excavation and survey. Taphonomy or lack of reporting may be a factor here (cf. O’ Sullivan 1984; Strachan 2013), but, accepting that it is dangerous to extrapolate from negative evidence, the conclusion must be that there is no evidence because these buildings are positively earth-packed or dry stone rather than clay-bonded. It is, therefore with some relief that we can now turn to a site with both excellent clay preservation and a nuanced interpretation of that evidence.

### 5.3.3 NENDRUM

The excavated evidence at the early medieval monastic site of Nendrum, Northern Ireland, describes some of the most sophisticated employment of clay mortars known to this author from any period, and indicates the builders had a close technical familiarity with their materials. All the surviving clay mortar materials in evidence at this tidal mill were quarried from the local shoreline, but the assemblage included clay from two discrete sources, with contrasting geological provenances, and different physical properties which were employed within distinct masonry contexts (McErlean and Crothers 2007, 118-120). An orange-coloured glacial clay of terrestrial origin and a grey-coloured clay of marine origin were both evident within various parts of the structure, ‘as a matrix or bonding agent’ (*ibid*), but it became apparent across this site that where these two materials were found within adjacent contexts, then the orange glacial invariably overlay the grey material. This grey material was found to have a higher clay fraction, and in some contexts was mixed with ‘gravel and stones and had a stiff, sticky consistency when wet, drying out to hard surface with an almost cement-like quality...’ (*ibid*). The grey marine clay seemed more impervious, and often appeared to have been used as a core sealant (for instance within the inner core and foundation of the dam) whilst the outer structure was bonded with the orange glacial material. Moreover, although the walls of the phase 2 wheelhouse appeared to be essentially dry-built, some evidence for (orange glacial) clay-bonding survived in the wall cores (*ibid*, 100), and this rectangular 8<sup>th</sup>-century structure predates the emergence of lime mortar at this site (within the round tower and later pre-Romanesque chapel) by around 200 years.

### 5.3.4 WHITHORN

Across the North Channel from Nendrum at the early ecclesiastical site of Whithorn (Galloway) it is the early use of lime mortar which once more is most often discussed, but the evidence for clay mortar use here is perhaps even more remarkable. The best surviving and most comprehensive clay mortar evidence excavated at the site is also dated to the early 8<sup>th</sup>-century, when a clay-walled possible burial chapel was constructed adjacent to the Northumbrian church, in which:

“The provision of a stone plinth and the careful preparation of the clay showed that the builders were fully conversant with the practicalities of clay-walled construction, while the long life of the building attests to their skills and the care with which it was maintained” (Hill 1997, 165).

The upper course of this stone plinth was ‘bonded with clay’, whilst the clay-rendered walls displayed both a finer textured material (implying a different specification) and float-trowel tool-marks (*ibid.*). The clay preparation pits excavated to the east may have been for later maintenance, but remind us of the much later description of Irish clay mortar preparation discussed above, and similar Scottish evidence at 16<sup>th</sup> century Roxburgh (RCAHMS 1956:422), Raits (Lelong and Wood 2000), and possibly late medieval Dun Eistean (Lewis) (Barrowman 2008).

There do not appear to be any antecedents for this sophisticated use of clay within Galloway or Northumbria (*ibid.*; Newman and Brennand 2007, 86), and although Hill (1997, 165) speculates that the ‘technical knowledge’ may have been introduced by Pecthelm from south-west England, that this building survived until the mid-ninth century and is contemporary with the mill at the ‘neighbouring’ monastic site of Nendrum (described above) and with clay-bonded masonry at Whitby and Monkwearmouth (Cramp 1976, 225-7, 233) may be more pertinent lines of enquiry.

There was also evidence (albeit more fragmentary) for the earlier use of constructional clay at Whithorn as within an enclosure wall associated with the 8<sup>th</sup>-century first phase of the Northumbrian Minster ‘Patches of alluvial clay survived’ survived within the masonry core (Hill 1997:143). Although it is the infamous 5<sup>th</sup> century (*ex situ*) evidence for lime mortar at this site which is most frequently discussed (Thomas 1971, 14), contextually the lime evidence associated with this 8<sup>th</sup> century (clay-cored) enclosure wall is more convincing.

It is remarkable that once again our earliest evidence for the use of clay mortar, in plaster, core and bonding contexts, is within the same ‘sub-Roman’ and Northumbrian context as the evidence for lime mortar, and further questions at what point the use of clay mortars became traditional in this region. Hill is astute in his recognition of these materials, the recording of their contexts and in acknowledging that the 5<sup>th</sup> century lime evidence (along with that for glass and metal working) represents an ‘alien or ‘transferred’ technology produced by ‘skilled artisans’ using both imported and local materials (Hill 1991:4-7), although the apparent confluent emergence of both clay and lime mortars within the archaeological record here during the 8<sup>th</sup> century is not discussed.

Unfortunately, however, on the basis of their similarly clay-bonded methods of construction, Hill (1997, 9-10) also drew parallels between these early medieval Whithorn structures and the chapel previously re-excavated from below the east-end of the Whithorn Priory Church

by Radford (1950). Although this is an improvement on Radford's 'Celtic monastic' dry-stone comparanda, and conviction that this structure was the remains of St Ninian's 5<sup>th</sup>-century church of St Martin (*ibid.* 118-119), this remains a very early suggested date and a very slim material basis for contemporaneity. This underlying chapel and a number of similarly situated buildings will, however, be the subject of the next section of this chapter.

### 5.3.5 PRE-ROMANESQUE CHAPELS IN THE SCOTTISH NORTH ATLANTIC

It is significant that the excavators and surveyors of early masonry church buildings in Man, Islay and Iona have been working within an archaeological discourse which has not sought a nodal 'top-down' historically-informed interpretive model. This contrasts with a number of other early to high medieval narratives, such as Benedict Biscop's church constructions in 8<sup>th</sup>-century Northumbria or Olaf Kyrre's recruitment of 'foreign craftsmen' to build and embellish his cathedrals in 11<sup>th</sup>-century Norway (Blindheim 1987, 17) in a region otherwise dominated by timber buildings. It is also notable that the building of Christchurch Cathedral in Orkney is reported to date to a similar mid-11<sup>th</sup>-century period and yet (although the identity of the masons remains obscure) archaeologists have suggested masonry buildings in this district have a much earlier heritage which probably pre-dates the Saga-informed royal imposition of Christianity onto the Earldom.

In an important summary of the known archaeological evidence for possible first Millennium ecclesiastical buildings in the Northern Isles, a similar 'continuity of site' interpretation to that already discussed above for Islay and Man was suggested by Barrett (2003, 211), who highlighted the 'reasonable proposition' that any evidence for Viking Age Christianity here is likely to underlay later church buildings associated with Pictish sculpture (cf. Barrowman 2012, 197-198). Although constructional technique was not discussed in this paper, it is notable that two of the final shortlist of four possible first-Millennium chapels were masonry, and this parallels my earlier study of the regionality of bicameral chapel structural forms in Atlantic Scotland which highlighted a number of underlying unicameral buildings with early evidence for lime mortar use (Thacker 2011; 2015). These are the earliest ecclesiastical masonry structures in the Scottish North Atlantic for which we have a clear high medieval upper terminus, and some of their structural details are collated below in table 2:

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<u>Site</u>	<u>Wall Width</u>	<u>Core</u>	<u>Coating</u>	<u>Entrance</u>	<u>Possible Date</u>
St Ninian's, Shetland. 6.5 x 5m	0.9m	?	Lime	West in later	? O' Dell Barrowman
St Ronan's, Iona. 4.5 x 3.5m	0.8m	Clay	Lime	West	? O' Sullivan
Whithorn, Galloway.	1.0m	Clay	Lime	Probably West	? Radford
Teampull Ronain, North. Rona.	?	?	Lime	West	C.10-11 <sup>th</sup> Nisbet/Gailey Thacker in prep
Isle May, Fife. >4.0 x 3.2m >5.8 x 3.2	1.1m 1.1m	Clay Lime (shelly)	? ?	West? West?	Late C10th 10-11 <sup>th</sup> James/Yeoman
Newark, Orkney.	0.75-0.95m	?Lime	Lime	Unknown	C.10-11 <sup>th</sup> Barrett
St. Nicholas, Stronsay, Orkney.	0.6m	Lime?	Lime	West	C.11 <sup>th</sup> Lowe <i>et al.</i>
St Peter's, Brough Birsay, Orkney.	1.0m	'...walling suggests masonry was mortared...but no mortar remains' (Cruden 1965).		West in later	? Cruden
St Magnus, Birsay, Orkney.	1.5-1.3m	Lime	?	Probably West	C.11 <sup>th</sup> Barbour
Clow Chapel, Watten, Caithness	0.75m	'Although inventory states 'without mortar', a small amount of lime mortar was found' (Talbot 1978).		'South-west' (Talbot 1978).	C.12 <sup>th</sup> ? Talbot
Portmahomack, Ross-shire. 'probably earlier than C13th plinth'	1.2m	Lime	?	South	C.12 <sup>th</sup> Carver

Table 2 (above) – Excavated Scottish North Atlantic buildings underlying or abutted by later Romanesque churches (also including the May chapels).

Although likely to represent a broad range of dates these chapels appear to present a reasonably structurally-coherent group. All of these buildings are unicameral, and west doorways are most common, with only the chapels of Clow and Portmahomack displaying lateral entrances and both of these are likely to be at the very late end of the spectrum. Wall thicknesses vary quite widely, but of the five buildings with west or probable west doorways whose core bonding material is known, three are clay-bonded. Most strikingly, accepting the Brough of Birsay structure was much degraded, all of the demonstrably pre-Romanesque chapels located within our survey region display evidence for the use of lime mortar and many of these are likely to predate the previously widely accepted 12<sup>th</sup>-century lower terminus for the use of lime mortar in the region (see thesis introduction).

The chronological ambiguity inherent in the evaluation of coating materials which are constructionally secondary, however, is a significant interpretive issue which has stymied the discourse. For instance, although White Marshall and Rourke's suggestion (2000, 95, footnote 110) that the lime mortar coating the underlying clay-bonded structure at St. Ronan's Iona was secondary may be strictly speaking correct, the excavators on Iona clearly imply that the lime coating was coeval with the building in their descriptions and reconstruction illustration (O' Sullivan 1994). Likewise, Yeoman's suggestion (2009, 239) that both May and St Ronan's 'lacked mortar in their construction' is consistent with his characterisation of both buildings as 'drystone' (*ibid*, 236) or 'unmortared' (James and Yeoman 2008, 38), even though 'traces of clay-bonding' were described at May and this is clearly not an appropriate characterisation of clay mortar-bonded and lime-coated St Ronan's (O' Sullivan 1994). This might be contrasted with Lowe's (1987) approach to the Northern Isles corpus (see above), and suggests that where buildings are clay-bonded and lime-coated, terminological ambiguity allows building characterisation to depend on which technology the commentator wishes to emphasise.

The building excavated at St Magnus Birsay, however, stand out from the group in table 2 because the massive size of the foundations were fully lime-bonded, and this led the excavation team to suggest this was a 9<sup>th</sup>-10<sup>th</sup>-century oratory 'in the Irish tradition' (Barber 1996, 27) comparable to the stone-roofed buildings such as St Columb's, Kells discussed by Leask (1955, 27-41). Barrett (2003) was correct to question the dating of this structure on the basis of a radiocarbon dated burial which wasn't stratigraphically overlaying, and more recent interpretation from Ireland would in any case date the vaulted Irish comparanda to around 1100 (Ó Carragáin 2010, 255). Elsewhere in the region, the comparably thick lime-

bonded walls of Tammaskirk Rendall (1.2-1.8m) might offer a good comparison given the excavators ambiguity regarding possible multiperiodicity between the nave and chancel (Clouston 1931); whilst St Patrick’s Chapel, Peel, Isle of Man, also had massive walls (Freke 2002).

Elsewhere in the Scottish North Atlantic there are other upstanding clay-bonded unicameral chapel buildings for which very early dates have sometimes been suggested on the basis of clay bonding evidence, although there are no overlaying or abutting buildings to provide a ready upper terminus (see table 3 below).

<u>Site</u>	<u>Wall Width</u>	<u>Core</u>	<u>Coating</u>	<u>Entrance</u>	<u>Possible Date</u>
Ardwall	0.8m	Clay	?	West	
Eileach an Naomh Chapel	0.85-1.0m	Clay	?	West	C.11-12th
Barhobble, Galloway	0.95m	Clay	?	Lateral	C.12th
Tigh a’ Bheaneach	1.1m	Clay	No evidence	Lateral	C.12-13th
Skinnet	1.2m	Clay	No evidence	Lateral	
Marwick Orkney	1.2m (average)	Clay	Lime	Lateral	
St Ninian’s Bute	1.2m	Clay	Clay	Lateral	
Kilhousland, Bute	1.1		No evidence	Lateral	
Kilmichael, Bute	1.0m	Clay	No evidence	Lateral	

Table 3 (above) – some upstanding clay-bonded buildings of the Scottish North Atlantic.

It is probable that the chapels included in this table overlap chronologically with those in table 2 and some of the earliest of these may also be pre-Romanesque and/or pre-parochial. It is resonant, however, that none of these buildings were accorded parish status and none

were developed by the later addition of a chancel. Indeed, the remarkable corollary to Lowe's statement is that none of the surviving upstanding, excavated or reported unicameral chapels in the Northern Isles (ie. those which did not subsequently have a chancel appended) are demonstrably lime-bonded. Although the details of some of these buildings are problematic and the materials fragmentary, sites with unicameral clay-bonded chapels of medieval date within the Scottish North Atlantic which are subsequently developed, as at St Ronan's Iona, tend to be completely rebuilt.

#### 5.3.6 SUMMARY OF CLAY MORTAR 'ORIGINS'

The above review of the early Scottish North Atlantic evidence most clearly associates the use of clay mortars with Roman archaeological contexts in the very same period that lime emerges in the archaeological record, and this correlation is repeated in the sophisticated evidence for both clay and lime mortar techniques at Northumbrian monastic sites including Whithorn in Galloway. The evidence at Nendrum is more functionally specific, and not so clearly associated with the overt symbolism of upstanding ecclesiastical buildings, but this is another local north channel/Solway monastic context, and will have been subject to similar monastic knowledge exchange networks.

The strong correlation between the evidence for clay and lime mortared structures at particular sites is paralleled by the lack of evidence for either masonry technique further north and west, until later in the medieval period. In order to understand how or why we need to consider some evidence from further north.

#### 5.4 THE NORTH NORTH ATLANTIC 1.

In his seminal discussion of the development of Norse building techniques in the Scottish Isles, Aage Roussell accepted that Scandinavian building in the late Iron Age and early medieval periods is more strongly associated with timber building, but also drew attention to evidence for Viking Age secular building in stone and earth in SW Norway (Roussell 1934, 8). The colonial evidence across the North Atlantic, however, suggests regional developments in the uses of many different materials, including particularly sophisticated turf-building techniques, and various combinations of materials are also apparent. Many of these are nicely summarized by Small (1966) in discussion of his excavation at Underhoull, Unst (Shetland), where a longhouse building dated by him to the 10<sup>th</sup> century on regional

comparanda (although a later Norse date has been more recently suggested, see Bond *et al.* 2007, 11) displayed a dry-stone inner masonry skin and an external skin of alternating courses of turf and stone (Small 1966, 237). The form of this structure is similar to a number of buildings subsequently reported from excavations across the region including: the 9<sup>th</sup>-10<sup>th</sup>-century farmstead of alternating stone and turf excavated at Toftanes (Faroes) (Hansen 1991); the longhouse constructed of two faces of large stone with a core of rubble and earth at Belmont, Unst (Larsen 2013); the stake and wattle longhouses more recently excavated in Dublin and carbon-dated to pre-1020-1190 (Ó Néil 2006); and the longhouse of turf walls on a stone footing at Bornais, South Uist (Sharples 2005). Most of these buildings have been interpreted to have had an earth or turf-packed core (e.g. Bond 2013; Larsen 2013).

The diversity and contemporaneity of this evidence supports Roussel's interpretation of regionality, but some commentators have gone further in suggesting that North Atlantic building masonry techniques developed directly from the earlier use of these materials. Freke (2002), for instance, speculated that the herringbone masonry style seen in walls of the (probably 11<sup>th</sup> century) St Patrick's Church at Peel (Man) may be a skeuomorph of Norse turf-building styles rather than evidence of Norman influence and, further north, Clouston (1931, 17) suggested that the poorly bonded masonry of some Late Norse Orcadian churches, such as Orphir, had emerged from the Norse turf or stone-and-turf structural emphasis on supporting a massive earth core. Even further north, the construction of the 13<sup>th</sup> century masonry church at Steigen (North Norway), has also been interpreted as 'influenced' by the 'northern building tradition' of medieval turf construction, as seen at Brattahild Greenland, (Urbańczyk 1999, 127): The church of Steigen has 'thick (1.9-2.0m) walls...[in which]...both faces are built of stone and mortar while the core consists of beaten clay mixed with pebbles' (Fygle 1980, 23 in Urbańczyk 1999, 127).

The Steigen example is interesting in appearing to parallel a similar constructional contrast between face and core masonry described at Hadrian's Wall above (Grew *et al.* 1980), whilst the description of 'beaten clay mixed with pebbles' is redolent of the cement-like mix of marine clay, gravel and stones identified at Nendrum (McErlean and Crothers 2007, 119).

#### 5.4.1 EARTH VS. CLAY

We should, however, question how convincing Urbańczyk's wider interpretation is when, although both materials are essentially dug out of the ground, earth and clay constructional techniques are usually very distinct. Earth and rubble packed cores are not strictly speaking

dry-stone but they are also certainly not clay-bonded, and to equate the use of earth cores in turf built structures with clay-mortars in partially lime-bonded masonry buildings, as at Steigen, denies the expertise of craftsmen such as those at Nendrum in their use of local materials. At Steigen we probably need a better description of that core-bed relationship.

For instance, the most salient masonry feature of the multiphase ‘royal’ timber building at the ‘Biggings’, in Shetland, was the construction of an 8.0m long, 1-1.4m thick protective stone wall along one side during phase 3 (c. 1200-1400), and the ‘internal packing’ of this wall ‘was of small stones and loose earth’ (Crawford and Ballen-Smith 1999:77). Similar evidence was described in another ‘cladding’ context at the timber chapel of the Brough of Deerness (Orkney) where, in the overlaying post-959AD masonry phase the ‘split stones and earth’ core of the later chapel contrasts with the ‘clay and rubble’ core of the near contemporary enclosure (Morris with Emery 1986, 320-321).

Careful characterisations can also often get lost in general typological multi-site reviews. For instance, Marstrander’s (1937, 414) general description of the *keel* sites of the Isle of Man as ‘built of unhewn stones, slabs, earth and rubble, in ancient times, with no other kind of agglutinate than earth or clay...’ fails to distinguish between these two materials, and this may be for good reason. The vague descriptors adopted by the RCAHMS for many of the similar Islay chapels, for example, present an ambiguity which reflects the archaeological evidence; as without cleaning it is often not possible to confidently determine how masonry bonding or packing materials should be characterised and so in Swift’s study (1987, 178-9) in Islay all these buildings were ultimately characterised as ‘dry-stone’.

Thirteen of these Islay medieval chapels were visited in the course of this current research and I would not only concur with Swifts pragmatic assessment but would go further and suggest that, as the only buildings with unambiguous clay-bonding evidence here are the probably 16<sup>th</sup> century chapels of Kilbride and Cladh Eilister, most of these smaller rounded pre-Romanesque buildings were probably earth-packed. The similarity of the (Norse) Islay chapels and (Norse) Manx chapels keels has also already been remarked upon, but in the excavation and survey reports of Kermode (1908; 1910; 1911; 1915; [1918]) and Bruce (1968) these Manx buildings are almost completely dominated by ‘earth’ and rubble packed masonry, and only three possible clay mortared buildings are reported. These include: St Patrick’s chapel (Jurby), which is probably 17<sup>th</sup>-18<sup>th</sup>-century; Keel Woirrey, (Kerrodhoo) in which was reported as ‘plastic’ ‘marl’ ‘cement’ by a third party; and Ballakilly (Malew)

whose walls were more convincingly described as ‘set in mud mortar’ but which was considered to be a building ‘not of the early keeil type’ (Bruce 1968, 7-10).

Late modern builders in the Isle of Man made the distinction between mortars of ‘*cray* (clay) and... *laagh* (mud) ...made from sand/earth and lime/puddle clay mixed with chopped straw or chaff’ (Cannell 2001, 72), but when the foundations of the *keeil* at Peel (Man) were excavated, the massive 1.4-1.6m wide walls of the structure were described as of ‘slates set in a fine mottled sand’ (Freke 2002, 132), without any mention of mortar. On various grounds Freke ascribes this building to the 10<sup>th</sup>-11<sup>th</sup>-century (Freke 2002, 13) which is broadly contemporary with other full-lime bonded buildings on the site, and so it is perhaps possible this ‘mottled sand’ is degraded mortar.

In seeking to trace the roots of North Atlantic Norse masonry buildings back to Norway, however, Roussell (1934, 8) does not describe early medieval Norwegian structures as clay-bonded, but as of ‘stone and earth’. Furthermore, although the 10<sup>th</sup> to 12<sup>th</sup> century rectangular but round-cornered ‘Norse’ buildings of Bornais were interpreted by Sharples and Parker-Pearson in terms of continuity of native single-skinned stone revetment walling traditions (1999, 58), again, these walls were not clay-bonded. The Anonymous life of Cuthbert of Lindisfarne describes how the 7<sup>th</sup> century saint built an enclosure on Farne by ‘...placing together and compacting with earth, stones...’ (Colgrave 1940, 97; Hamlin 1985, 287), whilst the excavation of an enclosure surrounding one of a ‘suite of 9<sup>th</sup> to 10<sup>th</sup> chapel[sites]’ at St Moluag’s Raitts (Highland Scotland), also ‘...established that it had been built of stone with an earthen core...’ (Lelong 2000, 46).

Although none of these latter examples are churches or chapels, all other sites which look like Swifts earliest Islay A/B chapels are earth-packed (and round-cornered): at Baliscate (Mull) the first stone chapel was built on a well-constructed terrace and had an ‘earthen core’ (Wessex Archaeology 2010, 7); at Speke Keeill (Isle of Man) the walls were ‘...dry-stone...supported by layers of turf’ (Wessex archaeology 2007, 9); at Ardnadam (Cowal, Argyll) the walls are earth, turf and timber set; whilst at Tigh an t’Sagairt (Lewis) the chapel is built of ‘stone and mud’ (RCAHMS 1914). We can probably add to this list with the site surveyed for this thesis at St Clements (North Uist) (chapter 6). Other evidence suggests these are all the earliest chapels in their respective regions, but all are earth-packed, not clay-bonded, and the evidence for clay-bonded masonry within these early Pre-Romanesque

chapels of the region is (almost) non-existent when this material and structural distinction is observed.

#### 5.4.2 THE NORTH NORTH ATLANTIC 2.

Rather than look to the turf-built church of Brattahild (Greenland) for direct influence of the clay and lime church of Steigen (Norway), therefore, I would suggest two other church sites investigated within Greenland are better comparanda. Indeed, these sites suggest a much richer level of contemporary craftsmanship pertained across the region, and provide further clues as to the mosaic of materials in which the builders of the period displayed expertise.

Excavation beneath the 13<sup>th</sup> century Episcopal church of St Nicolaus in Gardar (Greenland) revealed an earlier, probably early 12<sup>th</sup> century, church constructed of ‘...small flat stones, laid in thick clay, to a width of about 1.6m’ and a coeval bell-tower which by contrast was lime mortar bonded and bedded (Norlund 1930, 37). The later cruciform cathedral certainly pre-dates the three burials found within the north chapel, and carbon-dates of 1225-1275AD support Norlund’s suggested construction date of around 1200 (Lynnerup 1998, 14-16), but the masonry of this overlaying building was also of clay-bonded masonry wherein the ‘joints and the inner parts of the masonry were still entirely filled with clay’ (Norlund 1930, 34; my translation). Meanwhile, the contemporary and neighbouring church of Hvalsey was built of split granite ‘bricklaid in clay and furrowed in lime and mortar, inside as well as outside...’ (Bruun 1918) and, although neither the cathedral nor the earlier church at Gardar displayed surviving lime mortar evidence, the lime-bonding of the 12<sup>th</sup> century bell-tower at this site and that coating the church at Hvalsey were both thought to have been made from burnt shells (Norlund 1930; Clemmensen 1911; Nyegaard 2009 and references therein).

The cruciform and glazed cathedral of Nicolaus at Gardar was clay-bonded with evidence for a dressed soapstone south doorway, a turf-built west gable, and some courses were evident where the stone was ‘set in turf’ (Norlund 1930, 36), whilst the lime-bonded masonry of the earlier bell-tower is described as ‘of the same character as the small portion in the north-east corner of the later [clay-bonded] nave’ of the cathedral church (Norlund 1930, 47). The walls of the churchyard also belong to the same phase as the cathedral, but these ‘have been built with no other binding material than earth (turf)’, and no trace of clay was found (*ibid*, 54).

Remarkably then, these buildings demonstrate the full spectrum of clay and lime mortar evidence with which this chapter has been concerned. Within a hundred years the builders at

these two Greenland churches had built substantial (Garder was 27.1 x 15.8m externally) church buildings using clay-bonded uncoated masonry, clay-bonded lime-coated masonry, lime-bonded masonry, earth-packed masonry, turf and stone, and purely turf-built walls, and this very detailed description of the remarkable range of bonding materials in use at a single medieval site enables a much greater understanding of the archaeology.

#### 5.4.3 – SUMMARY

This section has investigated the early medieval masonry of the North North Atlantic through discussion of a range of domestic and later ecclesiastical buildings in Shetland, the Faeroes, Norway and Greenland. This sought to highlight structural distinctions evident between earth-packed and clay-bonded masonry structures and suggests that, when these distinctions are recognised, then it is clear that once again the evidence for clay mortar use emerges at the same time as lime mortar in a number of social contexts in different periods. This section also highlighted that many of these different structural and material forms are evident in different contexts at the same sites at the same time.

#### 5.5 CLAY AND LIME MORTAR ARCHAEOLOGY IN CONTEXT

This section will describe five case studies which display different types of clay and lime mortar evidence, including a number of sites from table 2 (above) which have previously been interpreted as the earliest masonry chapel buildings in Scotland. A fuller understanding of these buildings is therefore a particular concern to inform our understanding of the emergence of mortared masonry, although each of these sites also presents certain challenges of interpretation.

A particular concern for this discourse is to investigate how clay and lime mortars degrade and the evidence for mortar coating stratigraphy. It has become increasingly evident during the course of this thesis research that, within ruined buildings, both clay and lime mortars generally degrade much faster within the rubble core of masonry walls (than in the wall face) and this very often results in buildings with an apparently dry-stone rubble core but fully mortar-bonded wall faces. Even further, dissolution processes acting on fully lime-bonded buildings can also result in a degraded core mortar material comprised of the former temper only and, where that temper material had a high silt fraction, the surviving material can be almost indistinguishable from a clay mortar to the unaided eye. As mortar dissolution

processes continue it is therefore possible that a building may be progressively characterised as: fully lime-bonded initially; then clay-bonded and lime-coated; then dry-stone and lime-pointed; and finally dry-stone. This process is illustrated in appendix 5 and, as the foregoing case studies will describe, can make building survey very challenging.

#### 5.5.1 TEAMPULL RONAIN, NORTH RONA

*Teampull Ronain* is a bicameral masonry church located on the small island of North Rona, 45 miles north of the Outer Hebrides. The surviving fabric of this building is multi-phase, but its primary phase corbel-roofed chancel cell is generally interpreted as an early medieval dry-stone monastic chapel which can be ascribed to the 7<sup>th</sup>-9<sup>th</sup>-centuries on the basis of Irish and Manx comparanda and Dicuil's description of Viking expansion in the North Atlantic (Muir 1861; 1885; RCAHMS 1928; Nisbet and Gailey 1960; 1961). Following the Christianisation of the Norse population, another dry-stone cell is thought to have been appended to the west in the 12<sup>th</sup>-century, to form a bicameral nave-and-chancel church which was subsequently pointed in a red-coloured clay and then with various shell-lime mortars (*ibid.*).

*Teampull Ronain* was visited twice during this thesis research, and during these investigations at least three separate shell-lime mortared phases were recognised (see chapter 2) including some fully-bonded bed and fragmentary core contexts which suggest some of these materials are constructional (Thacker 2013a). Moreover, degradation of these mortars has also led to a spectrum of evidence taphonomy, including large masonry contexts with dry-stone cores, and bedding materials which display a spectrum of textures from white shell-lime mortar, to red shell-lime mortar, to red clay with shell inclusions, to red clay (see appendix 5). *Teampull Ronain* may be a unique site in evidencing the development of high medieval mortared masonry from a dry-stone early medieval cultural milieu, but (given the discussion above) previous very early chronologies and structural characterisations of the building are problematic (Thacker in prep).

#### 5.5.2 ST NINIAN'S, SHETLAND

The church on St Ninian's Isle (Shetland) was not visible during the RCAHMS surveys of the mid-20<sup>th</sup>-century (1946 III, 44), but excavation in the late 1950's discovered the remains of a bicameral nave-and-chancel church, beneath which an earlier (apparently dry-stone) unicameral chapel coated with lime mortar was also revealed (O'Dell 1959; 1960; Small

1973). The mortar binding the masonry of the overlaying bicameral church was interpreted as a shell-lime during the original excavation (O' Dell 1959, 42), and this has recently supported by lab-based analysis (Hall 2012), but the mortar coating the earlier building was not characterised during excavation and (apart from a small lined 'inspection pit') the site has since been back-filled to cover this early phase.

The nave of the exposed and so now upstanding bicameral church displays large sections of exposed wall core and facing, within which the shell-lime mortar appears consistent and contiguous in core, bed and internal and external coating contexts. I did not note any evidence for contrasting historic mortar materials in the upstanding building during these rapid surveys (other than small post-excavation cementitious repairs), or for the sections of medieval re-facing and re-building reported by Thomas (1973, 12). As noted above, the 'straight joints' he noted are a common feature of Norse masonry of the period, especially in internal wall faces (Clouston 1931, 17; see Uyea chapel survey chapter 3 and appendix 12).

The chancel of this building survives as little more than turf-covered footings, but within this the high altar can be inspected in full plan and the masonry here is also bound by a shell-lime mortar which closely matches that noted in both the nave and chancel walls. It is notable, therefore, that O' Dell had described (in some detail) that there was no lime mortar here, only 'shelly clay', and later investigators have subsequently characterised the feature as 'dry-stone'. Similarly problematic descriptions of degraded masonry fabric, however, are not unusual. The shell-lime bonded curtain wall at Dun Ara on Mull, for example, was described by the O.S. (1972) as 'bounded with mud and sea shells', but this confusion has added significance at St Ninian's because (as at *Teampull Ronain*) the masonry of the underlying building was also characterised as dry-stone, with a lime mortar coating (see appendix 5).

Examination of the archive photograph of an exposed internal corner of the underlying building, taken during the excavation, suggests that this earlier masonry may have been much more formally-built than that of the overlaying bicameral building, and the core masonry appears to me to be bound. Closer inspection of the masonry of the south nave wall from the inspection pit reveals that the mortar coating the internal wall face of the upstanding building forms a mortar fillet which probably denotes an earlier floor level. The small volume of protruding masonry at the base of the pit is supposed to be a section of the earlier underlying building, but the fabric here is now very voided and in a state of semi-collapse. This stonework appears very different to the formal masonry contained in the excavation

photograph and none of the lime mortar ‘plaster’ reported to coat this earlier building appears to survive here.

Barrowman has suggested the underlying building may date to between the late 7<sup>th</sup> and 9<sup>th</sup>-century by relating this apparently early masonry (within the inspection pit) to the side slabs of a radiocarbon dated long cist burial (2012, 197), but this would be much more convincing if that underlying chapel fabric were better understood. Although there doesn’t appear to be any reason to doubt that the mortar reportedly coating the early building was associated with the primary masonry only (especially considering the fillet described above), considering O’Dell accurately interpreted the mortar of the overlying building as a shell-lime his silence on the possible lime provenance of the much more significant material coating the earlier underlying building is curious. Perhaps it was more fragmentary and challenging to characterise. His mis-characterisation of the altar masonry can once again very probably be explained by the degradation of the mortar, dissolving back into a mixture of silty temper and kiln relicts which he then reasonably identified as ‘shelly clay’ and then characterised as dry-stone (see appendix 5), but the methodology by which the underlying building was also characterised as dry-stone is unknown and it is possible that a similar process of binding material degradation has occurred (as indeed Cruden 1965 suggests for St Peter’s Birsay). I would suggest the early unicameral chapel at St Ninian’s is unlikely to have been constructed in dry-stone *sensu stricto* and the issue requires re-investigation.

### 5.5.3 NEWARK

The site of a putative chapel at Newark, Deerness (Orkney) was identified as having good research potential for three interrelated reasons:

- Firstly, although again never fully published, previous excavation had identified this site as a multiphase bicameral chapel (Brothwell 1977), and so investigation was required as part of my ongoing research of this building type.
- Secondly, in an important review of the evidence for the early church in the Northern Isles, Barrett (2003) had identified this site as the earliest Christian chapel in the Northern Isles and suggested the building was first millenium on the basis of coin and associated radiocarbon-dated burials excavated by Brothwell.
- Thirdly, recent building survey had refuted the identification of the building as a chapel at all, and re-characterised the now upstanding remains as a range of the domestic ‘New Work’ otherwise located to the east (Lowe 2000; 2001).

- Fourthly, an even more recent survey and analysis of the cliff-section, from which the building is also eroding, had suggested the building in question was indeed the chapel as planned by Brothwell (Raey 2014).

I had hoped to be able to contribute to this discourse through mortar survey, as a medieval mortar from a putative high medieval chapel in this region was likely to be distinguishable from an early modern one associated with the ‘New Work’ (see chapter 3). Raey kindly met me on site to discuss the section, and highlighted a demolition layer containing fragments of lime mortar which appeared to underlay the masonry of the eastern ‘New Work’, but not the putative chapel.

Subsequent *in-situ* examination suggested that the remains of these structures did indeed contain mortars with contrasting carbonate and temper fractions, and the mortar associated with the eastern ‘New Work’ masonry displayed limestone inclusions which were absent from both the western masonry and the demolition layer. As this eastern New Work section was generally regarded as 17<sup>th</sup>-century, this mortar conforms to the emerging regional typology (see chapter 3).

The exposed masonry of the putative chapel, however, is more complex. Raey had noted a fragment of mortar on the tail of a face stone (with included shell) and suggested this evidenced an earlier post-12<sup>th</sup>-century building (2014, 10), whilst examination of the walls at the collapsed south-west corner suggested that the wall faces of the upstanding walls were lime mortar coated and bedded to the full depth of the face-stone. But the core of these upstanding walls were clay-bonded and, although no very extensive *in-situ* kiln-relict evidence was visible to the unaided eye, the bedding and coating mortar did appear to match that in the demolition layer underlying the ‘New Work’. Moreover, fragments of a similar mortar were also noted adhering to core-rubble within the clay-bonded walls of that later section to the east, indicating that this later (probably 17<sup>th</sup>-century) building had been at least partly constructed with masonry material re-used from the earlier structure.

Whilst that interpretation is straightforward and convincing, however, the earlier western building is undoubtedly more complex than is immediately apparent. The clearest lime provenance evidence was a low concentration of discoloured *C. edule* fragments with some maerl, and thin section analysis of a loose mortar sample collected from the shore suggested this was a biogenic-lime (Thacker 2015c), but on reflection the loose sample collected is of little stratigraphic value. Post-analysis literature search indicated that both recent surveys

were clearly hampered by the lack of publication of the original excavation but also, although they have come to different conclusions regarding the early building for reasons which are not explicitly discussed, they both generally agree on the stratigraphic details of the site and Lowe had even noted that the earlier building was mortar coated (2000). For my own part, however, the clearest evidence against regarding the now upstanding early building as a chapel is the lack of a nave entrance within surviving walls high enough to suggest one would be visible, and there is no very clear evidence for multiperiodicity in the bonded faces of the structure itself. Apart from the mycoform structure (Brothwell 1977), there is no underlying building evident either.

In interim here, therefore, this preliminary masonry and mortar survey supports both previous surveys. It appears certain that at least one phase of the western building had been demolished by the time the eastern limestone-lime New Work was constructed, but it is probable the earlier western building also has a multiphase past with more than a single mortared phase. The evidence for a biogenic lime, however, is tantalising evidence for the possible high medieval structure suggested to be 10<sup>th</sup>-century by Barrett (2003), and there is clearly excellent archaeological potential for a more comprehensive re-investigation to include mortar sampling in an attempt to resolve the issue.

#### 5.5.4 BRECKNESS HOUSE, STROMNESS, ORKNEY.

The 17<sup>th</sup>-century ruin of Breckness House was visited later in November 2014 and found to be a roofless L-shaped building whose masonry walls all generally survived to two full storeys, although no gables remained. This former high status residence of the Bishop of Orkney had previously been characterised as clay-bonded and harl-pointed by the RCAHMS (1946) and clay-mortar was indeed initially noted in some beds of the external face of the east wall to within 80mm of the external wall face. This was a brown-coloured clay, of similar colour to the local flags and with large red-brown angular lithic inclusions to 60mm. In some contexts it was evident that this material had been coated with a brown lime mortar of similar, but slightly lighter, colour and texture, although this coarse limestone-lime mortar also included a high concentration of yellow-brown subangular lime inclusions to 12mm. Closer inspection of this external face of the east wall, however, revealed that in other contexts the face stones were clearly lime-bedded, and with a contrastingly shell-tempered mortar material which in some contexts also underlay the coarse brown lime mortar previously described. Examination of a clearly secondary doorway in the south wall

indicated this had been slapped-in with the same coarse brown mortar, suggesting a general re-coating of the building coeval with this later doorway.

Although the masonry of the east wall had been initially characterised as clay-bonded, the quoins of the building appeared to be fully lime-bedded in primary shell-rich mortar, as were large sections of core between closely spaced features such as the east doorway and an adjacent window. There appeared to be great variation in the depths of these apparently primary lime and clay mortar materials, and in some contexts clay mortar beds were evident overlaying lime mortar beds in masonry which otherwise appears well-bonded and coeval. More significantly, however, the building displayed internal masonry arches with apparently fully lime-bonded *voussoirs*, although the general internal face-work surrounding them was clay-bonded. Given the widespread association of arcuate masonry with lime-bonded masonry this is significant, and adds to the value of a case study which suggests:

- That lime and clay mortars were used within the same building, at the same time, by the same craftsmen.
- That clay mortar could be an appropriate masonry material even in very high status formal contexts where lime was also available.
- That even where the main structure of a building is clay-bonded, arches and other dressed or undressed features may be lime-bonded.

Of course, Breckness House is from a particular 17<sup>th</sup>-century context in an early modern period when the wider surveys in this North-East Region suggest clay mortar use was very common. The similarity of the evidence to the masonry at Newark may be relevant for future survey, but clay and lime mortars are also often reportedly associated with the Late Norse period and in that regard our last case study in this section which will discuss the masonry of the church at Eynhallow.

#### 5.5.5 EYNHALLOW CHURCH

The substantially upstanding church on the island of Eynhallow had previously been characterised as a predominantly two phase clay-bonded structure, in which the primary tri-cameral Romanesque chapel had been converted to domestic accommodation in the early post-Reformation period (RCAHMS 1946). It was also generally accepted that the chancel arch had been rebuilt later in the medieval period, but there was widespread disagreement over the relationship of this feature to the rest of the building and conflicting interpretations

of whether the western cell was primary or secondary, and/or a porch, sacristy or tower (see the various plans and descriptions of Dryden 1866; MacGibbon and Ross 1896, 116; RCAHMS 1946, 231; Radford 1962, 184; Lowe 1987).

I was concerned that although previous interpretations had suggested the main phases were separated by over 300 years, the masonry of the building had been characterised monolithically, as a clay-bonded and lime coated structure, whilst some interpretations had even suggested the primary building was not associated with lime mortar at all (Lamb 1993). MacGibbon and Ross, however, had reported that ‘Plaster, apparently ancient’ survived in a number of contexts, most of which were in the chancel (1896, 120), and (as with Newark) I suspected that there may be a contrast between any putative 16<sup>th</sup>-century and high medieval lime mortars which might inform a re-analysis of the building’s phasing. Physically surveying the chapel fabric was also a priority because an earlier desk-based survey had suggested Eynhallow church was the only surviving reportedly clay-bonded arcuate bicameral chapel in Atlantic Scotland (Thacker 2011; 2015a).

Once on site, however, the reasons for the previous confusion over this structure and its phasing were immediately apparent. The constructional use of various combinations of both clay and lime mortars were evident and although both medieval phases of this structure appeared to contain peat-fired maerl-rich mortars, the primary phase appears to display a clay-bonded core in some contexts (most convincingly immediately above the arch in the nave west wall) whilst the secondary medieval phase associated with the chancel arch appears to have been fully lime-bonded. That the primary phase had also contained lime mortar, however, is suggested by a number of fully lime-bedded face stones which, like the *voussoir* at Breckness House, included the arch-stones of the west nave wall. Moreover, this interpretation is clearly supported by examination of the main abutment between the medieval phases in the north wall, where the secondary chancel arch directly abuts multiple mortar and lime-wash layers which had coated the reveal of the primary north pier.

The extent of the later medieval work, which appears to have included the whole chancel, was assessed by reference to the fully lime-bonded masonry, and this interpretation was subsequently supported by the discovery of the footings of an earlier (primary) chancel east wall protruding from the secondary north and south chancel walls (Thacker 2015d). As was suggested at Uyea Shetland (see chapter 3) this primary masonry indicates the bicameral building had originally been constructed with a small internally-square chancel cell (*contra* Radford 1962) but, unlike at Uyea, the primary chancel arch at Eynhallow was the full width

of that chancel cell and lateral nave entrances were evident in both north and south walls (see chapter 6).

Consideration of this evidence suggests there is no surviving evidence for clay-bedded arcuate masonry in the Scottish North Atlantic. Like the 17<sup>th</sup>-century burial aisle at Uyea Shetland and the ‘New Work’ on mainland Orkney, almost all the masonry of the post-Reformation phases of the building appeared fully clay-bonded, but these had lintelled opes and limestone-lime bonded details such doorway jambs. This later use of clay confuses the evidence in some contexts (such as the rebuilt wallheads of the western tower) making their interpretation challenging, but further demonstrates the remarkable array of different phase-specific coeval constructional lime and clay mortar combinations in evidence in this building and the wider region. The above material characterisations have now been supported, in interim, by petrographic analysis of a number of clay and lime mortar thin-sections and, although more work is required and planned, this re-analysis has begun to enable the medieval development of the church to be interpreted more clearly.

## 5.6 CONCLUDING DISCUSSION

This chapter set out to explore the evidence for the use of clay mortars within the medieval and later buildings of the North Atlantic, and re-assess a number of claims which had previously been made for the material. These included its association with an intermediate stage in the medieval development of lime-bonded masonry, with native or vernacular craftsmanship, with economic poverty, with a particular region, and with Norse settlement.

The clearest message to emerge from this research, however, is that the evidence for clay and lime masonry mortars is very closely interrelated, and this appears evident in the archaeological record of the region from the earliest period. Both materials emerged together in the Roman buildings of northern England and southern Scotland and this association appears to continue into the sub-Roman and early medieval ecclesiastical sites. Some specialised use of clay mortars was noted in Northern Ireland but further north and west there doesn’t appear to be any widespread use of clay as a constructional masonry mortar through the Iron Age and early medieval periods. The previously ascribed chronologies of many reportedly early medieval ecclesiastical buildings are problematic, but where clay is associated with pre-Romanesque chapels in Galloway and Iona these are again also associated with lime mortars coatings. By the high medieval/Romanesque period, clay-bonded masonry is evident at a number of sites throughout the North Atlantic, including

Garder, Steigen, and Eynhallow although these sites also evidence lime mortars which are very likely to be primary/contemporary, and across most of the region fully lime-bonded chapels and churches dominate the corpus by this period. Clay-bonded churches are even rarer in the late medieval period, but more widespread evidence begins to re-emerge in 16<sup>th</sup> and 17<sup>th</sup>-century buildings such as: Kilbride church, Islay (Swift 1987); Dun Eisten, Lewis; the Kebister Tiend barn, Shetland (Owen and Lowe 1999, 91); Breckness House, Orkney; and Greenwells booth and Vöesgrind (both Unst, Shetland). In the later modern period, clay-bonding is a commonly employed structural form in post-Improvement domestic structures and farm buildings right across the North Atlantic.

Although there is no functional requirement for lime mortar in arcuate masonry, the association between the two materials is very strong and no clay-bonded arches or vaults were noted in the medieval or later buildings surveyed for this thesis, and no convincing evidence for their construction was reported elsewhere in the North Atlantic. Moreover, evidence for corbel-arching within clay-bonded buildings was also noted in a number of post-medieval buildings. Where arcuate masonry did survive in buildings with a clay-bonded core (so not at Pierowall, Westray unfortunately), then the arch stones themselves appeared to be lime-bonded. This was evident at Breckness House and Eynhallow, and descriptions of the crypt at Portmahomack suggest similar evidence may pertain here also (Carver 2008), whilst quoining and ope-reveals are also often lime-bonded in otherwise clay-bonded post-medieval buildings. Whilst arcuate and/or fine dressed clay-bonded masonry is reported in medieval building surveys elsewhere - including at Howth House of 13<sup>th</sup> century Ireland (Hayden 2006), Gardar Cathedral of 13<sup>th</sup> century Greenland (Norlund 1930), and within the Roxburgh Peel-houses of 16<sup>th</sup> century Scotland (RCAHMS 1956, 422) - once more all of these reported instances are also associated with contemporary lime mortars and so require closer inspection. Although clay-bonding and dressed masonry (and edge-laid rubble stone) are not mutually exclusive in all archaeological contexts, the association with lime mortar is very strong across the wider region in the medieval period.

Taphonomic processes of core mortar degradation and multiperiodicity can make it very challenging to characterise the materials and the depositional profile of clay and/or lime mortar evidence at some sites, and this problem is compounded in desk-based studies by the use of ambiguous terminology around phrases such as dry-built, earth-bonded, clay-bonded or mortared. An 18<sup>th</sup>-century account which described Braal Castle (Caithness) as

constructed of ‘...wonderfully thick in walls, which are partly built with clay, partly with clay and mortar mixed, and in some parts with mortar altogether’ (Cameron 1791-99, 50) provides a nice example of the issues presented at some sites. Understanding more fully how taphonomy might influence building and materials analyses is a pressing concern for future research.

There hasn’t been space here to discuss clay tempered lime mortars or lime-stabilised clays, although we briefly encountered them in 20<sup>th</sup>-century rural Ireland (Ó Danachair 1957) and Man (Cannell 2001). It is worth highlighting a Scottish example somewhat analogous to the clay mortars of the early medieval mill at Nendrum, however, as the 15<sup>th</sup>-century Old bridge of Dee in Aberdeen included ‘parts of the internal works...[where]...the mortar used had been strong red clay, with a mixture of hot lime...carefully beaten together and mixed through the rubble...[and this]...had stood firm against the wash of the water (Myln 1893, 38). Where flexibility and waterproofing are required then clay mortars can sometimes offer better performance than lime.

Whilst late and post-medieval documentation associates clay mortars with ‘cowans’ of lower status, the archaeological evidence in the Scottish North Atlantic suggests that the production and deposition of clay mortars was performed by craftspeople at many social levels in different periods including at formally-built high status sites with dressed stone. It is clear that these craftspeople were producing and using lime and clay mortars contemporaneously, and using a variety of masonry techniques appropriate to the bonding material in different constructional contexts. Indeed, clay-bonded foundations or under-storeys with coeval lime-bonded superstructures have been noted in Anglo Saxon Whitby (Cramp 1976), 12<sup>th</sup>-century Borders Scotland (Yeoman 1995, 45), and 18<sup>th</sup>-century Dumfries (Crosbie 1844), and a hierarchy of different contemporary materials at single sites is also commonly encountered.

Post-medieval reports from across Scotland and Ireland indicate that the specification of clay mortars was itself a specialist task, and this was certainly also salient in the early medieval evidence at Whithorn (Hill 1997) and Nendrum (McErlean and Crothers 2007). The evidence discussed in this chapter suggests that the use of clay mortars is not a simple response to a lack of knowledge of lime-burning technology or a prehistoric technically continuous masonry tradition, but rather, clay-bonded masonry techniques often appear to inhere in craftspeople who demonstrate a suite of technical skills which are likely to have been introduced, developed, translated and transmitted between different archaeological contexts in complex ways. In some districts a ‘trickle-down’ process of masonry

construction appears to pertain, such as in the Isle of Lewis where clay mortars appear in the high medieval chapel of *Tigh a' Bheannaich*, then in the late medieval tower of *Dun Eistean*, then in a small number of more widely distributed 18<sup>th</sup>-century tacksmans houses, then in the widely distributed white-houses of 19<sup>th</sup>-20<sup>th</sup>-century crofts. In these circumstances it appears likely that the social level of the craftsman will also have changed as clay mortared masonry becomes relevant in different social contexts, although that doesn't quite explain how the expertise was (traditionally?) translated.

This close relationship between clay mortars and lime mortars suggests we should associate their use within similar cultural paradigms, and relate both materials to a concomitant requirement for straight-sided, square-cornered, plumb masonry buildings. A similar change in the plan-forms of secular Irish buildings during the early medieval period is evident across the whole country, and has been interpreted as the result of a desire to use different constructional materials; resulting in 'increased evidence for joinery, stonework and clay or a combination of these' (Lynn 1974, 37). In ecclesiastical buildings others have suggested more complex, drawn-out regional early medieval transitions are apposite (White Marshall and Rourke 2000, 51–55), whilst in the west, the plan form transition within chapel buildings has been interpreted as involving the same dry-stone materials in a structurally staged developmental sequence taking four centuries (White Marshall and Walsh 2005). Swift noted a similar structural dichotomy in the pre-Romanesque chapels of Islay, from the rounded corners of the dry-stone buildings, to the square corners of the mortared buildings (1987) and, although by the time masonry chapels are being built in the Northern Isles they are mortared from the start, earth-packed, stone-and-turf and dry-stone masonry longhouse buildings had been widespread for some time.

Mortar materials then emerge in different political, cultural and social contexts through time, and the regionality of clay mortar use can be related to its changing relationship with different lime mortar materials. In the medieval period there seems to be a strong association between the use of clay and biogenic-lime mortars and it may be significant that this was even apparent at site level in Tuquoy where the secular buildings were repeatedly clay-bonded and biogenic-lime coated, but the chapel was fully limestone-lime bonded (see chapters 3). Although much more work is required here, in contrast to the post-medieval evidence at Breckness House, the possible association of limestone-limes with higher status high medieval buildings in the North-East Region (see chapter 6) might suggest clay-bonded limestone-lime coated buildings are unlikely to be widespread in this period. This association

is also apparent on a regional level. Galloway and Dumfries had strong shell-lime and clay-mortar influenced masonry cultures until the very recent past (Symson [1684]; Brown 1791-99, 288; Ewart 2001; Crosbie 1844), as did Isle of Man (Rigby 1927; Cannell 2001), Greenland, Lewis, Caithness, Orkney and Shetland (Nicolson 1972, 63). As we are aware (from chapter 2) western Denmark and Holland have been shell-lime manufacturing regions for much of their history, and even into the late 19<sup>th</sup>-century farmhouses here were often ‘brick laid’ in clay, and coated with shell-lime (Feilberg 1922).

The earliest medieval mortar evidence in the Scottish North Atlantic needs much more careful work, but again the apparent evidence for clay and biogenic-lime mortars is suggestive. Of the demonstrably pre-Romanesque buildings listed in table 2 most are beneath buildings which contain shell-lime or at least shell-rich mortars. Regarding fully-lime bonded buildings elsewhere in the region we might add to this the early lime-bonded church on *Scelig Mhichíl* (Pavia 2010), whilst the church on Inishmurray was also described as bound ‘with little cement of shell grouting and clay’ (Anderson 1881, 89), and the church on High Island was bound with a probable shell-lime also (White Marshall and Rourke 2000).

In Ireland, the coincidence between Ó Carragáin’s distribution of pre-Romanesque mortared masonry chapels (2005a, 37) and the distribution of limestone across the country is striking, and there are very few mortared pre-Romanesque churches in the sandstone-rich south-west of the country, in granite-rich east Galway, or north of a line from Mayo to Dublin. O’ Keefe (1994, 119) points out that, ‘for reasons yet to be established’, Irish Romanesque architectural developments made very little impact in the north of Ireland, but there is a significant small cluster of pre-Romanesque chapels in the north around Derry and Strangford Lough – in other words around Nendrum of the clay-bonded mill (McErlean and Crothers 2007) and the clay-bonded County Down chapels highlighted at the beginning of this chapter (Government of Northern Ireland 1966; Hamlin 1976). If the apparent medieval correlation between the use of clay mortars and biogenic rather than geogenic lime sources can be demonstrated in future work, this may explain why clay-bonded chapels are not salient in the archaeological record of limestone-rich mainland Argyll and Midland Ireland, and may suggest we should expect biogenic limes in clay-bonded Co. Down (Ireland).

Although difficult to definitively demonstrate, except where lime mortar is also evident in core contexts, where pre-Romanesque and Romanesque clay-bonded buildings in the Scottish North Atlantic have been lime-coated then the weight of evidence suggests that coating was generally applied in the primary phase. Evidence for stratigraphically pre-

secondary lime mortar coatings has been noted at Tuquoy Hall, Eynhallow and Breckness House, and might be assumed at St Ronan's Iona. The chapel on the the Brough of Deerness was coated with a shell-lime in a secondary phase, but this was not a clay-bonded building (*sensu-stricto*). This evidence does, however, add some complexity to our interpretation of the possible evidence at St Ninian's, whilst it is to be hoped that further mortar archaeology at *Teampull Ronain*, North Rona can resolve the mortar stratigraphy there. Where no evidence for lime mortar coating is evident upon a clay-bonded building then, given their excellent survival elsewhere, it can probably be assumed in most cases that none was ever applied, although lack of notice in third party surveys cannot be taken as evidence.

The chronology of these different structural types suggests that, rather than occupying a pre-existing evolutionary position, on a regional, sub-regional and very often site scale, clay and lime mortar use is generally contemporary. Rather than providing an upper terminus, the evidence for lime is therefore generally a lower terminus for clay mortared masonry use.

The evidence for the association of clay-bonding and/or shell-lime coating and shell-lime bonding in a number of the earliest known masonry buildings of the North Atlantic is suggestive, however, and similar associations are in evidence elsewhere around the world in contexts outside the former Roman Empire. In Swahili Africa, for instance, clay and lime mortar emerge together in the archaeological record at the clay-bonded and lime-coated Shanga mosque (Insoll 1996). This structure was dated to the late 10<sup>th</sup>-century AD on its association with two Egyptian coins, and appears to be a clear structural departure from the series of ephemeral (probably wattle and daub) buildings which underlay it (*ibid.*). Some 150 years after the Islamisation of the population, clay-bonded lime-coated buildings emerge together into the archaeological record and appear to dominate the masonry culture for the next 400 years – until fully lime-bonded arcuate buildings began to be built at very high status sites by imported masons (Sutton 2002; Wynne-Jones 2007; Killick 2009). The earliest clay-bonded and lime-coated masonry buildings of Swahili Africa, however, retained the plan-forms of their ephemeral predecessors, as new Islamic technologies were very carefully incorporated and developed. This process has been described as the 'indigenisation of Islam [where unique blends] of Muslim and Indigenous elements...' eventually emerged (Insoll 1996).

The reasons for using clay as a bonding material, even where lime is also being used, may be manifold. Clay mortar does not require fuel for its manufacture so it is certainly a much cheaper mortar material to produce and, depending on location, that cost differential could be

considerable. The increase in evidence for clay-bonding in the 16<sup>th</sup> and 17<sup>th</sup>-century Northern Isles may relate as much to the cost of fuel (see chapter 4) as to the recognition of widespread limestone sources or the loss of shell-lime making techniques. This may also suggest, however, that the clay in Orkney makes very good mortar, and so for this period a multi-skill set of lime and clay production was a requisite of the regional masonry culture.

By contrast, however, when the distinction between clay-bonded and earth-packed structural forms is made, then the surviving upstanding evidence for clay mortared masonry in the Scottish North Atlantic (as defined by this thesis so crucially precluding Galloway) in the Late Norse period is not widespread. From small chapels like Uyea to large Castles like Dunvegan, most buildings are fully lime-bonded and the majority of lime mortars are biogenic. Clay mortars are more indicative of Norse construction elsewhere in the wider North Atlantic because widespread sections of society in a wide range of locations were moved to build similar masonry buildings.

Accepting that previous chapters have demonstrated that different lime mortar materials have remarkable archaeological potential and regional distributions which suggest various materials had cultural relevance outside of environmental availability, from this discussion of the evidence of clay and lime it is now apparent that it is the use of mortar - *any mortar* - to somehow initially mediate a cultural negotiation which is the most fundamental concern of various people or communities at different times. Indeed, much of the archaeological potential of these materials is directly linked to the different ways in which that need has been met, and just like the evidence for different lime provenances, clay mortars have regionally, chronologically and socially-contingent distributions which allows us to investigate how that negotiation was mediated in any given context.

Importantly, however, this offers a change in paradigm which allows those of us working within northern and western Scotland to look at north-west European architectural trends, including those of Ireland, from an inclusive position. Invoking comparanda from other regions associated with different mortar materials (even where those materials are associated with architectural contrasts) may be acceptable where the reasoning is explicit. Recognising the archaeological potential of material contrast, this chapter simplifies the field and suggests we can now return to more conventional European typological methodologies, such as plan-forms, arch-types and altar positions, from a more nuanced regional perspective.



## Chapter 6 – Constructing Lordship in North Atlantic Europe: an inter-regional buildings approach

### 6.0 INTRODUCTION

Taking the conclusion of the previous chapter on clay and lime mortars as its departure point, this last substantive chapter will take a more cross-disciplinary and inter-regional approach to buildings analysis. The ultimate goal will be the construction of a framework for church and chapel development within the North-West Region, informed by an increased understanding of the various building cultures of the North Atlantic. The chapter will begin by comparing the wider historical, geographical and archaeological context of previously discussed case studies in Argyll and Orkney to present a more refined chronology of high medieval secular and ecclesiastical lordship construction in the South-West and North-East regions of the survey. This will demonstrate that important evidence for these cultural processes are preserved and betrayed by surviving upstanding buildings in historically-contingent plan-form, material sourcing, stone emplacement and mortar making techniques, which have striking regional distributions throughout the wider North Atlantic.

The regionality of this evidence will then be used to inform an interpretation of the chronology of lordship construction in the North-West Region through the study of the church and chapel buildings in Uist and Lewis. In this way the thesis will be returning to re-investigate the same northern Hebridean buildings with which the research began, but from a more informed inter-regional cross-disciplinary perspective.

### 6.1 A RETURN TO THE CASTLE AND CHURCH AT FINCHARN

In chapter 4, comparative microstructural analysis of mortar samples taken from Castle Fincharn enabled this ruined mid-Argyll structure to be correlated with wider geological, ecological and palaeoecological evidence, and allowed surviving mortar-fuel relicts to be radiocarbon dated to within a very narrow combined 1219-1269cal.AD range. Further discussion concluded that the widely reported dramatic 13<sup>th</sup>-century increase in high-status masonry building in the region was coincident with fundamental changes in the political and physical environment and that both were contingent expressions of lordship as stated by the 1240 royal charter. Similarities in mortar-making and stone-emplacement techniques, and architectural typology, suggested the nearby twin-lancet parish church was also broadly contemporary with the castle, and their geographical proximity and similar later biographies

were regarded as evidence that Castle Fincham was indeed the ‘Castle of Glassary’ referred to in later 13<sup>th</sup>, 14<sup>th</sup> and 16<sup>th</sup>-century documentation (MacPhail 1916). This interpretation was further supported by discussion of the curiously northern locus of church and castle within the medieval parish of Glassary, and this location was related to the sites pre-existing geo-historical importance as a focus of the larger *tuath* (see chapter 4 and Thacker forthcoming).

Moving that discussion on here, on the basis that some of the settlements included within the 1240 charter were located in Cowal, MacPhail had suggested that this was evidence that the document represented ‘confirmation’ of lands the MacGillechairs already held as part of a more scattered and so therefore pre-feudal chieftainship (1916, 121). More recent research by Butter (2007, 257-259) has identified a more complete possible list of these settlements, and mapping these here (see appendix 6.1) highlights a number of issues: firstly, the northern locus of Fincham within the lordship and parish of Glassary is not only geographically peripheral but also remote from the larger areas of settlement around Kilmichael in the south-west; secondly, in general these lands describe a very concentrated area of mid-Argyll which is remarkably coextensive with the post-Reformation parish of Glassary as defined in the *Origines Parochiales Scotiae* (Innes 1854, 43) and 18<sup>th</sup>-century statistical account (Campbell 1791-99); and thirdly, although an apparently a nicely topographically-constrained unit of land, the boundary between Glassary and Ardscofnish divides the main population focus of the Kilmartin valley between the two respective lordships/parishes, and (although very close) dissociates Glassary itself from the western sea.

Without ignoring those few possible Cowal outliers to which MacPhail refers I would therefore emphasise the general coherence of this lordship, whilst supporting his other argument that the 1346 royal charter (granting the Ardscofnish lands forfeit by John Ewenson MacGillechair to Gilbert de Glacester) represents a re-establishment of a holding which had previously been divided between the brothers Gillescop and Ewen (1916, 136-7). Excepting the boundary at Lochgilphead (which is complex), that other boundaries in this area are defined by more divisive topographical features is highlighted very well by the southern border between Knapdale and Kintyre which (like that between Lewis and Harris) was not within the glen at Tarbert, but in medieval Argyll was situated in the hills south of Skipness (Dunbar and Duncan 1971, 7). Like *Druim Alban* (Skene 1837; Dunshea 2013; see chapter 1) watersheds are more likely early medieval polity and settlement boundaries (cf. Ni Ghabhláin 1995, 254-257), and like the medieval *fylker* of west Norway (Woolf 2000, 102), river-valleys and lochs are more likely to provide a persistent central focus for settlement,

communication and government: The division of settlements by the boundaries of Glassary/Ardscotnish suggests these were not long-standing pre-existing sub-units of lordship.

Rather than representing continuity, therefore, recent division of the Gilchrist lordship is more probable, and this may also be an arrangement broadly coincident with the 1240 charter. In contrast, the 16<sup>th</sup>-century reference to Castle Fincham as ‘the messuage or manor-place’ of Glassary (MacPhail 1916, 206) describes a relationship of much longer duration, and suggests the division and/or rationalisation of Sween’s *tuath* from the late 12<sup>th</sup> to early 13<sup>th</sup> centuries formed feudal manors and parishes which crystallised more firmly within the later medieval landscape.

That this mid-13<sup>th</sup>-century archaeological and historical evidence emerges together at this moment of change is surely no coincidence, and remarkably our first historical evidence for the Church at Glassary also dates to 1240, when a MacDougall charter granting lands to the Bishop of Argyll was witnessed by ‘Sir Maluine, Dean of Glasserod’ (Duncan and Brown 1957, 210, 219, appendix 4). That this large rural deanery is also co-extensive with the northern portion of Sween’s lordship, and that it was called Glassary by 1240 is significant, as this name did not appear in MacGillechrist’s charter of the same year and neither castle nor manor/barony are known to be recorded until they were mutually associated in 1297 (Stevenson 1870, 191; Barrow and Royan 1985, 168). In this way, the documentary evidence suggests the physical castle building and concept of the later medieval lordship are contingent, whilst the name itself must have had some pre-existing territorial identity which then changed (again?) over this same period from deanery to smaller parish.

Despite these references, however, the early history of the diocese of Argyll is problematic and Cowan doubts that a ‘properly constituted’ cathedral chapter was in place before the mid-14<sup>th</sup>-century (Cowan 1980, 22). That the deans, archdeacon and single canon reported in 1250, 1284 and 1285 (*ibid*; Innes 1854, 42-43) and any putative cathedral church would have required financing, however, is certain, and that a quarter of the tithes of at least some parishes were granted by 1236 (Cowan 1980, 19; Turner 1998, 647) also nicely coincides with the construction of the masonry buildings at Fincham. As this castle and church were also legally and symbolically the architectural expressions of the newly established manor and parish whose shared biographies would ultimately also define the moment of their 16<sup>th</sup>-century downfall (see chapter 4), then the masonry church and parish might also be regarded as broadly contingent. This suggestion is significant in implying that the formation of

coherent secular and ecclesiastical territories may be reflected in the particular date that their associated castle and parish church buildings were founded (cf. Welinder 2003).

It is, therefore, to these masonry buildings that we shall now return, as the architectural typologies to which both the castle and church of Fincharn have been assigned are apparently well-known across Britain and Ireland.

In the most comprehensive architectural description of Castle Fincharn, the building was identified as the smallest of a ‘west Highland group’ of ‘hall-houses’, and as a ‘conventional’ example of this building ‘type’ and/or ‘class’, which is more commonly found elsewhere on the ‘western seaboard’ (RCAHMS 1992). That putative group included Castles Aros, Ardtornish, Coeffin, Skipness and Fraoch Eilean amongst others (RCAHMS 1980, 35; 1975, 27; 1971, 25), and the idea of a distinctive west Highland regionality has now become ingrained in some interpretations. Both this regionality and the typology itself, however, may be questioned.

The Scottish historiography of this ‘hall-house’ building type may be attributed to Cruden’s small grouping of independent 12<sup>th</sup>-14<sup>th</sup>-century first-floor hall buildings which were quite well distributed across the country in Argyll, Galloway, Ayrshire, Nairn-shire and Orkney and ‘whose analogy is the fortified manor-house [or ‘upper hall’] of England’ (1960, 91-99). Simpson used the same typology in discussion of three buildings from Moray and Galloway where, in a renunciation of MacKenzie’s (1927) view that stone and lime castles were rare in Scotland before 1297, he nevertheless described Rait as a ‘rare’ and ‘early’ Scottish example of ‘small stone medieval hall-house’ which could be dated by various comparanda and ascribed to local supporters of the Plantagenet occupation (Simpson 1961, 12). An apparently similar masonry building at Tasset in Northumbria was quickly identified as of similar architectural form, and that John Comyn received a license to crenellate on this site in 1267 suggested to Simpson that a similar chronology for the putative Scottish group was appropriate. This interpretation may find some support in more recent surveys undertaken in the Anglo-Scottish borders where the Comyn ‘manor-house’ of Tasset was recorded amongst 26 ‘hall-houses’, and where once more ‘Halls in which the principal accommodation lay on the first floor, raised above a basement storey, [apparently] form a distinct regional type’ (Dixon 1993, 27; 1992, 95). Simpson’s c.1300AD construction dates for the Moray buildings were not challenged during later archaeological excavation at Duffus (Cannell and Tabraham 1994; Tabraham 1997, 24; see chapter 4).

Whilst the historiography identifying ‘hall-houses’ appears to be much later in Ireland than in Scotland, an apparently similar proliferation of recently identified examples as in the north of England has been a cause of concern for some scholars (O’ Keefe 2014). These ‘two-storey, rectangular-shaped buildings with a first-floor entrance...[and with]...a defensive ground floor having only slit opes, while the timbered first floor contained the hall and more open windows’ (Sweetman 1999, 89), however, do appear to display many striking similarities to some Scottish examples, and like the Scottish examples many of these Irish buildings are reported to have a regional concentration of typologically early structures in the west of the country (O’ Keefe 1998a; Sweetman 1998, 15; 1999, 104).

Importantly, however, Blair had already noted that contemporary documentation relating to similar structures in post-conquest England generally referred to them as *camera or thalamus*, and this supported a nuanced argument in which he suggested that these buildings should probably be generally interpreted as the last surviving masonry component of larger medieval castle complexes, and private ‘chambers’ rather than public halls (Blair 1993; *contra* Quiney 1999). In consideration of the relevance of this typological issue for the Scottish comparanda it should be noted that the Comyn building at Tarset was also identified in medieval documentation as a *camera* (Dixon 1993, 27), whilst the building fragment often referred to by scholars as the ‘hall-house’ of Skipness was simply referred to as the ‘castle of Schepehinche’ in a 1261 MacSween charter (Graham and Collingwood 1923, 278, 280).

Whilst the function (or functions) of these Scottish buildings therefore clearly requires further work, their association with apparently similar structures in the north of England and with colonial Anglo-Norman manorial lordship still holds, and finds clear parallels with more recent scholarship on the Irish comparanda which (in contrast to the Scottish examples) often appear to be particularly well-documented. Most salient here are the 17+ surviving masonry ‘first floor halls’ recorded in County Galway alone, which annalistic references indicate were built almost exclusively between 1235 and 1250 by Anglo-Norman colonisers on their recently acquired manorial holdings (Holland 1996). Moreover, although none of these buildings have been radiocarbon dated, these historical dates largely correspond with various architectural details, most convincingly at Athenry where carved capitals within the hall are associated with the masonry ‘school of the west’, in a building constructed before 1241 (Leask 1958; Holland 1996, 10). In the context of this thesis chapter, and given the generally accepted regionality of western Scotland noted in chapter 1, this reported association of manorial castles with more Gaelic-Irish ecclesiastical

architectural typologies is remarkable and suggests we should take another look at the church at Fincham.

Like Castle Fincham, the architectural form of the neighbouring twin-lancet transitional church of Kilneuair may find close parallel throughout Argyll and in Ireland, where a particularly high concentration west of the Shannon in Connaught and Clare has been identified (Leask 1958, 53-76; Harbison 2008). The transitional architecture of west Ireland is largely associated with a surge in the patronage of Reforming monasteries by two well-known branches of Gaelic kingship at the end of the 12<sup>th</sup> and beginning of the 13<sup>th</sup>-centuries, and a ‘body of tradition’ of particularly fine masonry carving developed there within the first four decades of the 13<sup>th</sup>-century (Leask 1958, 53). By contrast, both documentary and architectural evidence suggest that lowland Scotland and northern England formed a single relatively homogenous sphere of influence in this same period (as part of the North-sea school; see chapters 1 and 3), whilst in the Scottish west Highlands and Islands a very strong Irish influence has been noted in the masonry of Iona, Saddell, Ardchatton Priory and Dunstaffnage chapel amongst other ecclesiastical buildings (RCAHMS 1975; 1982; Dunbar 1981; Walker 2000; Fisher 2005; Fawcett 2011, 87-88; 2012). Historically, that the architecture of west Ireland and Argyll might be closely linked is no surprise given the 13<sup>th</sup>-century MacRuaris were related to the O’ Connor kings of Connaught by marriage (Sellar 2000, 206), as indeed the 14<sup>th</sup>-century MacDonalds were to the Ó Cathán’s (Steer and Bannerman 1977, 203), but that various high status individuals within Argyll appear to have appropriated the architecture of both the colonial Anglo-Normans and Reforming Gaelic monasteries to express their lordship is remarkable.

Moreover, that the ecclesiastical and secular limits of Glassary are co-extensive reflects a widespread pattern well known in high medieval England (Bond 1988), Ireland (Otway-Ruthven 1980, 119-125 ) and eastern Scotland (Taylor 2014), and is a particular feature of manorial holdings, Anglo-Norman or otherwise (see Lyttleton and O’ Keefe 2005).

However, although studies in Perthshire and early 13<sup>th</sup>-century Moray suggest it was not unusual for parishes to be formed from ‘pre-existing secular units of lordship’, elsewhere in Scotland (Taylor 2014, 98) and across Britain, Ireland and the wider North Atlantic the process by which these co-extensive territories have coalesced shows great variation (e.g. Bond 1988; Brink 1998).

Given the generally fragmentary nature of the documentary record in Argyll, however, it has not been possible for historian’s to describe the process of parish formation through the

surviving documents alone and most commentators fall back on a broad 12<sup>th</sup>-century chronology. In ‘The development of the parochial system in Medieval Scotland’, for instance, Cowan (1961) like Simpson draws heavily on English comparanda to describe the evidence in Moray and the Borders, but Argyll is not mentioned at all and he would later contend that ‘if the evolution of the parochial system in both dioceses [of Argyll and the Isles] is obscure...no evidence at all is forthcoming in Argyll’ (Cowan 1980, 26). More recently, although also looking to other parts of Scotland for comparanda, McDonald (1997, 225-228) began to examine this issue by noting documentary references to individual buildings and this indicated that ‘It is not until the thirteenth century that there is evidence for the creation of parishes in the western seaboard’. Although McDonald also suggested that even by this period ‘the documentation is patchy’ (*ibid* 226), it must be admitted that compared to the silence of the previous century 13<sup>th</sup>-century references to the Parish churches of Kilmory Knap, Kilmorich Clachan, Kilmichael Inverlussa, Kilfinan, Inverchaolain and Dunoon amongst others (RCAHMS 1971, 64, 80, 94, 106, 150, 157) appear to represent a significant 13<sup>th</sup>-century increase in Argyll documentation. This is probably no coincidence, but to examine this issue further requires a more interdisciplinary approach and in a 12<sup>th</sup>-13<sup>th</sup>-century medieval Argyll context we should question whether the Irish comparanda may be more relevant than the English and Scottish material.

In this context, a wide-ranging study of the development of 44 parishes from 13 larger pre-colonial tuaths in Co. Fermoy (Ireland) is important in demonstrating that:

‘Even where no explicit statement describing a fee as a ‘manor’ exists, where one finds the local (land)lord possessing or claiming such a right [of advowson] one can be certain that this indicates that the parish in question has a parallel manor, and that the manor was established before the parish’ (MacCotter 2011-12, 229).

This correlation between recently formed manor and parish appears relevant in Fincham and Glassary where contemporary historical evidence also describes a fee (MacPhail 1916) later historical evidence indicates both manor and advowson pertained to the lord (*ibid.*), and where the archaeological and architectural evidence suggest the church and castle are broadly contemporary. This coeval castle/transitional church combination is one found elsewhere in this area of Argyll, notably at Skipness, *Fraoch Eilean* and neighbouring Craignish, all of which are broadly contemporary with Fincham, and the very close agreement between the radiocarbon date arrived at in this thesis for Castle Fincham and the

historical evidence from both the western Irish and Anglo-Scottish borders structures is striking.

Correlating the archaeological evidence with other historical evidence and geographical studies has informed our investigation of manor and parish formation in Glassary, and suggested that the physical buildings, the territorial concepts, and their administration are so closely related that they are at least broadly contingent. The construction of these buildings drew new lines in the landscape which would never be erased, and that these same two building types are the earliest medieval masonry buildings for which we have widespread evidence in the South-West Region suggests these relationships between the buildings and administration of lordship may have a much wider significance throughout the region. Map 6.2 (appendix 6) plots the distribution of twin-lancet churches across the Scottish North Atlantic and the high concentration in the South-West Region and (almost) complete absence from the two northern regions is striking. Before becoming too entrenched in a monolithic interpretation of lordship foundation, however, we will leave the south-west to investigate similar issues further north.

## 6.2 A RETURN TO THE HALL AND CHURCH AT TUQUOY

Like Fincham, the analysis of the mortars and masonry of the castle and church buildings on Wyre suggested that these secular and ecclesiastical structures were broadly contemporary, although these Orcadian buildings are around a century earlier in date (chapter 3). The use of biogenic-lime mortars across most of the North-East Region regardless of geology, and the high concentration of nave-and-chancel bicameral churches and chapels has indicated a distinct masonry culture pertained in this archipelago, which was nevertheless also related to more widely practiced North Sea techniques. Unlike in Argyll, however, the processes of parish formation and land taxation in Orkney has been studied in some detail by, amongst others, Clouston (1932), Andersen (1988), and Gibbon (2007) and some valuable historical evidence has resulted in a more nuanced debate on the relative chronologies of buildings, taxation systems and landscape settlement. Moreover, and usefully for this chapter, all of these authors have drawn attention to the medieval parish of Cross in Westray (Orkney), within which the building at Tuquoy was the parish church, to illustrate their various interpretations. Various themes already discussed above for Glassary are also relevant to this discussion.

The Orkneyinga Saga, which was probably composed shortly before 1200 (Andersen 1988), names three ‘farmers’ settled in Westray in 1136 (Pálsson and Edwards 1978, 102) and the extent of the farm in south-west of the island (which includes some of the best arable land in the region) can be reconstructed from place-name evidence and a process of elimination which excludes the neighbouring estates of Rapness and Pierowall (Thomsen 1990; Owen 2005). It is clear from these analyses that the single *ursland* of Tuquoy, in which the Crosskirk and hall case study is located, was the high-status focus of this farming unit which has been described by Thomsen as ‘the home fields or demesne of the former manor...’ (1990, 42, 45-46). Although this estate is not specifically identified in the saga, of the three Westray farmers it is very likely Tuquoy belonged to Thorkel Flettir and his unpopular sons Thorstein and Haflidi, until the estate was forfeit to the Norwegian crown after the battle at Florevåg in 1194 (Pálsson and Edwards 1978, 102; Thomsen 1990, 40-41; Owen 2005).

Long before the hall at Tuquoy had been recognised and excavated, however, Clouston had discussed the adjacent upstanding church to argue that a pre-parochial system of churches had been ‘established’ within Orkney, based on an *ursland* unit of taxation which he dated to the 11<sup>th</sup> century (1932, 143-5; Cant 1975). Although recent historical discussion of the contrasting 18 and 20 pennyland-to-ounceland systems in the high medieval Norse/Gaelic regions of Scotland broadly supports Clouston’s *ursland* chronology (Williams 1997), in Orkney this early date had already been questioned on the absence of any reference to the ‘ounceland’ before its 1263 appearance in Hakonarsaga, and to the contrasting ‘plowland’ measurement referred to in Earl Rognvald’s 1140 tax on the *Odallers* to fund continuing construction of St. Magnus’s Cathedral (Andersen 1988). Andersen’s subsequent suggestion that the ounceland and parish system were introduced together at some time between these two dates (*ibid.*), however, has itself also now been questioned by Gibbon who, on the basis of the similar 18 pennyland based taxation systems of Orkney and Shetland, dates the *ursland* to before Shetland’s 1195 annexation by the Norwegian crown, and suggests the parishes must have been in place before the *ursland*’s introduction, but after Rognvald’s 1140 cathedral tax (2007).

It is clearly significant for our discussion that this historical discourse on the chronology of the administration of the diocese and earldom hinges around the financing of St Magnus Cathedral, when the archaeological discussion around the diffusion of building techniques and materials in the wider region was also related to this building’s construction (see chapter 3) and the construction of masonry buildings more generally has often been related to the

imposition of administrative systems of lordship throughout north-west Europe. This issue has added importance here, however, because although historical interpretations of the chronological relationship between the secular and ecclesiastical taxation assessment have been recently convincingly subverted and refined, Clouston's (1932, 143-144) suggestion that many bicameral chapels were private chapels commissioned by high status Late Norse Orcadians before the parish system was in place and his discussion of Crosskirk Tuquoy are problematic.

That some of these proprietary chapels were indeed constructed before St Magnus's Cathedral has already been discussed, but it is important to retain awareness that the evidence is almost completely predicated on Saga references to identifiable buildings such as the church at Orphir (Pálsson and Edwards 1978, 97, 125). Although attempts have also been made to link other buildings (such as the church on Egilsay) to this same narrative and period (Ferne 1988), Orkneyinga saga provides very few historical anchors to fix the chronologies of these buildings and Lowe has cautioned that 'the dating of Northern Isles churches, few of which have been excavated and all of which lack readily diagnostic, datable features, is fraught with difficulties' (1993, 323). Moreover, none of these buildings have been radiocarbon dated and until the materials analysis conducted for this thesis the relative chronologies of apparently associated secular and ecclesiastical buildings such as those at Tuquoy and Wyre (Owen 2005, 201), have often been speculative. Within 12<sup>th</sup>-century Orkney (as in 13<sup>th</sup> century Argyll), these are important questions which, if possible, require greater chronological refinement.

The distribution of bicameral masonry churches within Atlantic Scotland had previously been plotted by this candidate for another project (Thacker 2011; 2015), and in appendix 6.2 this has been revised and further extended to include some 'pre-Romanesque' examples in Ireland (see Harbison 1982; Ó Carragáin 2005a; 2010, 235-253). It is clear that in both Ireland and the Scottish North Atlantic these church plan-forms are strongly associated with areas of concentrated Norse settlement, and this is highlighted by their almost complete absence from Argyll and much of Ireland. That association is further underscored by the evidence for church construction in Norway where, although a strong timber church building tradition allows that only around 25% of the medieval church corpus is masonry, 70-80% of these stone and mortar churches were built between 1130 and 1250 (Nedkvitne 2009, 189; see also Bauer 2008 for the Trondelag region specifically). This evidence suggests somewhat similar associations between mortared stone and *Romanitas* pertained in 12<sup>th</sup>-century

Scandinavia as has been suggested to motivate early medieval church builders across Britain and Ireland in the wake of the Easter debate (Ó Carragáin 2003, 150-152). In this later period the association between reform and bicameral nave-and-chancels has also been clearly demonstrated in England (Barnwell 2004a; 2004b; Gittos 2003), and the concentration of evidence for this plan-form in Dublin, Waterford, Cork and Limerick often directly related to the close historical links these Hiberno-Norse towns appear to have fostered with Reforming Canterbury (Philpott 1998; Hurley 1998; Holland 2000).

As has already been discussed, the narrative of apparently competing influence in Norse affairs by the German and English Churches from at least the 11<sup>th</sup>-century (Tschan 2002, 93) may be evidenced in North-East Regional building chronologies (see chapter 3) and a similar process may be in evidence in Norse Ireland. Although it has been argued that Cantaurian influence in Dublin is already evident from king Sitruic's pilgrimage in 1028 (Abrams 1998, 26-29) a wider regional view highlights that many Norse and Scottish leaders from across North Atlantic Europe were undertaking pilgrimage journeys to Rome in this period, and often returning to create dioceses and build cathedral churches dedicated to the Cross and/or Holy Trinity. Crosskirk-dedicated cathedrals in newly formed 11<sup>th</sup>-century diocese are reported in Waterford, Dublin, Orkney, Selja and Niðaros (Hurley 1998; Abrams 1998; Crawford 2005, 99) and although Canterbury is also a dual Crosskirk and Trinity dedication (Veitch 2001, 141; Hammond 2010), in the reign of Cnut connections between England and Germany were very close (Hare 2000; Blair 2005). Indeed, although a fragment of the True Cross appears to have been Enshrined within Sitruic's 11<sup>th</sup>-century foundation of Christ Church Cathedral in Dublin, the relic list also includes a number from martyrs so closely associated with Cologne that influence and support from the Empire cannot be doubted (O'Floinn 2006; Flanagan 2010). That no Irish saints are included here also appears to prefigure the later 11<sup>th</sup>-12<sup>th</sup>-century buildings archaeology of the island, and adds further support to interpretations that the Norse and Irish Churches in Ireland in this period were quite separate.

Over the next 150 years, however, a phenomenon which Blair (2005) describes as an architectural 'tide' began to rise and widespread sections of Norse society from rural farmers to urban bishops, in settlements from Lincoln to Norfolk, Schleswig to Trondelag, Caithness to Shetland and Dublin to Limerick would begin to construct masonry bicameral nave-and-chancel churches and chapels (see chapter 3), many of which would also be dedicated to the Cross. It is to that construction process that we shall now return.

### 6.3 SUITES OF MASONRY TECHNIQUE

All of the case studies presented in this thesis have wall-faces built of rubble rather than ashlar stone, and in each case variations in stone emplacement technique between different phases have been noted and associated with changes in the mortar evidence. In most cases this has suggested that a suite of masonry techniques is associated with each phase, and these are clearly culturally significant at single sites where apparently similar environmental sources are available.

As noted in chapter 5, these different techniques have a social or cultural dimension which scholars have often related to conceptions of ‘quality’, implying that the ‘level’ or type of training adhering within various craftsmen is visible (see particularly Gem 1988) and although attempts at more objective methodologies have been used with some success in previous studies (see Ni Ghabhláin 1995; Ó Carragáin 2005b) the more subjective parameter of ‘formality’ has been preferred during this thesis to describe the degree of accuracy of setting-out, regularity of coursing, particularly bonding etc. Within building descriptions it has been noted that it is often the primary phases of high status medieval buildings which display the most ambition in design and formality of masonry technique (see for example Cubbie Roo’s Castle Wyre, St Peters Thurso, St Magnus Cathedral, Iona Nunnery, Eynhallow, Kilneuair church) and very often these are also buildings which fit more comfortably within a specific historically-contingent regional typology. There are of course other interesting equally historically-contingent individual counter examples, such as the secondary western aisle at *Eaglais na ‘h’Aoidhe* (Lewis), but within the broader inter-regional focus of much of this chapter it is suggested that very typical regional building types are significant in demonstrating wider cultural-historical processes.

The regional summaries presented at the end of each chapter of this thesis have focused on the (much richer) archaeological potential of manufactured mortar materials, but it is clear from the associated case studies that the archaeology of stone-emplacement techniques also requires more investigation, and that these are also good exemplars of contrasting regional masonry cultures.

#### 6.3.1 A RETURN TO THE MASONRY OF THE SOUTH-WEST REGION

Out-with this thesis, Caldwell and Ruckley’s ‘preliminary analysis’ of the domestic architecture of the Lordship of the Isles has direct relevance to this chapter and is important

in drawing attention to regional stone-emplacement techniques within high status west Highland and Islands buildings for which '[t]here is practically no documentary evidence for dating' (2005, 99). This study characterised four very broadly dated 'main traditions' of masonry and for the purposes of this chapter I would highlight the 'formality' of the coursed masonry which is very often apparent in their (very similar) type 2 and 3 techniques, as many of the latter are Argyll buildings of broadly 13<sup>th</sup> century date (*ibid*). That this formal rubble stone-emplacement technique is also associated with the same castle buildings and transitional churches discussed at Fincham and elsewhere in this thesis is notable and, as discussed above, many of these ecclesiastical buildings also have dressed masonry mouldings and features which have been characterised as particularly Irish (e.g. Iona Nunnery church; RCAHMS 1982). Given that these buildings represent an apparently quite sudden and widespread emergence of masonry buildings within the archaeological record of the South-West Region, there is little evidence to suggest that this was initially an isolated gradual native development and it is possible that this particular suite of masonry techniques may also have been heavily influenced by masons from Ireland.

Again, comparison of the secular and ecclesiastical corpus is crucial to understanding this process and with regard to the secular corpus in Ireland a comprehensive analysis of early masonry castles in county Galway noted that:

'A common and typical range of construction methods can be recognised in the early castles. They used the local grey carboniferous limestone. Stonework is generally of mediocre quality except for the occasional window, door or quoin of dressed stone. Masonry is usually of roughly shaped rubble, well mortared and set in rough horizontal courses with large numbers of pinning stones. Good quality ashlar work is known from five sites but it is not common. Much of it has diagonal tooling marks. The mortar used is a rough lime mortar with a pebble, gravel or sand mix...The courses are normally two rows high. While the height varies, it is often about two feet, or 60cm, high. Layers or beds of mortar were normally laid down at the top of each course and sometimes within.' (Holland 1996, 10-11).

The similarity of this description to the rubble masonry of the castle and church at Fincham is notable and raises the possibility that masons from Ireland may have been directing the construction of secular buildings in mid-Argyll during the 13<sup>th</sup>-century boom period, as they so clearly were the ecclesiastical ones (Steer and Bannerman 1977; Dunbar 1981; Walker 2000, 29; Caldwell and Ruckley 2005, 98). This association may also explain the dominance of limestone-lime bonded mortars within much of Argyll as although the apparent spread of

limestone–lime masonry from east to west in Argyll may look like a colonial frontier (see maps 1.1.6-1.1.9, appendix 1), many of the earliest limestone-lime buildings (such as St John’s Killeen for instance) are also clearly of Irish design (Fisher 2005). Ó Carragáin’s suggestion that the ready availability of limestone in Limerick, Galway and Clare enabled small scale *pre-Romanesque* mortared masonry ‘industries’ to develop in these counties (2005a, 34) echoes MacNeil’s assertion that this same geological resource promoted castle building in the wider Connaught province in the 13<sup>th</sup>-century (1997, 155), and the lime-making expertise of the region is even commented on by Boate in the 17<sup>th</sup>-century (1652, 86-87). This is significant in highlighting the continuing influence of local geology on the limestone-based medieval masonry heritage of western Ireland, and that a ready availability of limestone pertained in mainland Argyll (see map 1.1.10; Stephenson and Gould 1995, 27). Indeed, many of the exact same clastic and calcareous meta-sedimentary formations of the Grampian Dalradian (including the limestones of Lismore and Islay) also outcrop across Ireland as far as Connemara (*ibid.* 1995, 46-47). Given the convincing evidence for historical and architectural links between these regions, this is a geology which teams of masons with a pre-existing Irish limestone-lime influenced masonry culture working within Argyll would have been well able to make use of.

There is no doubt that the construction of ecclesiastical buildings often demonstrates more technically demanding masonry skill than secular building, and this appears to be reflected in the contrasting chronological resolution of their typologies. Underlying this contrast, however, are important questions around the identity and roles of secular and ecclesiastical masons, builders and patrons, how these apparently contrasting techniques may have developed and whether any further evidence for knowledge exchange between the two can be identified (Fawcett 2012).

### 3.6.2 A RETURN TO THE MASONRY OF THE NER

Although the fissile quality of the ‘flagstone’ lithologies which dominate Caithness and Orkney promotes thinly-coursed horizontal stone-emplacement techniques, that these are also culturally-situated is demonstrated by the different styles displayed at sites such as the Brough of Deerness and Egilsay church, and that these are often phase-specific techniques is displayed very well at the Earls Palace Birsay and the Uyea case study (see chapter 3). Indeed, as was identified at Uyea, the more highly metamorphic geologies of Shetland are

also often very flat-laid in the high medieval period, as are the thin limestone rubble courses of shell-lime bonded Castle Rushen, Isle of Man (Rigby 1927; O' Neil 1951).

Horizontal stone-emplacement techniques also dominate the masonry at Crosskirk Tuquoy and Wyre (both Orkney), and (accepting upright base stones) this was also reported during the excavation of Tuquoy hall (Owen 1983). The similarity of the stone-emplacement evidence at this latter site with the primary Pictish farmstead at Buckquoy further highlights the longevity of this technique, precluding simple correlations with a particular period (Ritchie 1977, 182), but flat-laid stone-emplacement is also commonly associated with both dry-stone and clay-bonded masonry. The inherent stability of this technique, however, has also ensured the survival of many buildings which were originally lime-bonded, but in which the core mortar has subsequently completely degraded away (see appendix 5), and this inherent structural stability and the widespread availability of fissile materials throughout the North-East Region has probably increased the potential for more nuanced interpretation of these buildings in forgiving a wide spectrum of masonry formality.

Within the high medieval bicameral churches and chapels of the region it is notable that this range of formality is also associated with a wide spectrum of masonry arch evidence from the fully trabeate to the fully arcuate. Allowing that inclined jambs are a form of corbel-arching (Thacker 2015a), these include: lintel-heads on inclined jambs (Crosskirk Lybster); lintel-heads on corbel-arches on inclined jambs (Uyea); true-arch-heads on corbel-arches on inclined jambs (Lundawick); true-arch-heads on inclined jambs (Tuquoy); and true-arch-heads on plumb jambs (Eynhallow, Orkney) (see appendix 6). That many of these structural forms challenge our dichotomous conceptions of the trabeate and arcuate is reflected in the terminology employed here (what is the difference between a shouldered lintel and a corbel arch?) and this ambiguity is increased by a spectrum of radially which also evident within many of these features.

It is significant, however, that the wall faces of all of these buildings (with the possible exception of Crosskirk Lybster) were mortar-coated in their primary phases and so these stone emplacement techniques would not have been visible on completion of construction. These now ruined buildings therefore betray as well as display the mediation of particular historically, socially and culturally-contingent negotiations between the patron, craftsman and materials, and so we might reasonably expect the technical spectrum evident to describe something of the building context. More widely, the very fact that there is such a spectrum suggests these contexts may be diverse.

The chapel at Uyea, for instance, is a very significant building whose arches and stonework are clearly situated at the more trabeate and informal end of this arch spectrum (see figures 6.5 and 6.6, appendix 6). Although the primary masonry here is fully lime-bonded with an excellent shell-lime mortar, and the stone blocks themselves are sharply arched and tightly jointed, the stone emplacement technique displays such little bonding in general wall faces and between walls that these are often just uncoursed vertical stacks of generally flat-laid stones with associated ribbed joints (see chapter 3; appendix 12). The small dimensions of this bicameral chapel were further highlighted by the size of the chancel discovered during this thesis research, and this is significant for our interpretations as although surrounded by a graveyard with medieval markers this chapel was never a parish church and probably served this single island farm community only. The wider contrasts in the various suites of masonry techniques employed on this small island - between these shell-lime bonded informal high medieval chapel, cyclopean clay-bonded 17<sup>th</sup> century burial aisle, and very formally-coursed limestone-lime bonded 19<sup>th</sup>-century hall - is most striking. As is so often the case, this clearly demonstrates that more formal masonry techniques were possible in this location in different cultural contexts.

The nearby church of St Olaf's Lundawick (Unst, Shetland) is similar in many respects to the Uyea chapel, and both sites contain simple Norse grave-markers and the apparently typical Shetland 3-phase stratigraphical development of shell-lime (high medieval) to clay bonded (late medieval/early modern) to limestone-lime (modern) in the buildings themselves. The primary masonry at Lundawick is also shell-lime bonded and the ruin betrays a very informal stone emplacement technique in general walling (described by the RCAHMS (1946b) as 'rough') and the form of the surviving nave doorway arch is part-trabeate. Unlike Uyea, however, it is very likely that Lundawick was a head church for south Unst and so had a much larger congregation (Cant 1975, 15).

A third example in this spectrum may be described by the chapel at Wyre, where the portal arch-heads are carried on plumb jambs with only occasional corbelling in the arch head lower courses. This chapel was not a parish church, but was evidently within a high-status settlement with a wider community.

A parameter shared by the above (where they survive) is their particularly narrow 'door-like' chancel openings. Crosskirk Lybster and St Ninian's Shetland also fit into this category and St Ninian's is also a shell-lime bonded building which betrays a particularly informal internal stone-emplacement technique; the surviving south jamb suggests the 'chancel arch'

in this building would have been a mere 900mm wide (see chapter 5 and appendix 6.1.3). These narrow ‘door-like’ chancel arches clearly contrast with those North-East Region buildings in which the full width of the chancel is arched, such as Eynhallow, Sandsting (Shetland) and Kirk of Yell (Shetland) and where the separate chancel arch is very wide as at St Peters Thurso. As discussed by Clouston at Tammaskirk, elsewhere in north-west Europe this contrast is often regarded as an indicator of chronology (1931, 13-14). Although in England narrow chancel arches and non-radial voussiors are often associated with Anglo-Saxon technique (e.g. Taylor and Taylor 1965, 8), this form persisted here until the mid-12<sup>th</sup>-century (Hamilton Thomsen 1911, 76-78; Bond 1916, 9-13) when the change in liturgy which prompted the re-location of high altars further east is also associated with the construction of wider chancel arches (Barnwell 2004, 19; Howard 2007). Similarly narrow chancel arched ‘doorways’ in late 11<sup>th</sup> century Scandinavia, such as Christkirk Niðaros (Clouston 1931) have also been regarded as of ‘English’ origin (Paulsson 1958, 30-36; Blindheim 1965), and these associations suggest a chronology which may have relevance for the Scottish North Atlantic corpus also.

The suggestion that narrow chancel arches may be diagnostic of an early date in the North-East Region is further supported by correlating this evidence with nave doorway position and form. In Ireland, ‘The doorways of surviving pre-Romanesque churches are, apparently without exception, placed in the centre of the west wall’ (Hare and Hamlin 1986, 133; see also De Vegvar 2003, 160) whilst a general re-positioning to lateral north and/or south walls has been noted in 11<sup>th</sup> century England (Fisher 1970, 16; Gittos 2003, 96), 12<sup>th</sup>-century Ireland (Ó Carragáin 2010, 299), and 11<sup>th</sup>-12<sup>th</sup>-century Isle of Man (Swift 1986, 190-197). Doorway position is now firmly accepted as an indicator of chronology across Britain and Ireland in many contexts. As with previous discussion of clay-mortared buildings, and altar positions (Thacker in prep), some later continuity does not preclude an earlier chronological progression and all demonstrably pre-Romanesque chapels in the region are unicameral with west entrances (see chapter 5). Subsequent variability makes interpretation more complex, but all of the bicameral churches with narrow door-like chancel arches noted above also have nave doorways in the west wall. Linton Shapinsay (Orkney) is the only chapel known to have a narrow door-like chancel arch and a lateral nave entrance. This may be the exception that proves the rule: where the nave doorway heads of these typologically early buildings are also known, and this includes Linton, then they are also always arched in a very similar way (Anderson 1881; see appendix 6.1.3).

Those churches which display wide arched chancel openings, at Eynhallow (Orkney), St Peter's (Thurso), and Egilsay (Orkney), have lateral doorways in both nave side-walls, formal stone-emplacement techniques and bell towers, whilst the medieval parish churches of St Mary's Sandsting (Shetland) and Kirk of Ness, Yell (Shetland) have wide chancel openings and formal stone-emplacement techniques although the primary doorway position at these buildings no longer survives. Nave doorway heads in this lateral type are mixed, as Egilsay (which may be the earliest of the three known examples) has arch-headed lateral doorways and some possible evidence that the primary chancel opening here was somewhat narrower (Potter 2009, 72). Elsewhere, although their likely positions are known, the primary nave doorways at St Peters Thurso no longer survive whilst those at Eynhallow (which may be the latest of the three) were lintel-headed. It has been suggested that lintel-headed opes may be a chronological indicator of later medieval construction in the region (Lowe 1987, 129 -30), but this is likely to reflect the short-lived evidence for arcuate ope-heads in the high-medieval rubble buildings of the period, so again doesn't precluded an earlier medieval progression from trabeate to arcuate forms. In this later period, these doorway features may therefore describe another spectrum which once again draws attention to the intermediate position of Crosskirk Tuquoy (Orkney), which has an arched nave entrance in the south wall only. Bicameral churches in Ireland, such as Trinity, Reefert, Ratass and Killiney have been described as 'overlap' on the basis of their wide chancel openings with lintel-headed west doorways, all of which appear to date to around 1100 (Harbison 1982, 622-623; O' Keefe 1998b, 119-122; Ó Carragáin 2010, 135).

An important discussion of style and technology in 'overlap' Saxon-Norman churches from the same period, however, highlighted the problems inherent in ascribing chronological patterns to minor buildings in England which may have been built by native masons influenced by more major construction projects in various ways (Gem 1988; see also Thurlby 2003). Perhaps echoing Macalister (1935) and Phipps (1939), these studies appear to suggest that major buildings are a safer bet in terms of typology, as earlier forms or 'working habits' may have been maintained for longer periods in less high status contexts making fine comparative distinctions more difficult to draw.

Underpinning the striking architectural contrasts discussed in this section, however, are functional and symbolic changes in the liturgy, and in the North-East this highlights the association of many of the typologically later and more formal forms with bishopric or parish churches (*contra*. Gittos 2003). It is possible the change in doorway position is related

to a more rigidly defined space for church towers, for the font (as was suggested for St Thurso in chapter 3) and/or for burial in parish churches (cf. Fisher 1970).

Fundamentally, the informal stone-emplacement technique and arching styles at Uyea, Unst and Lybster suggest a more vernacular masonry culture and, as we are aware, Clouston interpreted this evidence elsewhere in the region as a native development from longhouse dry-stone constructional techniques (see chapter 5). This technical background would not preclude the construction of lateral doorways however and, particularly with regard to the head church of Lundwick, the balance of evidence suggests this Unst building and that of Uyea are relatively early.

Although I was unaware of the fact when interpreting the Argyll evidence, like the buildings at Fincharn the curiously peripheral position of the church at Tuquoy within the parish of Cross (Westray) has been interpreted as the churches pre-existing association with high status settlement (Gibbon 2007). However, although this is a convincing argument for the pre-existence of this Westry settlement and the location of the church, the argument does not demonstrate chronology in the church building itself and although Clouston had used Crosskirk Tuquoy as an exemplar for his model of the co-option of pre-parochial chapels to the parish system because he believed the western extension of the nave which is clearly evident in the building was associated with its elevation to parochial status and a concomitant increase in congregation (Clouston 1932; see appendix 10), this cannot be convincingly demonstrated. Indeed, although recent consolidation precludes examination of the mortars of the secondary western phase of the building, the fine-sandstone roll-moulded dressings with which it is currently associated are more probably 17<sup>th</sup>-century (Moore and Wilson 1998, 69) and so no certain medieval upper terminus for the primary building pertains at all (Lowe 1987 ii, 99).

The suggestion in chapter 3 that the extraordinary lime mortar associated with the primary phase at the Tuquoy church may represent the influence of Kirkwall cathedral masons is tentative at this stage, as apart from St Peter's Thurso and a single sample from the Cathedral nave there are as yet no other examples with which to compare it. The evidence is suggestive, however, and it is clearly a priority for future research to examine the mortar archaeology of the rest of the early Orcadian corpus, and most particularly the Cathedral, the Bishops Palace in Kirkwall, Orphir, and the Tuquoy church and environment much more comprehensively. In discussion of the interplay between technology and style (Gem 1988) the emergence of limestone-lime bonded technology within the region, and its comparison

with biogenic-lime-making techniques should enable more informed comparisons and may even provide a useful lower terminus. The constructional contrast between the church and both phases of the secular ‘hall’ at Tuquoy suggest different processes, and although the red sandstone gable mount recorded here in the 19<sup>th</sup>-century is no longer extant (MacGibbon and Ross 1896, 126; Lowe 1986 ii, 97), with its lateral southern door and wider chancel arch this Crosskirk is at the latter end of the bicameral typology and it is possible that this building was constructed as a parish church in the later 12<sup>th</sup>-century. Given the association of the Wyre chapel with Bishop Bjarni in this period, comparisons with the typologically earlier maerl-lime bonded chapel of St Mary’s are also apposite. Although again not a parish church, this further supports the early interpretation of that building suggested in this thesis.

### 6.3.3 BUILDING FORM, STONE EMPLACEMENT AND MORTAR PROVENANCE

Notwithstanding the Tuquoy evidence, comparing the relative bicameral and twin-lancet church distributions across the Scottish North Atlantic (Map 6.2) with mortar provenance distributions (Map 1.1.6, appendix 1) does suggest a broad correlation. The two extremes of this interpretation may be exemplified by comparing St Ninian’s church Shetland (which is shell-lime bound, has a very informal flat-laid stone-emplacement technique and is very probably early 12<sup>th</sup>-century), with Kilneuair church Fincham Argyll (which is limestone-lime bound, formally-coursed with edge-laid stone-emplacement, and is very probably mid-13<sup>th</sup>-century).

This contrast does not, however, represent a simple chronological development in mortar provenances. The initial development of a biogenic-lime masonry culture was suited to coastal communities and a lower level of land-ownership and lordship. The very informal stone-emplacement techniques noted at some bicameral church sites very probably does evidence a more localised skill-set and without denying its relevance to major building projects, biogenic-limes are very suited to the needs of small coastal communities who (where possible) relied on the terrestrial resources of their own holdings. Despite the concentration of similarly planned churches and chapels, these Scottish North Atlantic buildings are not so similar that they can be related to a single ‘off-the-peg’ workforce (*contra* Blair 2005) and very local masonry teams probably pertained. There is a wide range of formality in the biogenic-lime-bonded corpus, however, and, from whatever distance the building workforce are travelling, marine shells are a material which will not vary significantly from site to site (or even region to region). This enables a wider range of people

to collect the material and removes the need for itinerant limeburners to experiment with local geogenic sources (see chapters 1 and 5). Whatever date particular bicameral chapels might be ascribed, the very informal chapels are clearly more likely to relate to a native ‘bottom-up’ technical model.

In contrast, limestone-lime church-building masonry cultures, whether at Fincham in mid-Argyll or St Peter’s Thurso, generally appear to arrive. They are more generally associated with a professional travelling workforce, formal rubble stone-emplacement techniques which are often similar from building to building, and dressed sandstone details. These buildings also often appear to be associated with a higher level of lordship which in Argyll is associated with a period of imposed coextensive secular and ecclesiastical fiscal units. Much more work is required before we can suggest how this apparently two-tier system may have developed and interacted in the Northern Isles, but as the research currently stands there is no evidence for the potentially early construction of informally built limestone-lime church buildings.

#### 6.4 A RETURN TO THE OUTER HEBRIDES

Although the dearth of historical evidence in the South-West and North-East Regions has been stressed above, there is even less contemporary medieval documentation associated with the North-West, and apparently nothing contemporary from the Outer Hebrides before 1266 (Crawford 1987, 3). Geographically, this survey region clearly occupies a maritime position between the other two, and the distribution of various building forms draws attention to the [region’s architectural] heterogeneity of the region. Whilst the Outer Hebrides contain reasonably widespread evidence for bicameral nave-and-chancel chapels, there is no surviving evidence for this type of building on the mainland or Inner Hebrides. Most importantly, South Uist contains at least one example of both bicameral and twin-lancet churches (see Map 6.2). These South Uist buildings were very important to the development of my early researches in Outer Hebridean mortar archaeology (Thacker 2011), and this section will now return to these sites to ascertain whether a better understanding of the buildings archaeology of the rest of the Scottish North Atlantic can now inform a re-analysis.

## 6.4.1 CASE STUDY HOWMORE

That Howmore is perceived to represent a site of some significance is reflected in the large number of previous surveys of the six upstanding buildings surviving at this graveyard site which have usually been interpreted as representing two congregational churches, two roofed chapels and two probably unroofed burial enclosures (Muir 1885 50-51; MacGibbon and Ross 1897, 70-71; RCAHMS 1928, 106; Addyman 2000, 99). Many of these surveys also suggest that the cross-marked slab, which is currently lying recumbent within one of the ruined church buildings (Fisher 2001, 108), indicates the site has Christian associations which reach back to the early medieval (pre-Norse?) period, and this may have influenced persistent interpretations which have compared the multiplicity of upstanding structures with early medieval Irish chapel sites. The surviving evidence for inclining doorway jambs and steep gables within two of the buildings has also been highlighted to support theories that these were built within an early Irish Christian cultural milieu, and a pre-Romanesque interpretation of three of these structures has been suggested by more recent and more comprehensive upstanding building survey (Reynold's *et al.* 2004).

The buildings at Howmore have been examined twice for this research (2015e), and more comprehensive details of the most recent investigation are included in Appendix 9. The mortars and masonry of the site were subject to in-situ analysis and, excluding the two more recent burial enclosures and some secondary masonry, the four earlier buildings all exhibited shell-lime bonded and coated primary phases. These interpretations were supported by thick- and thin-section and XRD analysis, which demonstrated that although each of these mortars has their own characteristic composition, they all of contain similarly peat-fired Type 2-4 *C. edule* relicts, tempered by an angular quartz-rich aggregate which is probably terrigenous (Thacker 2011; see appendix 9).

One of the smaller chapel buildings, however, also displayed a contrasting shell-lime mortar (tempered with fine *machair* sand), and this appeared to be associated with a secondary masonry phase in the chapel's north wall which contained a previously undiscovered intramural tomb. That oral history refers to this building as *Caibéal Clann 'ic Ailean* (the Clan Ranald Chapel) is therefore salient, and the building contains a number of other ex-situ moulded sandstone blocks and a clan Ranald Armorial panel similar to that previously recorded in Arisaig was formerly also located here (MacLeod 1997, 78). Further examination of this Howmore tomb, however, suggested that the in-situ dog-tooth moulded

stone which had been interpreted in a recent survey as a fragment of 12<sup>th</sup> to 13<sup>th</sup> century chancel arch (Reynold's *et al.* 2004), was a reused sandstone jamb stone and an integral part of this secondary feature.

The most likely source for this (and another matching) dressed jamb-stone is another church on the site, the surviving upstanding remains of which are dominated by a single phase east wall with tall robbed-out transitional twin-lancet east windows (cf. Addyman 2000). This church is generally either referred to either as *Teampull Mòr* (RCAHMS 1928, 106; Fisher 2001, 108) or *St Mary's/Teampull Mhoire* (Thomas 1873; Reynold's *et al.* 2004; Raven 2005, 178; Fleming 2012), provides the clearest evidence of twin-lancet architecture within the Outer Hebrides and is generally regarded as the former parish church (Fisher 2001, 108). As such, parallels with the 13<sup>th</sup>-century parish church at Fincharn appear clear historically (in shared parochial status) and architecturally (in twin-lancet east windows), and further similarities will be discussed below. In the context of this chapter section, however, another very salient aspect of the remains of this Howmore building is the formality of the masonry; with regular course heights averaging 470mm (the course heights at Fincharn are 400-450mm; see chapter 4), course levels which clearly pass right through both wall faces and the core, and even the core rubble of this Howmore church is very regularly laid. The setting-out and stone-emplacement technique of the twin-lancets are both accurate and complex, with both windows and the central pier set-out to accurate complete triangles, and relieving arch-heads which incorporate a gable scarcement. In medieval Outer Hebridean terms, this is very sophisticated formal work.

Significantly, the core rubble in this structure also contains numerous pieces of light-brown coarsely-textured quartz-rich sandstone, and these fragments are concentrated in the primary core between the two lancets of the east wall. Sandstone does not outcrop the Outer Hebrides (Johnstone and Mykura 1989) and so this material must have been imported for the window dressings, and possibly for the aumbry and wall quoins also. Similar evidence for the incidental use of sandstone scalplings within masonry cores has been noted at a number of other rubble-built buildings with sandstone dressings during this research, and in South Uist this evidence suggests that the masons dressed this stone at Howmore rather than importing pre-hewn material (*contra* Simpson 1961 for Raits; see chapter 5).

The archaeological relationships between this 13<sup>th</sup>-century church and the upstanding fabric of the Clan Ranald chapel, and between the Clan Ranald chapel and *Caibeal Dughgail* (detailed in appendix 9) are convincing, but none of these structures can be physically related

to the other large building on the site. This structure, which is generally either referred to as St Columba's (Reynold's *et al.* 2004; Fleming 2012) or *Caibeal Dhiarmaid* (O.S. 1881; RCAHMS 1928, 106), is also large enough to have served as a congregational church but the surviving upstanding east wall does not readily conform to wider regional architectural typologies. The east window is simply splayed with a narrow 'slit' daylight-opening, above which is a slightly protruding lintel similar to the small burial chapels already noted. The surviving masonry contains no finely dressed freestone and that is significant in suggesting that the twin-lacet church had not yet been built, was still in use, or had already been robbed-out. There is a distinct use of chlorite schist pinnings in the building not seen elsewhere on site, but although the primary mortar of this putative church only differs in slight details from the primary phases of the other three main buildings, apart from a somewhat secondary internal coating there is no evidence within the constructional mortar or stone-emplacement technique to suggest that the masonry is anything other than single phase (*contra* Reynold's *et al.* 2004). In fact, it is this stone-emplacement technique which makes this building most distinct from the masonry styles of the other buildings as, although well bonded with course heights passing through both faces and core, this surviving east wall is thicker, all face-stones (except the window jambs) are flat-laid, and the courses are rising and dipping. The overall impression is of a less formal masonry style than the twin-lacet church (cf. Addyman 2000) and much less 'formalised' than either of the burial chapels.

It is certain that the north-west corner of the Clan Ranald chapel hints at more complexity than is visible above ground, but it would appear that there is no upstanding structure at this site which conforms to the 12<sup>th</sup> century bicameral typology distributed across the region. The remains of the less formal putative church building may also be important to understanding this site, but for the present we will have to look to other sites for clearer evidence of earlier periods.

#### 6.4.2 CILLE DONNAIN

The turf covered footings of the previously unrecorded chapel of *Cille Donnain* was located by a team from Sheffield University during fieldwalking and the site is located approximately 5.5 miles south of Howmore (Fleming and Woolf 1992; Fleming 2012). On the basis of the structures bicameral plan-form, comparatively large size, landscape similarities to Finlaggan Islay, and a constructed historical argument; the site was dated to the early 12<sup>th</sup> century and suggested to be dry-stone bishop's church related to the lordship of

Man and the Isles (*ibid.*). It was this dry-stone interpretation which had initially inspired my own survey into the structural range of bicameral buildings and, although at that time the ‘upstanding’ remains were considered too fragmentary to support any unambiguous interpretations regarding the presence or absence of mortar, the very narrow chancel ‘doorway’ was the subject of some speculation (Thacker 2011; 2015a). Informed by the fieldwork undertaken for this thesis, however, a better interpretation can now be suggested.

Although no mortar was found at the site, this is no surprise given the dissolution processes illustrated in appendix 5, and the width of the walls suggest this is very likely to have been a mortar-bonded and lime coated structure. In this region that mortar is almost certain to have been a *C. edule* (cockle) shell-lime (see chapter 2). Although the walls are also too fragmentary to allow a comprehensive assessment of the stone-emplacement technique the stone of the surviving wall faces is flat-laid, and at approximately 900mm wide the chancel opening is clearly very narrow. Together with the evidence for a west entrance, which is reasonably convincing (Fleming and Woolf 1992), the building footprint suggests this is a typologically early bicameral church. We might speculate that both the nave doorway and chancel opening were probably similarly arched with combined trabeate and arcuate form, on jamb scarcements or impostes (see appendix 6.1.3).

Given the distribution of churches and chapels of this plan-form within the region the lack of evidence in Man is curious (see Map 6.2) and so, despite the buildings apparent dedication and recent attempts to relate the Outer Isles more closely to Man in the 12<sup>th</sup> and even 13<sup>th</sup>-centuries (McDonald 2014), the particular form of the *Cille Donnain* chapel suggests culturally material links between South Uist and the North-East Region can be more simply demonstrated (Fleming and Woolf 1992). This building is clearly typologically earlier than the bicameral chapel of *Teampull Eoin* (Lewis) which, although never a parish church, displays a wide chancel opening and a lateral (south) lintel-headed door, and has been dated to the later 12<sup>th</sup>-century (Thacker 2011; *contra*. RCAHMS 1928). The team who rediscovered *Cille Donnain* commented on its relatively large size, which they suggested could be compared with the parish or ‘head churches’ of St. John’s Norwick and Kirk of Yell (both Shetland), or the slightly larger Egilsay and Brough of Birsay (both Orkney) (Fleming and Woolf 1992; Fleming 2012, 75). In terms of structural typology, however, the South Uist church contrasts with all of these wide chancel-arched examples, and with the primary phases of the other putative bishop’s church at St Peter’s Thurso. This may push its date earlier but there is no evidence to suggest that this building was a parish or bishop’s church,

and *Cille Donnain* conforms much more closely to a proprietorial chapel, such as St Mary's Wyre, which also probably dates to the early-mid 12<sup>th</sup>-century. Thorfinn's 11<sup>th</sup>-century lordship is said to have included all the Northern Isles, Hebrides, Man and much of Northern Scotland (Crawford 1987, 75-76) and the church archaeology suggests that culturally the Outer Hebrides, Northern Isles and Caithness remained closely related.

In order to find a chapel type which demonstrates possible links with Man, however, we will have to discuss another probably earlier site.

#### 6.4.3 ST CLEMENT'S TIGHARRY

The turf-covered footings of the chapel of St Clement's are located within an irregularly-shaped stone and turf built enclosure, on the west coast of the neighbouring island of North Uist near the township of Tigharry. This very small E-W oriented rectilinear building measures just 3.5 x 4.5m internally, within walls surviving up to 1.0m high and 1.1-1.2m thick. Both wall faces are constructed of generally flat-laid, undressed gneiss stone (there is one upright basal orthostat) containing a core likely to consist of rubble and earth, whilst the corners of the building are rounded and the doorway is in the west: facing out to the prevailing weather from the Atlantic Ocean which is approximately 40m metres away.

Although at approximately 21 x 26m the enclosure/grave yard at St Clements is quite wide, this building has clear parallels with the *Keeils* of the Isle of Man and Swifts type A Islay chapels (see chapter 5). Comparable structures within the Western Isles are not common, although a similar chapel in terms of both form and landscape location is known on the east coast of the Isle of Lewis (close to *Eaglais na h'Aoidhe*) at *Tigh an t'Sagairt*, and both should probably be quite broadly dated to the late 10<sup>th</sup> or 11<sup>th</sup>-centuries (Thacker in prep.). For further context it is significant that a Norse cross-slab discovered in the burial ground at *Cille Bharra* in neighbouring Barra was 'decorated with a cross and interlace that recall memorials from Govan and the Isle of Man, and was dated by art historian's to the late tenth or early eleventh century' (Abrams 2007, 170).

Like the somewhat similar chapel of *Tigh an t'Sagairt* in Lewis a salient feature of St Clement's is its very close proximity to the parish church site of *Cille Mhoire* Hougharry, and from the above evidence it would appear likely that St Clement's, *Tigh an t'Sagairt* and the later bicameral chapel of *Cille Donnain* lay outside that system. Indeed, this criterion was used by Vebæk (1968) to locate a group of very similar chapels in Greenland (see chapter 5).

It is significant that the above analysis of the upstanding buildings archaeology parallels the wider distributions of church and chapel buildings across the wider North Atlantic, apparently reflecting the geographical position of the Outer Hebrides and suggesting that Uist in particular has developed within the different cultural spheres of Man, Orkney and Argyll in different periods. Do these buildings evidence how lordship was constructed in the North-West Region in this pivotal period?

#### 6.4.4 PARISH FORMATION IN SOUTH UIST

Importantly for our understanding of Outer Hebridean polities at this time Raven's thesis demonstrated that in South Uist the 'primary unit...[and]...basis for the structure of the larger secular and ecclesiastical power groupings: the lordship and the parish' was the *tir unga* or ounceland, and that a clear relationship between 'early chapels' and ouncelands was evident (Raven 2005, 129). Resolving the chronologies of these processes, however, is problematic and his (more tentative) suggestion that the chapels may be later than the ouncelands (*ibid*, 119, 185) has clear parallels with Clouston's (1932) interpretation of the evidence in Orkney and now appears unlikely (Andersen 1988; Gibbon 2007). As above, the form of the church at *Cille Donnain* suggests this building is likely to be an early 12<sup>th</sup>-century structure from within a Norse-Orcadian cultural milieu and as such is also likely to predate the post-1140 Orcadian ounceland and parish system suggested by both Andersen (1988) and Gibbon (2007).

In the apparent absence of firm evidence, speculation on the formation of the parish system in Sodor has been dominated by discussion of the presumed motives of various historical personalities, and so varies within the usual 12<sup>th</sup> century comfort zone (eg. c.1103-54 in Williams 1997, 54; c.1153 in Sellar 2000, 191; c. 1189 organisation or possible re-organisation in Islay, Caldwell 2008, 39). The forms of the surviving upstanding chapels at St Clement's and *Cille Donnain*, and the proximity of St Clement's to Hougharry parish church (North Uist) suggest both are pre-parochial and there is no evidence for the elevation of bicameral chapels to parish status in the North-West Region. The weight of evidence, therefore, suggests that the parish system known from the later medieval period had not been formed in South Uist before Somerled's reported conquest of 1156 (McDonald 2015) or the 1154 transfer of the diocese to the newly formed Archdiocese of Niðaros. That a parish system had been formed in Sodor before the death of Bishop Rognvald (c.1170) may seem probable based on the statement in the Chronicle of Man that he was the first bishop to

receive a tithe (Woolf 2003), but this is not certain and I would suggest that in this diocese monolithic interpretations may be of limited relevance (cf. Abrams 2007).

The tax assessment system visible in later medieval documentation indicates a South Uist ounceland was worth 20 pennylands (Raven 2005, 102) and the similarity of this evidence to that in both western regions of this thesis (Williams 1997; Thomson, 2002) clearly dissociates South Uist from the 18 pennyland system of Orkney and Caithness, whilst Man does not appear to have had a pennyland system at all (Williams 1997, 141). If Raven's interpretation that the parish system was based on the *tir Unga* (2005, 129) is accepted then, as most commentators now date the ounceland system to the later 12<sup>th</sup>-century at the earliest (Andersen 1988; Thomson 2002; Gibbon 2007; *contra*, Williams 1997), this suggests both assessment systems were Clan Sorley impositions. Although the historical record is not clear who exercised overlordship of the Uists between 1156 and 1266 (see Raven 2005, 56-58), most commentators accept that the Kingdom of Man retained Man, Skye, Harris and Lewis only after the return of Godfrey in 1164 (Cubbon 1983, 25; Crawford 1989, 142; Sellar 2000, 193; Caldwell 2008, 33-35). The buildings evidence may allow us to confirm this (see below).

Although, given the Manocentric perspective of the chronicle, we cannot suggest that because Bishop Rognvald is reported as receiving tithe from the Isle of Man (Anderson 1922; Woolf 2003) he was not receiving the same from the northern part of the kingdom; other evidence does suggest a spectrum of systems may have been in place. In 1223 the Pope had to specifically order Hebrideans to pay all their tiend and although their reluctance to do so has been interpreted as a Europe-wide phenomenon in a period which also saw the murder of Bishop Andrew in Caithness (Crawford 1985, 28-29), in late 12<sup>th</sup>-century Ireland this has been related to possible continued payments to the pre-parochial Mother-church (Flanagan 2010, 87). Of more significance to this thesis, however, is the continuing relationship between buildings and political administration, and once more we should note that the Papal grant of 1231 which specifically listed the churches from which the bishop of Sodor could collect his third coincides with the construction of the first Cathedral of the Diocese at Peel in the Isle of Man (Poole 1911; Cowan 1980, 16). Remarkably, this appears analogous to the formal administration of parishes in the Orkney Diocese after the construction of St Magnus's Cathedral almost a century earlier, and with the early 13<sup>th</sup>-century buildings evidence in Argyll.

The administrative units listed within this grant are also revealing, however, as although the names of the Inner Hebridean localities within the diocese, such as ‘*Aran...Ile...Mule...Skey*’, are listed in geographical order from south to north and remain easily recognised, at the end of the list (where we might expect the Outer Hebridean Islands to be recorded) the names of ‘*de Howas, de insulis Alne, de Swostersey, et episcoporum h[...]*’ are not so easily translated (Poole 1911, 259). Although this document has come down to us in a slightly garbled 17<sup>th</sup>-century version only, that it provides much more detail on the Isle of Man parishes but lists the Inner Hebridean part of the diocese in terms of islands only, and then becomes much more unrecognisable in the Outer Hebrides is probably no coincidence. Indeed, this list also appears to broadly reflect the 1412 declaration to Sir John Stanley which confirmed that there were 24 parishes in the diocese, 16 of which were in Man (Williams 1997, 53). We may be able to dismiss the added detail that this system was formed during the 11<sup>th</sup>-century rule of Godred Croven as a later medieval foundation myth, and the 1231 Papal grant also clearly lists more than 8 parishes in the ‘Out Isles’, but that the system was of some antiquity by the early 15<sup>th</sup>-century is likely and the continued lack of detail regarding the Hebrides is striking. Moreover, that the 1231 reference to ‘*de Howas*’ might represent Howmore (cf. Lindsay in Poole 1911, 263) must be considered a possibility.

With this historical perspective it is perhaps no surprise that the bicameral buildings evidence in the Outer Isles contrasts with that of Man. This places more emphasis on the archaeological record and questions whether we could recognise a parish or other administration system from the North-West Region buildings archaeology when at Fincham it was suggested the construction of the transitional masonry church was contingent with the concept of the parish of Glassary. The evidence from South Uist might suggest a similar relationship pertained between the church and parish of Howmore as most commentators identify the transitional twin-lancet building (described above) as the parish church of *Teampull Mòr* or St Mary’s, and suggest that the simpler building to the east dedicated to Columba and otherwise known as *Caibeal Dhairmaid*, is a contemporary church or chapel (eg. Fleming and Woolf 1992, 347; Fisher 2001, 108; Fleming 2012, 78).

These associations are not, however, supported by the historical record. In line with the translation suggested for the 13<sup>th</sup>-century papal reference to *de Howas* discussed above, surviving 15<sup>th</sup> and 16<sup>th</sup>-century charter and other contemporary accounts specifically identify this administrative unit as *Skerehowg* or the parish of *Howf* only (Innes 1854, vol. 2, 369;

MacPhail 1914, 48, 95; Monro [1549] 1999, 327). It may be significant that the term *Skere* appears in both secular and ecclesiastical documents (see below) but, crucially, mid-15<sup>th</sup>-century papal correspondences repeatedly refer more directly to a succession of rectors of ‘St Columba de How in Hwgyst’ (Cameron 1934, 125; Kirk et. 1997, 421; Thomas 2008, 74), clearly suggesting St Columba’s is the parish church.

Indeed, the first and only reference to a church of ‘St Mary’s’ on the site appears to be a late 17<sup>th</sup>-century report identifying the churches of ‘St Columba and St Mary’s in Hoghmore’ (Martin [1695]), without of course identifying which building was which. The late 19<sup>th</sup>-century local informant to the Ordnance Survey (Neil McIntyre of ‘Howbig’!), however, identified a number of the Howmore buildings, including *Teampull Mòr*, and the entry elaborates that ‘This name signifies “The big chapel” and applies to the ruins of an old church or chapel the history of which nothing is known about in the district’ (O.S. 1876-78). The first edition Ordnance Survey map quite clearly ascribes this name to the twin-lancet 13<sup>th</sup>-century building at the west end of the site (O.S. 1881; RCAHMS 1928, 106, fig 161). Although in his later description Muir pointedly avoided the name/dedication issue (1885, 50; MacGibbon and Ross 1896-7, 70-71), recent commentators have tended to equate the name ‘*Teampull Mòr*’ with Martin’s 17<sup>th</sup>-century reference to St Mary’s church on the presumption that *Mòr* (Gaelic: large) is a corruption of *Mhoire* (Gaelic: Mary) (Raven 2005, 178; Fleming 2012, 78). This may appear to be justified by Thomas’s description (published three years before the O.S. name books) in which he identified the two larger Howmore churches as *Teampull Mhuire* and *Teampull MacDiarmaid* (1873, 242), and similar confusion is evident a number of other sites in the Scottish *Gàidhealtachd* (eg. Kilmore and Kilbeg in Sleat, Skye, for instance, was the 16th parsonage of Kilmoir; Cowan 1967, 184). Indeed, somewhat earlier than Martin, Bleau’s atlas of 1654 includes depictions of ‘How M:’, ‘How beg’, and ‘Auon How Moir’, but at 161.6 m<sup>2</sup> the Howmore building has also been described as the largest known medieval church in the Hebrides outside Iona (see Thomas 2008, 113; *contra*. Thomas 1873), and so the more descriptive name is at least appropriate.

There is clearly some confusion here, but that the parish church of How was dedicated to Columba in the later medieval period is clear and there is no reason to presume that a church dedicated to Mary ever held that status. The question therefore remains as to which building is which, and in order to investigate this issue we will have to return to the South-West Region.

## 6.5 Secular vs. Ecclesiastical buildings – Parish formation in Argyll

The structure of this thesis has emphasised the regionality of the Scottish North Atlantic mortar archaeological record, and each chapter summary has often highlighted the general homogeneity of the high medieval masonry cultures of each region before discussing how that changed over time. Within the inter-regional context of this final substantive chapter, however, that current evidence suggests both northern regions of this survey are dominated by various biogenic lime-burning cultures clearly draws attention to the widespread limestone-lime evidence within the high medieval South-West Region, and a possible association with the cultural influence of Ireland has been highlighted above. Returning to Argyll in this section, however, reminds us of the greater heterogeneity of the early evidence here, and to an apparent dichotomy between the almost completely limestone-lime dominated masonry of the mainland buildings and the widespread evidence for shell-limes in the islands which does not simply correlate with available limestone or shell resources. At a finer scale of analysis, chapter 2 also drew attention to another possible dichotomy between the shell-lime churches and limestone-lime castles which, it was suggested, might have a social correlation.

Informed by later work, however, and in particular by discussion of Wyre (Orkney) and Fincharn (Argyll) which has stressed the contemporaneity of co-extensive secular and ecclesiastical lordship and buildings in different periods, this social interpretation now appears incongruous: Surely, if these western Argyll buildings were also coeval and of similar patronage, we should expect similar masonry techniques to be evident. This section will therefore return to the buildings of the Island and Sound of Mull to examine this evidence in a little more detail and assess whether this contrast can tell us anything about these cultural and political processes.

Indeed, the issue is highlighted by the most comprehensive case study undertaken during this thesis research, at Mingary Castle in Ardnamurchan (Highland), in which a wide range of different suites of masonry evidence with contrasting phase-specific building stone emplacement styles, building stone lithologies and lime mortars were noted (see chapter 4; appendix 14). Mesozoic limestones outcrop quite widely in the locality and most of the castle phases, including the primary phase curtain wall, are dominated by limestone-lime mortars from this source, although the rapid survey programme suggested the local parish

church of St Comgan's (which is located only 1.2 miles away) may be bound with a shell-lime mortar.

A closer look at the chronology of these buildings, however, begins to contextualise this contrast. The primary phase of Mingary castle has now been radiocarbon dated to within a narrow range in the very late 13<sup>th</sup>-century or early 14<sup>th</sup>-century (see chapter 4; appendix 14), whilst the window style and unicameral architecture of the surviving fabric at St Comgan's suggests an early transitional probably late 12<sup>th</sup> or early 13<sup>th</sup> century construction date (RCAHMS 1980).

These archaeological resources appear complimentary: in comparison to the secular corpus, the medieval church architecture in the South-West Region appears much more dynamic in form and style in this period (cf. Ni Ghabhláin 1995, 110), whilst the massive volume of ruined multiphase masonry at the castle has allowed the structure to be radiocarbon dated within reasonably refined limits. Indeed, this is the same comparative <sup>14</sup>C-archaeological/architectural/mortar analytical combination used to compare the broadly contemporary castle and church at Fincharn, although at Mingary the mortar evidence is contrasting and the upstanding church (and so perhaps the parish) may predate the upstanding masonry castle by up to 100 years. A similar scenario may be in evidence further down the Sound, where the church of Pennygown on Mull was also interpreted on site as shell-lime bound with early 13<sup>th</sup> century transitional architecture, but the nearby MacSorley secular castle of Aros is limestone-lime bound and recent evidence appears to suggest this building has also been constructed in a later period than that suggested by its generally accorded very broad 13<sup>th</sup>-century date (Thacker 2016). Moreover, Pennygown may have served the north of the very large medieval parish of Torosay as a dependency of the main parish church at Loch Spelve, whereas Aros Castle may be more closely associated with an even closer (private?) chapel which has been dated to the 13<sup>th</sup>-century on the art-historical style of some surviving loose fragments of dressed stone (RCAHMS 1980). Castles Duart and Ardtornish are also limestone-lime bound although at least one phase of the nearby parish church of Morvern at Kiells may be shell-lime.

The plotted distributions of limestone in the locality (see Map 6.3, appendix 6) highlight that although Aros Castle is limestone-lime bound there are no calcareous outcrops very close by. Moreover, with further reference to this map, it is no surprise that the two Lismore castles of

Coeffin and Achadun are limestone-lime bound given that limestone geology almost completely dominates that island, but that the excavated nave and tower of the neighbouring Cathedral of Argyll (also on Lismore) was reported to be shell-lime (Brown and Duncan 1957, 45, 48) is remarkable. This evidence demonstrates once more that this apparently social dichotomy is not a simple correlate of environmental availability even at finer scales of analysis. The 13<sup>th</sup>-century parish churches of Kilvickeon (Mull) and St Ronan's (Iona) are also shell-lime bound, as of course are the early 13<sup>th</sup>-century Iona Abbey and Nunnery (see chapters 2 and 4), but the striking material contrasts between these castles and churches are coincident with a chronology which has significant regional implications.

The building evidence suggests that the parish system in and around Mull was formed quite rapidly in the early 13<sup>th</sup>-century in order to support the recent foundations at Iona. The sophisticated transitional architecture at the Abbey and Nunnery of Iona was built by masons trained in Ireland and familiar with both shell-lime and limestone-lime masonry techniques, and shell-limes may have already been in evidence on the island by this period in 12<sup>th</sup>-century St Oran's, and perhaps St Ronan's also (see chapter 4 and appendix 15). It has been estimated that the Nunnery church on Iona took 25 years to build (RCAHMS 1982, 22), and during that time shell-lime burning and mortar-making would have become a more integral part of the masonry culture of the community as large Abbey and Nunnery masonry buildings rose. It would appear that this culture was subsequently brought to bear on the construction of a number of parish churches on Mull and other islands whose Ionan ownership was confirmed by the Papal Bull of 1203 (Smith 1895, 5-8), and may also have spilled over onto the neighbouring mainland sites at Kilchoan and Kiells, where limestone does outcrop, and possibly even to the limestone-dominated island cathedral of Lismore. It is notable that, although this and other churches in the Sound (and on Islay) were in lay patronage at the very end of the 15<sup>th</sup> and into the 16<sup>th</sup>-century (Thomas 2014, 133, map 5.2), the parish church of Kilchoan is immediately adjacent to the Iona estate of Ormsaigbeg (RCAHMS 1982, 146-7).

Most of these churches display a particular early transitional style of architecture which dates to the very late 12<sup>th</sup>-century or 13<sup>th</sup>-century. Given the close chronologies of the adoption of Reforming Rule at Iona and the founding of the Argyll diocese, it would be good to refine these construction dates further to ascertain if any particular buildings predated the 1203 Bull (to indicate a 'pre-Reform' pre-parochial dependent church system, as per Veitch 1999), but

the forms of these buildings do suggest a major construction programme for a specific purpose. As at Fincharn, Man and elsewhere, the ecclesiastical buildings and documentary evidence in western Argyll appear to be broadly contemporary.

By contrast, however, (apart from the very small shell-lime bound ‘castle’ of Dun Ara at the northern tip of Mull which contrasts conspicuously), the secular castle building ‘programme’ within the sound of Mull generally appears to be part of a different, often later 13<sup>th</sup>-14<sup>th</sup> century process. Limestone-lime burning and mortar-making were an integral part of a suite of techniques which now made up the (perhaps more industrialised) masonry culture of the region’s castle builders. The use of Ininnmore sandstone in the primary phases at Mingary, Duart, Aros, Ardtornish and Coeffin suggests that this material was also part of that masonry culture (Caldwell and Ruckley 2005) and that this stone type appears to be absent from Pennygown and St Comgan’s (but may have been used in the later medieval phase at Kiells; RCAHMS 1980) suggests that its use may also have some social and chronological significance. Each of these stone and mortar provenances requires sampling and/or further geoarchaeological work but at present these materials do suggest contrasts with interpretative potential (see chapter 7). That many of these later castles, such as Mingary and Ardtornish, were built close to very isolated limestone outcrops and parish churches, situated them close to lime making resources, fertile land, and Christian communities who may have had a pre-existing parochial identity, although given the tendency for Clan chiefs to build private chapels (as at Aros and Borve castle, Benbecula) and seek permission for portable altars (Thomas 2008, 53), how often those parish churches were frequented by the clan *fine* is not clear.

In summary, therefore the contrasting mortar archaeologies of the Island and Sound of Mull appear to have an environmental, social, architectural and chronological basis. It may be possible to refine these relative castle/church construction dates further by radiocarbon dating the ecclesiastical corpus but these preliminary steps toward a more refined chronology suggest that parish and lordship formation, even within a small part of Argyll, was not a monolithic process but evolved differently in various locations. This poses questions about how different clans consolidated and mediated territories at different scales, how power was delegated, and what secular lordly architecture and administrative systems looked like here before the early-13<sup>th</sup>-century. The contrasts between the castle and church archaeologies in the Islands and Sound of Mull suggest parish formation in Argyll may not always be the

same simple proprietary process proposed for Orkney, Fincham and much of Scotland (*contra*. Barrow 1980, 137), but reflect local developmental patterns of lordship. Indeed, this more refined chronology subverts the colonial narrative upon which the feudalisation of Argyll by the Scottish crown and other overlords is based, and suggests that (far from representing a simple frontier of change) Fincham may have been one of the last parishes imposed on the communities of the region, as further west the parish system was probably already in place (*contra*. McDonald 1997, 226). Moreover, although Woolf (2003, 175) suggests that it is the late 12<sup>th</sup>-century foundation of the See of Argyll which prompted the increased association of the Sodor bishopric with Man alone, I would suggest that it is the adoption of Reforming Rule at Iona (and the foundation of Ardchattan) which is key to understanding this process in providing a fresh impetus to these monastic communities supported by the patronage of various branches of the Clan Sorley lordship. This suggestion is also supported by the apparent history of poverty and vacancy at Lismore, emphasised by numerous commentators (Turner 1998; Cowan 1980; Brown and Duncan 1957; Barrell 2003, 25). Although we must be careful not to impose the political stresses of the early 13<sup>th</sup>-century back to the See's foundation in the late 12<sup>th</sup>, emphasising Iona's role also neatly sidesteps the confused issues of diocesan territoriality in the islands of Argyll, and represents a pattern of building castles and founding priories which is well evidenced in the Gaelic west of Ireland (Loeber 2001) and Galloway (McDonald 1995). In some parts of Argyll, this may have been sponsored by Clan Sorley at Iona and Ardchattan at the expense of the Episcopal system.

Just previously, in the face of late 12<sup>th</sup>-century Irish Reform, the anomalously powerful position of the *comarba* of Colum Cille appears to have been reconciled by granting abbot Flaithbertach Ua Brolcháin 'a chair like that of every bishop' (Herbert 1988, 117). By contrast, the pre-eminent position of Iona in western Argyll society, its independence from diocesan control granted by the Papal authorities in 1203 (MacQuarrie 1987), together with repeated early vacancies in Argyll and Sodor (possibly including the important 1203-1210 period; Woolf 2015, 340), suggests such formalization wasn't required here. Indeed, the Abbot of Iona probably remained a more powerful regional figure than these bishops right up until the politically motivated annexation of Iona at the very end of the 15<sup>th</sup>-century (Barrell 2003, 25-26).

The historical evidence relating to Lismore is fragmentary, but the apparent association of the parish church at Fincharn with the cathedral chapter may also describe this putative Episcopal/monastic tension in a slightly later mid-13<sup>th</sup>-century period, and highlights the various strategies of the different Argyll clans in negotiating the process of territorial lordship in the face of aggression from the Scottish Crown. Church Reform has a long history in defining identity and justifying conquest in both Ireland (Flanagan 2010) and Scotland (Veitch 1999), and appears to have continued to have some Episcopal currency here. But if we can accept Oram's (2012) suggestion that it was Ruairi mac Raonail's (of Kintyre) acceptance of the over-lordship of the king of Man which prompted Alexander II to impose himself in Argyll in 1221-2 (Barrell 2000, 85), then it would seem that by the time of Alexander's tour the Clan Sorley had been negotiating their own brand of Europeanisation for some time. To my mind, the fast pace of political and social development in the far west, as well as the increasing consolidation of power by the Scottish crown in the east, adds to a sense of squeeze surrounding MacGillechrist's newly defined lordship in mid-Argyll.

Unfortunately, however, this debate has not thus far been well-served by architectural interpretations of the Cathedral on Lismore, the upstanding remains of which have only been dated to between 1225 and 1357 (Fawcett 2002, 35, 137; 2011, 147). Rapid survey undertaken during this thesis research has preliminarily identified the generally limestone-lime bound masonry of the upstanding chancel and highlighted how this appears to contrast with the shell-lime masonry reported during excavation of the excavated nave and tower (Brown and Duncan 1957, 45, 48). This supports those previous interpretations which have suggested the masonry of the nave and tower must be of different phases to the upstanding chancel (*ibid.*; RCAHMS 1975, 160), but as the excavation was unable to investigate 'for a distance varying between 25 and 50 feet of the west wall of the choir' (Brown and Duncan 1957, 44) we should question all subsequent interpretations which assume but do not demonstrate that the nave post-dates this upstanding structure (eg. *ibid.*; RCAHMS 1975, 160). Although small isolated phases of later medieval possible shell-lime construction at Keils and Sween, and the more substantial secondary medieval structures at Mingary should make us cautious at this stage, the general archaeological record of this region's mortars would suggest that the shell-lime nave and later tower of this church is more likely to be the earlier phase and that, like many other churches discussed in this thesis (including nearby Ardchattan), the chancel may have been rebuilt in the later medieval period.

The opinions of the excavators regarding Lismore cathedral's relative lack of architectural merit, their emphasis on the informality of the 'rough' masonry style of the nave, as well as their acceptance of the dioceses apparent later medieval 'struggle against poverty' and (more pejoratively) 'isolation' (*ibid.* 42, 50) all suggest preconceptions. It is certainly possible that this does explain the extraordinary shell-lime evidence, but given that the remains of the nave and tower survived as footings only, and that even these contained a dressed sandstone plinth, it is also possible the excavators were influenced by the buildings very fragmentary accepted history. In this regard, the RCAHMS (1975, 160) subsequent suggestion that the nave's construction may have been 'hasty' is also curious and has little archaeological merit. Again, a more refined understanding of the relative and independent chronologies of the different phases of this building would be useful and may have important implications for our understanding of the formation of the diocese.

That the parish system might not have been widespread in Argyll until the early 13<sup>th</sup>-century, however, should not surprise us given McDonald's (1997) account of Somerled's conservative approach to church Reform, the close ties between Argyll and Ireland emphasised by this thesis, and the often suggested 13<sup>th</sup>-century dates for the formation of the parish system in Gaelic west Ireland (Nicholls 1972). That this parallels contemporary historical accounts in Ireland is well known, and even by 1186 Archbishop John Cumin's '...provisional synod...decreed that mass was not to be celebrated in chapels *constructed by laymen* to the injury of the mother churches without the permission of the bishop of the diocese and the pastor of the mother-church...' (Flanagan 2010, 88; my italics). There is very little or no evidence for pre-conquest parishes or tithe payment in 12<sup>th</sup>-century Ireland outside of the Norse towns (Empey 2002), and it is likely that the 12<sup>th</sup>-century population of Lorn and mid-Argyll were also largely served by fine timber-built monastic mother churches with dependent chapels (cf. Harbison 1982, 624-9) and the *tuath* halls of the clan elite such as Dun Sleive and Somerled were probably similarly constructed.

The association of lime mortared stone with Reform in Ireland, however, clearly predates the Cambro-Norman parochial system, and is explicit in the accusation levelled at the Reforming bishop St. Malachy whose mid-12<sup>th</sup>-century programme of masonry church building prompted the *aircinnech* to ask: 'who do you think you are, a Viking?' (Hudson 2006; or 'Frenchman' Ó Carragáin 2010, 2-3). O' Keefe's contention that the evidence from St Peter's church in Waterford 'suggests that the Hiberno-Scandinavian community had its own

independent tradition of church architecture’ in the 11<sup>th</sup> and early 12<sup>th</sup>-century (1994, 121) is very pertinent to this discussion, and this ethnic dichotomy appears to be clearly demonstrated in the chronologically-sensitive inter-regional contrasts of churches and chapels throughout the North Atlantic discussed in much of this chapter. This clearly suggests that, at least in the 12<sup>th</sup>-century, masonry and timber buildings were a significant means by which the culture and identity of landholding and lordship were constructed and mediated, and if the claim of the Clann Somhairle to the Kingship of the Isles was made on the basis of their Norse Uí Ímair ancestry (Woolf 2005; Duffy 2006; Downham 2007), in the 12<sup>th</sup>-century this was not reflected in their adoption of contemporary Norse building culture. Concepts of Irish and Norse heritage provide complex means of mediating identity across Scotland (Broun 1999; Woolf 2002) and are not mutually exclusive, but this evidence suggests that the more typically Gaelic putative timber-built castle and church buildings of Argyll were an important means by which lordship and resistance to the emerging state of Scotland were negotiated.

This section of the chapter, however, cautions that by the 13<sup>th</sup>-century increasingly refined scales of investigation and chronology can be important for more nuanced cultural interpretations, and in this endeavour we must look to the mortar archaeology in combination with all the other fragmentary evidence. Hurley’s suggestion that the failure of the Hiberno-Norse Christ Church of Cork (Ireland) to achieve the same cathedral status as the similarly dedicated Norse buildings in Waterford and Dublin ‘relates to the continuing power of St Finbarr’s monastery’ in that district (Hurley 1998, 172), and Ó Carragáin’s (2010, 235-253) discussion of the bicameral church architecture of Glendalough, are both important examples of how the politics of Reform can impact on building history, architecture and archaeology at more focused scales. In a similar way, the masonry churches of Fincham (mid-Argyll) and Kilvickeon (Ross of Mull) may both be 13<sup>th</sup>-century parish churches, but they are very different animals.

## 6.6 CONSTRUCTING LORDSHIP IN THE NWR

The absence of contemporary documentation for the high medieval period from within the North-West Region has already been remarked upon (Crawford 1987), but the standing buildings corpus is also remarkable. In Lewis, Harris, North Uist and South Uist there are no substantially upstanding medieval castles, whilst in Lewis, Harris, North Uist, Skye, and the west coast mainland, there are no substantially upstanding parish churches which can be

dated with any confidence to before the 14<sup>th</sup>-15<sup>th</sup> centuries. The upstanding medieval castles of Moidart, LochAlshe, West Ross, Assynt, Benbecula, Barra and Skye (such as the case study at Duntulm) are potentially rich sources of information, but most are generally ascribed to the late medieval period, and any putative high medieval primary phases have only been very tentatively dated – often to within the nearest century at best.

Complimentary with this buildings corpus is the mortar record of the North-West Region, and despite the apparently inexorable spread of limestone-lime mortar-making techniques across all three survey regions (appendix 1, 1.1.6-1.1.9) the most salient aspect of the medieval mortar archaeology of the North-West Region island groups is the apparent continuity of the shell-lime mortar-making traditions, which generally applies whether in limestone-rich Skye or limestone-free Uist. In fact, in two of our main North-West Region case studies, at *Eaglais na h'Aoidhe* and Howmore, despite remarkably contrasting stone-emplacement techniques between distinct phases, any material variation in the medieval shell-lime mortar archaeologies is minor, and at some level this homogeneity suggests cultural continuity.

This continuity, however, contrasts with the varying medieval chapel forms surviving in Uist which, it was suggested above, evidence the influence of various other Scottish North Atlantic communities and/or polities. Indeed, it is salient and significant that the Outer Hebrides does not represent the core distributions of any of these building forms, which are situated in Man, Orkney and Argyll respectively. Given the apparent correlation between building and politics noted repeatedly in this thesis, it is therefore reasonable to draw on the evidence from these other regions in investigation of the North West. This section will continue to suggest that ‘conventional’ typologies (such as doorway positions, window types etc.) from across North-west Europe can be applied to the evidence, and will continue to employ masonry analysis as the primary form of evidence whilst the relationship between archaeological, architectural and historical evidence will continue to be a persistent feature of discussion.

#### 6.6.1 TRANSITIONAL HOWMORE?

As at Lismore Cathedral, the art-historical dating of ex-situ architectural mouldings is useful in providing a broad lower terminus for masonry buildings which are no longer upstanding, but these are usually of little archaeological survey value unless they can be related to extant

fabric. Moreover, dating the ex-situ mouldings from Howmore simply on the basis of a dog-tooth design is of even less value than usual as this motif continued to be carved throughout the medieval period across north-west Europe and late medieval evidence for similar motifs can be found very locally within the 14<sup>th</sup>-15<sup>th</sup> century tower at Duntulm, North Skye (Miket and Roberts 2007, 64; see chapter 2). Perhaps an even more pertinent comparison, however, is the 15<sup>th</sup> or 16<sup>th</sup>-century intra-mural tomb-recess within the south wall of St Bean's church, Argyll (RCAHMS 1975, 153), and the late 14<sup>th</sup>-century O' Cahan tomb frontal at Dungiven Priory, Derry which, like contemporary dogtooth moulded work at Iona Abbey, is thought to be the work of Donald O' Brolchan (McNeill 2001, 349). If, however, it can be demonstrated that the re-used dogtooth moulded stone of the Clan Ranald tomb at Howmore was originally associated with the primary phase of the transitional church then its archaeological value begins to be much increased as this building is clearly 13<sup>th</sup>-century.

Speculating on that association further, the best architectural context would be the early 13<sup>th</sup>-century foundations at Dunstaffnage and Killean and at Ardchattan where, although the east gable no longer survives, similar work is extant in a west window of the primary south transept (Fawcett 2011, 146, RCAHMS 1975). Although all of these comparanda have mainland Argyll associations with limestone-lime masonry, each is also related to the 13<sup>th</sup>-century buildings on Iona and all are clearly Irish work in both design and technique (*ibid.* Fisher 1997). Moreover, it is possible that these building phases are redolent of a particularly western Irish Reform masonry culture which dates to the first four decades of the 13<sup>th</sup>-century (Leask 1958, 53), and this is a chronology which fits with the limited MacSorley documentary evidence available in Argyll (Fawcett 2011, 155).

Unfortunately, dressed work in many Argyll parish churches (including Fincharn, Craignish and Kildalton) is often robbed-out, but, although many commentators privilege moulded and sculpted masonry (see for examples Harbison 2008, 11-14), Leask's western school is a 'body of tradition' which includes features capable of being rendered in rubble work. This is seen most clearly in the church on Nave island (RCAHMS 1984, 34), but is also evident in features such as widely splayed window embrasures and triangular central piers noted at Howmore, and this adds weight to the distribution maps in suggesting a lack of freestone is not a simple constraint on the adoption of the twin-lancet transitional forms, although the correlation is very strong (see appendix 6.1.2). Accepting these associations at Fincharn, does this twin-lancet form of chapel say something about parish formation elsewhere?

Like the case study churches of Glassary (Argyll) and *Aoidhe* (Lewis) the parish of ‘*Hough*’ in South Uist was not named after its Columban dedication and so we are probably entitled to assume that the name describes a pre-parochial territory of some kind. Clancy (2010, 9) briefly notes this phenomenon at a number of early medieval monastic sites, but if Marstrander’s etymology of the Old Norse *skiri* as in *Skerehowg* (MacPhail 1914, 48, 95) is accepted, then even this descriptor may even imply a secular rather than ecclesiastical unit (William’s 1997, 90). Certainly the use of the term and name for both South Uist parishes in later medieval secular and ecclesiastical documentations implies these fiscal units were (again like Glassary) co-extensive by that time.

Again, the relative chronologies of the secular and ecclesiastical buildings are important to approaching some understanding of the meanings of these polities as (unlike at Fincharn and a number of other mid-Argyll sites) there is no 13<sup>th</sup>-century secular building clearly very closely associated with the twin-lancet church at Howmore. Although, as we have seen, this scenario was not unusual in some parts of western Argyll in this period, with reference to the contrast in buildings between the northern regions of this thesis and Argyll in the earlier 12<sup>th</sup>-century (appendix 6) this Uist evidence looks like a cultural clash - concomitant with a change from a North-East influenced proprietorial Norse society of local chiefs to a new and higher level of overlordship.

The castle at Borve in Benbecula will have provided a secular focus for this island lordship at some point and, although not emerging into the historical record until the later 14<sup>th</sup>-century (identified as ‘*Vynwayle*’; Raven 2005, 301) it has recently been suggested this building (like Fincharn) may be primarily of ‘hall-house’ type. There are, however, certainly differences in technique between these two buildings. Borve castle displays a much more coarse masonry style than *Teampull Mòr* at Howmore, with massive stone, thick walls and a much coarser shell-lime mortar, and like Aros Castle the building is also associated with a nearby chapel. However, although no moulded dressings were noted in the wall faces of Castle Borve during rapid survey, once again there are scalplings of imported sandstone within the building’s masonry core which suggests that (like *Teampull Mòr* Howmore), dressed stones were used here but have been subsequently robbed-out from the standing structure. In terms of archaeological potential, this use of dressed sandstone within the Outer Hebrides is analogous to our earlier discussion of limestone-lime mortars in that: both materials need to be imported, both are often associated with clear architectural statements of lordship in

various periods, and both can often be provenanced to particular locations. In the 12<sup>th</sup>-13<sup>th</sup>-century period we are primarily concerned with here, however, dressed sandstone is only found at three or four Outer Hebridean church sites most notably including: *Teampull Mòr*, Howmore (South Uist); *Teampull na Trionaid*, Carinish (North Uist) and St Moluag's, Europie (Lewis).

#### 6.6.2 TEAMPULL NA TRIONAID (NORTH UIST)

Like Borve Castle, the archaeology of *Teampull na Trionaid* remains poorly understood. The upstanding church was interpreted by the RCAHMS as 16<sup>th</sup>-century on the basis of the resemblance of a single small surviving rubble-built 'lancet' window in the north wall to one at Rodel (Harris), although this account also suggested the building was closer in scale to a 14<sup>th</sup>-century building (1928). This last caveat may be a reaction to the historical record, but the 16<sup>th</sup>-century chronology of the primary phases of both church and later burial aisle were not disputed during recent archaeological recording (Cressey and Whitelaw 2011, 17).

Although the often acerbic Cowan and Eason very plainly state that claims this church was a monastic cell were 'apocryphal' (1976, 99), my earlier research into the churches of the Outer Hebrides highlighted how this evidence had been conflated with *Eaglais na h'Aoidhe* (Thacker 2011; Knott and Thacker 2011; see also MacKinlay 1910), and that the 'lands and chapel' in Uist were indeed gifted (possibly in confirmation) to Inchaffray in 1389 is well known (Ewart *et al.* 1996).

Like the church at Howmore this is a very large building with a coursed shell-lime bound masonry style which is particularly formal and which apparently once boasted dressed stone features. The nave entrances are laterally-positioned, and although the east window has been described as 'very large', the evidence for this feature is extremely fragmentary. Oral tradition recounts that the church was a monastery and seminary founded by *Bethoc* (first prioress of Iona) of the clan Somhairle in the early 13<sup>th</sup>-century, and this suggestion is supported by the lack of parochial status (Beveridge 1911) and Cristological dedication to the Holy Trinity (Hammond 2010). Each of these pieces of evidence suggests this Carinish Church may indeed have been a 13<sup>th</sup>-century monastic building (see also Dunbar 1981, 42). The size and obvious status of both the Howmore and Carinish churches are extraordinary, and both churches are conveniently located within their long-isle contexts. Those central locations, however, do not apply to our third building.

### 6.6.3 ST MOLUAG'S EOROPIE (LEWIS)

The church of St Moluag's is located at the northern tip of the Isle of Lewis, and contains primary transitional east and west dressed sandstone windows within very formal shell-lime bonded rubble masonry walls. The main body of the church is unicameral, although primary south- and north-eastern cells have resulted in an unusual 'T' shaped plan-form which has drawn comparisons with Gardar Cathedral in Greenland and suggested a mid-12<sup>th</sup>-century date to some observers (Caldwell *et al.* 2009). The basis of this comparison is somewhat superficial, however, as Gardar is essentially a bicameral building, and a later 12<sup>th</sup> or early 13<sup>th</sup>-century date is more appropriate for unicameral St Moluag's (see chapter 2; Dunbar 1981; Thacker in prep.). Remarkably, however, the primary south nave doorway of the church displays an arch-form which springs from corbelled courses in a similar way to St Olaf's Lundawick, Shetland (see Chapter 3), although the dressed sandstone windows are more evocative of Argyll. This building may therefore be considered a hybrid reflection of its north-western location, although these very simple dressed-sandstone windows could have been imported pre-hewn (cf. Simpson 1961 for Rait).

Like the church of *Teampull na Trionaid* described above, St Moluag's does not have parochial status and the medieval parish church of St Peter's is only 1 mile away. A very small unicameral ruined building, which is the mainland focus of a double ecclesiastical site which includes the offshore corbelled chapel of Teampull Ronain, is also located very close-by (see chapter 5; Muir 1861; 1885; RCAHMS 1928; Nisbet and Gailey 1960). Like the chapels at Uyea and Lundawick (see chapter 3) this offshore corbelled building is associated with Norse-Christian sculpture from the 10<sup>th</sup>-12<sup>th</sup> centuries (Stephenson 1981) and elsewhere I have suggested that the double site of *Teampull* Ronain is a foundation of that same period (Thacker in prep). These buildings and sculpture are convincing evidence for continuity of ecclesiastical settlement at St Moluag's which may also pertain at Howmore and Houghgarry in Uist, and significantly *Teampull* Ronain Eoropie is also located on a prominent mound.

### 6.6.4 RUBBLE CHURCHES WITHOUT DRESSED STONE

Discussion of the form and location of the Lewis church of St Moluag's draws attention to the surviving fabric of the nearby parish church of St Peter's, which like many parish churches in the region contains no evidence for fine-dressed stone and displays a masonry style which can safely be regarded as late medieval (Thacker 2011). Again, the remains of a much smaller and probably earlier unicameral building have been reported nearby

(Barrowman 2005), but the only upstanding parish church building within Lewis for which an earlier date might be suggested is the primary phase at *Eaglais na 'h'Aoidhe*, where an evocatively flat-laid local sandstone rubble phase was recently recorded but is otherwise too fragmentary to evaluate architecturally (Knott and Thacker 2011). At the extreme southern end of the archipelago the unicameral church surviving at Eoligarry (Barra) presents substantially upstanding side walls and the masonry style is generally flat-laid shell-lime bonded rubble masonry with round-arched rubble opes (Lowe *et al.* 2002). But the primary lateral entrance suggests a later date, although this is another multi-chapel site.

The most convincing early masonry fabric at an Outer Hebridean parish church site, however, is undoubtedly in Benbecula where a substantially upstanding building of two clearly distinct shell-lime bonded masonry phases is located on an island within a recently drained loch. Although the mortar associated with the earlier western part of the monument has almost completely dissolved away, recent falls in the north wall have exposed visibly lime-bonded primary core (*contra*. Thacker 2011) and this phase only remains so upstanding because (like Wyre in Orkney) the church walls were built in an extraordinarily flat-laid masonry technique. This primary phase has very small nave windows and single western entrance, and all of these rubble-built features have lintel heads supported on inclined jambs (RCAHMS 1928; Thomas 1873). By contrast the masonry of the secondary east end of each side wall is quite formal: coursed with smaller edge-laid blocks and taller slit-windows in the north and south walls. Significantly, however, although the east wall of the church collapsed in the early 20<sup>th</sup> century this had been previously been reported to be around 5-feet wide (Thomas 1873, 239-240) and that appears to be supported by the surviving remains. This is significant in suggesting that this east wall may have been primary, that the contrasting secondary masonry represents repairs or modifications to the east end of the side walls only, and that the large dimensions of the ruined monument may also conform to those of the primary congregational church.

The contrast between the form, dimensions and stone-emplacement techniques evident within the two phases of this building clearly suggest contrasting masonry cultures. Both phases, however, are shell-lime bound and the slit-windows in the side walls of the east end suggest the secondary phase is also pre-Reformation, but with a more formal masonry style similar to that seen in later medieval work locally such as at St Michael's Grimsay (Thomas 1873, 244-45; Thacker 2011). Indeed, oral tradition attributes both buildings to the later 14<sup>th</sup>-

century, but the most significant detail is that the primary phase of this building (unlike *Caibeal Dhiarmaid* Howmore) has a later medieval upper terminus at least.

The inherent structural stability of the primary phase of this Benbecula church, and its continued use in later periods, has allowed a large volume of upstanding survival and this has enabled a rare glimpse of a building whose masonry style and architectural form suggest construction in an early period (cf. Ni Ghabhláin 1995, 118). Whilst suggestions that this building is pre-Norse (Thomas 1873) should be dismissed, that it is pre-parochial is perhaps more likely and it is of further significance that, like the parish church of *Eaglais na h'Aoidhe*, the building is dedicated to Columba.

#### 6.6.5 CONSTRUCTING LORDSHIP IN THE NORTHERN HEBRIDES

This very brief survey of selected elements of the upstanding Outer Hebrides pre-Reformation corpus has been presented to suggest that four or perhaps five main levels of pre-Reformation church building evidence can be characterised here. These include small Manx and Irish-influenced dry-stone and earth-packed unicameral chapels with western entrances; lime-bonded generally flat-laid rubble-built Norse-influenced bicameral chapels with a spectrum of entrance orientations and chancel arches; churches with very formal rubble stone-emplacement techniques, sophisticated architectural forms and imported sandstone features; and rubble buildings with formally coursed rubble masonry styles including frequent use of edge-laid slabs but no dressed sandstone. These church buildings present contrasting forms and yet are often located in such close proximity to one another that chronological and social contrasts must be suspected. That there may be a fifth level of congregational church within this model, represented most clearly by the primary phase of the Benbecula parish church, will be considered further below.

It is the use of imported materials and techniques which associates the buildings at Howmore (South Uist), *Teampull na Trionaid* (North Uist) and St Moluag's Europie (Lewis) with particularly bold colonial architectural statements, and in the context of the wider North-West Region this group of buildings may be joined by the cathedral church on Skeabost Island (Skye) and St Moluag's church (Raasay). From a 13<sup>th</sup>-century perspective these buildings are broadly contemporary; congregational churches; widely distributed; apparently unassociated with nearby contemporary high status secular buildings; and clearly well funded.

The confused dedication evidence at Howmore, however, is crucial to our further interpretation of this evidence and here it seems very likely that the transitional twin-lancet structure was indeed the parish church, and that it was therefore this building which was dedicated to St Columba. This interpretation finds some support from the field notebooks of Alexander Carmichael who identifies: ‘Caibeal the caibeal mor (S. Columba). Outside the wall Howmore...[whilst]...Neil Maceachin says that an caibeal is caibeal mor and the new Caib Dhiarmaid’ (1870-72, 34r).

Paired Columban/Marion dedications are common throughout Uist and a ‘subsidiary’ chapel dedicated to Mary in Benbecula may represent paired male/female religious provision as seen in the estates at Trotternish, the traditions on Taransay (Harris) and of course on Iona itself (see RCAHMS 1982 146; O’ Sullivan 1994). The relative chronologies of these buildings in the Outer Hebrides appear diverse, but that St Mary’s was an earlier dedication at Howmore, may be supported by the place-name evidence itself which ultimately also found its way into Bleau’s atlas as ‘Auon How Moir’ (1654). If this is accepted, then strong parallels with the lost parish church of *Cille Mhoire* at nearby Houghgarry (North Uist) are salient, and in this scenario we should probably expect to find church buildings at both sites with flat-laid stone-emplacement, a western doorway and (of course) a shell-lime mortar. Continuing these parallels with Houghgarry and *Teampull Ronain* Europe we should expect to find *Cille Mhoire* Howmore somewhere on the mound currently occupied by the *Caibeal Clann ic’ Ailean* complex, and that the early masonry churches of both Houghgarry and Howmore were replaced by Clan burial chapels is surely more than coincidence. *Teampull Choluim Chille* Benbecula and *Eaglais na h’Aoidhe* are both associated in oral tradition with early medieval founding saints and it is probable both buildings were re-dedicated to Columba in secondary constructional phases when parochial status was secured. The primary phase of the Benbecula church, however, was clearly already a significant congregational building and it is possible a traditional monastic community was located here and failed in the wake of the foundation of *Teampull na Trionaid*. In South Uist, however, a completely new parish church dedicated to Columba was constructed at Howmore with fine imported materials, and this surely also represents consolidation of the MacSorley lordship (Fleming and Woolf 1992, 347; Raven 2005, 185-186). The Columban dedication allows further parallels between *Teampull Mòr* Howmore and the twin-lancet parish church of Kilneuir Fincharn, and like Fincharn the Howmore ecclesiastical site was probably already one of regional religious importance.

The broadly contemporary foundations of *Teampull na Trionaid* and St Columba's Howmore appear to represent an Episcopal/monastic colonial project and it is not untypical for Reforming monasteries to be founded on new sites such as that at Carinish. This is probably an Ionan daughter house as oral tradition suggests. This Episcopal/monastic combination in Uist, highlights an apparent contrast with the similar pairing of *Eaglais na h'Aoidhe* and St Moluag's in Lewis wherein, despite high quality imported dressed sandstone in one of the secondary phases at *Eaglais na h'Aoidhe*, a dressed sandstone east window is conspicuous by its absence (Knott and Thacker 2011). There is no space to reconsider this here but this is an issue which should be re-investigated. Like Glassary (Argyll) and *Hogh* (South Uist) the use of a topographical name for the parish of *Aoidhe* suggests this site and name have an earlier territorial history and it is possible to speculate that either 'de insulis Alne' or more likely 'et episcoporum h[...]'] from the 13<sup>th</sup>-century Sodor list of mother-parishes may be appropriate (Poole 1911).

As the closest ecclesiastical site to the newly constructed Stornoway castle, the rise of the Lewis MacLeods from the 14<sup>th</sup>-century provides a context for their later medieval appropriation of *Eaglais na h'Aoidhe*. The patronage of parish churches and other chapels by later medieval Outer Hebridean clan chiefs such as Roderick MacLeod and Amy MacRuari enabled the native masonry industry to develop more formal stone emplacement techniques in this period, highlighting the curation of earlier phases within both the *Aoidhe* and Benbecula church buildings. As in the other two survey regions of this thesis, these buildings point to a pre-existing shell-lime masonry culture within the North-West Region before the construction of high status churches at Howmore, Carinish and Europie, consistent with the Pre-Romanesque biogenic-lime masonry culture of the Northern Isles western Argyll, western Ireland and possibly Man. There is no certain Outer Hebridean evidence for pre-Romanesque clay-bonded lime-coated masonry buildings like that beneath St Ronan's Iona, although the form of the early churches at Europie, Howmore and Hougharry remain unknown. It is, however, likely that a native biogenic lime-burning culture developed here similar to that described for the Northern Isles from the 11<sup>th</sup> or perhaps even 10<sup>th</sup>-century and clay mortars may or may not have been associated with that suite of masonry techniques. Within the model of lordship construction proposed here, however, it is not possible to highlight a negotiation between itinerant masons and the environment at Howmore similar to that of Rushen or St Magnus's because, unlike Man and Orkney, there is no limestone in Uist for them to burn. Their only option was the native 'skilp' (cf. Dahl 1968; see chapter 5)

or the importation of limestone as well as sandstone, and there is no evidence for geogenic-lime mortars in the Outer Hebrides until the post-medieval construction of the MacKenzie western aisle at *Eaglais na h'Aoidhe* with which this thesis began (Thacker 2011).

The reuse of dressed masonry from the 13<sup>th</sup>-century churches of St Columba's Howmore and St Columba's (Skeabost) within the 16<sup>th</sup>-century burial chapels of the Clans Ranald and Nicholson, however, suggests both of these high status churches were ruinous at the Reformation. The volume of later medieval rubble churches and chapels may have already weakened the power of these high status Church institutions but, between these buildings and the very high concentration of early modern burial aisles surviving across the northern Hebrides (Thacker 2015b; see chapter 2), a continuing and developing native professional shell-lime masonry culture was thereby sustained in different social contexts for centuries; moving around the region before finally dying in Uist sometime in the mid 20<sup>th</sup>-century.

## Chapter 7 – Summary and Conclusions

This thesis presents research which has investigated the archaeological potential of masonry mortars in the medieval and later buildings of the Scottish North Atlantic, through a programme of on-site survey, lab-based analysis and experimentation. The aims of the research were open-ended but pragmatic, and initially almost wholly concerned with beginning to establish how focused examination of masonry mortars can inform building survey across the region. In this regard, the fundamental characteristic of the evidence was established very early in the project and then demonstrated repeatedly: Historic mortar-making techniques in the medieval and later Scottish North Atlantic changed over time and from place to place. The research was then concerned to establish how that evidence changed, when it changed and ultimately why?

An extensive programme of non-intrusive rapid building survey was undertaken across the region and this was combined with more comprehensive investigation of nine main multiphase case study sites. Although the rapid survey results must remain provisional, where these were subsequently followed by more comprehensive analysis then those earlier interpretations were generally supported. Each of the nine case studies was re-phased according to the mortar evidence visible on-site, and these interpretations were in turn supported by microscopic analysis of mortar samples collected from each building phase, often combined with comparative analysis of materials collected from the local environment.

Three main lime-source materials were identified during this research, including different limestones, mollusc shells and coralline algae, and a lab-based experimental programme established that these biogenic sources display a series of (taxa-specific and irreversible) physical, microstructural and mineralogical changes which could be characterised according to four main stages of alteration at different temperature ranges. Shell and maerl inclusions from within historic mortars were then compared against this reference data to suggest 'equivalent firing temperatures' for individual clasts in hand-sample, thin-section and with XRD. In this way, together with more conventional geoscientific and archaeobotanical analysis procedures, criteria for identifying different mortar kiln-relicts and added-temperers were established. These material investigation and analytical procedures are included within the first three substantive thesis chapters (chapters 2-4), each of which also considers a focused discussion of one of three sub-regions.

Chapter two considered the mortar archaeology of the north-west Scottish mainland and northern Hebrides and demonstrated that the medieval corpus here is almost completely dominated by lime mortars made from roasted marine mollusc shells, even at sites where limestones visibly outcrop. This mortar evidence remains strongly represented in the region in some contexts until the late 18<sup>th</sup>-century, although gradually and relentlessly over the post-medieval period the corpus becomes increasingly dominated by lime mortars made from geogenic carbonate sources, including on major islands such as Lewis where these are not available and must be imported. Within individual multiphase buildings these contrasting shell and limestone materials are almost always mutually exclusive and phase-specific but, within the general regional trend, shell-lime bound structures are sometimes also evident in later contexts than limestone-lime bonded structures within the same locality or multiphase building.

In chapter three it was established that the Late Norse buildings of north-east Scotland and the Northern Isles were also dominated by lime mortars made from biogenic carbonates, and again this included localities with extensive limestone outcrops which were quarried to make lime in later periods. In this north-east region, however, biogenic lime-source materials included both mollusc shells and maerl ‘gravels’ and this research recognised and characterised maerl-lime mortars in the archaeological record for the first time in high medieval buildings on Wyre. The distribution of maerl-limes here appears to be restricted to high medieval Orkney, but the Orcadian corpus in this period is complex and includes geogenic-lime mortars in some contexts which may be socially or politically-contingent. The post-medieval evidence in this region, however, is mostly dominated by limestone-limes, and the process by which the mortar archaeological record changes in the Northern Isles appears to be associated with periods of no building activity and subsequent cultural change.

Chapter four considered the mortar archaeology of Argyll, Morvern, Ardnamurchan and the southern Hebrides, and examined the evidence for mortar fuel in some detail. This research included the archaeobotanical and radiocarbon analysis of wood charcoal mortar fuel kiln-relicts from two high status medieval and later castle buildings and comparative analysis of fuel, limestone and aggregate inclusions from within the mortars of different building phases were compared with source material samples collected from the local environment. This enabled these buildings to be related to surrounding woodland, sand deposits and geological outcrops, whilst narrowly constrained radiocarbon dates enabled an integrated approach to the wider archaeological, architectural and historical evidence. At Castle Fincharn this

suggested that the castle and church buildings were both broadly contemporary with the division of a larger lordship to form the barony and parish of Glassary, whilst further west a dichotomy between contrasting shell-lime mortar bonded churches and limestone-lime bonded castles suggested different social processes were in evidence.

Chapter five was less concerned with materials analysis and more concerned with evaluating the relationship between lime and clay mortars in the archaeological record across North Atlantic Europe. This discussion suggests that, when less ambiguous terminology is employed, clay mortars are very closely associated with lime mortars in the archaeological record in different periods and that clay mortared masonry construction was not a pre-existing North Atlantic building technique. Just like the evidence for different lime mortar sources, clay mortar preparation demands skills which must be disseminated, and the resulting evidence has environmentally, regionally, chronologically and socially-contingent distributions. This discussion also emphasised that both clay and lime mortars enabled people to construct reasonably similar buildings in different periods. On a broader level this evidence suggested a much simpler and more sophisticated approach to mortar archaeology could be adopted which acknowledges the archaeological potential of these various mortar materials in establishing: how individual buildings developed; how particular phase-specific materials relate to techniques evident in the wider corpus; how the local environment developed; and a date for the structure itself - without privileging that materiality over building form and function.

Informed by all the previous thesis chapters, chapter six presented a much more comparative and interdisciplinary discussion of the buildings evidence across all three survey regions in an attempt to understand how these relate to different aspects of lordship construction. The study highlights striking contrasts in building form between the north and the south of the survey area which may be equated with interrelated issues of social and religious identity, and contrasts within Argyll corpus which relate to varying chronologies and contrasting processes of parish formation and lordship construction. Ultimately that heterogeneity was related to complex evidence for church and chapel construction in the northern Hebrides, in order to suggest a preliminary model for lordship construction throughout the medieval period.

As suggested by the title of this thesis, for much of the medieval and later periods the use of mortared masonry across North Atlantic Europe is restricted to high status buildings many of which are specifically associated with the administration of lordship at various geographical

scales. That interpretation is clearly supported by the close relationship between the surviving archaeological and documentary evidence for ecclesiastical and secular masonry buildings in the Scottish North Atlantic discussed in this thesis. Indeed, as almost all of the medieval buildings investigated during this research exhibited surviving evidence of primary lime coatings I would suggest that lime mortar was a material expression of lordship in this period, as both secular and ecclesiastical medieval buildings ultimately appropriated its powerful anthropogenic otherworldly qualities. This thesis contends that, as meaningful signifiers of social order, masonry mortars are in essence cultural materials which should be considered within the same interpretive paradigms as other expressions of material culture.

Within this cultural paradigm, a number of themes have been developed within this thesis in response to contrasts apparent in the surviving evidence, including contrasts: between regions with and without masonry buildings at any given time; between mortar materials and environmental availability; between mortar materials in different types of contemporary masonry buildings; and between buildings or phases within the same building over time. In summary, it was demonstrated that contrasts in lime burning and mortar making technique were often predicated on craft traditions which emerged within (and then disappeared from) the archaeological record of the Scottish North Atlantic in different periods depending on both environmental availability, socio-economic circumstances and regional politics.

The term ‘masonry culture’ was adopted to describe how these different traditions impacted on the site, sub-region and wider regional buildings corpus, but included within this term is an acceptance that architecture only emerges through a wider dialogue between a number of different interrelated craft traditions and building specifications (Francisco 2007). This negotiation is also reflected in the composite (i.e. stone and mortar) structure of most historic masonry buildings, and over various chronological and geographical scales the surviving masonry evidence exhibited by a lime-bonded rubble building may be simplified to 4-5 different comparative combinations:

Where mortar compositions in multiphase buildings are very consistent, even when strikingly contrasting phase-specific stone emplacement techniques are in evidence (e.g. medieval *Easglais na h’Aoidhe* and Howmore), then continuity in regional lime-making traditions is suggested; but where phase-specific contrasts in mortar compositions parallel changes in stone emplacement technique (e.g. Iona, Mingary and St Mary’s Dunvegan), then discontinuity in both traditions is indicated. In neither example would change be expected were both techniques simply predicated on local geology, but in both examples the masonry

culture (and so resultant material culture) has changed. Equally, consistent stone-emplacement techniques and mortar compositions suggests continuity of masonry culture (e.g. Fincharn) and, where such structures are distant from one another, this may indicate movement of masons (e.g. Mingay/Tioram). Where stone-emplacement evidence is consistent across different sites but contrasts in mortar manufacturing technique are apparent, then the movement of masons may once more be the correct interpretation, but here the craftspeople either possess lime-burning expertise with different materials, or the products of different limeburners may have been employed. Where dressed freestone of different geological provenance or hewing technique has also been incorporated within the masonry culture (e.g. St Peter's Thurso), then our interpretations of that dialogue may be yet more complex and the archaeological potential of the evidence increased.

Evidence for the movement of mortar materials in all periods was considered, including the movement of limestone to shell-rich coastal sites without locally outcropping calcareous rock, and marine shells to inland sites where limestone does outcrop; and each of these instances were suggested to relate to the masonry culture negotiated by the craftspeople concerned. The evidence examined thus far, suggests contrasts in mortar evidence are not simply incidental to local material availability, although in the high to late medieval period different mortar making traditions often appear to be initially quite securely regionally situated within broader regional masonry culture. The boundaries of these medieval traditions may fluctuate as, depending on political circumstance, socio-economic context, environment, and of course chronology, different technical traditions are conserved, translated and/or adopted. The chronological resolution for understanding apparent material and technical contrasts in each context is dependent on evidence quality and quantity and will improve as this research continues, but at present the apparently sudden disappearance of the shell-lime evidence in Shetland and the appearance of maerl-rich mortars on Iona are excellent late medieval examples of a process which elsewhere was often more complex.

Where dressed sandstone is in evidence, then this has begun to allow further comparison of stone and mortar material sources, and this is considered a fertile field for parallel future research. Picking up on a region focussed on within the thesis, the Sound of Mull and northern Hebrides contain limited potential sandstone quarry sites and further chronologically-refined interpretations of stone sources in various 13<sup>th</sup>-century secular and ecclesiastical buildings would add greatly to our understanding of the movement of

resources within or between various lordships – including at Howmore and *Eaglais na h'Aoidhe*.

This thesis has developed a research platform for future interdisciplinary discourse across the wider region. Similar studies in Jutland, north Germany and Ireland would be helpful, as would further intrusive investigation of our earliest masonry evidence in Iona, Newark, Birsay, St Ninian's Shetland, and Portmahomack.

Each of the studies presented here should be considered working documents, which will be amended, refined and developed in future work as our expertise develops and understanding of the resource responds to emerging results. Future studies will need to be more comprehensive and include all available comparative evidence, including fixed in-situ core mortar samples and multiple potential aggregate and geogenic calcareous sources as a matter of course. More data from the archaeobotanical analyses of mortar fuels should also allow a better understanding of technical choices in various environmental situations, and how those strategies relate to the radiocarbon evidence. The research included within this thesis is in an early developmental stage, but has clearly demonstrated that the archaeological study of surviving mortar materials has considerable potential to enhance our understanding of past societies. Future studies of upstanding medieval buildings must now relate any surviving materials to the wider physical and cultural environment and consider radiocarbon analysis, woodland histories and the changing masonry cultures of the surrounding regions. Essentially, in examining a medieval mortar the archaeologist is looking at culturally selected and altered elements of a medieval beach, a medieval woodland and a medieval quarry.