Beyond the core? An investigation into the early Neolithic of the North Isles of Orkney, with a focus on the chambered tomb sequence

by

Michael (Mike) LAWLOR

A thesis submitted in partial fulfilment for the requirements for the degree of Doctor of Philosophy at the University of Central Lancashire

April 2023

Title

Beyond the core? An investigation into the early Neolithic of the North Isles of Orkney, with a focus on the chambered tomb sequence

RESEARCH STUDENT DECLARATION FORM

Type of Award: Doctor of Philosophy

School: School of Natural Sciences, University Of Central Lancashire

1. Concurrent registration for two or more academic awards

*I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution

2. Material submitted for another award

*I declare that no material contained in the thesis has been used in any other submission for an academic award and is solely my own work

3. Collaboration

Where a candidate's research programme is part of a collaborative project, the thesis must indicate in addition clearly the candidate's individual contribution and the extent of the collaboration. Please state below:

*Not Applicable

4. Use of a Proof-reader

No proof-reading service was used in the compilation of this thesis.

Signature of Candidate ______________________________

Print name: Michael Lawlor

Abstract

The Orkney islands are renowned for their rich Neolithic archaeological record. Recently considerable work has been undertaken on Orkney's Mainland around sites such as the Ness of Brodgar but less attention has been given to the periphery islands that make up the archipelago. Similarly, a comprehensive study of its chambered cairns has not been published since 1989. Working with the benefit of more recent enhancements of the Orcadian early Neolithic archaeological record this research considers the early Neolithic chambered cairns of the North Isles of Orkney. Using a combination of desk-based assessment and fieldwork, it examines the tomb thematic by considering three key areas; chronology, structural phasing and spatial analysis. The earliest evidence for the Neolithic is potentially in the North Isles and it is arguable that the centre of early Neolithic activity sits there. It is only towards the later Neolithic that the social core shifts to the Mainland. In addition to this a new axial alignment technique has been developed that has identified nuances within construction mythologies employed by the builders that identifies phasing and suggests a longevity of tomb use. This indicates that many early Neolithic tombs were multi-phase and therefore in use over a longer period when compared to other early Neolithic monuments of Britain and Ireland. This thesis also demonstrates that chambered tombs were not located by virtue of a universal social template but instead each island had different needs and requirements and people built each tomb to comply with those requirements. This thesis also introduces two new hypotheses namely that chambered tombs were purposely aligned upon settlements and tombs were intrinsically associated with marine and terrestrial routeways and travel strategies.

Table of Contents

Acknowledgements

I would like to start by thanking the staff of The Archaeology and Anthropology Department of UCLan School of Law and Policing for providing me with the opportunity to embark on this research and develop other skills such as working on excavations, taking tutorials, and arranging conferences. I would like to express my deepest gratitude to my supervisor Professor Vicki Cummings for her continued support. Her impeccable knowledge of the subject area, enthusiasm and continued patience had a considerable motivating impact that meant that I was able to get the most out of this amazing academic experience. I truly believe that this endeavour would not have been possible without her. Thank you, Vicki!

Thanks also to Dr James Morris for his advice and thoughts throughout and in the final stages running up to the thesis submission. Similarly, to Dr Rick Peterson for your input when taking up the role as academic supervisor for the very final stages of this work. I am also grateful to Professor Duncan Garrow, Reading University (external examiner) and Professor David Robinson (internal examiner) for their time, guidance, and advice on how to improve my final thesis and for making my viva a pleasurable experience.

I would also like to show express my gratitude to my friends Peter Hatton MBE, Damian Worsley and Neil McLeod who gave up their time to accompany me on those long survey trips to Orkney and for their impressive ability to feign an interest in Archaeology!

Last but certainly not least I would like to give special thanks to my family, Nic, Amie and Sam for their patience and encouragement throughout.

List of Figures

List of Tables

Appendices.

Appendix 1* - Master Orkney Chambered cairns data.xlsx

Appendix 2 *- Initial data mine Orkney.xlsx

*These live links will take the reader to the relevant appendix, both databases have been added as open access.

Chapter 1 - Introduction

Introduction

The Orkney archipelago lies some 16km north of the coast of Scotland and is almost always referred to collectively despite consisting of many smaller peripheral islands. Today these islands are politically and administratively one group though the islands are split into three distinct geographical areas: the Mainland, the South Isles and the North Isles. This thesis will focus on the North Isles tombs but will include evidence from across the archipelago to provide context (Figure 1.1and 1.2).

Neolithic Orkney is defined by its collection of striking monuments and archaeological remains with the most iconic and widely recognised being found clustered in the southeast of Mainland Orkney. The Stones of Stenness, the Ring of Brodgar, Skara Brae, Maeshowe and the Ness of Brodgar are today known collectively as the 'Heart of Neolithic Orkney', a UNESCO World Heritage Site (WHS). This terminology implies a core and a periphery placing the centre of the Neolithic activities on Mainland Orkney with the North and South Isles being somewhat peripheral. But what was the situation in the early Neolithic? While considerable research has been conducted on the Neolithic of Orkney, historic long-standing archaeological interpretations are now being refined. It is now timely that previous conceptions are revisited and retheorised in relation to what happened during the earliest times following the arrival of the first farmers to the archipelago. Fundamental to the changing narratives is the extensive work being undertaken surrounding the Heart of Neolithic Orkney WHS. The evidence gleaned from more recent archaeological investigations in this area coupled with the considerable advances in scientific dating methodology are refining what we know about the Neolithic throughout the islands. This work seeks to address any potential unbalanced narrative by complimenting the considerable work at the core with new work within the North Isles periphery.

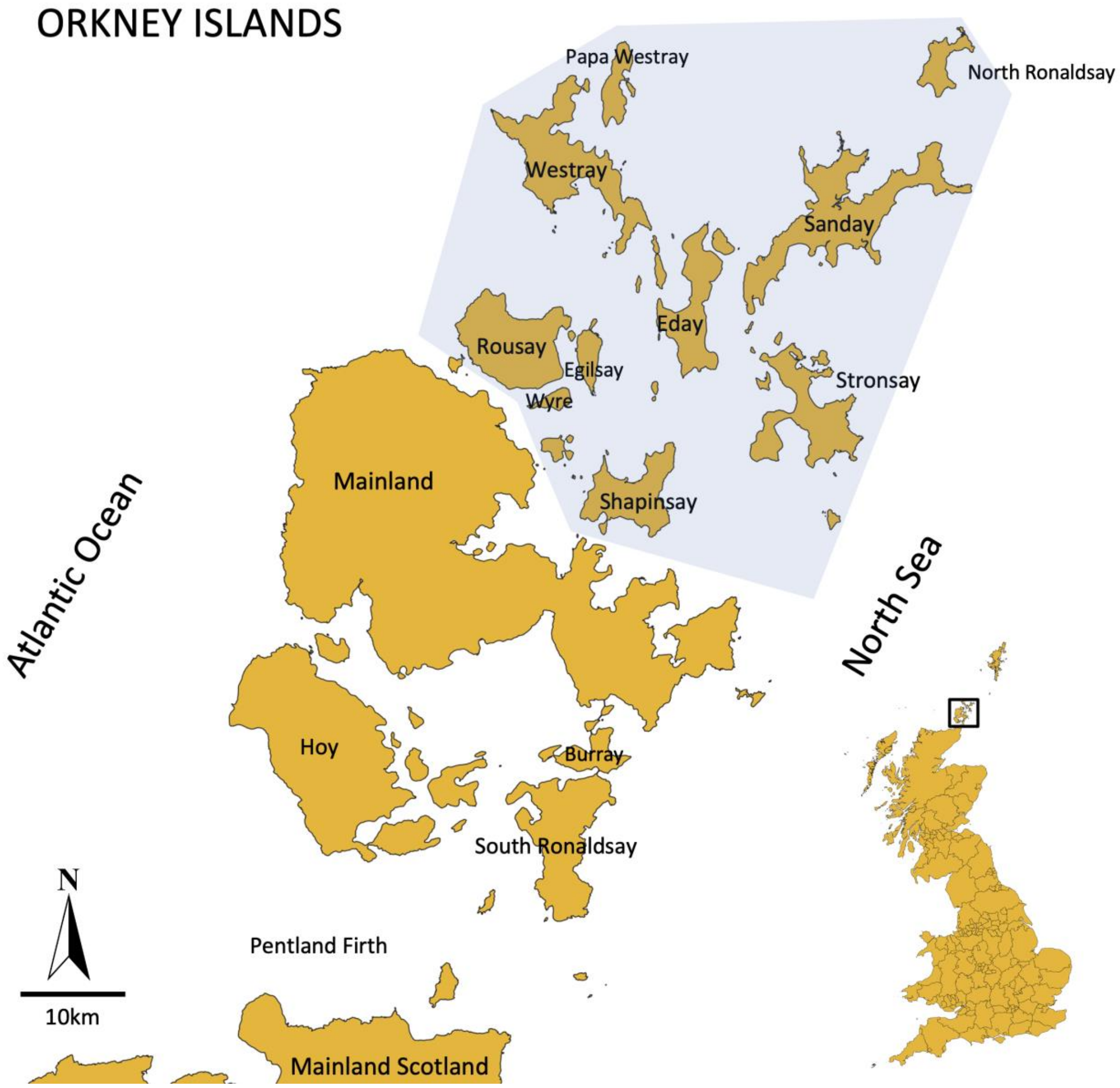


Figure 1.1. Map of the Orkney islands with the North Isles highlighted in blue. (QGIC national border base map annotated by author).

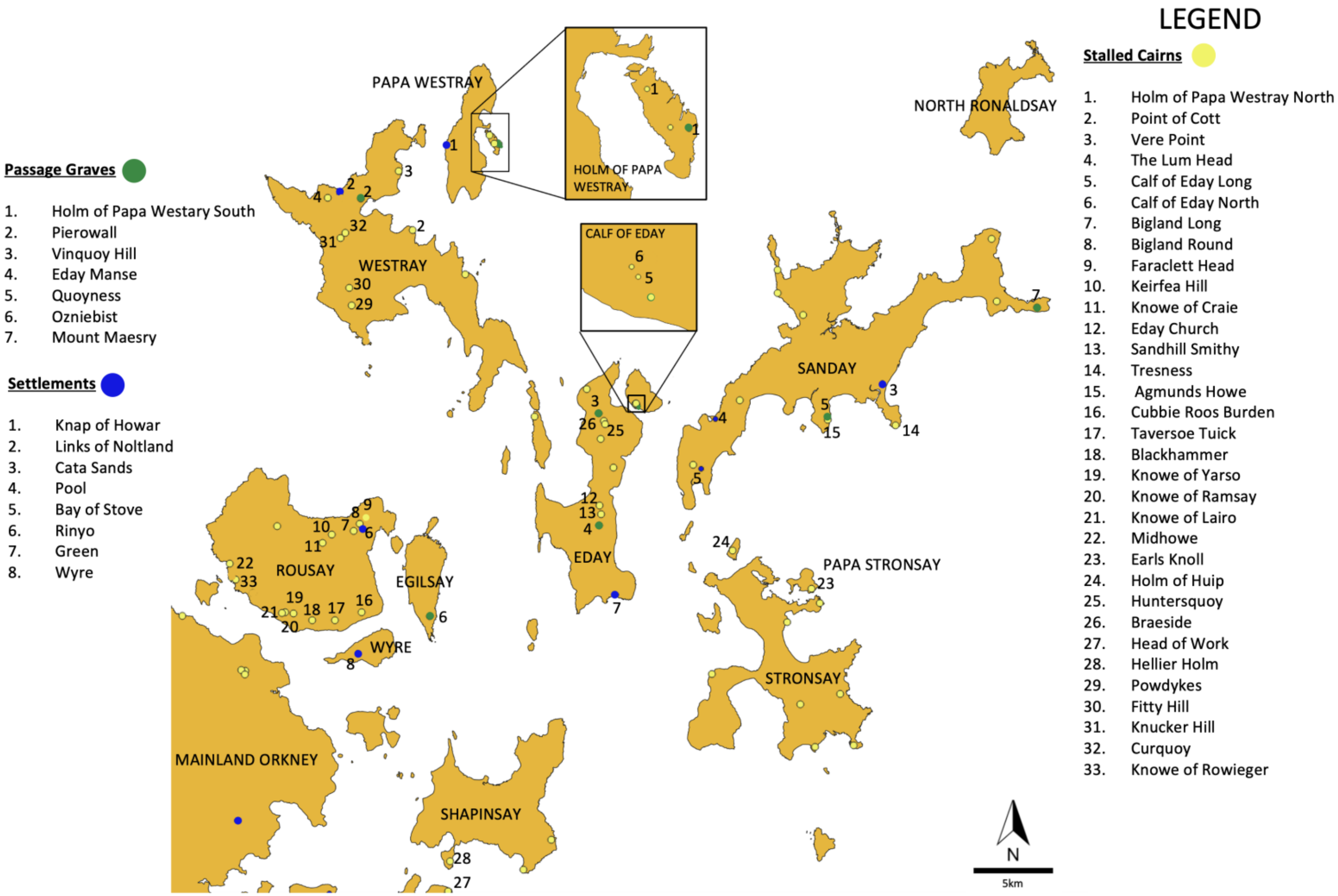


Figure 1.2 Map of the North Isles of Orkney annotated with sites in this work. QGIS mapping annotated by author.

The focus of the research

This research is a fresh investigation into the early Neolithic of Orkney with a primary focus on its chambered tombs whilst incorporating other related evidence such as recent dating evidence, structural analysis together with environmental and spatial detail. Today and throughout the historic periods the North Isles have experienced distinct cultural identities and this research seeks to establish if this was so during the early part of the Neolithisation of the islands. Thematic periphery island research is an area of study that has previously been neglected (Bayliss *et al.* 2017, 1172) and this work challenges the previously accepted narratives by specifically looking at the peripheral communities of the North Isles with the benefit of new and important evidence that had been unavailable to previous scholars.

Chambered tombs

Historically there has been considerable work on the chambered cairns undertaken and *The Chambered Cairns of Orkney* (Davidson and Henshall 1989) remains the definitive guide to these sites. This volume lists 80 monuments throughout the islands: 55 (69%) are classified as Orkney- Cromarty type; 12 (15%) as Maeshowe type and 12 (15%) that are presently of uncertain classification; the atypical (and not separately categorised) rock-cut Dwafie Stane on Hoy makes up the total. The importance of the North Isles is abundantly clear with 53 (66%) of all monuments in Orkney being located on these islands. This comprises of 40 (75%) Orkney-Cromarty; seven (13%) Maeshowe and six (11%) unclassified tombs. This presents a clear picture that the North Isles have a significant part to play in any narrative surrounding the chambered tombs of Orkney. Further, throughout the archipelago 69% and in the North Isles 75% are classified as Orkney-Cromarty type and therefore temporally positioned in the early Neolithic as determined typologically. Statistically alone it is abundantly clear that in order to interpret early Neolithic society the chambered cairn evidence is critical.

Settlement activity

It was previously thought that stone was the earliest building material to be utilised in Neolithic architecture in part due to relative dating assumptions of sites such as the Knap of Howar site in Papa Westray were early (see Ritchie *et al*. 1983). In contrast, recent investigations (see Richards and Jones 2016) now suggest the first domestic structures were of timber construction and were probably in use from 3445–3370 cal BC (Bayliss *et al.* 2017, 1181). The first stone houses were a little later but were certainly in use concurrently probably from 3410– 3330 cal BC (Bayliss *et al.* 2017, 1181). This means broadly that houses and stalled cairns were utilised within the same temporal phase (see Bayliss *et al.* 2017; Richards and Jones 2016). The earliest evidence of settlement growth appears during the period 3600 cal BC - 3500 cal BC (Richards and Jones 2016) with house sites for the Neolithic the mainland site of Wideford Hill (Richards and Jones 2016, 16), Ha'Breck on the small north island of Wyre (Brend 2010e; Farrell *et al.* 2014; Lee 2014; Lee and Desalle 2016; Thomas 2011) and Green in Eday (Miles 2007a; 2008a; 2009a). Recent excavations at the early Neolithic house at Cata Sand in Sanday (see Cummings and Richards 2016) has identified the stone phases are preceded by wooden structures a situation that is replicated at the other sites (Vicki Cummings *pers. comm*.). Importantly, the nearby early Neolithic chambered cairn at Tresness is likely contemporary to the Cata Sand house and appears to have also undergone significant remodelling with a number of phases from early Neolithic to Bronze Age being identified (see Anderson-Whymark and Cummings 2019; 2021; Cummings *et al.* 2018). Publications are forthcoming though they do paint a changing narrative around materiality within settlement between the earliest stages of the early Neolithic. The evidence provided by this site when added to the excavations at Tresness will provide new evidence and insights into the temporal and spatial relationships between these structures. Figure 1.3 demonstrates that there is some variance in the core and periphery settlement usage which will be reinvestigated during this research (Bayliss *et al.* 2017, fig 7).

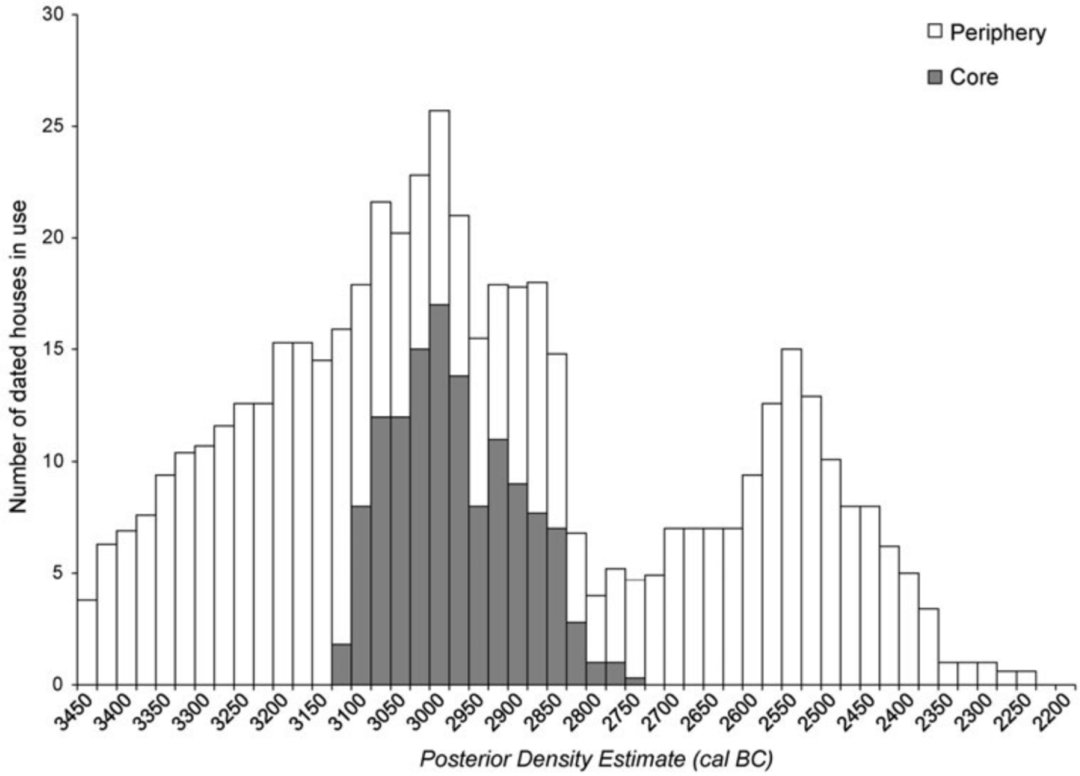


Figure 1.3. The number of dated Neolithic houses in use in Orkney during the later fourth and third millennia cal BC. The core referring to sites in the area around the WHS (Bayliss *et al.* 2017, fig 7)

The significance of the Heart of Neolithic Orkney

Since its designation the Heart of Neolithic Orkney World Heritage Site (WHS) has been a catalyst for research and the archaeological spotlight has been firmly placed on the archaeological remains and the landscapes in which they sit. There is little doubt that the focussed WHS research agenda (see Downes *et al*. 2005) has enhanced the archaeological record and Orcadian Neolithic narrative considerably. Has it enhanced the narrative for mainland Orkney only or for the Orkney islands as a whole? Whilst clearly a location of pivotal importance to late Neolithic societies it does not take into consideration the North Isles communities and what was happening there. The WHS focus is on the series of upstanding monuments in one small – though significant – part of Orkney but the scientifically accepted evidence and the new theoretical thought emerging from these important sites need to be placed in their broader island context. The research agenda for the WHS has identified that the spatial parameters "….*needed to be extended well beyond the designated areas in order to place the WHS in context*" (Downes *et al*. 2005, 37) and to develop the understanding of this site research needs to be of a "*nested approach* *with varying scales and inputs and this includes an acknowledgement of the international, regional, local and site specific data in order to refine the current narratives* (Downes *et al*. 2005, 36).

The changing narratives of Neolithic Orkney

The Neolithic sequence of Orkney has been often divided into two; the early Neolithic exemplified by the presence of stalled cairns and Unstan Ware pottery and the late Neolithic where passage graves and the Grooved Ware ceramic traditions are dominant (see Cleal and MacSween 1999; Hunter and MacSween 1991; Richards and Jones 2016). This chronological scheme (see Figure 1.4) followed studies in the 1960s and 1970s specifically on chambered cairns (Henshall 1963; 1972) and social structure (Renfrew 1979) where it was suggested a model of social evolution from disparate and segmented groups who used round based pots and built stalled cairn to the later territorially centralised chiefdom controlled societies with Grooved Ware and passage graves (Renfrew 1979). Renfrew identified this in his investigations and put forth that there was cultural differentiation between these two peoples.

"Either there is a chronological priority of Unstan Ware over Orcadian Grooved Ware, so that the latter superseded the former (and might have developed from it), or we might envisage two different groups of people, perhaps different original, simultaneously using Unstan Ware on the one hand and Grooved Ware on the other. In this case the 'Unstan Ware People' would be responsible for the stalled cairns, and the Grooved Ware people for the Quanterness - Quoyness group (Maeshowe type)" (Renfrew 1979, 206).

The proposed transition between and stalled cairns and passage tombs traditionally fell around the turn of the fourth to third millennium BC (Card 2005, 47) with an overlap period for Unstan and Grooved Ware falling between 3300 BC and 3000 BC (Renfrew 1979, fig 54). This schema - which held currency until post-millennium scientific advancements - was born out of a culture-historical approach that was heavily diffusionist and heavily reliant upon typological assessment of material culture.

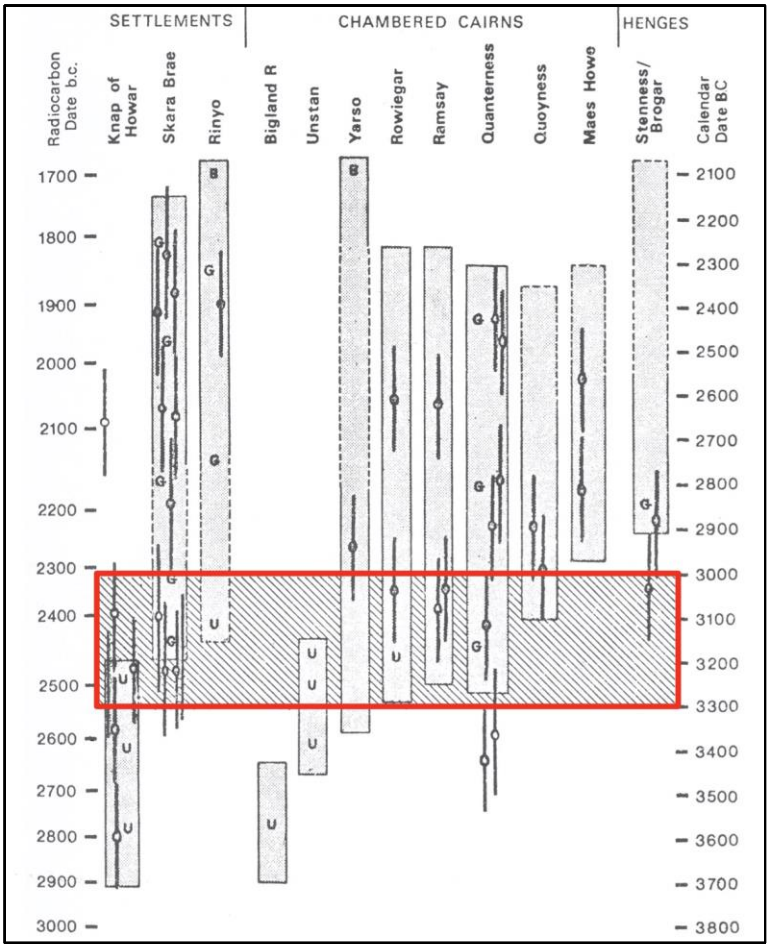


Figure 1.4. Schematic diagram produced after Renfrew with the chronology and relationships between settlements, chambered cairns and stone circles; ceramic technology suggested sequencing is shown with a suggested transition period shown in the red box - U (Unstan Ware) and G (Grooved ware)(Fraser 1980, fig 4) (after Renfrew 1979, fig 54).

In the 1980s congruent studies focussed specifically on chambered cairns across the archipelago with detailed thematic works (Davidson and Henshall 1989; Fraser 1983). In the decades that have passed archaeological, theoretical and scientific approaches have advanced markedly with an acceleration after the turn of the millennium. Consequently, chronological sequencing narratives of Neolithic societies is today considerably more sophisticated (Ashmore 2000a; Bayliss *et al.* 2017; Griffiths 2016). In the most recent and comprehensive study it is proposed that the Neolithic arrived in the islands c. 3600 cal BC with an amplification of settlements and monument construction from c.3300 BC. The study identified a peak of settlement activity around c.3100-2900 cal BC before experiencing a period of abatement between c.2800 - 2600 cal BC (Bayliss *et al.* 2017). Other Bayesian statistical revaluations of available radiocarbon and other chronological data has refined this temporal narrative further (see Bayliss *et al.* 2017; Bunting *et al.* 2022; Griffiths 2016). As 'new methodologies are applied to sites our understandings are developing at pace and it has been possible to untangle those previously complicated sequences (Bayliss *et al.* 2017, 1174). There have also been a concentration of fresh programs of dating reanalysis from key sites across the archipelago namely chambered cairns at Holm of Papa Westray North (Ritchie 2009, 59) and Quanterness (Schulting *et al.* 2010); settlement sites at Pool, Sanday (MacSween *et al*. 2015), Barnhouse (Richards *et al*. 2016a), the Ness of Brodgar (Card *et al*. 2018) and the Links of Notland in Westray (Marshall *et al.* 2016). Following these works a new more sophisticated chronological synthesis is emerging (Bayliss *et al.* 2017; Griffiths 2016). It has now been suggested that both Orkney Cromarty and Orcadian passage graves were constructed and used contemporaneously around the middle centuries of the 4th millennium cal BC. In respect of ceramic technologies which helped formulate the earlier typological relative dating models the newly developing picture is more complex. Unstan and Grooved Ware ceramics now appear like the cairns to be contemporaneously in use at some sites around the early fourth millennium cal BC (Figure 1.5), though the settlement site at Pool in Sanday does seem to present contextually sound evidence supportive of Renfrew's evolutionary sequence (MacSween 1992). On this, Richards advocates that caution should be exercised when applying this evidence to the wider Orcadian archipelago narratives *"…. in a single part of a relatively small island situated peripheral to mainland, Orkney* (Richards 1993, 201). The intimation from this statement alone is pointing future researchers to at least consider the question, was something different happening in the North Isles?

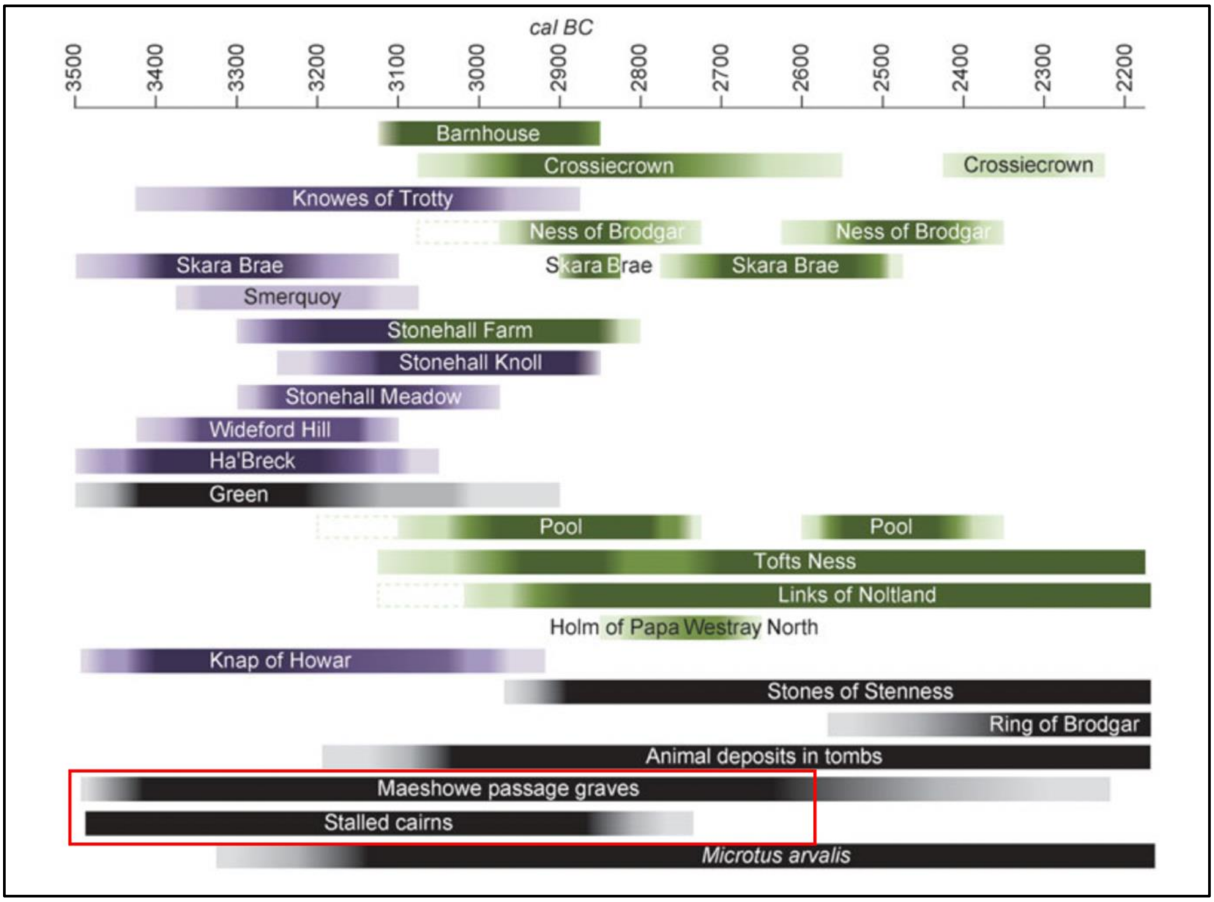


Figure 1.5. A schematic diagram showing key Orcadian Neolithic sites and suggesting a refined chronological sequencing. Red box highlighting the current chronological scheme in respect of Orkney-Cromarty / Maeshowe type cairn sequencing. Unstan Ware sites in purple and Grooved Ware sites in green (after Bayliss *et al.* 2017, fig 5).

It is now evident the earlier narratives are no longer as simplistic as the previously suggested early / late Neolithic chronological scheme and it is these complexities that this work will unpick. On these recent enhancements to the evidential representation Richards talks of a '*messy*' picture emerging (Richards and Jones 2016, 6) with the narratives becoming increasing blurred as advances in archaeological science are made. He suggests that *'a different interpretative framework becomes necessary to accommodate new evidence and more sophisticated chronologies'* (Richards and Jones 2016, 7). In concurrence following the recent Bayesian statistical remodelling of the Orcadian sites by Bayliss she comments '*The emergent chronology… appears to present a more complex picture of extensive and overlapping activities, concurrences and discontinuities occurring at different sites throughout Orkney during the fourth and third millennia cal BC. This prompts a radical reassessment of this period*' (Bayliss *et al.* 2017, 1182). These qualified assertations are difficult to argue against and present the motivation and a thematic approach that will resonate throughout this research.

Intellectual argument, aim and research questions

The intellectual arguments for looking at the North Isles within this thesis has been made out herein this introduction. In summary, research of the Neolithic of The North Isles region of has have become less defined as focussed thematic study has been somewhat neglected (Bayliss *et al.* 2017, 1172) a contrasting situation to that seen on Mainland Orkney. Consequently, the emerging Neolithic archipelago wide picture is becoming 'messy' (Richards and Jones 2016, 6) and there is a danger of the Orcadian past being presented as a fragmented view. Since the publication of 'The Chambered Cairns of Orkney' (Davidson and Henshall 1989) much has been learnt particularly in respect of radiocarbon dating studies (Bayliss *et al.* 2017; Card *et al.* 2018; Griffiths 2016; MacSween *et al.* 2015; Martinková, *et al.* 2013; Marshall *et al.* 2016 Richards *et al.* 2016a; Ritchie 2009 and Schulting *et al.* 2010). The results of these studies will be added and pulled together to present a more board picture. New research will be constructed to look at relevant themes - architectural, spatial and landscape analysis. By doing so this work will address this potential imbalance and will, by challenging previously accepted findings, present new ones. Furthermore, it will include relevant archaeological developments and discoveries that were unavailable to previous scholars looking (see Fraser 1983; Davidson and Henshall 1989). By bringing the picture in the North Isles up to date this thesis will complement the ongoing WHS research agenda on mainland Orkney (Downes. et al. 2005, 37) and will bring symmetry to the overall Orcadian picture.

Aims

The overarching aims of this thesis are centered on providing a comprehensive examination of the early Neolithic period in the North Isles of Orkney, with a focus on tomb construction, siting decisions, and the societal influences shaping the use of burial monuments. The specific research questions crafted to address these aims are outlined below:

1. To understand how and why people of the early Neolithic constructed their tombs and what influenced their decision-making process when siting the tombs within the landscape.
2. To investigate how social interaction and cultural traditions influenced the use of these burial monuments.

Research questions

1. Are there similarities or nuances between the individual island's environments and geomorphologies? - (Aim 1 and Chapter 3)
2. What dating evidence is available and is this sufficient to establish a chronological framework of construction and use early Neolithic monuments in the North Isles of Orkney? - (Aim 1 and Chapter 5)
3. Can architectural nuances within building methodologies be unpicked to identify different phases of construction for Neolithic monuments and if so what does this imply about longevity of tomb use? - (Aim 1 and 2, Chapter 6).
4. What is the spatial and temporal relationship between the tombs, settlements, and the landscape more broadly? Were the tombs aligned upon specific targets such as astronomical bodies, landscape features, other tombs or settlements? - (Aim 1 and 2, Chapter 7, 8 and 9)
5. Can settlements contemporary with the early Neolithic chambered tombs be identified? If so, what is the relationship between settlements and tombs? - (Aim 2 Chapter 8 and 9)

6. Can potential locations of yet unidentified tombs or settlements be proposed by analysing the spatial arrangements of known monuments? - (Aim 1, chapter 7,8 and 9)

7. Can terrestrial and maritime routeways be identified by analysis the locations of tombs and settlements and suitable landing points? - (Aim 1, Chapter 8 and 9).

8. Did the individual island communities operate under the same social processes as the mainland or indeed each other? where they segmented or part of a wider community (chiefdom)? - (Aim 2 chapter 7, 8 and 9)

By addressing these aims, objectives through the research questions this thesis will contribute to our understanding of the early Neolithic period in the North Isles of Orkney shedding light on the various aspects of tomb construction, use and socio-geographical context within whish these activities occurred.

First, however, is a review of the current state of knowledge in relation to chambered tombs more widely.

Chapter 2 - Literature Review

Introduction

This chapter will begin by outlining our current understanding of the Neolithic of Britain and Ireland. This will form the backdrop for the more focused review of the narratives concerning all elements of chambered tomb studies of this period. It will begin by considering the Cotswold-Severn regional group of monuments. This approach has been taken as these tombs have been subject to the most focused archaeological investigation over the years and can be seen as the basis from where key methodological advancements have been made before being applied to the other regional funerary structures. The chapter will then explore key debates such as typology, regional diversity and classifications before addressing the architectural features of the tombs and what happened within them. The chapter will then present a detailed chronological review of the different theoretical approaches adopted by archaeologists in the investigation of these monuments; from Antiquarian activity to the present day. Each of the periods of archaeological thought have had influential parts to play on shaping the narrative of Neolithic chambered tombs. By virtue of the nature of this research this chapter will place emphasis on matters concerning the Orcadian monumental tomb traditions.

The Neolithic of Britain

In Britain and Ireland the Neolithic period commenced around 4100-2500 cal BC (Whittle *et al.* 2011, 836) a period encompassing some 60 generations (Cummings 2017, 1) and with it saw the arrival of an agricultural subsistence strategy that persists today. The Neolithic is defined by the introduction of new domesticated plants and animals and was accompanied by innovations in material culture in the form of new ceramic and lithic technological advancements. It also saw for the first time the people of these isles undertaking the construction of megalithic architecture such as chambered tombs. It was the period which saw people of the British Isles commence the transition from the mobile hunter-gatherer way of life to that of a farmer (Cummings 2017, 28). Its arrival was not universal across the British Isles with the first appearance of this new way of life evolving at different times for different places and regions and island groups (see Garrow *et al*. 2017; Whittle *et al.* 2011).

When and how the Neolithic 'way of life' came to Britain has long been debated and whilst the narrative is constantly changing it remains incomplete. In the 1920s Gordon Childe described it as a Neolithic revolution born from the migration of people or the diffusion of ideas that were then adopted by indigenous people. He identified a change in the subsistence economy but the processes for change were not his focus given the culture historical approach he adopted (Childe 1925). In the 1950s Stuart Piggott proposed a theory that argued for 'multiple colonization' (Piggott 1954). More recently arguments have tended to concentrate on the processes involved and a phrase that has become synonymous with this period is the 'Neolithic package'– ceramics, polished stone tools, domesticates, cereals and megalithic architecture (Cummings 2017, 29; Whittle *et al*. 2011). It has been argued that the term tends to imply wholesale and even simultaneous change (Cummings and Morris 2018, 1). This appears not to be the case. Different aspects of the package made an appearance at different times both within the broader Neolithic narrative but also as to when they took hold in different parts of the country (see Garrow *et al.* 2017; Whittle *et al.* 2011).

The question as to how the Neolithic arrived in Britain and Ireland has been dominated by two opposing arguments; colonisation and/or acculturation (Figure 2.1). Alison Sheridan's 'migration and colonisation by European farmers' theory (see Sheridan 2004a; 2010; 2010b) versus Julian Thomas's 'indigenous adoption' model being the exclusive driver of the transition (see Thomas 1991; 2003; 2004; 2007; 2008; 2013). However, more recently, others have argued for an amalgamation of the two to refine interpretation of the transition processes (see Anderson-Whymark and Garrow 2015; Cummings 2017, 38; Cummings and Harris 2011; Garrow *et al.* 2017; Garrow and Sturt 2011; Thomas 2013, 423; Whittle *et al.* 2011, 861).

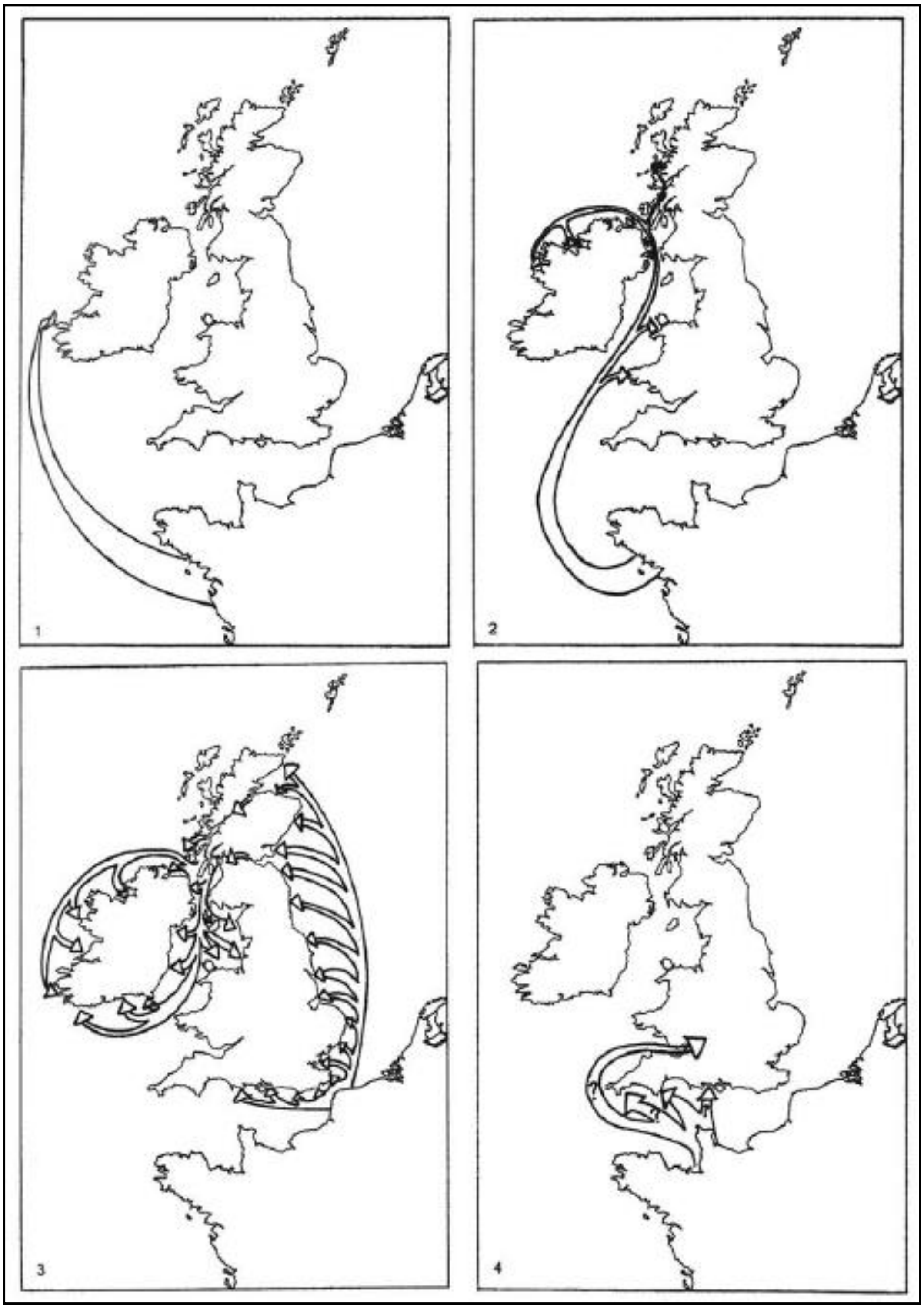


Figure 2.1. The suggested theories for routes the original farmers took to introduce the Neolithic to Britain and Ireland (Sheridan 2010b, fig 9.1).

Sheridan has long advocated a model that in Britain the transformation from forager to farmer occurred over several centuries but essentially argues that the key influencers of the change process were migrating continental groups who were already operating a farming subsistence lifestyle for some millennia (Sheridan 2000; 2003; 2004a; 2007; Sheridan *et al.* 2004). Figure 2.2 shows the four-stage model for the arrival of the Neolithic (Sheridan 2010b, fig 9.1). She argues that there were several key phases to the introduction of the Neolithic into Britain and Ireland. Weight is given to the identification of domesticated cattle remains discovered at Ferriter's Cove, Co. Kerry and Kilgreany Cave, Co. Waterford, dating from the fifth millennium BC or late Mesolithic. This is evidence, she argues, to indicate contact with European farmers prior to the onset of the Neolithic. Sheridan suggests this as evidence as a failed early attempt at colonisation. She goes on to cite the discovery of a Carinated Bowl of the Breton ceramic tradition discovered in Achnacreebeag in the west of Scotland again dating to the early fourth century BC. Despite the lack of dating evidence for this artefact she suggests is presence was indicative of the arrival of migratory individuals with ceramic making skills (Sheridan 2000). This theory relied on chrono-typological monument and ceramic evidence only limited presentation of radiocarbon determinations to develop her narrative (Garrow *et al.* 2017, 98).

In contrast, Thomas has argued in support of processes whereby the native Britons were themselves the active agents of change through acculturation. The traditions, practices and material culture that we today understand as Neolithic were adopted by transference from personal interaction with farmers from the Atlantic coast of mainland Europe. He suggests that the inception of the Neolithic period in Britain and Ireland brought wholesale change with the appearance of a new culture that was 'sudden and synchronous' (Thomas 2003). He argues that whilst the Britons of the very early Neolithic did build tombs for their dead, employ new ceramic and stone technologies and subside on domesticated plants and animals they could not be described as total adopters of the traditions in use in Europe. Whilst undoubtedly initially introduced from mainland Europe the way the domesticates were used in Britain and Ireland was subtlety different. As opposed to the wholesale uptake of domesticated animals there is evidence of them being used alongside wild resources or for special purposes a fact that, Thomas argues, weakens any total migration hypothesis (Thomas 2003, 73).

More recently modern scientific techniques have been used to refine the narrative. The first comprehensive review of the British Neolithic radiocarbon evidence was carried out and considered determinations from 1762 sites (Collard *et al.* 2010, 867). This study was able to add to these debates by estimating changes in population density during the early Neolithic of Britain and Ireland between (Figure 2.2).

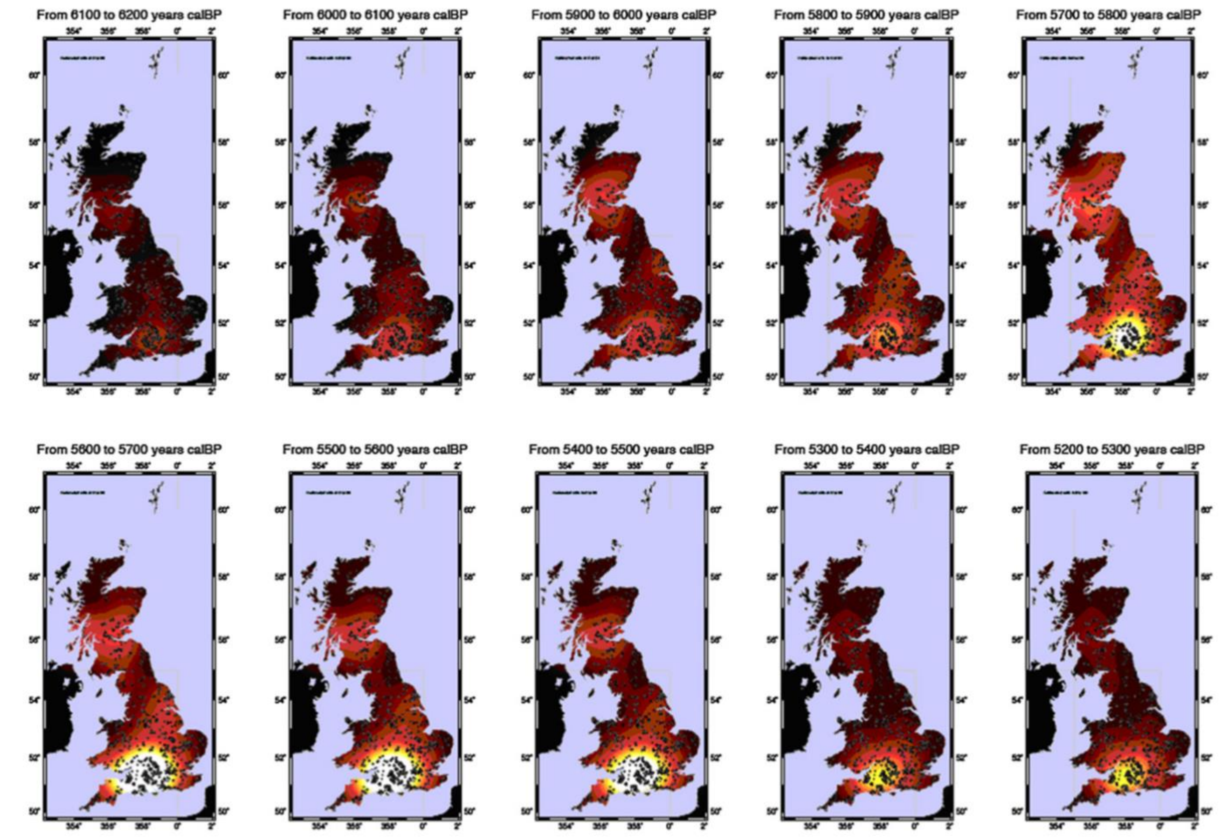


Fig. 2. Spatial density of full set of dates between 6100 and 5300 cal BP in 100-year time slices.

Figure 2. 2. Spatial density results of population density between 4100 and 3300 cal BC in 100-year time slices (Collard *et al.* 2010, 868).

The following year the influential 'Gathering Time' project (Whittle *et al*. 2011) was published. This substantial study utilised Bayesian statistical modelling techniques applied to radiocarbon dates thereby developing a new framework for addressing chronology as a key area for understanding. The latest additions to this debate are formed as a result of recent advancements in aDNA analysis (see Brace *et al.* 2019; Thomas 2022) One study proposes a large scale seaborne foundational migratory event by incoming European farmers (Brace *et al.* 2019, 769) with others arguing for a more complex protracted process (Thomas 2022, 520). These scientific advancements will be looked at in more detail later in this chapter in respect to the impact it has had on chambered tomb studies. More broadly that work has been able to conclude that the Neolithic first appeared around the 41st century cal BC but identified that this did not represent a nationwide or wholesale adoption. The Neolithic instead took hold in Britain at different times in different places, arriving first in the south-east then south-central England before spreading further afield (Figure 2.3).

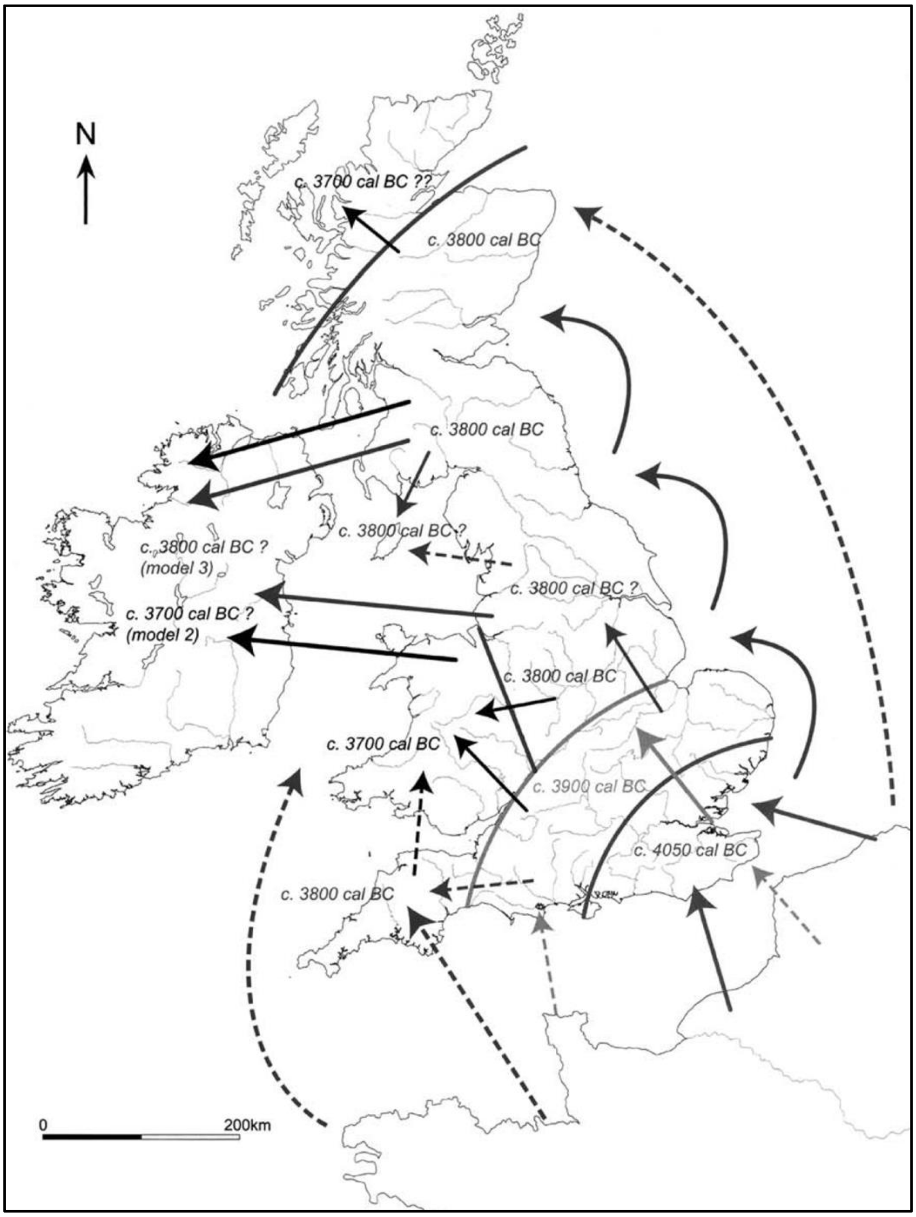


Figure 2.3. The arrival of the Neolithic to Britain and Ireland following '*The Gathering Time*' project (Whittle *et al.* 2011, 869).

This work presented evidence that this was a process that took some 350 years or more to disseminate throughout Britain and Ireland (Figures 2.2 and 2.3) between 4050-3700 BC. This work also suggested that this was a process driven by migrating people as well as the acculturation of the indigenous forager bands, a suggestion that sits between the Sheridan and Thomas arguments and has been followed by more recent studies (see Anderson-Whymark and Garrow 2015; Cummings 2017, 38; Cummings and Harris 2011; Garrow *et al.* 2017; Garrow and Sturt 2011; Thomas 2013, 423; Whittle *et al.* 2011, 861).

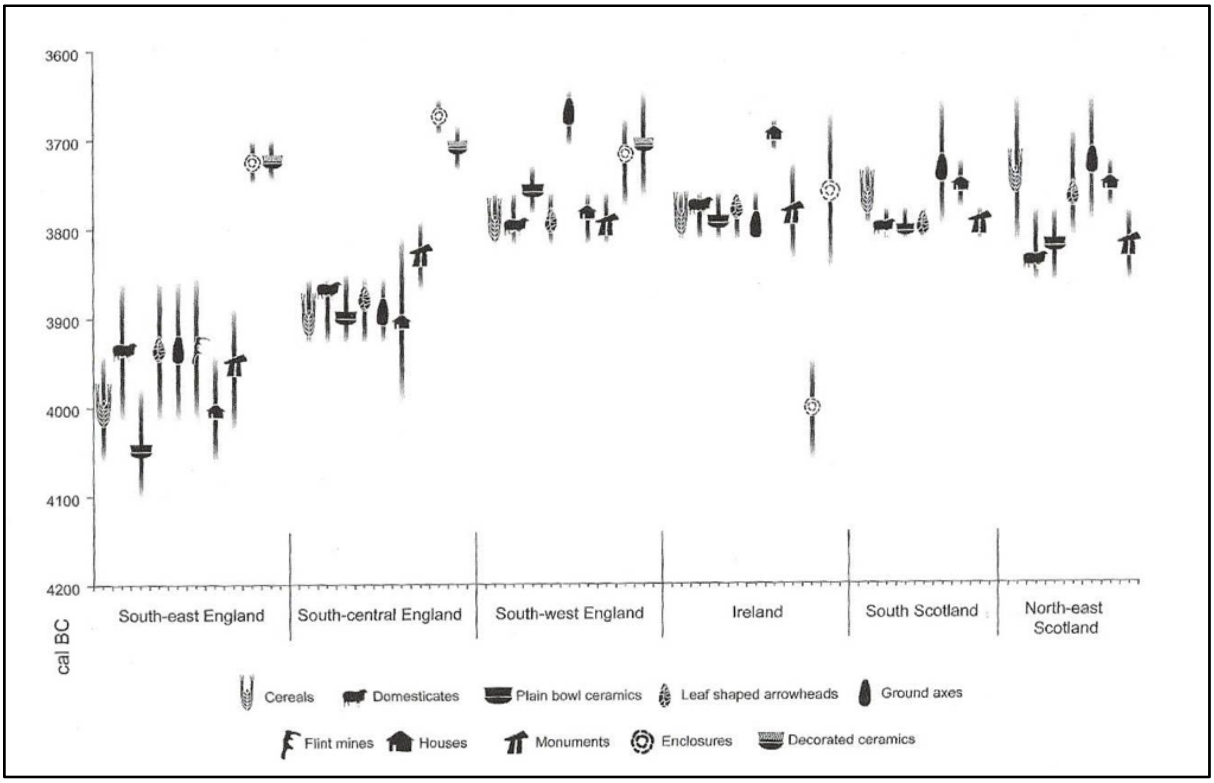


Figure 2.4. Diagrammatic representation of the appearance of aspects of the Neolithic package in different geographical regions of Britain and Ireland (Whittle *et al.* 2011, Fig 14.179)

Early indications from a new discipline, the science of ancient genomics looks set to add to this debate with the publication of a recent study into aDNA that will be discussed in detail later in this chapter (see Brace *et al.* 2019). In summary it has suggested that Neolithic ways were introduced to Britain by incoming European farmers with some admixture with local Mesolithic hunter-gatherers (Brace *et al.* 2019). This work is not conclusive though it is certainly adding to the debate with others more recently refining its findings even further by contextualising the use of these landmark scientific results with wider archaeological knowledge (see Fowler *et al*. 2022; Thomas 2022). Table 2.1 presents a comparison of the models discussed above pulling together the key aspects of the arguments by Brace *et al.* (2019); Sheridan (2007; 2010); Thomas (2022) and Whittle *et al*. (2011).

Date cal. BC	Sheridan	Brace *et al.*	Whittle *et al.*	Thomas
4400				Protracted contact between continental Neolithic communities and Mesolithic groups in Britain, exchange of things and practices
4300	Small-scale movement of farmers from northwest France to southwest Ireland			
4200	Movement of farmers from Morbihan to west Wales, west Scotland and northern half of Ireland			
4100			Small-scale incursion of continental farmers into the Greater Thames Estuary	Interaction and arrival of small numbers of migrants results in the creation of a 'Minimal Neolithic' in southeast England: pots, flint mines, flints, halls
4000	Movement of users of Carinated Bowls from Nord Pas-de-Calais to much of Britain and Ireland		Gradual chain migration leads to Neolithic expansion into south central England	
3900	Trans-Manche-Ouest movement of farmers from Normandy and north Armorica to southwest England	Continental farmers arrive in Britain, marginally earlier in the west than the east	'Surge' of Neolithic things and practices into southwest England, Wales, Scotland and Ireland. Demographic expansion and acculturation of Mesolithic groups	Establishment of Neolithic in Britain attracts a migration stream from northern France, concentrated on southwest England, Wales, Midlands: funerary monuments, richer assemblages
3800				
3700	'Diasporic' strands of Neolithic retain contacts with continental homelands, creating diverse insular societies	Low levels of subsequent admixture with hunter-gatherers, principally in west and north Scotland	Continued continental contact and insular developments result in the construction of causewayed enclosures	Continued, slow-paced migration becomes more attenuated in the north; insular Neolithic communities become increasingly focused on wealth accumulation and competition
3600				

Table 2.1. Comparison table showing key points from Sheridan 2007; 2010; Brace *et al.* 2019 and Whittle *et al.* 2011 and Thomas 2022 (Thomas 2022, 515).

Chambered tombs: the national scale and distribution

One of the key components of the Neolithic was the introduction of megalithic architecture with stone chambered tombs representing the earliest examples. In Britain across the fourth and third millennium BC these monuments started appearing across the landscape with much diversity in design. They exhibited similarities to those seen across the Atlantic seaboard of continental Europe through to northern Germany and southern Scandinavia (see Childe 1925; Piggott 1954; Renfrew 1983; Sheridan 2004a; Tilley 2004; Whittle 2000). These similarities include architectural and structural features, the space they occupied within their landscape and the associated contents in terms of human and animal remains and material culture (Darvill 2004, 79). Glyn Daniel noted that these megalithic tombs of architectural splendour constitute '*the first surviving architectural monuments in north-west Europe and merit our special attention on this account alone*' (Daniel 1963, 11).

Chambered tombs are one of the most visible legacies of the Neolithic and one that differentiates this period from others. Constructed from stone, timber and earth these tombs display an element of regional comparability but they are not designed or built to a blueprint (Smith and Brickley 2009, 9). That said, the similarities are such that it is possible to argue for common social purpose likely linked to the early Neolithic sociality and cosmology (Cummings 2017, 89: Renfrew 1983, 152). Stuart Piggott highlighted there are some common elements to chambered tombs but given the geographical and cosmological diversities within Britain and Ireland the architecture of these monuments chambered exhibit considerable diversity with variations of '*bewildering complexity*' (Piggott 1954, 122).

Regional distribution and classification

The distribution of these monuments throughout Britain and Ireland has no easily identifiable pattern. Monuments do not appear in all areas of the country despite there being clear evidence for Neolithic activity throughout (Figure 2.5). It is therefore correct to say that chambered tombs were not part of a universal British Neolithic package (Cummings 2017, 137). They occur in northern and western regions in detached clusters and appear sporadic in distribution and their interpretation has been a constant source of archaeological attention.

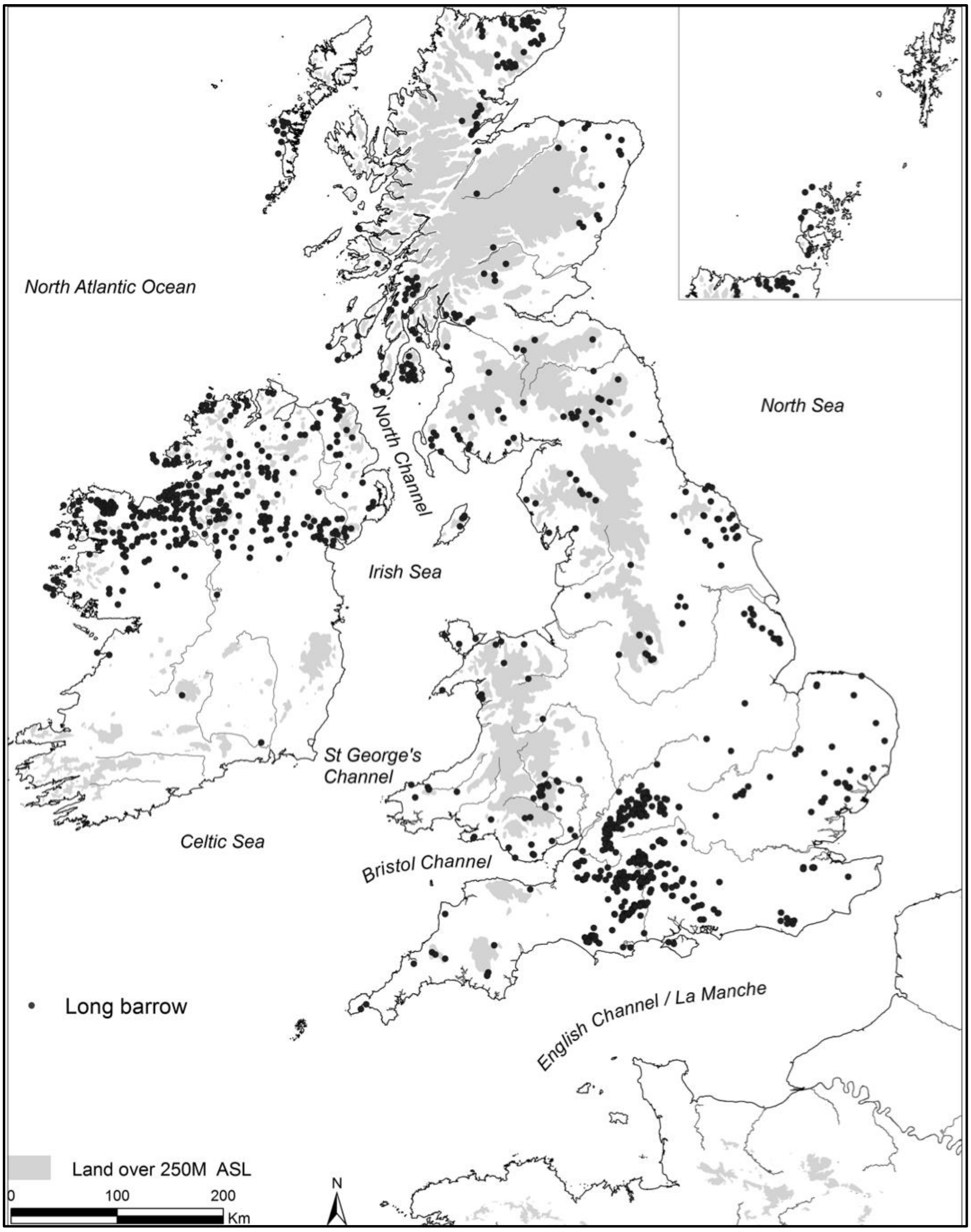


Figure 2.5. Map of Britain and Ireland showing the distribution of known early Neolithic chambered tombs labelled using the archaeological term long barrow (Darvill 2010, Figure 39).

Neat formal classifications between these regionally diverse tombs are complicated and even problematic. It has been said of the British monuments *"Much ink has been spilt – and many copy-books blotted – over the classification of megalithic tombs"* (Fleming 1972, 57). Work over the years has developed classification systems that are workable - if not definitive - and this thesis will follow these (see Ashbee 1984; Crawford 1925; Cummings 2017, 96; Cummings and Richards 2021; Darvill 2004; Davidson and Henshall 1989; De Valéra 1959; 1960; Fleming 1972; Henshall 1963 a; 1972; Henshall *et al.* 1995; Henshall and Ritchie 2001). This has evolved using a regional approach which has seen them divided into four distinct groups – the historical evolution of these classifications will be discussed later. The most marked concentrations of chambered tombs are located in south-central England and are known by archaeological classification as the **Cotswold-Severn group**. In the north of the island of Ireland there are **court cairns.** In western Scotland the monuments are described as **Clyde cairns** and in the north of Scotland and Orkney the **Orkney-Cromarty** type tombs are located. In addition to these monuments there are **Zetland group** tombs and **passage tombs**. **dolmens** represent a separate classification to chambered tombs but are included due to the part they play in the narrative of funerary architecture in the Neolithic of Britain and Ireland.

The Cotswold- Seven Group

The Cotswold-Severn group has a rich inventory with some 200 recorded examples (Darvill 2004, 83). They emerged around 150 years after the Neolithic first appeared in Britain 3980 and 3800 cal BC (Wysocki *et al.* 2013). This group is also associated with the most comprehensive literature in respect of archaeological investigation (see Crawford 1925; Darvill 2004) and consequently has the most developed narrative. The scholarly interest in the Cotswold-Severn monuments has often played host to the development of new methodologies that have proved to be models and templates to be more broadly utilised across the other groups of tombs. As suggestive within the name the Cotswold-Severn group of tombs - previously described as Severn-Cotswold by Stuart Piggott (Piggott 1954) - are distributed in the vicinity of the Severn valley encompassing the Cotswolds area and into south Wales (Figure 2.6).

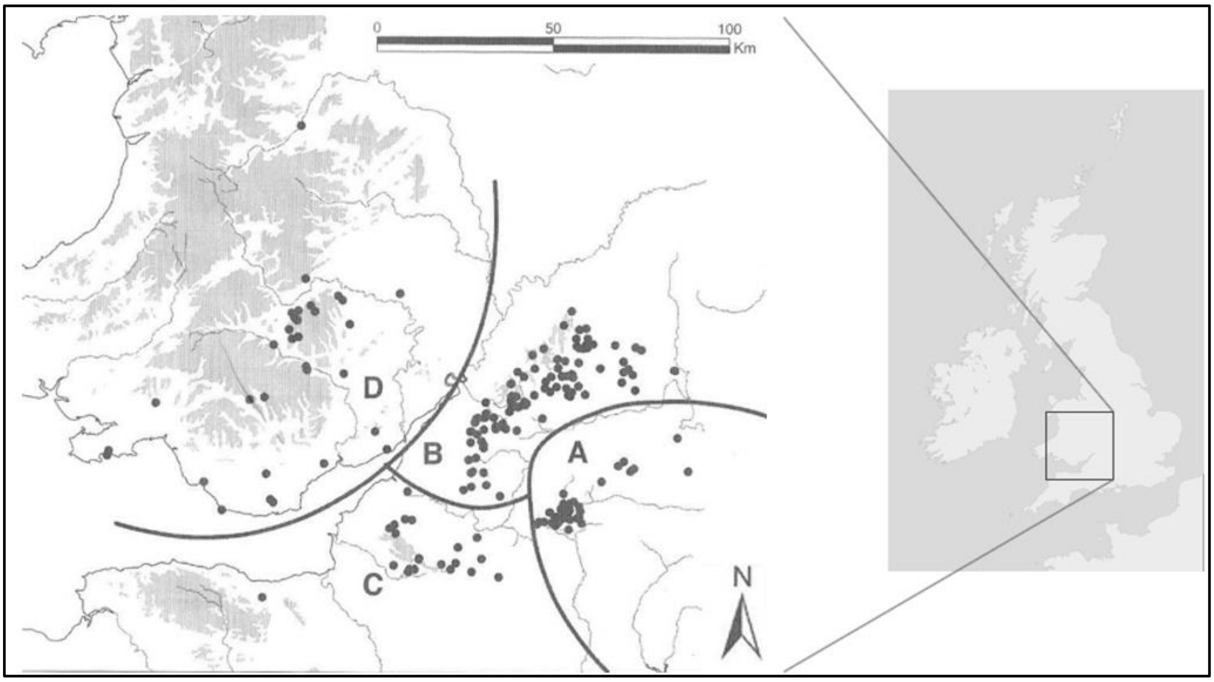


Figure 2.6. Distribution map of the recorded Cotswold-Severn tombs broken down into topographic zones; A - North Wessex Downs; B – Cotswolds Hills; C – Mendips and south of the River Avon; D – Hill and vales west of the River Severn (Darvill 2004, 87).

Typically, these monuments have chambers positioned with access from a short passage connecting them to the entrance way (see Ashbee 1984; Crawford 1925; Darvill 2004). The long barrow at West Kennet in Wiltshire is arguably one of the best known examples of a Cotswold-Severn type tomb. The first recorded in a drawing by William Stukeley in 1723 was used in the 1950s to reconstruct the façade stones as they can be viewed today (Figure 2.7).

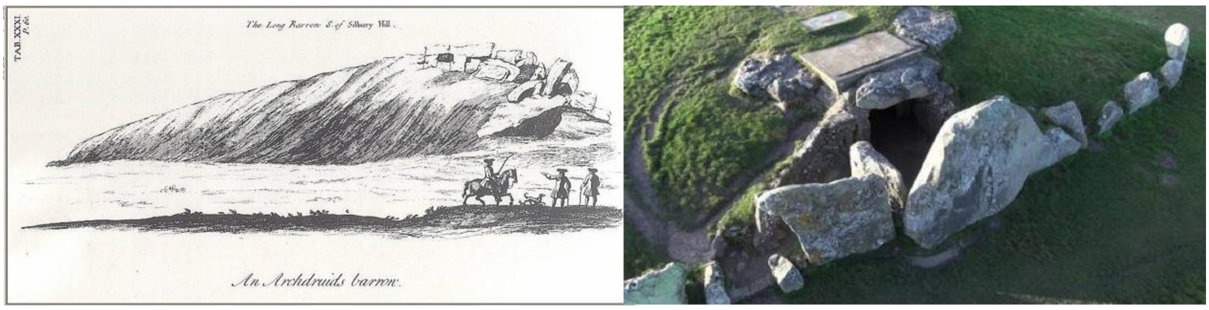


Figure 2.7. West Kennet Long Barrow one of Britain's best known chambered tombs. Left - The first image of West Kennett Long Barrow dated 1723 by William Stukeley (Mortimer 2014, 74); Right – A modern photograph showing the chamber entrance and forecourt area with standing stones as reconstructed from the Stukeley image.

Excavated by John Thurman in 1860 it subsequently became one of the first monuments in Britain to be scheduled under the Ancient Monuments Act of 1882 by the first Inspector of monuments General Pitt-Rivers (Piggott 1958, 235) (Figure 2.8).

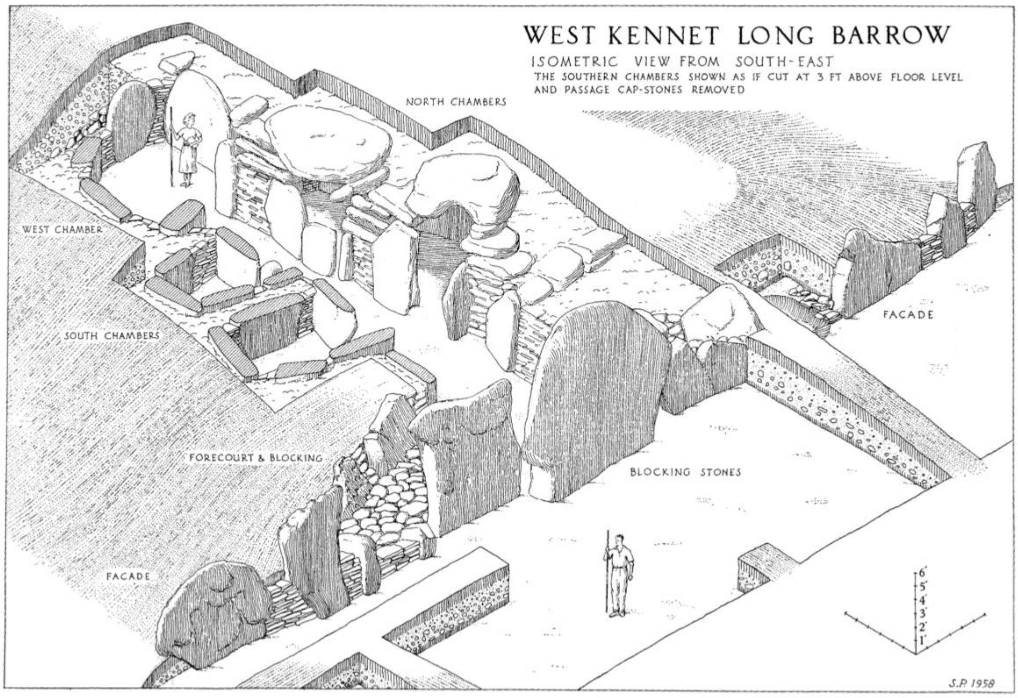


Figure 2.8. West Kennet Long Barrow one of Britain's best known chambered tombs. Left Isometric drawing of West Kennet Long Barrow (Piggott 1958).

This monument contains five large chambers each that are of a size that readily accommodates a standing person. It is contained within a trapezoidal mound 100m in length and between 21m and 12m wide.

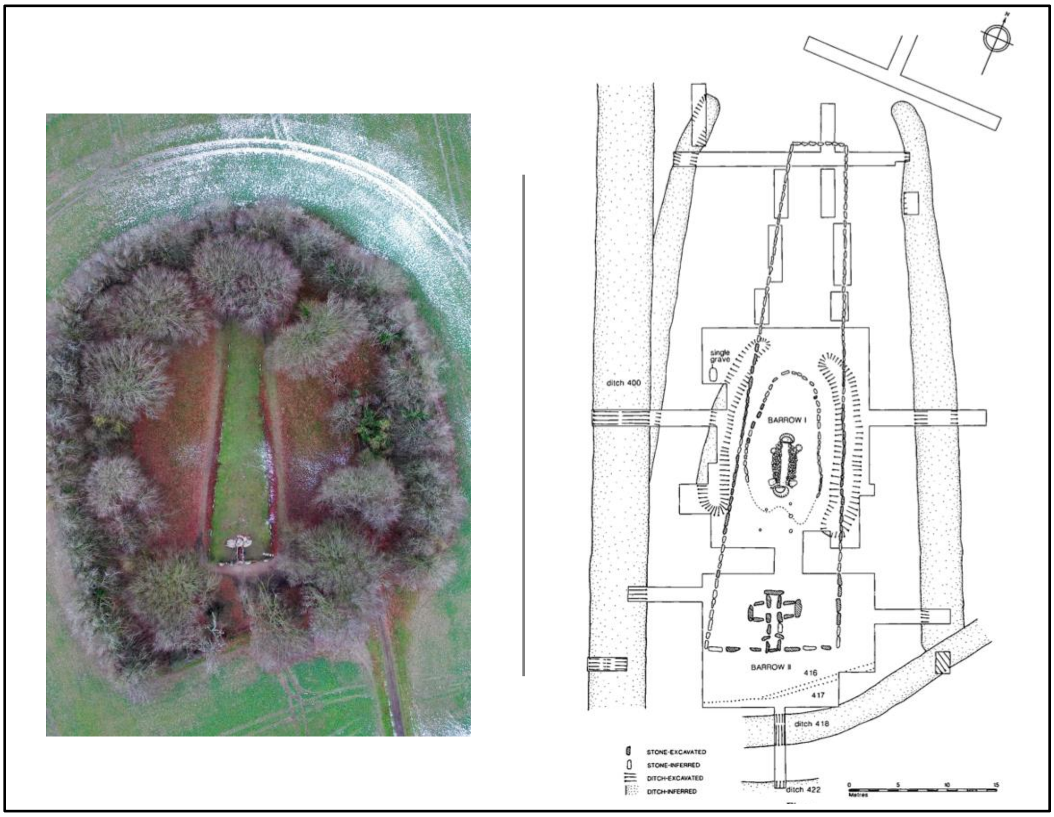


Figure 2.9. Wayland's Smithy; Left - Arial image of the monument and its immediate surrounding area (https://www.airchaeology.org/2019/02/06/waylands-smithy/); Right - Plan of the monument depicting both phases of the monument - Barrow 1 is no longer visible (Whittle *et al*. 1991, fig2).

Figure 2.10. Wayland's Smithy showing the forecourt area and a view into the passageway and chamber (author own photograph 2019).

A notable example displaying the classical Cotswold-Severn characteristics is Wayland's Smithy long barrow which is situated in Oxfordshire on The Ridgeway. Again its form is that of a trapezoidal long barrow that encompasses a transept chamber sequence at its southerly facing and wider aspect (Figure 2.9). The structure also shows a façade made up of four large orthostats interspersed with drystone walling (Figure 2.10) creating a forecourt area a characteristic feature of these type of monuments (Darvill 2004). This monument represents one of the most southeastern limits of the Cotswold-Severn type on monuments (see Corcoran 1969a; Peers and Smith 1921; Whittle 1991; Whittle *et al.* 2007).

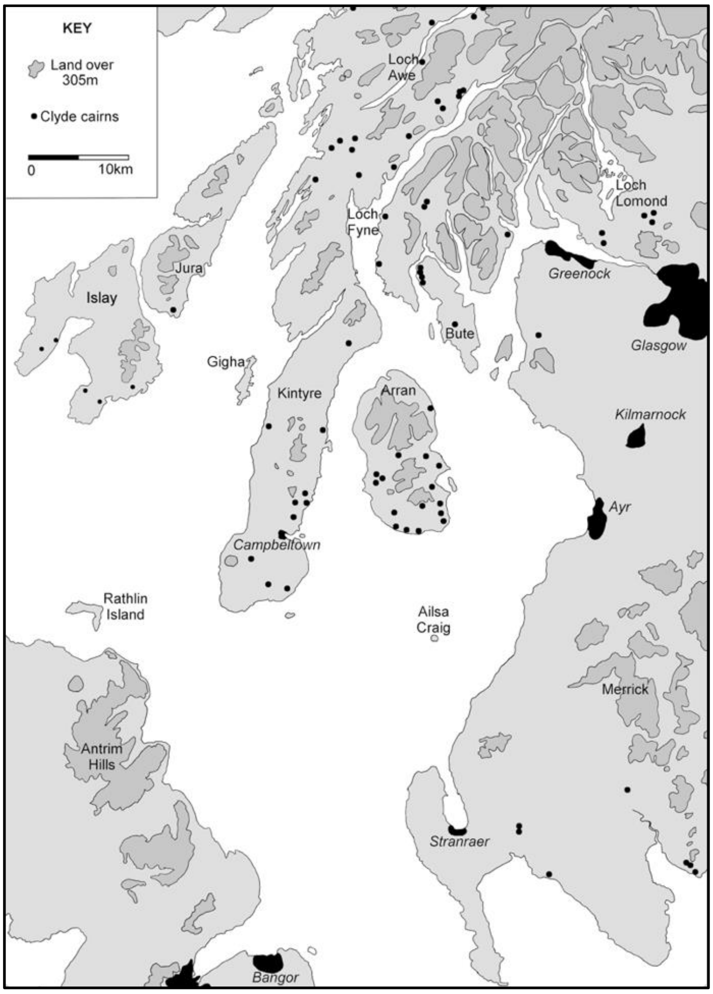


Figure 2.11. A distribution map showing of the known Clyde cairns sites (Cummings 2016, fig 3,2)

Clyde cairns

The Clyde cairns of western Scotland (see: Collins 1973; Corcoran 1972; Cummings and Robinson 2015; Henshall 1972; Scott 1969) were first classified as part of the Clyde-

Carlingford culture (Childe 1934; 1935; 1940). These monuments are distributed throughout western Scotland in an area broadly concentrated between Argyll to the north and the Solway Firth in the south (Figure 2.11) with 55 currently recorded (Cummings 2016, 42). Excavations at Blasthill have produced dates for a Clyde cairn as early as 4040 cal BC to 3710 (Cummings and Robinson 2015, 87; Whittle *et al.* 2011). Whilst these investigations were unable to conclude if this early date related to primary use or from pre-cairn deposits it remains possible that the Blasthill monument is one of the earliest chambered tombs in Scotland (Cummings 2017, 111). There are some notable similarities between the features of the Clyde cairns and court cairns hence their previous joint classification. Architecturally they consist of small box-type chambers situated in a row (Figure 2.12) displaying some similarities to the court cairn chamber configuration.

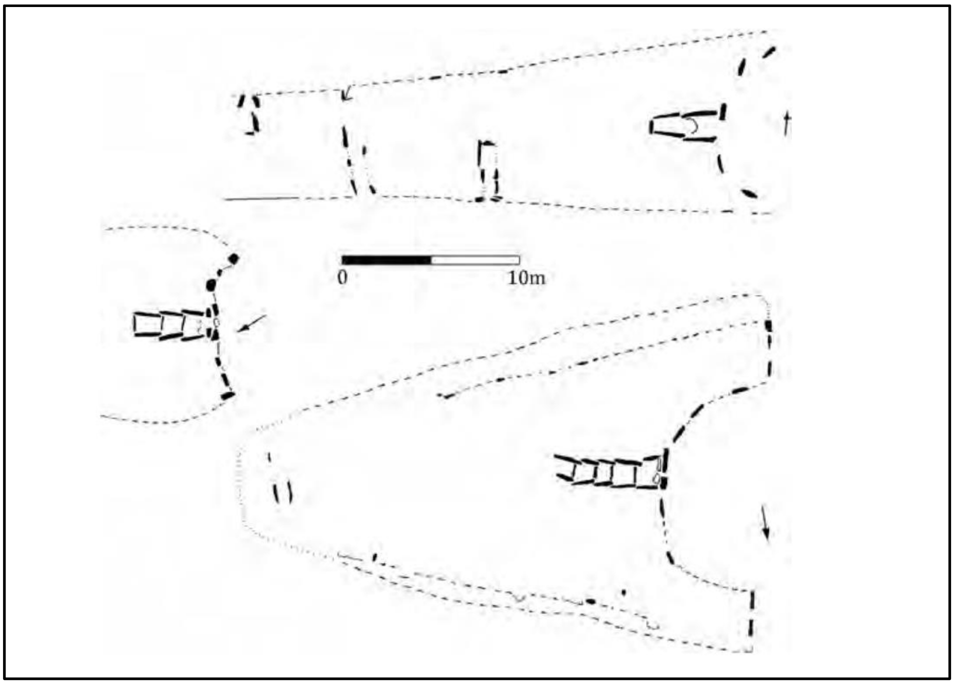


Figure 2.12. Plan of a selection of Clyde cairns. Top Gort na h'Ulaidhe, Kintyre; Monamore, Arran; and bottom East Bennan, Arran (after Henshall 1972) (Cummings 2017, 98).

They are formed using single stone slabs positioned to form a rectangular box chamber (figure 2.13) and are sited at the terminal end of the associated large rectangular or trapezoidal cairns (Scott 1969). They are accompanied by a characteristic concave or crescentic forecourt areas formed large standing stones (figure 2.12 and 2.14) which is in contrast to the shape of the courtyard type area seen at the entrance in the Irish tombs.

The use of these sites has frequently been discovered to span multiple archaeological periods (Corcoran 1972).

Figure 2.13. A close-up photograph showing the architectural make up of a typical Clyde cairn chamber, example from Cairnholy I in Dumfriesshire, Scotland (authors own photograph 2020).

Figure 2.14. Photograph depicting the characteristic concave forecourt façade with the entrance to the chamber area shown in the middle of the image (authors own photograph 2020)

Classic examples include the Cairnholy I and II, monuments situated in Dumfries and Galloway in the west of Scotland on an elevated position with views over the Irish sea towards the Isle of Man (Figures 2.13, 2.14 and 2.15). Both monuments are set within long cairns and are located within a matter of tens of meters from each other. They are made up of simple box type chamber preceded by a porch or short passage connecting the chamber to the entrance. Cairnholy I has an façade of standing orthostats framing a forecourt area (Cummings 2003; Piggott and Powell 1949).

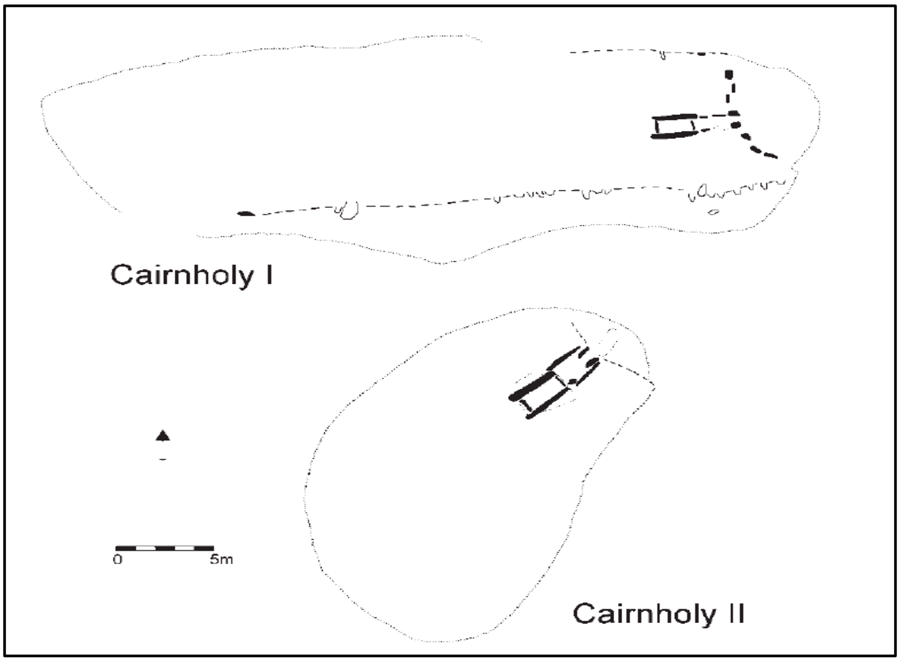


Figure 2. 15. Plan of Cairnholy I and II, both monuments are located within 10s of meters apart (Henshall 1972).

Court cairns

Court cairns can be found in the north of island of Ireland above a line between Galway Bay and Dublin (Figure 2.16).

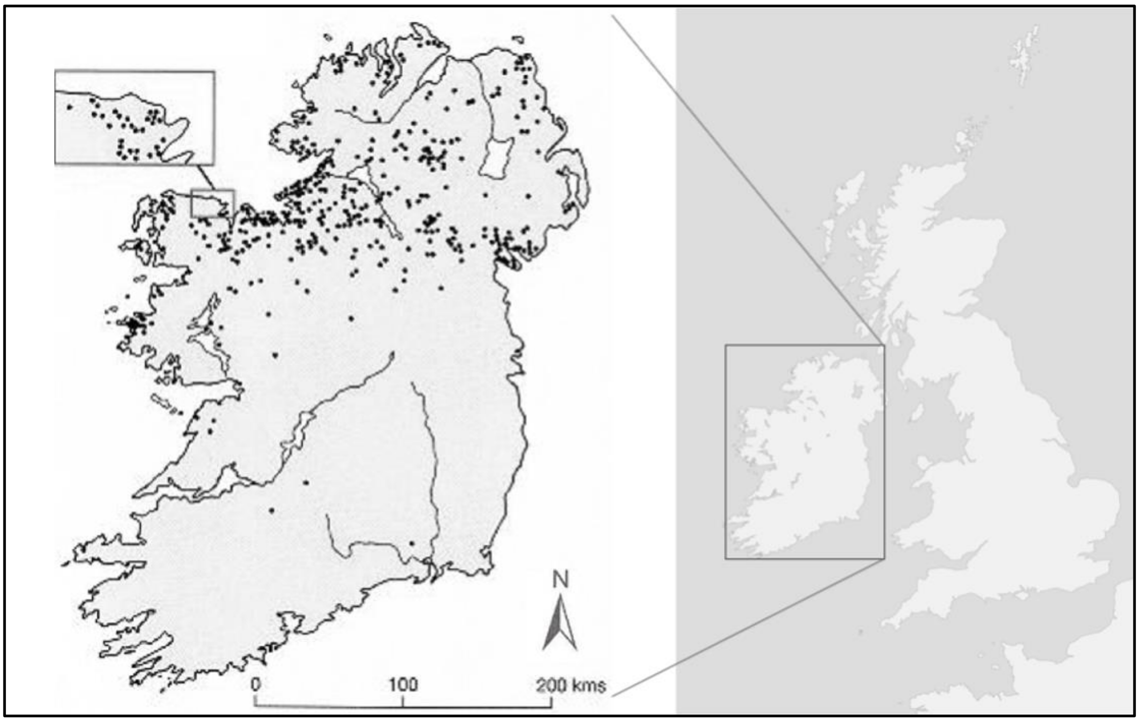


Figure 2.16. Distribution map of court cairns of Northern Ireland (adapted from http://www.irishmegaliths.org.uk/distmaps.htm).

It has been suggested that these tombs were constructed and used between 3700-3550 cal BC there have been 394 court tombs all considered to belonging to the early Neolithic (see Cody 2002; De Valéra 1959; Jones 2007; Ó Nualláin 1976; Schulting *et al.* 2012). They typically comprise an arrangement of small box style chambers positioned in a row that are routinely, though not always, accessed via the monuments lateral end (Cummings 2017, 97) (Figures 2.17 to 2.19 inclusive). This aspect of the tomb is not dissimilar to the configuration of the Clyde cairns. The Ballymarlagh monument, Co. Antrim, and the Ballymacdermot tomb in Co. Armagh (Figure 2.16)(de Valéra 1959) are typical examples and the court forecourt and the chamber configuration are clearly seen in these examples. There are some diverse variations on the fundamental theme as seen at Deerpark tomb in Co. Sligo (Figure *2.*18). Atypically, it has two eastern galleries and one to the west all three being split into two chambers. They are both then served by a central court as opposed to the more typical encountered entrance court (Ó Nualláin 1976, 103).

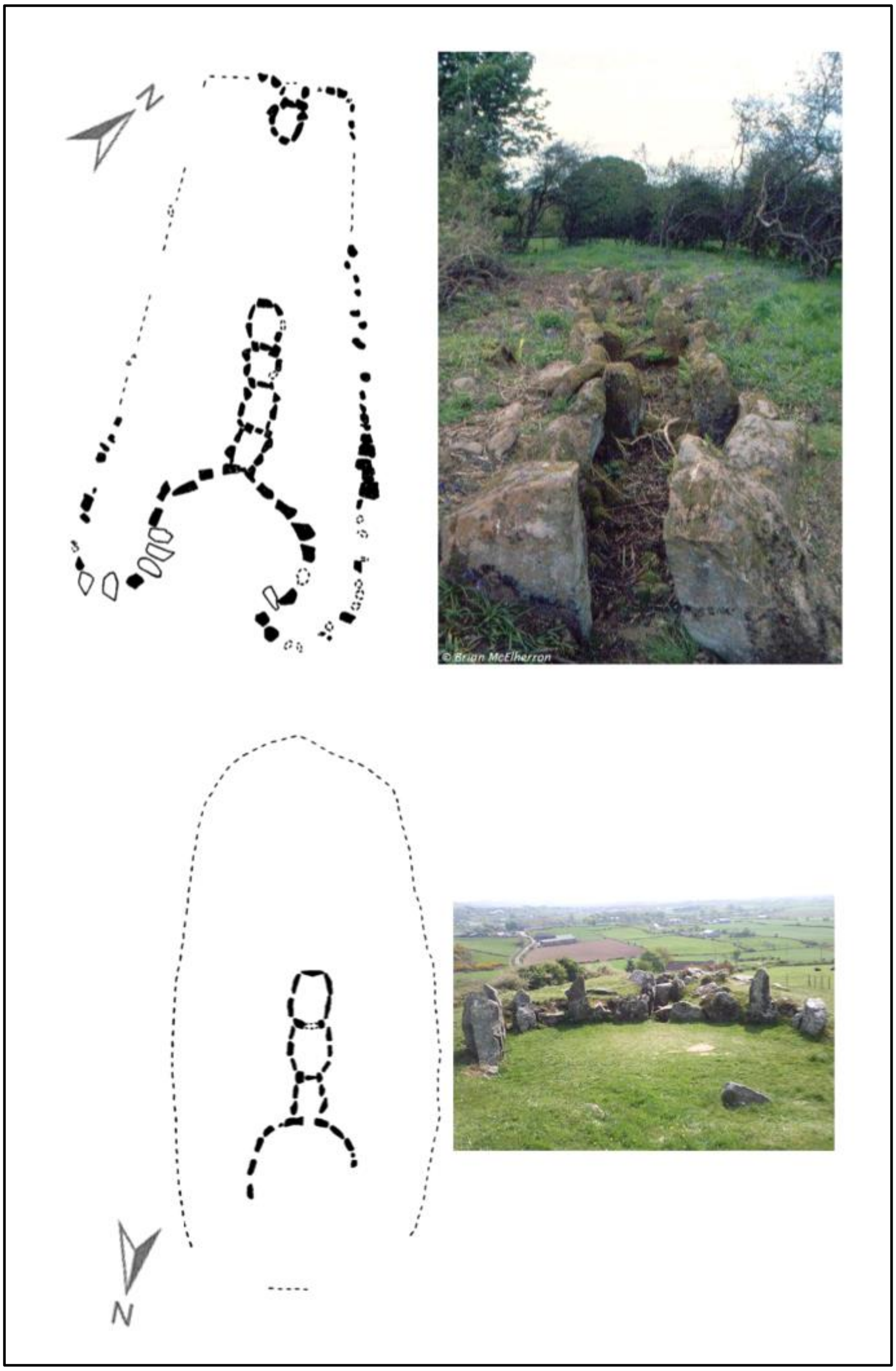


Figure 2.17. Top-Ballymarlagh court cairn, Co. Antrim plan and photograph (De Valera 1969, plate XXI) and modern photograph; Bottom-plan of Ballymacdermot court cairn in Co. Armagh together with modern photograph (De Valera 1960 , plate XXVI).

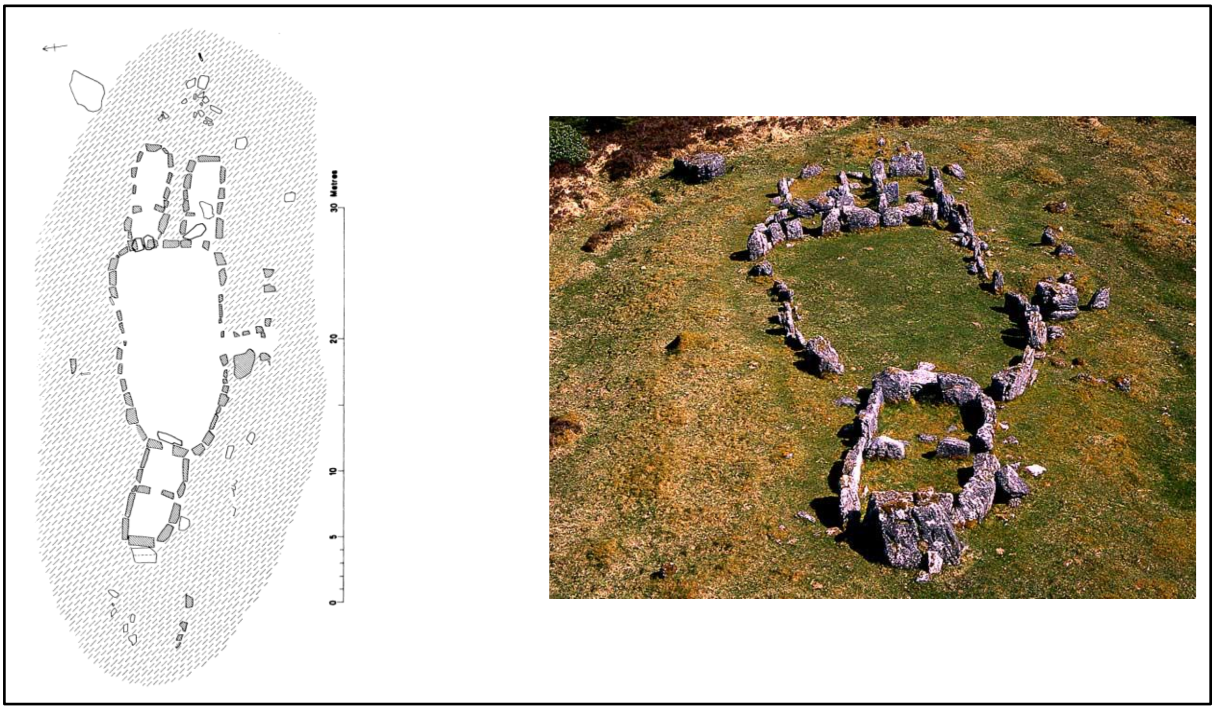


Figure 2.18. Left – Plan of the chambered tomb at Deerpark Co. Sligo and example of a court cairn (Ó Nualláin 1976, 103); Right - a modern photograph of the same site.

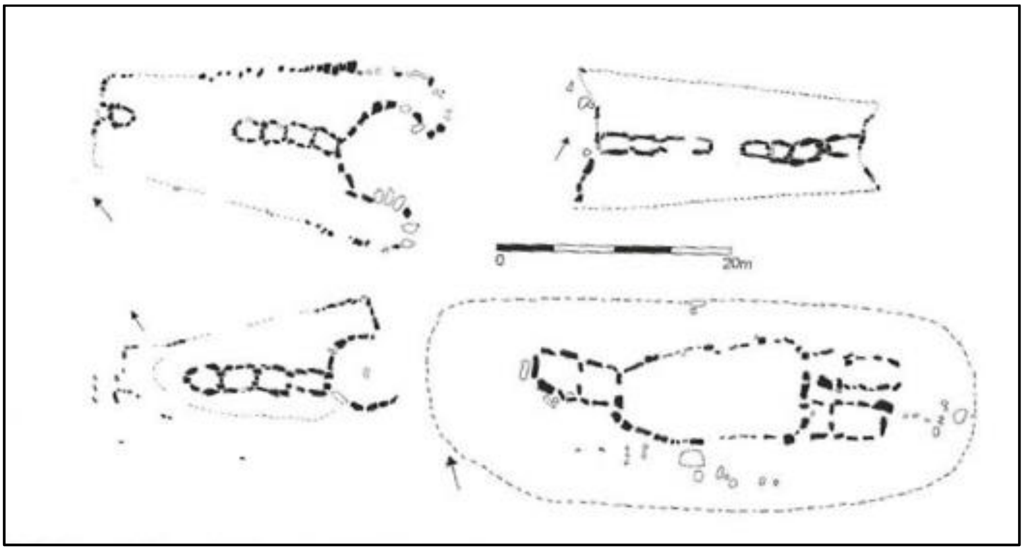


Figure 2.19. Selection of plans from court cairns. Top left: Ballymarlagh, Co Antrim; top right: Audleystown, Co. Down; bottom left: Browndod, Co. Antrim; and bottom right: Deerpark, Co. Sligo. After de Valera 1960 (Cummings 2017, 101)

Orkney-Cromarty group

The Orkney-Cromarty type or stalled cairns are found in Orkney with examples in the northern Scotland mainland at Caithness and Sutherland (see Davidson and Henshall 1989) and sit at the periphery of Neolithic Europe (Figure 2.20).

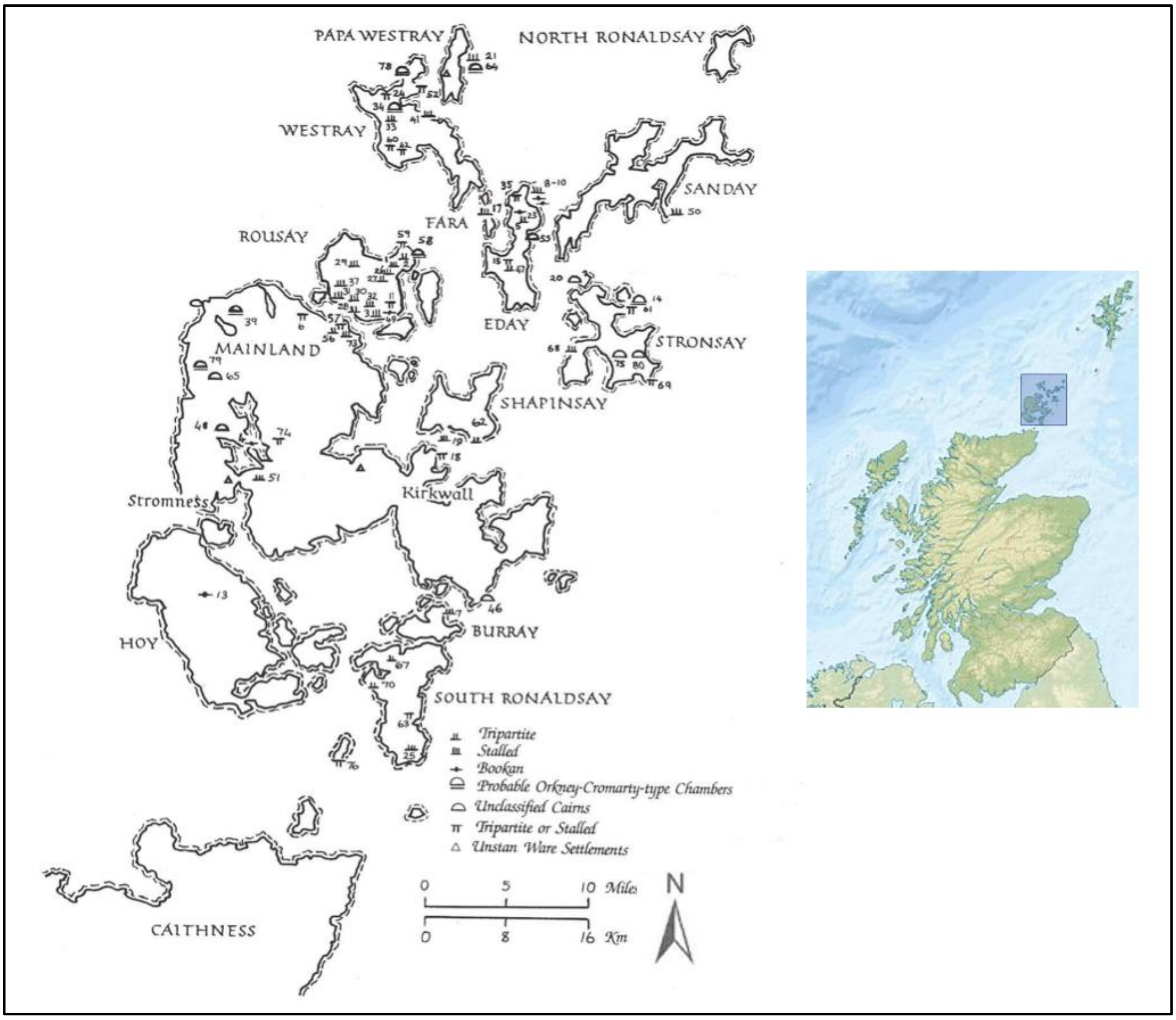


Figure 2.20. Early distribution map showing the location of Orkney-Cromarty type chambered tombs (Davidson and Henshall 1989, fig 5) with authors geographical insert.

There are currently 59 Orkney-Cromarty tombs known in the islands and they have been divided into subgroups called ‘tripartite’, ‘stalled’ and ‘Bookan’ types (Davidson and Henshall 1989, 19) (Figure 2.21). The tripartite has a central chamber divided into three compartmented areas by the use of three opposing orthostats creating stalls. These stalls allow for passage through the whole length of the tomb. Given the smaller size these tripartite cairns are typically covered with a small, rounded cairn (Davidson and Henshall 1989, 19).

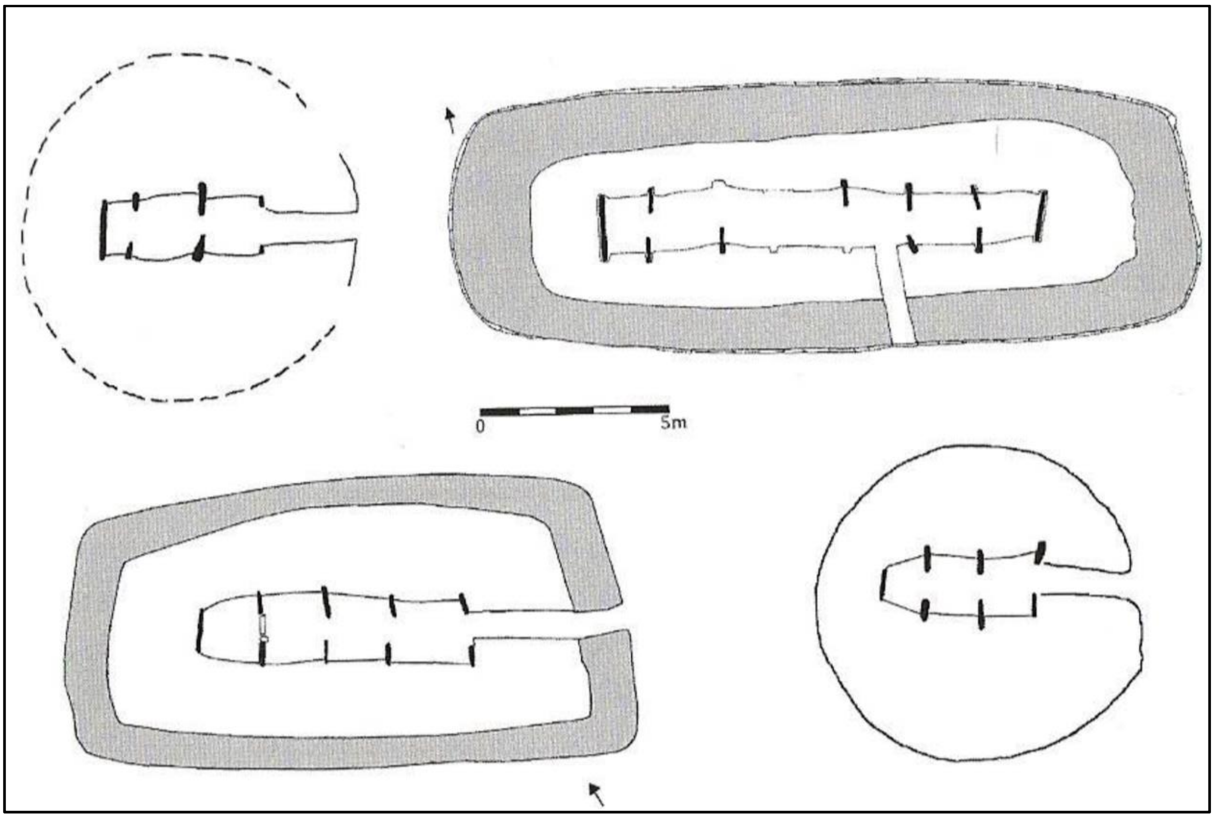


Figure 2.21. Selection of plans for stalled cairns form northern Scotland and Orkney. Top right Warehouse North, Caithness: top right: Blackhammer, Rousay; bottom left: Knowe of Yarso, Rousay; and bottom right: Keirfea Hill, Rousay (after Henshall 1963) (Cummings 2017, 99)

Stalled cairns are essentially an extended tripartite tomb with similar architectural structure. They can vary in size from 4.8m to 26.8m (Davidson and Henshall 1989, 22). Given the size it is more prevalent for these to be covered by rectangular or sub-rectangular mounds. The round: rectangular cairn ratio of roughly 3:1 (Davidson and Henshall 1989, 19). One of the best preserved and extended examples is the stalled cairn at Midhowe, Rousay Orkney (Figures 2.22 and 2.23).

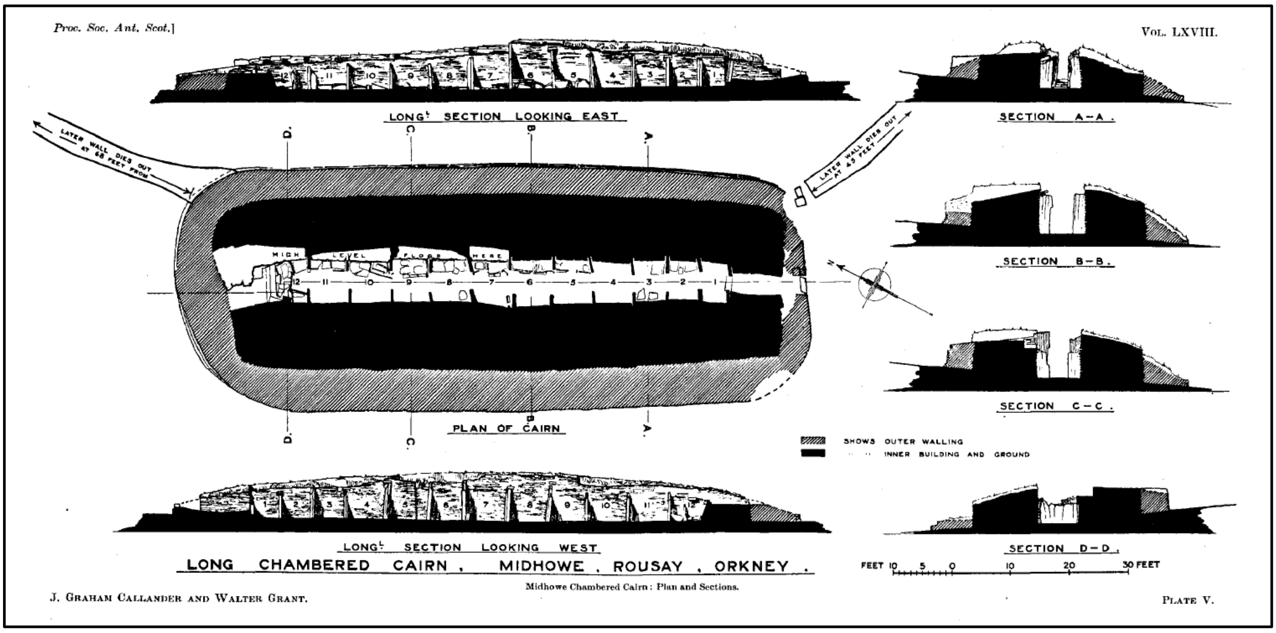


Figure 2.22. Left top – Plan and section drawings of the Midhowe stalled cairn, Rousay, Orkney (Callander *et al*. 1933, plate V facing 342).

Figure 2.23. Photograph showing the stalled form of chambers protruding from the cairn body at Midhowe – human remains were discovered ordered within these stalls (author's own photograph 2021).

The least ubiquitous sub-class is that of the 'Bookan' type of which there are only seven recorded with four of these being two storied. They are typified by a passage leading to a chamber that is finished with high quality stonework and contains shelves and or benches. Taversoe Tuick on the Island of Rousay in Orkney is an example of such a tomb (Figure 2.24).

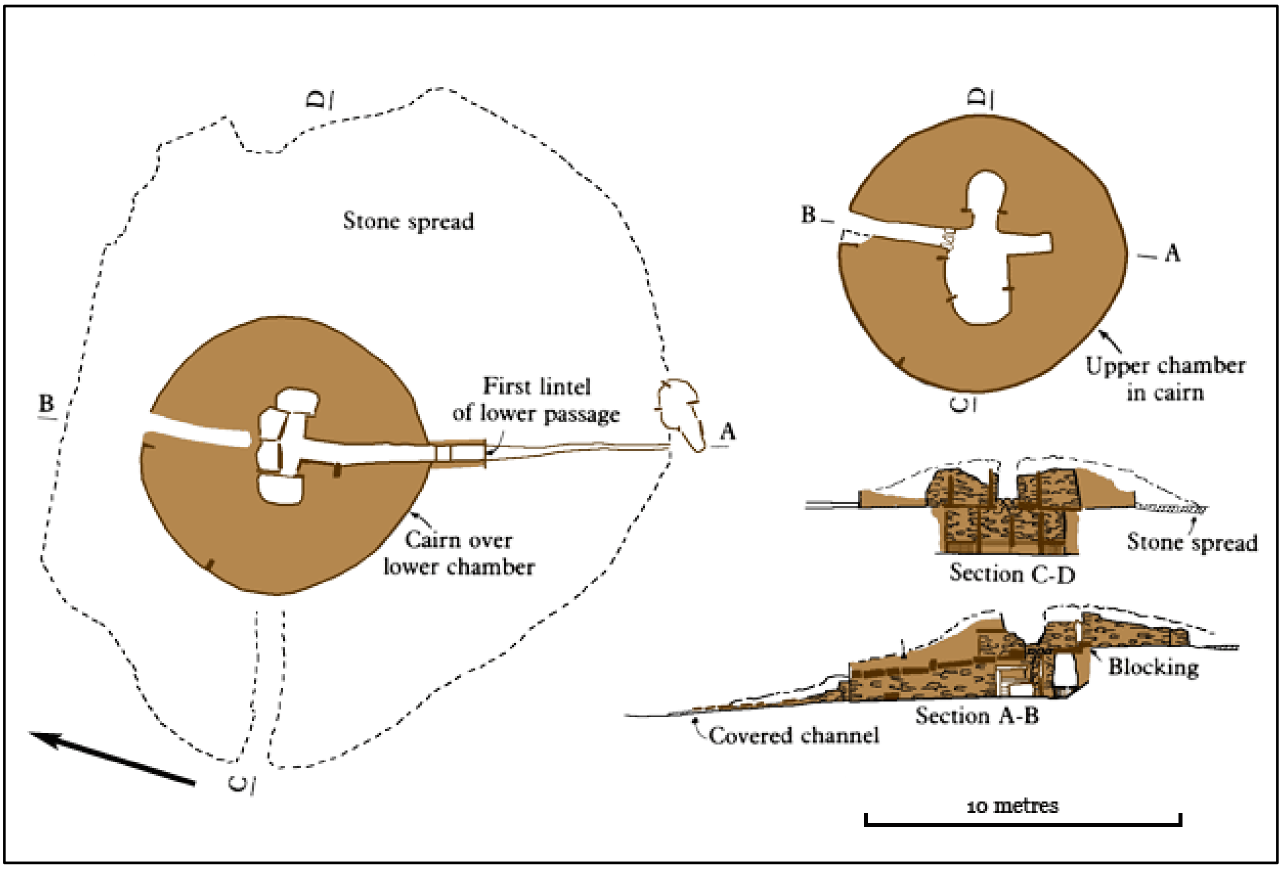


Figure 2.24. The Bookan type chambered tomb Taversoe Tuick, Rousay, Orkney plan of the tomb redrawn (Davidson and Henshall 1989, 160) the passage feature can be clearly seen.

Zetland Group

There is very little known about this group of monuments situated on an archipelago sat at the very extremes of Western Europe - Shetland. The Neolithic of these islands is poorly understood and remains *"something of an enigma"* (Sheridan 2012, 6), there is currently no dating evidence is directly related to the Zetland group of tombs and the arrival of the Neolithic practices are poorly understood (Melton 2009; Montgomery *et al.* 2013, 1063; Sheridan 2014, 87). The monuments of this period are of a unique design (see Figure 2.25) and do not demonstrate any characteristics of the Orkney-Cromarty type tomb prompting the suggestion that the Neolithic arrived in Shetland from western

Scotland and not Orkney as there are no similarities between these two North Islands tomb architecture (Sheridan 2012, 13). The Zetland monuments are typically small structures situated in remote locations including hilltops and utilise trefoil or rectangular shaped chambers. In total 57 have been catalogued and they are covered by a round or unusual heel shaped mound and as such are often referred to as heel-shaped cairns (Henshall 1972, 135). They are included here for completeness given the geographical association.

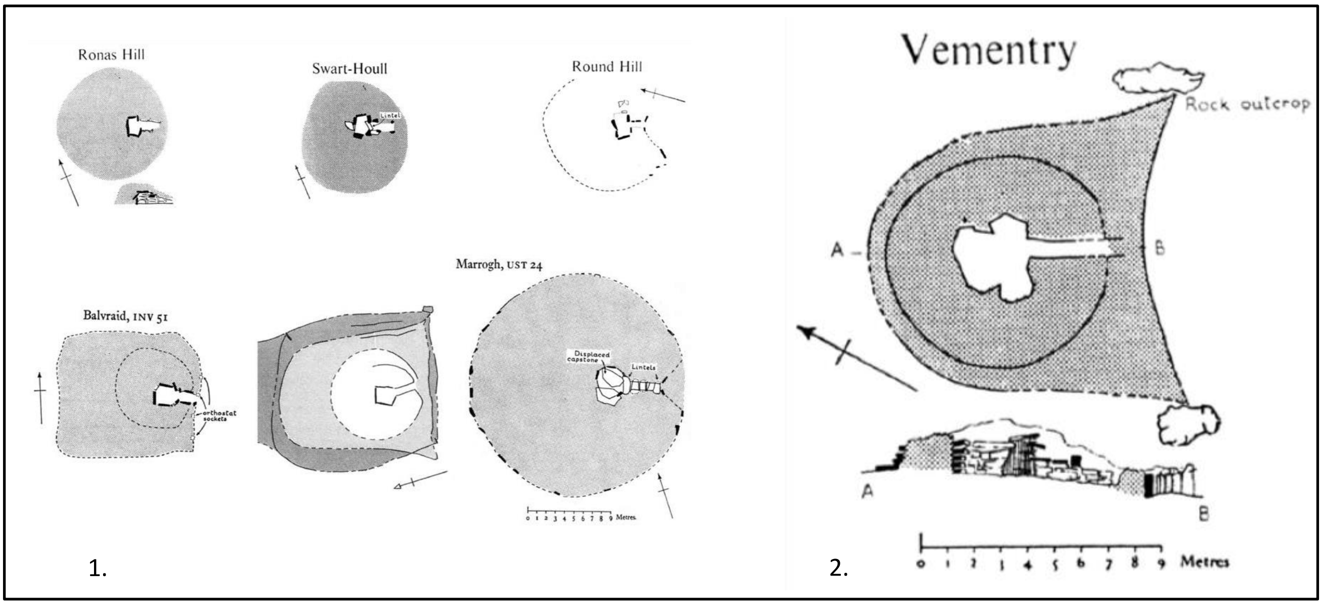


Figure 2.25. 1. A selection of early Neolithic Shetland tombs (Sheriden 2012,10); 2. A Neolithic passage tomb at Vementry showing two phases the circular phase and the heel shaped phase (Henshall 1963, fig 11)

Dolmens

Dolmens are a form of Neolithic monument designated by a separate classification (see Cummings and Richards 2021). Despite being a form of chambered tomb visually they are markedly different from the ones already considered. Often seen described within the literature in the archaeological record as portal dolmens, quoits, portal tombs or simple passage tombs (Cummings 2017, 114). They are identifiable as considerable capstones raised of the ground and supported by standing stones often with the most minimal of connecting points and predominantly only three. This then creates a form of chamber below as seen in this example at Pentre Ifan in Pembrokeshire, south Wales (Figure 2.26).

Figure 2.26. Dolmen at Pentre Ifan in Pembrokeshire, south Wales. Clearly showing the precariously yet purposely placed capstone balanced on the points of three standing stones (authors own photograph)

The capstones are a key feature with examples weighting many tonnes given they are placed delicately on typically three smaller upright stones. They are often described as naturally weathered on the outer and upper facets though the undersides have been treated differently in that they are purposely being shaped and dressed by flaking and pecking (Cummings 2017). The example at Garn Turne in Wales weighs 80 tonnes (Barker 1992, 29). The largest recorded capstone is at the Brownshill dolmen at Kernanstown in Ireland estimated at 160 tonnes (Kytmannow 2008, 47) (Figure 2.27).

Figure 2.27. Photograph of the largest recorded dolmen cap stone, Brownshill at Kernanstown in Ireland estimated at 160 tonnes showing a person situated for scale (Kytmannow 2008, 47).

It has been suggested that the configuration of the partially dressed and massive capstone is a way of special display by its builders with some suggesting it representative of a stone floating above the earth (see Richards 2004; Whittle 2004). These monuments are significant as they are a noted feature that appear early in the Neolithic sequence in Britain (Schultz-Paulsson 2017) though not in Orkney. Interestingly these monuments correspondingly appear in great numbers within the southern regions of Scandinavia (Eriksen and Andersen 2016).

Passage tombs

Passage tomb are typically associated with the middle and late Neolithic (Bayliss *et al.* 2017; Cummings 2017, 145; Davidson and Henshall 1989) and represent some of the most elaborate and recognizable megalithic monuments of the Neolithic in Britain and Ireland (Figures 2.28, 2.29 and 2.30).

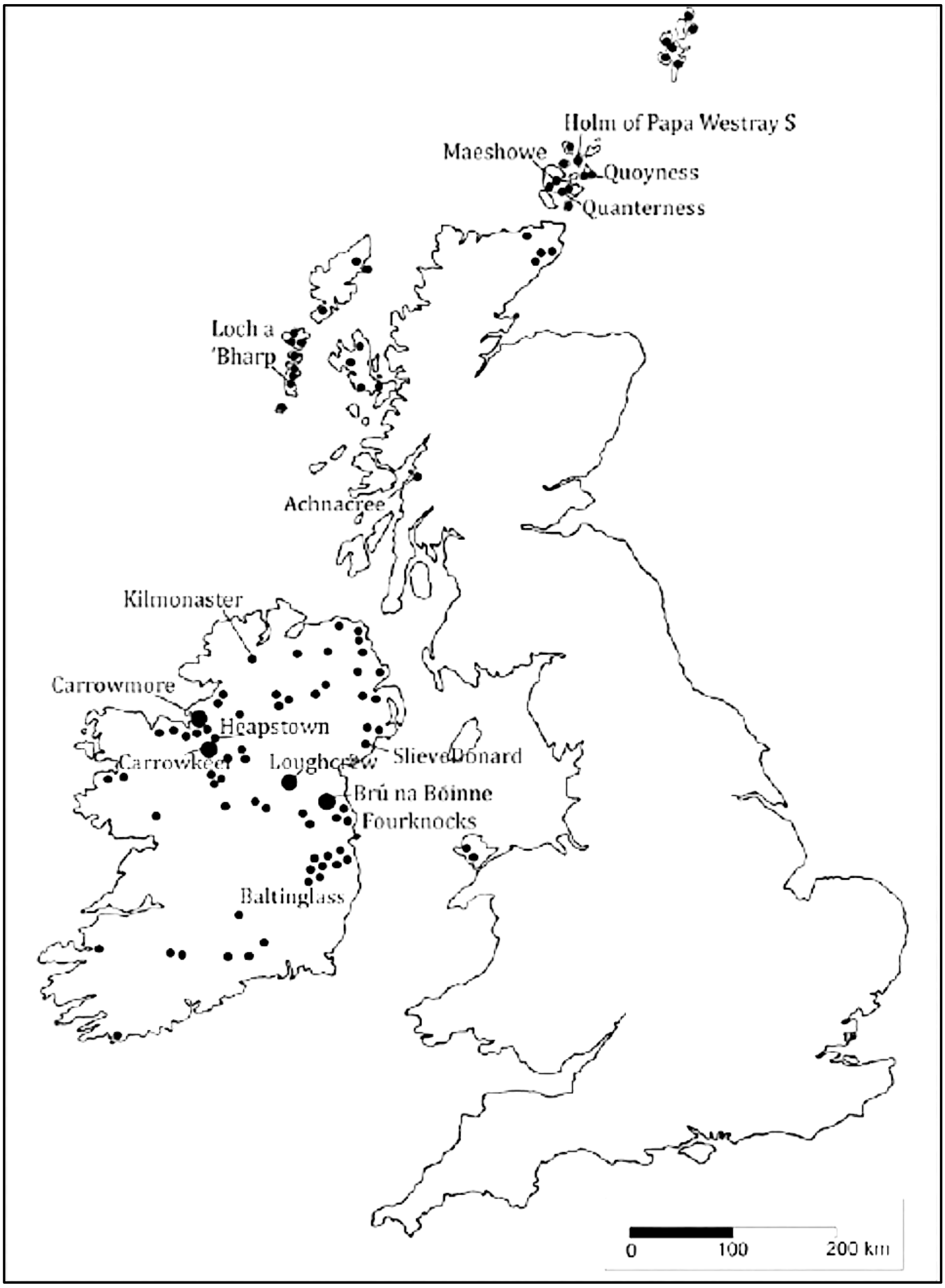


Figure 2.28. Distribution map of the passage tombs of Britain and Ireland (Cummings 2017, Fig 6.4).

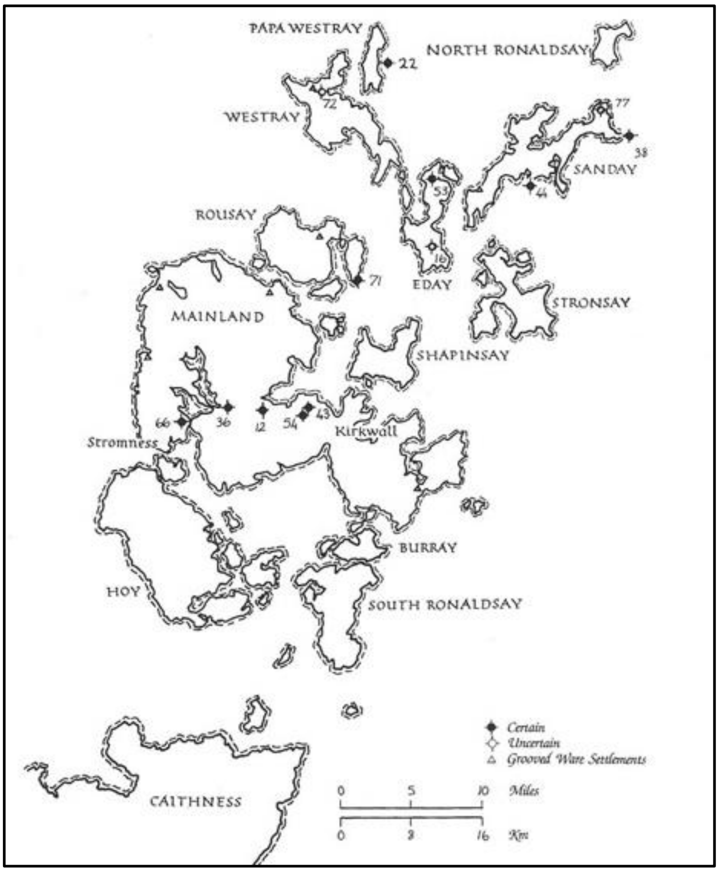


Figure 2.29. Early distribution map showing passage graves in Orkney (Davidson and Henshall 1989, fig 6)

Figure 2.30. A selection of passage tombs 1. Newgrange, Co Meath, Ireland (https://www.go-to-ireland.com/what-to-see/newgrange/); 2. Interior of Maeshowe, Orkney (authors Own photograph 2020); 3. Quoyness, Sanday (authors own photograph 2019); 4. Knowth passage tomb complex, Co Meath

(https://www.knowth.com/aerial.htm); 5. Bryn Celli Ddu, Anglesey Wales A(authors own 2018)and 6. The exterior of Maeshowe (© *Copyright* Charles Tait).

The geographic distribution of these tombs is thought-provoking with the most concentrated area being in Ireland followed by the western and northern isles of Scotland with two on the Welsh island of Anglesey with an absence over the remainder of the island (see Figure 2.28). Architecturally, as the name suggests they are categorised by the presence of stone-built passage. These can vary from just a few meters in length to the 10 meters at Maeshowe (Richards 1993) and 19 meters at Newgrange (O'Kelly 1982). The passage then leads to a main central chamber that plays host to several sub-chambers. There is an impressive concentration around Brú na Bóinne, Co. Meath (Eogan 1986) and here the main difference between these and earlier chambered tombs and indeed passage tombs further afield is they are arranged in large complexes. The complex at Carrowkeel, Co. Sligo in Ireland is situated prominently on ridge or hill tops and have a demonstrable date of activity around the end of the fourth millennium BC (Hensey *et al.* 2014) (Figure 2.31). There is some similarity with architecturally and temporally between the Irish passage tombs and the Maeshowe type tombs of Orkney.

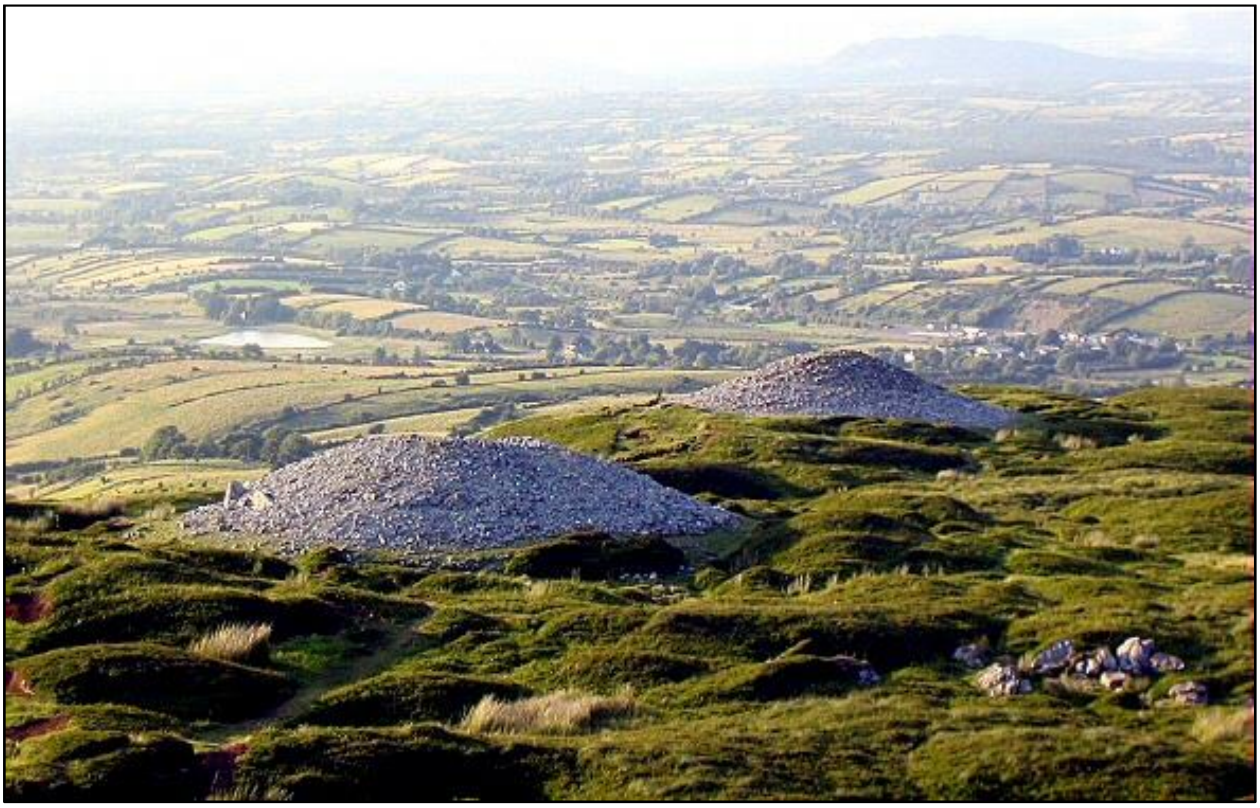


Figure 2.31. The complexes at Carrowkeel, Co. Sligo showing the prominent location on ridges or hill tops (Photo Mayo Archaeological Society).

Chambers and cairns

Since the times of Sir Richard Colt Hoare these monuments are discussed as funerary structures (Darvill 2004, 101). It would be impossible to speak of chambered tombs without looking in detail into their defining features - the chambers themselves. Architecturally these monuments comprise chambers of differing forms. They are essentially a boxlike space of varying dimensions in a single or multiple arrangement (Darvill 2004, 102). This box shape is formed using large standing stones or orthostats as walls and topped with a capstone or a number of flat stones. Some of these capstones are significant pieces of stone requiring substantial engineering techniques for installation. Whilst the general shape is similar the arrangement of them does see some regional variation in composition as detailed in previous sections (see specifically Figures 2.12; 2.18; 2.21 and 2.32).

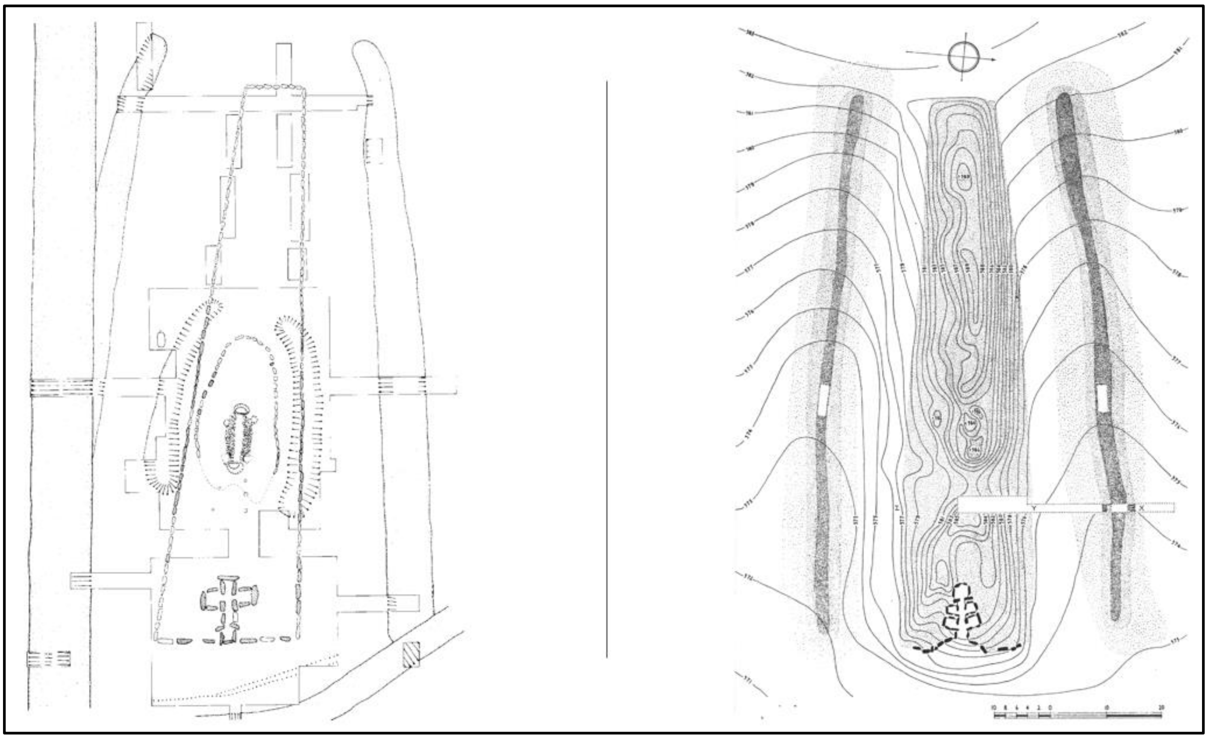


Figure 2.32. Cotswold-Severn chambered tombs examples, Left – Plan of Wayland Smithy depicting the transept chamber configuration (Bayliss *et al.* 2007, 104); Right – Plan of West Kennet Long Barrow showing a variant chamber configuration (Bayliss *et al*. 2007, 86)

The availability and type of building material and the autonomous nature of the community structures will have had a part to play in this divergence. Another architectural technique utilised for forming the chambers is corbelling. This sees smaller slabs of stone overlapping and raising up until the gap is filled making a space with considerably more headroom. It is often identified in excavated tombs as collapsed given its less robust nature. This type of architectural chamber roofing solution has also been noted extensively in passage graves along the Atlantic seaboard of northwest Europe (Darvill, 2004). Examples of this effect can be seen in Quoyness chambered tomb on the Orcadian island of Sanday (Figure *2.*33).

Figure 2.33. Dry stone corbelling effect within the chambered tomb as Quoyness, Sanday Orkney (authors own photograph 2021)

It has been suggested that most of the chambers will have been accessed by the removal of the capstone from above before depositing human skeletal remains (see Cummings

2017) which are present in the vast majority of tombs (Darvill 2004, 101). Alternatively, others can be accessed from passages and entranceways that are large enough for people to walk upright inside as at West Kennet. In contrast, stalled cairns are more usually accessed through low entranceways only achieved by crouching or crawling. There are tombs recorded as having single or multiple chambers. The most in Cotswold-Severn group is seven (Darvill 2004, 102). One Orkney-Cromarty example at Knowe of Ramsey on the island of Rousay has 14 stalls or compartments (Davidson and Henshall 1989, 21). The most elaborate configuration are the cruciform or transept arrangement as seen at Wayland's Smithy (Figure 2.32).

A key correlating feature is the containment of the chambers within a barrow or cairn. This is essentially an earthen and/or stone mound that adds presence to the tomb and would have created a monumental spectacle within the landscape. Since William Cunnington's time in the late 19th century it has been recognised there are three types of mounds - trapezoidal, rectangular and ovoidal. The trapezoidal forms are often noted as higher at one end than the other when viewed in profile and are the most common variation (Field 2006, 58). The barrows often include an area of forecourt bound by horns as if welcoming the visitor to the entrance of the tomb. At some examples the forecourt area is present but only houses a non-functioning entrance known as a false portal, the actual entrance being at the lateral end of the barrow known as a lateral chamber as at Hazleton North and Belas Knap. The reason for these fake entrances have been suggested to be a pragmatic deterrent for grave robbers (Grinsell 1953, 13) to the thesis by Darvill suggesting symbolic purpose as a portal into other worlds (Darvill 2004, 116).

Contents of the tombs

As intimated in the name a key function of a chambered tombs is to deposit human remains as part of the Neolithic mortuary rite though it is certain not all people were buried in monuments (Cummings 2017, 136). The evidence strongly suggests excarnation was extensively practiced in the Neolithic (see Fowler 2010; Smith and Brickley 2009) by a variety of techniques such as the exposure the body to the elements or scavenger action (see Lawrence 2006). Other methods include skeletisation by prior burial or the manual removal of soft tissue, by water deposition (Cummings 2017, 90) or perhaps by the placing bodies in chambered tombs to achieve total decomposition.

The chambers typically, though not universally, contain articulated and/or disarticulated human remains, cremated remains and items of material culture (see Cummings 2017, 92; Darvill 2004, 165; Smith and Brickley 2009). In contrast to the regional variations in architectural form of the tombs and material culture it appears that the treatment processes in terms of human remains are broadly comparable across the country (Smith and Brickley 2009, 55). Excavation reports have recorded large assemblages of the bones of multiple individuals. Often they are discovered inside chambers as either disarticulated or less frequently anatomically ordered (Darvill 2004, 141). Progressive disarticulation is another term associated with deposition of human remains in tombs. It suggests that human remains are rearranged by the attendants of the tombs as later remains were interred hence the common disarticulated manner of discovery. This has been called the 'Ossuary Theory' first suggested By Greenwell (Greenwell 1877, 527). At West Kennet the remains of five articulated adults were discovered amongst the primarily disarticulated remains (Smith and Brickly 2009, 53). At Midhowe (Figure 2.21 and 2.22) in Orkney crouched and articulated skeletal remains were found amongst the disarticulated remains. These remains were placed in different locations according to the bone type, e.g. skulls in one place and long bones in another (Lawrence 2006, 48). This phenomenon is not uncommon throughout the country. Not all remains of the time were laid within chambered tombs and as such it is thought this form of burial was reserved for 'special' people selected by the community for whatever reason (see Fowler 2010). The relatively small quantities of bone throughout the British Neolithic chambered tombs suggests that most of the population were subjected to practices that rendered them invisible in the archaeological record (Barrett 1988, 32; Fowler 2010, 15). There is clear evidence on Orkney that there was internment of human remains in tombs that were later being subjected to rearrangement conforming to the widespread (Britain) phenomena of disarticulated bones of multiple individuals (see Henshall 2004).

The amount of Orcadian evidence available in respect of the human remains is far less than other parts of the country (Barber 2000, 185) in contrast to the material culture record (Figure 2.36). This partly due to the local soils, the wet and acidic make up of which has a destructive effect with the processes of taphonomy leaving scant bone evidence in the local archaeological record. Further, the standards of anthropological investigation had been questionable on occasions. This appears particularly the case at Isbister tomb - the *'Tomb of the Eagles'* on South Ronaldsay, Orkney - declared at the time as being the finest example of British Neolithic human remains ever discovered (Chesterman 1983, 115). Other excavations at Midhowe stalled cairn in the 1930s discovered 25 individuals in supine crouched position within the stalls yet interred amongst disarticulated and even sorted and heaped remains (Callander and Grant 1934). Later in the 1970s Colin Renfrew excavated Quanterness cairn (see Renfrew 1979), with the skeletal analysis being carried out by Chesterman (1979). These two excavation reports confirmed his previous wider attestation that excarnation was highly prevalent in the British Neolithic and that Orkney was no different (Chesterman 1979, 106; 1983, 124). The style of deposition is comparable with evidence from the wider British chambered tombs though the numbers are not. This complex picture was summarised by Hedges '*the difficulties in interpreting the deposits in chambered tombs is generally recognised, for chambers are likely to have been in use for a very long time ... thus the apparent association of objects can be misleading'* (Hedges 1983, 43).

As well as human remains material culture in the form of grave goods and other purposely placed deposits are often found within chambered tombs. The passage of time and its effects on taphonomy and degradation of organic material and the attention by past people who have come into contact with the chambered tombs (both socially and professionally) of Britain and Ireland have left relatively scant evidence of what was contained within.

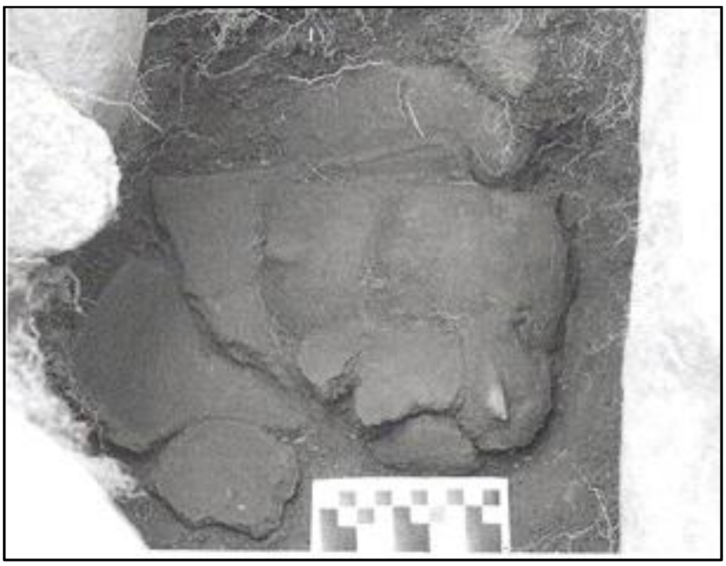


Figure 2.34. An example of an early Neolithic pot during excavation at Blasthill, Kintyre (Cummings 2017, Figure 4,13).

The study of pottery and stone tools in detail is beyond the scope of this work save to say that they are often represented within tomb sites. In respect of primary deposits pottery fragments have been discovered within tombs though should not be described as common particularly within the Cotswold-Severn area (Whittle *et al.* 2011, 759). In Ireland and in Northern Britain the discovery of pottery is more frequent in tomb sites but does remain in small quantities (Cummings 2017, 61). The typology of the ceramics broadly amounts to small drinking and eating vessels or small cooking pots and are often broken and spread throughout the tombs like the example at Figure 2.34 from the chambered tomb at Blasthill, Kintyre. Residue from the pottery dated the use to between 3630-3360 cal BC (Cummings and Robinson 2015). During the early Neolithic the pottery type was predominately undecorated Carinated Bowls and their use has been assumed to be linked to contact with pot-using communities form Europe (Gibson 2002a, 70; Müller and Peterson 2015, 588; Sheridan 2007). The middle Neolithic saw pottery develop into Impressed Ware and finally in the late Neolithic into Grooved Ware (Müller and Peterson 2015, 11). Darvill has suggested that pottery and material culture *per se* was treated with less reverence than the human remains (Darvill 2004, 167), some associated with remains and others the spatial relationship is not so clear. The Cotswold-Seven tomb at Hazelton North (Figure 2.35) is an example of a chambered tomb with well investigated grave goods deposits. The pottery at this site was found to be atypical in respect of its use of burnt bone temper a technique that is rarely seen at this time (Smith and Darvill 1990, 152).

Figure 2.35. Human remains showing relationship with stone tools at the Cotswold-Seven chambered tomb at Hazelton North (Saville 1990, front cover).

Further, material culture was found to be specifically associated with human remains (Figure 2.35). A virtually fully articulated human remains was found to be holding a hammerstone in one hand and a flint core in the other (see Saville 1990). Polished stone axes are a distinctive object that has seen much archaeological attention. They are often found in special locations such as causewayed enclosures, settlements, rivers and wetland sites (Cooney 2000, 208; Edmonds 2012) and chambered tombs are no exception. A fragmented piece of such jadeite polished an axe was found at the Clyde cairn Cairnholy I and it originated in the Alps (Piggott and Powell 1949). Stone items such as quartz pebbles are frequently noted at chambered tomb excavation sites throughout Britain and Ireland (Bradley 2000a; 2000b; Cummings, 2009; Eogan 1986, 47; Jones 1999, 348; O'Kelly 1982, 21; O'Sullivan 1993; Scarre 2004). The specifics of these artefacts will be discussed more detail later in this chapter when considering new materialism in relation to tombs. In 2006 Ann Clarke researched the stone tools of the Northern Isles and within the scope of this work was a study into stone tools forum within funerary contexts including chambered tombs. Of the 31 tombs that had been subject to excavation at the time 40% (10% from Maeshowe type an 30% from Orkney-Cromarty type) course stone artefacts had been discovered associated with the monument. These finds from chambers include cobble tools, flaked stone bars, stone disks, Skaill knives and balls of quartz and were likely contemporary to the tombs use (Clarke 2006,103). A recent study on grave goods has noted the rich archaeological record from the Orcadian tombs paints a complex picture. With the longevity and multi-phase nature of the archipelagos tombs together with low antiquarian excavation standards being cited as a hindering factor to interpreting the dynamics of funerary material culture (Cooper *et al*. 2022, 228).

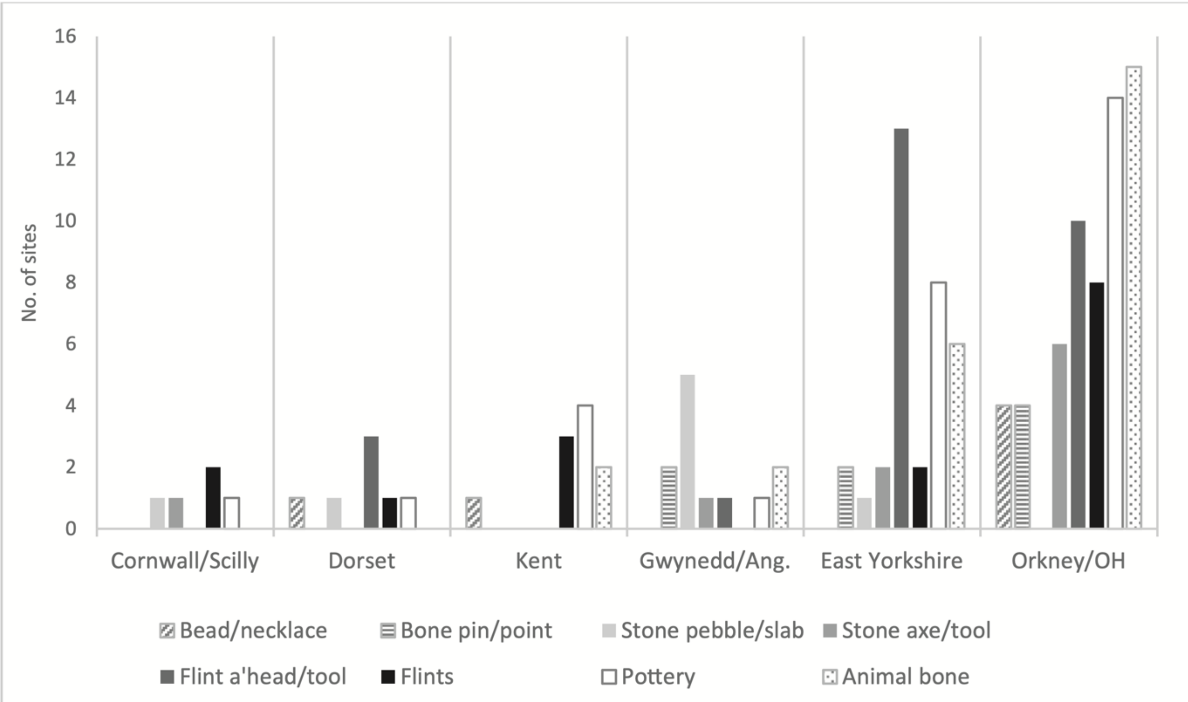


Figure 2.36. Occurrence of sites with material culture by classification found in association with human remains on British Neolithic sites (Cooper *et al.* 2022, fig 8.02).

A history of chambered tomb investigation in Britain

The investigation of chambered tombs has long been the subject of scholarly attention, an interest which has spanned all the significant periods of archaeological thought. This section will begin with an overview of the Antiquarian era before looking at how the first professional archaeological approach of culture history and its typology and diffusionist theories (see Trigger 1989, 211-311) impacted on the study of chambered tombs. Processualism or New Archaeology will then be detailed with a look at how the scientific methodologies were responsible for advancements in the chambered tomb narrative particularly in respect of dating and chronology. The work will then detail post-processualism or interpretive archaeology era whose proponents advocated a theoretical interpretive approach of that applied number of diverse themes to understand the past (see Trigger 1989, 386-480). Finally, it will outline the developments that the new millennium has brought to archaeology and a notable swing back towards a scientific technique (see Harris and Cipolla 2017).

Antiquarians and the 'Barrow Diggers'

"*Since the eighteenth century there has been scholarly interest, fantastic speculation and misguided theorising*" (Piggott 1954, 122). Literary sources have documented "*mound digging*" from the very beginning of the British historic period where the motivation of those engaged was likely robbing out for building materials (Smith and Brickley 2009, 17) or treasure hunting (Grinsell 1957). More formal recordings came with the work of King Henry VIII's antiquary John Leland (1506-1552) who published an inventory describing the respective mounds as containing stone chambers (*sepulchres ex secto lapide*) in which "*there hath be found mennes bones insolitae magnitudinis* [in unusually great numbers]" (Toulmin-Smith 1964, 102).

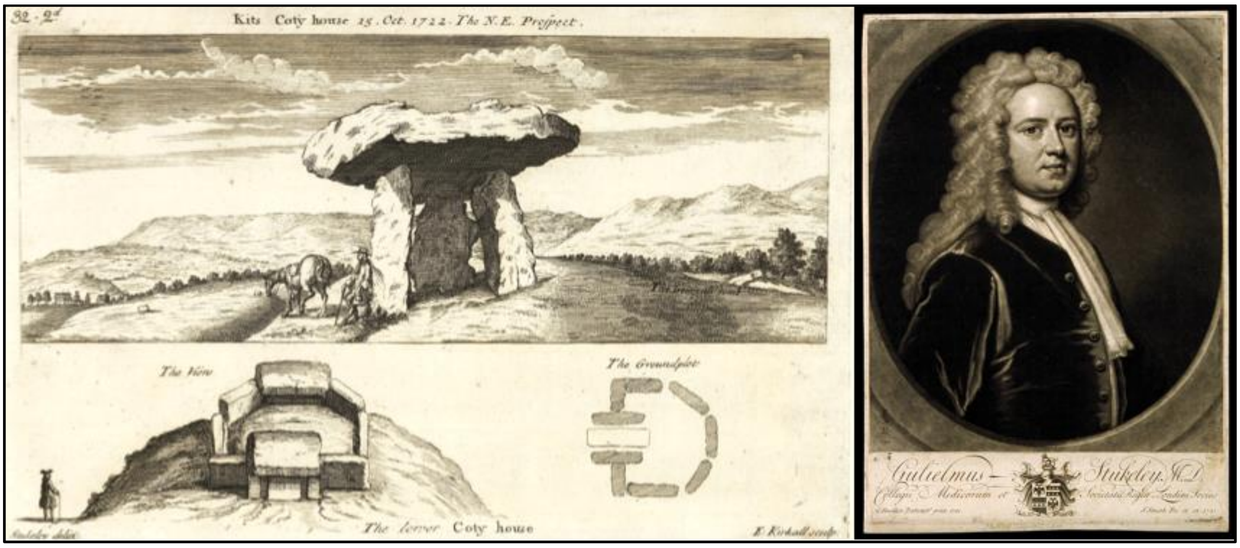


Figure 2.37. Kits Coty House a chambered tomb - survey drawings dated 15th October 1722 shows the important detail that was recorded by early antiquarians such as one of the most celebrated William Stukeley (pictured) (Mortimer 2014, 107).

During this period records suggest the folklore dominated thinking as the tombs were described as houses of the dead of great battles. This belief was challenged by John Aubrey (1626-1697) in his publication *Monumenta Britannica* (c.1674) when he hypothesised that the tombs were the resting places of high status individuals, his argument likely biased by his Biblical and classical education (Smith and Brickley 2009, 19). William Stukeley (1687-1765) (Figure 2.37) concurred but went further to suggest that the typology was related to the rank of those interred the most elaborate being the domain of arch-druids. His naming strategy confirmed this with him designating titles such as 'Kings Barrow', 'Druid's Barrow', 'Arch Druid's Barrow' and the 'Druid and his Wife Barrow' (Darvill 2004, 20). Stukeley did however recognise that the monuments were of great antiquity (Smith and Brickley 2009, 19). Thereafter followed a period of activity by '*barrow diggers*' (Darvill 2004, 21). Sir Richard Colt Hoare (1758-1838) was the best known of a veritable army of English gentlemen both learned and enthusiastic amateurs who desired intellectual understanding of the monuments. His work *Ancient Wiltshire* published in 1810 that was prefaced with the dictum '*we speak from facts not theory*' (Colt Hoare 1812, 7) and was meticulous in detail. It considerably advanced knowledge of this subject albeit predominately only in southern England. Despite the attention to detail exhibited by Colt Hoare he himself wrote whilst reporting his excavation of a Stoney Littleton long barrow near Wellow in Somerset reported that having gained entry they proceeded to '*clear rubbish'* from inside, this 'rubbish' included human remains (Colt Hoare 1821). This was a product of the time when professional practices were not as developed as today. By virtue of this comment alone it serves to remind the modern investigator that activities of barrow diggers and antiquarians may well have disturbed contents of these barrows.

The Orcadian record similarly details antiquarian activity. Some of the first literary references to these monuments date back 1192 to the *Orkneyinga Saga* the Icelandic epic describing Viking soldiers sheltering from the weather within Maeshowe chambered tomb on Mainland Orkney (Palsson and Edwards 1978, ch.93). It is clear that early antiquarian activity in Orkney does not replicate the intellectual interest that Cotswold - Severn group attracted. Early Antiquarian attempts at interpretation suggested the monuments were 'Picts houses' contemporary with the British Roman era (Davidson and Henshall 1989, 6). This early confusion was likely due to the superficial structural similarity between tombs and domestic structures on the islands (see Richards and Jones 2015). More detailed investigation followed with excavation records existing for the Mainland chambered tomb of Quanterness in 1805. These were compiled by antiquarian George Barry (1748-1805) who concluded the non-domestic use when he reported ' *it had not been destined for the abode of men'* (Barry 1805, 99). Between 1849 to 1869 early

Antiquaries George Petrie and Captain F.W.L Thomas recorded tombs within the North Isles as well as mainland Orkney

Culture-history

The early 20th century saw a swift development in archaeological practice and fieldwork methodology. The theoretical framework of culture-history was also operating. This approach looked at cultural diversity and the diffusion of identified traits to account for the spread of ideas (Trigger 1989, 211-311). The ideas of the time had inevitable influences upon the early megalithic monument study and looked at attributing the influx of these monuments to outside cultural influences that occurred during migration of people and diffusion of ideas (Trigger 1989, 223). The basic findings of one its key proponents V. Gordon Childe (Childe 1925; 1942; 1947) are not completely without substance even by today's standards (Harris and Cipolla 2017, 14-16). It is now clear there were some chronological errors in his work only due to him being committed to typologically based relative dating techniques - the benefits of science-based absolute dating was not yet developed. The tombs in Britain and Ireland were predated by similar structures in Europe. Between 1939-1942 scholars were engaged in the debate around the colonization theory with '*vigour and asperity*', amongst these where Childe, Hawkes, Daniel, Forde and Scott and Piggott (1954, 124). Their arguments are critical to any understanding as to how chambered tomb investigation evolved and perhaps more importantly the typological aspects of this subject. Childe proposed two key branches of megalithic traditions calling them passage-graves and gallery-graves (Childe 1947, 316). He suggested a typological designation and went on to argue that the first such monuments in Britain were the gallery-graves of western Scotland and northern Ireland and within his typology he included the Cotswold-Severn as a form of gallery grave. He argued for the diffusion of the tombs construction techniques and function and suggested the cultures utilising these monuments originated from the Middle East (Childe 1957, 222) from those similar structures utilised by cultures of the eastern and western Mediterranean, the Pyrenees and Almeria in southern Spain (Childe 1940, 46). He went further to suggest they held specific affinities to the western Scotland tradition (Piggott 1954, 124).

Childe classified the tombs into three main groups; gallery graves or long cists or which were to be found in Clyde-Carlingford area (west Scotland and Northern Ireland); Severn Estuary and Cotswolds; Ireland and Kent, unchambered long barrows and collective tombs of the Windmill Hill Culture, and passage-graves of the Boyne Group in Ireland; Pentland (Caithness and Orkney); Beauly (Moray) and Scilly and south Ireland (he calls them entrance-graves). This classification formed the basis for his key proposal that the diffusion of ideas and technology in this case the tomb construction style was evidence of areas settled by European farmers. He also identified that the two strains of passage and gallery graves could be seen mingling into a hybrid version in Orkney and Caithness (see Childe 1947). Later that same year Hawkes following Childe essentially concurred with Childe's diffusion model route from southern Spain, southern France and in the Catalan region to the Clyde-Carlingford area. Hawkes also noted a fusion of typology in respect of north-west Scotland (hybridisation of passage-graves and gallery-graves). The first comprehensive synthesised work of the chambered tombs was carried out in 1920 and detailed the monuments of the Cotswolds region and was carried out by O.G.S Crawford (1886-1957) and entitled *'The long barrows of the Cotswolds'* (Crawford 1925). Later Glyn Daniel developed Childe's earlier typological model and for the first time in 1937 proposed the classification Cotswold-Severn group with Stuart Piggott referring to them as Severn-Cotswold long cairns (Darvill, 2004, 37; Piggott 1954, 127).

This early pioneering work by those such as Glyn Daniel, Gordon Childe and Stuart Piggott saw extensive excavations at chambered tomb sites across Britain and Ireland in the mid-twentieth century, including sites on Orkney. These works formed the basis of our understanding of these monuments with the formulation of classification typology on a geographical basis as discussed earlier and also made early attempts to understand chronology. Childe published the first inventory of Orcadian tombs in 1946 and attempted a typology classification using the term Orkney-Cromarty tombs but his typology has been a described as too confusing (RCAHMS 1946, 1, 15). Post-war, with a new paradigm at its most developed, Stuart Piggott's *Neolithic Cultures of the British Isles* (Piggott 1954, 241) produced a more acceptable classification that added clarity to the situation and continues to be utilised with only minor changes in terminology. He originally referred to the Orcadian tombs as Camster tombs and identified them as a separate classification Severn-Cotswold and Clyde-Carlingford. He commented that the developments were as a result of islands stand-alone evolution stating "the *Orcadian abnormalities seem the result of local development without outside contacts*" (Piggott 1954, 243).

Processual archaeology

Between the late 1930s and 1970s there was a notable peak in investigations and excavations of early Neolithic monuments more broadly in Britain and Ireland. Processual or New Archaeology introduced a new theoretical approach that used a more statistical and scientific model and was enhanced significantly by the radiocarbon dating revolution (Harris and Cippolla 2017, 3). The 1960s saw the American anthropologist Lewis Binford introduce a framework that challenged the culture-historical approach of previous years. He argued that the structures of culture could be read in conjunction with other social structures of kinship, politics and economy (Binford 1964, 425). His 'systems theory' approach had a significant impact on archaeological studies and became a highly influential approach to looking at the past (Trigger 1989, 8). The interest now was in what processes caused change and what patterns could assist in interpretation as opposed to simply describing it having been formulated by a consortium of those disillusioned by the culture-history approach (see Binford 1962; 1967). The New Archaeologist should now ultimately be concerned with not just *"the Indian behind the artefact but rather with the system behind both the Indian and the artefact*" (Flannery 1967, 120). It has been said that radiocarbon dating was influential if not paradigm forming in the era of New Archaeology (Trigger 2006).

Colin Renfrew emerged as an early British exponent and used it as a catalyst for the reinvestigation of British prehistoric societies which significantly influenced the narrative surrounding chambered tombs. In Orkney in the 1970s Renfrew commenced a period of extensive work which mirrored his work on the Cotswold-Severn group. Prior to 1972 there were no radiocarbon dates available for any tomb site on Orkney (Renfrew *et al.* 1976, 194). Renfrew, in seeking to address chronology, chose Quanterness on Mainland to excavate with his primary objective being to obtain radiocarbon dates for the site. On conclusion of this work he 'suggested with confidence' the dates 3000 cal BC – 2400 cal BC (Renfrew *et al.* 1976, 200). This allowed him and others for the first time to address the issue of the Orcadian chronology (Davidson and Henshall 1989, 7). He continually worked to understand the social organisation of Neolithic Orkney and a key conclusion for the first time in tomb enquiries suggested they had a social function beyond simply burial structures. He proposed they were important territorial markers. Childe had previously argued that there appeared to be a connection between tombs and modern settlement pattern (Childe 1942). Renfrew went further and divided the islands into territories utilising a Thiessen polygons analytical methodology centred on the tombs as seen in Figure 2.38 (Renfrew 1973, 149-50) a model that was widely adopted (e.g. Fraser 1983; Hedges 1984; Richards 1998; Sharples 1985).

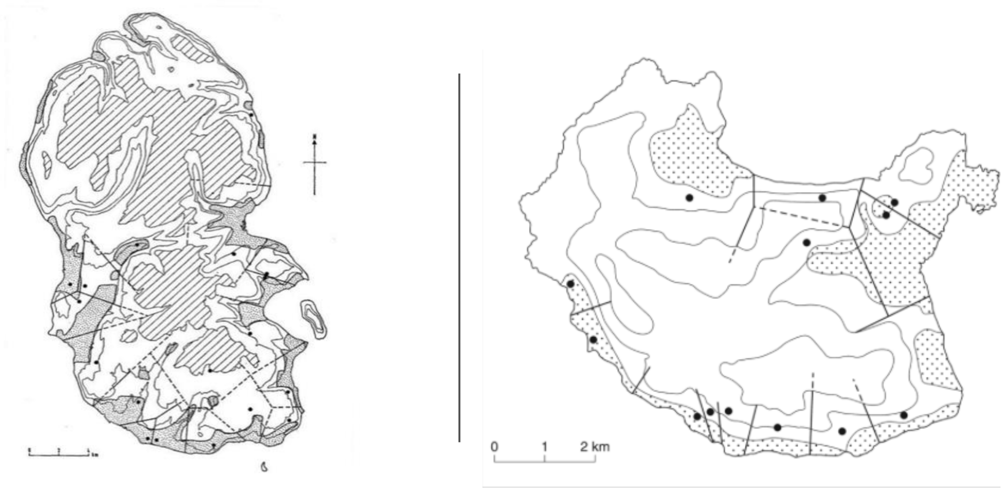


Figure 2.38. Colin Renfrew's Thiessen polygons. Left analysis map of the isle of Arran based upon locations of chambered tombs from 1973 (Renfrew 2011); Right The same exercise conducted on chambered tombs on the Island of Rousay, Orkney (Renfrew 1973).

Later Davidson and others enhanced this debate by using spatial analytical techniques and developed this hypothesis further (Davidson *et al.* 1976). He, like Childe and Renfrew, operated with an assumption of indivisibility between cairn locations and noted that the visible areas have some correlation with modern cultivated lands and known settlement as per the shaded areas at Figure 2.37 (Fraser 1980, 4; Renfrew 1979, 13).

Post-processual archaeology

The fundamental tenet of the processual era was that if we apply scientific techniques to the subject matter then a more objective narrative will follow. In the 1980s postprocessualists frustrated with this approach yearned for a more interpretive view of the past - requiring a more fundamentally subjective approach. Post-processualism is more accurately described as a collection of themes that make up the interpretive archaeologist's theoretical toolbox (Johnson 2019, 105): phenomenology, object biography agency and new materialism are just a few that have been applied to the study of chambered tombs and will now be explored in more detail.

Phenomenology and a wider post-processual approach to landscape archaeology

Landscape archaeology historically has a complex and tangled history (Hodder 2012, 167) and had previously developed into a description of the landscape that took little or no cognisance of the people and how their world view shaped that landscape. It has had a marked influence on the study of Neolithic chambered tombs (Hodder 2012, 178). In this period there was an interest in how people experienced a place and how they were connected to it (Bradley 1998, 18) and went beyond the simple indivisibility assessments of earlier years (e.g. Fraser 1983; Renfrew 1979). One of the first theoretical approaches to landscape was phenomenology. First developed by prominent scholars of philosophy (see Heidegger 1962; Heidegger *et al*. 1962; Merleau-Ponty 1996) its usefulness within an archaeological context was explored by Chris Tilley and Julian Thomas in the early 1990s. It is concerned with "being in the world " (Harris and Cipolla 2017, 95) and defined as "the study of human experience and consciousness in everyday life" (Johnson 1999, 192).

Early works included Tilley's '*A phenomenology of landscape*' (Tilley 1994) and Bradley's '*The Significance of Monuments* (Bradley 1988). These works introduced the archaeologist to a fresh approach the investigation of landscape that was in direct opposition to the processual style rigid map assessment, aerial photography and plans approach. To interpret landscape properly and effectively, they argued, we need to visit sites and personally experience a location with the benefit of all our senses. In testing this hypothesis Tilley first visited and simply walked and experienced the 9.8km Dorset cursus Neolithic monument at Cranborne Chase. This experience allowed him to be with the monument and to look at the monument in a new and innovative way that brought him closer to experiencing the place as peoples contemporary to the monument did. In this approach perception is key (Tilley 1994) Figure 2.39 shows the results of a section of this phenomenological survey.

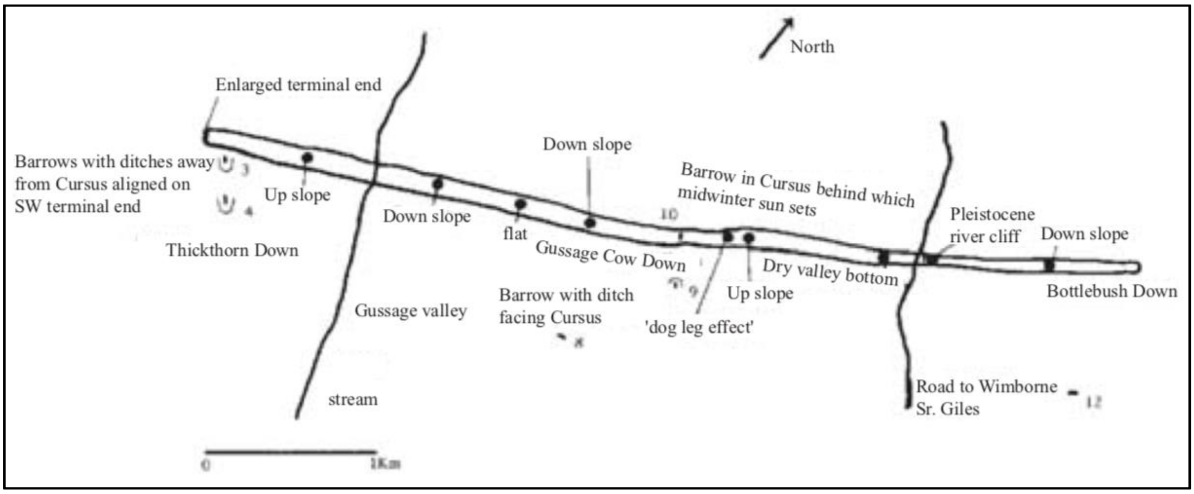


Figure 2.39. An annotated sketch map produced by Tilley showing archaeological and topographical features of the Dorset cursus that he witnessed during his phenomenological survey (Tilley 1994, fig 5.20).

Initial critique came from Andrew Fleming who suggested that this approach is simply too subjective and not rigorous enough to satisfy the requirements of modern archaeological investigation. He expressed that it is simply wrong to try and interpret an ancient site through modern spectacles (Fleming 1999). Others commented that phenomenology as a methodology wrongly assumes a '*common biological humanity*" (Brück 2005).

Despite the critics this approach has been hugely influential upon the study of Neolithic tombs and has encouraged archaeologists to look in more detail of that intimate relationship between humans and things (e.g. Bender 1993; Cummings *et al*. 2002; Fraser 1998; Tilley 1994; Thomas 1991). The Cotswold-Severn monuments of the Black Mountains in south Wales monuments were examined using this approach and it was argued that there was an entwined relationship between the monuments and the natural topography of the observable landscape such as prominent outcrops, mountains and river valleys (Cummings *et al.* 2002; Fleming 1999; Tilley 1994). Tilley suggests (Figure 2.40) that the contours of the capstone at the Pentre Ifan dolmen mirrors that of the peak of Carn Ingli in acknowledgement of special local significance of that mountain (Tilley 1994, 105).

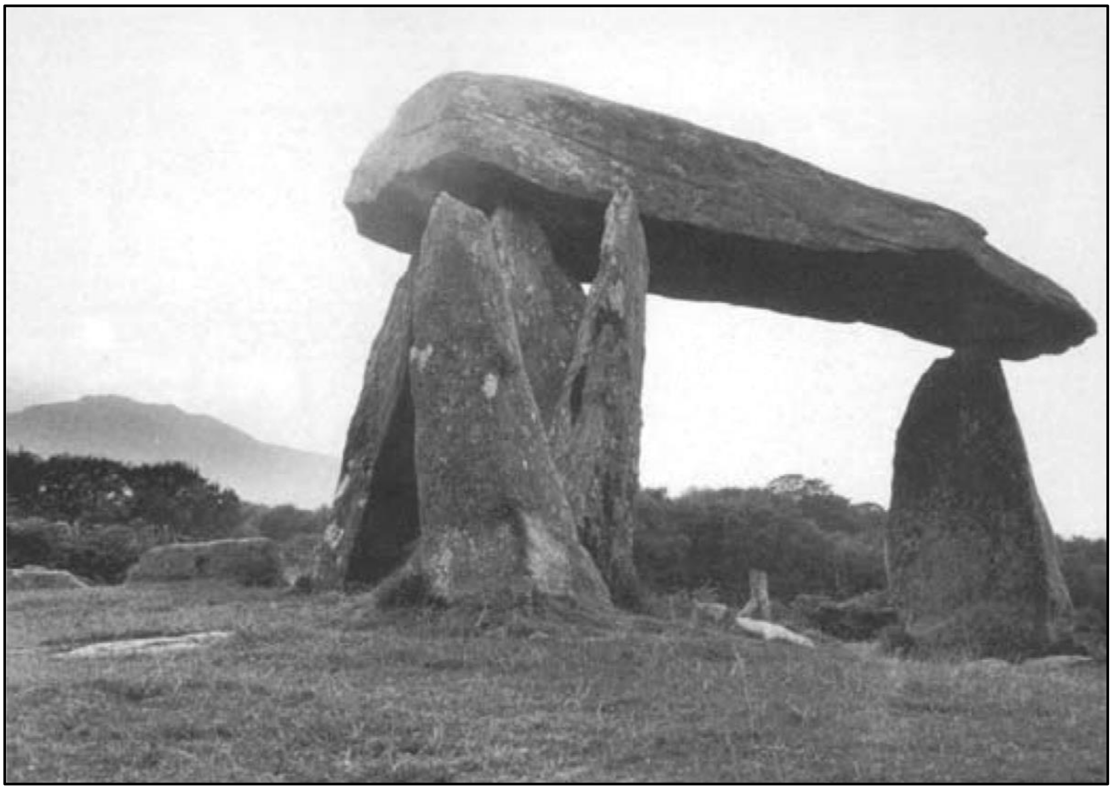


Figure 2.40. A photograph of the Pentre Ifan dolmen, south-west Wales and the Carn Ingli mountain in the background. This photo was used as evidence to suggest that the positioning of the capstone is mirroring the shape of the distant mountain (Tilley 1994, figure 3.19).

Following Tilley many have commented that chambered tombs are specifically sited to ensure visibility (or obscurity) from certain locations (see Bender *et al.* 1997; Cummings 2002; Tilley 1994). Moving north a similar pattern has been identified with Clyde cairns with many of the monuments positioned within sight of the sea (Cummings 2002, 132 and see Figure 2.41) with a view from Cairnholy I in south-west Scotland with a clear view of not only the Irish sea but also the Isle of Man. In Orkney has it has been noted the most prevalent orientation of its tombs is towards the sea but notably in such a way that the most effective and clear view of the tomb is from the offshore position and not the land (Davidson and Henshall 1989, 17; Woodman 2000, 95) the commanding costal positions potentially being useful to the maritime aspect of Neolithic life in particular transport and navigation (Noble 2006; Philips 2004, 380).

It has been noted that the building at specific locations could be to commemorate '*ancestral memories'* of past times when the sea and water played a more meaningful part in their cosmology (Fowler and Cummings 2003). Social reasoning for the siting has been explored using the separate though linked theoretical approach - memory. What part did memory have to play in the choice of a site? It has been suggested that builders may have made this decision having been influenced by 'fragments of memory' that invoked conciseness and remembrance of distant yet meaningful places (Cummings 2003, 25).

Figure 2.41. A south facing photograph of part of the Cairnholy I forecourt stones showing the view the monument has of the Irish sea and the Isle of Man on the distant horizon (author's own photograph)

With the post-processual interest in landscape came a development of Geographic Information System (GIS) mapping technologies. GIS analysis is a desk-based approach. It is a methodology that could be described as diametrically opposed to personal perception techniques of phenomenology but nevertheless they complement each other when undertaking the archaeological investigation of tombs. It has currency due to its ability to accurately assess wide areas and effectively demonstrate the interrelationship between tombs and their surroundings (Brück 2005), be that settlement, fertile land, fishing grounds or special topographical features. At its best it is utilised as a tool to be considered in conjunction with other theoretical approaches and site visits. An example illustrative of this point is the investigation of Pentre Ifan chambered tomb in Wales here the investigator has visited the site and produced 360-degree survey drawing, photographic images and GIS viewshed analysis (Cummings 2008, 286-289). These methods are fundamental methods and will readily form a basis to the application of other theoretical approaches (Figure 2.42).

Figure 2.42. Landscape recording techniques from Pentre Ifan, south Wales. Left 360 diagram; centre photographic evidence of the site; right GIS viewshed analysis (see Cummings 2008, 285-290)

In addition to these influential new approaches to the landscape at the same time there was a growing interest in themes such as ancestor relations and how the ancient Britons were influenced by their memory. Materialism also became a theme for consideration when understanding and interpreting matters concerning the construction and use of Neolithic burial monuments (e.g. Cummings and Whittle 2003; Edmonds 2012; Tilley 1994; Whittle 2004).

The ancestors

A notable theme within the post-processual literature is that of ancestors and their association with chambered tombs. Colin Renfrew was one of the first to consider the treatment of the dead as being aligned to ancestral traditions with his theories of territorial control and that of social identity (Renfrew 1973). Following Renfrew the literature is littered with hypotheses linking Neolithic tombs with the ancestral connections to the builders (see Cummings and Fowler 2003; Edmonds 2012, 21; Parker Pearson and Ramilisonina 1998a, 318; Thomas 1991, 76; Tilley 1996, 210; Whittle 1996, 1). The number of publications demonstrate the influence this thinking had on Neolithic narratives. Conversely, Whitley talks of "*too many ancestors*" and argues that the ever present ancestor hypotheses within Neolithic archaeology is over emphasised and writes "*A spectre is haunting British archaeology – the omnipresent ancestor*" (Whitley 2002, 119). Others have concluded that whilst there is some evidence to suggest the ancestors memory may have motivated the building of tombs it is by no means universal. The revelation that many tombs were only in use for relatively short period - some as little as a few generations (see Whittle *et al*. 2011) - may be evidence that would weaken any proposition that the Neolithic Britons cosmology included ancestor cults and ascendant veneration (Fowler 2010, 18).

To whom the 'privilege' of a tomb burial was afforded has long been debated particularly within this interpretive era. It has been argued that these are places where good or influential ancestors remains are interred in order that their community contribution may be remembered and venerated (Smith and Brickley 2009) and have a positive influence on the living community members (Fowler 2010). Familial groups, founding lineages and group leaders have all been hypothesised as being present within these monuments. There is some anecdotal evidence to support the familial connection following detailed analysis of the human remains that has been able to identify signs and traits within remains that can be described as genetic or familial (see Darvill 2004, 159; Smith and Brickley 2009). Conversely, others have interpreted them as places for bad or difficult deaths (Fowler 2010). Arguing they were places to store deviant spirits. Places made of stone; an enduring element - to contain forever the spirits of the dead that may have a perceived capacity do harm to the living - in essence the spirit jail for the 'unacceptable dead' (Barber 2000, 187; Fowler 2010, 2; Leach 2008).

Materiality

This interpretive theme seeks to understand the social interaction and entanglement relationship between the builders and users of the tombs and the materials utilised (Fowler and Harris 2015). An early adopter of this approach was Chris Gosden, his book

'Social Being and Time' outlined how archaeologists may benefit from an approach that considers the human relationship with its materials (Gosden 1994, 82). This approach addressed the inadequacies of processual scientific approach and has been described as the bridge between science and theory (Jones 2004, 329). Ingold in 2007 creatively asked readers of his paper to find a stone, wet it and sit it in front of you whilst reading the paper (Ingold 2007). This was demonstrated how perception of a material item changes over the relatively short time required to read the paper. His argument was that objects and their materiality are perceived not by their own biography and agency but by how they are entwined in the present world. He went on to suggest that objects should not be considered as fixed and simply processual but need to be considered with a wider subjective eye (Fowler and Harris 2015, 145). Not unsurprisingly the theoretical concept of materiality has been extensively explored from an archaeological viewpoint (see Conneller, 2011; Hodder, 2012; Jones 1999) and has influenced the investigation of chambered tombs. A comprehensive study of chambered tombs of the Clyde type on the western Scotland Isle of Arran considered the relationship between the building materials used and the surrounding landscape (Jones 1999). The relationship between the type of stone used in the construction of the Arran tombs and the geology in the immediate local was investigated was able to suggest a direct correlation. The work argued that the stones employed in the tomb construction were the stones that could be locally sourced. In areas of granite the tombs were constructed of granite and in areas of sandstone dominant geology the tombs were made of that same material. Moreover, tombs from areas that had both forms of geology utilised both materials in the build process (Jones 1999, 343). This demonstrated the importance of establishing an understanding the wider geological and topographical features of the area immediately surrounding a tomb. Jones argued that there was a purposeful and intended relationship between the local geology and the materials used far beyond the mere pragmatic advantages of sourcing material close to any construction location (Jones 1999, 348).

Others have suggested colour was also important to the builders and was further considered alongside texture at other chambered tomb sites (see Bradley 2000b: Scarre 2004). Studies of the passage graves of Ireland identified a practice of placing of contrasting pebbles of quartz (white) and granodiorite (black) around the entrance way of tombs and was specifically noted at Newgrange (O'Kelly 1982, 21). The use of the same materials was also seen at the passage tombs as Knowth (Eogan 1986, 47) and Knockroe (O'Sullivan 1993; 1996). White quartz pebbles are not an uncommon discovery at chambered tomb excavations throughout Britain and Ireland (Cummings 2009; Darvill 2002; 2010). It has been suggested that the presence of these stones may be linked to an operating belief system. Many ethnographic accounts (see Brumm 2004; Kahn 1990; Robinson 2004; Roe and Taki 1999) have pointed to the Neolithic operating an ontology of animism. Following this it has been suggested there was a spiritual connection that extended beyond animals and living things to include reverence towards inanimate materials such as these stones (Cummings 2012, 31).

Archaeological thought - the new millennium and beyond

After the new millennium there was a swing back towards the 'scientific' with advances that have had (and will continue to have) a significant impact on how we understand the Neolithic in Britain and Ireland. Osteoarcheological methodologies for assessing human remains, Bayesian statistical modelling - a new method of analysing Carbon-14 (^{14}C) radiocarbon dates and developments in ancient DNA (aDNA) studies and stable isotope analysis are all having a part to play in refining narratives. All will now be considered individually but broadly the difference between this scientific horizon and the previous one of the processual era is that now science is applied in conjunction with aspects of earlier developed theory. The approach for the new millennium incorporates appropriate aspects from each of the said 'paradigms'. All are still operating though the previous schools of thought are still very much operating (Harris and Cippola 2017).

Taphonomic analysis of skeleton human remains

The literature of Neolithic chambered tombs has tended to concentrate on the architectural composition of the monuments it is fair to state that the occupants of these funerary structures have seen less attention. For a long time any reporting on the human skeletal remains has comprised of cursory summaries if reported upon at all (e.g. Grimes 1939; Savory 1956; 1984). Their value was simply not realised due to the complexity of the often disarticulated and incomplete nature of the human bone assemblages discovered within Neolithic tombs (Wysocki and Whittle 2000, 591).

In the late 1990s the situation started to change with advancements in forensic anthropology methodologies and multi-disciplinary collaboration researchers started to redress previous shortcomings and capitalise on the archaeological evidence that can be gleaned from human remains (Haglund and Sorg 1997; Hunter *et al.* 1996). Parc le Breos Cwm is a Cotswold-Severn type Neolithic chambered tomb situated on the Gower peninsula of south Wales and was the first to benefit from the new methodological approach to human remains (see Whittle *et al*. 1998). This monument was first excavated in Antiquarian times by Sir John Lubbock (Lubbock 1871). The records in respect to the bones were not of a standard that could add benefit to the modern investigations. Details of the human skeletal assemblages amounted only to the briefest of mentions "*each set of bones was found in a small, confused mass*" (Vivian in Lubbock *et al.* 1887, 198). The monument was revisited in the early 1960s but no report was published report save a brief note (Atkinson 1961). Atkinson did however express the opinion that the human remains had been so badly treated by the earlier Victorian interventions that they were of no value to archaeology (Atkinson 1978). Challenging these findings archaeologists have set about reviewing this material with the utilisation of modern techniques. The first issue to be reviewed was relating to the MNI estimate. The first investigators had estimated MNI working to the practices of the day. During the Antiquarian period the sophistication levels of MNI estimation was basic and relied on a simple count of the skulls and jaw bones (Ashbee 1970, 61). Lubbock utilising this methodology estimated an MNI of 24 (Lubbock *et al.* 1887) which turned out to be a gross underestimation. Utilising modern methodologies this work established an MNI of 40 (Whittle *et al.* 1998, 143). Other techniques were also applied to the remains. The identification of Musculoskeletal Stress Markers (MSM) in the remains (see Hawkey and Merbs 1995) were able to identify from the bones that the males had strongly developed leg muscles whilst the female occupants of the tomb were found to be characteristically gracile. This is suggestive of the males having roles that involved wide distance ranging such as herding or hunting (Whittle *et al.* 1998, 164). Also MSM signs in upper limbs were similar to comparative data sets from marine populations who repetitively employ a rotary movement of the arms, a practice typical of using paddles (Hawkey and Merbs 1995). These two revelations about the mobility of individuals in the tomb was only established by virtue of modern scientific advancements. Osteoarchaeological techniques identified have been utilised to refine narratives around social behaviour and burial practices. It has been identified the early Neolithic was not a peaceful time with interpersonal violence qualifying as a feature of life. One study suggests that between four and five percent of crania examined from British sites having been subject to blunt force trauma with two percent of these injury being peri mortem and likely related to death (Schulting and Wysocki 2005, 132). At Hazleton North that the remains of 41 (MNI) individuals (Cuthbert 2019; Rogers 1990) were treated differently in the separate chambers of the monument (Fowler *et al.* 2022, Supp info Section 1) with five individuals remains from the north chamber having been subject to knowing by scavengers suggesting that these remains had not been deposited as part of the primary burial process (Cuthbert 2019, 92).

Following this pioneering work the same methodologies were utilised to review the MNI at the Orcadian tombs of Isbister and Quanterness. The former had been reported to have a human remains assemblage comprising of an MNI of 341 individuals (Chesterman 1983, 77) and the latter with 165 individuals (Beckett and Robb 2006). By contrast the 36 MNI assemblage discovered during excavation at West Kennet (Figure 2.43) was and has been held to represent the largest assemblage in mainland Britain (Bayliss *et al.* 2007, 86). These two Orcadian findings have been interpreted as evidence that on Orkney it is possible that the tombs were used for the mortal remains repository for the a complete community population. If correct this would be unique in the British Neolithic narrative. Equipped with the benefit modern techniques Rick Schulting suggested the methodology utilised at the time to calculate MNI at Quanterness and Isbister may have produced a considerable over estimation (Schulting *et al.* 2010, 5). A re-evaluation of the bones at these sites was undertaken. The Quanterness evidence reduced the MNI to just 59 individuals (Crozier 2014, 27) and at Isbister to 85 MNI (Lawrence 2006, 55). This recalculation of MNI demonstrates this perfectly and successfully challenged the 'complete population' hypotheses by Renfrew and others. When the revised MNI and are considered it is clear that the situation in Orkney now aligns to the wider British narrative, that tombs contain only a representative 'special 'sample of the population (Smith and Brickley 2009).

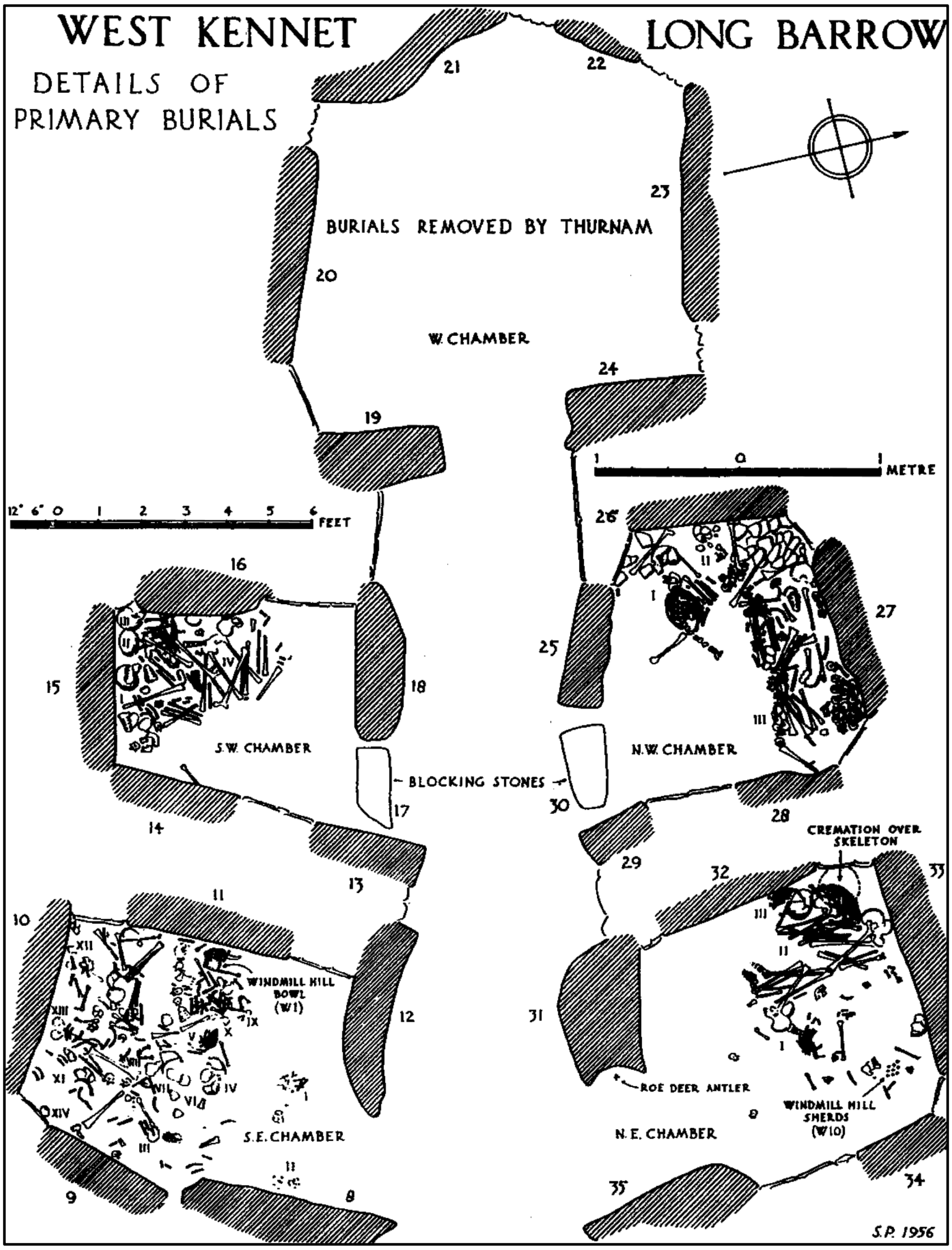


Figure 2.43. Plan by Stuart Piggott showing the distribution of human remains in West Kennet Long Barrow (Piggott 1958).

Bayesian statistical modelling

There have been a number of Carbon-14 (^{14}C) radiocarbon dating revolutions. First, upon its introduction in the 1950s (Arnold and Libby 1949; 1951) and second, in the late 1980s with the advent of Accelerator Mass Spectrometry (AMS) the availability of which allowed for extremely small samples to be tested (Bayliss 2009, 125; Dennell 1987). What could be termed 'The millennial revolution' commenced with the emergence of Bayesian modelling, a statistical methodology capable of providing much more focused results from data than previous scientific practices. It is an approach which mathematically calculates more accurate conclusions from available data (see Buck *et al.* 1996). This methodology had an immediate impact on Neolithic studies generally (Bayliss 2009) and more specifically of chambered tomb chronology. In 2007 a series of special issue papers were published in *Cambridge Archaeological Journal* which was concerned with building chronologies for five Cotswold -Severn tombs long barrows applying Bayesian modelling to the data. Ascott-under-Wychwood long barrow utilised 44 available radiocarbon dates which once subjected to Bayesian modelling identified dating the earliest activity to the mid 40th century cal. BC. This work has identified that the use of the monument was over a period of only three to five generations (Bayliss *et al.* 2007, 29). At Wayland's Smithy long barrow with a total of 23 radiocarbon dates from excavations the Bayesian modelling suggested deposition began in the earlier 36th century cal. BC and likely lasted only a generation (Whittle *et al.* 2007, 103). At Hazleton North long cairn activity commenced with construction in the first half of the 37th century cal. BC and was used primarily for burials over a period of two to three generations (Meadows *et al.* 2007, 45). West Kennet Long Barrow was limited by the lack of construction context radiocarbon dates but nevertheless suggested a date for the primary mortuary deposits with activity lasting only 10–30 years (Bayliss *et al.* 2007, 85). This statistical technique had a significant effect on the narrative of usage at chambered tombs as prior to this work it had been reported that contemporary communities used the tombs over many hundreds of years if not close to a thousand (Piggott 1962, 78).

Following the publication of *Gathering Time* (Whittle *et al.* 2011) the same methodology has been applied to other the regional groups of tombs. In Orkney the work was able to suggest a revised chronology for the arrival of the Neolithic in Orkney suggesting at 95% probability that the Neolithic in Orkney began in 3730–3480 cal BC (Griffiths 2016, 287). Another study places the start of established Orcadian Neolithic activity a little later around 35th century cal BC based on radiocarbon analysis of palaeoenvironmantal samples that identified a notable woodland reduction phase around this time (Bunting *et al.* 2022 ,97). Prior to these works the Neolithic in this area was considered active from between the mid 4th millennium to the start of the second millennium – slightly later than other areas of Britain and Ireland (see Whittle *et al.* 2011). In this study radiocarbon dates were utilised from previous excavations (see Renfrew *et al.* 1976; 1979; Schulting *et al.* 2010). Despite the limitations of relatively small data set in respect of the Orcadian passage tombs (Cooney *et al.* 2011, 657) it was able to suggest the Orkney-Cromarty chambered tombs were first *in use* 3640-3440 cal BC and Maeshowe type only a short time later at 3590-3340 cal BC (Griffiths 2016).

Bayesian analysis was similarly applied to the Irish passage tombs. At Carrowmore tombs have been dated to 3630–3120 cal BC (Bergh and Hensey 2013) and at Newgrange to 3340–2910 cal BC (Cooney *et al.* 2011, 657) adding some weight to previous suggestions that the Orcadian passage tombs have been directly influenced by the Irish tomb's tradition (Sheridan 2014; Schulting *et al.* 2010, 39-41). Bayesian modelling has been able to ascertain that the use of the Clyde cairns has been as early as 4040-3710 cal BC (Cummings and Robinson 2015, 87). Court cairns despite of limited availability of suitable of samples dates for use can be determined as between 3700-3570 cal BC (Schulting *et al*. 2012, 42).

Isotope analysis

The use of isotope analyses is expanding and becoming a routine methodology in the investigation of mobility and migration and is broadening our understanding of human and faunal diets and consequently substance strategies. When coupled with aDNA it is now possible to interpret population and ancestry alongside the origins of individuals and their lifetime mobility. Radioactive isotopes (used in radiocarbon dating) are constantly decaying and it is this decay rate that is used to calculate the age of samples and therefore provide archaeological dates. In contrast stable isotopes - carbon (δ^{13}C) and nitrogen (δ^{15}N) and strontium (^{87}Sr/^{86}Sr) – do not decay. These are routinely explored with the aim of understanding any geographical movement by humans and animals throughout their lives (e.g. Britton *et al.* 2008; Chenery *et al.* 2010; Eckardt *et al.* 2009; Evans *et al.* 2006a; Evans *et al.* 2006b; Evans *et al.* 2007; Gigleux *et al.* 2017; Schulting *et al*. 2017). Its continuing use has been applied to the Neolithic (e.g. Barclay and Brophy 2020; Brace *et al.* 2019; Evans *et al.* 2019; Madgwick *et al.* 2019; Richards and Hedges 1999; Richards 2000; Viner *et al.* 2010). By extracting these isotopes from archaeological remains such as bones and teeth it is possible to identify where they originated from geographically (Montgomery *et al.* 2013) and to provide evidence of the individuals diet over a period of ten years prior to death (Ambrose 1993; Schwarcz and Schoeninger

1991). A recent study based on strontium analysis on two sites at Penywyrlod and Ty Isaf in Wales show ratios exceeding the local biosphere parameters indicating that the childhood diet was outside the region. The work concluded that the early farmers in southern Wales were migrant individuals (Neil *et al.* 2017, 388). Another work found that these early farming communities practiced a subsistence strategy that involved regular mobility across geographical regions and not the fully sedentary lifestyle often associated with farming communities (Neil *et al.* 2016, 11).

Furthermore such techniques are able to distinguish between terrestrial animal proteins and those chemical signatures from proteins of marine origin (Richards 2000, 124). One of the largest isotope-based datasets analysed the remains of 131 pigs from feasting contexts at Durrington Walls (Madgwick *et al.* 2019). This work proposed that there was a broad spectrum of geographical origins of these feasted animals with not all the pigs being reared locally (see Figure 2.44). For the first time this work introduced the notion of a pan British network with connections reaching as far as Scotland and Wales (Madgwick *et al.* 2019, 1).

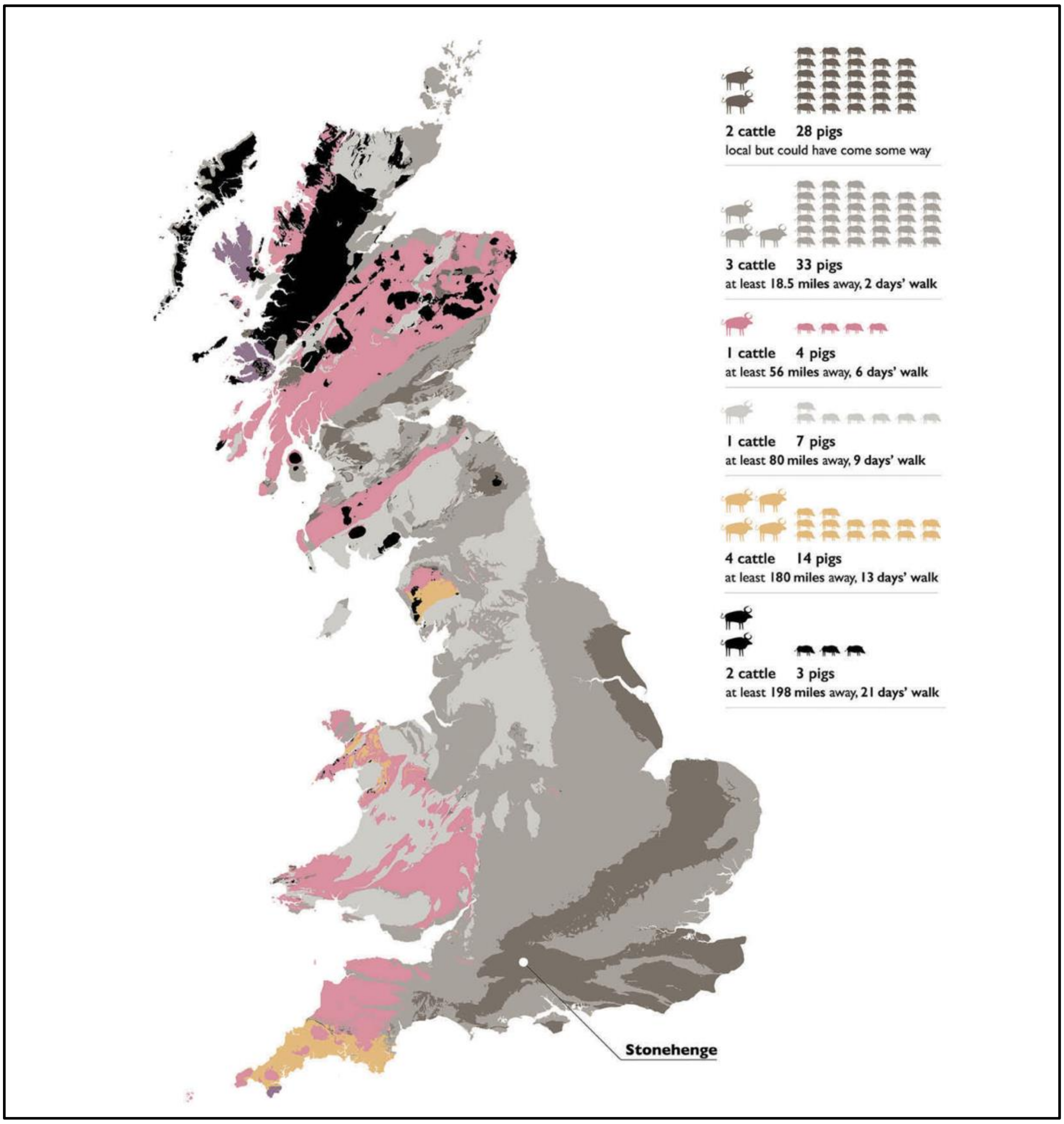


Figure 2.44. One of the versions of the map used in the *Feast!* exhibition and in original and redrawn versions in subsequent press coverage, purporting to show the distances from which cattle and pigs were coming (Brophy and Barclay 2020, Figure 3).

Chemical analysis of 78 samples of human skeletal remains coastal and inland sites in England and Wales were examined. These were from provenanced Mesolithic sites and early Neolithic tombs, causewayed enclosures and caves. The results were able to clearly demonstrate a rapid move away from the marine diet at the start of the Neolithic (Richards and Hedges 1999, 895). This analysis has been used more widely with similar results identifying the dietary habits of people in north-west Europe following transition to farming (Montgomery *et al.* 2013; Tauber 1981; Richards *et al*. 2003). These studies suggest that there was little or no dependence on marine diet resources once agriculture became established in stark contrast to the diet of British Mesolithic people who relied heavily on marine foods as part of their hunter-gatherer fisher lifestyle (Montgomery *et al.* 2013; Richards and Hedges 1999; Schulting *et al.* 2012).

Moreover, this finding has created a dichotomy of evidence that has provoked debate. Chemical analysis of stable isotope data shows no reliance on a marine resource whilst excavation evidence is showing a continued use of such marine resources. Shells of edible marine molluscs have been found at numerous chambered tomb sites such as Cairnholy I in the southwest of Scotland (Piggott and Powell 1949), Bryn Celli Ddu in Anglesey, Wales (Hemp 1930) and within three of the most prominent passage tombs of Orkney, *viz*, Isbister, Quanterness and Quoyness (Colley 1983; Wheeler 1979). The Glecknabae chambered tomb on Bute was even built over a significant shell midden (Pollard 2000).

In Orkney isotope the human remains of the stalled cairn Knowe of Rowiegar were analysed (Gigleux *et al.* 2017). Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) measurements confirmed earlier findings by suggesting that the individuals relied upon a predominantly terrestrial diet with only a small amount of marine protein being consumed. This supported other studies from Orcadian chambered cairns of the Orcadian North Isles (see Lawrence 2012; Montgomery *et al.* 2013) and followed earlier findings that upon the onset of the Neolithic Orcadians swiftly ceased the reliance upon a marine diet in favour of terrestrial food resources (Richards and Hedges 1999; Schulting and Richards 2002). Again, these findings where critically challenged with claims that the evidence was not supported by other archaeological evidence and the science results stood in isolation and that a result from one individual does not constitute a basis for a community wide finding (Milner *et al*. 2004, 18). The original authors in response acknowledge the small dataset but maintain that the findings represent a change in subsistence habits (Richards and Schulting 2006). Regardless of the scientific evidence many debates have ensued as to why people would cease to harvest and eat such a readily available food source (Bailey and Milner 2002; Bonsall *et al.* 2009; Hedges 2004; Milner *et al*. 2004; Richards and Mellars 1998; Richards and Schulting 2006; Schulting and Richards 2003a).

Ancient DNA

Finally the last area of scientific advancements that has had an impact on archaeology is that of ancient DNA (aDNA) studies. There have been a number of previous works utilising aDNA but the genetics field was not as developed as today and did not add significantly to archaeological narratives (e.g. Ammerman and Cavalli-Sforza 1984; Bellwood and Renfrew 2002; Renfrew and Boyle 2000; Richards *et al.* 1996). Today the field of ancient genomics has developed considerably since these early attempts in no small part to the capture of the first ever sequence of an ancient human genome in 2010 (Rasmussen *et al.* 2010). The continuing identification of human genome datasets spanning prehistoric eras (aDNA) to modern populations (DNA) has been critical in this development and archaeological investigations are now seeing its value (Hofmann 2015).

As highlighted in the opening section of this chapter how the Neolithic came to Britain has been the subject of vigorous debate with the migration v acculturation argument being the cause of some tension amongst leading academics. Ancient DNA methodologies that have recently been applied to this question. One comprehensive study has indicated that continental Europeans are of broadly Aegean ancestry but there is also evidence of local Mesolithic foragers admixture (Brace *et al.* 2019). This work relied on a sizable genome wide dataset from all over Britain and Ireland from confirmed Mesolithic and Neolithic sites. The study was able to show genetic connections between British and Western hunter-gatherers (WHG) of the continental Mesolithic periods with no continuation of exclusively forager aDNA into the Neolithic period. It identified that there was notable regional variation in Britain that prompted the suggestion that there were multiple sources of people with varying amounts of WHG admixture suggestive of large scale seaborne migration and concluded that Neolithic ways were introduced to Britain by incoming European farmers (Brace *et al.* 2019, 769). Others have rejected this aspect of the work (see Thomas 2022) instead suggesting that the Neolithization of Britain was more of a long term and complex process as opposed to a foundational migratory event (Thomas 2022, 520). The debate continues and aDNA is undoubtably a significant milestone in understanding the Neolithic of Britain. The technique has also been applied to chambered tombs. Work has been undertaken in Ireland with the sampling of 43 whole genomes from individuals remains found in portal tombs, court cairns and passage graves monuments that cover the temporal extent of the Irish Neolithic. In the earlier monuments - Poulnabrone portal tomb and Parknabinnia court tomb - the samples used identified no close familial connection but did indicate evidence of a patrilineal ancestorial links (Cassidy *et al.* 2020, 387). The Poulnabrone data also identified the easiest evidence of a male infant with Down Syndrome (Cassidy *et al*. 2020, 387). In contrast, the findings at the passage grave at Newgrange, Co. Meath concluded that the sampled remains belonged to a close family group - likely a ruling elite. The individuals in this tomb practiced both polygynous and incestual relations with the adult son of such a union being afforded burial in a primary location within the tomb indicating this situation was a culturally accepted practice (Cassidy *et al.* 2020, 384). Interestingly distant relatives of this male were also identified at Carrowmore, Carrowkeel and Millin Bay passage monuments situated c. 150km away from his resting place. This work also proposed tentatively that similar social arrangements may also be present in Wales and Orkney where similar passage graves are to be found (Cassidy *et al.* 2020, 386).

A more recent investigation at Hazelton North a Cotswold-Severn tomb in Gloustershire has similarly been able to report direct kinship via patrilinear descent with some maternal connections. Polygyny here was also identified with one male reproducing with four females whose offspring were placed in this same tomb (Fowler *et al.* 2021). The strength of these techniques are enhanced with the addition of isotope analysis to the individuals biography by ascertaining that the individuals likely moved around and resided in the same locations within 40 km of their burial place (Neil *et al.* 2016). The three individuals sampled from monument 1 at Trumpington Meadows in Cambridgeshire revealed that two were brothers (Scheib *et al.* 2019).

Summary

This literature review has purposely encompassed the widest possible information of British early Neolithic tombs. It has covered current academic literature that will impact on this thesis and as such was intentionally wider than merely the Orcadian tombs. Having first detailed current thinking on how the Neolithic was introduced to Britain and Ireland. It has detailed that the acculturation versus migration arguments for the arrival of the Neolithic package are far from settled. Though this chapter has shown that the development of advanced isotope and aDNA analytical techniques are certainly refining the narratives.

The chapter then covered the diverse nature of Neolithic funerary architecture across Britain and Ireland and how the often cited regional classifications have developed. It is clear that there was no blueprint for these tombs across the wider Islands and it is correct to say that chambered tombs were not part of a universal British Neolithic package. It has shown that regional classifications can be problematic as they do not account for nuances within tombs in a more localised context; an area the remainder of this work will go on to unpick. For clarity at this early stage of this thesis the monuments of Orkney are frequently referred to within academic literature as **Orkney-Cromarty** and **Maeshowe** type tombs and these labels have been used here within this literature review chapter. Moving forward the terms **tripartite stalled cairns** and **stalled cairns** will be used when discussing Orkney-Cromarty type and **passage graves** when discussing Maeshowe type. It is felt these terms are a more accurate determination of type for classification for Orkney specific tombs and is more appropriately used when discussing monuments in their wider context.

This chapter then covered the investigation methods utilised over the years to investigate these tombs. From *Barrow Diggers* to the use of modern scientific techniques to fully demonstrate how the scholarly interest of these early Neolithic funerary structures has evolved. It was considered a fundamental basis for this thesis and critical to understand the wider British context. Without this understanding it would not be possible to fully evaluate what we currently know about the early Neolithic narratives in Orkney.

The following chapter will shift focus towards the Orkney archipelago with a more detailed study of the geomorphology and environmental diversity of the individual Orcadian North Isles that form the basis for this work.

Chapter 3 – The North Isles-A geographic and environmental synopsis

Introduction

This chapter will detail the environmental and landscape aspects of the Orcadian archipelago. The aim is to identify what environmental change has taken place since the early Neolithic and to assess geomorphological diversity within the individual islands This will provide a foundation for the later research (chapters 5-9). The level of detail is considered critical: to understand the tombs one needs to understand the landscape in which they are located.

One of the first literary records of the islands was initiated by Roman historian and chronicler Tacitus when documenting a journey of the Roman General Agricola that took him north of *Britannia* when he "*discovered and subjugated the Orcades, hitherto unknown*" and wrote the islands were "*beaten by a wild and open sea*". It is a good place to start this chapter as indeed the wild and open natural environment of Orkney has had a major part to play in how people have interacted with the landscape, particularly the North Isles. This chapter will start with a summary of the islands as we see then today as there is much diversity across these landmasses which require attention before moving onto discussions in chapter 9. This chapter will then examine the geological and geomorphological nuances of the archipelago. It will consider the sea, its tides and levels and how its effects have shaped the landscape before moving on to consider the land and how it appeared in the Neolithic period drawing on the latest scientific findings. By understanding the nature of the islands this chapter will provide a firm foundation to investigate the landscape in relation to the chambered cairns of these islands.

The Islands

The archipelago known as Orkney is situated c.10 km north of the mainland of Scotland's northern coastline and is separated by the perilous Pentland Firth. The islands that make up the Orkney group are located where the Atlantic Ocean meets the North Sea. The islands lie between 58° 41' and 59° north and 2° 22' and 3° 26' west. Given the northerly position of the islands the summer months see around six hours of darkness and a situation that is reversed in winter with only six hours of daylight (Berry 2000).

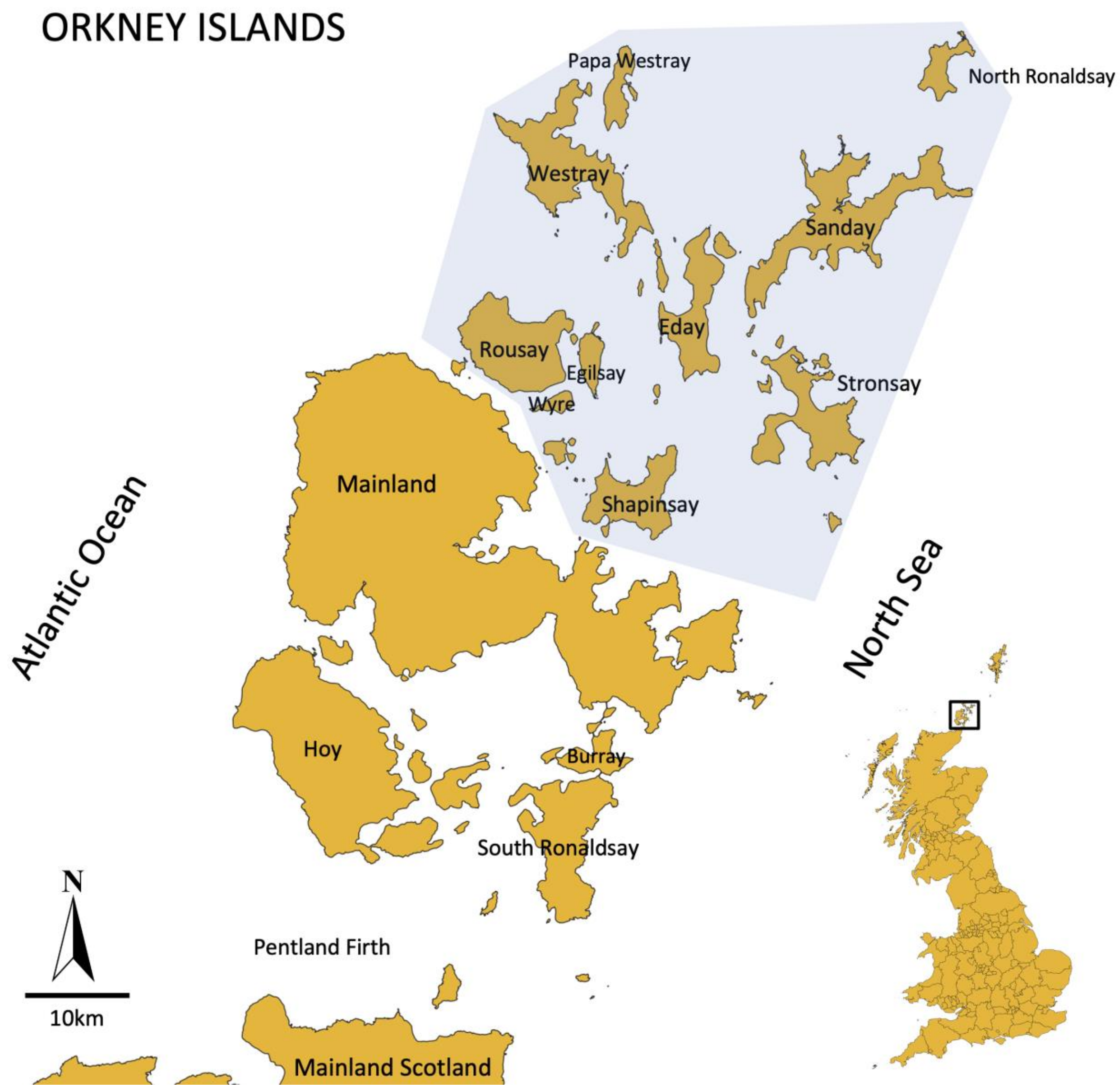


Figure 3.1. Map of the Orkney islands with the North Isles highlighted in blue. (QGIC national border base map annotated by author).

Current sea levels see the archipelago split into over 70 islands with some skerries only being visible at low tide (Haswell-Smith 2008) 20 of which are permanently inhabited. In total the group measure 80 km north to south and 47 km east to west covering a total area of a 974 km^2 (Figure 3.1) with a combined coastline of 918 km. The islands can be divided into three broad areas. The Mainland (Orkney), the South Isles and the focus of this work, the North Isles (highlighted in opaque Green in Figure 3.1). There is some topographical diversity across the islands but broadly speaking they are low-lying landmasses that are interspersed with points of higher altitudes (Sturt 2005, 71). Hoy is the exception with an atypically higher topographical profile in contrast with other islands within Orkney. Figure 3.2 shows the distribution of the higher peaks which will have relevance later in this work.

Figure 3.2. Map of the top 10 highest peaks in the Orkney Islands. 1-Ward Hill, Hoy (481m); 2- Cuilags, Hoy (435m); 3- Knap of Trowieglen, Mainland (399m); 4 - Mid Hill, Mainland (275m); 5 - Blotcnie Fiold, Rousay (250m); 6 - Wideford Hill, Mainland (225m); 7 - Milldoe-Mid Tooin, Mainland (224m); 8 - Keelylang Hill, Mainland (221m); 9 - Fitty Hill, Westray – (169m); 10 - Ward Hill, South Ronaldsay (118m) (Google Earth Pro base map with annotations by author)

The mainland is the centre of activity nowadays and archaeology suggests the situation may have been the same in the Neolithic. The Heart of Neolithic Orkney UNESCO World Heritage Site that comprises the Maeshowe chambered tomb, the Stones of Stenness and Ring of Brodgar and the settlement site at Skara Brae and the later Neolithic complex of The Ness of Brodgar that sits on the isthmus between the sea loch of Stenness and freshwater loch of Harray complete the protected area. The Southern Isles consist of Hoy with its atypical chambered tomb - The Dwafie Stane - the classification of which has been problematic as its architecture is unique in Britain and Ireland. The island is home to the two largest mountains Ward Hill and Cuilags (Figure 3.2) that are visible from as far away as Westray Eday and Sanday in the North Isles. (Figure 3.3).

Swona, Burray, South Ronaldsay, Graemsay and a smattering of smaller uninhabited islands that sit with the large natural bay Scapa Flow at its heart. The Churchill Barriers are part of a road system that connects many of these islands to Mainland Orkney. The Northern Isles are the most extensive of the islands consisting of larger land masses that are today only accessible by sea or air.

Figure 3.3. Arial Image of the North Isles of Orkney with showing islands mentioned in this work (Google Earth Pro).

The North Isles of Orkney – an introduction

Herein follows a summary and introduction to each of the North Isles. In some instances, more than one island is presented; this is due to their locality and that the islands are seen as part of the same small, localised island group; for instance, Westray and Papa Westray.

Rousay, Egilsay and Wyre

This small cluster of islands lie to the north of the mainland separated by the Einhallow Sound (Figure 3.4). Rousay is the fifth largest island in the archipelago and the second largest of the North Isles group with a total area of 49 km^2. Rousay's history and heritage can be traced in its record from Orkney's first inhabitants during the Mesolithic to the modern day. It is home to an extremely rich archaeological record which sees a concentration of some 150 archaeological sites which has seen it described the 'Egypt of the North' (Tait 2011, 464) in popular culture literary accounts.

Figure 3.4. Digital satellite photographic image of the Island of Rousay (main island), Egilsay (E) and Wyre (SE). The blue dots represent the location of Neolithic chambered cairns and the yellow dot is an established Neolithic settlement (annotated Google Earth Pro).

One short stretch of coastline from the Midhowe Broch and the adjacent early Neolithic stalled cairn (Figure 3.5) to the Bay of Westness has been described as the most important mile of history in Scotland (Tait 2011, 474). Topographically there is a very distinct low-lying band of fertile land following the coastal margin with the centre of the island being dominated by higher moorland and the islands largest and Orkney's fifth highest peak, Blotchnie Fiold, at 250 m high. It is at the line of demarcation between these contrasting land systems that lies a rocky outcrop ridge that some of the most interesting and celebrated the chambered tombs of Rousay are situated.

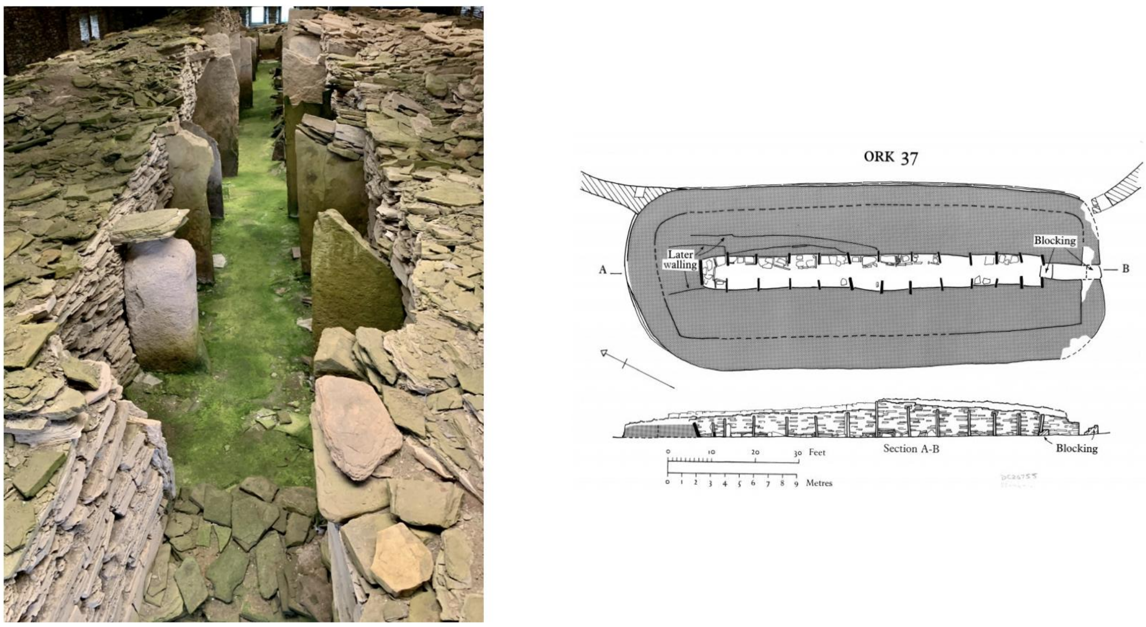


Figure 3.5. Midhowe chambered tomb on Rousay (authors own photograph) and the plan of the same (Davidson and Henshall 1989,14).

Westray, Papa Westray and the Holm of Papa Westray

Westray is situated at the north western extent of the Orkney group and covers an area of 47 km^2 (Figure 3.6). Known as the "*Queen o' the Isles*" it has a modern day population of around 600. The western façade of these islands sees a notable line of tombs that are positioned in upland areas as opposed to on the coast as seen on other islands. Links of Noltland is a Neolithic settlement site (Figure 3.7a). This site is located within a shallow and sandy bay within a dune and machair environment offering some shelter from the Atlantic weather fronts and at time punishing seas.

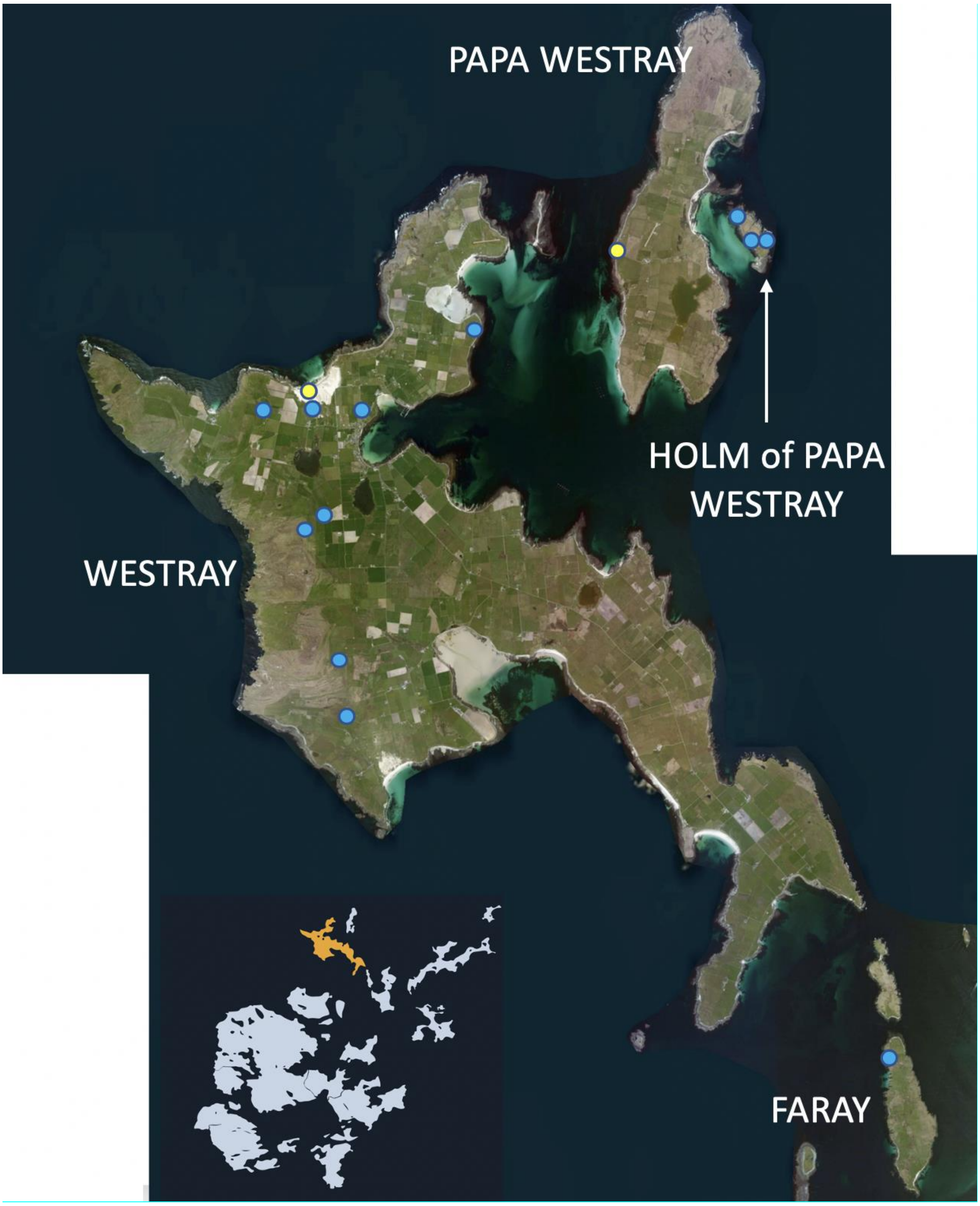


Figure 3.6. Digital satellite photographic image of Westray (Main Island), Papa Westray (north-west Island) and the Holm of Papa Westray (small island to E of Papa Westray. Legend as per fig 3.4) (annotated Google Earth Pro).

Considerable evidence has been discovered at this site over the years of excavations including the famous Westray Wifey (Figure 3.7c) and the Westray stone (Figure 3.7d) discovered at the Pierowall passage tomb just a few kilometres away from the Links of Noltland.

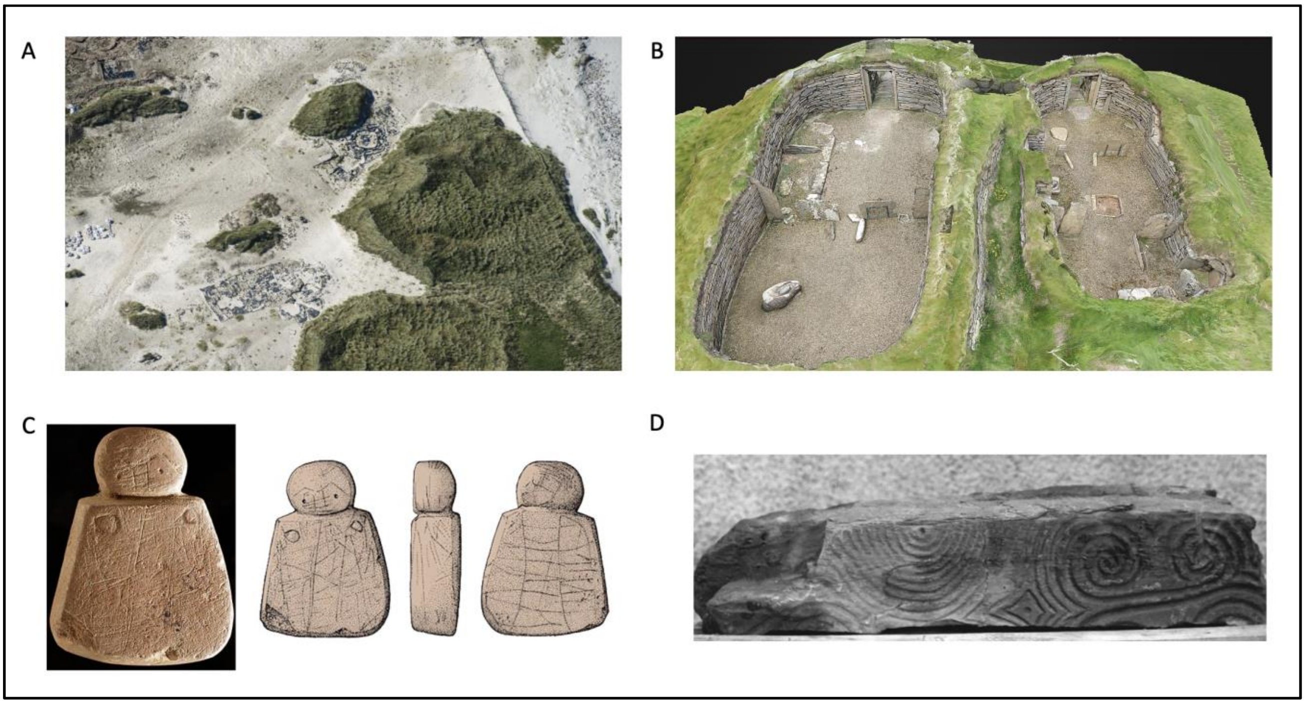


Figure 3.7. ***A*** **-** Arial photograph of Links of Noltland Neolithic settlement site (Canmore); ***B*** – 3D photogrammetry model of Knap of Howar Neolithic farmstead (Hugo Anderson-Whymark Sketchfab); ***C*** – Photograph and graphic of the Westray Wife Neolithic figurine (Orkneyjar) ; ***D*** **-** Pierowall stone Neolithic art from Maeshowe type cairn at Pierowall, Westray (Canmore).

To the northeast of Westray lies a 9 km^2 island less than a kilometre across the Papa Sound. This is the island of Papa Westray, colloquially referred to as *Papay* that is home to a small population of some 90 people. It is a low-lying fertile piece of land with the high point at only 48 m (North Hill). On the west coast there are two early Neolithic houses - Knap of Howar – interpreted as a Neolithic farmstead (see Ritchie *et al.* 1983) (Figure 3.7b). Papa Westray has no recorded chambered tombs but as will be discussed later The Holm of Papa Westray is likely to have been a peninsula of Papay as opposed to the near island that it is seen today. The Holm of Papa Westray is only 0.2km^2 and is today uninhabited. It sits less than 100 meters to the east from its once parent island across the Papa Sound. The Holm is again a low-lying island with its highest point only 15m high. Today is has considerable peat coverage that we will see later formed after the early Neolithic. Westray is represented by ten recorded chambered cairns with only one confirmed as a Maeshowe type at Pierowall. Seven confirmed Orkney-Cromarty type and two of uncertain classification.

Eday

The small island of Eday (Figure 3.8) measures just 12km north to south. It covers an area of 27km^2 with a modern population of 160. It is located centrally at the heart of the northern isles with Sanday being situated 2.2km to the east, Westray 3km to the west and 4km south-east lies Stronsay.

Figure 3.8. Digital satellite photographic image of Eday (main Island) and Calf of Eday (smaller island to north-east) Legend as fig 3.4 (annotated Google Earth Pro).

This is an advantageous strategic position for transport throughout the North Isles. The circles of Figure 3.9 are representative of a range of a 10km return journey (Brookbank

2000, 102) for a non-sailing vessel of the type that have been associated with Neolithic seafaring (see McGrail 2001). This model will be refined in chapter 8 of this study.

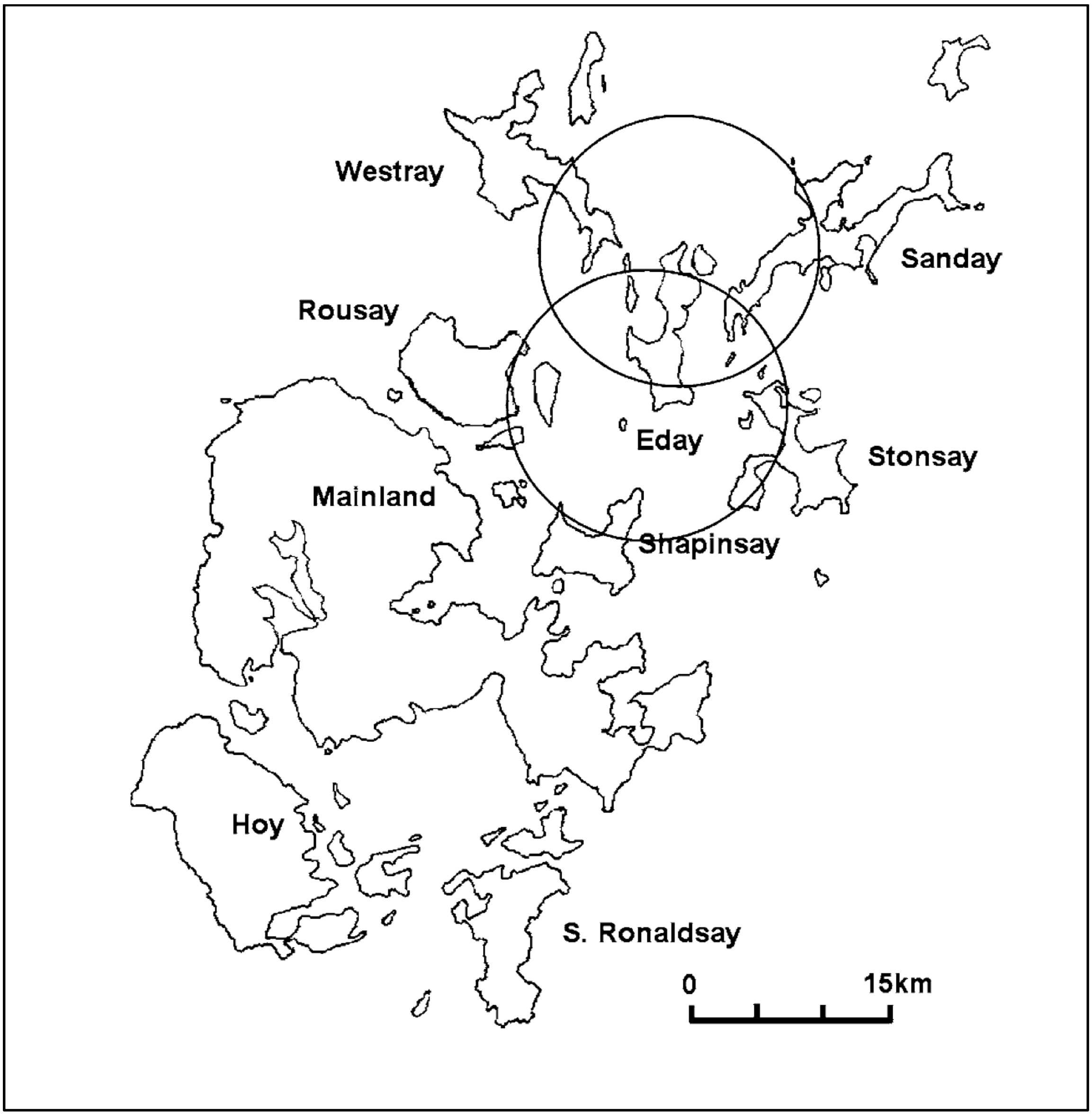


Figure 3.9. Map showing the 10km return journey from Eday centred on Eday North and Eday South (Brookbank 2000, 102).

The island comprises two areas of contrasting landscape. The north is dominated by upland moors and the south separated by a narrow isthmus with the more fertile low-lying farmland. The 101m Ward Hill is the highest point on the island can be found in this southern portion. Eday has eight chambered tombs recorded on the island five Orkney-Cromarty type, two Maeshowe – Vinquoy Hill (Figure 3.10a) and Eday Manse and one that is presently of uncertain classification - Withebeir (Davidson and Henshall 1989).

The island also has similarities to Rousay with its rich archaeological record but also it is today poorer in terms of economic output. This may indicate that as the islands have not been extensively farmed more archaeological evidence remains as there has been less need to rob valuable stone from early sites or indeed destroy because of farming requirements. The Calf of Eday is the heavily peat covered island that is today uninhabited and is home to three further Orkney- Cromarty type cairn with one having a stalled chamber configuration and the remaining two having the less common Bookan-type chambers (Figure 3.10 b/c).

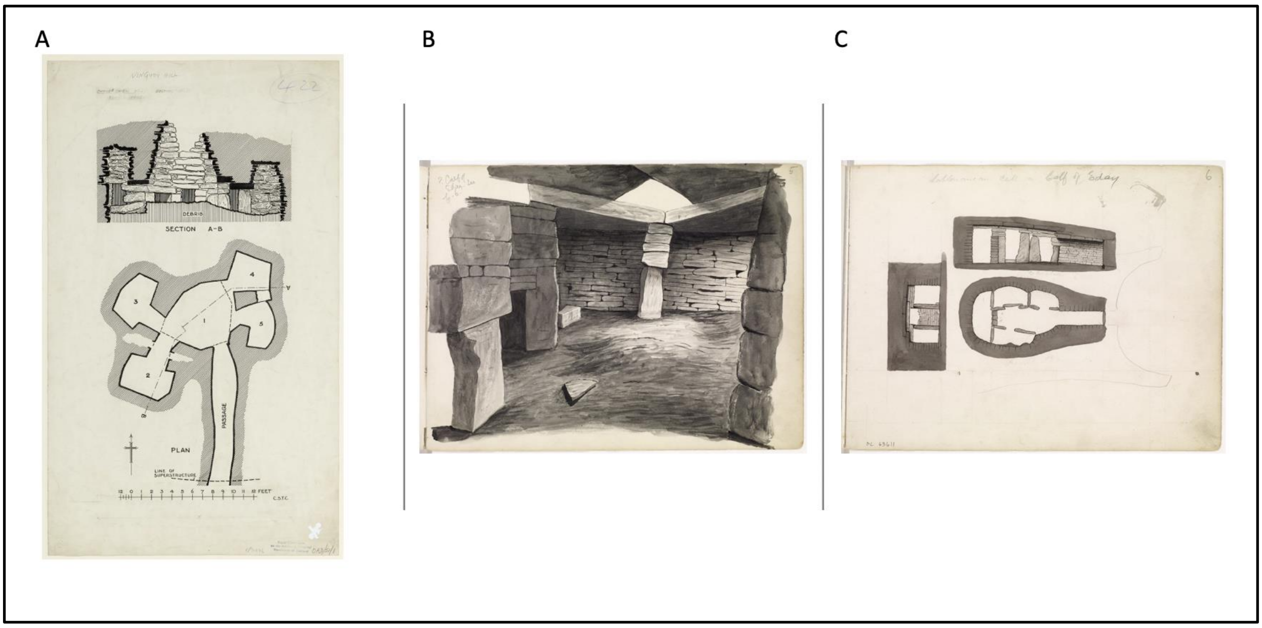


Figure 3.10. a–Plan, section of Vinquoy Hill, Maeshowe type tomb (https://canmore.org.uk/collection/1887633); ***b***- Undated sketch on page 5 in sketchbook by George Petrie showing perspective view of interior of Calf of Eday (North) Bookan-type stalled cairn, looking SE from the NW compartment with gap in roofing lintels (https://canmore.org.uk/collection/1793268); ***c***- Drawing showing plan and elevations of chamber at Calf of Eday, North West, Orkney, by George Petrie (https://canmore.org.uk/collection/1793783).

Figure 3.11. Digital satellite photographic image of Sanday - Legend as fig 3.4 (annotated Google Earth Pro).

Sanday

Sanday is the largest of Orkney's North Isles with a land mass of 50 km^2 and situated on the north-eastern extent of the group (Figure 3.11). Heavily fertile it is the most intensively farmed due to its environmental suitability for agriculture. It is positioned on the eastern extent of the North Isles between Eday to the west, Stronsay to the south and North Ronaldsay to the north. Its name derives from its of long stretches of beaches, dunes and bays. Early Norse settlers named the island *Sandey* or *Sand-øy* this later became "Sanday" during later periods when the islands become English speaking. Despite the myriad of gently sloping beeches the island is notoriously difficult to navigate by sea due to many shallow reefs and rocky subsurface seascape hence the distinctive Start Point lighthouse built in 1807 is an imposing modern feature. That said there are many sheltered bays that would have attracted prehistoric mariners at least these who were familiar with the nuances of the local waterways. The geomorphological processes that created this coastline and were responsible for the agriculturally valuable machair formations will be explored in more detail later in this chapter. Sanday has a notable archaeological record with the earliest activity being recorded in the southwest of the island from the Mesolithic (Wickham-Jones *et al.* 2018). The chambered tombs at Tresness (Anderson-Whymark and Cummings 2019; Davidson and Henshall 1989, 163) (Figure 3.12a) and the passage grave at Quoyness (Davidson and Henshall 1989, 154) (Figure 3.12b) situated on adjacent promontories within sight of each other are examples of early and late Neolithic chambered cairns on the island. Settlement has also been well accounted for with the Tofts Ness excavation (see Dockrill *et al.* 1994), Pool Bay (see Hunter 2000; 2007) and the more recent Cata Sand (Cummings *et al*. 2017) (Figure 3.12c).

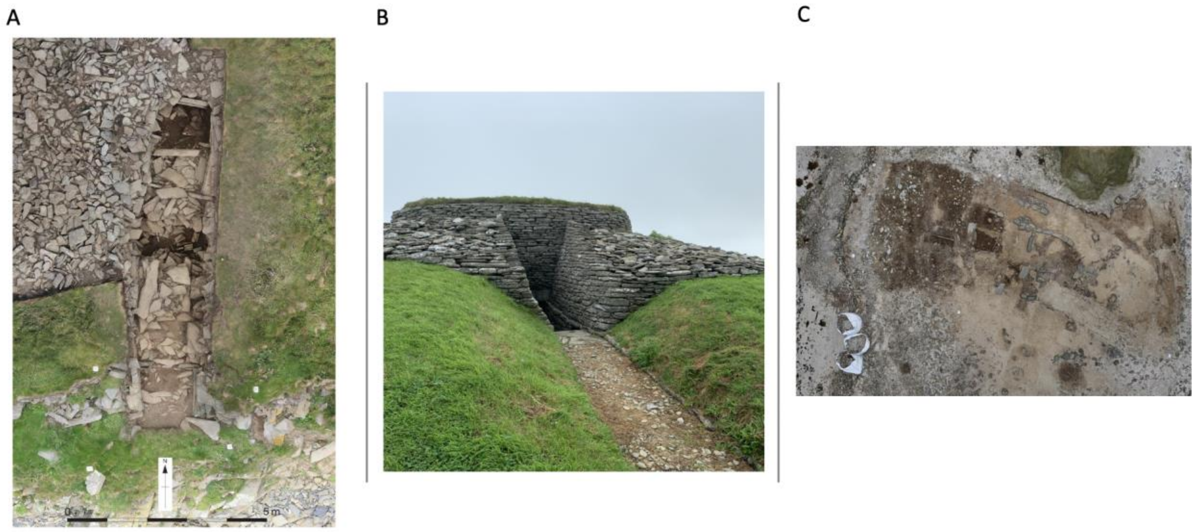


Figure 3.12. a - Photograph of Tresness chambered cairn (Anderson-Whymark and Cummings 2019); **b -** Quoyness Maeshowe type chambered cairn (Authors own image) and **c -** plan photograph of the early Neolithic house at Cata Sand (Cummings *et al.* 2017).

Stronsay

Stronsay is another fertile island of 33 km^2 in area situated some 3.5 km south of Sanday although there is a smattering of smaller uninhabited islands situated between the two (Figure 3.13). It is the easternmost landmass and like Sanday it is very low-lying fertile landform which attracts its population of farmers and fishermen. The highest point being Burgh Hill which stands at 46m above sea level.

Figure 3.13. Digital satellite photographic image of Stronsay (main Island) and Papa Stronay (NE) Legend as fig 3.4 (annotated Google Earth Pro).

Stronsay has three Orkney-Cromarty chambered cairns and three further burial monuments of uncertain classification one being Earls Knoll on Papa Stronsay a small island 0.7km^2 that is currently inhabited by a community of Transalpine Redemptive monks. Today it can only be accessed by boat – though this has not always been the case and its status as an island will be looked at in more detail later.

Figure 3.14. Digital satellite photographic image of Stronsay (main Island) and Papa Stronay (NE) Legend as fig 3.4 (annotated Google Earth Pro).

North Ronaldsay

North Ronaldsay has a total area of 7km^2 and is most isolated island and situated at northern extreme of the archipelago (Figure 3.14). It lies further north than the southern tip of Norway and it is within sight of Fair Isle which in turn sits within sight of Shetland, a fact that will have had some implications for early migrants. Like many other of the northern isles it has a flat topography with high point of 20m. To date there has been no evidence of Neolithic activity on the island though as an observation it is more likely that such evidence has not yet been discovered.

Geology and geomorphology and use of the land

Throughout the Holocene human activity has had its part to play in shaping the landscape as we see it today but forces far more influential have been at play for millions of years. An understanding of the islands natural history is essential if we are to best formulate narratives as to how people from the Neolithic lived and worked the land. The bedrock geology is influential for its supply of appropriate building materials, the superficial or surface geology will also play a part in the suitability of land to base a society upon and determines if the land is viable for arable or pastoral farming practices. Other natural process will be detailed in this part of the chapter. It will explain the glacial activity and how erosion of the landscape and sedimentary deposition processes upon its coasts have shaped the islands. By ascertaining and understanding **where** Neolithic people lived, we have a fundamental basis for understanding **how** they lived.

The Bedrock geology

The underlying geology (Figure 3.15) of these islands is predominantly of the upper and middle Devonian periods dominated by flagstones and sandstones (Davidson and Jones 1990, 10). These rocks belonging to the Caithness Flagstone Group (Mykura 1976; Fletcher 1996) and were laid down 400 - 380 million years ago (Wickham-Jones 2013, 4). At this time Britain was positioned c.10° south of the equator as part of the post-Pangaea supercontinent that incorporated modern day Europe and North America. These Devonian geological formations were created in rivers and fresh water lakes in a basin called Lake *Orcadie* with the laying down of silt and gravel deposits (see McKurdy 2010).

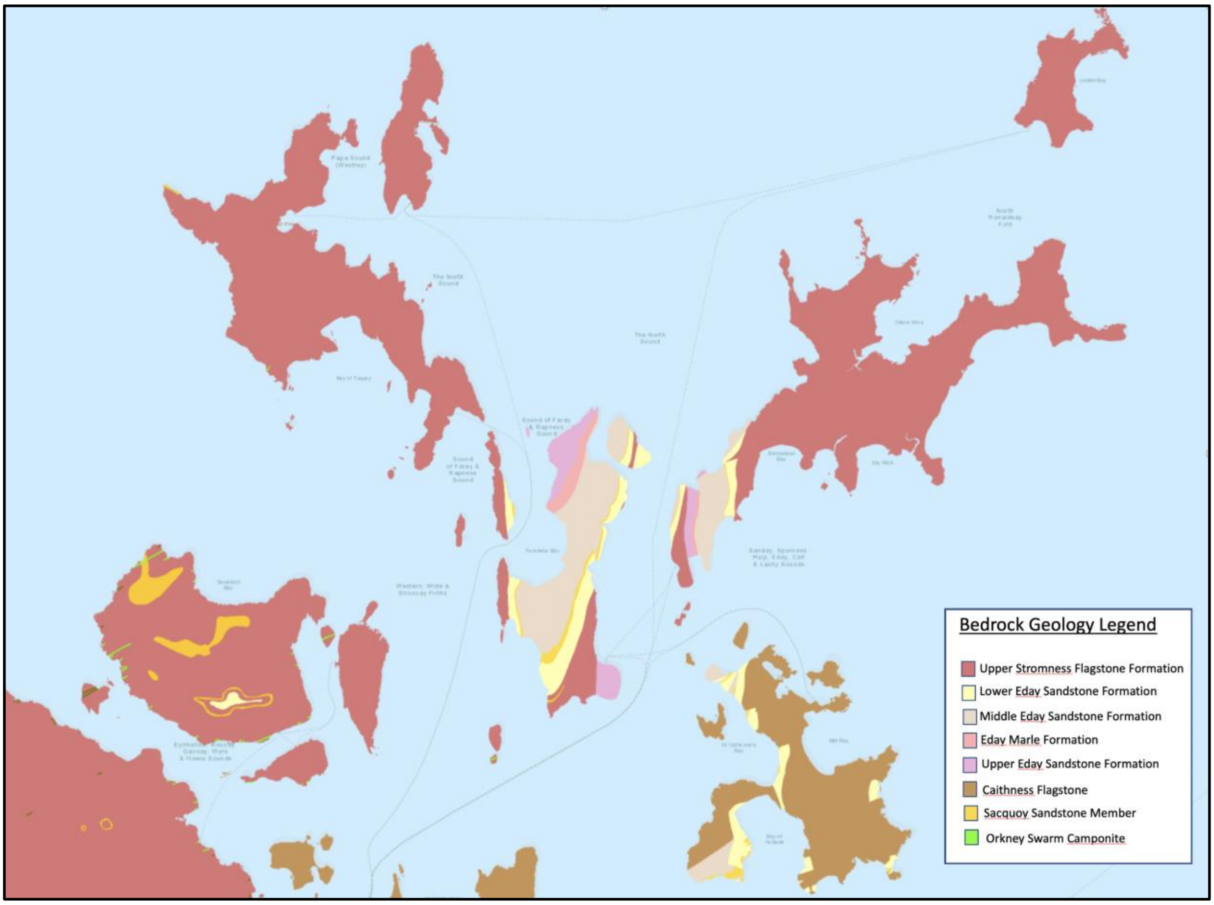


Figure 3.15. bedrock Geology map of the Orkney Islands obtained from the British Geological Survey (http://mapapps.bgs.ac.uk/geologyofbritain3d/).

The more common nomenclature for this geological collective is Old Red Sandstone, a term that is present in many archaeological references to Orcadian geology. Contrary to any suggestion this name may conjure the sandstones are not simply red instead they present in varying hues from darker red through to yellow (Figure 3.16) as seen at the cliff formations in the north of Eday. There is a small diversity in geology on the mainland and Hoy with occasional igneous and granite deposits (Mykura 1976, 97).

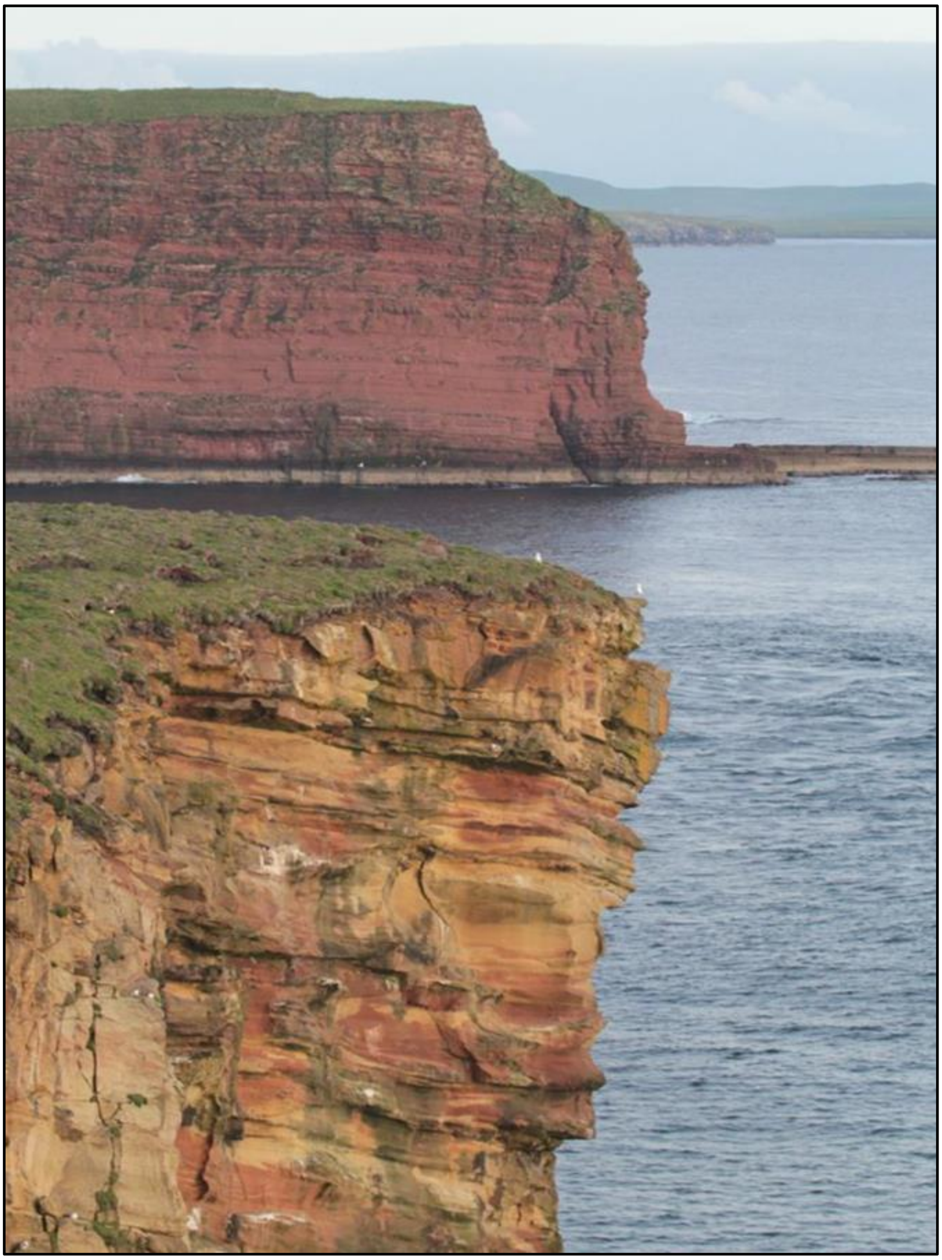


Figure 3.16. Old Red Sandstone rock formations at Red Head cliffs at Eday displaying the varying hues from darker red through to yellow (https://www.nilps.co.uk/area/eday).

Whilst these rocks represent the foundation of the geology the landscape as we see it today has been sculpted by glacial action; the advancing and retreat of glaciers throughout the quaternary glacial epoch or Ice Age (c. 2.5m BP to date) (Shackleton and Hall 1989). This period is formally divided into two intervals or sub eras (Hedberg 1976). The Pleistocene (c.2.5 - 2.6m BP to 10k BP)– meaning '*most recent'* and the present epoch the Holocene (10k BP to date) – meaning '*wholly recent'* (Lowe and Walker 2014). Many glaciers have come and gone during this time with the Last Glacial Maximum (LGM) around 18000 BP (McKurdey 2010, 22). Since then the land has changed and human development has evolved more quickly than any other period. The glacial processes since the LGM have eroded and sculptured the Orcadian landscape into the gently rolling and predominantly low-lying archipelago of today. Sea levels have changed considerably which means there has been much more land in the earlier pre-Neolithic prehistoric past (Wickham-Jones *et al.* 2018).

Figure 3.17. Photograph of an abandoned monolith that has been matched to the great stone circles of Orkney. This quarry is Vestra Fiold on mainland Orkney (Richards 2013, 129 fig 5.28).

One of the key characteristics of these types of rock it that it is relatively easily quarried from many outcrops across the islands like the one at Vestra Fiold on Mainland (Figure 3.17) with a monolith that has been geologically matched to the great stones at Ring of Brodgar and Stones of Stenness on mainland (Richards 2013, 128). In addition to its ready availability once quarried these rocks are easily split and shaped into angular and regular stones. These flagstones are fundamental to early Orcadian settlement and chambered tomb architecture.

Surface geology and geomorphology

An understanding of geomorphological depositional and erosional influences over the millennia are critical in an interpretation of the past landscapes. In addition, human activities have had an indirect influence on the geomorphological processes. Woodland clearance and its effect of hillside runoff and the consequent transfer of sediments and the relocation and cultivating plants and animals all have a geomorphological footprint.

A chambered tomb sat precariously on a cliff edge today may have been many meters in land. Today climate change is an ever present and it would have had no less an impact on the lives of Neolithic Orcadians.

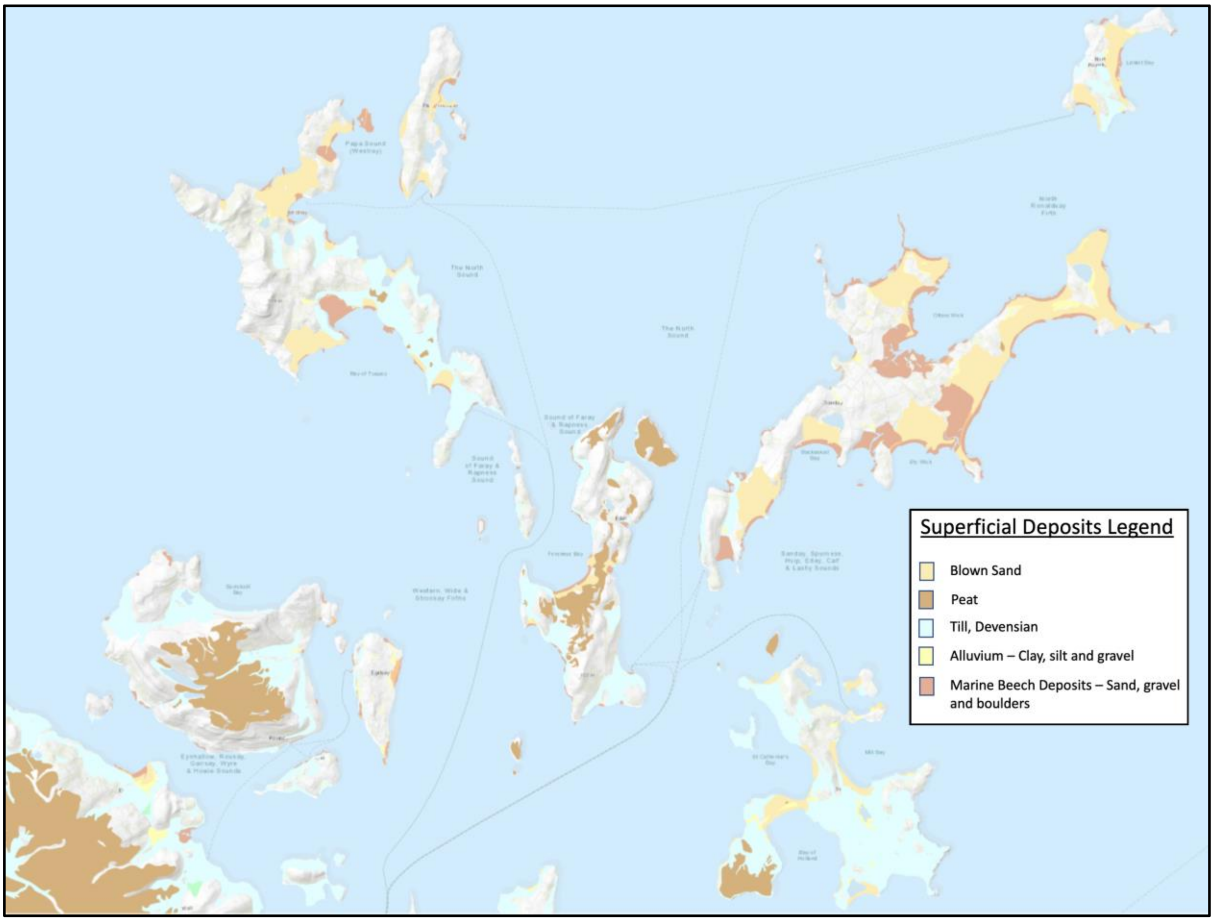


Figure 3.18. Surface or superficial Geology map of the Orkney Islands obtained from the British Geological Survey (http://mapapps.bgs.ac.uk/geologyofbritain3d/).

The surface geology of the Northern Isles does show some diversity (Figure 3.18) and comprises of glacial till, peat, wind-blown sand and beach deposits from offshore erosive processes. The glacial till often referred to as boulder clay was formed by the entrainment and erosion of unsorted material following the LGM (see McKurdy 2010). It is made up of clay material and boulders of varying size and angular and sharp rock fragments as opposed to smooth and worn rocks associated with transport by water. Deposits of till can be noted in the stratigraphy on all the northern islands group with extensive deposits on Westray and Stronsay. Till is very fertile and as such is important for arable agricultural practices (Clouston 1927).

Peat is a common superficial deposit especially within the northern isles as depicted at Figure 3.18. Detailed knowledge of peat throughout the islands is less than extensive and has been formulated from investigations within known archaeological sites see Skara Brae (Clarke 1976a; Shepherd 1996), Tofts Ness (Dockrill *et al.* 2007) and Pool (Hunter *et al.* 2007). These studies have tended to focus on the localised site-specific analysis and have rarely extended beyond. There have also been several studies utilising peat core samples (Bunting 1994 1996; Keatinge and Dickson 1979; Farrell 2009). These works have shown that most of the peat formation occurred towards the end of the Neolithic period (Berry 2000:70; Davidson *et al.* 1976). Peat is widespread in Orcadian upland environments and is particularly prevalent within the northern group on Westray, Rousay, Stronsay and Eday with the Calf of Eday having a extraordinary coverage laid to a depth of between 50cm and 100cm (Consultant 1988, 18). It is likely that the extensive peat coverage on Eday is blanketing the landscape and having a detrimental effect on archaeological visibility and therefore investigation on Neolithic activity is problematic in heavily peated areas (Farrell 2009, 21). Another form of peat deposit is coastal or loch peat where once vegetated land has been inundated by water to completely change the ecological environment of the landscape and will be discussed later when considering the paleoenvironmental character of Orkney.

Wind-blown sand and the deposition of offshore eroded sediments have also played their part in the changing shape of the northern islands. On Sanday this is particularly prevalent (Davidson and Jones 1990) and undoubtedly had its part to play in the naming of the island. In geological terms the changes made by such deposits are rapid and over a few short millennia landscapes can be completely altered. Figure 3.19 shows evolutionary modelling of an environmental system called machair that has its history in coastal windblown sand deposits and provides a beneficial landscape conducive to early farmers requirements.

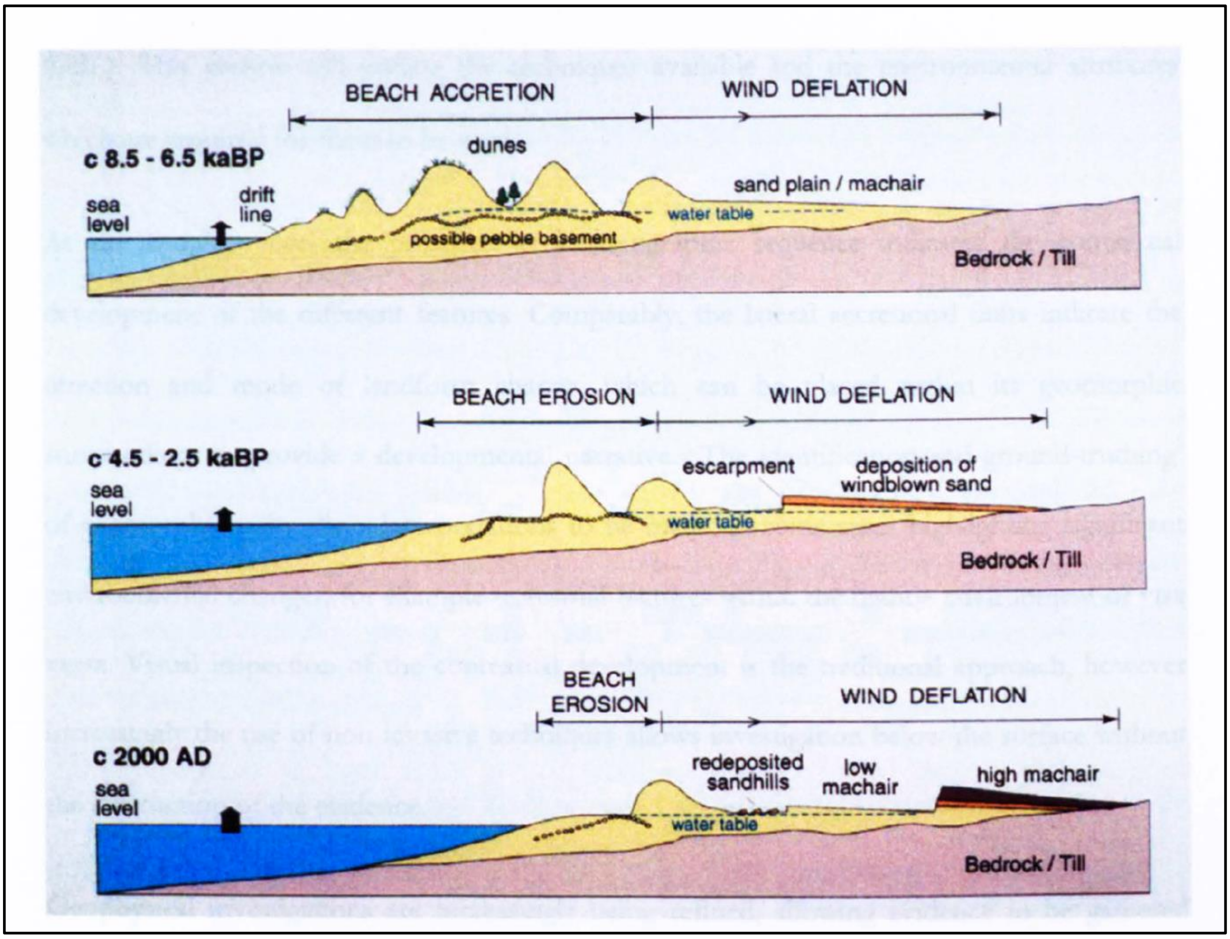


Figure 3.19. An evolutionary model of machair formation from c. 6500 yBP to date (Hansom and Angus 2001).

Machair is a landform system and environmental phenomena unique to the north and northeast of Scotland and Ireland but also in the North Isles of Orkney which have been locations favourable to human activity in the Holocene (Hansome and Angus 2001) (Figure 3.19). They are located within cooler climates adjacent to the sea and typically occur on low-lying sandy coastlines in association with dunes. Diagnostically there are two features that typify these landscapes. First, they contain wind-blown sand. The significance of this is that it is shell rich and consequently contains high levels of calcium carbonate which is a natural fertiliser (Edwards *et al.* 2005). The second defining feature is a sheltered location and therefore protected from eroding processes (see Richie 1979). Figure 3.20 shows the extent of machair landforms in the Orcadian North Isles group. It has a widespread presence across these islands with Eday being the only exception though it should be noted that such sites have been difficult to model due to their susceptibility to coastal erosion and other geomorphological processes. Machair environments and other drift superficial deposits are not consistently depicted on geological mapping.

The natural fertilizer that these environments contain and the rich diversity of wildlife that are attracted to these areas made them an attractive place for the prehistoric Orcadians. A recent study of such machair environments in Benbecula and Grimsay in the Outer Hebrides suggest an anthropogenic role in their formation and development dating their presence to c. 5730 cal BP (Edwards *et al.* 2005). Similarly, an Orcadian example form the Bay of Skaill dated the machair formation to c.4950 BC (de La Vega Leinert *et al*. 2000). The former work was able to conclude that human activities such as the grazing of animals and the removal of hazel shrub may have had an accelerating and determining influence on the creation of these environments (Edwards *et al.* 2005). It has been further suggested that the machair environments were at their 'healthiest' around 4-3ka BC (Rennie 2006, 247). In short, the potential for Neolithic activity in and around these environments is noteworthy for the planning of future archaeological investigations and will be discussed in detail in chapter 9.

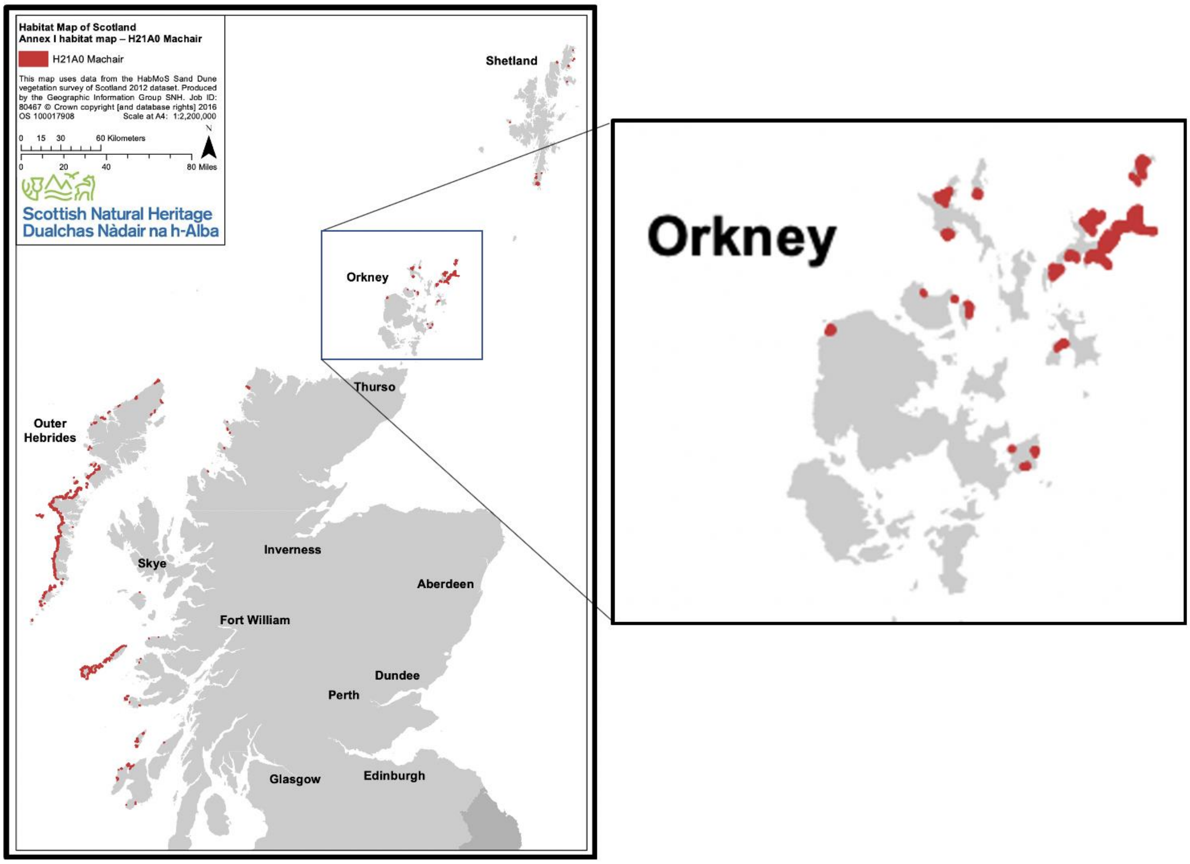


Figure 3.20. Machair environments in Scotland with an highlighted insert showing the distribution in Orkney (Machair Habitat Map of Scotland H21A0 – HabMos Sand Dune vegetation survey 2012)

Exploitable surface geology

Flint as a natural resource was extremely important to prehistoric people due to its technologically eminent suitability for tool making and as such would have been considered valuable to prehistoric culture. The two types of flint that are present in Orkney are the Orcadian flints and those imported by geological processes or people from elsewhere. There are no *in situ* flint source sites in Orkney or Scotland in contrast to its abundant availability in the south of England where its importance and use is richly evidenced as part of prehistoric narratives. There are, however, occurrences of flint and chert in nodule form in deposits of flint gravels and in some of the islands glacial till beds (Wickham-Jones and Collins 1977, 7). Figure 3.21 maps the distribution of flint and chert across Orkney (after Wilson *et al.* 1935). For flint the study details only three locations where there are known sources in Orkney (Wickham-Jones and Collins 1977, 10). At the southern aspect of North Ronaldsay chalk flints contained within boulder clay have been identified and these sources bare some similarities to those found in Aberdeenshire and Banffshire (Wilson *et al*. 1935, 105). Further, sites on Swona and Stroma have produced rounded flint pebbles across the islands (Wilson *et al.* 1935, 123).

Chert sources have been identified as exposed within sandstone prevalent throughout Eday with a highlighted example exposed at Eday Sound (Wilson *et al.* 1935, 102). On the mainland the Stromness flagstone on the western coast an example being close to Noust of Nethertown (Mykura 1976, 74; Wilson *et al.* 1935,) and sources within the boulder clay to the north of Shapinsay (Wilson *et al.* 1935 113).

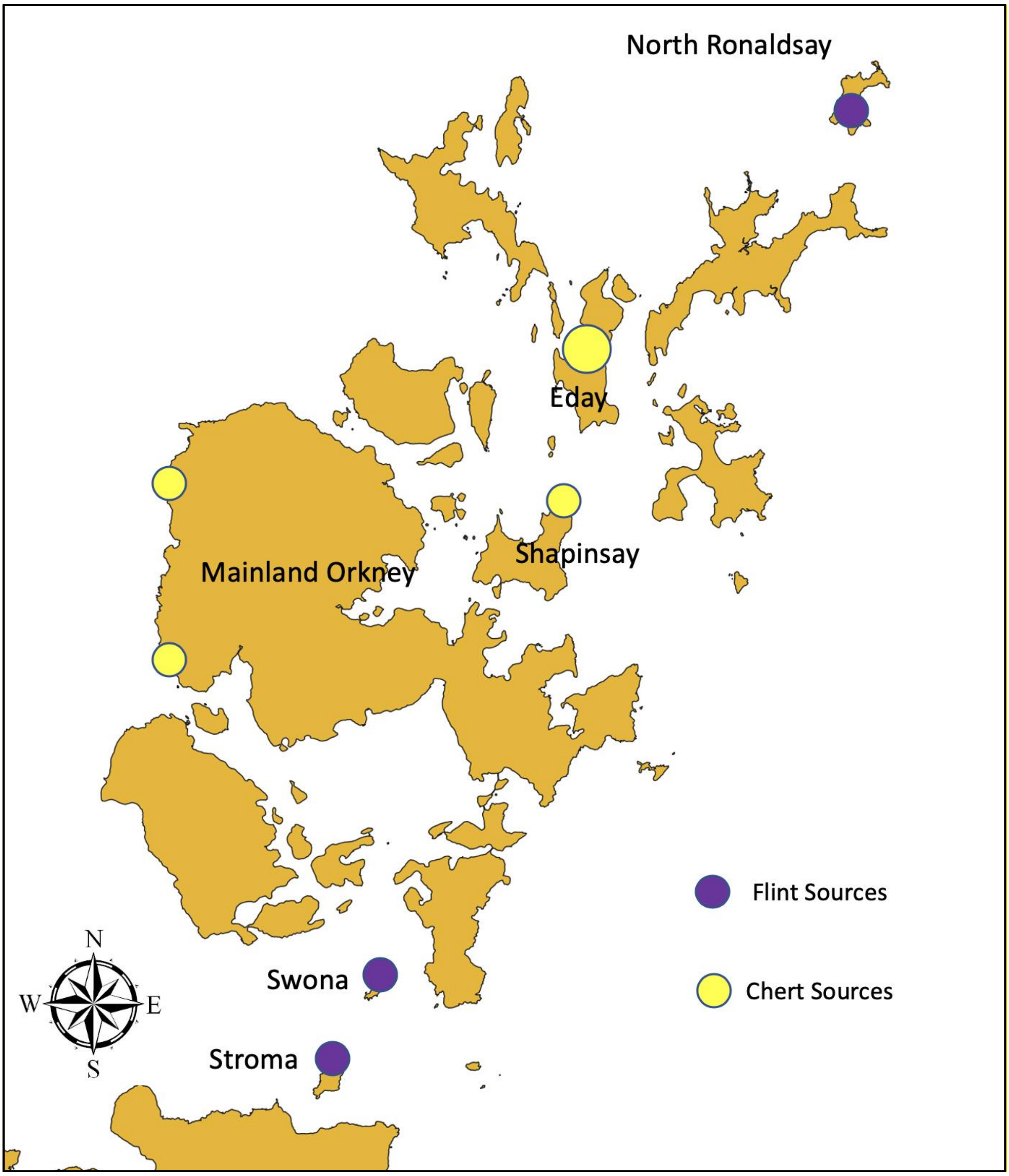


Figure 3.21. The distribution of flint and chert across Orkney (after Wilson *et al.* 1935).

In addition to these identified glacial till laden sources flint is readily found on many beaches and as such ancient Orcadians frequently utilised these beach flint pebbles in tool manufacture (see Clarke 2006). It has been established that there are deposits off-shore (Gemmel and Kesel 1979, 66) with one substantial source being a large submarine outcrop located c. 20-30 km east of Orkney in the North Sea (Wickham-Jones 1977, 7). Nodules from this and similar deposits have been repositioned onto beaches as the direct result of the submarine erosive processes that will be discussed later. It has also been suggested that some of it may have been transported to the coast in the roots of drifting seaweed (Piggott and Powell 1949, 160). Furthermore, as a likely consequence of marine erosion and glacial activity upon these deposits the quality of the flint was affected and its suitability for human technological exploitation was poor in stark contrast to other areas of Britain. Consequently, Orcadian flint tool artefacts were often described as being of the crudest form (Lacaille 1954, 269). A new and extensive study of lithic artefacts in Orkney '*The Working Stone Project'* (see Edmonds *et al.* 2021) has been able to refine our understanding. As part of this work substantial fieldwalking surveys across some 300 Orkney beaches was carried out and concluded that contrary to previous findings flint is (and was) a readily available resource across the islands. The study hypothesised that Orcadian flint may well have been in such abundance that it is possible it may have been exported to other near mainland Scotland communities. Despite glacial till being prevalent across the whole of the islands Figure 3.22 demonstrates that the eastern facades of the island are the locations where flint is most prevalent, likely due to the submarine deposit to the east. In the northern isles the deposits were concentrated most in the north east of Orkney at North Ronaldsay, Stronsay, Sanday and Eday, though other less dense concentrations were found on Westray and Papa Westray.

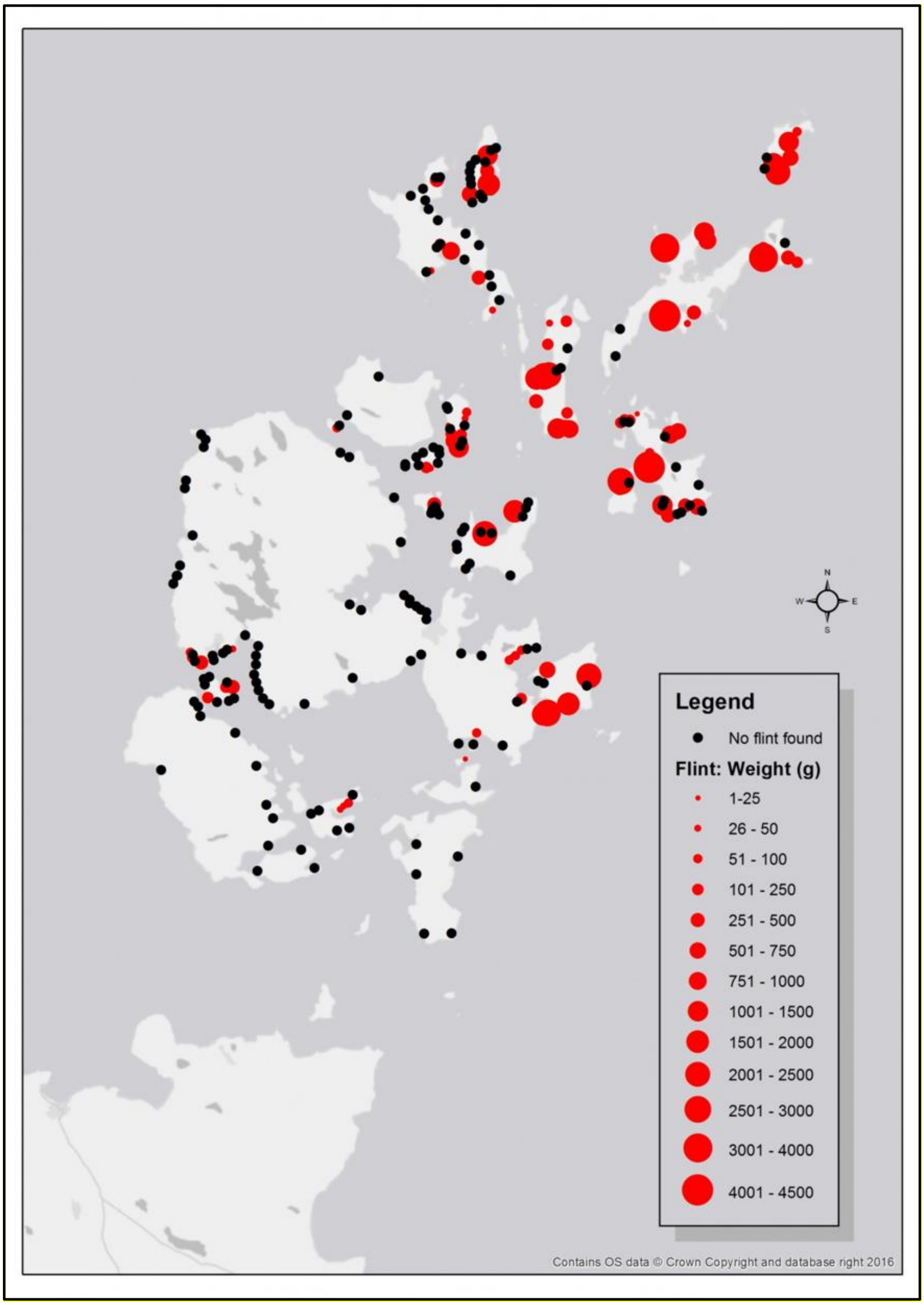


Figure 3.22. Distribution map of beach flint finds following field surveys as part of the working stone project (Edmonds *et al.* 2021) (https://www.orkneystonetools.org.uk/themes/raw-materials/sedimentary/orcadian-flint).

Land use in prehistoric Orkney

Recent paleoenvironmental studies that have helped refine the narrative as to how the island looked in prehistory. The early interpretations described the islands being covered in birch-hazel scrub woodland during the Mesolithic which pollen analyses suggested a gradual decline in the 5th millennium BC (Davidson and Jones 1985).

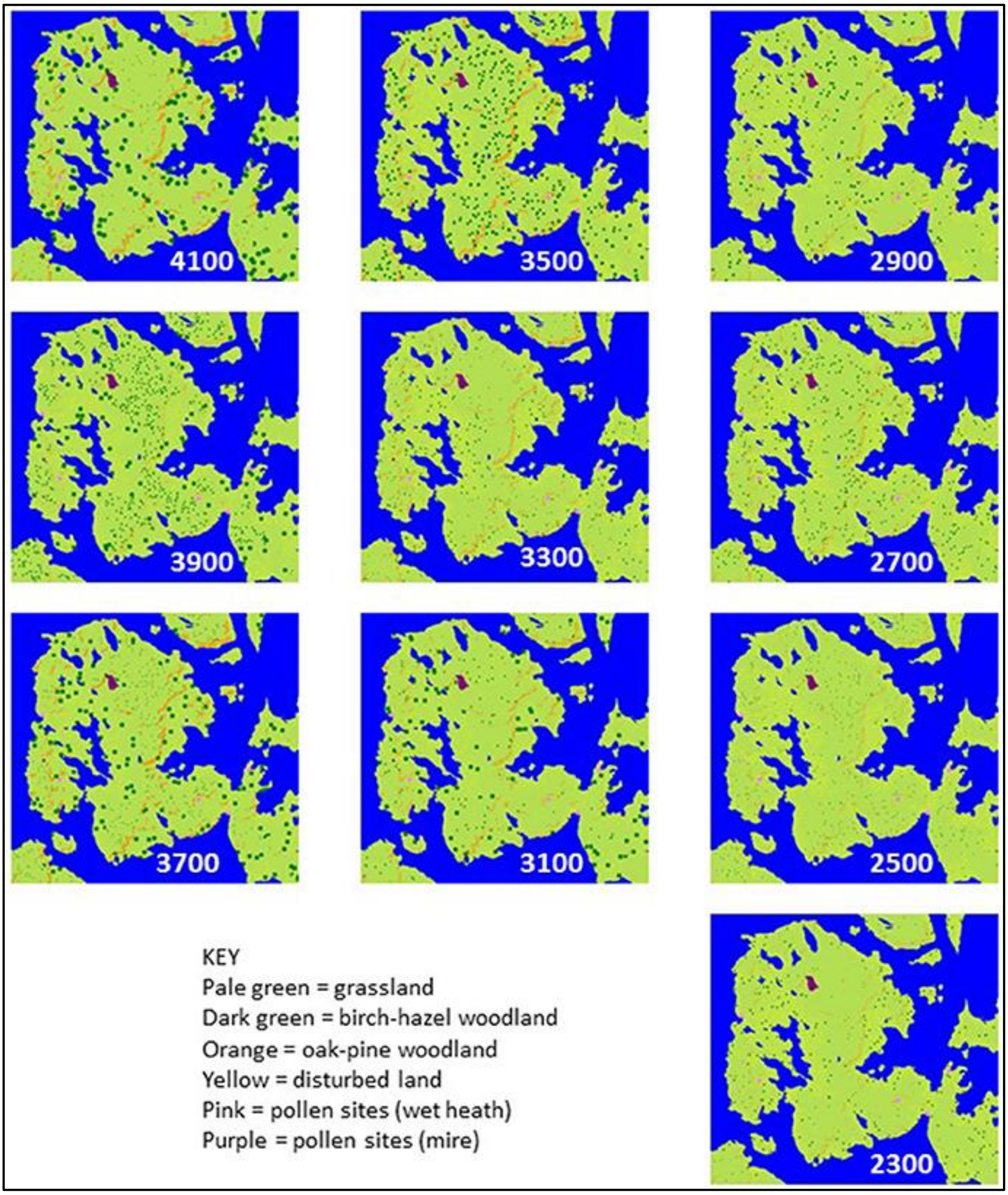


Figure 3.23. A graphic modelling the vegetative coverage in 200 year time slices between 4100-2300 cal BC (Bunting *et al*. 2018).

Eventually the arboreal landscape did succumb to the activities of the earliest farmers who almost entirely cleared the land for agriculture within at most a few hundred years at the onset of the Neolithic (Davidson and Jones 1985; Dickson 2000; Tipping 1994). A counter argument identified that some woodland remained present until the Bronze Age (Farrell *et al.* 2014). The latest studies undertaken combined data from paleoenvironmental (Bunting *et al.* 2018) and archaeological dating (Griffiths

2016; Bayliss *et al*. 2017). Figure 3.23 shows the *"plausible"* reconstructions within 200 year temporal slices between 4100-2300 cal BC which was able to model the vegetative coverage during that time (Bunting *et al.* 2018). It suggested that at 4200 BC 12% of Orkney was wooded. The most intense period of Neolithic settlement according to the archaeological record was between 3600-3400 cal BC (Bayliss *et al*. 2017); dates which coincided with the most intense period of landscape change. The Bunting study demonstrated in a more focussed way that the environment was not completely devoid of trees. Whilst it remains likely that human clearance activity for agricultural reasons was the main contributing factor to the decline of woodland it must be noted that during the early Neolithic period land disturbance from farming practices accounted for only 4% of the total available land (Bunting *et al.* 2018). A notable change in tree cover coincides with the period that covers the transition from wooden domestic structures to that of stone and also the construction of the first chambered tombs (Bayliss *et al.* 2017). The model also shows a marked prevalence for grassland which would be conducive to findings that the Neolithic Orcadian farming strategies relied heavily on cattle grazing (Card *et al.* 2017; Mainland *et al*. 2014). Such strategies would not have required the extensive land clearance.

Recreating that palaeoenvironment in Orkney is a growing research area and sets to refine previous narratives. It remains the case that limited modern studies have been conducted in the North Isles but they are not completely devoid of mention. In 1893 Walter Trail Dennison an Orcadian antiquarian wrote of Otterswick Bay in Sanday "*There can be no doubt that we have here the remains of trees that have one time grown and flourished at a level considerably above their present position. And this is no isolated instance of submerged trees being found in Orkney*" (Dennison 1891). By utilising all available data Figure 3.24 has modelled the submerged forests that have been identified from surveys of peat in coastal locations in relation to the modern map of Orkney and the Mesolithic (Timpany *et al.* 2017).

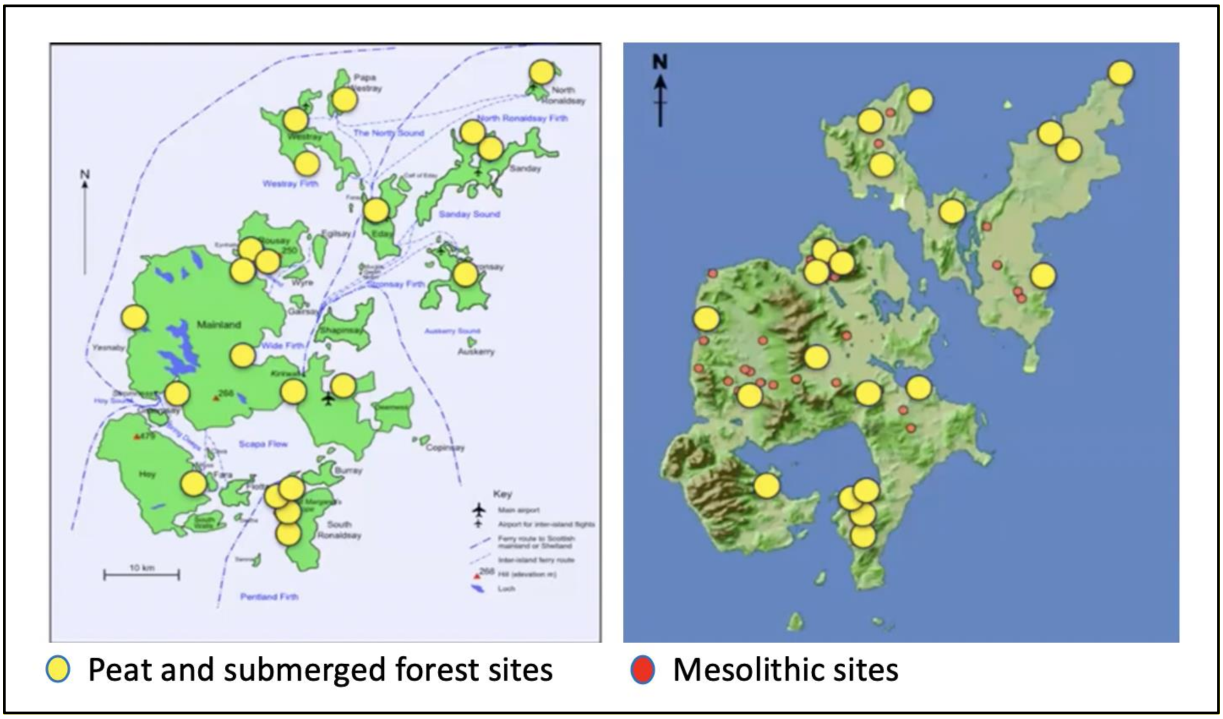


Figure 3.24. Modelling showing peat and submerged forest sites (yellow) overlain with the early Mesolithic sites (red) (Timpany *et al.* 2017).

These peat remnants have had a preserving effect on environmental evidence that has proved invaluable in concluding the type and density of woodland. It will be noted that when these sites are overlain with the early Mesolithic landscape (Figure 3.24) they are not all situated on the coast. This is likely to be a result of methodological strategies which mean coastal sites are the most easily recognisable locations to identify such past environments. Recent work on submerged forests within intertidal and loch peat sites in mainland Orkney has been able to reconstruct the landscape even further, albeit in an ostensibly localised manner (see Timpany *et al.* 2017). The study centred on the Bay of Ireland in Mainland Orkney reconstructed aspects of the landscape to a detailed level. Figure 3.25a shows the paleoenvironmental analytical diagram of this location. These data clearly demonstrate changed in the environment around 3500 BC with the location changing to a freshwater loch environment from woodland.

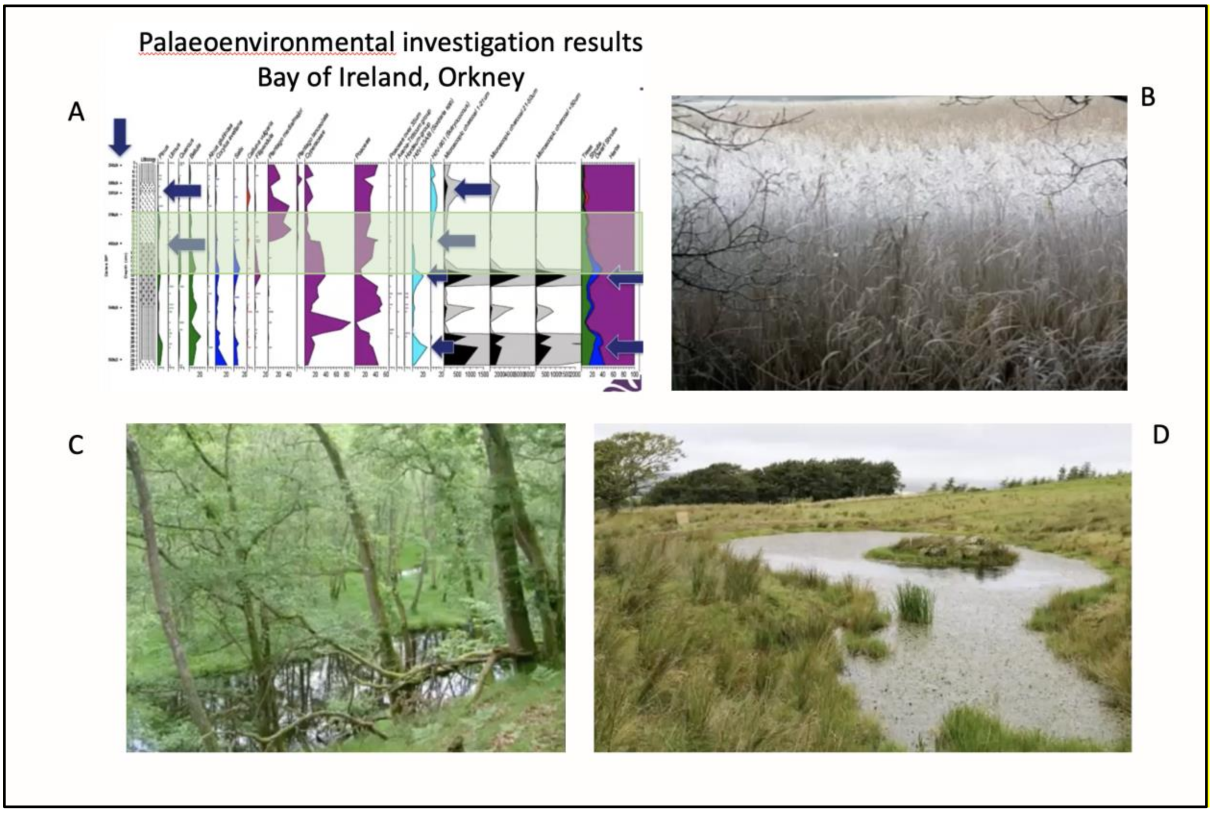


Figure 3.25. **a** - The paleoenvironmental analytical diagram of this location); **b-** The suggested landscape changes from the Mesolithic; **c** - The suggested wooded environment of the late Mesolithic and early Neolithic; **d**– the later Neolithic fresh water loch landscape (after Timpany *et al.* 2017).

This has been established by distinct changes in sedimentary cores, pollen occurrences, increases in algae and the presence of freshwater diatoms (Timpany *et al.* 2017). Figure 3.25 b-d- (inclusive) demonstrates the sequence of environmental change in this specific area as evidenced by the paleoenvironmental data analysis diagram (Figure 3.25a). In a few millennia the landscape changes from the Mesolithic era reed swamps (Figure 3.25b) to the wooded environment of the late Mesolithic and early Neolithic (Figure 3.25c) before its transformation into the freshwater loch landscape that was interspersed with islands (Figure 3.14d). It is important to note that these comprehensive works have been focussed on sites on mainland Orkney, though these are within a close spatial range they cannot be conclusive when considering the paleoenvironment of the North Isles.

Modern land use

Agricultural practices have been omnipresent since its onset in the Neolithic and humans have exploited and manipulated the landscape for their subsistence ever since. Today approximately 60% of the land is used for agriculture; sub-divided between improved grassland (60%) rough grassland (35%) and land for arable crops and market gardens (5%) (Consultant 1988, 31).

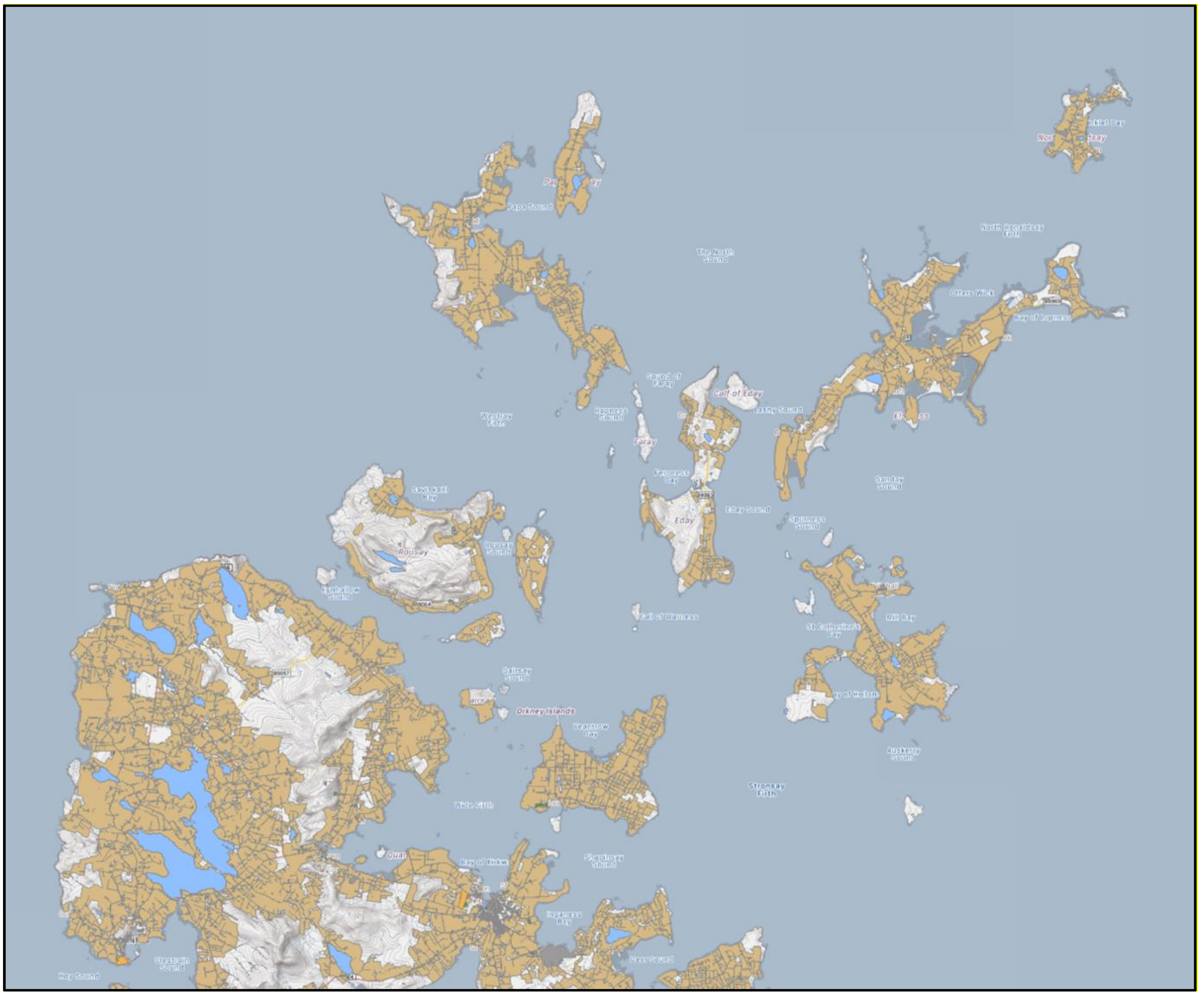


Figure 3.26. Regularly or recently cultivated agricultural land – arable or market gardens https://map.environment.gov.scot/sewebmap/ HabMoS – Other Land use map).

A large proportion of the Orcadian landscape today is used in agriculture (Figure 3.26). Pastoral practices dominate with currently c. 30,000 head of beef cattle and sheep being managed, although arable farming is used it is to a lesser extent (see Farrall 2009). The remaining land is split between heath, moorland and rough pasture that is utilisable for some pastoral farming and other non-agricultural ecological environments such salt marsh, machair and upland vegetation (Davidson and Jones 1985). Many areas of land have been improved over the years for the purposes of agriculture or more pragmatic domestic uses. Locals have exploited the land for peat cutting operations to fuel houses for millennia and have left a legacy of mosaic like marsh and bog areas throughout the modern landscape (Crawford 2000). Agricultural practices on the islands they have remained largely unchanged into the 20th century (Firth 1920) and the collateral benefactor of this situation is archaeology. The use of mechanical and deeper ploughing methods only being introduced in modern times (Davidson *et al.* 1976) and this has contributed to the remarkable prehistoric preservation that the islands enjoy.

The sea

Many chambered tombs have views of the sea, are visible from the sea or are situated on the coast next to the sea and those present in Orkney are no exception (Phillips 2004, 371). The sea is often a backdrop to life and death in the Neolithic (Scarre 2002a, 26) with the coastal areas being of significance to the early Orcadian occupants. It is for this reason that a complete understanding of where the sea and the coast fit into the life strategies of the Neolithic people. Before we can understand how people use the sea in a time without detailed charts and literature, we must first understand how the sea looked and behaved in the past. Sea level change is topical today, but this section will show it was equally if not more important for the people who lived in Orkney in prehistoric times. The changes experienced by the first Orcadians and the first farmers was at a level much more than today and would have seen often detrimental effects amongst prehistoric communities. This part of the chapter will address such issues of sea level, climate and human influenced changes to the landscape.

Relative sea levels

Sea level change and the science behind it is a complex area with several geomorphological processes coinciding temporally and spatially. The Relative Sea Level (RSL) is the area that is important from an archaeological point of view is critical to understand how these changes impacted on the people who lived during these times. Sea level change is not uniform across the globe (see Dawson 2018). There are two influences; glacio-eustasy which is concerned with the sea level changes caused by glacial melt (or formation) activity and glacio-isostacy which is how the earth's crust behaves whilst floating on its underlying mantel (Dawson 2018). The height of the land is significantly impacted when the land is experiencing glacial coverage and the land become depressed into a lower position. First the land where the ice is situated but also the land surrounding the glacier can bulge. During the LGM c.18,000 BP Orkney sat at the very edge of the glacier that covered Scotland and recent investigations have been able to calculate the land that the Orkney sat outside the area for any notable shoreline uplift (Bates *et al.* 2013) (Figure 3.27). Another diagnostic feature which supports the lack of glacio-isostacy uplift operating on Orkney is the absence of raised beaches (Davidson and Henshall 1989, 11) which are prevalent in the Outer Hebridean islands, Skye and Mull (Bates *et al.* 2013).

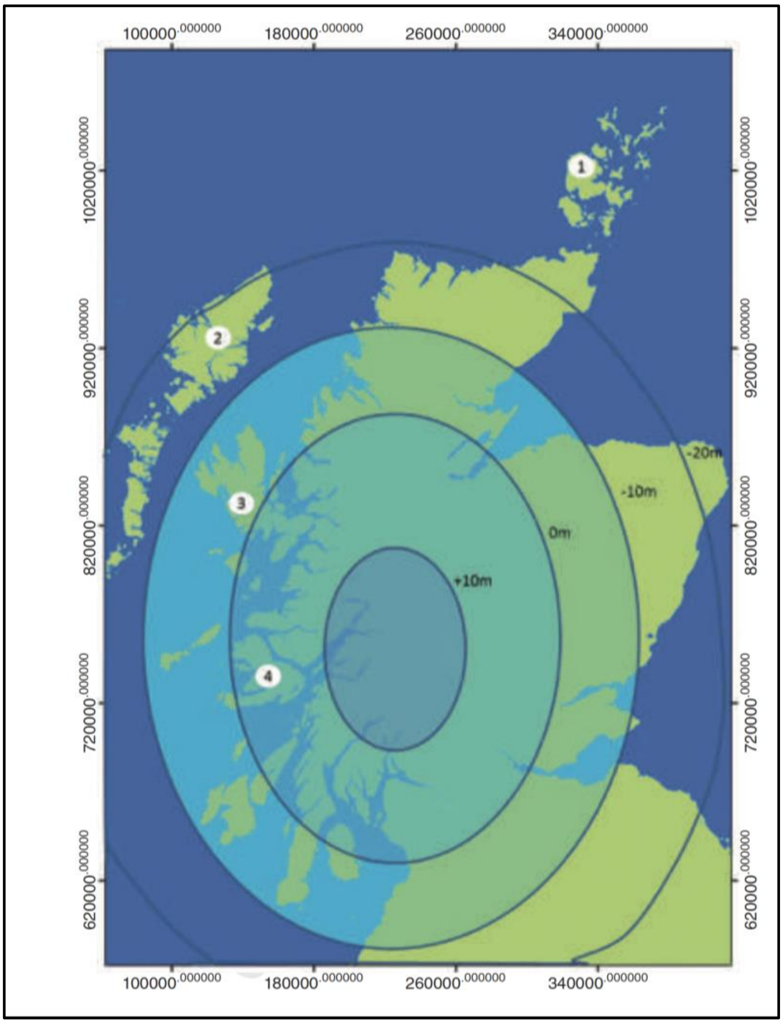


Figure 3.27. Shoreline uplift isobases (m OD) for the main glacial shoreline. 1 Orkney; 2 Outer Hebrides; 3 Skye and 4 Mull (Bates *et al*. 2013).

These theories were first presented by geologist Maclaren in 1841 who determined that as glaciers form the sea level falls as water is drawn up and stored as ice and conversely as they recede and melt the sea levels rise. Maclaren theorised that the sea level would drop 110-130m (Lowe and Walker 2014) during glacial stages this figure has been confirmed by modern ice core analysis (Lowe and Walker 2014). Studies in Orkney are in their relative infancy (Dawson *et al.* 2017) and its position presents a diverse and complex coastline, a legacy of the combined effects of glacial erosive activity and the effects of climate. The complexity is further enhanced by the geographical position of Orkney and how it must endure the coaction of the two major water systems – the Atlantic and the North Sea. The dominant Atlantic seaboard subjects the landscape to strong and therefore highly erosive winds and tides from the west (Dawson *et al.* 2017). In contrast, the North Sea is a relatively shallow body of water that creates complex current movement and consequently the eastern aspect of the islands experience the movement and deposition of fine deposits capable of increasing the land. The Pentland Firth exemplifies this and is often described as the most perilous of seas that witnesses some of the most extreme currents in the whole of the British Isles.

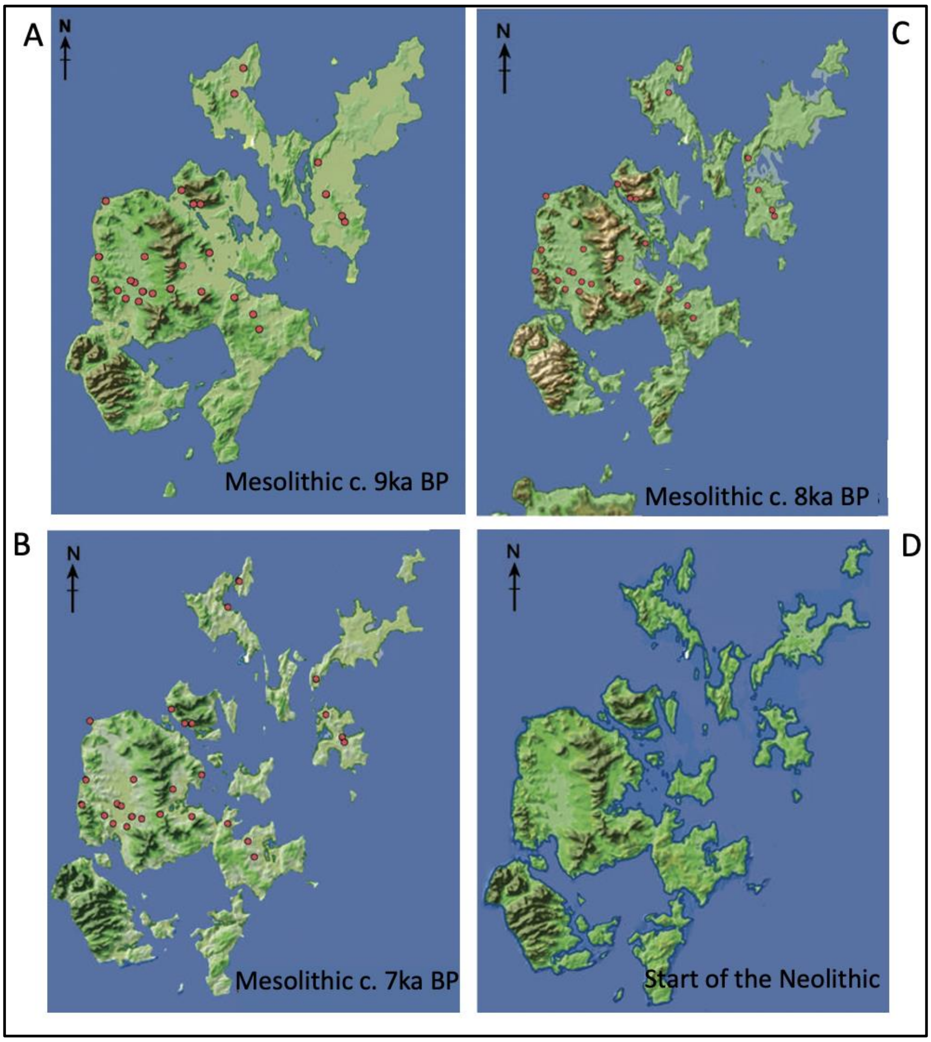


Figure 3.28 – A Digital Terrain Map representation of the Orkney Islands from c.9kaBP to the onset of the Neolithic – the red dots represent known Mesolithic sites (adapted from fig16.4 Wickham-Jones *et al.* 2018 with permission).

Results for early enquiries into sea level change in Orkney have been varied over the years from suggestions that they are within the current tidal range (Fraser 1983) to 5 m below current levels (Lambeck 1991). A study in Sanday in 2006 discovered willow shrubs that had been submerged to a level of -1.6m on today's levels and dated to a millennium prior to the Neolithic (Rennie 2006). Important new work on Holocene sea-level change has been carried out utilising internationally accepted oceanographic methodologies (core extraction and low density sediment analysis together with other geophysical remote sensing techniques) to model changes and produce sea level index points (Dawson 2018, 23). Mesolithic activity in Orkney has already been established though not to any great extent. Figure 3.28 is a Digital Terrain Map (DTM) representation of Orkney from c.9 ka BP to the onset of the Neolithic – the red dots represent known Mesolithic sites (Wickham-Jones *et al.* 2018). What this demonstrates is the significance the Holocene RSL change has had on the land of the Orkney Islands and therefore inevitably on its occupants. Between 9000 BP and 7000 BP RSL rose c 10cm every generation (Wickham-Jones *et al.* 2018). By the start of the Neolithic the RSL was in the vicinity of -2 m OD then rising to achieve current levels c. 4500 BP (Dawson and Smith 1997; De la Vega *et al*. 1996; 2000; Morner 1980; Phillips 2002, 265) (Figure 3.29). It follows that it is entirely possible that early Neolithic sites may well today be submerged but at the very least positioned in locations looking very different than they do today (Wickham-Jones *et al.* 2018).

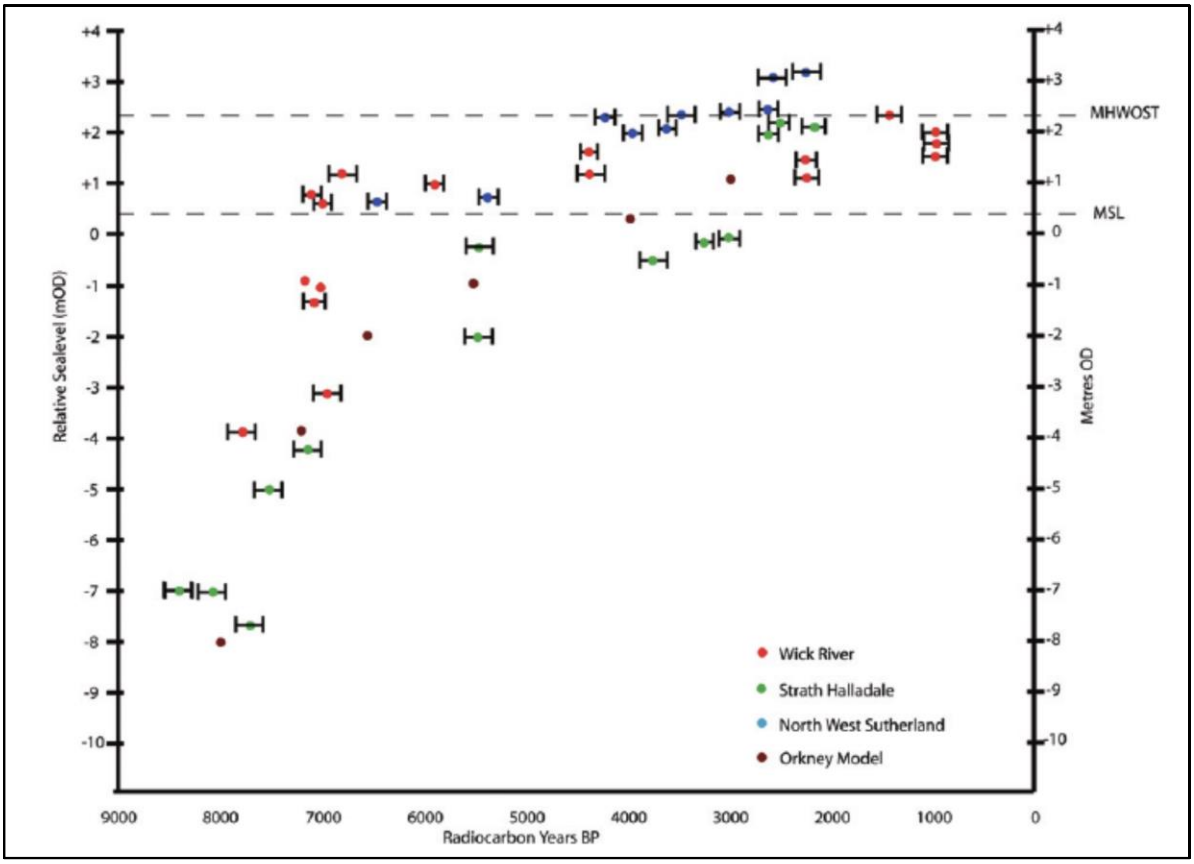


Figure 3.29. Sea-level reconstruction for Orkney and other areas in Scotland after Morner 1980; Dawson and Smith 1997; De la Vega *et al.* 1996; 2000.

Figure 3.30 shows a representation of Orkney with a -2 m OD RSL (Philips 2004, 376). A more focussed representation of two North Isles examples with the same -2m RSL can be applied depicting them in contrast to how they are presented today (Figure 3.31). Both examples are islands today though in the Neolithic Papa Stronsay, with the Orkney-Cromarty tomb Earls Knoll, was attached to Stronsay. Similarly, the Holm of Papa Westray with its three tombs was attached to Papa Westray as a promontory location. These findings have been suggested by previous commentators (Brown 2003, 20; Richie *et al.* 1983, 59; Sturt 2005, *fig* 7.4) but now with the application of the most recent evidence it seems clearer that modern islands that contain chambered tombs may well have been connected to their parent island or at the very least readily accessible at low tide. Instead of seeing these cairn locations in island settings they should now be considered as sited upon peninsulas – these small details have the potential to refine interpretive narratives of the landscape locations of chambered tombs. This same methodology will be applied later in chapter 8 to the coastal change around Rousay with Egilsay and Wyre.

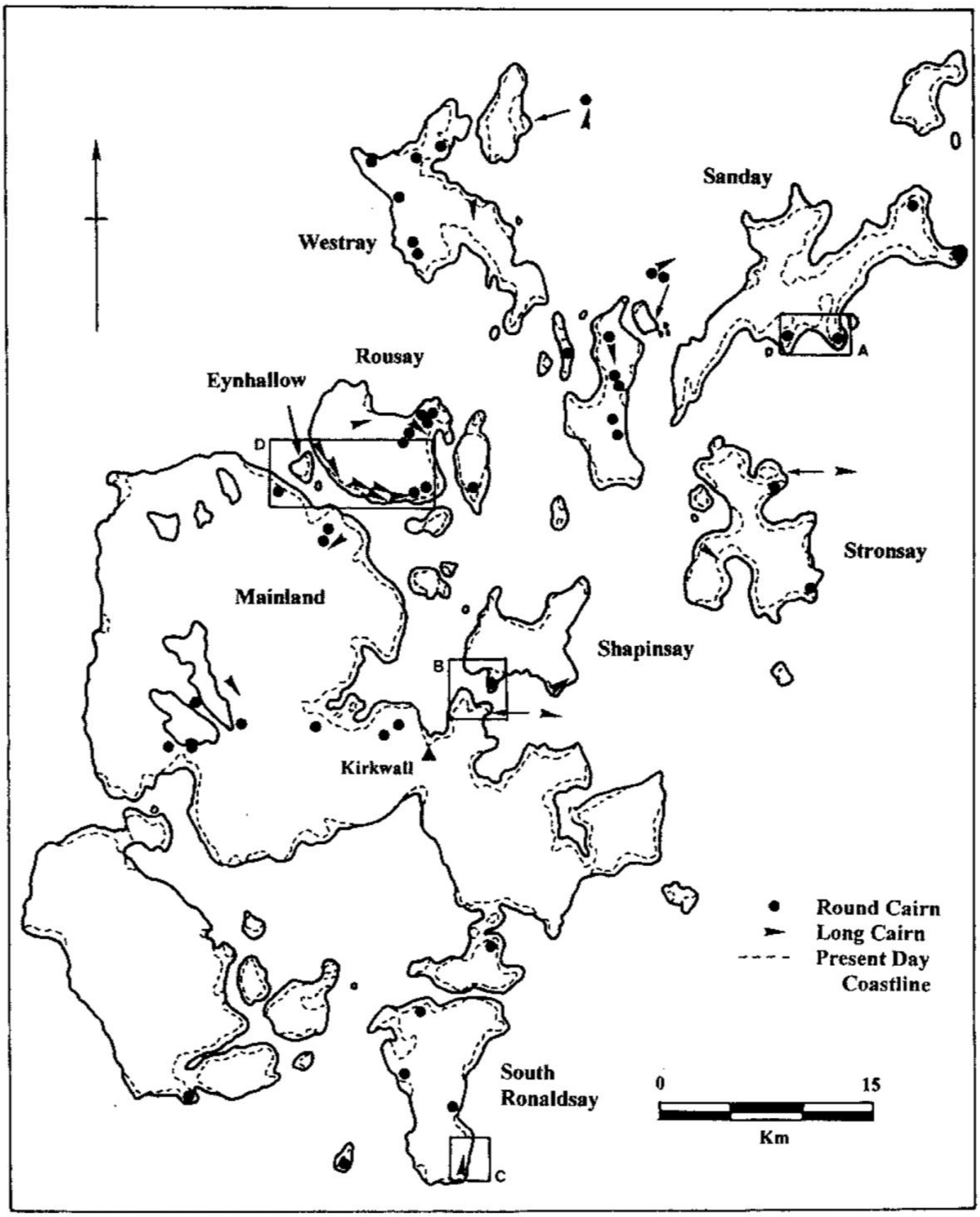


Figure 3.30. A map representation as to how the land would look if a -2m RSL was applied (Philips 2004, fig 3).

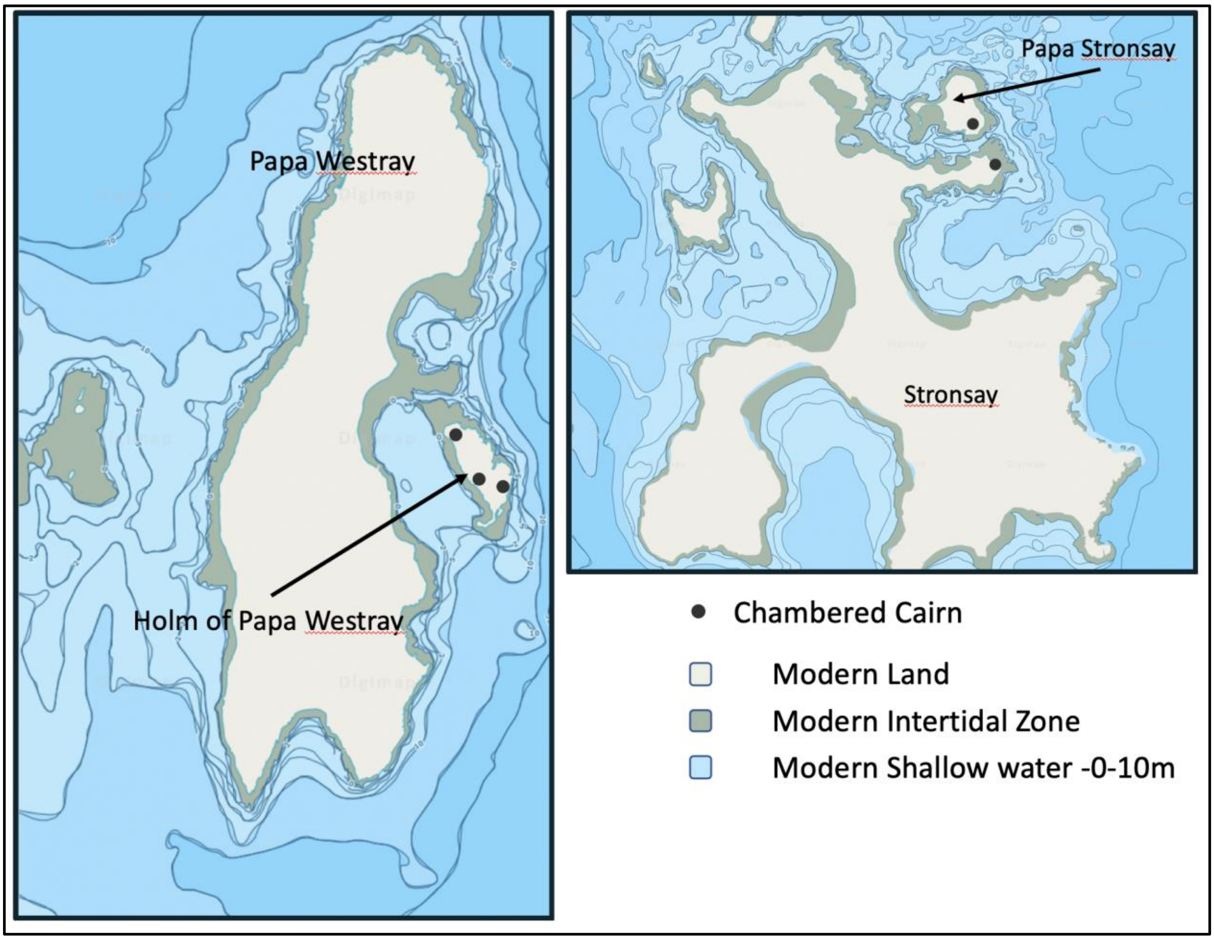


Figure 3.31. Modern marine contour charts of Papa Stronsay and The Holm of Papa Westray and their relationship to their parent island. If the 2m submarine contour is traced it can be clearly seen that these were islands in the Neolithic. Base map (https://digimap.edina.ac.uk/marine. under licence) and annotations by author.

Coastal erosion

RSL is not the only issue to that informs our understanding of the sea. Coastal erosion has had and will continue to have its effects on the islands and landforms (Miller 1976, 32) though broadly the landforms of the Britain of the Neolithic will be similar to today with more localised changes that will have had its impact on prehistoric seafaring (Mc Grail 1993, Garrow and Sturt 2011, 62). Erosive processes can also play out in the submarine environment and as we have seen has an effect of depositing sediments and forming new landforms or shaping earlier ones. The irony of this situation is that erosive processes are creating additional landforms in certain places.

Coastal erosive effects have been responsible for the uncovering of any number of archaeological sites from numerous periods (Richards 2005, 7). There are complex processes at play and by nature are localised to the extent it requires detailed local field study. In 2006 one such study was carried out in the Cata Sand area of Sanday with the objective of understanding the behaviour of soft coastlines and the behaviour of sedimental deposits (see Rennie 2006) the importance of this research upon the current work is significant as it considered not only geomorphological and geological evidence but also the rich Neolithic archaeological data available in the area. It was able to suggest that island building did occur during the Holocene.

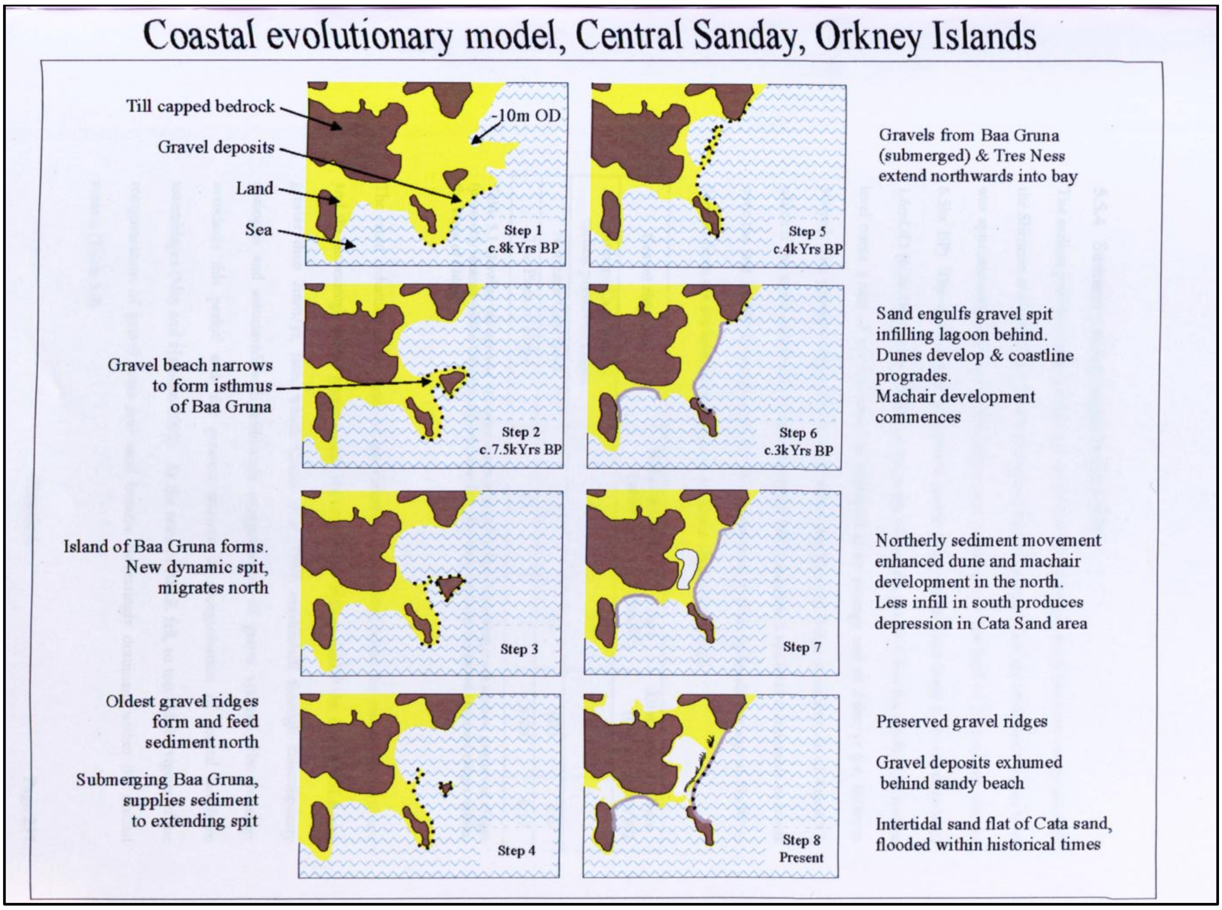


Figure 3.32. Coastal evolutionary model of Cata Sand and surrounding area in Sanday, Orkney (Rennie 2006, 224).

The model was produced from a geomorphological methodology that was able to suggest that the coastline in the Bay of Newark area (Cata Sand) of Sanday was different to what can be seen today. Rennie was able to present an evolutionary model of the location form c. 8 k years BP to present (Figure 3.32). It covered a time when the island of *Baa Gruna* was present to the early Neolithic times when the small islet was beginning to be submerged and its till sediments being broken up and deposited to form the dunes and machair environment at Cata Sand (Rennie 2006, 224). His work has been complemented with the recent discovery of an early Neolithic settlement comprising of a house or houses within the dunes at Cata Sand. Instead of being isolated as today these houses will have been sat on the sheltered edge of the landmass of 5.5kaBP as modelled by Rennie. This goes to exemplify the benefits of utilising data from other academic disciplines and shows the benefits of detailed and localised investigations. This work is particularly important as the area has a rich Neolithic archaeological record that is being developed by several recent and extensive excavations in this area that remain under investigation (Anderson-Whymark and Cummings 2019; Cummings *et al*. 2017) (Figure 3.33).

Figure 3.33. Left - Proposed coastal configuration solid black line (step 4 Figure 3.32) after Rennie 2006; Right/top – Cata Sand Early Neolithic House Right/ bottom Tresness stalled cairn. Google Earth Pro and Sketchfab images)

Similar studies at Skara Brae have been able to ascertain that it was built beside a inland fresh water loch as oppose to on the coast as today (de la Vega *et al.* 1996, 85; de la Vega Linert *et al.* 2000, 509). This loch was eventually inundated by windblown sand and likely led to the abandonment of the settlement which was eventually consumed by the dunes until its rediscovery in 1850 ironically as a consequence of coastal erosion (Richards 1991, 24).

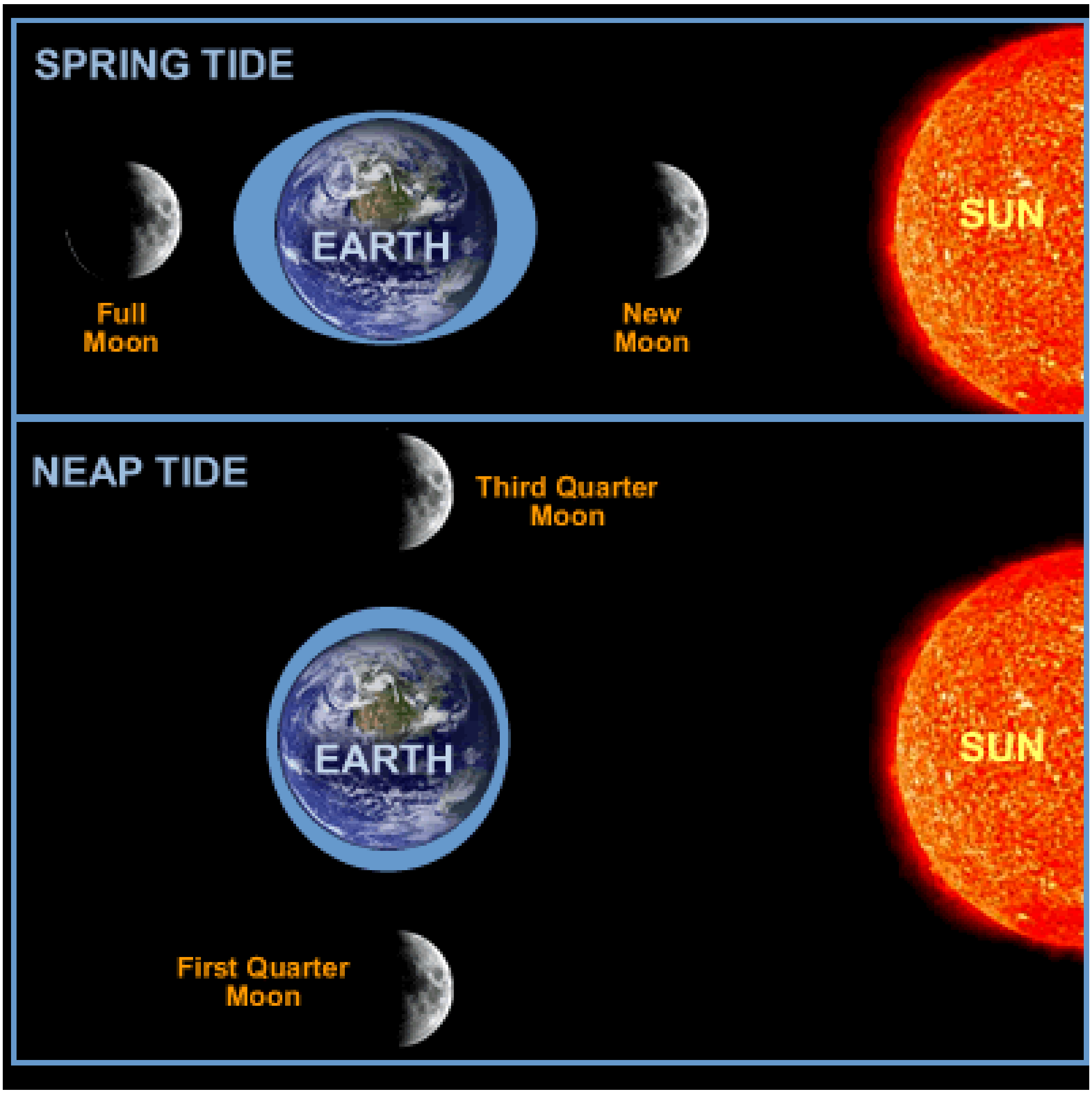


Figure 3.34. Graphic explaining the astronomical effect on the tides (Windows to the Universe 2009).

The tide and its range

Understanding the tides and the part they played in the lives of prehistoric peoples is essential if we are to fully understand how people utilised the land of the northern isles. Tidal activity is modelled over a 24-hour period with broadly two high and two low tides each day (Figure 3.34a). The appearance of the moon within its monthly cycle correlates directly to the tides due to the gravitational pull form the moon that has a direct influence on the height of the tides (Figure 3.34b). When there is a full moon or new moon the gravitational pull is at its greatest and the tides are higher these are called *spring tides*. Conversely, when the moon is in its 1st and 3rd quarter the gravitational pull is least and the tides described as *neap tide*. Both spring and neap tides occur and occur twice in the lunar month and will have influenced the prehistoric Orcadian's strategies in respect of sea travel. One of the earliest maps of the Orkney Islands by Sayer and Bennett in 1781 instructs mariners to take exceptional care when crossing the Pentland Firth at spring tides and notes a journey at neap tide can cause little concern. Currents during the day can vary from very strong at times of the day to literally still at certain times within the cycle. Figure 3.35 depicts the tidal streams over one 12-hour cycle with the model highlighted in blue being the high tide and the point at which the tide direction changes. Focussing on the North Isles the strength of the tide (larger red arrows) favour easterly and westerly movement (Hydrographic Office 1899) through the central channel that separated the North Isles from the mainland group. What is notable here is there is sheltered or quieter tidal streams between the North Isles meaning at certain times of the day which are contusive to interisland travel. Orkney's tidal range is relatively small some 1.2m at small neaps to 4.1m at exceptional spring tides with there being an increased range of around 1m due to the influence of the Atlantic, eastern aspects or the archipelago subject to the North Sea see a slightly lesser range.

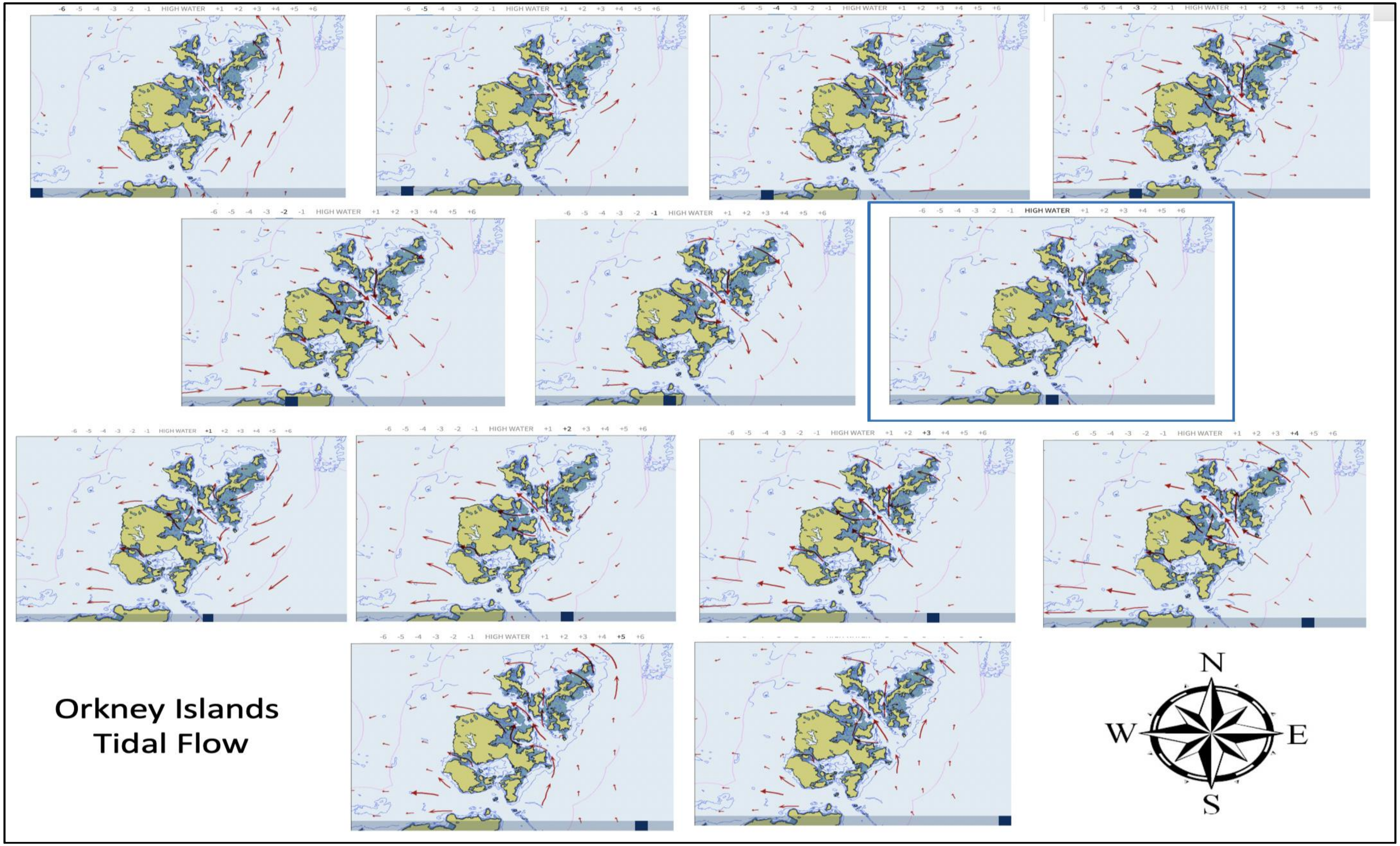


Figure 3.35. Graphic displaying the tidal streams around Orkney over one 12-hour cycle. The longer the red arrow the stronger the tide. The model is presented with high tide highlighted in blue and the +6 and -6 being following from there (Orkney Harbour Master website - https://www.orkneyharbours.com/info/tides).

Extraordinary Natural Events

Sand horizon layers have been recorded on several prehistoric sites and in some cases have been interpreted as resulting in the abandonment or temporary cessation of activities at a location (Sommerville *et al*. 2003). Storm events have been cited as likely responsible for two thick sand horizon layers seen at the northern isles sites at Pool (see Hunter 2007) and Toftsness (Dockrill *et al.* 2007) on Sanday. Wind-blown sand can certainly cause such a feature; but there might be another cause. In 8151 BP a well-documented submarine landslide 'the Storegga Slide' occurred to the north of the British Isles. The enormity of this event saw an area estimated to be 20% larger than the modern country of Scotland fail and slip (Løvholt *et al.* 2017). This event resulted in a catastrophic tsunami - the 'Storegga Tsunami' - which could have seen run up heights on Orkney of over 20 meters. Storegga deposits are only just being noted within Orkney archaeology (Caroline Wickham-Jones *pers. comm*). There has been no detailed research on the impact across the archipelago, and such deposits have yet to be positively identified in relation to archaeological material. Though there is little doubt the effects in terms of human populations and coastal landscape this tsunami will have been catastrophic immediate and enduring (Waddington and Wicks 2017; Wicks and Mithen 2014). The relevance to this well-known and detailed study is comparative to a second similar geological event that occurred not only in the Neolithic but at the very time that early farmers where establishing themselves and the earliest of the monumental funerary architecture was being constructed (Griffiths 2016; Schulting *et al*. 2010). The Garth Landslide - named after Loch Garth on Shetland where sedimentary evidence was first noted - occurred around 3500BC (Bondevik *et al*. 2003; 2005; 2005b; Dawson *et al*. 2006; Ishizawa *et al.* 2016) and has produced similar sedimentary findings to the Storegga event some 2650 years previously. Though there has been an assessed run up half that of Storegga this remains a significant event that would have created a wave devastating to coastal and low-lying island populations. It has been suggested that the Garth tsunami was possibly related to the Afen landslide (see Bondevik *et al*. 2005b; Haflidason *et al*. 2005; Long *et al.* 2003) though it is unclear if magnitude of the Afen slide was able to initiate a tsunami (Bondevik *et al.* 2005b). Later work by (Frohlich *et al*. 2009) has established that relatively small landslide of the extent of Afen may produce a local wave event. At the time of writing there has been no specific published evidence of this event discovered on

Orkney though work is being conducted in this regard (Caroline Wickham-Jones *pers. comm*.). The Neolithic settlement site at Pool, Sanday has a clearly documented double sand event marker within the Neolithic sequence (Hunter 2007) (Figure 3.36). This was interpreted as a "*brief, uneventful duration around 3600BC*" (Hunter 2007, 62) a period that coincides with ceramic and architectural technological changes in the area (MacSween *et al.* 2015). One recent study has initially proposed the possibility that there may be a relationship between the Garth tsunami and the construction of Orkney Cromarty tombs (Cain *et al*. 2019, 734). This hypothesis will require further refinement and ground proofing, but it is fair to assess that the tsunami did coincide temporally with the establishment of early farming communities and if the Garth tsunami did run up on Orkney this will have had its effects on the Neolithic coastal dwellers.

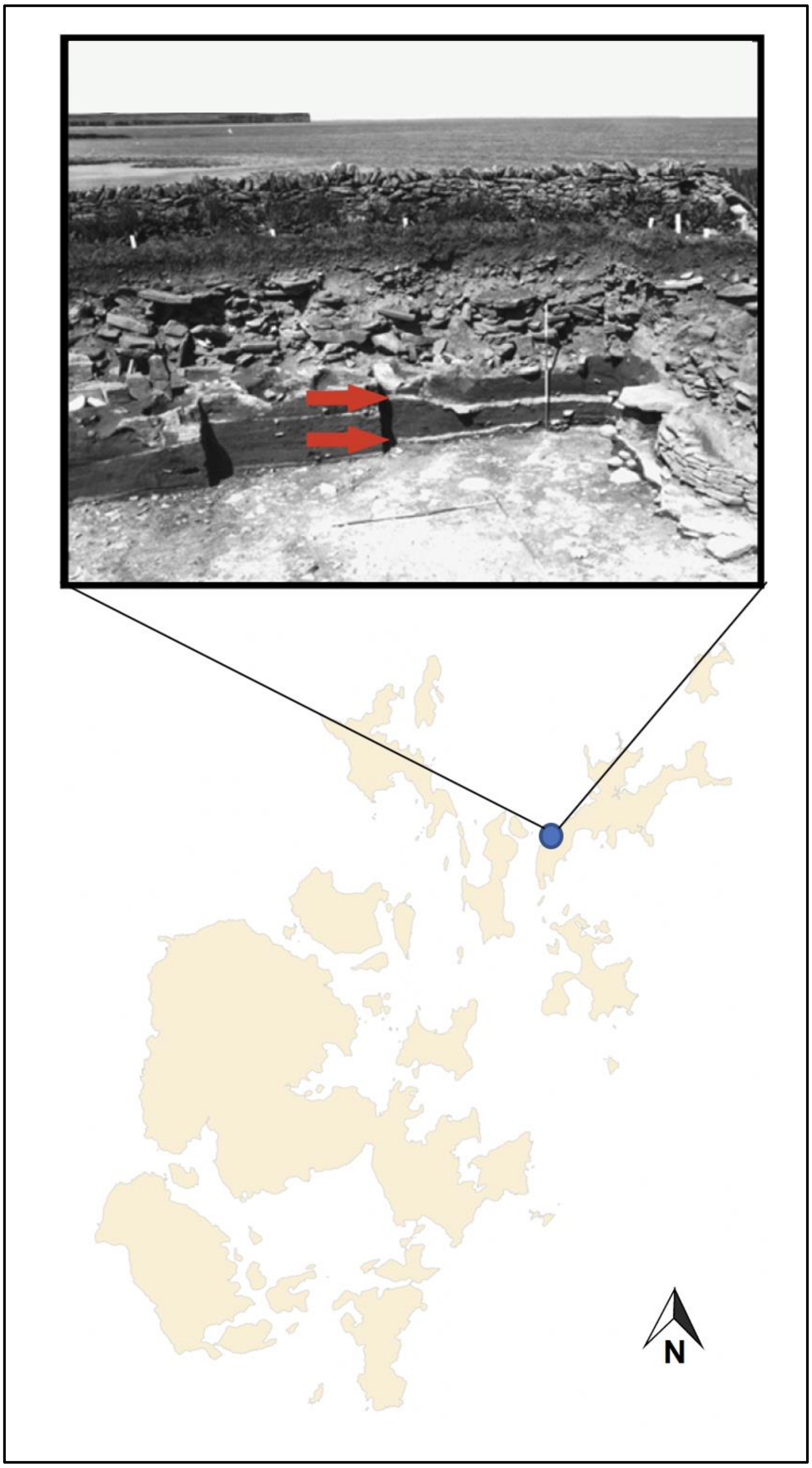


Figure 3.36. A photograph of the double sand horizon recorded at the excavation at Pool Sanday (after Hunter 2007, 25).

These short-term catastrophes will have had an impact of any coastal/island communities established at the time and in the immediate aftermath, but additional evidence from climatic studies has shown there may well have been a longer term and influencing climatic event acting upon Orkney at this time. Climatologists have long been aware of the phenomena of Western European Atlantic storms or Holocene Storm

Periods. These tended to occur in winter months and occurred over decades with increasing ferocity (Zappa *et al.* 2013). The high energy effects of these storms create the movement of sand blown and deposited across the land has the ability to induce changes in that landscape that would certainly have an impact on the viability of habitation and the productivity of early farming. In Orkney today archaeologists at coastal sites are only too familiar with the effects of mild wind (relatively speaking). Wind-blown sand can cover an excavated area in literally minutes. Orkney at least in the sea facing coastal areas will have been particularly effected by such climatic changes particularly on the western façade that will have been most exposed to such palaeostorm events (Dawson 2009). It has been documented that such events may have resulted in the temporary abandonment of sites desertion of settlements (Sommerville *et al.* 2003). This very phenomena was seen as a contributing factor of the dereliction of the agricultural landscape at at Tofts Ness on Sanday, Orkney during the early Bronze Age (Dockrill *et al*. 1994; Simpson *et al*., 1998; Sommerville *et al*. 2007). Examples across the wider region have also been recorded. In Outer Hebridean studies where the long-term outcome of such storm events and blown aeolian sand have provided a landscape for people to thrive upon in the terms of the machair environments and the consequent settlement they attract (Garrow and Sturt 2011; Henley 2003).

Orcadian climate

Given the environmental changes to the Orkney archipelago detailed in the chapter it is clear that the landscape particularly in coastal areas was probably different, through not considerably, during the early part of the Neolithic.

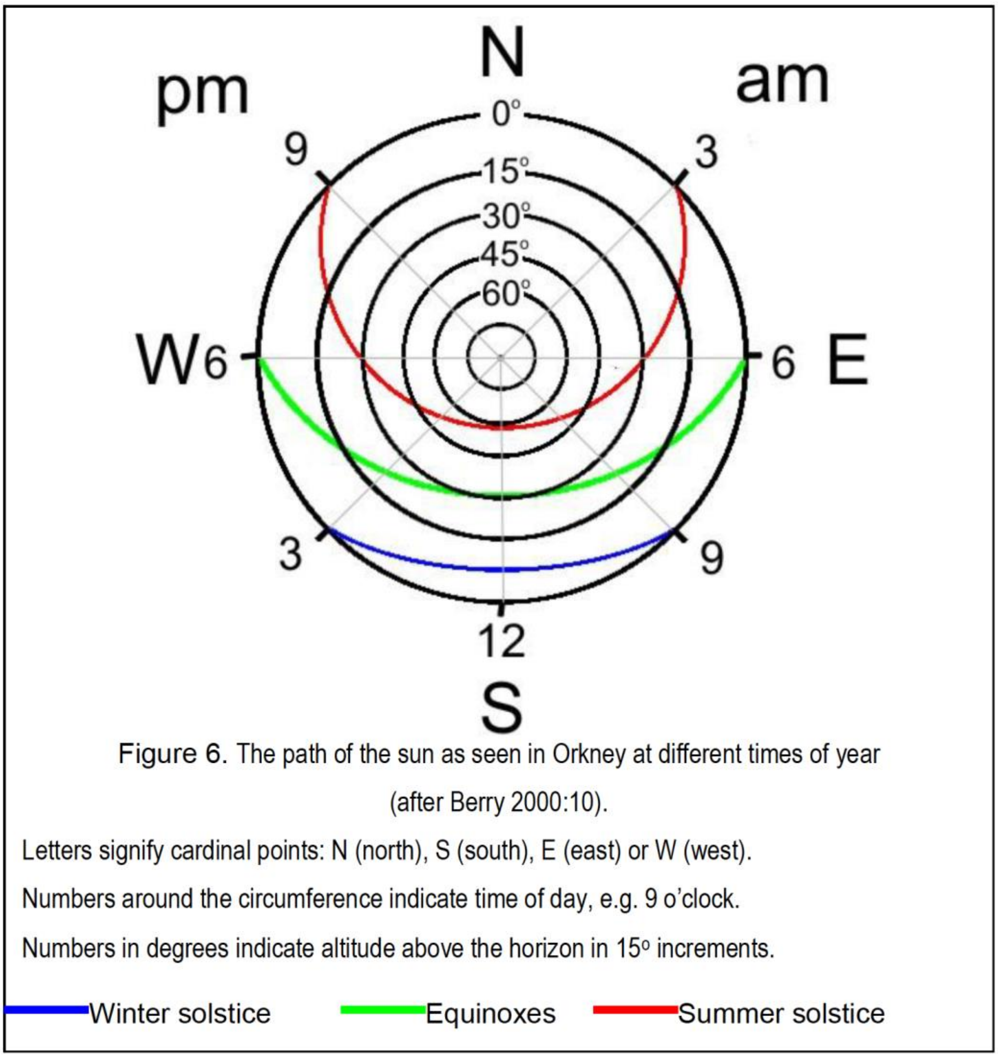


Figure 6. The path of the sun as seen in Orkney at different times of year (after Berry 2000:10).

Letters signify cardinal points: N (north), S (south), E (east) or W (west).

Numbers around the circumference indicate time of day, e.g. 9 o'clock.

Numbers in degrees indicate altitude above the horizon in 15° increments.

Figure 3.37. The path of the sun in Orkney as seen at different times of the year (Berry 2000, 10).

Orkney's climate today is cool and temperate in part due to its global position and exposure to strong maritime influences (Senior and Swan 1972). This had been particularly prevalent in the early Neolithic which came towards the end of the Holocene Climatic Optimum (Hypsithermal) broadly between 7000 BC and 3000 BC (see Bell and Walker 2014, 91). This period saw a warmer climate (c.1-3 ˚C) with northwest Europe experiencing warmer July temperatures (Huntly and Prentice 1993, 136) that will have had a positive impact of life farming subsistence viability. Archaeology has been an unintended benefactor of the Orcadian climatic conditions. Due to the open aspect of the landscape and its frequent susceptibility to maritime influences and fierce salt laden winds it has taken its effects on the land. The tree coverage or lack of it is obvious to any visitor to the islands and the conditions mentioned are key inhibiting factors tree growth (Davidson *et al.* 1976). The collateral biproduct of the consequent lack of wood has been instrumental in the survival of its monumental architecture as the islanders where compelled to exploit the plentiful availability of flagstone for building materials – and stone endures.

The harshness of its weather conditions brings challenges to any agriculturist using the land in terms of temperature, rain and wind exposure. The hours of daylight and of bright sunlight show great seasonal variation (Figure 3.37) with a mean average of 18 hours daylight in the summer and just 6 hours in the winter with a mean monthly sunlight of c. 173 hours and in winter c. 22 hours (Berry 2000, 10). The amount and effectiveness of daylight hours is frequently disrupted from Spring to Autumn when the warmer air interacts with the colder North Sea. This metrological phenomena of low cloud and fog coverage colloquially referred to as the '*Haar*'. The islands experience relatively mild winters in terms of temperatures with the average being 5-6 °C but also lower than should be geographically expected with an average around 15 °C to a maximum of 19 °C. The rainfall throughout the islands is not particularly high with annual ranges from 800 mm to over 1000 mm upon higher land of the archipelago (Davidson and Jones 1990, 17). The driest months are April to July.

The most impactive climatic feature is that of the wind with significant gale force winds occurring more than once a week in winter (Berry 2000) and being over 35% likely at any other time of the year (Davidson and Jones 1990, 17). These climatic features can have detrimental effects on arable farming practices and consequently upon pastoral practices due to limited fodder availability. Broadly speaking the climate was very similar in Neolithic times making these islands a challenging place to live and work.

Summary

This chapter has been compiled into key two sections **The North Isles of Orkney – an introduction** and **Geology and geomorphology and the use of the land.** It started with a has comprehensive introductory summary of each North Isles which was important to set the scene and fully understand and thereby identity nuances between them.

There then followed a detailed look at **Geology and geomorphology and the use of the land with the following aspects being covered.**

- The bedrock geology
- The surface geology
- The exploitable surface geology
- Land use in prehistoric Orkney
- Modern land use
- The sea
- Relative sea levels
- Coastal erosion
- The tide and its range
- Extraordinary natural events
- The Orcadian Climate

The key finding of this chapter is that these islands are not all the same and this was important to establish early in the thesis to better inform interpretations as to how the early farmers used their tombs. There is a diversity that will have had an impact on prehistoric life as is does today. Whilst Rousay and Shapinsay are relatively close to Orkney Mainland and by intimation in this thesis closer to the core of the neolithic activity the remaining islands are very much peripheral and this will have had its effect on the spread of farming across the archipelago.

This chapter has been able to demonstrate that what is there to see today has been sculpted and modified for many millennia. Though broadly in terms of geomorphology the islands are the same today as they would have been experienced by the first farmers. Relative sea levels have changed and therefore a number of the smaller islands are either attached today or at least tidal islands and this is detailed in forthcoming chapters when relevant. As many tombs are found on such islands this analysis was critical for the research detailed in coming chapters.

The purpose of this chapter is to understand the environment and landscape they are located within. The forthcoming chapters will focus on the identified key themes of chronology, phasing and architecture and spatial arrangement.

Chapter 4 Methodology

Introduction

This chapter will detail the methodological approaches employed throughout this research. From the outset it was clear that this research would rely primarily on established archaeological techniques, but some adaptation would be required to meet the project aims. The starting point was a recognition that fundamental to understanding the early Neolithic monuments was a requirement to adopt a phenomenological approach and visit each monument physically to appreciate its landscape setting. It quickly became apparent that this may not be achievable for logistical reasons, essentially due to the location of some tombs being on remote or unoccupied islands that have no easily arranged transport links and this was exasperated by limitations as a consequence of Covid restrictions.

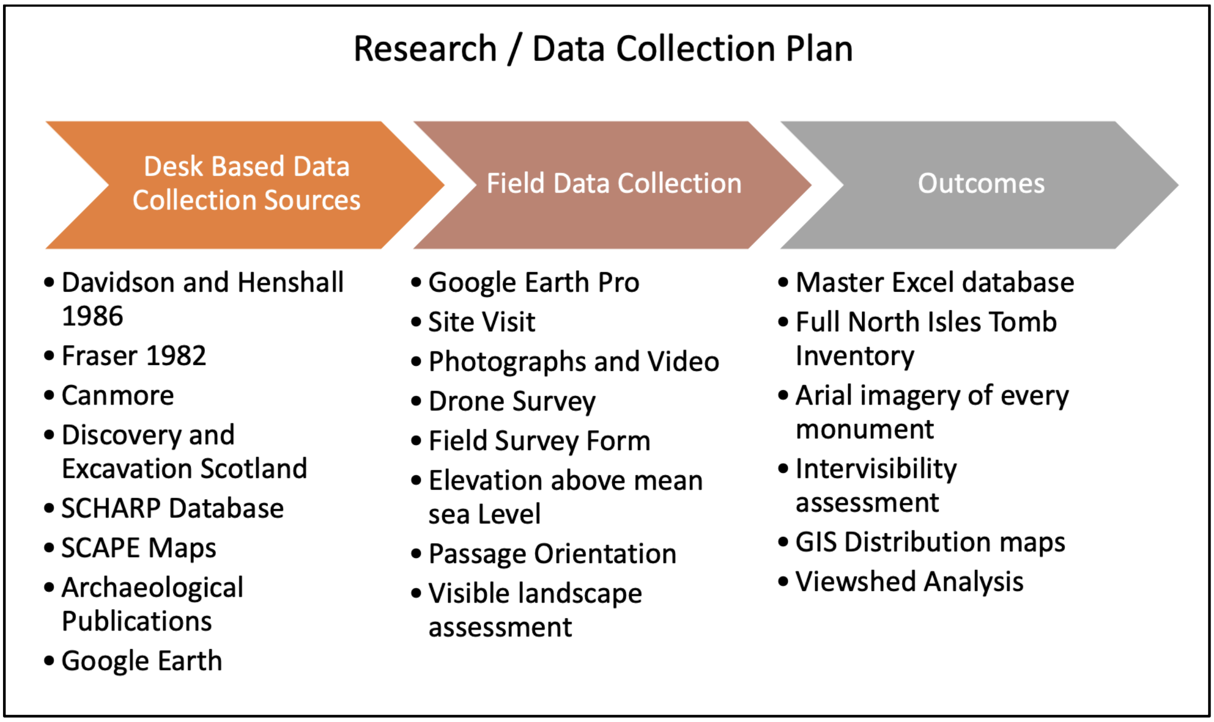


Figure 4.1. Process diagram of research plan including sources and outcomes.

A comprehensive **Data Collection Plan** was formulated (Figure 4.1) which identified early in this work that there would be a dual approach to the data collection methodology involving extensive desk-based research and fieldwork activities.

Desk based assessment

The initial task at the data collection phase was the creation of master database using Microsoft Excel which was initially populated with data contained within a synopsis of publications and online databases (see Appendix 1). This master spreadsheet was intended as a living document and was added to throughout this research. This initial population task involved reading each entry of the only published gazetteer of the monuments (Davidson and Henshall 1986, 101-186). This comprehensive inventory contained 81 entries and was the most recent collection of published information on this subject matter. The information extracted was digitised for the first time to assist in later analysis of relevant information. Furthermore, Henshall created a ORK number reference system that remains dominant in Orcadian monument literature (Davidson and Henshall 1989). This work has followed Henshall and retained the referencing system here.

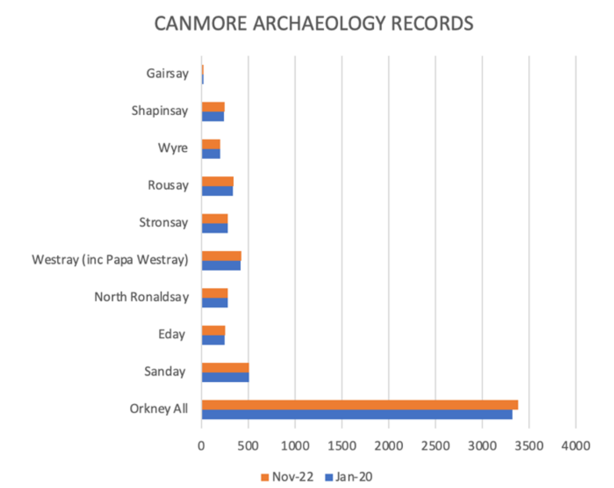
Next, the comprehensive task of researching all up to date online databases which had the potential of containing information relevant to the research. The Historic Environment Scotland online resource (CANMORE) is the database of Historic Environment Scotland and takes its information from archaeological fieldwork, Local Authority Historic Environment records and other relevant sources. It is an extensive digital live database updated daily. It was critical to the initial research data collection phase. This method of research required a review of over 3000 individual records - relating to the Neolithic in Orkney - which were uploaded as a csv. files before being added to a master database with relevant data for this research that would be used as a working copy throughout. This database is entitled 'Master Orkney Chambered Cairn Data' can be seen at appendix 1 (Master Orkney Chambered cairns data.xlsx). The records from the initial data mining exercise is attached electronically at 'Initial data mine Orkney' at appendix 2 (Initial data mine Orkney.xlsx) and is split into island by island tabs. Both these databases can be accessed electronically with links in the Appendices section of this thesis.

CANMORE was not the only database that was identified. The SCAPE trust is a charity established to work with the public to research the archaeology of Scotland's coast. The scheme also holds an extensive database that had value as a research source. Through its Scotland's Coastal Heritage at Risk Project (SCHARP) in total 868 archaeology reports were sifted and read for relevance (appendix 2 SCHARP tab)). This online resource displayed a mapped presentation of data points within *OpenStreet* mapping software. Only North Ronaldsay, Sanday and Westray and Papa Westray of the North Isles have been subject to surveys and reports. Having spoken to staff at the charity it was established that whilst there were plans to complete the other islands this is something that had to be put on hold due to the C19 pandemic. The csv. file for these sites was also uploaded and researched. Sites of any value to this thesis were added to the master excel spreadsheet to complete the desk-based population of the spreadsheet. An extract of this is at figure 4.2 and the full Master Orkney Chambered Tomb data that was utilised throughout this research (see Appendix 1). For ease of later analytical work the master database contained the ORK, Inventor and CANMORE reference numbers which were followed by type classification and chamber type as published in Davidson and Henshall (1989). Map reference; island; location and references were included from CANMORE. In addition, other points such as intervisibility, orientation and elevation fields were input following the field survey phase live. It is worthy of note that comprehensive survey data from an earlier study (Fraser 1983) was accessed and utilised where tombs were unable to be visited. The data in this work was in broad agreement with only some minor alterations to elevation and alignment on some monuments likely due to availability of more advanced GPS recording methods. Orientation, Altitude, What Three Words and intervisibility were added during field surveys onto the database via an IPad Pro.

There were some adaptations to the initial data collection plan required as the research progressed. Following these searches all the data was uploaded in the form of Microsoft excel compatible csv. files and added to the master spread sheet. Canmore was interrogated initially on 27 Jan 2020. Figure 4.3 shows the extent of the records returned. It should be noted that a second search was undertaken on 15 November 2022 (as detailed in Figure 4.3) and the new entries assessed to ensure that any new and relevant data was included in the final submission of this work and this should be taken as the data cut-off date. The search term used predicted to be wide ranging and were ' Mesolithic , Neolithic and Bronze age' with the inclusion of the individual islands name. This was repeated for all the North Ilses. This produced data on settlements, tombs, standing stones lithic find spots and other Neolithic related entries. Predictably the issue was the amount of these data was considerable and a system required designing to ensure a more focussed, relevant, and manageable dataset.

Henshall Inventory N	Inventory numbe	Canmore ID	Name	Type Class	Cairn Typ	Chamber Type	Map	Parish	Island	Location	NMRS Ref	What Three Words ///	Intervsiible wit	Altitude (MaMSL	Orientation (outward)	References
1	566	2708	Bigland Long	Orkney-Cromarty	Rectangular	Stalled Chamber	HY 435321	Rousay	Rousay	NE side of Island	HY 43 SW 12	///skewed.unsettled.dare	2, 58,59	17	130 (stalled) (115 tripartite)	RCAMS 1946, 205; Henshall 1963, 183, Davidson and Henshall 1989, 101.
2	565	2709	Bigland Round	Orkney-Cromarty	Round	Tripartite Chamber	HY 438325	Rousay	Rousay	NE side of Island	HY 43 SW 13	///sparkles.sprain.found	1, 58,59	40	124	RCAMS 1946, 204; Henshall 1963, 183-4;NMRS ORD /27/4; Davidson and Henshall 1989, 101-102
3	573	2645	Blackhammer	Orkney-Cromarty	Rectangular	Stalled Chamber	HY 414276	Rousay	Rousay	Near South coast of Island	HY 42 NW 3	///fully.warm.roadways	6	65	180	Calander and Grant 1937; RCMS 1946, 211-13; Henshall 1963, 184-5; Davidson and Henshall 1989, 102-3.
4	708	1697	Bookan	Orkney-Cromarty	Round	Bookan-type chamber	HY 286141	Sandwick	Mainland Orkney	NE shore of Loch Stenness	HY 21 SE 10	///reassured.crown.reinstate		26	156	Petrie 1863, 35-6; Petrie Notebook 7, 2-3,5; Petrie 1871; RCMS 1946, 263-4; Henshall 1963, 186
5	218	3143	Braeside	Orkney-Cromarty	Rectangular	Tripartite Chamber	HY 563375	Eday	Eday	N end of Island 1km SW of Carrick House	HY 53 NE 10	///flashback.defining.rotatio	23.53, 55	20	169	RCMS 1946, 59-60; Henshall 1963, 186-7; Davidson and Henshall 1989, 104-5.
6	274	2213	Burgar	Orkney-Cromarty	Round	Stalled Chamber ?	HY 347278	Evie and Redall	Mainland Orkney	NE coast	HY 32 NW 15			10	25	RCAMS 1946, 81; Henshall 1963, 187
7	864	9577	Burray	Orkney-Cromarty	Short-horned cairn	Stalled Chamber ?	ND 488988	South Ronaldsay	Burray	NE corner of Burray	ND 49 NE 3			7	106	The Orcadian, 21.2.1863; Petrie Sketchbook 3, 20; Petrie Notebook 7, 67, 76, 82-3; Petrie 1871; Anderson 1886, 290-1;
8	245	3151	Calf of Eday Long	Orkney-Cromarty	Rectangular	Stalled Chamber and Bookan-type chamber	HY578386	Eday	Calf of Eday	SW side of Calf of Eday	HY 53 NE 18	///sharpness.gamer.never	9,53,	17	66 (A), 113 (B)	Calder 1937, 115-29, 134-46, 151-3; RCAMS 1946, 65-7; NMRS o/ 1706-10; Henshall 1963, 188-91; Davidson and Henshall 1989, 107-9.
9	246	3153	Calf of Eday North-West	Orkney-Cromarty	Round	Bookan-type chamber	HY578385	Eday	Calf of Eday	SW side of Calf of Eday	HY 53 NE 2	///sharpness.gamer.never	8,10,53	15	227	Farrer 1857a, 155-6; Petrie 1863, 36-7 ; Petrie 1927, 19-20 ; Petrie Sketchbook 3, 5-6 ; Clader 1936, 226-7 ; RCAMS 1946, 69-70 ; Henshall 1963, 192; Davidson and Henshall 1989, 101.109-10.
10	247	3164	Calf of Eday South-East	Orkney-Cromarty	Round	Bookan-type chamber	HY 579385	Eday	Calf of Eday	SW side of Calf of Eday	HY 53 NE 3	///sharpness.gamer.never	9,53	10	217	Calder 1938, 209-13; RCAMS 1946, 70-1 ; Henshall 1963, 193-4; Davidson and Henshall 1989, 110.
11	574	2638	Cubbie Roo's Burden	Orkney-Cromarty	Round	Orkney-Cromarty chamber	HY 439279	Rousay	Rousay	South coast of Rousay	HY 42 NW 23	///remaining.outsize.baked	49	55	180	RCAMS 1946, 213 ; Henshall 1963, 194; Davidson and Henshall 1989, 111.
14	998	3290	Earl's Knoll	Orkney-Cromarty	Long	Orkney-Cromarty chamber	HY 668292	Stronsay	Papa Stronsay	SE side of Papa Stronsay	HY 62 NE 13	///overt.rosette.faster	38,44,50,55	8	90	OSA 15 (1795), 418-9 ; ONB 24 (1878), 39 ; RCAMS 1946, 336 ; Henshall 1963, 197; Davidson and Henshall 1989, 115
15	223	3210	Eday Church	Orkney-Cromarty	Round	Tripartite or stalled Chamber	HY 560334	Eday	Eday	Centre of Island of Eday 0.7 km SW of Bay of London, 270m WNW of the former parish church.	HY 53 SE 5	///schematic.someone.congr	16,20, 47,53,55	20	113	RCAMS 1946, 60-1 ; Henshall 1963, 197-8; Davidson and Henshall 1989, 116.
17	254	3184	Fara	Orkney-Cromarty	Round	Stalled Chamber	HY 527379	Eday	Fara	N end of Island of Fara	HY 53 NW 1		43,53	5	256	RCAMS 1946, 72 ; Henshall 1963, 198-9; Davidson and Henshall 1989, 117
19	807	2402	Helliar Holm	Orkney-Cromarty	Round	Stalled Chamber	HY 484154	Shapinsay	Shapinsay	Small island of Shapinsay	HY 41 NE 2	///uniform.sour.cocoons	18, 26,43	27	117	RCAMS 1946, 280 ; Henshall 1963, 200; Davidson and Henshall 1989, 119.
21	545	3243	Holm of Papa Westray North	Orkney-Cromarty	Rectangular	Stalled Chamber	HY 504522	Westray	Holm of Papa Westray	on island Holm of Papa Westray	HY 55 SW 2	///tuned.should.sunbeam	22	5	326	Petrie 1857, 62, pl 3 ; RCAMS 1946, 189 ; Henshall 1963, 200-1 ; Ritchie, 2009; Davidson and Henshall 1989, 120.
23	217	3142	Huntersquoy	Orkney-Cromarty	Round	Tripartite Chamber and Bookan-type chambers	HY 562377	Eday	Eday	N end of the island of Eday 0.8km SW of Carrick House	HY 53 NE 1	///immunity.bronzer.node	5,53,55	25	upper 263; lower 89	Calder 1938, 193-204, 213 ; RCAMS 1946, 56-9 ; Henshall 1963, 203-5; Davidson and Henshall 1989, 123.
24	1042	2769	Iphs (The Lum Head)	Orkney-Cromarty	Round	Tripartite Chamber (Prob)	HY 422491	Westray	Westray	N side of island of Westray	HY 44 NW 14	///seagull.lilac.committee	33	57	84	RCAMS 1946, 352 ; Henshall 1963, 205; Davidson and Henshall 1989, 124.
25		9554	Isbister	Orkney-Cromarty	Oval	Stalled Chamber with cells	ND 469843	South Ronaldsay	South Roanladsay	near SE corner of Island	ND 48 SE 1	///bleaching.wept.require		34	78	P.R. Ritchie, 1959 ; Henshall 1963, 205-7 ; Hedges 1982 ; Hedges 1983
26		2714	Kierfea Hill	Orkney-Cromarty	Round	Tripartite Chamber	HY 424319	Rousay	Rousay	N side of island of Rousay	HY 43 SW 18	///locator.shrugging.asserts	19,55, 58,58	180	102	NMRS ORD/202/1-2 ; Henshall 1963, 207-8; Davidson and Henshall 1989, 130.
27	568	2715	Knowe of Craie	Orkney-Cromarty	Round	Tripartite Chamber	HY 419315	Rousay	Rousay	SW slope of Kierfea Hill	HY 43 SW 19	///suspend.universes.flatten		110	93	NMRS ORD / 36 /1-3, MS/ 396/1 ; RCAMS 1946, 206 ; Henshall 1963, 208-9; Davidson and Henshall 1989, 131.

Figure 4.2. Extract from the excel master spreadsheet designed specifically for this research the full version can be seen at Appendix 1 ([Master Orkney Chambered cairns data.xlsx]).



	Jan-20	Nov-22
Orkney All	3321	3384
Sanday	504	506
Eday	250	251
North Ronaldsay	281	283
Westray (incl Papa Westray)	421	422
Stronsay (incl Papa Stronsay)	282	282
Rousay	339	342
Wyre	200	202
Shapinsay	240	249
Gairsay	19	19

Figure 4.3. Graph and table showing the amounts of individual records that needed to be researched in the initial data trawl broke down into islands and providing searches at the beginning of the research and at the time of writing up so as to capture all the relevant data.

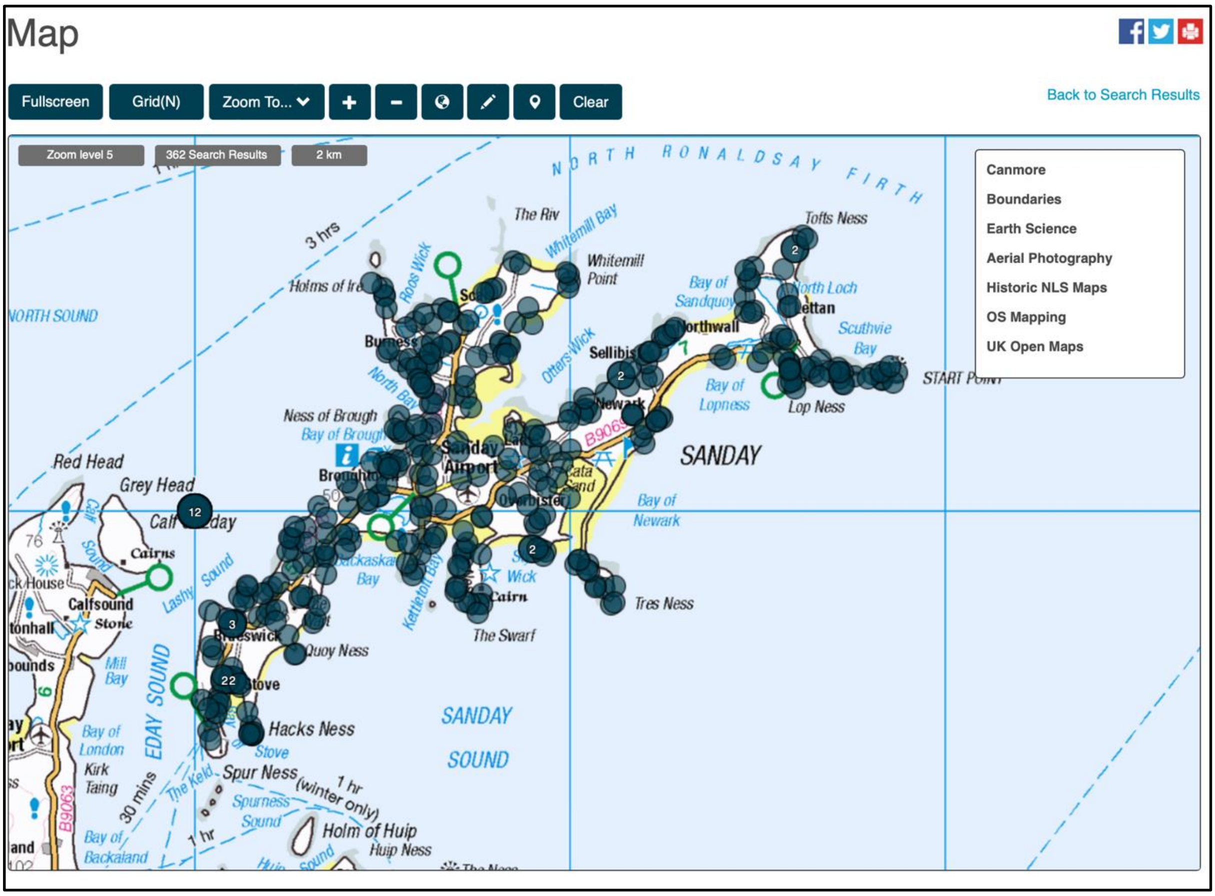


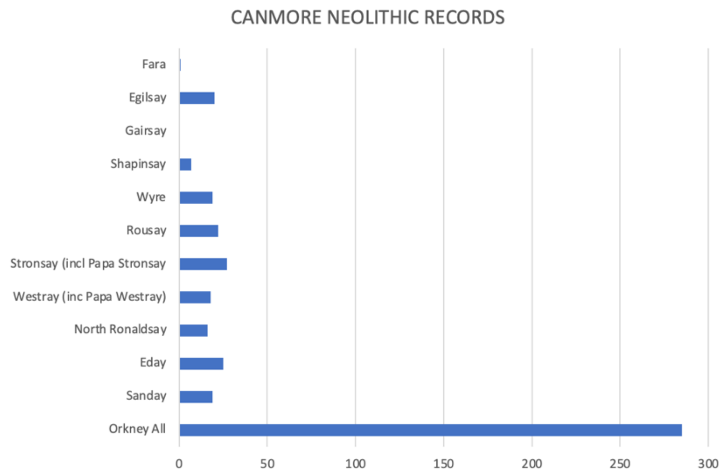
Figure 4.4. Image showing the task at hand from the initial key word search. The data required to be filtered to allow it to be workable. The map shows every site on Sanday by way of an example (Canmore Map search - Neolithic Sanday)

Initially all data deemed potentially important to this work was therefore included in the search parameters. This included the Mesolithic - of which there is relatively small number on Orkney - and Early Bronze Age data both of which had a potential to have a bearing on any aspect of this research that was interested in multi-phased tombs that may have spanned different archaeological periods. Following the csv. files download each entry was looked at and a decision was made as to its relevance to this research by interrogation and filtering.

This was required as the initial download of information was simply too large to allow for have any meaningful data analysis an example of the entries download for just the island of Sanday is shown in Figure 4.4. It returned results whereby it was not possible to see any patterns in the data. Consequently, a decision was made to restrict the relevant data for inclusion in the master database and the following criteria was implemented.

- Any North Isles Neolithic entry
- Any Orcadian Neolithic chambered cairn site
- Any Orcadian Neolithic settlement site
- Any Orcadian individual Neolithic dwelling site
- Any North Isles Neolithic find spot (lithics and ceramics)
- Any North Isles standing stones

This produced the effect of returning a manageable and meaningful amount of data outlined in Figure 4.5 and broken down by North Isles Island by island.



Orkney All	285
Sanday	19
Eday	25
North Ronaldsay	16
Westray (inc Papa Westray)	18
Stronsay (incl Papa Stronsay	27
Rousay	22
Wyre	19
Shapinsay	7
Gairsay	0
Egilsay	20
Fara	1

Figure 4.5. A graph and table showing the relevant records to this work that remined once filtering had occurred.

The requirement for such an extensive data trawl was realised because of personal knowledge of two sites where I had been part of the excavation team. Both early Neolithic and both intrinsically relevant to this thesis – Cata Sand early Neolithic house and the nearby multi-phase stalled cairn at Tresness. The issue was identified when a key word search ‘*Sanday Neolithic’* on CANMORE database search (even when using the advanced Search facility) did not show both these sites in the returned data. It was by virtue of this fact alone that all the records required careful sifting so as not to miss sites relevant to any interpretations. This was a potential problem for the research given the possibility of important data - required in this collection phase - to be missing. Following discussions with CANMORE staff it was ascertained that this anomaly was due to the Cata Sand site not having the word Sanday in the location field or in the title of the site on the CANMORE database. This issue extended the time taken to identify sites of relevance considerably and required an in-depth read of thousands of sites. Nevertheless, it was deemed necessary for the integrity of the data collection phase. Once complete this database formed the foundation of this work and consisted of the most up to date and relevant data resource available anywhere.

In summary the data collection plan (Figure 4.1) was followed, records obtained and reviewed. Davidson and Henshall (1989) and Fraser (1983) both produced 81 records. The online downloads produced by CANMORE (3321 records) and SCHARP (868 records). Data synthesis was then undertaken and records were sifted to create the final master database of 174 sites that were considered integral to this research and would be used in the future analysis techniques employed.

Figure: 4.6. QGIS generated distribution map of all chambered tombs (yellow dots) within the North Isles of Orkney. Labelling and annotations followed later using Microsoft programs.

Geographic Information Software (GIS)

The use of Geographic Information Software (GIS) software in archaeological investigations is fundamental to the modern practitioner to the point that it is no longer seen the domain of GIS specialists (see Connolly and Lake 2006). Though as with many methodologies there are some aspects to be aware of. It becomes easy to rely on the researched desk top data and to accept it without question. This can lead to a situation of becoming over dependant on the GIS programs to the detriment of real time personal ground experience (Connolly and Lake 2006, 1). In this work GIS software has been used in support the field activities that will be detailed later in this chapter. It has also been used to provide a clear pictorial presentation of what was physically seen 'on the ground' an example being when identifying that modern roads seen during field surveys broadly follow the same routeways that are geographically the most efficient route. This was carried out with utilising a QGIS least cost path plugin and was critical in analysing relationships between tombs and routeways (see chapter 8).

The GIS software used throughout was QGIS and supported by Google Earth Pro. The master spreadsheet data was imported into QGIS (version 3.4) as separate delimited text Raster layer for databases as described earlier in this chapter (*viz.* classification of tombs, settlements, CANMORE entries and SCHARP data). This provided a baseline for this research project and was used to create many of the distribution and analytical figures presented throughout this work. These base maps used UK boundary maps and themed entries were added (see Figure 4.6 and Figure 4.7). Other data were added to QGIS which was obtained under licence from EDINA Digimap. At various stages of this research downloads from aerial collection, maritime collection, historical collection and Ordnance Survey collections were all used following licence approval. For presentation purposes a mixture of sources has been used. Figures within this work contain a mixture of QGIS maps and Google Earth Pro aerial photographs (e.g Figure 4.8) have been used to support the analysis within chapters 5 to 9 inclusive. The same data (from the master database) used to create the QGIS projects was also input into Google Earth Pro as this program was found to be considerably more intuitive and responsive for the tasks required in this work.

Google Earth Pro, spatial, landscape images and viewshed use.

Google earth Pro emerged as a fitting and accessible tool during the research design phase of this thesis, offering a versatile platform for visualizing geographic and spatial data. The software facilitated the creation of maps, conducted viewshed analyses (depicted in green in relevant figures), and managed landscape data. Particularly advantageous was its utility during tomb field surveys, where access on an iPad Pro enabled researchers to confirm views from physical presence at a site. It is acknowledged, however, that the choice of tools in archaeological research is contingent upon project-specific requirements, and for more specialized Geographic Information System (GIS) functions, dedicated GIS software may be deemed necessary.

During the research design phase of this work the decision was made to use Google Earth Pro viewshed analysis over traditional GIS tools (in this case QGIS that was used elsewhere in this research) was considered. Google Earth Pro was deemed suitable for the research needs without necessitating extensive training that could potentially divert time from other crucial aspects of this study. Traditional GIS tools are acknowledged for their expense, steep learning curve (Conroy et al., 2008; Renner et al., 2009; Yu and Gong, 2012; Wood et al., 2007), and comparatively lower flexibility for geo-visualization (Wood et al., 2007). Additionally, these tools can present challenges in operating and seamlessly integrating vast volumes of data from diverse sources automatically (Yu and Gong, 2012).

It should be noted for clarification that here Google Earth Viewshed tool was utilised as confirmation and visual presentation of physically visited sites. Its effectiveness in communicating results through figures was noteworthy, surpassing what could have been achieved with photographs alone. An added advantage is the transparency of the tool, facilitating replication and verification by other researchers, as outlined by Herndon et al. (2023).

It has been said "The era of RSBD (*Remotely Sensed Big Data - Google Earth Pro being an example)* has arrived for archaeologists (Herndon et al. 2023, 11) and this research has confirmed that it was effective in respect of the needs of this research design strategy. This declaration underscores the transformative impact of online tools such as Google Earth Pro as an alternative consideration in archaeological research, providing researchers with powerful and accessible means to analyse and communicate spatial

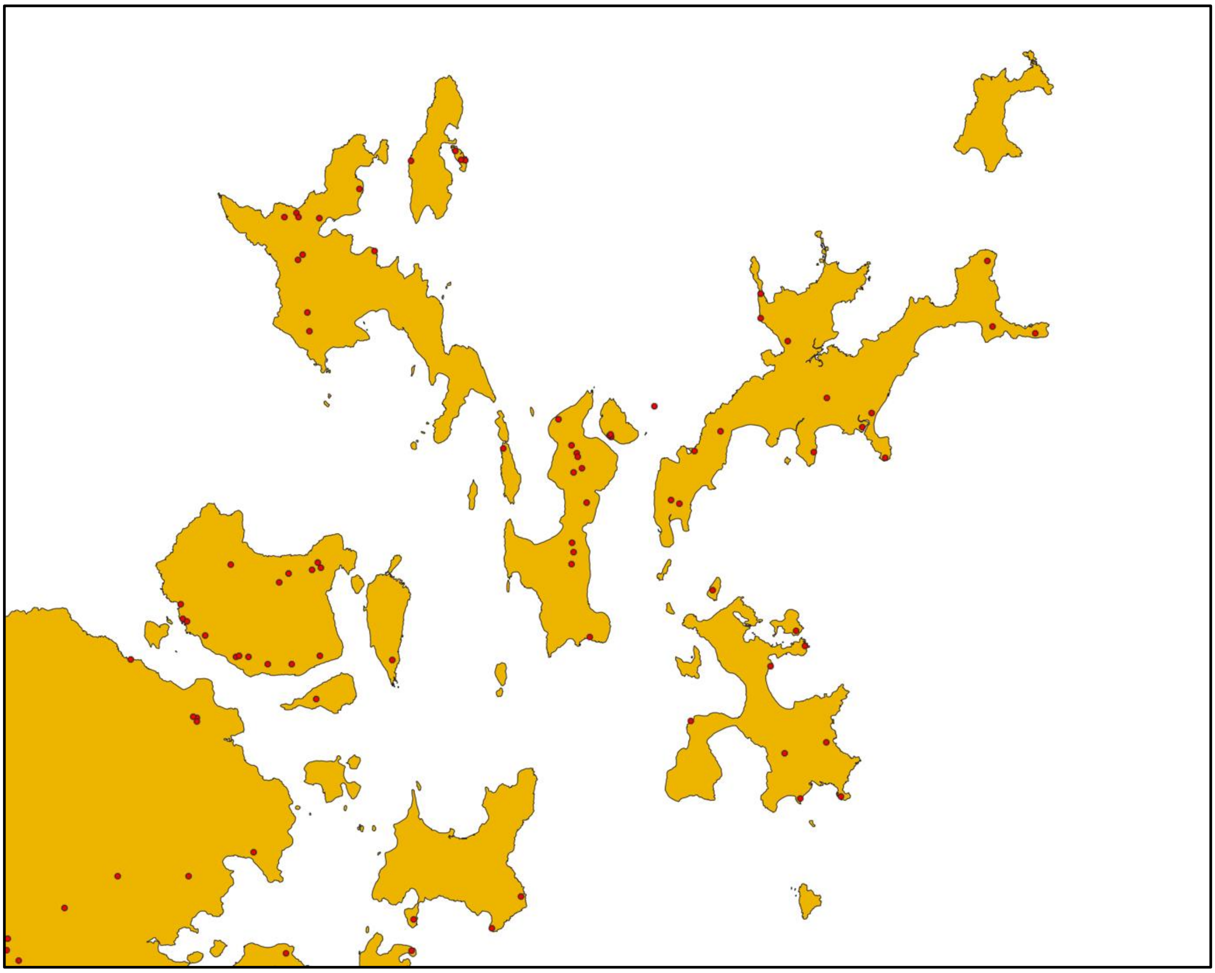


Figure 4.7: QGIS generated distribution map of all chambered tombs, settlements, houses and Neolithic findspots and stone circles within the North Isles of Orkney. Labelling and annotations followed later using Microsoft programs.

Figure 4.8. Google Earth Pro map with all monuments and settlements

Fieldwork / Site survey process

Logistically this was the most challenging aspect of this research due to several issues including remoteness of sites, weather and COVID 19 restrictions. A detailed plan was required prior to commencing this fieldwork to ensure that the maximum number of monuments within the North Isles could be visited. It was initially the intention to visit 100% of the tombs though the logistical issues surrounding such an ambition were perhaps not fully appreciated when this intention was born. A comprehensive program of visits was decided upon that would need to be carried out over many journeys to the different islands. Also, a Survey Process or '*Actions on site*' was established (Figure 4.9). This was to ensure that maximum use of the time and to act an aide memoire to ensure no activity was missed. To support this, a bespoke *Monument survey form* (Figure 4.11) was designed that would be completed at each tomb location. These obtained data would be transferred to the master excel spread sheet.

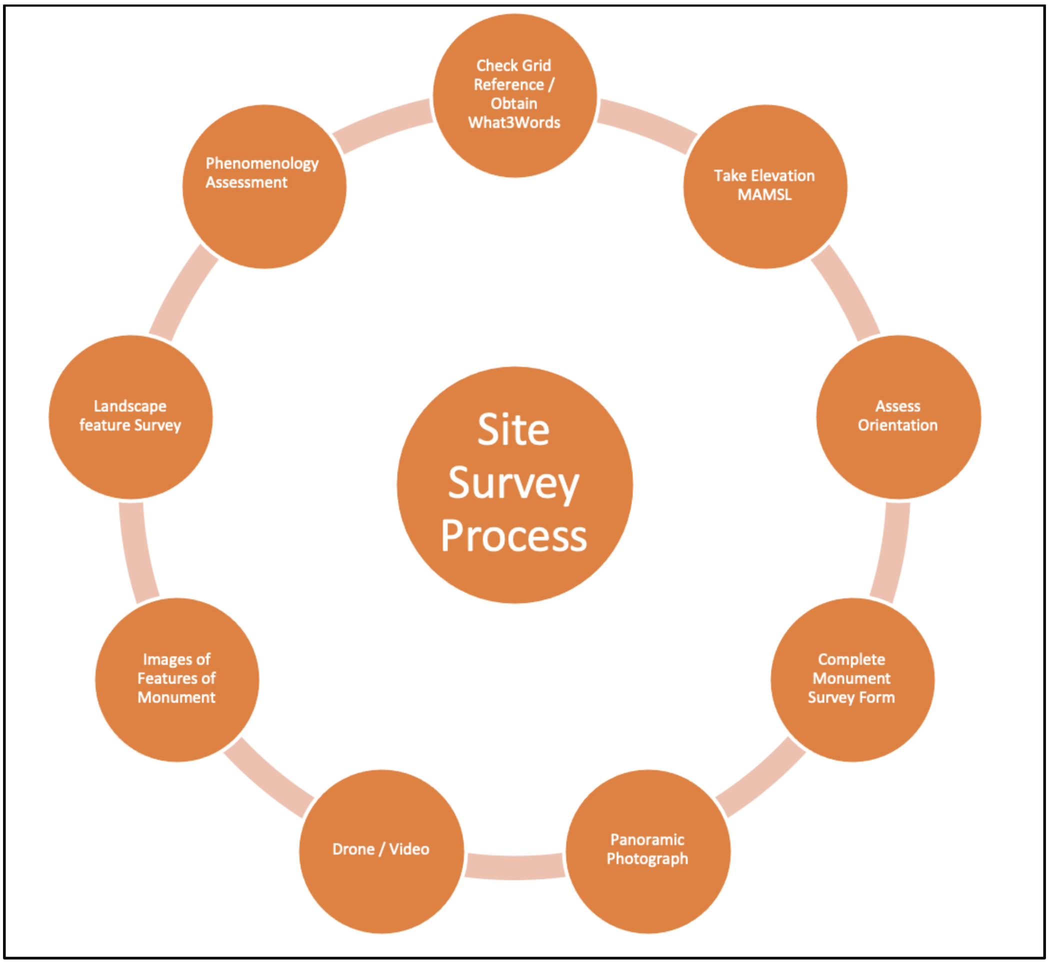


Figure 4.9. A graphic showing the 'on site' actions that were designed specifically for this work and carried out during the fieldwork stage of this work.

Identifying the site

Prior to visiting each site, the Ordnance Survey 6 figure grid reference was obtained and reviewed together with aerial photographs that were obtained from CANMORE. Google Earth Pro was also utilised to assist in the pre-site visit as virtual reconnaissance. It was noted that CANMORE from time to time is a little out on the grid reference and it is sometimes difficult to identify a monument from Google Earth Pro. To alleviate this issue for future researchers, it was decided that the alternative location recording system would be ascertained at each site - What3words. This is a globally accepted mapping system that is gathering interest and is significantly easier to use with a free mobile application and the inputting of the unique three words that will pinpoint any 3x3m square in the world. This is a system that has been integrated into UK emergency services as well as UK Heritage organisations (British Museum and Portable Antiquities Scheme). It also has plug in widgets for ArcGIS and QGIS. It was decided that this would be obtained as an alternative system to future proof this research and to assist non-professionals or interested members of the public to readily find a tomb using the What3Words app. Simply put, it is an effective navigation system for the digital age that was included with little effort. Of course, the standard map referencing formats are also recorded on the master database and inventory within the appendices to this work. In addition, Orkney 1:25000 scale OS Explorer series maps were utilised in this task.

Orientation and alignment

Alignment of the chamber or passage (leading out of the tomb) was systematically obtained, except in cases where the state of degradation made on-site assessment impossible. In accessible tombs, a laser line (Figure 4.10) was projected onto the floor to accurately record the alignment, as depicted in Figure [Number]. Field orientations were then measured using a field Silva compass, a Garmin handheld eTrex GPS device, and the Ordnance Survey app on an iPhone 13 Pro. The accuracy of the latter was verified and found to be consistent with the more conventional methods. In instances where a slight change in axial alignment was noted, two readings were taken for precision. When on-site orientation was indiscernible, historical archaeological plans and sketch plans from Davidson and Henshall's work (1989) were referenced to obtain the reading (Figure 4.11). These sketch plans, despite being preliminary, were demonstrated to be highly accurate upon comparison with field readings obtained during this research.

Additionally, for non-visited tombs, these plans were cross-checked against the last comprehensive study of alignment (Fraser 1983, Appendix A). The results from this work were also checked against the readings taken in this research, consistently showing accuracy within a few degrees. Nevertheless, the new readings from this study took precedence due to employment of more accurate technological tools. All tombs that were visited and alignments (and altitude) recorded have been marked with an asterisk in Colum P of Appendix 1 (Master Orkney Chambered cairns data.xlsx), providing a comprehensive reference for the recorded orientations.

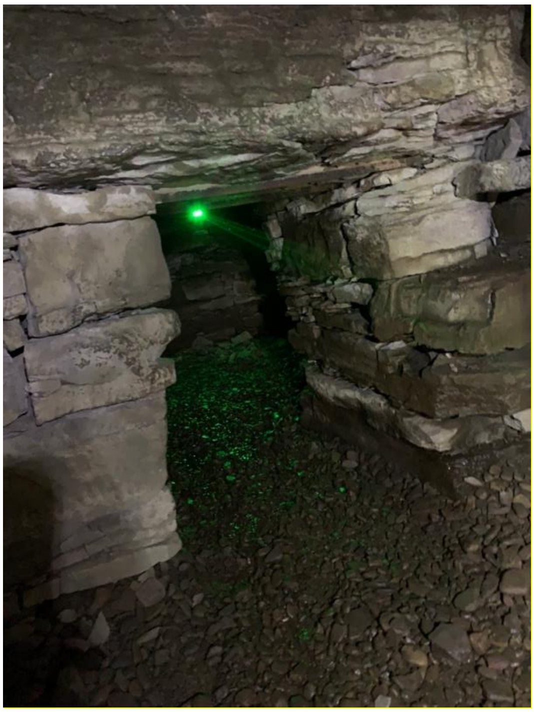


Figure 4.10. Photograph of laser line alignment technique at Wideford hill Chambered Tomb (Authors Own photograph 2021).

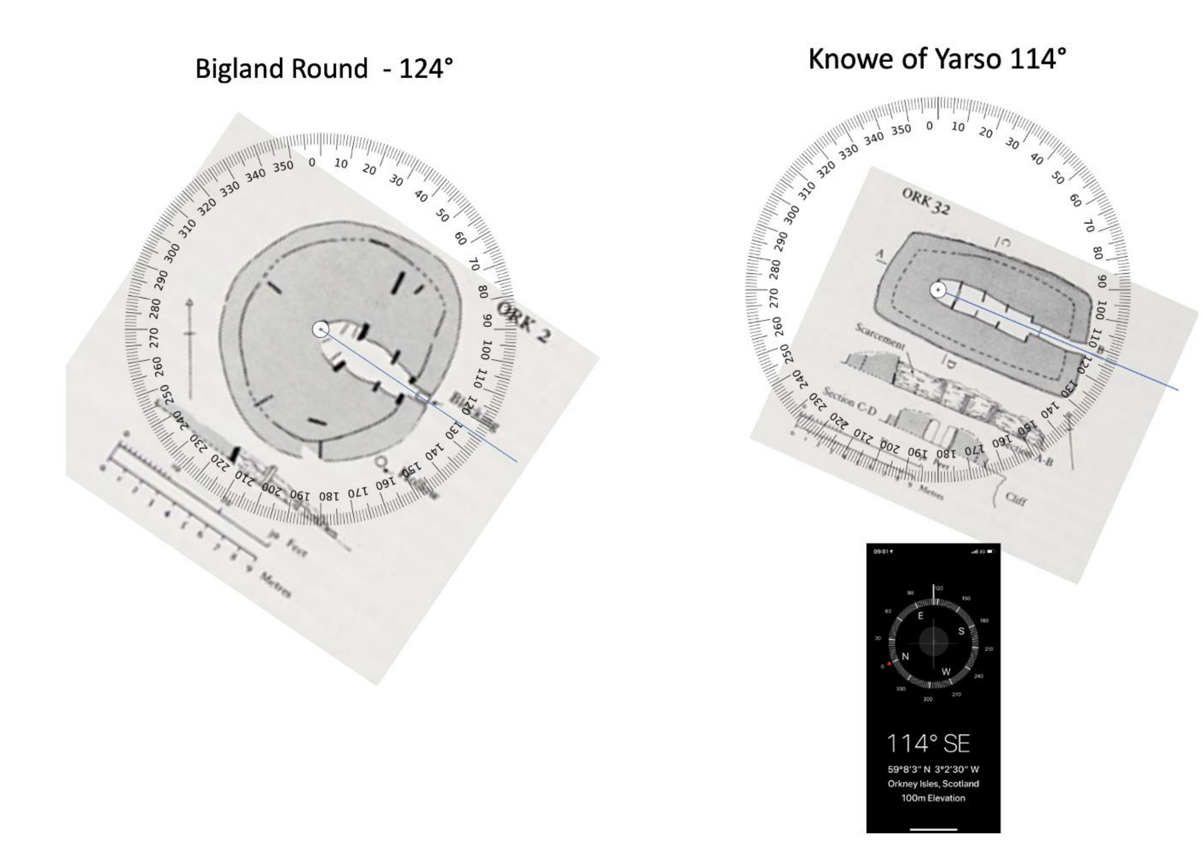


Figure 4.11. When on-site orientation was indiscernible, historical archaeological plans and sketch plans were utilised to assess alignment and orientation. Left - Bigland Round tomb alignment reading Desk based process (adapted from Davidson and Henshall 1989, 102) and Right – Knowe of Yarso alignment reading desk-based process (adapted from Davidson and Henshall 1989, 138) with screenshot of field captured data.

In examining the alignment with the rising and setting sun in chapter 7 the Celtic / Pagan Wheel of the year framework was chosen as it celebrates key events throughout the year, coordinating with natural cycles that may have held significance for ancient farmers. This selection was based on the understanding that a knowledge of the yearly cycle would have been crucial for Neolithic farmers. However, it's essential to clarify that the suggestion here is not that this Pagan/Celtic yearly cycle was necessarily part of Neolithic cosmology. Rather, it is posited that these natural cyclical changes would have had an impact on farming strategies, requiring an understanding of when to expect the breeding of livestock and the onset of the growing season, even if this knowledge was derived from observations of natural cycles.

Figure 4.xxx details the names of these festivals along with the corresponding dates and degrees of the rising and setting sun at these times, as they relate to the coordinates of

Orkney (59° North latitude) (Figure 4.12). This information was obtained from the comprehensive online resource (https://www.suncalc.org) The sunrise and sunset positions were then juxtaposed against the orientation data to ascertain the relationship tombs had with these 'special' days. This analysis provides insights into potential alignments with celestial events tied to the agricultural calendar, contributing to a more holistic understanding of the cultural and practical considerations that may have influenced the placement and orientation of Neolithic tombs in Orkney.

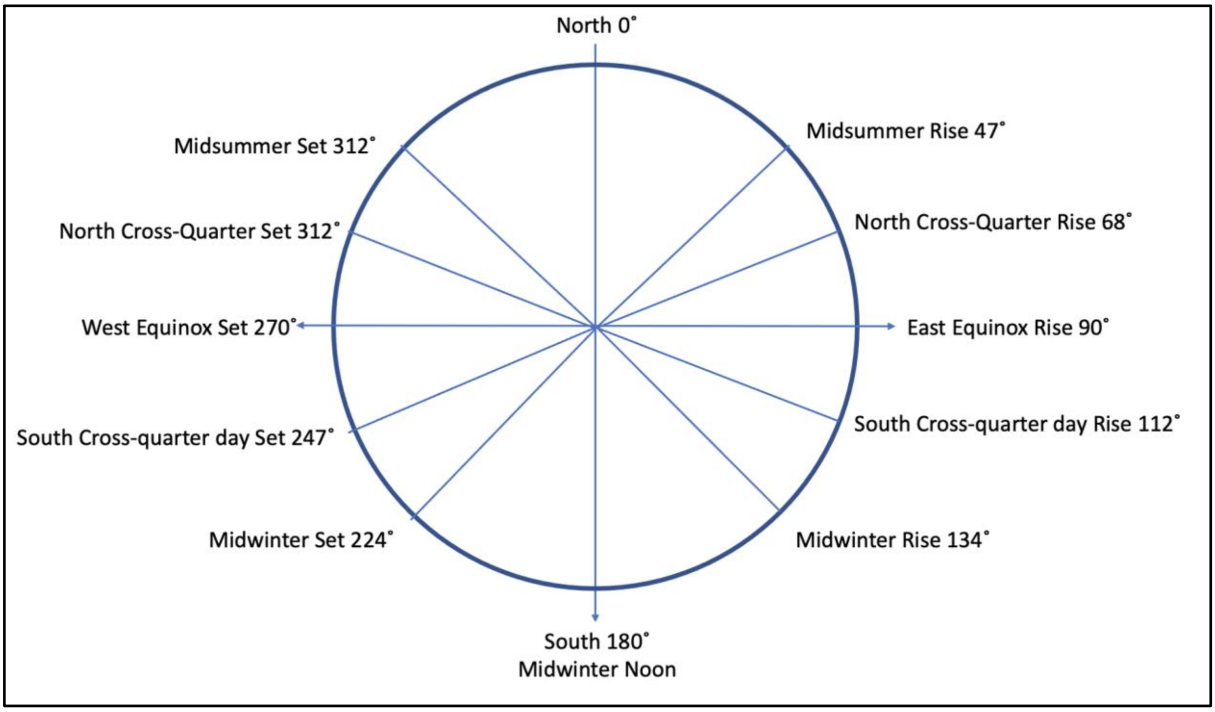


Figure 4.12. The astronomical cycle of the year with sunset and sunrise as relating the different points of the annual cycle – this is specifically for 59˚ degrees North latitude (Orkney) (produced from figures from https://www.suncalc.org).

Elevation

Elevation as Meters Above Mean Sea Level (MAMSL) was obtained at each site from the level of the natural ground closest to the entrance at each monument or the best assessment of where this position was. This was considered a method that would bring some uniformity to this process given the diverse condition and positioning of the tombs. Some are set on slopes; some are not identifiable in the ground and the vast majority are in a state that means the true height is not detectable so the measurements taken at the top of the current cairn remains will have been meaningless. The elevation reading at each site was taken using a Garmin handheld etrex GPS system that was calibrated at the start of each day. Altitude - note of altitude accuracy on handheld GPS system concurred with physical map readings and later Google Earth Pro elevation data but on occasions did not perform within the compass app (that included altitude) on the iPhone 13 Pro. It is felt for the purpose of this research and the relevance of elevation data it is appropriate to utilise any source of elevation recording though it needs to be said that the exact position was not recorded and anyone replicating this work may be a metre or two out either way. If it had been critical, then the 8-fig grid reference or what3words reference would have been taken at the same point as the elevation reading. It is felt this is a level of accuracy that was not required to achieve the objectives of this research.

Monument Survey Form

Figure 4.13 is a form designed, bespoke to this research, to capture all the necessary data and to act as an aide memoire on site. It has been included here in order to show the preparation however the details in the table at Appendix 1 were input directly on site once readings had been taken, they were input live onto this database using an IPad Pro. It was specifically important when to support later analysis and in writing up this research as well as identifying intervisible monuments, settlements, and landscape features. There are no hard copies of this form remaining due to the fact it was only used as a guide to input directly onto the IPad electronically.

Orcadian Monument Survey Form

Name of Monument:

ORK ref:	CANMORE ref:
Map ref:	
Island:	
Date visited:	Visibility / conditions:
Classification: Tripartite / Stalled / Bookan / Maeshowe / Other / Not known	

Cairn	Length:			
	Width:			
	Height:			
	Area:			
	Orientation:			
	Shape:			
Passage	Length:			
	Width:			
	Height:			
	Shape: straight			crooked/dogleg
	Orientation 1:			
	Orientation 2:			
Chamber(s)	Length:			
	Width:			
	Height:			
	Cells:			
	Compartments:			
	Orientation:			
	Shape:			
	Stall orthostat: H	D	W	Spacing

General

Topography:

Visibility Survey

	Sea
Near:	Fresh water
Intermediate:	Farmland
Distant:	Settlement
	Beach/Landing site

Islands:

Indivisibility with Canmore Sites (incl ref number)

Settlement:

Tombs:

Other of note (lithic scatters etc):

Altitude:

Approach:

Figure 4.13. Copy of Orkney Monument Survey Form designed bespoke to this research.

Photography

Given the magnitude of the task visiting all the tombs over this geographic area time on site was finite so a process was adapted to be carried out at each site (see Figure 4.9). Following the recording of required on the above form still photographs were taken in the form of a 360-degree panoramic sequences. This was carried out using a prime 50mm Prime lens on Nikon z6 full frame camera. This lens is closest to normal eyesight and was felt necessary when later ascertaining if it was reasonable to assess that monuments were intervisible. A zoom lens was also used to capture features simply to assist in analysis from computer top reviews. Video images (via facility on Nikon Z6) were recorder with commentary when appropriate.

Figure 4.14. Drone utilised at several sites during fieldwork. DJI Mavic Enterprise pictured at Westray (authors own photograph).

A drone system was also utilised on several sites where permission had been sought and gained by Historic Environment Scotland and in the case of one survey, the Landowner. A qualified and CAA licenced drone pilot was used to carry out these surveys. The low-resolution thermal sensor of the DJI Mavic Enterprise (Figure 4.14) was able to provide some results that refine the currently available information. The point of this was to demonstrate the research flexibility and the possibility to identify or see more clearly images gained from normal sight as identified in other areas of archaeological fieldwork (Casana *et al.* 2017). This technique was able to add to the current information and was particularly useful on some of the lesser studied monuments the example presented here being Vere Point stalled cairn on Westray. Figures 4.15 and 4.16 show these possibilities with the extent of the cairn surrounding the monument much more visible in the thermal image (Figure 4.16). Before this work only record was the sketch plan (Davidson and Henshall 1986, 167) adapted for figure 4.17.

Figure 4.15. Drone image taken without infrared camara of Vere Point, Westray (authors own image)

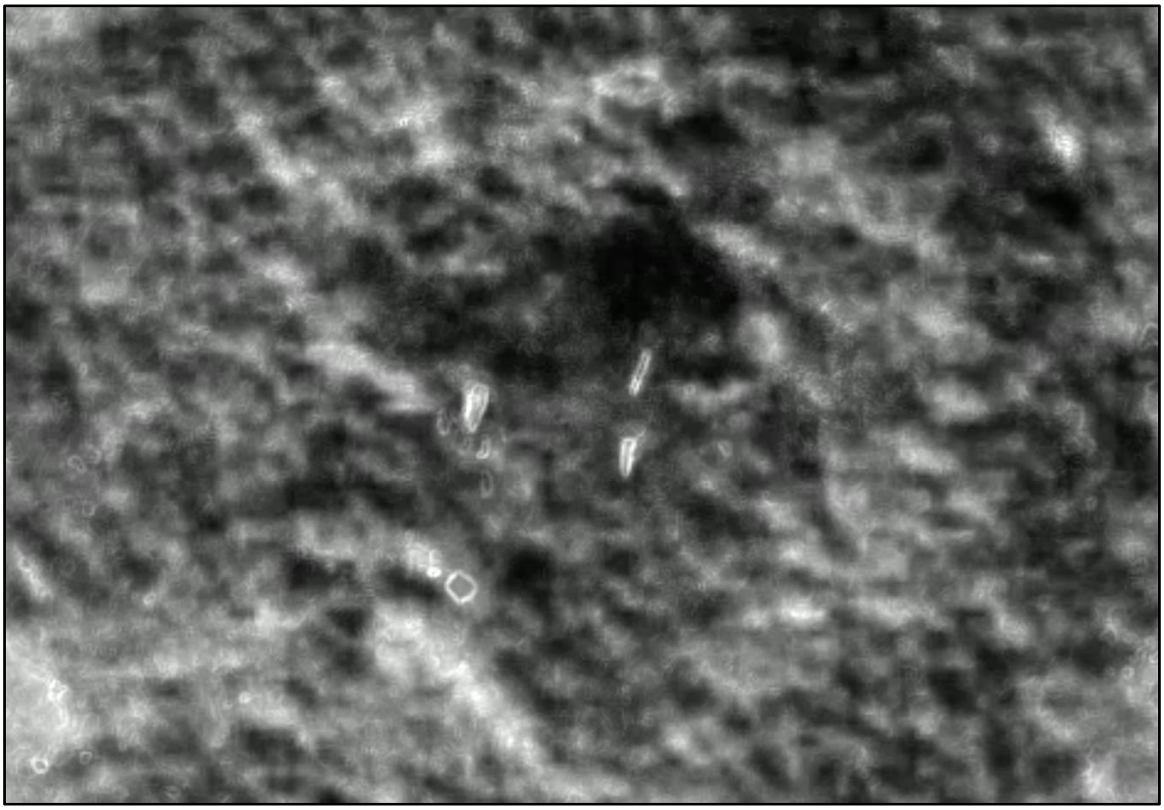


Figure 4.16. Low-resolution thermal sensor image of Vere Point, Westray taken during the field survey better showing the cairn and stone remains that the simple photograph in figure 4.12 (authors own image)

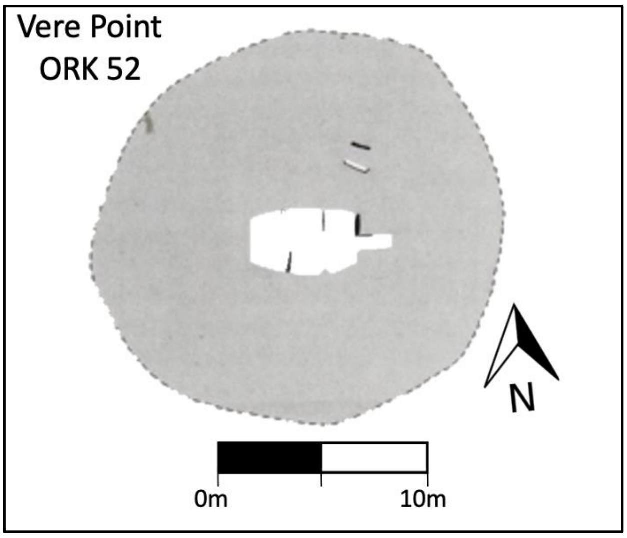


Figure 4.17. Prior to survey as per Figures 4.12 and 4.13. This is the only documentary record of the site at Vere Point Westray (adapted from Davidson and Henshall 1986, 167). Shown here by way of an example as to how knowledge was refined using different recording methods.

Still photographs were also taken of any features that were worthy of note for architectural analysis or deemed relevant; examples being at Figure 4.15. It was the recording of these nuances that were able to assist in the analysis and presentation of findings throughout this work. Example being at Figure 4.18 (left) an image of a stalled cairn backslab is recorded that became important as this work progressed. Figure 4.18 (centre) shows possible lintels (top one of the three) with cup mark art which were noted in the ruins of a church co-located with the greatly degraded remains of Eday Manse passage grave. Given the location, type of stone and the cup marks it is likely that this lintel is robbed out from the tomb in antiquity. Similarly, 4.18 (right) is a missing orthostat from Unstan stalled cairn which assist in the multi-phase analysis interpretation within chapter 6.

Figure 4.18. Examples of feature specific photography taken during this research. Left - An architectural feature of a stalled cairn back slab, Rousay; Centre – A lintel containing probable cup mark art that may have been robbed from Eday Manse Chambered Cairn and used in the later building on the same site; Right – a missing orthostat slot at Unstan multi-phase monument (all images authors own)

Phenomenology

Factored into each site visit was time to simply sit and take in the location. It was considered that at least in part this phenomenology approach as first used in Tilley's influential *A phenomenology of landscape* (1994) was an essential part of each survey. By utilising this approach, a more subjective and in-depth examination of the landscape settings was achieved. Intervisibility with landscape features, the sea and other monuments was critical to this work. Whilst some features were technically intervisible, this could have been ascertained broadly from map research by being present it was possible to make a subjective assessment as to siting decisions made by the builders, the aim being to interpret if a particular intervisibility finding was intentional and acting upon the builders mind or merely fortuitous. Presence at the site allowed for this in a way that map study alone would not have achieved. Furthermore, this aspect of research was instrumental in identifying relationships with beach landing points and routeways so critical to discussions in this work.

Issues with the field surveys

The islands under study are remote, with many having few inhabitants and little in the way of interisland public transport links. Once on the islands, there is a need for a vehicle, which can only cover part of the journey before continuing foot. Navigating to sites by map reading and GPS was utilised. The remoteness was perhaps not appreciated initially particularly given that the researcher was not based in Orkney. This resulted in plan changes due to essential field surveys being more time consuming that originally accounted for. This issue was overcome by extending field survey trips and adding more visits to Orkney as required. Rousay had to be visited twice due to inclement weather conditions on the first visit that hindered visibility that was a key area of research. The original fieldwork plan also faced challenges due to the prevalent Covid-19 pandemic. Despite these obstacles, a revised plan was formulated, and the following fieldwork goals were achieved:

2018 – 14 days excavation and surveys - Sanday, Mainland
2019 – 7 days field surveys - Eday, Rousay, Mainland, Shapinsay
2020 – 14 days field surveys - Westray; Papa Westray; Eday; Stronsay; Papa Stronsay, Mainland.
2021 – 25 days field surveys and excavation – Sanday, Mainland
2022 – 10 days field surveys – Rousay; Westray; Wyre; Mainland

In total 70 days fieldwork was embarked upon in pursuance of this research.

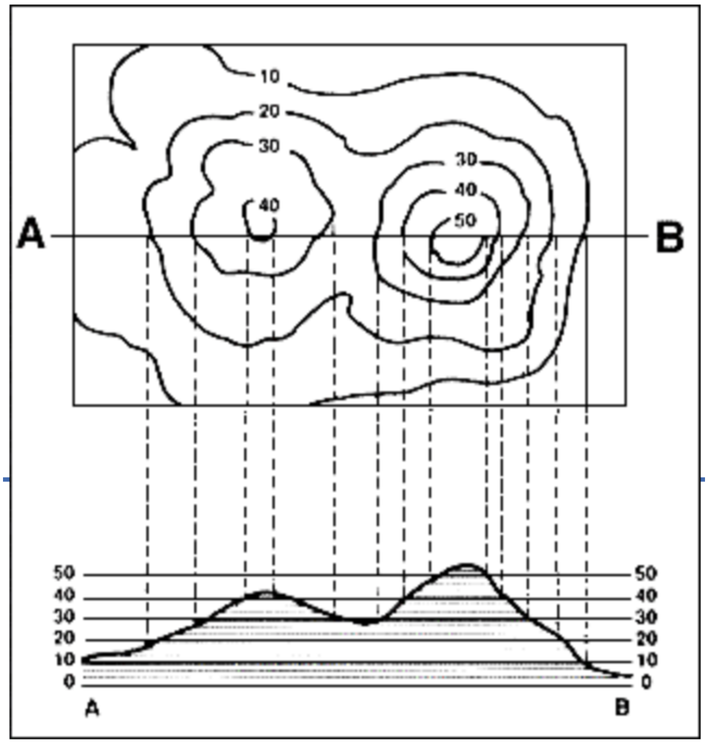


Figure 4.19. Example of the map profiling assessment that was used when other more modern methods were not able to provide results (https://teamgeographygcse.weebly.com/height-on-maps.html).

Once the programs logistics were addressed a plan was made with the intention of visiting as many sites as possible. Holm of Papa Westray (three tombs) and Calf of Eday (three tombs) (they are uninhabited islands) and one on Egilsay were not able to be visited due to transport though this was deemed not critical as the six tombs on these islands have been thoroughly investigated and a recent archaeological record was available. In addition, personal conversations have taken place with people who have visited these islands to investigate certain issue primarily concerning intervisibility. These matters were resolved using viewshed analysis and physical topographic profile mapping with a OS 1:25000 map (see Figure 4.19). This was used in good effect to ascertain if the Setter Stone in Eday (5m high) could be seen from the Calf of Eday monuments. Photographs taken during surveys, conversations with archaeologists who have visited the Calf of Eday sites and Google Earth Pro were less than conclusive. Consequently, the physical topographical profile diagram solved the issue in the negative.

The transport logistical issues were overcome when required for the research. Papa Stronsay is an island that has no public access, but the chambered cairn Earls Knoll is situated there, it was felt a visit was important for aspects of the research. Desk-based research pointed towards its intervisibility with other tombs (Tresness and Quoyness) and its potential alignment with the distant Fair Isle though it was impossible to confirm without a visit. This island is uninhabited save a permanent congregation of Transalpine Redemptorist monks so contact was made with the senior monk of the Order and despite this speculative request he granted permission to visit even arranging a boat transfer and a tour of the site and island as a whole (Figure 4.20). All the monuments on Rousay required a revisit due to the first survey day being hindered by a persistent *Haar* (a low-lying sea fog) preventing any intervisibility assessments to be made. In summary 85% of tomb sites were physically visited together with 100% of settlement sites.

Figure 4.20. The author and Br Nicodemus Mary discussing the landscape and orientation of Earls Knoll chambered tomb on Papa Stronsay (authors own photograph)

The analysis

This analysis phase of this thesis was be divided into three distinct themes:

- Chronology
- Architecture and phasing,

- Positioning and location

In the initial phase of the research, it was decided that a qualitative and thematic approach would be adopted in order to fully explore the key aspects of chambered tombs. By unpicking nuances within these themes was intended that the greatest interpretive understanding could be achieved. Each theme required a separate methodology and they are detailed below.

Chronology

Chapter 5 is a synthesis of tomb, settlement and ceramic traditions. It pulls together published radiocarbon dating evidence and presents it in a new way to demonstrate the chronological sequence of the developments throughout the early Neolithic between 3800 - 3000 cal BC. Each publication that had information to offer in respect of radiocarbon dating was comprehensively researched and utilised (see Card *et al.* 2018; MacSween *et al.* 2015; Marshall *et al.* 2016; Richards *et al.* 2016a; Richie 2009; Schulting 2010). In addition to these site specific publications wider studies utilising Bayesian statistical methodologies and AMS techniques were included (see Bayliss *et al.* 2107; Griffiths 2016; Schulting *et al.* 2010). The more recent work (Bayliss *et al.* 2107) saw 613 radiocarbon and 79 luminescence dates from across 31 sites considered. A methodology was designed to best present this synthesis in a new way. To that end a system was designed called 'Progressive temporal slice analysis'. This consisted of a process whereby 100 year time slice maps were produced from 3800 - 3000 cal BC to cover the start of the Orcadian Neolithic 3730-3480 cal BC (Griffiths 2106, 287) to a time that overlapped into the later Neolithic (3000 cal BC).

These sites were modelled to produce date ranges that would be visually presented as map-based time slices from 3800 to 3000 cal BC with tomb and settlement evidence added to demonstrate how the archipelago temporally developed, according to current evidence. These maps were produced form QGIS distribution maps that were annotated using Microsoft software to present a visual representation of the development of the use of the tombs and settlements over the relevant period. All cal BC determinations are at 95% probability unless otherwise stated. It is important to note that the time slice analysis has been formulated from the earliest parameter determination. This was used consistently for all the dates to create an uncluttered picture of how the use of the different type of monuments changed over the period of the early Neolithic.

It is not possible to use these data to categorically state that the start of the parameter is precisely the start of the activity. By way of example, statistically a date of use between 3725-3610 cal BC for a monument is equally as likely that the actual date of use will fall anywhere within the specific monuments time parameter. This was identified early in the analysis and a decision made to plot the development as 100-year intervals using an analysis method that consistently utilised the **earliest probability of activity** only. This 100 year time slice approach was decided upon as it produced a set of results that were meaningful, particularly given the sparse nature of dating evidence. Furthermore, it was always a consideration that the dates presented by the publications are primarily as a result of radiocarbon analysis of contents of the tomb and not necessarily the date of construction.

As there are only 10 chambered tomb sites with attributable c14 dates, this amounts to 12.5% of all the currently recorded tombs . Namely, one set radiocarbon determinations for a tripartite monument (Knowe of Lairo), six for stalled chambers (Point of Cott; Holm of Papa Westray North; Midhowe; Knowe of Roweiger; Isbister; Knowe of Yarso) and three for passage graves (Quanterness, Quoyness and Pierowall). At this stage it is clearly only possible to include monuments within the time slice that have calibrated radiocarbon dates associated with them, though there will be some discussion in later chapters how this temporal framework may be added to utilising a typological approach.

Problems with this approach

The time slice approach, based on the universal first possible appearance of chambered tombs and houses in Orkney, faced challenges due to wide-ranging time parameters and the inherent complexities of dating data derived primarily from tomb contents rather than construction processes. However, the incorporation of other archaeological data, such as the Orcadian ceramic sequence was designed to provide for a more rounded view.

The ever present issue in respect of archaeological interpretation of Neolithic tombs is that the radiocarbon dates originate from tomb contents and not construction activities.

This coupled with the Orcadian practice of redepositing remains between tombs underscores the limitations of the current dating evidence within the Orcadian tomb record. It became clear very quickly that the tomb radiocarbon dating record is far from complete – regardless, this analysis was designed to examine if a broad sequencing framework could be established that would complement work later in the thesis. For completeness dates were checked against the Oxford ultrafiltration anomaly used that has been identified as unusable namely OxA-9361 to OxA-11851 inclusive and OxA-12214 to OxA-12236 inclusive (Bronk Ramsey *et al*. 2004). It was expected that the authors of the original publications would have been only too aware of this anomaly though it required checking in the event some of these problem dates persisted in the earlier site-specific publications.

Another issue that was identified is that despite utilising the same methodologies and data there are some discrepancies of interpretation of the time parameters between the Griffiths (2016) and Bayliss *et al.* (2017) works. This was highlighted within a synthesis time bar analysis diagram (Figure 4.21) and is an anomaly of the selection of data to be used in the Bayesian modelling undertaken by each study. In summary the chronology analysis was able to produce a broad framework from modelling published radiocarbon data.

Architecture

Chapter 6 discusses in detail architectural nuances with the intention of understanding multi-phase construction processes. It was necessary to devise a new methodology to assist with this. It had been noted during the physical survey part of this research that there is often an axial asymmetry to monuments which was particularly noted with the passages of many of the tomb structures. This prompted a methodology that utilised all available qualitative data to investigate the alignment of the structures across their own axis. This technique lends itself well to the design of the tripartite and stalled cairns given the design of the structures.

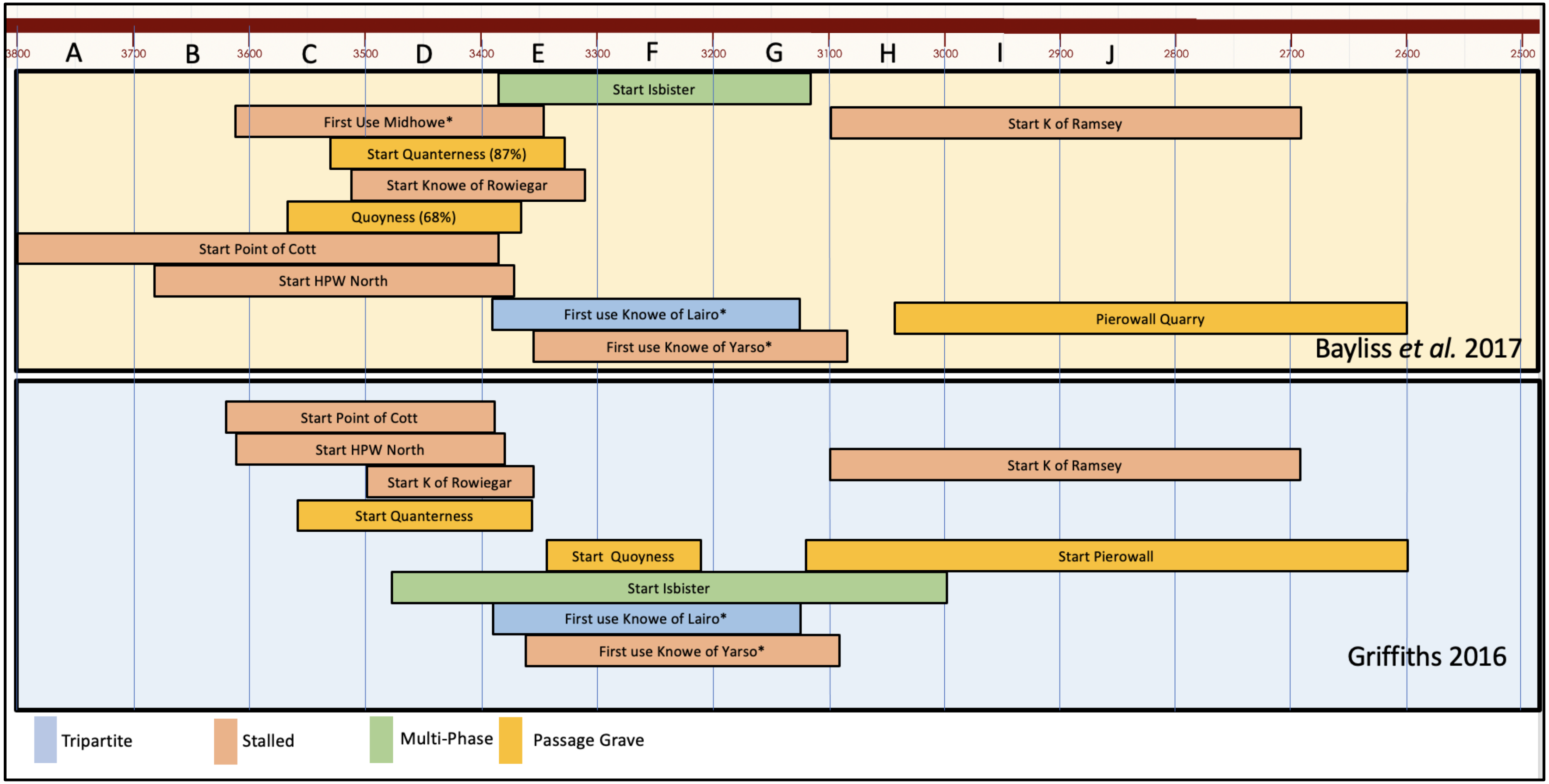


Figure 4.21. Reproduction of Figure 5.4 (this work) - Comparison of Bayesian modelling results utilising data from the two latest papers in this area (Bayliss *et al.* 2017; Griffiths *et al.* 2016).

The basis of this methodology was to obtain the most accurate archaeological record data available for each tomb considered. The sketch plans of the monuments presented in the gazetteer of *The Chambered Cairns of Orkney* (Davidson and Henshall 1989) do not contain sufficient detail to allow this technique to work. Therefore, archive photographs, plans and excavation reports and physical surveys were researched to provide information to assist in considering any question of phasing. Historic Environment Scotland and individuals have in recent years carried out detailed modelling of a finite number of tombs and have produced 3D photogrammetry models of the structures which are becoming increasingly popular and as such many are available on sites such as Historic Scotland and Sketchfab. This data has been critical in the success of this technique and as more sites are surveyed utilising this technique the axial alignment analyses technique will be able to be applied more widely - the axis being the central line that is critical to building design to achieve a balanced and stable structure. This approach is a fundamental to architectural design principle and is as important today as it will have been for our earliest builders. The technique involves acquiring the best available plan of the tomb and then visually obtaining the centre point of the axis of the structure and drawing a line until the axis begins to change alignment. The process is systematically repeated throughout the monument until the whole structure has been covered.

Figure 4.22: An illustrative example of the axis analysis methodology to be utilised during this work. Here the example used is Tresness chambered cairn Sketchfab model 2021 with authors annotations (https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

By example, a high-quality 3D photogrammetry model (Figure 4.22) was produced and processed using Sketchfab software, a screenshot is taken here. The axis point of the different sections were identified and the blue lines added thereby making it possible to identify where the changes occur thereby presenting an opportunity to consider if these aligned sections are **representative of different phases of construction**. In this example there are four identified changes, two in the chamber and two in the passage. If the level of survey images are to the standard of the example here then this task is relatively straightforward as the photogrammetry software (sketchfab) allows for accurate measuring as oppose to simply 'eyeing in' the centre point in the analysis was relying on drawn plans. In addition to the alignment of these axis sections other aspects of each tomb has been considered to assist in making phasing deductions, they are;

- **Intrinsic characteristics of building material such as colour, composition, size and shape of the stone** - Aspects such as was the stone used beach worn or quarried stone what was the colour and geological matrix of the stone used. Both these points may indicate stone was obtained at different times of from different places.
- **Quality of masonry work –** By sight the quality of the masonry work can appear different. Whether neatly arranged or roughly placed this quality is notable. The difference may point to either the skill of the mason or the time taken over the construction. Such observation may be useful in interpreting if community masons were used or if tombs were built over time or in haste perhaps say following the death of a tomb worthy individual.

When evidence obtained from these methods were added to the axial alignment analysis it was possible to make assertions in respect of multi-phasing of the tombs. Again we see limitations in this processes as the number of monuments that currently have the level of detail in respect of plans, excavation reports and 3D photogrammetry are limited. It is notable that the best results are achieved where 3D models are available or by being part of the excavation team as in this example. It should be acknowledged that the 3D photogrammetry model at Figure 4.19 was produced by Dr Hugo Anderson-Whymark though I was grateful to assist in its production and to receive training in this full process during excavations at Tresness, Sanday in 2021.

Location analysis

Chapters 7 and 8 detail analysis of the spatial aspects of the monuments with the former addressing orientation and alignment and the latter looking into landscape settings and relationships with settlements landscape features and other monuments, routeways (both terrestrial and marine) and suitable sea landing points. The orientation readings from fieldwork and desk-based assessment were input into orientation wheel diagrams. The fieldwork method for obtaining the orientation has been described previously. The desk-based methodology was used where the passage was not identifiable due to degradation of the tomb. The process adopted in this situation was to obtain the most accurate archaeological plan, overlay a 360˚ protractor, insert the axis of the passage and read the orientation. Any physical reading took priority as a more accurate method of measure. The starting point for outward passage orientation was the wheel diagram at Figure 4.20 (Davidson and Henshall 1986, Fig 30). The fieldwork and the desk-based approach was designed to obtain additional alignment data to enable the creation of more detailed diagrams (Figures 4.21 shows an example reproduced from Chapter 7). The wheel diagrams in this work were produced using almost double the orientation dataset from the previously published works (Figure 4.10). This uplift allowed for a more meaningful analysis with a breakdown into classification types and even island by island data. It was this latter analysis that identified island by island differences that added to discussions later in the work. For completeness a randomly computer-generated orientation wheel has been included for comparison utilising a random number generating software. This was intended to demonstrate that the alignments are not random and it supports the argument that the true alignments were an intentional building decision.

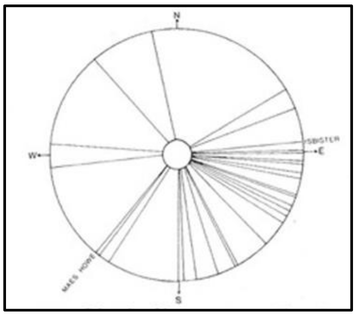


Figure 4.23 Wheel diagram of passage orientation of all classification of tombs on Orkney (Davidson and Henshall 1986, fig 30).

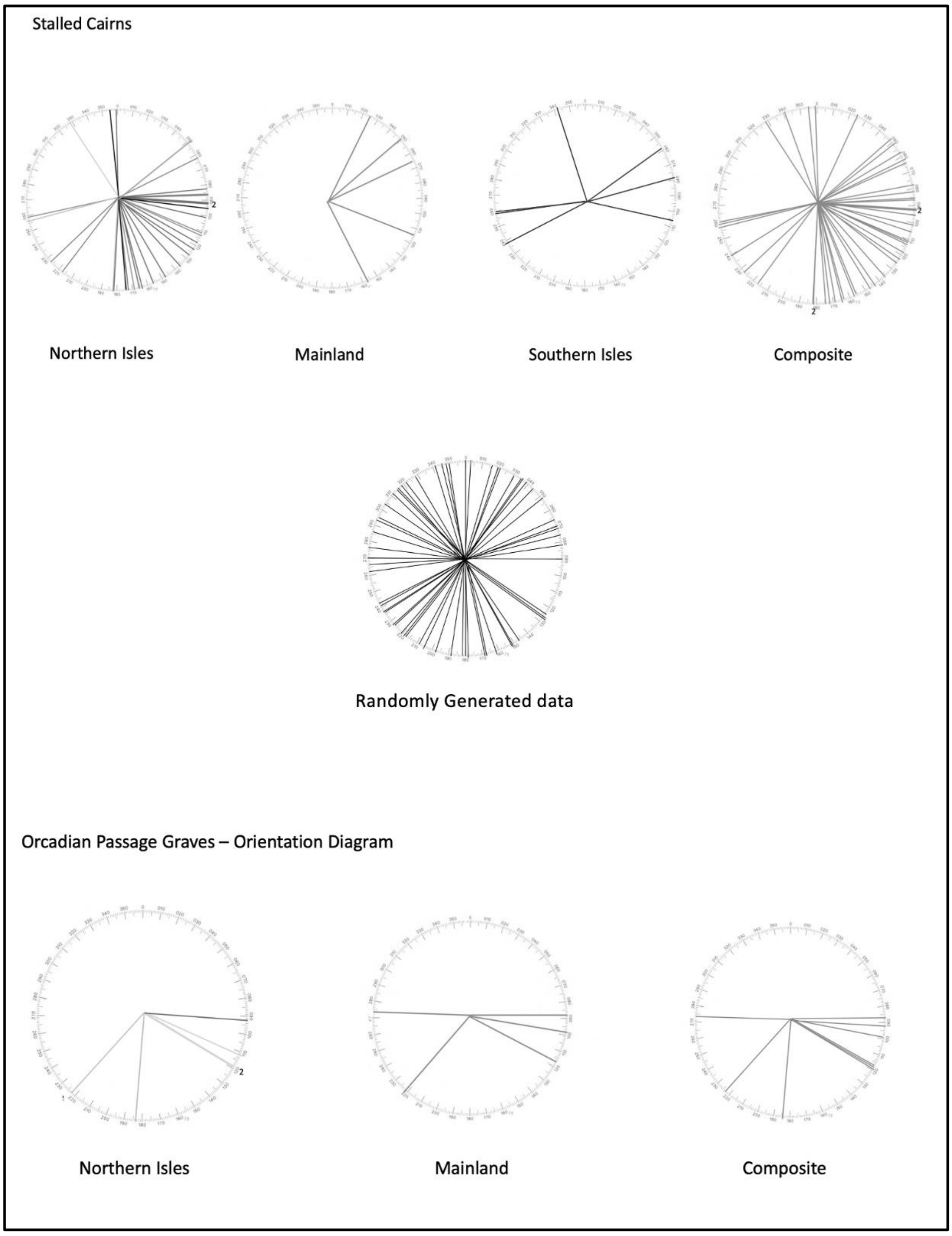


Figure 4.24. Reproduction of figure 7.2 (this work) **-** Orientation wheel diagrams created by the author from alignment data within the archaeological record or field surveys. Top - breakdown of stalled cairns (tripartite, stalled, Bookan and stalled with cells); Centre – a orientation wheel composed from random number generator software; Bottom - same for Orcadian passage graves

It was decided that detailed mathematical high-accuracy was not sought in this work due to there being no evidence that Neolithic people relied on such precision (Ruggles 1984; Ruggles and Barclay 2000), a point addressed in Chapter 7. Consequently, the methodology incorporated a process which addressed this lack of contemporary astronomical knowledge or measuring capability. It was decided that analysis would be undertaken with a plus or minus 5˚ accuracy to assess astronomical alignment. This has been deided upon as having considered matters of axial precession, obliquity and eccentricity it has been calculated that in Neolithic times there was only 1˚ difference between the rising sun of today (Ruggles 1999). Furthermore, and relevant to the Orcadian North Isles, the weather often prevents an observer from seeing any sunrise. In addition, whilst present on excavation for extended periods on Sanday it was only possible to see the distant Fair Isle at the extent of the horizon for a few days or even parts of days by virtue of a phenomena that means that observation on the horizon, particularly sea horizons the view suffers significantly from haze and atmospheric refraction (see Ruggles 1999, 139; Schaefer 1986). Consequently, any specific azimuth may well have been unobtainable then as it is today. Furthermore, it has been suggested that solar references are likely to have been used by people in the Neolithic but only in a more general or broad sense to determine direction (Ruggles and Barclay 2000, 67). Due to these issues discussed above and the fact that detailed mathematical accuracy is not the intention of this research the methodology has incorporated a process which addresses this lack of contemporary astronomical knowledge or measuring capability.

For these reasons in chapter 7 the analysis monument alignment was decided to be plus of minus within 5˚ of one of the key points in the astronomical year have been included as being aligned at or about a specific date within the astronomical year (see Figures 4.23 and 4,24). The parameter of 5˚ has been decided upon as it is known that the sun rises at different points on the horizon every morning. This change is around 1˚ a figure that can be worked out mathematically though any formula would be beyond the knowledge of Neolithic observers (Ruggles and Barclay 2000, 67). In the absence of this any comparable level of accuracy could only be achieved using pinpoint observations and it still may take several days identify these changes. This analysis was purposely designed not to be mathematically exact and so a variation of 5° (c. 5 days) was deemed appropriate to assess the relevance of the orientations.

The aim was to investigate if there were any seasonal considerations operating on the mind of Neolithic builders when deciding the orientation of their tombs. The online software www.suncalc.org was utilised to understand rising and setting sun positions.

Relationship with landscape, settlements and monuments

Chapter 8 considers into the findings of visibility surveys concerning landscape features and other tombs. Altitude and intervisibility assessments were conducted using data from field surveys, presented graphically in Figure 4.22. The tombs considered in this intervisibility study underwent a comprehensive evaluation, focusing on analysing the visibility between other tombs and settlements that would have been feasible during the Neolithic period. An illustrative example provided is the observation that Vinquoy Hill on Eday can be seen from Fitty Hill on Westray, though only with the aid of tools like binoculars.

This detailed examination of visibility was crucial in Chapter 9 to a crucial role where assessments where assessments were made regarding whether a tomb was intentionally sited to leverage intervisibility considerations. The assessment involved visiting tomb locations, working with maps, and identifying the locations of other tombs, all recorded on an iPad. For tombs that were not physically visited, data was obtained from Fraser (1982, Appendix A).

This work went beyond technical intervisibility by incorporating a personal phenomenological viewpoint. It considered whether intervisibility was a significant factor in choosing the tomb's location or if it was merely a coincidence, given the open and expansive views across the archipelago. This nuanced discussion is explored further in chapter 8 and 9 , illuminating the multifaceted considerations that may have influenced the placement of the Neolithic tombs of Orkney.

Use of Google Earth Pro

It will be noted that these assessments were not completed on all monuments given the logistical issues as discussed above. Photographs and annotated figures from *QGIS* and *Google Earth Pro* were utilised in this chapter as visual demonstration of the points made were the most efficient way to make the points on intervisibility. Further to this Google Earth Pro viewshed analysis images were used when assessing the relationships between tombs and settlements and tombs and other tombs. Google earth Pro emerged as a fitting and accessible tool during the research design phase of this thesis, offering a versatile platform for visualizing geographic and spatial data. The software facilitated the creation of maps, conducted viewshed analyses (depicted in green in relevant figures), and managed landscape data. Particularly advantageous was its utility during tomb field surveys, where access on an iPad Pro enabled researchers to confirm views from physical presence at a site. It is acknowledged, however, that the choice of tools in archaeological research is contingent upon project-specific requirements, and for more specialized Geographic Information System (GIS) functions, dedicated GIS software may be deemed necessary.

During the research design phase of this work the decision was made to use Google Earth Pro viewshed analysis over traditional GIS tools (in this case QGIS that was used elsewhere in this research) was considered. Google Earth Pro was deemed suitable for the research needs without necessitating extensive training that could potentially divert time from other crucial aspects of this study. Traditional GIS tools are acknowledged for their expense, steep learning curve (Conroy et al., 2008; Renner et al., 2009; Yu and Gong, 2012; Wood et al., 2007), and comparatively lower flexibility for geo-visualization (Wood et al., 2007). Additionally, these tools can present challenges in operating and seamlessly integrating vast volumes of data from diverse sources automatically (Yu and Gong, 2012).

It should be noted for clarification that here Google Earth Viewshed tool was utilised as confirmation and visual presentation of physically visited sites. Its effectiveness in communicating results through figures was noteworthy, surpassing what could have been achieved with photographs alone. An added advantage is the transparency of the tool, facilitating replication and verification by other researchers, as outlined by Herndon et al. (2023).

It has been said "The era of RSBD (*Remotely Sensed Big Data - Google Earth Pro being an example)* has arrived for archaeologists (Herndon et al. 2023, 11) and this research has confirmed that it was effective in respect of the needs of this research design strategy. This declaration underscores the transformative impact of online tools such as Google Earth Pro as an alternative consideration in archaeological research, providing researchers with powerful and accessible means to analyse and communicate spatial data.

The process that was utilised commenced with taking data from the master database the sites were then exported into Google Earth Pro using the location data. Each monument and settlement were then checked using the satellite imagery of Google Earth Pro. Once this was set up and the point of a tomb or settlement pinpointed and stored the viewshed facility in this software was used to present the computer generated viewshed analysis (in vivid green). The viewshed had also been checked on site, (when Orcadian weather permitted) by utilising Google Earth Pro on and IPad Pro, to support the physical observations made during fieldwork and enhance the presentation of the findings in this written work.

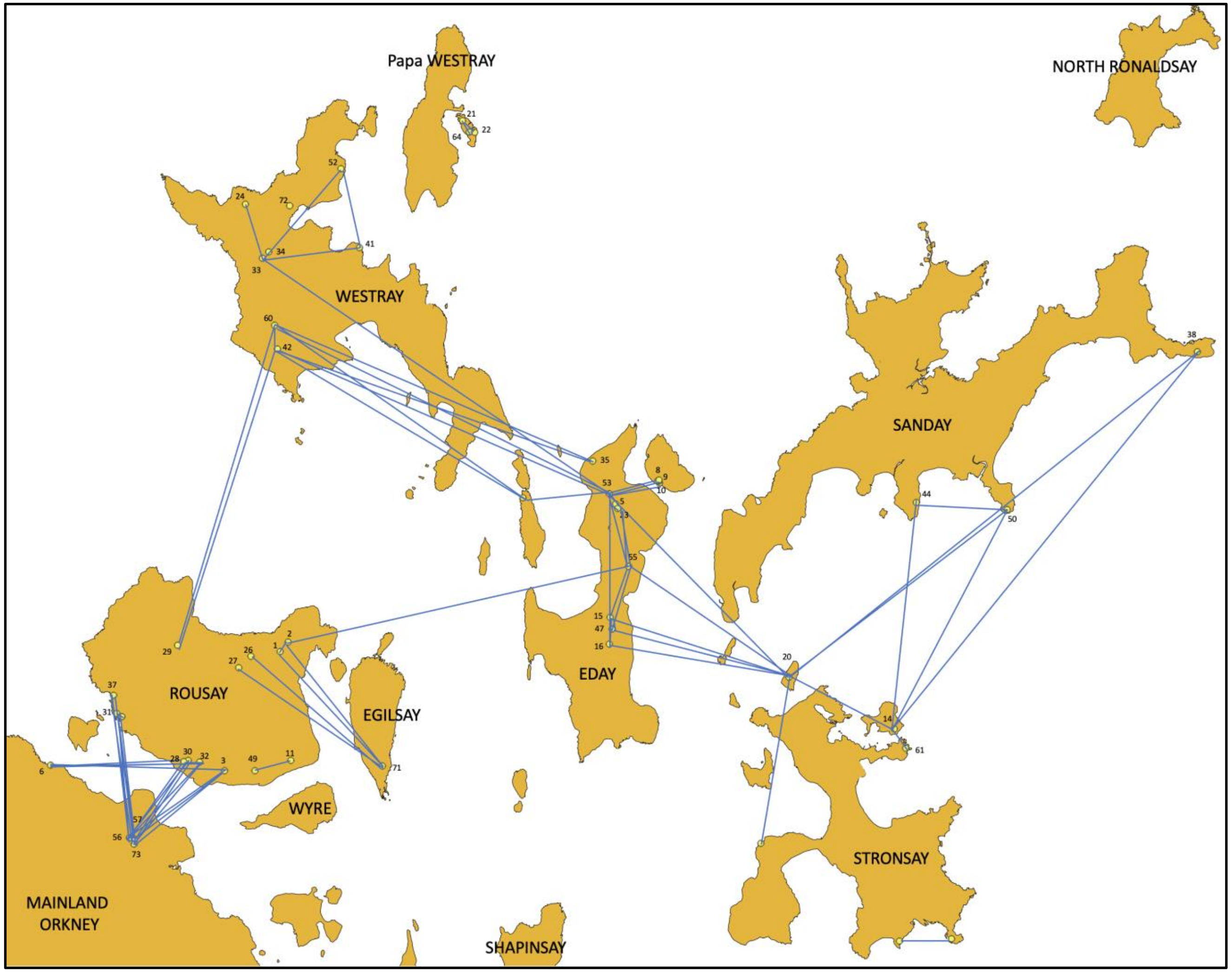


Figure 4.25. Diagram showing the intervisibility assessment of all the monuments of the North Isles. This was created from visiting all tomb sits hence not all the tombs are represented (QGIS base map with authors annotations).

A viewshed has been produced for every monument and settlement. From the data received during field surveys at the tomb sites a full intervisibility assessment was carried out and the results are reproduced in tabular form in the chapter before being used to create a map representation (Figure 4.25). These were achieved by physically attending the sites and using a map and pre-visit reconnaissance notes to identify landscape features, other tombs and that could be seen from a particular site. The results were recorded and entered to the master database. Relationship with settlements, clustering assessments and landing point assessments were all carried out at the same time.

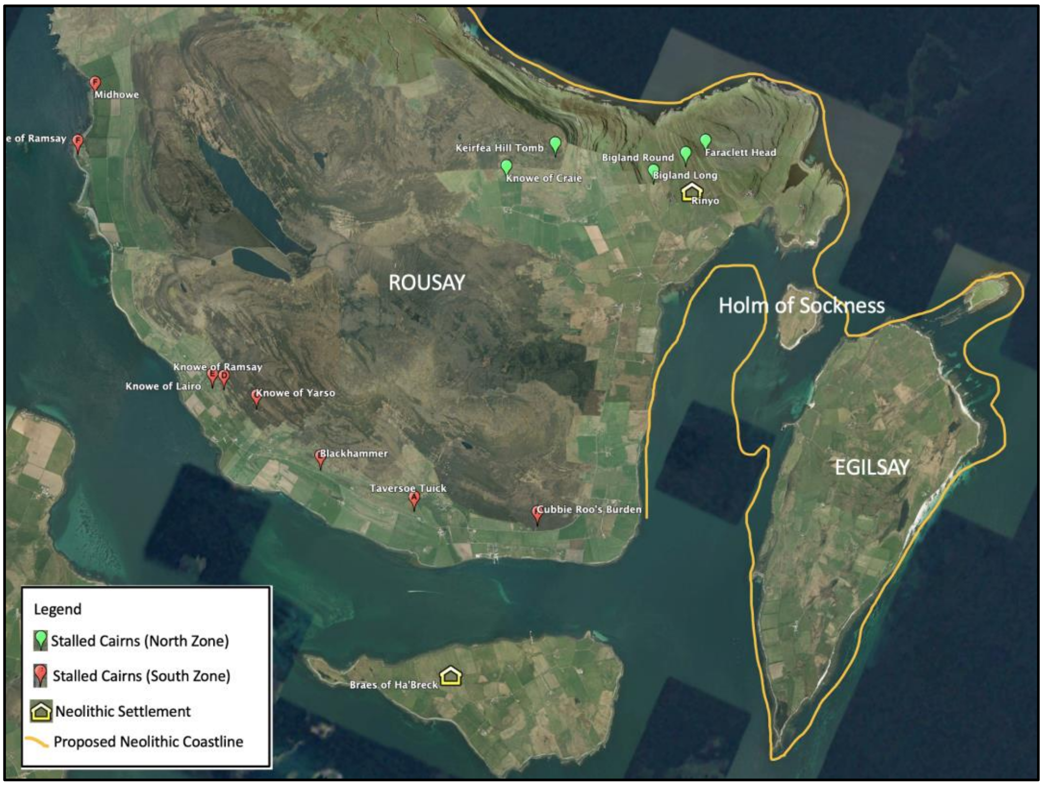


Figure 4.26. Figure 5: Extract from marine chart showing sea depth contours annotated with the mustard line that demonstrates how the island of Egilsay may well have been a peninsular of Rousay in the past (Google Earth Pro base map with authors annotations)

Later in this thesis routeways both marine and terrestrial are considered which included suitable landing sites. First a comprehensive analysis of the submarine contours was carried out to understand how the early Neolithic 5m lower sea level (Lambeck 1991)(and presented as at figure 4.26). Online marine *EDINA Digimap* mapping data was utilised in this exercise with raster nautical charts from UK Hydrographic Office paper charts were explored for all the North Isles. It was identified that a number of islands that have tombs – Holm of Papa Westray and Egilsay – may have been connected, intertidal or certainly considerably easier to access during the early Neolithic. This was then analysed and the coastline for each of the islands assessed for suitability for landing a Neolithic craft (see full discussion around this in chapter 8).

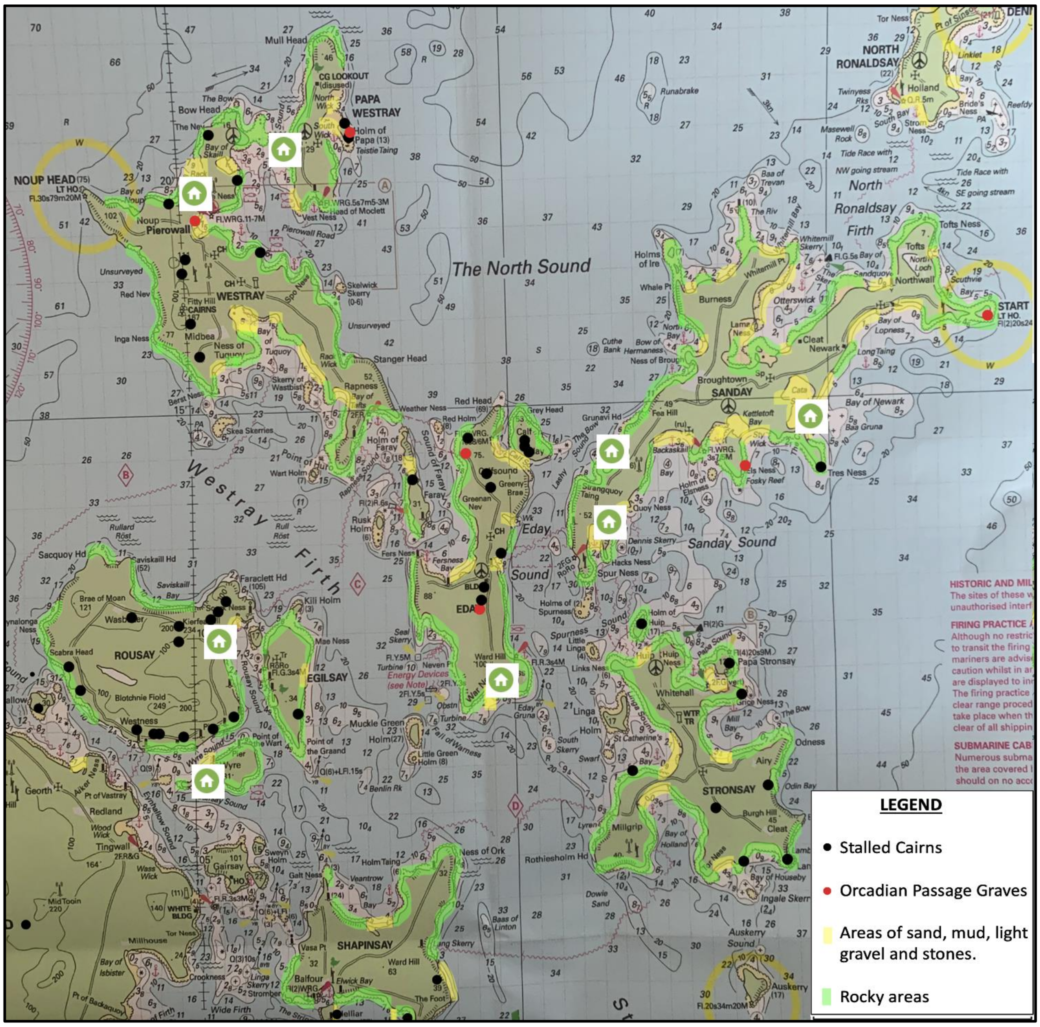


Figure 4.27. A photograph of the marking up of the map during landing point analysis.

The research employed a combination of Imray charts, the latest Google Earth Pro satellite images (Imagery date 2021), and on-site physical observations during fieldwork. While it's essential to acknowledge that not every potential landing location was visited, this amalgamation of tools was considered highly accurate for assessing the suitability of locations for the landing of watercraft used during the Neolithic period.

Imray charts, known for their nautical accuracy and detail, served as valuable references for understanding maritime features and coastal geography. The integration of these charts with the latest satellite imagery from Google Earth Pro offered a comprehensive and up-to-date visual representation of the landscape. The imagery date of 2021 ensured that the research team had access to recent and relevant data for their analysis. The fieldwork, with its direct physical observations added a crucial layer of first-hand information to the research. While not every potential landing site was physically visited (for logistical reasons), the combination of charts, satellite imagery, and on-site observations provided a robust framework for evaluating the suitability of various locations viable for the landing of neolithic craft. This was then drawn onto the Imray map to assist assessment (see Figure 4.27)

This approach was considered methodologically sound integration of modern technology, historical chart data, and direct field observations, aligning with the research's aim to identify terrestrial and maritime routeways. The utilisation of such a diverse set of tools strengthens the reliability and comprehensiveness of the assessment of landing and thereby assisting the later analysis into connectivity and marine and terrestrial routeways.

One the landing points were identified the next stage of the methodology was considered the land and sea routes that aided island to island travel. The determination of landscape routes in the North Isles involved a version of a phenomenological approach, blending walking and/or driving on modern routeways in person to experience the landscape and the location of relevant sites. This practical exploration was complemented by topographical images, when necessary, to ascertain the likely routes taken in the prehistoric past. An essential aspect of the research design from the outset was the inclusion of a personal phenomenological presence in the landscape (see Tilley 1994).

The topography of these smaller islands led to the theoretical conclusion that the modern roads closely mirrored, if not exactly replicated, the routes ancient inhabitants would have used for travel. The advantage of studying small islands lies in the ability to traverse each road on foot or by car, revealing their interrelationship with tombs and settlement sites on the ground. The decision to prioritize personal presence and experience in the landscape was deemed appropriate for the research needs, eliminating the necessity for extensive training that might have diverted time from other crucial aspects of the study.

Moreover, traditional GIS tools known for their complexity and associated learning curve (Conroy et al., 2008; Renner et al., 2009; Yu and Gong, 2012; Wood et al., 2007) were not considered essential.

The decision to forego the least cost path analysis tool in QGIS was made following considerations and discussions with academic advisors. In the context of this research, the purpose of field surveys was to avoid remote desktop analyses, such as GIS, in favour of a more personal phenomenological presence in the landscape. This approach is particularly suitable for Orkney, as discussed in Chapter 3, where the environment has undergone relatively fewer changes since the Neolithic compared to other regions. Similarly, for the maritime routeways, a comprehensive study integrated Imray nautical charts (C68 - Cape Wrath, Wick and the Orkney Islands), Google Earth Pro satellite images (Google Earth imagery 2021), and on-the-ground physical observations, including distance analysis.

Sea routes were added with the intention of assessing the relationship tombs had with inter-island sea routes. This considered the type of craft used and modelling that has been carried out in this respect (see Blankshein 2021; Broodbank 2000, 102; Callahan and Scarre 2009; Nobel 2006, *fig 9*). Furthermore in 2016 a documentary '*Britain's Ancient Capital: Secrets of Orkney'* the BBC in collaboration with Orcadian archaeological and maritime specialists undertook an experimental archaeology project to explore Neolithic seafaring using a hide boat. The project covered construction to voyage and saw an experienced eight person Orcadian crew paddled a large skin/ hide coracle type craft across the Pentland Firth Hoy to Mainland. The 14.5 km crossing took 4 hours and 50 minutes which provides some tested evidence and therefore a basis for broadly assessing the distances that could be travelled at a time contemporary to the chambered cairns. This information was then used to create a map that calculated distances between the landing points identified in the earlier analysis. It is acknowledged that there are features of the tides that include seasonal changes, Spring and Neap tide adjustments, localised rip tides and tidal races which may have affected any journey. This detail is out of the scope of this research, but it is suggested that these nuances and risks of travel will have been within the knowledge of the Neolithic mariners and therefore considered. It was able to confirm that travel between the North Isles would have been comfortably accomplished within the range of several hours journey time. Pulling together all these analytical methodologies was able to produce Figure 4.28 that formed a basis of discussion in later chapters.

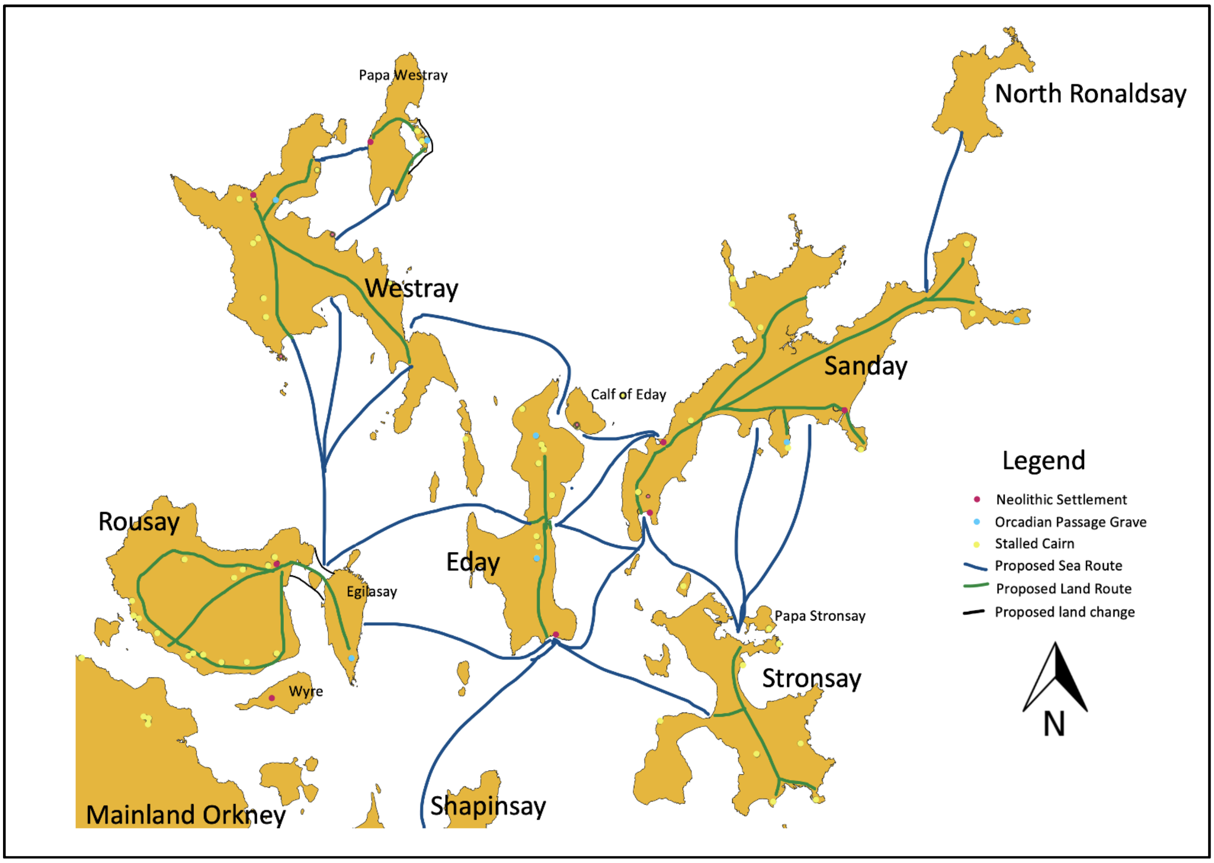


Figure 4.28. A hypothesised complete Neolithic route map of potential inter-island travel (QGIS generated map with authors annotations).

Chapter 5– The chronology of early Orcadian chambered cairns

Introduction

To understand the part funerary architecture played in Orcadian early Neolithic societies the monuments must be viewed in four dimensions - the traditional spatial dimensions of height, width and depth with the addition of a fourth one - time. Arguably the most enlightening of evidence when attempting to refine narratives surrounding the monuments of early Neolithic Orkney is dating evidence and the chronological sequence that follows. This chapter will look at temporality and will synthesise the currently available radiocarbon dating evidence and present it in a new way (Figure 5.1). It is acknowledged from the outset that whilst this area is developing with the advancements in scientific and statistical techniques it is far from complete and a certain amount of extrapolation from the incomplete data will be required. Nevertheless, this work has been able to model a framework of activity in the early part of the Neolithic and by extending this a more nuanced narrative begins to emerge.

State of play prior to the Bayesian revolution

Monuments

The conventional typological trajectory concerning the emergence of Orcadian tombs can be presented in its simplest form as tripartite to stalled to passage grave. It is often argued (and was presented in chapter 2) that the first monuments were tripartite chambered tombs of the Orkney Cromarty tradition which show architectural similarities to the tripartite chambers in Caithness and Sutherland areas of northern mainland Scotland (see Davidson and Henshall 1989, 87). Thereafter followed the elongated iteration of the stalled chambered monuments that shared the same principles of design but contained more chambers numbering between four and fourteen as seen at Knowe of Ramsay (Davidson and Henshall 1989, 21). The passage graves, often referred to as Maeshowe tombs, conclude the sequence and somewhere within this model appears the Bookan and '*hybrid*' versions such as Isbister and Unstan. It has been previously suggested that

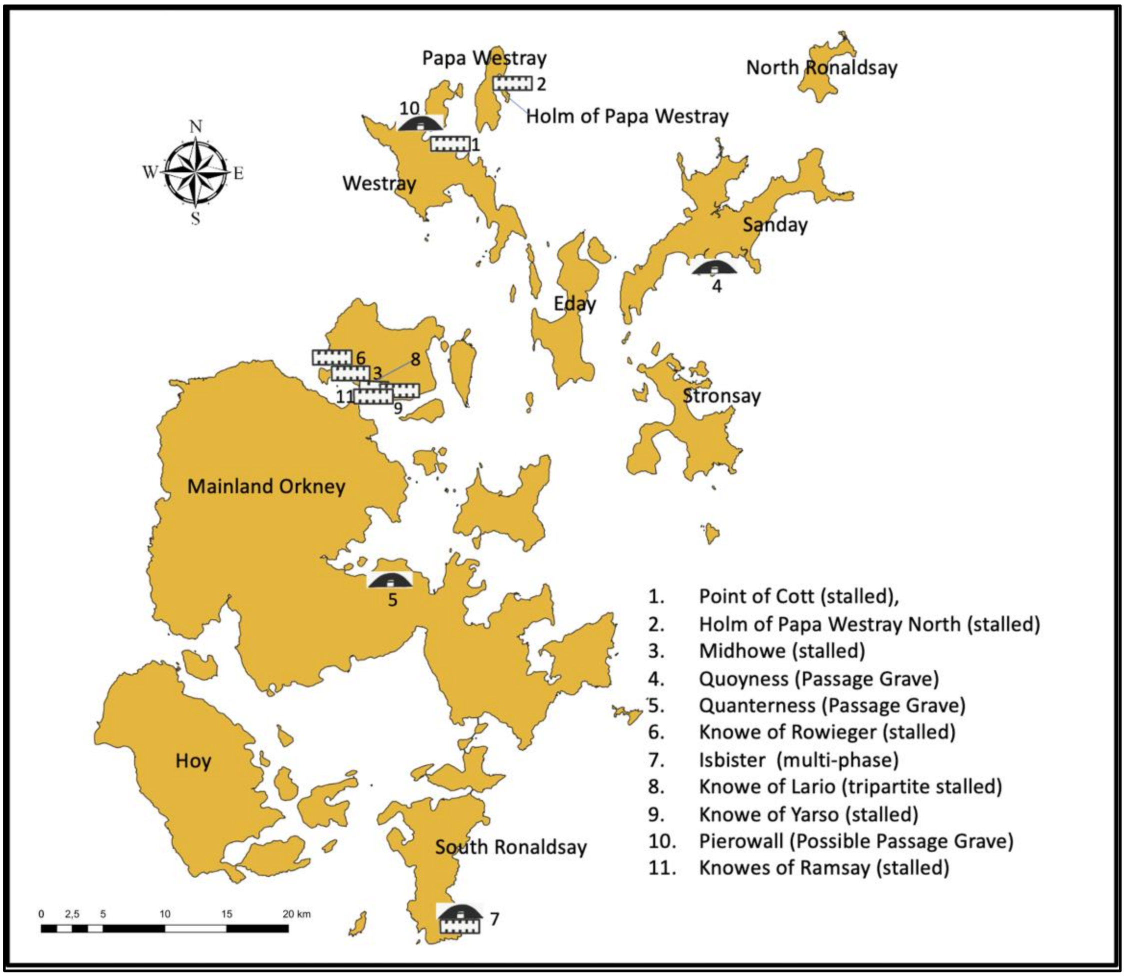


Figure 5.1. Map showing chambered cairn site locations considered in this chapter (QGIS generated map with authors annotations).

passage graves followed stalled cairns by 'several centuries' (Davidson and Henshall 1989, 85; Henshall 1985; Renfrew 1979, 208; Renfrew *et al.* 1976), though more recently as dating evidence become available it appears possible to see a temporal concurrency, overlap or transition between c. 3300 and 3000 BC (Bayliss *et al.* 2017; Griffiths *et al.* 2016; Schulting *et al*. 2010, 2) and it is this nuance that will be considered more in this chapter.

The Present dating picture in Orkney

As outlined in Chapters 1 and 2, prior to the last decade there was a general acceptance of the narratives concerning chronology in Neolithic Orkney. This broad sequence was subdivided into the early and late with some overlap or transition arising somewhere around 3000 cal BC (Card 2005, 47). The early phase is represented by a culture or tradition that is associated with 'Unstan ware' round bottomed ceramics (Hunter and MacSween 1991), tripartite and stalled chambered cairns (see Davidson and Henshall

1989). It was suggested these were used by small scale segmentary and self-contained communities. The later phase saw a trajectory of social evolution and with societal units becoming more centralised and controlled in what has often been described as chiefdoms (Renfrew 1979). Further, this later material culture and monumental phasing has traditionally been associated with the Grooved Ware ceramic tradition (Cleal and MacSween 1999) and passage grave architecture (see Davidson and Henshall 1989). Fundamentally this broad modelling has at its heart the accuracy of the chronological evidence available at the time which was essentially based on chrono-typological assessment.

Early radiocarbon dates

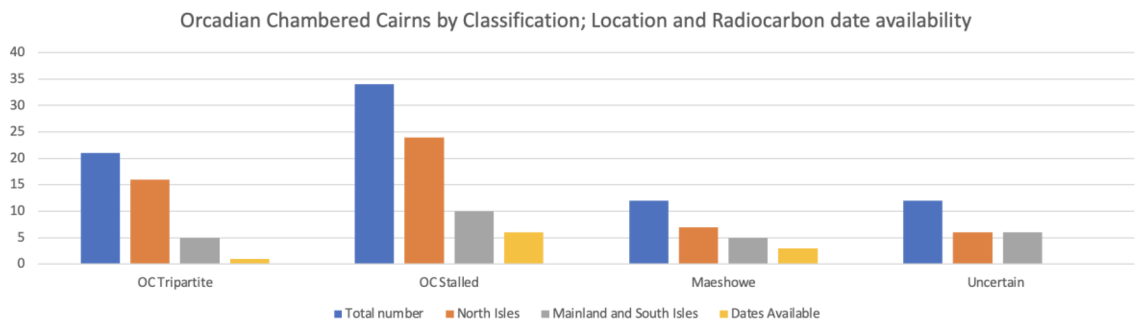
Prior to 1972 when Colin Renfrew conducted his comprehensive excavation at the passage grave of Quanterness there were no radiocarbon dates available for Orkney's monuments (Renfrew *et al*. 1976, 194). Renfrew's work on dating was a catalyst for a flurry of early dating activity which saw some 80 radiocarbon determinations from 11 Neolithic sites across the archipelago (Clarke 1975; Renfrew and Buteux 1985). A second wave was undertaken on the turn of the millennium by Patrick Ashmore (2000). This work saw some 119 radiocarbon dates amassed from 18 settlement and tomb sites. The early/late sequence was partly formulated from these early dating studies and typological considerations. Though the picture was developing it was not until the advent of the Bayesian statistical modelling that the interpretation of chronological evidence started to see some refinement (Bayliss *et al*. 2007).

Chronological modelling

A number of recent significant studies have been undertaken on early chambered cairns and other Neolithic sites. These include the Holm of Papa Westray North (Ritchie 2009) Quanterness (Schulting 2010), Barnhouse (Richards *et al.* 2016a) and the Ness of Brodgar (Card *et al.* 2018), Pool (MacSween *et al.* 2015) and the Links of Noltland (Marshall *et al.* 2016). All have produced important chronology data. Additionally, a specific study on the remains of the Orkney Vole (*Microtus arvalis*) obtained from excavations across a range of Orcadian Neolithic sites (Martinková, *et al.* 2013) has some influence in the present considerations. These data have been synthesised utilising Bayesian statistical methodologies in three influential papers, the outcome being a refinement of the early Neolithic chronology (see Bayliss *et al.* 2017; Griffiths 2016; Schulting *et al.* 2010).

Progressive temporal slice analysis

Despite Orkneys rich early Neolithic archaeological record dating evidence remains relatively barren (Figure 5.2) in respect of the funerary monuments. At present there is one set of radiocarbon dates for a tripartite monument (Knowe of Lairo) amounting to 5% of the populated record, six for stalled chambers (Point of Cott; Holm of Papa Westray North; Midhowe; Knowe of Rowieger; Isbister; Knowe of Yarso) representing 18% of the total and three for passage graves (Quanterness, Quoyness and Pierowall) which accounts for 25% of this type. In total of the 80 monuments listed in the database here, there are radiocarbon dates that are usable for just 10 or 12.5% of all the currently recorded tombs. This clearly indicates that the dating record is far from complete - regardless this analysis has been able to formulate a broad framework which will be built on later in this thesis.



Classification	Total number	North Isles	Mainland and South Isles	Dates Available
OC Tripartite	21	16	5	1 (5%)
OC Stalled	34	24	10	6 (18%)
Passage Graves	12	7	5	3 (25%)
Uncertain	12	6	6	0

Figure 5.2. Table and graph showing the numbers and percentages of Orcadian tombs by classification, location and radiocarbon data availability. The percentage figure relates to percentage of that classification currently with dating evidence.

In 2010 the first of three comprehensive Bayesian studies revisited the question of dating at Quanterness with the benefit of more accurate AMS techniques (see Schulting *et al.* 2010). More recently Griffiths (2016, 287) provided a detailed synthesis of the Orcadian chronological narrative for the fourth millennium cal BC. This work suggested a date for the arrival of Neolithic practices in the archipelago as 3730-3480 cal BC with 95% probability (Griffiths 2016, 287).

From the outset a number of issues have been recognised as providing a challenge to the analytical process. First, as often encountered of this area of study and very much a blockage to accurate sequencing, the majority of the dates provided are for the **use** of the tombs and not their construction. Principally the radiocarbon dating determinations relate to human remains and it must be considered that in some cases at least the disarticulated bones of the deceased that are likely to have represented secondary or tertiary deposits added over time or moved from other locations (see Richards 1988). Consequently, it is appropriate to discuss such determinations as being relevant when considering tomb usage though they cannot be used to provide evidence of the date the monuments were constructed. Second, Bayesian statistical modelling as an archaeological tool is only able to support subjective judgements around chronology. This is a scientific analytical methodology that is based upon inferences derived from observations of stratigraphic and other forms of data concerning chronology. There may be points of ambiguity or argument concerning aspect of individual inferences, just as a radiocarbon date is a percentage and can be arguable on sampling strategies and as a consequence two researchers with the same radiocarbon determinations may provide differing conclusions (e.g. Bayliss *et al.* 2017 and Griffiths 2016). Finally, a number of the dates have been obtained from a single or a few samples with little stratigraphic support; these must be treated with caution, but they are nevertheless information that can be utilised when assessing the areas chronology and should not be dismissed outright.

These data have been extracted and have been utilised to produce the composite 'century time bar parameter' (Figure 5.3) for chambered cairns and the settlement evidence can be seen in Figure 5.4. A synthesis of tomb, settlements and ceramic traditions has then been utilised to depict the chronological sequence of the developments throughout the early Neolithic between 3800 - 3000 cal BC (see time slice A to H below). A brief analysis of the relevant tombs and settlements accompanies the time slice and a discussion focussing on the dating evidence when necessary. It can be seen (Figures 5.3 and 5.4) despite utilising essentially the same methodologies and data there are some discrepancies of interpretation of the time parameters between the Griffiths and Bayliss works.

The challenges inherent in reconciling two sets of data derived from an incomplete archaeological record are acknowledged and will be discussed at various points throughout this chapter. The utilisation of cal BC determinations at a 95% probability, unless explicitly stated otherwise, underscores a commitment to robust statistical standards. It is essential to recognize that the time slice analysis has been constructed from the **earliest** parameter determination consistently applied to all dates. This uniform approach aims to present a clear and uncluttered overview of how the use of different types of monuments appeared during the Neolithic period.

However, it is crucial to note at this early juncture that this method is not without its complexities particularly as there are many instances where time parameters are wide-ranging. For example, Quanterness has date parameters spanning from 3630-3090 cal BC (Griffiths 2016, 263) and 3635-3013 cal BC (Schulting et al. 2010, 8). Such extensive periods encapsulate the transitional phases between stalled and passage grave traditions across the archipelago, introducing challenges in accurately pinpointing the temporal placement of the monument's construction. The dating of the contents within these wide time parameters presents uncertainties, as the actual date could fall anywhere within the specified range, as illustrated in Figures 5.3 and 5.4. Further complicating the picture is that the radiocarbon dates emanate from tomb contents and not construction processes. Furthermore, given the practice of primary secondary or tertiary burial rites across Orkeny during the Neolithic the contents of tombs are probably subject to movement between one tomb and another (Colin Richards perr com) and therefore may prove to be of little use when assessing construction sequence.

While it is not feasible to definitively assert that the start of each time slice parameter accurately reflects the corresponds to the commencement of the construction activity, the chosen approach remains valuable in providing insights into the earliest potential appearances of different monument types across the archipelago. This method serves as a practical means to delineate temporal patterns, despite inherent uncertainties, and contributes to a nuanced understanding of the chronological evolution of Neolithic monuments .

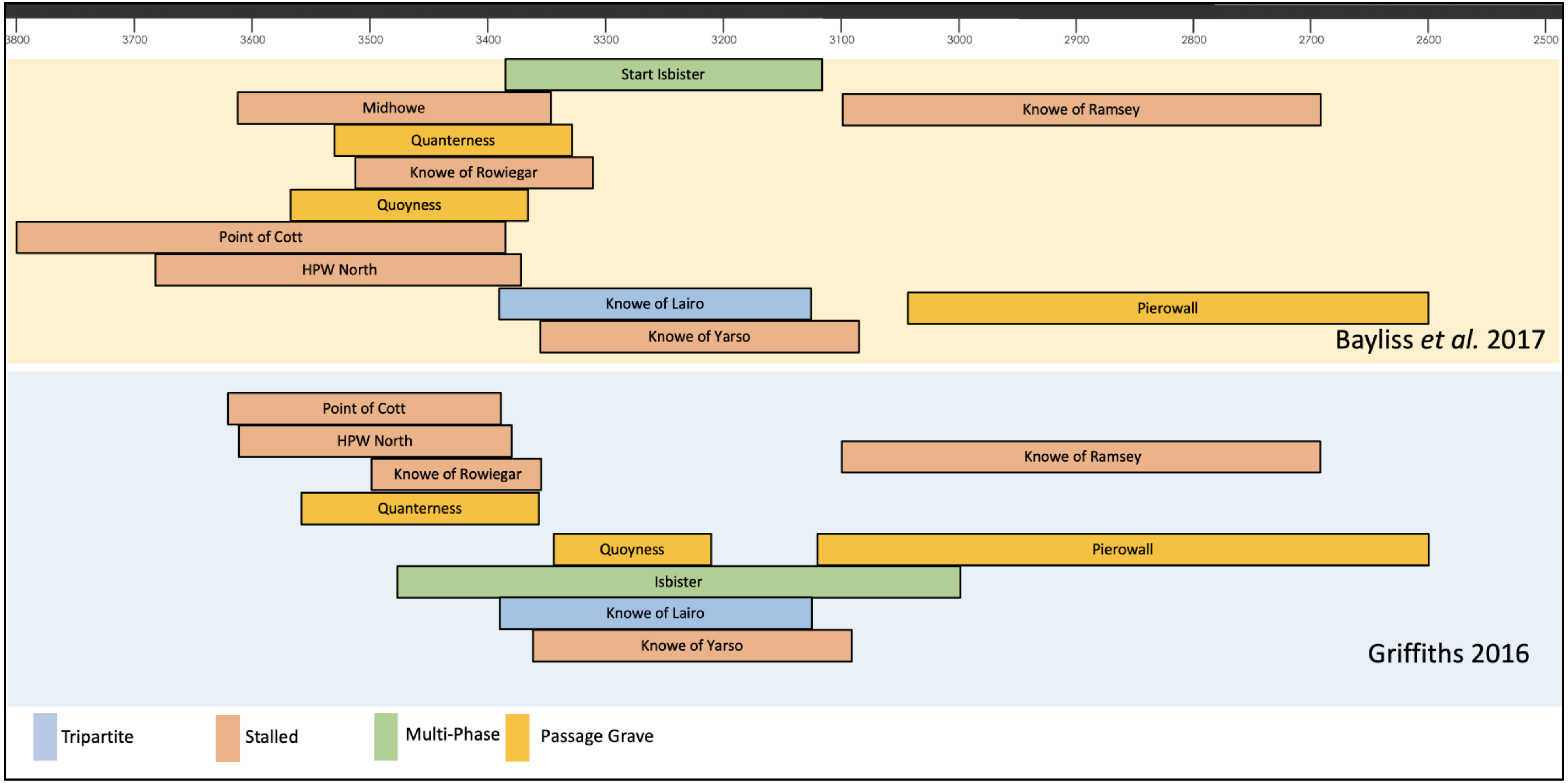


Figure 5.3. Comparison of Bayesian modelling results utilising data from the two latest papers in this area (Bayliss *et al.* 2017; Griffiths 2016).

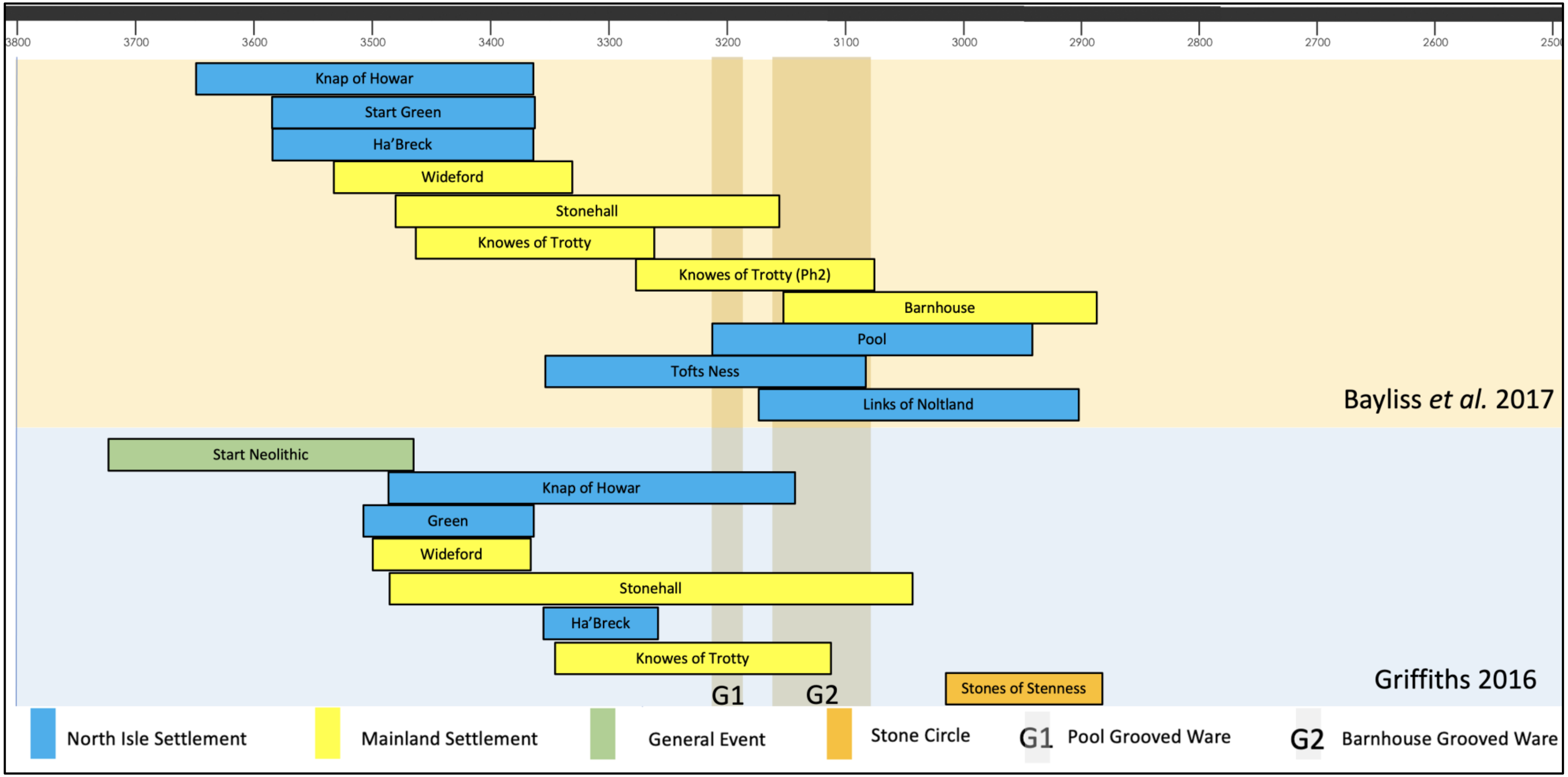


Figure 5.4. Comparison of Bayesian modelling results for settlement activity and Grooved Ware horizons (G1 - Pool and G2 - Barnhouse) utilising data from the two latest papers in this area (Bayliss *et al.* 2017; Griffiths 2016).

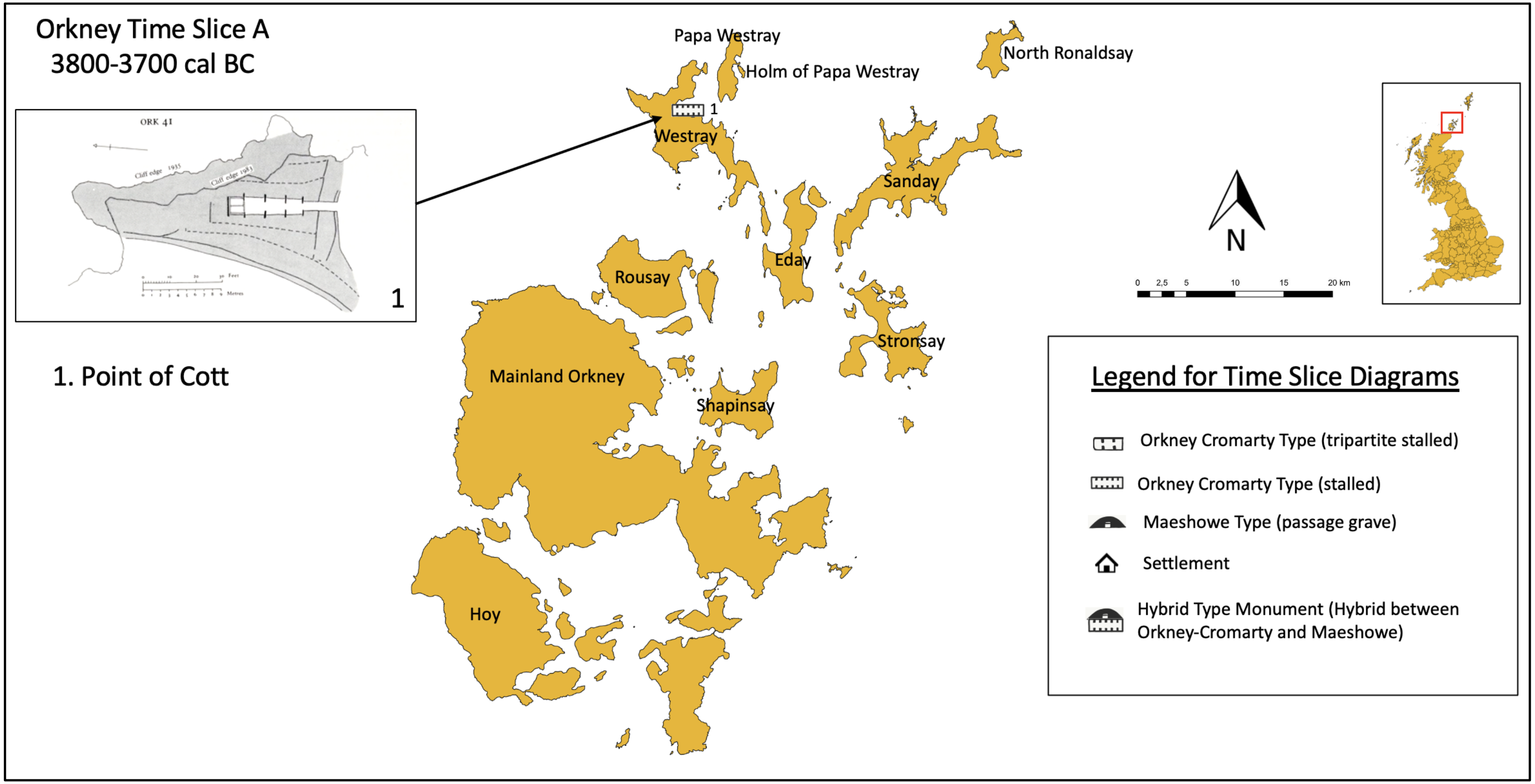


Figure 5.5. Time slice A (3800-3700 cal BC) of the Orcadian Early Neolithic depicting monuments and settlements that have been subject to Bayesian statistical modelling of available radiocarbon dates and could date to this period. 1. Point of Cott stalled cairn, Westray (Davidson and Henshall 1989, 150); The labels and legend will apply throughout this chapter (QGIS base map with authors annotations).

3800-3700 cal BC

This time slice (Figure 5.5) is extremely early in the sequence of the Orcadian Neolithic with the start of the period being dated to 3730-3480 cal BC (Griffiths 2016, 272). The megalithic tomb at the **Point of Cott** could date to this period (Davidson and Henshall 1989, 149). It is situated on the island of Westray and is a stalled chamber divided into four compartments covered by a long horned cairn. It is possible that the primary phase of this monument was in the form of a tripartite chambers as human and faunal skeletal remains were only discovered in the first three compartments (Barber 1984b; Davidson and Henshall 1989, 150) suggestive of the end chamber being used in a different time and maybe earlier (see also chapter 6) though radiocarbon dating evidence is unable to assist in this assessment. Bayliss estimates the boundary parameters of remains within the chamber as being 3800-3380 cal BC (Bayliss *et al.* 2017, supp mat 95). The excavations did highlight several pre-cairn deposits which contained lithics and have been assessed as likely Mesolithic redeposited artefacts (Finlay 1997) and shows that places may have been regarded as special in the Mesolithic as well as the Neolithic. It is the earliest in this modelling and on current evidence might represent the first chambered cairn across the archipelago. This monument has been placed into this early time slice by virtue of the Bayliss work though it has also been interpreted as first appearing in the following century time slice (see Figure 5.7) at 3620- 3390 cal BC by Griffiths (2016, 272). This divergence in interpretation is not unusual given the subjective nature of these works and in this case has been caused by Griffiths exclusion of bulk animal and other faunal remains as not being attributable to the early phases of the monument.

3700-3600 cal BC

This period (Figure 5.6) sees the more probable start dates for the stalled cairn tradition on Westray and Rousay though there is a marked difference in the architectural sophistication between the northern examples and Midhowe. The Holm of Papa Westray North (HPWN) (Davidson and Henshall 1989, 120) is a stalled chamber with a rectangular cairn and as will be seen in chapter 6 may be a multi-phase monument. The radiocarbon dates are not sophisticated enough temporally to distinguish dates for these phases. This situation is typical for all the proposed multi phased tombs discussed in chapter 6. Bayliss places the start of human burials here as between 3685 – 3375 cal BC, and Griffiths' dates are virtually concurrent at 3610-3370 cal BC (Griffiths 2016, 29).

The conjoined house site at the Knap of Howar located on Papa Westray has also been assessed as belonging to this period. Accepting this evidence these North Isles monuments exhibit the earliest dates for stalled cairns in the archipelago and it follows that these locations in the north west of the islands represent the first arrival of the Neolithic in Orkney (Griffiths 2016, 272). Midhowe (Figure 5. 7) is an exceptional stalled long cairn which in contrast to the two North Isles tombs in this time slice displays more advanced architectural sophistication. Again, this may well be explained by the architectural sequence of the multiple phase (see chapter 6). The radiocarbon date parameters from this site were 3630-3370 cal BC (Griffiths 2016, 271) and it does not follow that the early phases were as architecturally impressive as the final phase in the monuments use. This monument also contained an assemblage of round based Unstan Ware pottery (Callander and Grant 1934; Kinnes 1985) which is entirely expected given its place in the chronology.

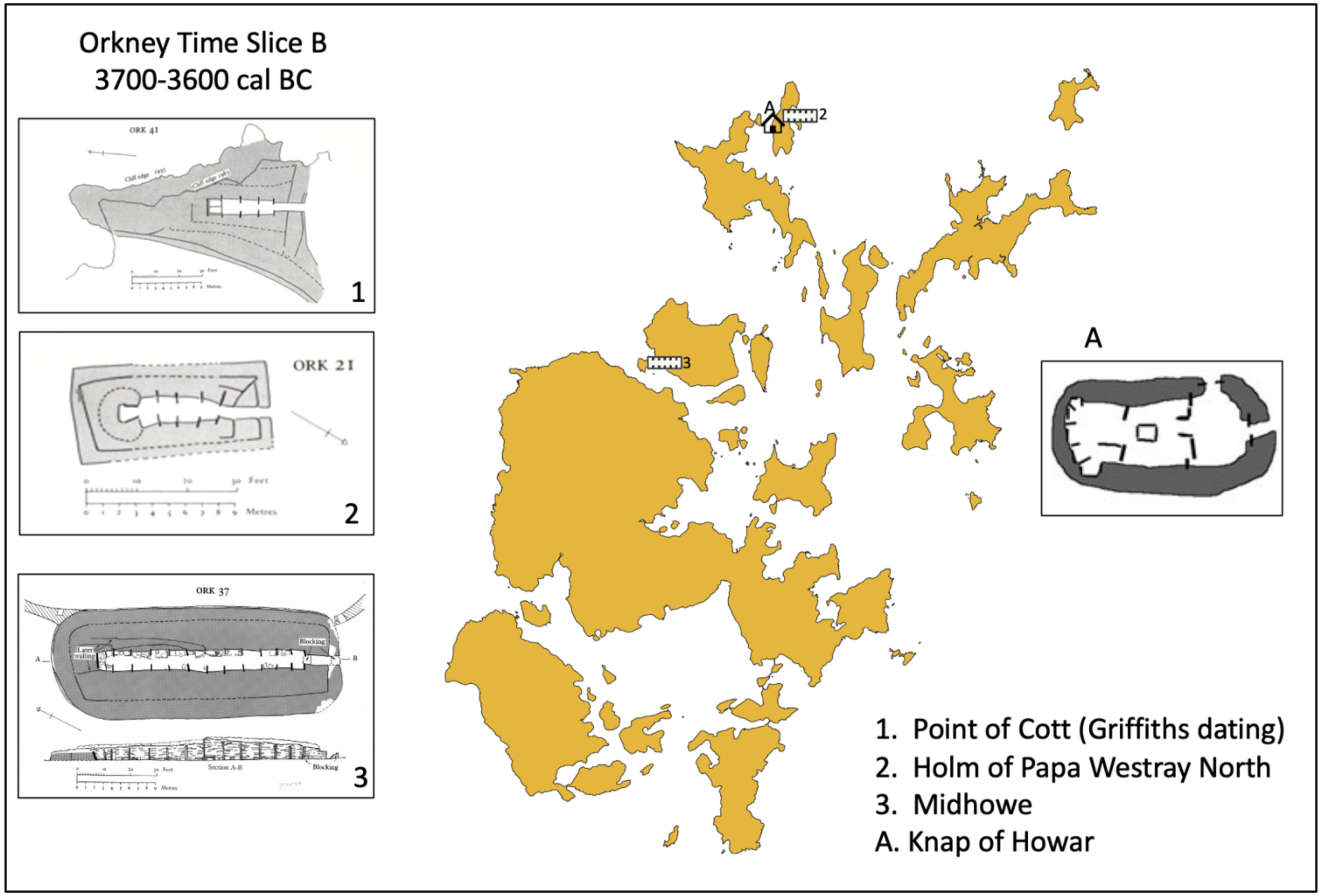


Figure 5.6. Time slice B (3700-3600 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. 2. Holm of Papa Westray North (stalled cairn) (Davidson and Henshall 1989, 121); 3. Midhowe (stalled cairn) (Davidson and Henshall 1989, 146); A Knap of Howar, Papa Westray (Bayliss *et al.* 2017, fig 3a) (QGIS base map with authors annotations).

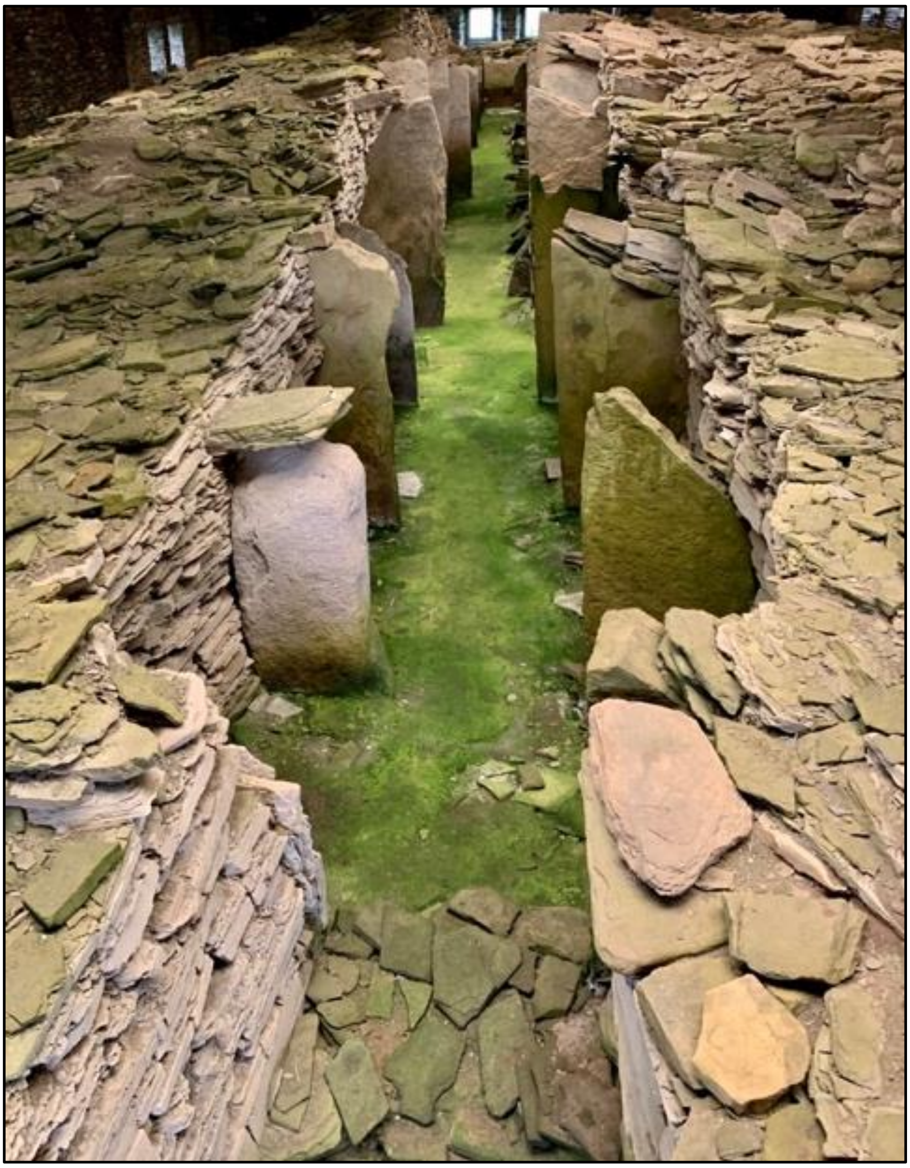


Figure 5.7. Photograph of Midhowe Orkney Cromarty stalled cairn, Rousay clearly showing the quality of the architecture and the opposing orthostats that form the stall chambers – authors photograph.

Figure 5.8: Time slice C (3600-3500 cal BC) of the Orcadian early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. 4. Quoyness, Sanday (passage grave) (Davidson and Henshall 1989, 155); 5. Quanterness, Mainland (passage grave) (Davidson and Henshall 1989, 151); 6. Knowe of Roweiger, Rousay (stalled cairn) (Davidson and Henshall 1989, 137).

3600-3500 cal BC

Quanterness and Quoyness at this juncture

Quanterness passage grave (Figure 5.9) was subject to a thorough excavation between 1972-4 (Renfrew 1979; Renfrew *et al*. 1976;) with a key objective of acquirement of samples suitable for radiocarbon dating. Renfrew's investigation produced a significant assemblage of 34 vessels of Grooved Ware, along with lithics, human and animal remains. The human bones were discovered within the main chamber, disarticulated and showing signs of excarnation practices (Chesterman 1979). A recent reinvestigation applied AMS radiocarbon dating techniques (see Schulting *et al.* 2010) to these remains and models have been formulated from these results (see Baylis *et al.* 2017; Griffiths 2016). There is some conflict noted between the stratigraphy and the dates that has affected the integrity of the sequence and is suggested to be as result of post-depositional disturbance (Schulting *et al*. 2010, 16). This finding is of critical importance when attempting to interpret the veracity of data obtained from the Bayesian modelling.

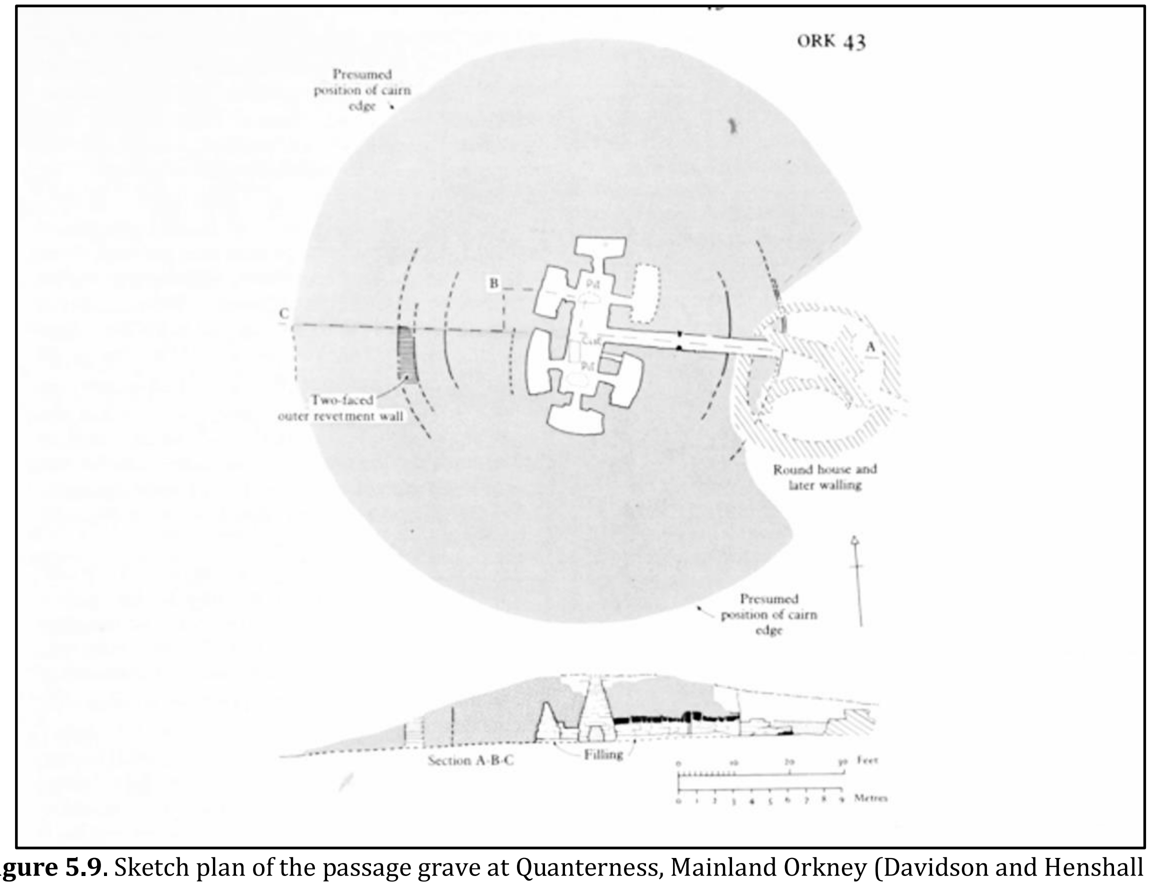


Figure 5.9. Sketch plan of the passage grave at Quanterness, Mainland Orkney (Davidson and Henshall 1989, 151)

One of the most noteworthy departures from these previous theories is the chronological narrative surrounding Quanterness. The more recent dating of the samples places the use of this tomb earlier in the Neolithic sequence than previously thought with parameters covering a few centuries following the mid forth millennium cal BC (see Bayliss *et al.* 2017; Griffiths 2016; Schulting *et al*. 2010). Individual sample details are the key in understanding this. A sample of organic soil deposit remains within the chamber described as being '*immediately on bedrock*' (Renfrew 1976, 51) was able to produce a radiocarbon parameter determination of 3630-3090 cal BC (Griffiths 2016, 263) or 3635-3013 cal BC (Schulting *et al.* 2010, 8) the differences (albeit negligible) are attributable to micro differences in the Bayesian approach adopted by each study. Stratigraphically there is nothing to suggest that these samples were from a time related to construction or early activity at the tomb. Without the stratigraphic confirmation samples such as this may well be from earlier activity at the site that are not directly related to the stone passage grave. Moreover, the practice of the redistribution of human remains between different tombs - a phenomena that has often been argued (Richards 1988; Schulting *et al*. 2010, 16) - should be considered likely in the case of Quanterness. Following the more accurate AMS re-examination it can be seen that a number of these larger human bones were able to provide determinations earlier in the date parameters, for example a cranium dating between 3517-3137 cal BC. Furthermore, the smaller remains such as a phalanx and metacarpal and calcaneus have later parameters broadly equal around 3350-3000 cal BC (See Schulting *et al*. 2010, 14, Table 3). As crania and long bones are pragmatically more likely recovered from excarnation rituals or from primary burial locations it points to the possibility that the earlier dated remains are redeposited bones and therefore originate from a date earlier than the construction of the tomb. The smaller bones are more likely relating to bodies that entered the tomb articulated and therefore is supportive of the later time slice appearance.

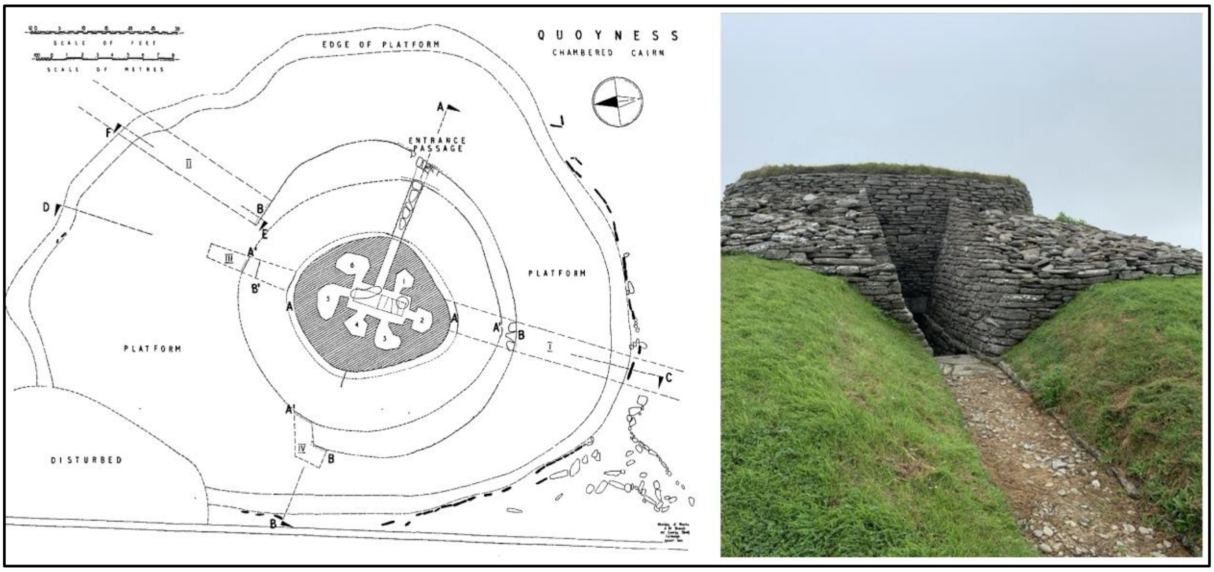


Figure 5.10. Sketch plan (Childe 1954, 122) and photograph (authors own photograph) of the exterior of Quoyness Chambered cairn, a passage grave on Sanday, Orkney.

Grooved Ware at Quanterness

If the earlier Bayesian dates are to be accepted, then current thinking would expect the presence of round bottomed pots or Unstan Ware ceramics, but this is categorically not the case. Quanterness contained only Grooved Ware ceramics (Henshall 1979, 74) represented by a large assemblage of at least 34 pots (Schulting *et al*. 2010, 9). The appearance of Grooved Ware is significant when dating the early Neolithic narratives beyond simply Orkney as it is widely accepted that this tradition originated in the islands (Ashmore 1998; Bayliss *et al.* 2017; Brophy and Sheridan 2012, 29; Cleal 1999; Jones 2002; MacSween 1992; Parker-Pearson 2012, 99; Sheridan 2004; Sheridan 2010; Schulting *et al.* 2010; Thomas 2010). The first appearance of ceramics of the Grooved Ware tradition appear at Pool, Sanday between 3210-2935 cal BC (95% probability) (MacSween *et al*. 2015, fig 9). It was acknowledged that these ceramics were technologically crude and decoratively less aesthetic than later forms, nevertheless classified as Grooved Ware. It is mentioned at this juncture as a demonstration of how the use of single source evidence for interpretation of chronology may lead to unsuitable conclusions (see Figure 5.9a). As discussed in the introduction to this chapter this type of monument would not be expected to appear so early in the Neolithic trajectory though the Bayesian modelling of a number of papers clearly place these monuments within this time slice – if the earliest date is used (see Bayliss *et al.* 2017; Griffiths 2016; Schulting *et al.* 2010). The most recent model was able to provide a posterior density estimate for the start of activity at Quanterness as 3535-3330 cal BC (87% probability) (Bayliss *et al.*

2017, supp mat 88). Griffiths' findings broadly concur placing activity that can be associated with the tombs use at 3560-3340 cal BC. Schulting results are also similar with determinations of 3517-3137 cal BC. By following these determinations in isolation has the real potential of a misinterpretation the chronological sequence of the Neolithic. Similarly, Quoyness (Figure 5.10) is a passage grave (Childe 1954; Davidson and Henshall 1989, 154; Henshall 1963, 228) situated at the south aspect of the north island of Sanday on the Els Ness peninsular. Bayliss utilised three radiocarbon determinations which probably relate to the period of its use (MacSween *et al*. 2015) and determined start of deposition parameters as 3575-3110 (65% probability) with the Griffiths study placing the earliest activity at 3340-3090 cal BC (Griffiths 2016, 273). The earliest date parameter by Bayliss for the start of deposition of human remains is problematic as the date is from a single human rib from the cairn and not the chamber that may well represent redeposited remains. Consequently, these two passage graves have been placed later in this time slice analysis (see Figure 5.17 for Quanterness and Figure 5.19 for Quoyness). This is the first time passage grave monuments appear in the time slice analysis with for both Quanterness and Quoyness (see Figures 5.3 and 5.8). The analysis method has presented a case for the passage grave tradition that does not align to current thinking and does not align with this current date parameter, and therefore, these monuments will be discussed in later time slices (3200-3100 cal BC) in this chapter. This case serves as a robust illustration of the limitations inherent in relying solely on date parameters for the reasons as discussed earlier in the chapter. The use of the earliest dates, in isolation, has likely misplaced passage graves in the Orcadian sequence, assigning them a chronology that is too early.

This instance underscores the importance of a cautious and nuanced approach to the interpretation of dating data. The methodology employed in this research, while providing valuable insights, is acknowledged as having inherent limitations. It emphasised the need to complement Bayesian statistical analyses with other archaeological findings, especially those related to ceramic traditions. As the subsequent sections will demonstrate, incorporating additional archaeological evidence has led to the re-evaluation of the temporal placement of monuments such as Quanterness and Quoyness, situating them in a later time slice (3200-3100 cal BC) towards the end of the available Bayesian data for these tombs, as opposed to the earliest dates. This approach has highlighted the dynamic and iterative nature of archaeological research urging scholars to consider multiple lines of evidence and refine interpretations in response to new findings. It underscores the importance of a holistic and interdisciplinary perspective to construct a more accurate and nuanced understanding of the temporal and cultural dynamics of the archaeological record.

3600-3500 cal BC

This period (Figure 5.11) sees the earliest date for activity at the stalled chambered long cairn at the Knowe of Rowiegar (Davidson and Henshall 1989, 136). Along with Midhowe they represent two of the most elongated of Orcadian stalled cairns each with twelve compartments. The earliest evidence is of settlement and house evidence may first appear in this period (Richards and Jones 2016) and have a boundary parameter for construction and use around 3530-3360 cal BC (Griffiths 2016, 287).

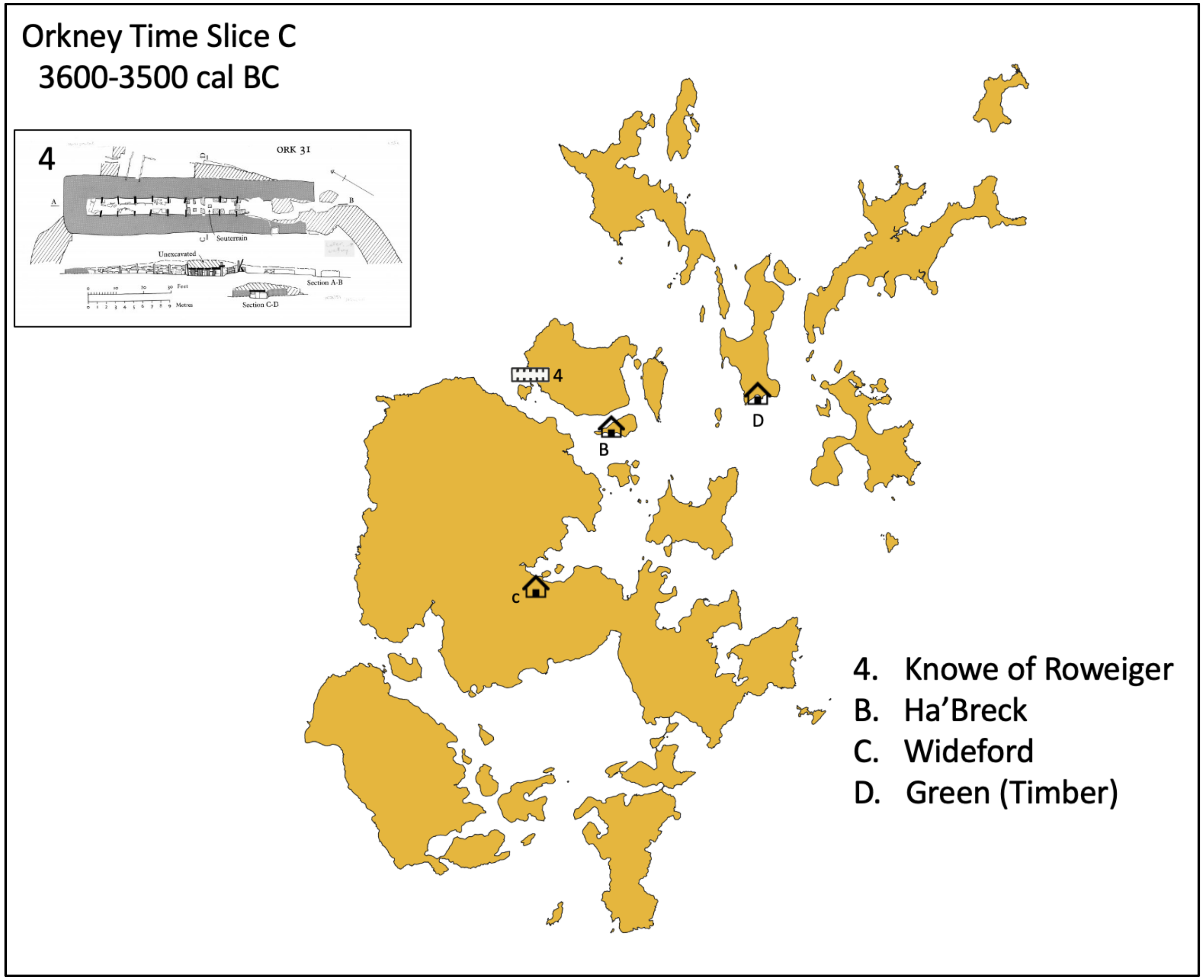


Figure 5.11. Time slice C (3600-3500 cal BC) of the Orcadian early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. 4, Knowe of Roweiger (stalled cairn), Rousay (Davidson and Henshall 1989, 137). B. Ha'Breck Wyre ; C. Wideford; D. Green Farm, Eday

3500-3400 cal BC

The activity during this period (Figure 5.12*)* saw no new tombs with the earliest date in this time slice. Though it did see their use as demonstrated by the spread of dates discussed above. We begin to see the beginning of a significant period of growth of settlement sites within the mainland area of Orkney specifically around the Bay of Firth. At Stonehall Meadow a settlement site close to the tomb of Quanterness.

Figure 5.12. Time slice D (3500-3400 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. E Stonehall Knoll House, Mainland (Bayliss *et al*. 2017, fig 3b).

3400-3300 cal BC – First possible appearance of

This period (Figure 5.13) can be summarised by an increase in tomb activity on the island of Rousay and an increase in habitation structures with the first possible dates for stone houses at Smerquoy to 3460-3120 cal BC; Stonehall Meadow 3490-3040 cal BC and the Knowes of Trotty to 3340-3130 cal BC (Griffiths 2106, 275*).*

We also see the earliest possible date for Isbister on South Ronaldsay (Figure 5.14). This is a stalled cairn that is often referred to by its popular eponym '*The Tomb of The Eagles*'. The monument has been described as a stalled cairn with side cells (Davidson and Henshall 1989, 125). Later in chapter 6 it will be suggested this is a multi-phased monument that underwent adaptations during its usage that may be linked to different cairn building traditions. The primary phase at Isbister chamber is divided into the stalls by means of four opposing orthostats typical of stalled architectural tradition. The secondary phase may have included the addition of two end cells and the final stage is represented by the addition of three side cells configured not unlike the Quanterness (Figure 5.14) side cells. This sequence is discussed in detail in chapter 6.

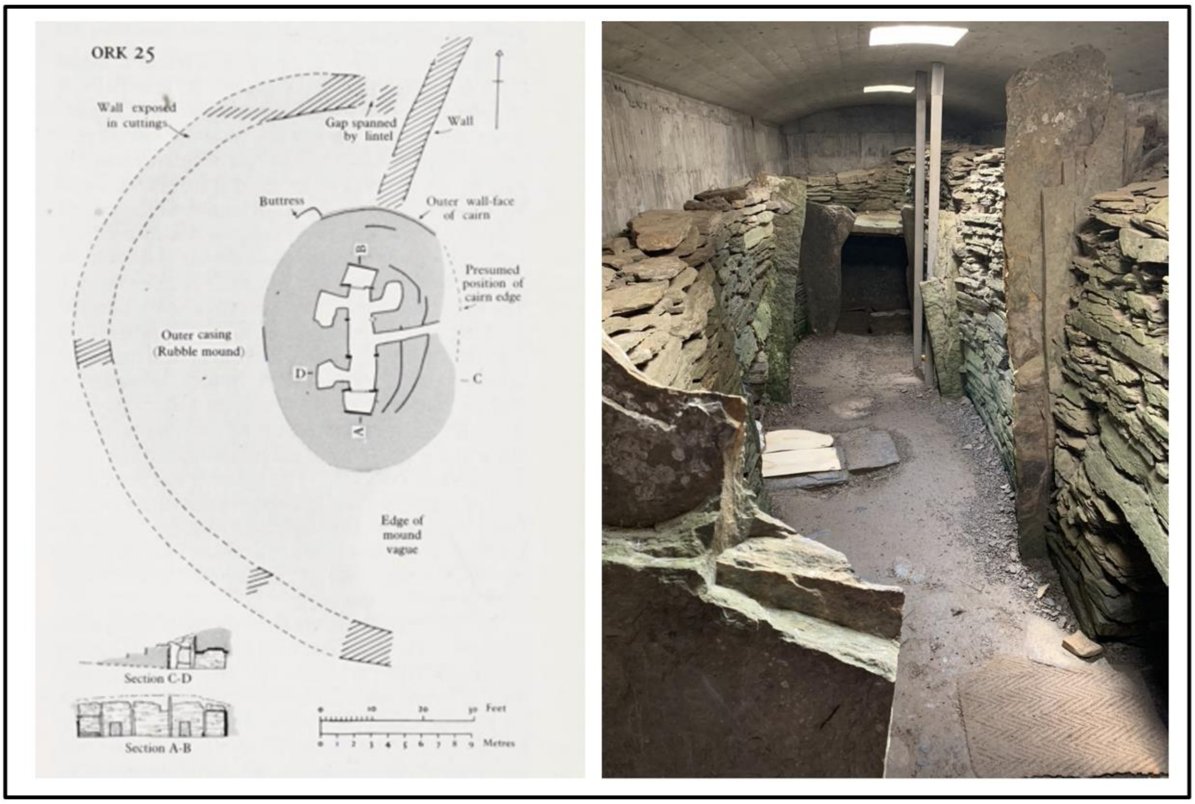


Figure 5.14. Sketch plan (Davidson and Henshall 1989, 125) and photograph (authors own photograph) of inside of Isbister tomb, South Ronaldsay.

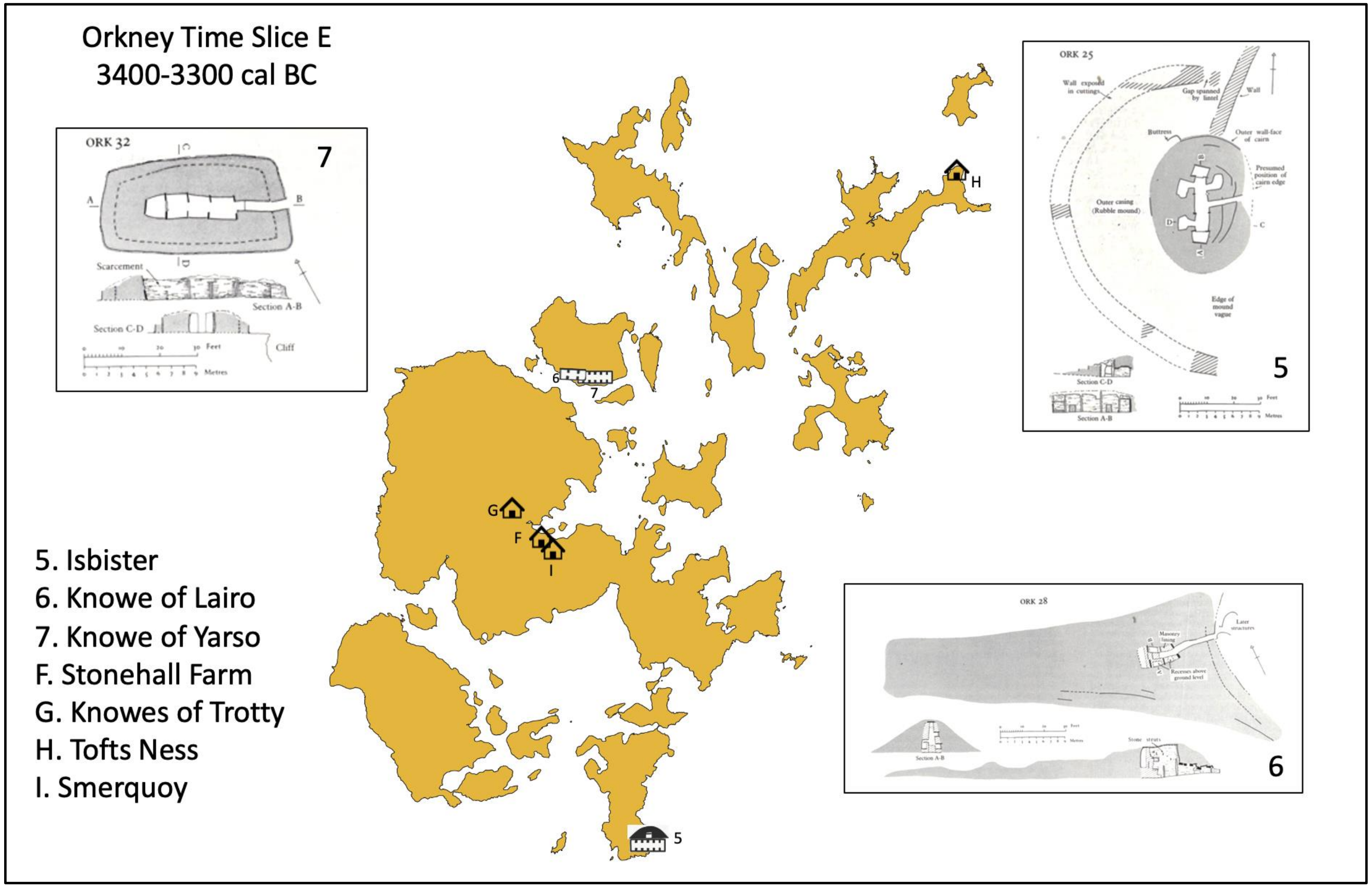


Figure 5.13: Time slice E (3400-3300 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. 5, Isbister, Tomb of the eagles (stalled with side cells) South Ronaldsay (Davidson and Henshall 1989, 125); 6. Knowe of Lairo (stalled tripartite chamber) Rousay (Davidson and Henshall 1989, 135); 7. Knowe of Yarso (stalled cairn) (Davidson and Henshall 1989, 138); F. Stonehall Farm, Mainland; G Knowes of Trotty; H. Tofts Ness, Sanday and I. Smerquoy, Mainland.

The placing of this monument accurately within a chronological framework using Bayesian techniques has been significantly hindered by the non-professional stratigraphic recording at the time of the early excavation due to it being carried out by the landowner who was not an archaeologist (Kinnes 1984). This fact alone likely accounts for the conflict between the stratigraphic record and the dating determinations an example being that samples from the foundation deposit date to later than those from the stalled chambers yet similar to the infill contexts from the end of use phase (Griffiths 2016, 283). This dichotomy is suggestive of the contents being mixed and redeposited thereby having a detrimental effect on any attempt to utilise Bayesian techniques. In the time slice representation (Figure 5.13) it can be seen that Isbister might appear a century or so earlier than the passage grave monuments of Quanterness and Quoyness. This positioning is supported by the presence of ceramics belonging to the round based of the carinated and 'Unstan' tradition (Davidson and Henshall 1989, 127).

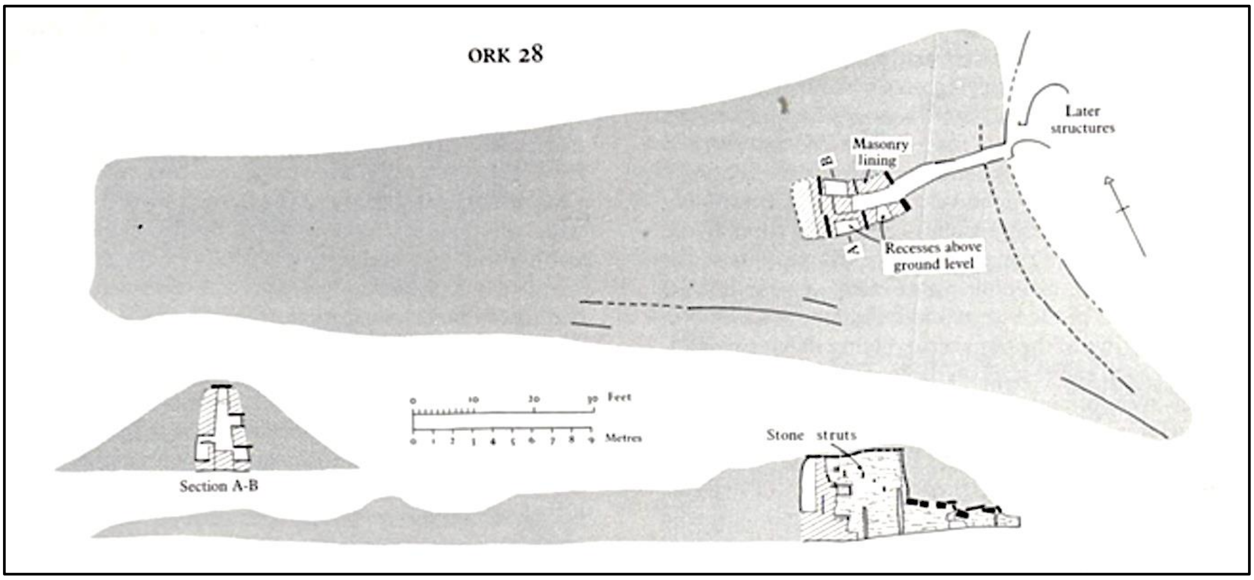


Figure 5.14. Sketch plan of Know of Lairo, Rousay (Davidson and Henshall 1989,133).

The Knowe of Lairo (Davidson and Henshall 1989, 132)(Figure 5.14) is likely to have originally been a tripartite cairn situated at the southernmost coast of Rousay. Again, as with Isbister we see within this time slice that people are remodelling the classic stalled designs. The chamber at Lairo had some architectural alteration, perhaps even before the tomb's completion and use (Davidson and Henshall 1989, 133). Radiocarbon determinations at this site is of a single human adult male skull and provides limited evidence to fully benefit from Bayesian modelling nevertheless Griffiths indicates the monuments usage as between 3370-3100 cal BC (Griffiths 2016, 273).

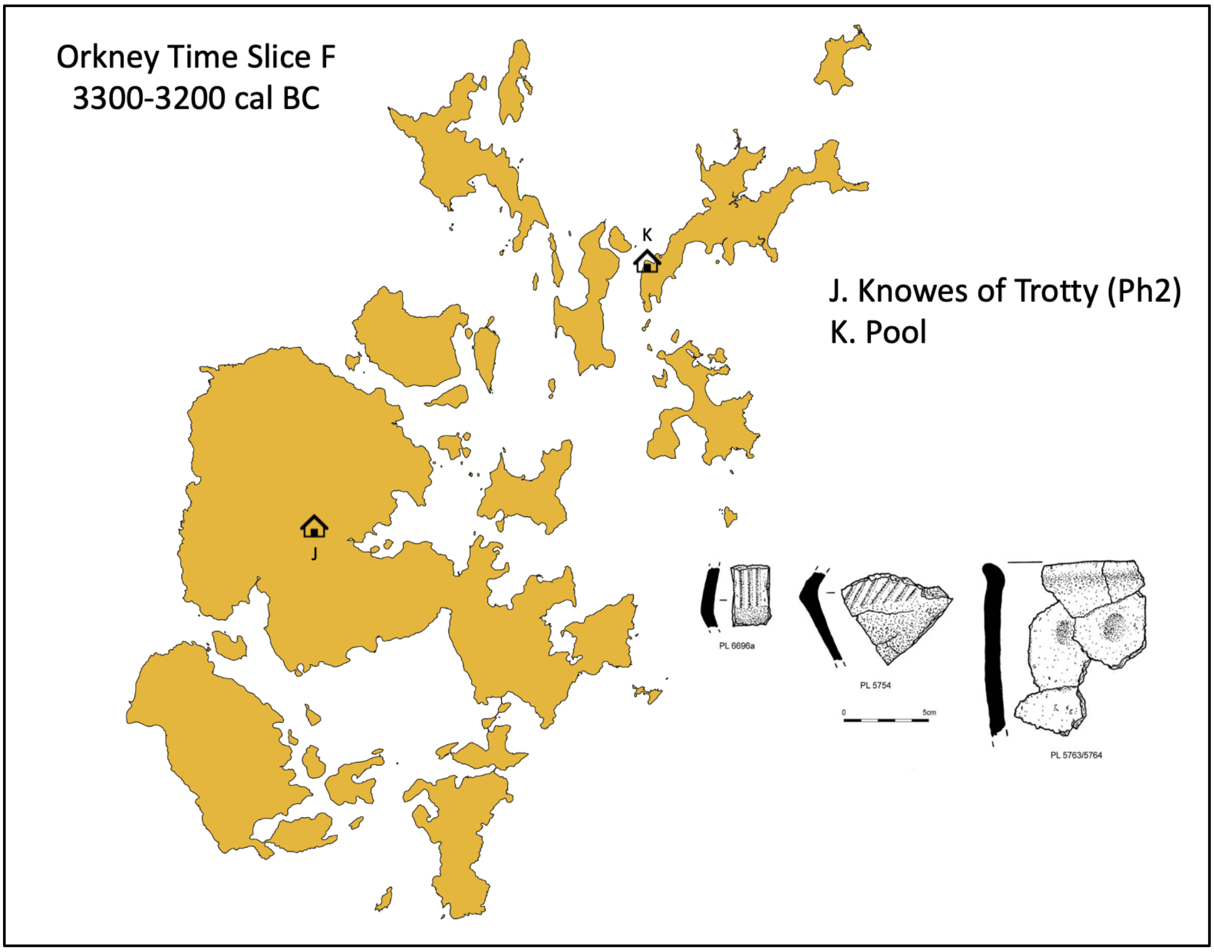


Figure 5.15. Time slice F (3300-3200 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. J. Phase 2 of The Knowes of Trotty, Mainland and K. Pool, Sanday; insert drawing of the first Grooved Ware Ceramics from Pool Sanday (MacSween 2007a, fig 5).

3300-3200 cal BC

Figure 5.15 shows a continuation of the settlement concentration within the core areas at Knowes of Trotty. Moreover, there now appears a new North Isles settlement at the multi-phase site in Pool Sanday. This site is important as it is the first archaeological context where ceramics from the Grooved Ware tradition were discovered. Phase 1 excavations of this site - which is also within this time slice - have demonstrably labelled this as an Unstan Ware site. Following a short hiatus phase 2 saw the arrival of Grooved Ware ceramics, albeit in a somewhat cruder form than we will see in later examples. This is the first of such pottery within Britain (MacSween *et al.* 2015, fig 9).

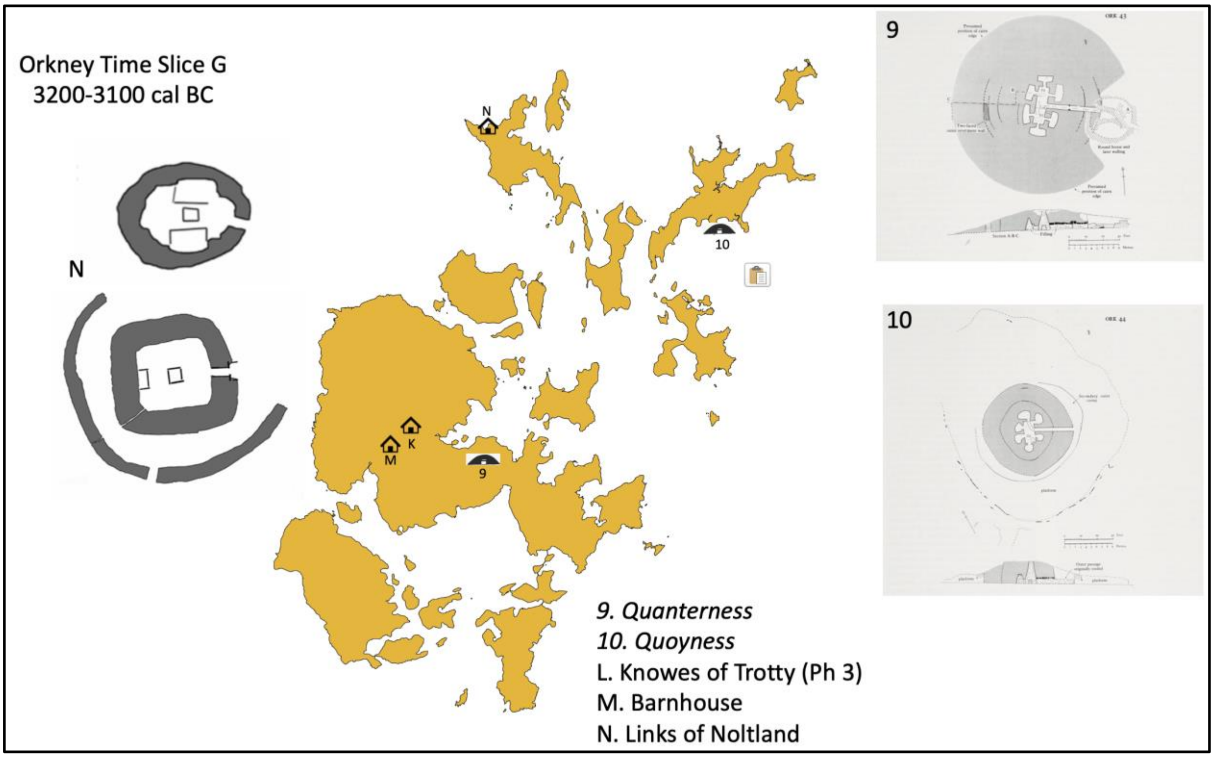


Figure 5.16. Time slice G (3200-3100 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates; 9. Quanterness passage grave Mainland Orkney (Davidson and Henshall 1989, 151); 10, Quoyness Passage Grave, Sanday (Davidson and Henshall 1989, 155); L. Knowes of Trotty (phase 2), Mainland; M. Barnhouse settlement, Mainland (Bayliss et al. 2017, fig 3c and 3f); N. Links of Noltland, Westray.

3200-3100 cal BC

This time slice (Figure 5.16) arguably sees the emergence of the passage grave tradition (Quanterness and Quoyness although see above) and the earliest phases of settlement site at Barnhouse**.** Quanterness is a significant monument in the chronological narrative and has been discussed in detail previously in this chapter. The second horizon for Grooved Ware sits within this current time slice and results have demonstrated a parameter of between 3160-3090 cal BC (Richards *et al.* 2016, 219) as discovered at the earliest phases of the Barnhouse excavations (see Figure 5.17). This more refined form of Grooved Ware ceramic started to appear from this early date across other significant Orcadian sites such as the Stones of Stenness (Richie 1976) and the Ness of Brodgar but critically here exclusively at Quanterness (Schulting *et al*. 2010, 13). The similarity between the pottery at these sites has been argued (Henshall 1979, fig 33; Schulting *et al*. 2010, illus. 20) and this argument has extended beyond the merely aesthetic with the lithic inclusions in the matrix of the ceramic being also similar (Jones 2005, 280). Together this has presented a strong case for this period being the appropriate appearance of passage grave type monuments in Orkney and a connection with the significant settlement site of Barnhouse and arguably the start of the late Neolithic in Orkney.

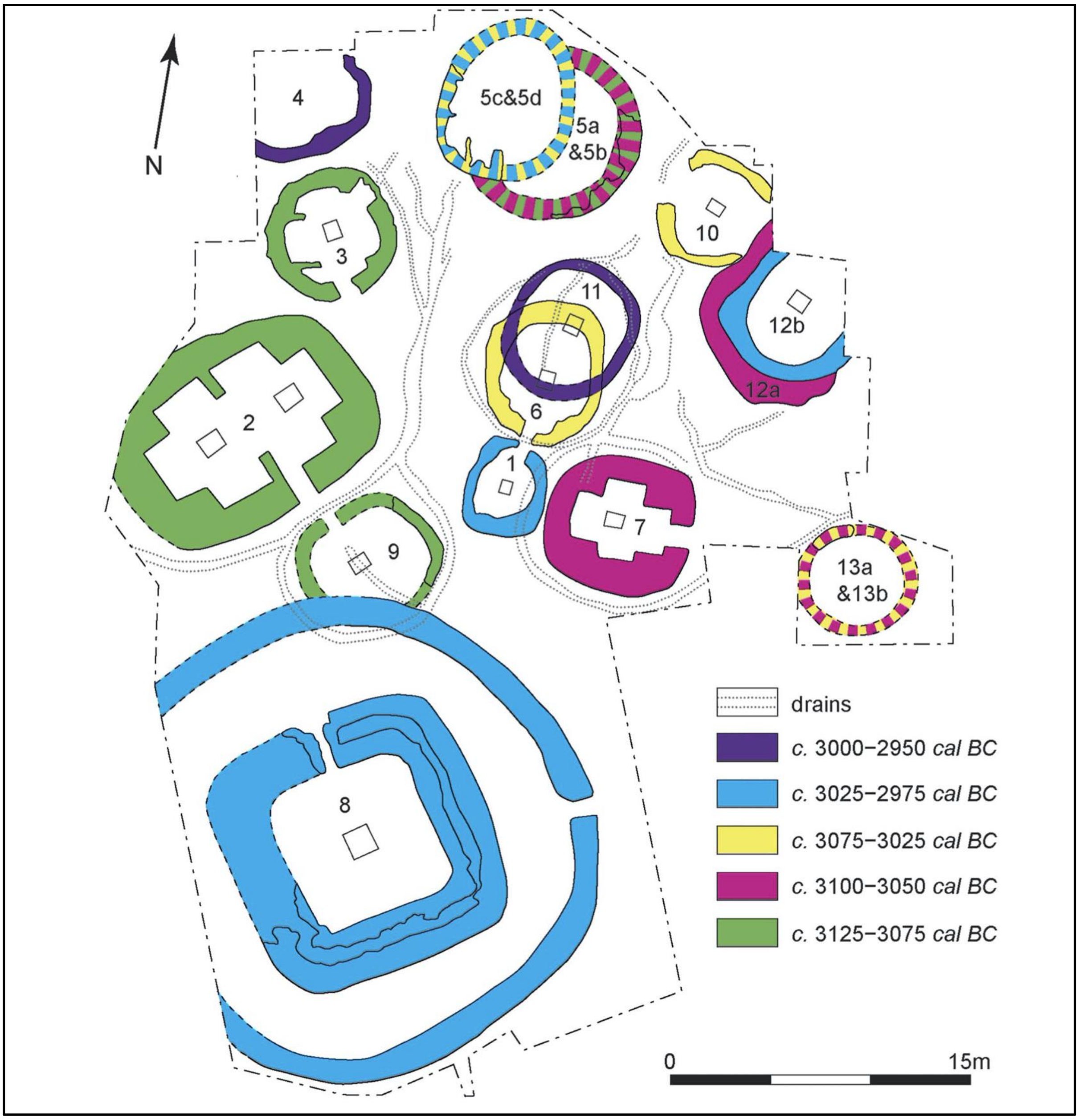


Figure 5.17. Interpretive plan with chronological colour coding for the different buildings at Barnhouse (Richards *et al.* 2016, fig 12)

3100-3000 cal BC

The last period (Figure 5.18) in this assessment sees the arrival of the probable passage grave at Pierowall on Westray whilst at the same time the stalled tradition remains represented by the Knowe of Ramsay on the island of Rousay with dates for this specific time slice period. This is the final period before we enter the late Neolithic period which saw a considerable growth of monument and settlement construction but also megalithic architectural practices such as Maeshowe chambered tomb, stone circles at Stones of Stenness and Ring of Brodgar and monumental ritual sites such as the Ness of Brodgar. The beginnings of these more organised projects can be seen within this time slice.

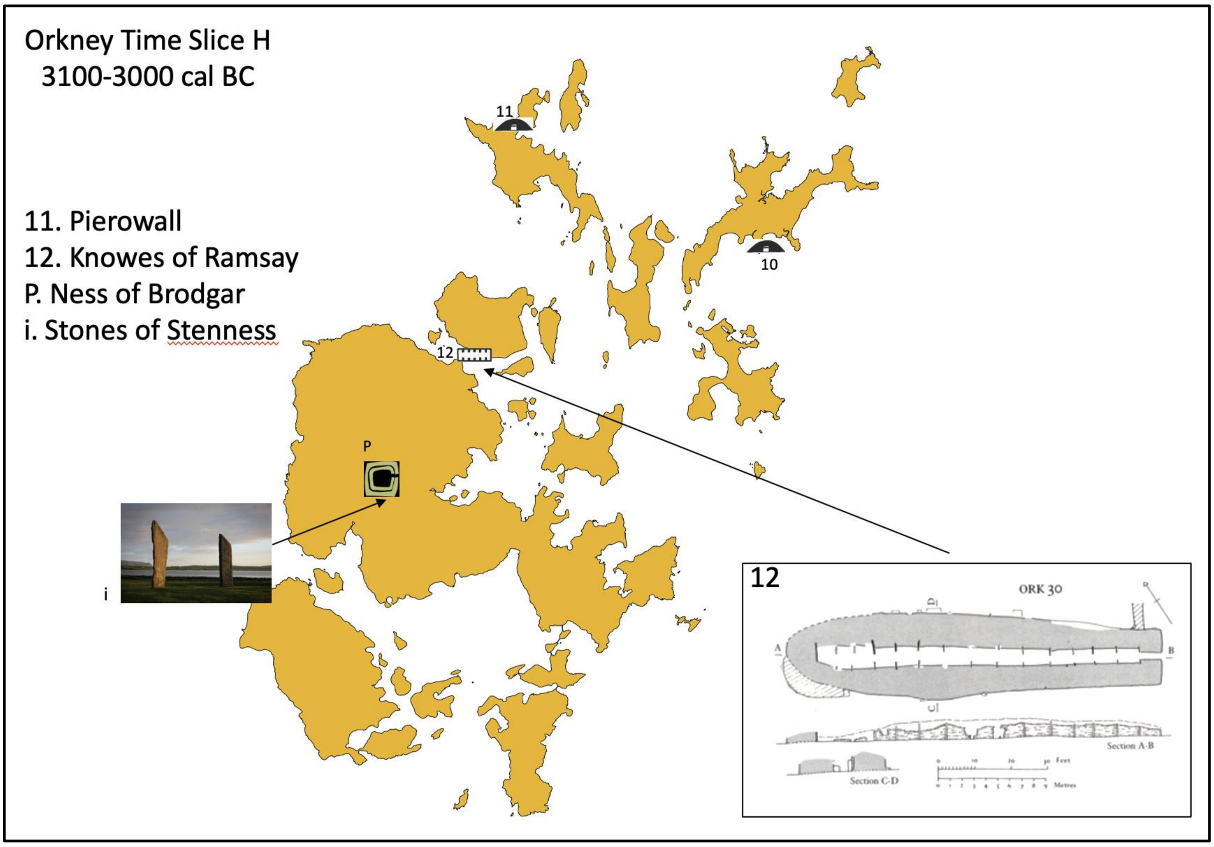


Figure 5.18: Time slice H (3100-3000 cal BC) of the Orcadian Early Neolithic depicting monuments and settlement that have been subject to Bayesian statistical modelling of available radiocarbon dates. 11. Pierowall (Possible Maeshowe type), Westray, 12. Knowes of Ramsay (stalled), Rousay (Davidson and Henshall 1989, 135); P Ness of Brodgar; i. Stones of Stenness (authors own photo).

Summary

This chapter has introduced a methodology aimed at creating a chronological framework for Orcadian tombs using contemporary radiocarbon dating data. The time slice approach, based on the universal first possible appearance of chambered tombs and houses in Orkney, faced challenges due to wide-ranging time parameters and the inherent complexities of dating data derived primarily from tomb contents rather than construction processes. The example of Quanterness and Quoyness highlighted the potential pitfalls of relying solely on this methodology.

However, the incorporation of other archaeological data, such as the Orcadian ceramic sequence enabled a refinement of the chronological picture, aligning more closely with current thinking. The persistent issue of the radiocarbon dates originating from tomb contents and not construction, coupled with the likelihood of movement of remains between tombs due to Neolithic burial practices, underscores the limitations of the current dating evidence within the Orcadian tomb record. This emphasises the inability to precisely date construction events due to wide-ranging parameters due to the current limitations of available data.

Whilst acknowledging these challenges, this chapter has shown the value of the chosen approach in providing insights into the potential earliest appearances of different monument types across the archipelago. The key finding, however, is there is insufficient current data related to the construction (and indeed phasing – see chapter 6) of early Neolithic tombs to effectively model temporal sequencing. This limitation points to the need for more robust dating evidence from archaeological investigations a point that has been reported to Scotland's Island Research Framework for Archaeology (SIRFA) Symposium in March 2023.

Despite these constraints, the methodology has demonstrated the potential to challenge accepted typographic chronoloy theories and hypotheses, revealing the possibility of overlapping and temporally coexisting aspects between stalled and passage tombs. This nuanced understanding contributes to a more dynamic interpretation of the Neolithic landscape in Orkney, showcasing the complexity of temporal relationships among different monument types.

Chapter 6 –Analysis of tomb architecture and phasing

Introduction

This chapter extends the chronological analysis introduced in the previous chapter by delving into the potential phasing of chambered tombs in Orkney. In the previous chapter it was established that the available radiocarbon data for Orcadian tombs is insufficient for discerning construction or phasing dates, thereby hindering a comprehensive understanding of the chambered tomb sequence across the islands. Faced with this limitation in scientific dating evidence, a chrono-typological approach becomes necessary to refine our understanding of the stalled/passage grave traditions. This methodology, grounded in typological characteristics and chronological considerations, offers an alternative means of exploring the temporal relationships among different types of chambered tombs in the absence of precise construction dates. The principal objectives of this chapter are:

1. To look for evidence for multi-phase construction, and
2. To add nuance to the chronological model as demonstrated in the previous chapter with the aim of developing a typo-chronological framework that is capable of being applied across the North Isles.

The current Orcadian picture

The issue of multi-phasing is important and has been subject to little study. It will be recalled (chapter 1) that the prevailing thinking suggests that tripartite stalled cairns were amongst the earliest to appear. Thereafter followed stalled cairns then the multi-phased structures like *Unstan* and *Isbister* and later the tombs of the passage grave tradition (Figure 6.1 and 6.2). This sequence is now being questioned and the situation is far more complicated than early model proposed. The contrasting architectural sophistication between the tripartite and elongated stalled cairns is visibly evident but as we have seen already in chapter 5 it does not follow that one is necessarily earlier than the other. The balance of evidence required to argue for multi-phasing at monuments like *Isbister* appears less problematic as this tomb shares clear architectural features that are common to both the stalled and passage grave traditions- opposing orthostats side cells and passages. Matters become a little more complex when attempting to identify phasing the earlier monuments - stalled and tripartite – and it is this that will be unpicked throughout this chapter. It will ascertain if it is possible to identify phasing of construction when looking at the less obvious phased monuments, specifically the stalled variety of monument in their tripartite and elongated forms. By carefully analysing the detail presented from excavation plans and digital imagery such as 3D photogrammetry (see methodology chapter 4) can possible primary phases of monuments be identified? Moreover, does it follow that some of the monuments that are plainly architecturally advanced such as *Midhowe* are simply the product of many adaptations, extensions and phases of an earlier primary monument? To answer these questions this chapter will introduce the newly developed methodology of axis alignment analysis. It will apply the methodology to plans, excavation reports and 3D photogrammetry models for six stalled monuments of the North Isles and two of the more readily identifiable hybrid monuments of *Isbister* and *Unstan* by way of testing the axial alignment hypothesis. It will investigate if there is a basis for suggesting any change in uniformity of alignment is supporting evidence for interpreting a subsequent phase of building. This chapter will then introduce phased sketch plans to demonstrate the findings. This comparative study was dictated by the availability of a workable archaeological record. It is important to note that whilst the Henshall gazetteer sketch plans of the monuments (Davidson and Henshall 1989) have served this research well they do not contain the detail necessary to carry out qualitative analysis. It has been necessary to obtain the best available data for this technique to be effective. By detailing the results this chapter will present how is it possible to demonstrably argue for a hypothesis that some stalled cairns began with a simple tripartite structure.

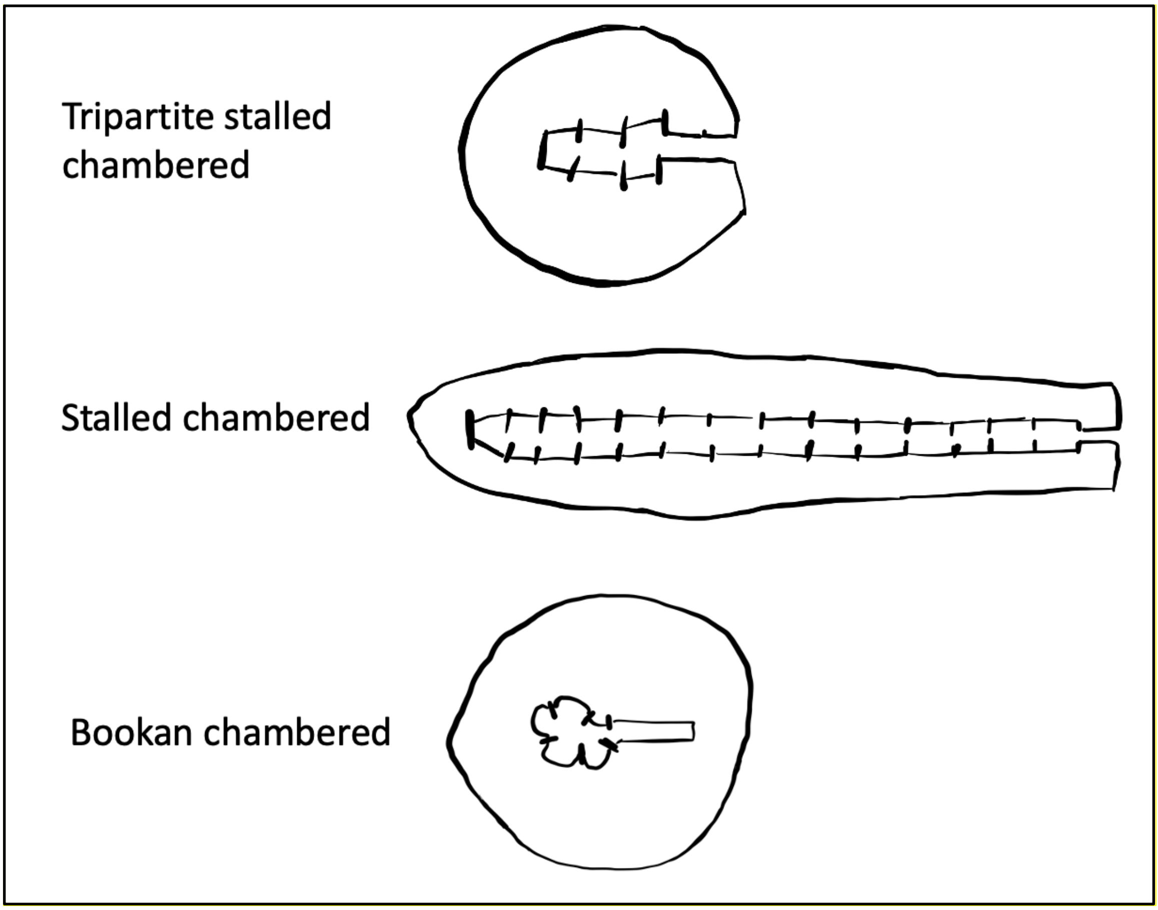


Figure 6.1. Sketched examples of the different classifications of Orcadian tombs. Top - Tripartite Chambered Tomb in this case ORK 26 Kierfea Hill(Redrawn from Davidson and Henshall 1989, 130); Middle – A stalled chambered cairn in this case ORK 30 Knowe of Ramsay (Redrawn from Davidson and Henshall 1989, 135) and Bottom - A Bookan chambered cairn in this case ORK 10 Calf of Eday South(Redrawn from Davidson and Henshall 1989, 111).

Chronological analysis suggests that the earliest chambered cairns within the Orkney archipelago may have appeared in the north-west on the island of Westray and with the emergence of Point of Cott and Holm of Papa Westray North (HPWN) (see chapter 5) which do appear architecturally less sophisticated than some of the other stalled cairn examples. Conversely, Midhowe arguably represents the most impressive of the stalled variety. Aside from its preservation and modern impressive presentation, this tomb is exceptional in length with twelve compartments and is contained with a truly monumental rectangular cairn. Yet this monument appears in the chronological time slice analysis of 3700-3600 cal BC at a time which appears to be contemporary with the less sophisticated tombs. It is this dichotomy that prompted the analysis that will now be presented. Here consideration will be given to the intrinsic axial alignments of the structures and how this may be related to distinct construction phases or stages of the tombs. The tombs analysis within this chapter have been selected as they have a level of archaeological records which are conducive to this technique (see chapter 4 Methodology). Seven stalled cairns have been selected as having such usable data together with the monuments of Isbister and Unstan which are perfectly suited to this methodology given each tomb shares characteristics and features from the stalled and passage grave traditions. It is predicted this technique will have longevity as the more comprehensive the archaeological data for the tomb the more effective the technique is. The recent excavation and recording of the Tresness tomb to the highest of surveying standards supports this and is detailed in this chapter.

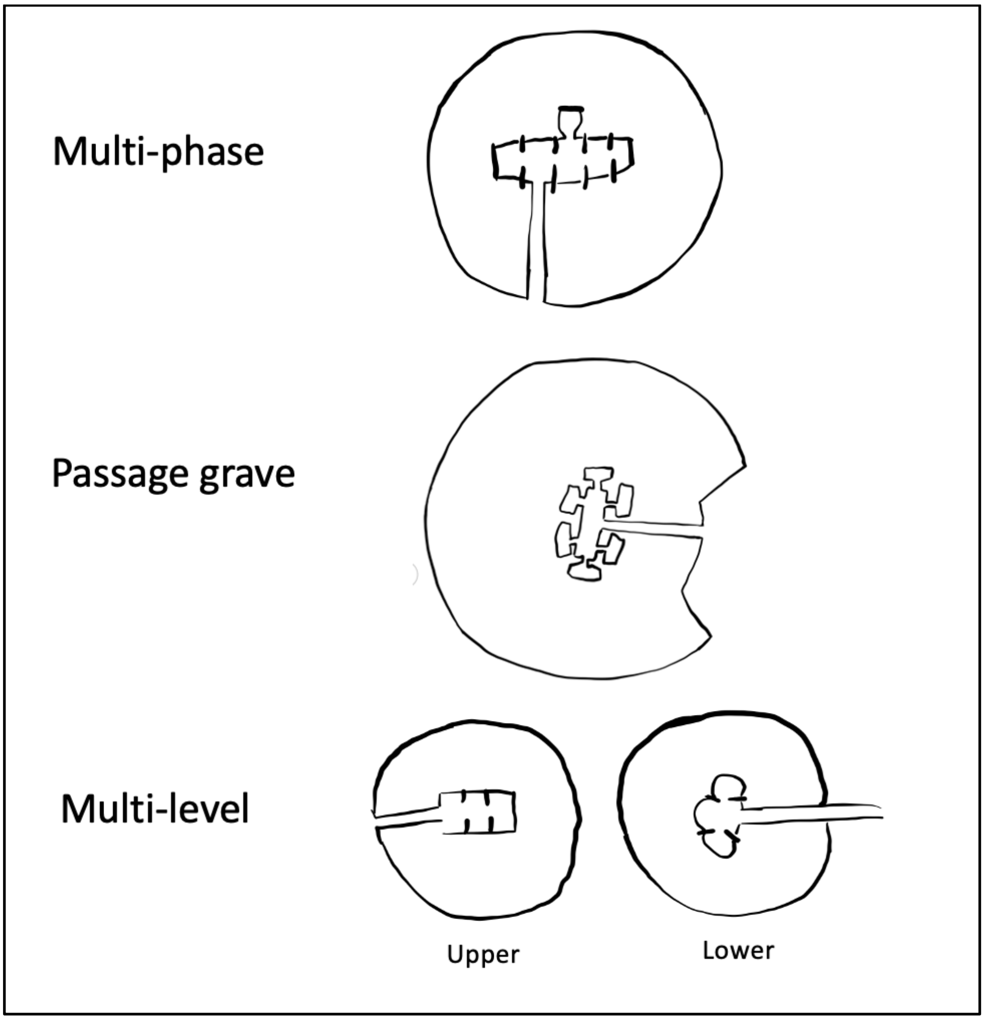


Figure 6.2. Sketched examples of the different classifications of Orcadian tombs. Top - Multi-phase (previously referred to as hybrid) in this case Unstan ORK 51(Redrawn from Davidson and Henshall 1986,164). ; Middle – Orcadian passage grave or Maeshowe type in this case Quanterness ORK 43 (Redrawn from Davidson and Henshall 1986, 151).and Bottom; a muti-level monument in this case Huntersquoy ORK 23 (Redrawn from Davidson and Henshall 1986, 124).

Characteristics of Neolithic tombs

It has been suggested that the most pragmatic and likely process employed when building a stalled cairn would be to first either clear the topsoil or place the foundations of the structure directly on the existing ground surface to create and plan out a monument's base. Next, setting in the back slab and standing opposing orthostats (Davidson and Henshall 1989, 20) would create the skeleton of the monument by placing large opposing upright orthostats. A second less conspicuous feature is that of the back slab. This upright stone is typically set not at 90° but slightly leaning outwards away from central passageway of the tomb. This angle has been noted during field surveys and has been noted in many excavation reports previously. The back slab is positioned at the distal or terminal end of the monument and is often smaller than the overall height of the distal cell seldom measuring over a metre (Davidson and Henshall 1989, 19). There are a small number of tombs (Unstan and Isbister) with what appear to be two back slabs situated at either end of the main chamber. These phenomena may be aligned to extensions from different phases of construction. The back slab typically only forms part of the terminal end with the remainder being made up of drystone walling that is concave and narrows as it incorporates back slab as depicted in Figure 6.3.

Figure 6.3. A selection of images showing the back slab. Top left - Tresness; top centre - Knowe of Yarso; Top right - Blackhammer and bottom - Unstan (authors own photographs).

Analysis of monuments

This section will undertake a detailed analysis of the stalled cairns that have qualitative archaeological data associated with them. The monuments identified as the earliest will be looked at first followed by those monuments that have features that have been labelled hybrid tombs with identifiable classification features from the stalled and passage grave traditions. The order of the analysis follows the chronological work (see chapter 5) with tombs that do not currently have any dating data (Calf of Eday Long, Tresness and Blackhammer) included at appropriate junctures. By presenting in this way it considers the monuments from a typo-chronological perspective when scientific dating evidence is not present.

Stalled cairns

Point of Cott

The chambered cairn at Point of Cott, Westray was identified as possibly the first datable monument in Orkney within the time slice 3800-3700 cal BC but more likely within 3700-3600 cal BC (se chapter 5). It is a stalled cairn that was extensively excavated in the early 1980s which demonstrated that the monument was made up of two distinct structures (see Barber and Coy 1997). First, the south element which is readily identifiable as a stalled cairn with four compartments and a passage. The first three cells - which contained most of the ceramic and burial deposits - and a dual cist-type construction present in the form of a terminal chamber. The north element of this series of structures has not been classified nor resolved during the Barber excavations as it was reported as being largely destroyed either because of the robbing of stone for the main cairn construction or because of coastal erosion (Figure 6.4 inset).

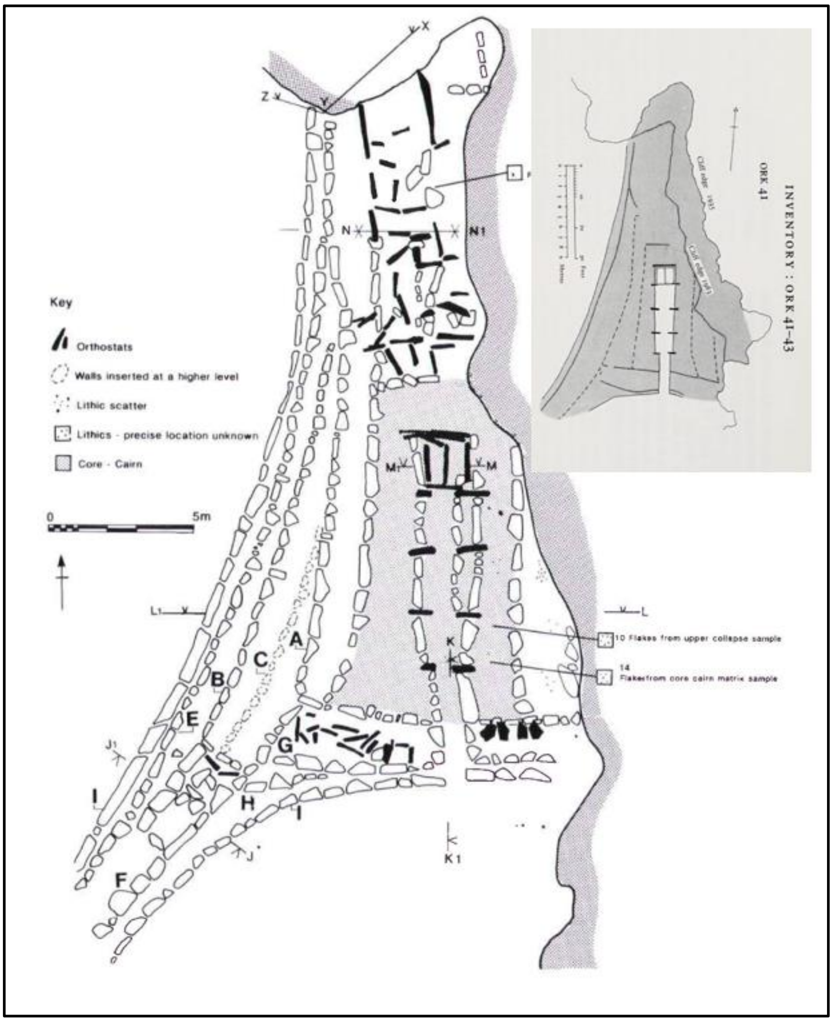


Figure 6.4. Plans of Point of Cott showing the stalled cairn structure to the south with the undetermined structure abutting to the North (Barber and Coy 1997, Figure 3) and sketch plan (Inset) of the same monument (Davidson and Henshall 1989, 150).

Before applying the axial alignment analysis to this monument, it is possible to identify evidence that supports the hypothesis that the monument was a multi-phased construction with several features being added to a primary phase of a simple tripartite structure. It was not possible to suggest in what order the additional aspects were added. The infill drystone walls between the orthostats forming compartments one, two and three were constructed corbelled or bowed in horizontal plain and built as in fill between the orthostats (Barber 1997, 24). This technique was only evident in the first three compartments, the fourth or terminal chamber having straight walls and a rear orthostatic wall (Barber 1997, 12). This again is suggestive of a different intention for compartment 4, likely as a terminal cell with back slab.

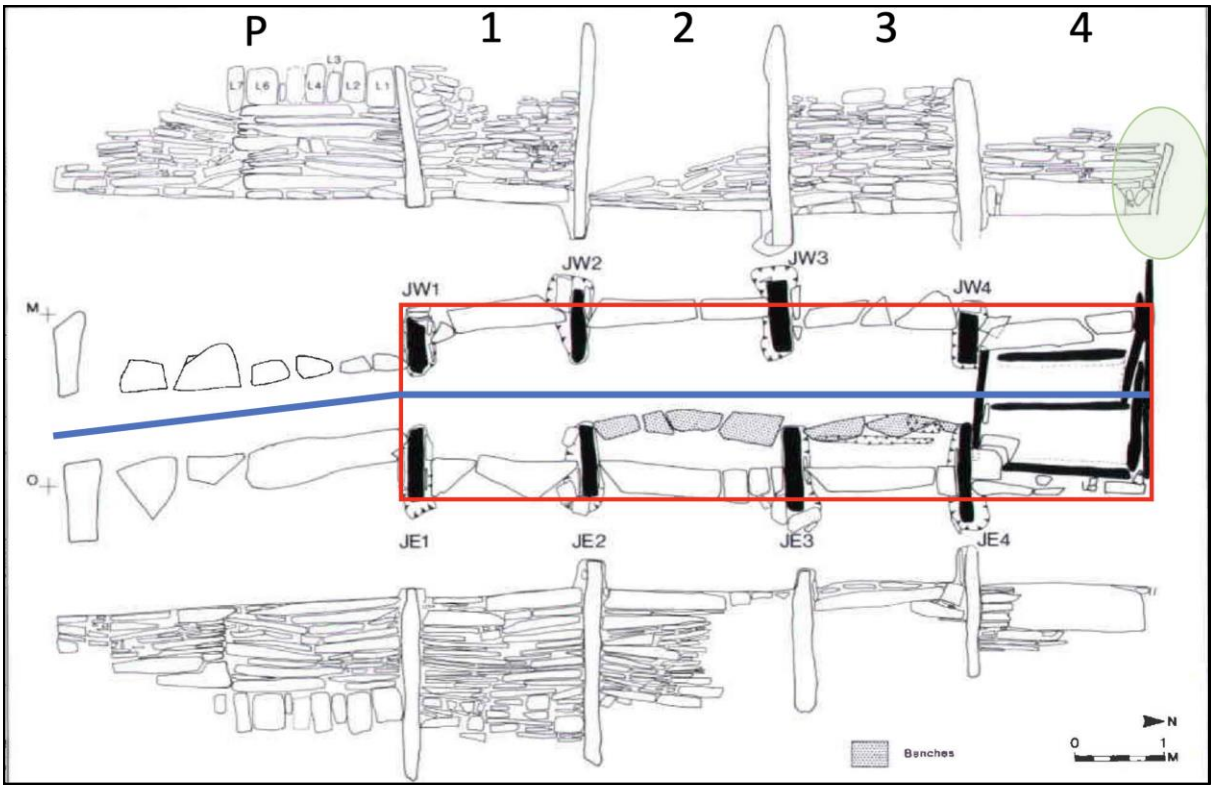


Figure 6.5. Plan of the base course of Point of Cott together with the elevation drawings of the chamber walls. P representing the passage and compartments 1-4 (incl) (Barber and Coy 1997, figure 5)

Figure 6.5 shows how the builders have used larger and longer stones at the base of the infill drystone walling before building up with narrower stones to create the walls across cells 1-4 inclusive (Barber and Coy 1997, fig 5). This technique is not replicated under the passage section where longer more slender blocks of stone appear to be utilised a subtle difference which may be suggestive of its construction occurring at a different time to the main chamber. Similarly, compartment four has had a box-like construction of larger stones added which is representative of a later Early Bronze Age cist. Critically for phasing at the terminal end of cell 4 can be seen an outward sloping orthostat (Figure 6.5 green highlight) that whilst small, is positioned typically as a back slab feature and therefore would suggestive that it was part of the primary phase four celled stalled cairn.

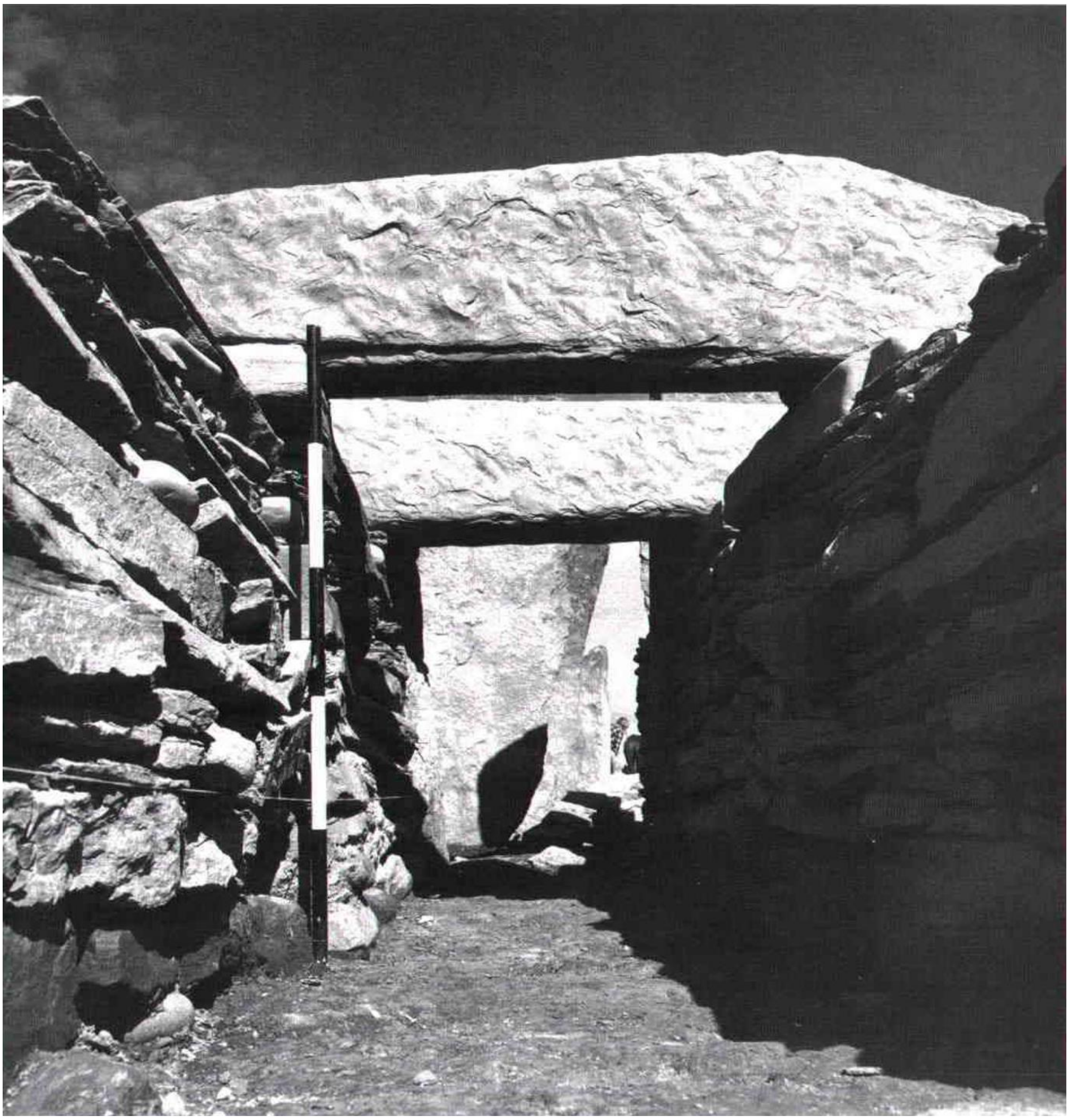


Figure 6.6. Photograph taken from the passage looking north that shows the asymmetry of the structure with the main chamber aligning off to the right (Barber and Coy 1997, ii).

Once the axis alignment analysis is applied it is clear to see that there are two different alignments albeit by c. 8° (Figures 6.5 (blue line) and 6.6). It is suggested that if the passage, the centre portion (highlighted in the red box Figure 6.5) were all built contemporaneously then there would be a probability of similar walling techniques together with and a more symmetric axis alignment given the levelling techniques that would have been employed by the ancient surveyors/builders in setting out the construction. It is therefore suggested that this monuments primary phase was a stalled cairn before receiving later extensions in the form of a passage and cairn together with an adaptation to the end cist-type chamber in the EBA (Figures 6.7 and 6.8). The suggested phasing sequence of this monument within the Neolithic is depicted in Figure 6.7.

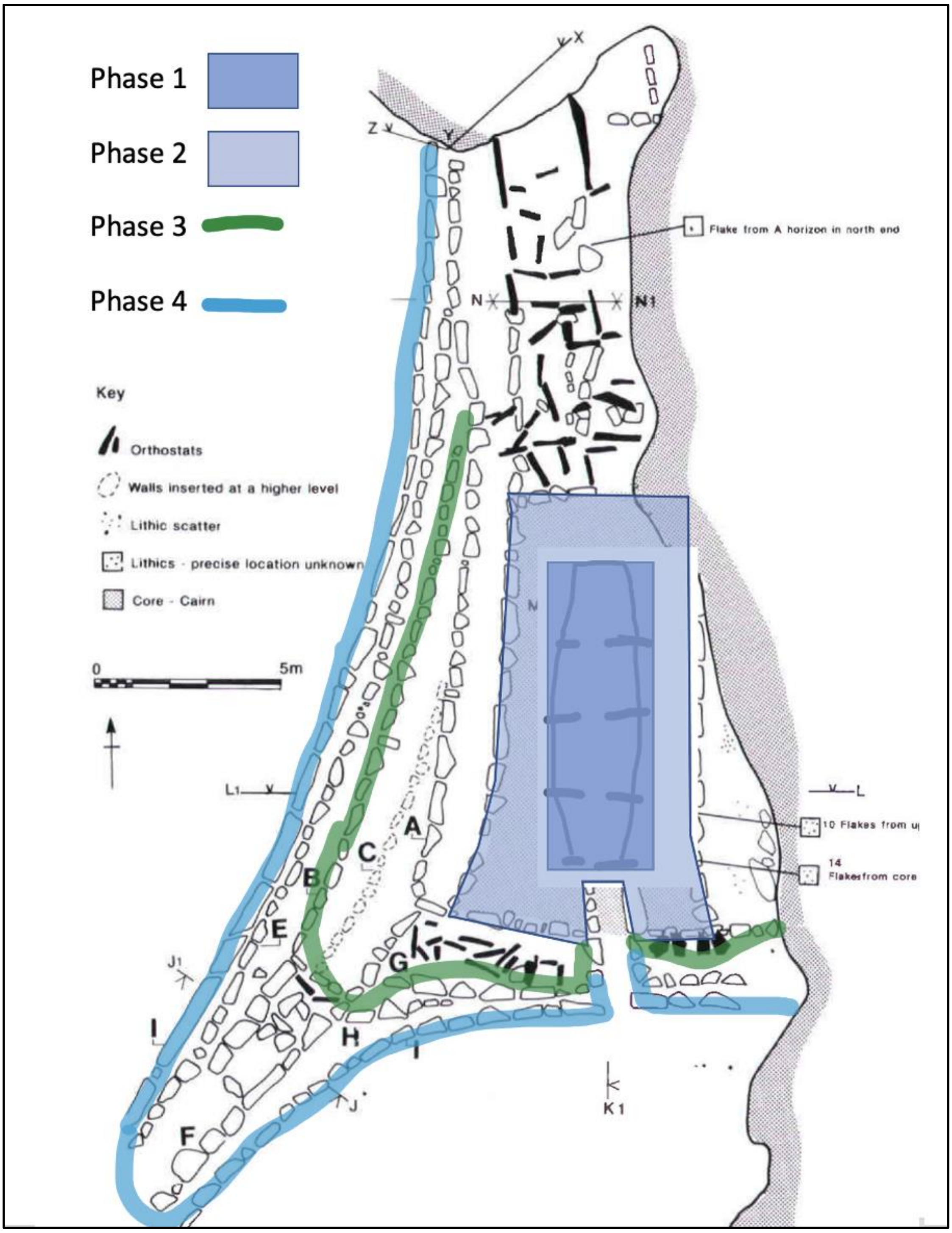


Figure 6.7. Phasing suggestion for Point of Cott added to Plan from Barber and Coy (1997, fig 22a).

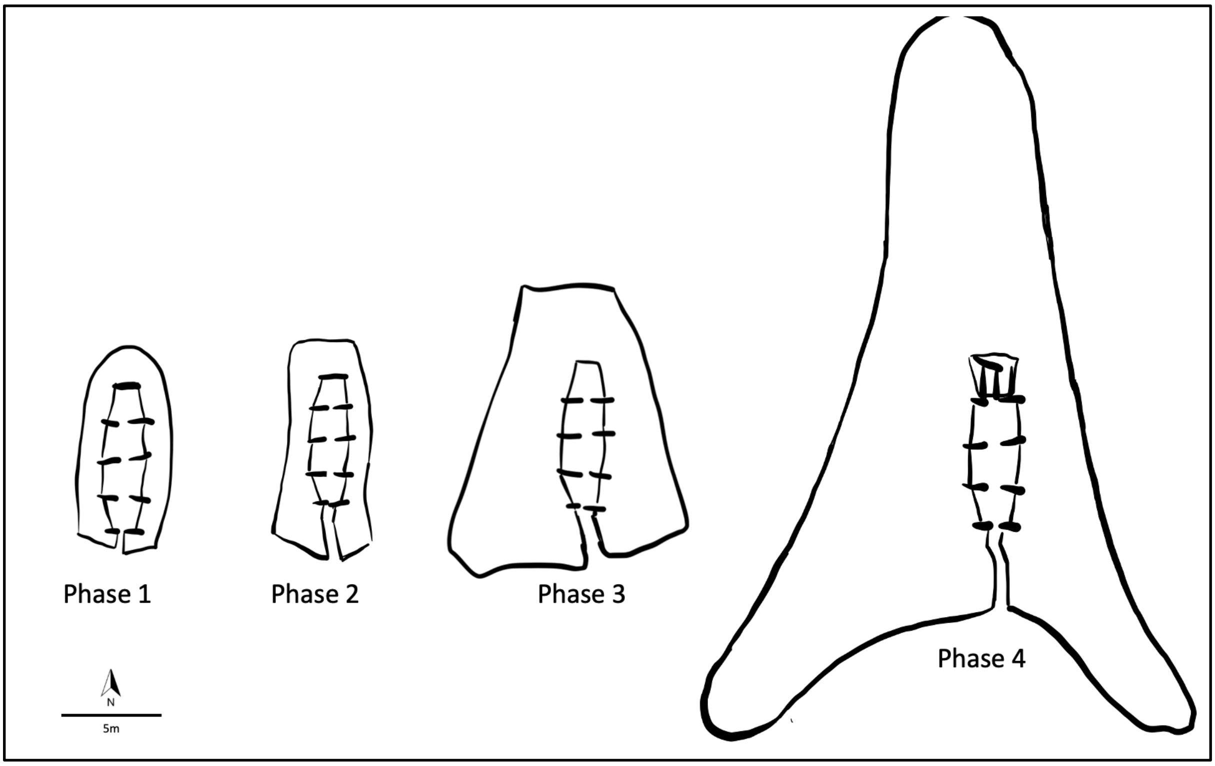


Figure 6.8. Proposed phasing sketches as a result of the axial and architectural analysis undertaken in this work (adapted from Barber and Coy 1997, Figure 22a)

It has previously been suggested (Barber 1997, 58) that there were two identifiable phases the initial phase between 3400-3300 cal BC and the later phase towards 2900 to 2800 cal BC. It is now suggested that there are three phases to the construction of the tomb structure (see Figure 6.14). The surrounding cairn is also part of the biography of this monument with the suggested early phase as at Figure 6.13 (blue shading). The more elaborate horned cairn extension is likely to have been undertaken at the same time as the alterations of the tomb itself. The work by Barber (1997) shows two elongated structures laid out facing each other. Initially it seemed possible that this could be interpreted as two opposing stalled cairns. If correct this configuration would be anomalous in respect of Orcadian monuments. A likely explanation for this array of stones can be explained as also part of this later cairn extension utilising a previously identified construction technique which maximises architectural efficiency in terms of both labour and material (see Barber 1992, 29; McFadyen 2006, 353). This approach uses box-like orthostats to create the cairn as opposed to a solid stone building method. This building methodology has been identified at the Neolithic tomb at Vestra Fiold on Mainland Orkney (Richards *et al.* 2013, 183) and seems the most likely interpretation for the later phase of *Point of Cott*. It is now suggested that the phasing has more than two phases as this analysis has identified at least four with the later one being potentially in the Early Bronze Age.

Holm of Papa Westray North

This stalled cairn was identified and excavated in 1849, by Traill and revisited by Petrie in 1854 (Petrie 1856). This cairn appears early in the Orcadian Neolithic chronological time slice sequence of the previous chapter. A detailed investigation was carried out by Ritchie in the early 1980s which was able to add a suggested construction sequence to the monument's biography. These excavation records (see Petrie 1856; Ritchie 2009) and a surface 3D photogrammetry models' axis analysis was carried out.

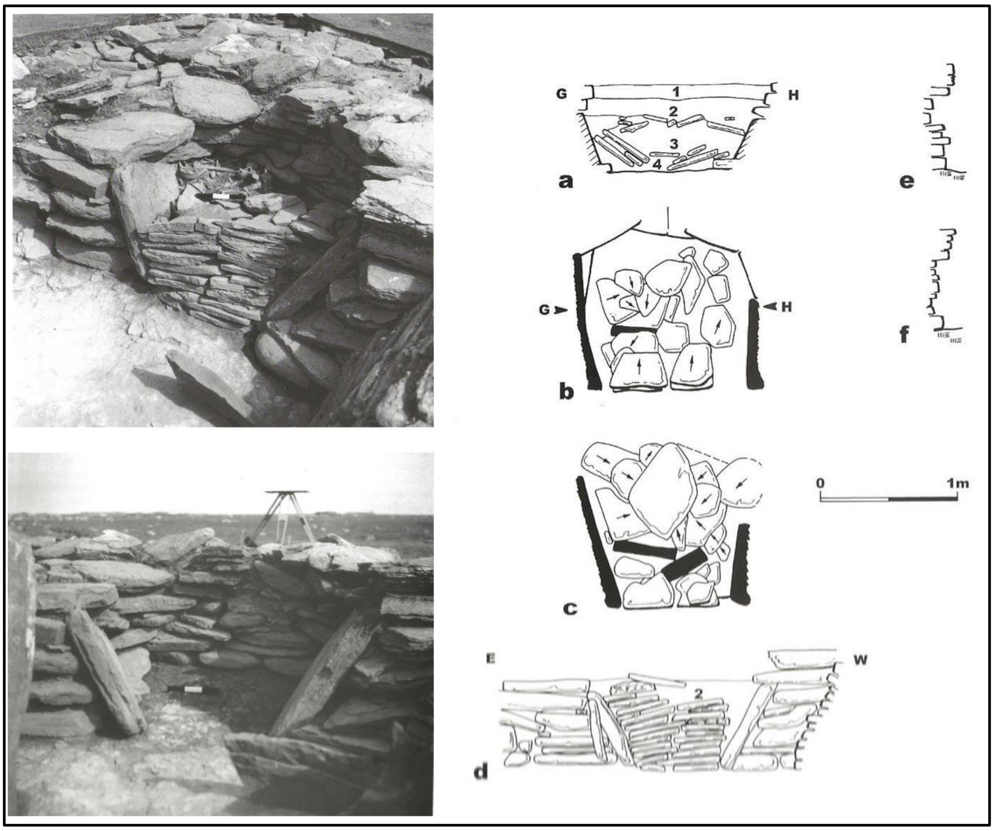


Figure 6.9. Photographs of cell five at HPWN showing blocking wall and contents (left/bottom) and the fully excavated cell (left/top) and section (a) plan (b and c) and profile (d) (Ritchie 2009, illus 16 and 5)

It was identified that the primary phase of this tomb was cell five (Figure 6.9) a small crudely constructed single cell round cairn made up of medium sized beach-worn boulders - the entrance is seen in the vicinity of *P2* on the plan (Figure 6.10). The characteristics of the building stone contrast with the neatly placed flagstone type slabs of compartments one, two and three of this structure (Ritchie 2009, 3). Ritchie maintains this phase was clearly designed to abut the original single cell cairn (cell five) and suggests that some effort had been made to align cell five and four with the reminder of the structure (Ritchie 2009, 3) though this has not been maintained throughout the full axis with cell four and five and the entrance passage being notably asymmetric. A blocking drystone wall was used to separate the primary phase from the stalled cairn phase that followed as seen in Figure 6.9 (bottom/left).

Noticeably this is the only monument without a back slab prompting several possibilities for its absence. First the builders of this early monument utilised the primary phase round cairn blocking wall as representative of the back slab enhanced by an intention to incorporate earlier burial structures in the stalled cairn. Second, and equally likely, the early iterations of the stalled variety conformed less to what can later be seen as essentially a blueprint for construction.

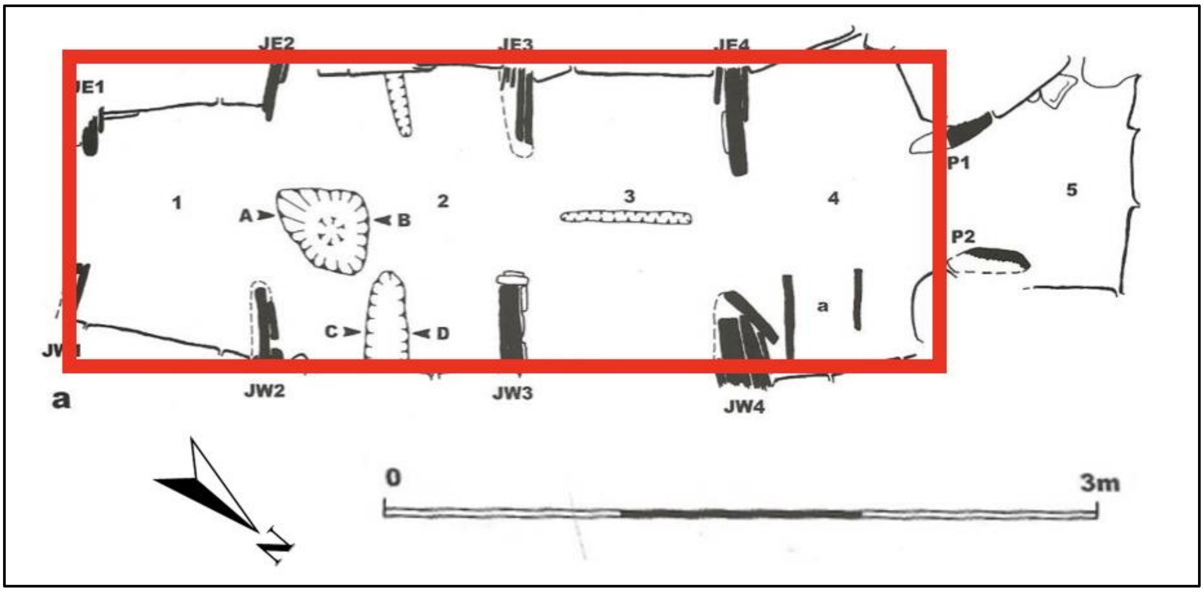


Figure 6.10. Proposed stalled cairn phase (red box) imposed on plan of monument from recent excavations (Ritchie 2009, illus 11)

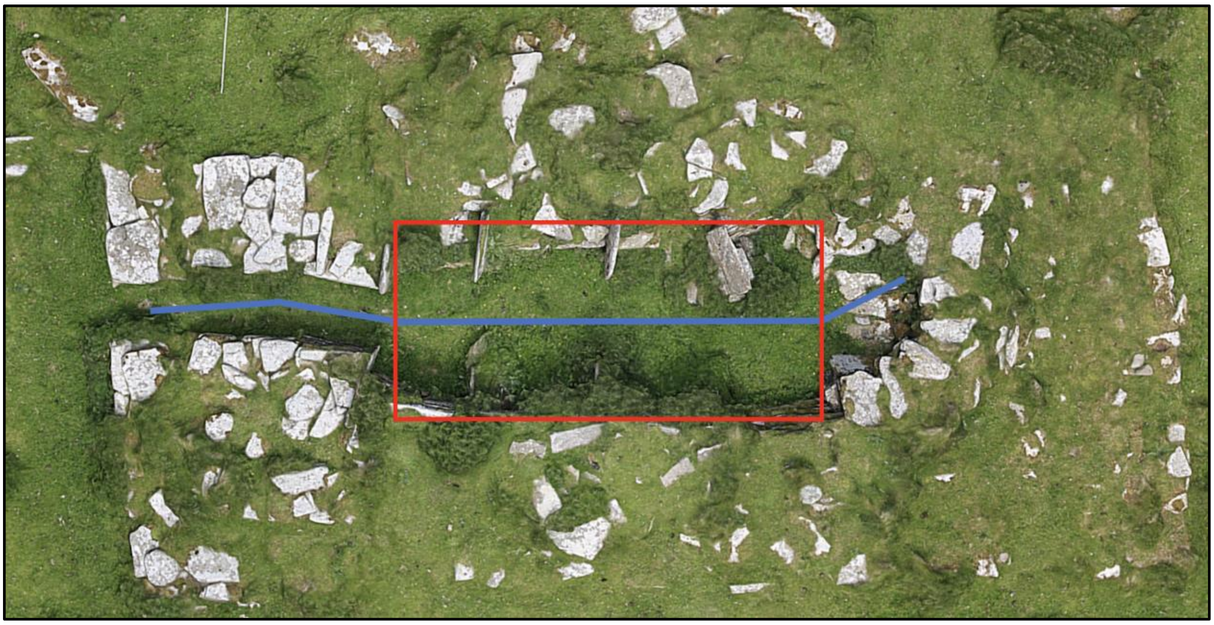


Figure 6.11. Photogrammetry model of Holm of Papa Westray North annotated with stalled cairn phase (red box) and axial alignment analysis (blue line) showing asymmetry throughout the monument. Model y Anderson-Whymark with annotations by athor (https://sketchfab.com/3d-models/holm-of-papa-westray-north-neolithic-cairn-b3c3864778a94a79bdbbcfd0ec778f1c.

Figure 6.11 demonstrates the axis alignment technique for identifying phasing. The red box represents a potential stalled cairn construction that consists of the area bounded by the opposing jamb stone orthostats (JE1-4 and P1-P2 inclusive Figure 6.10) and it can be clearly seen that the different phases; cell 5, cells 1-4 inclusive and the passage have different axis alignments and consequently it is proposed that these are different phases the sequence of which is seen at Figure 6.12. Weight is added to the veracity of this technique as modern archaeological excavations have established that cell five was an earlier structure than cells one, two and three and four (Ritchie 2009, 3).

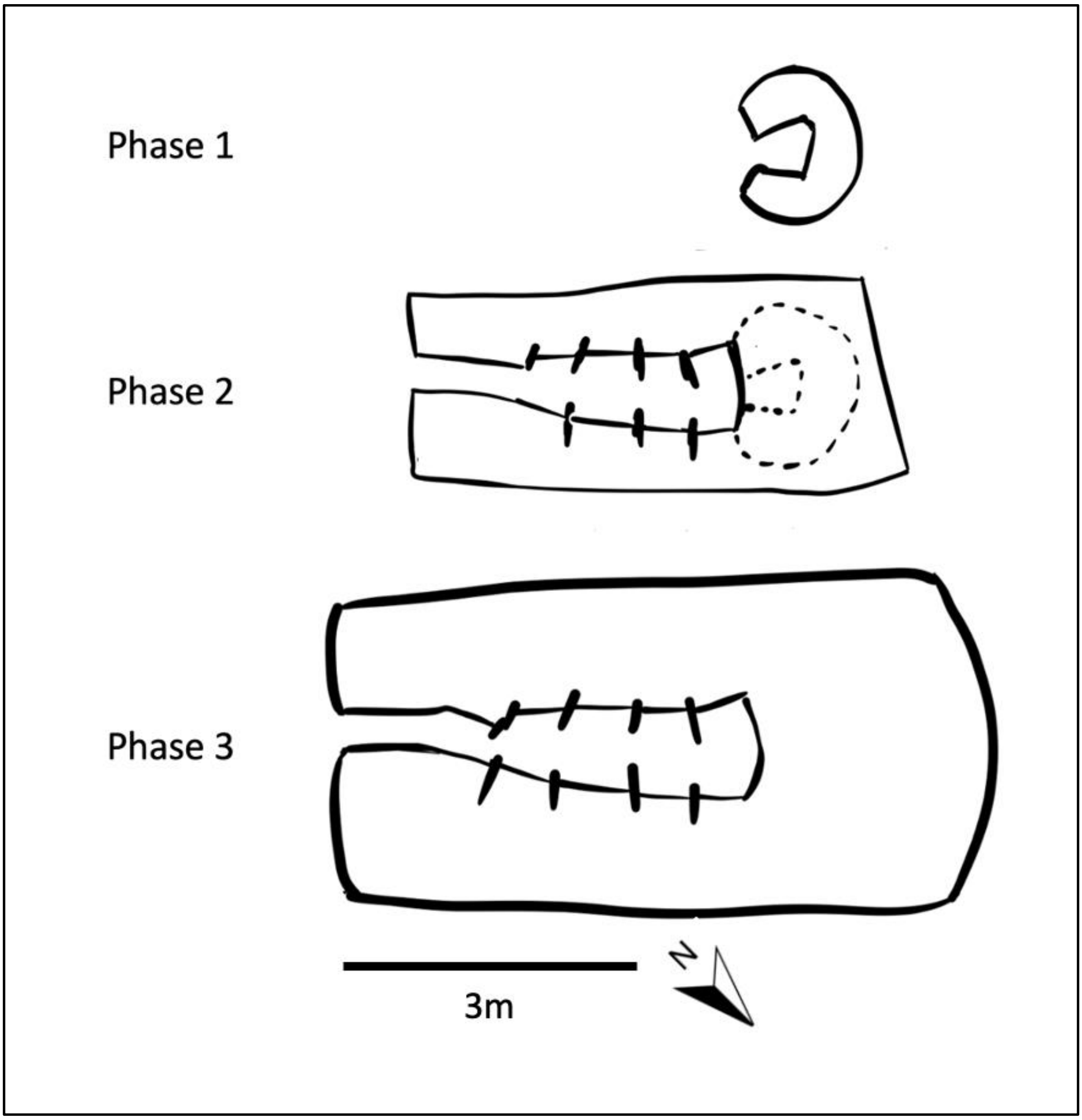


Figure 6.12. Proposed phasing plans following the axial and architectural analysis undertaken in this work. Showing the three phases in the construction sequence.

It follows that the possible sequences to the construction of this tomb occurred over several building phases albeit it is impossible to determine the time scales operating between phases and the radiocarbon evidence is unhelpful in this regard. The first small round cairn (cell five at Figure 6.10 and phase 1 at Figure 6.12) was constructed and in place before the decision was made to add stalled extension (red box Figure 6.10 and phase 2 Figure 6.12). The final phase saw the extension of the passage and the expansion of the surrounding cairn. This phasing was established during excavations (see Ritchie 2009) and is shown here by way of demonstrating that the axis alignment analysis corresponds with the on the ground findings well and adds veracity to this technique throughout this chapter. The phasing sequence of Holm of Papa Westray North can be seen at Figure 6.12.

Calf of Eday Long

The juxtaposition of primary phase small single cell structure as shown at Holm of Papa Westray North is not atypical; this situation is replicated here at a second monument Calf of Eday Long and at Taversoe Tuick. It is a multi-phased monument that has incorporated an earlier smaller burial monument that does not conform to the stalled cairn or passage grave traditions. Calder produced a sequence of construction plan (see Figure 6.8) (Calder 1937, fig 3) suggested that the four cell stalled cairn was the primary phase with the smaller cell B (Figure 6.13) being a second phase of construction.

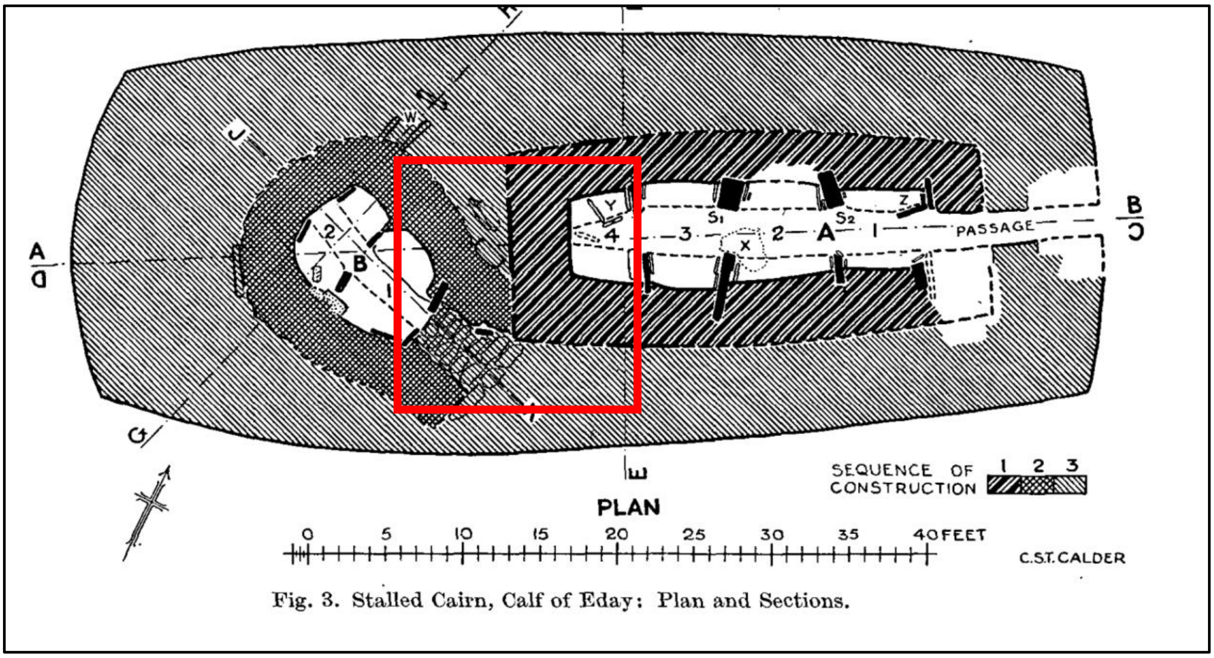


Figure 6.13. Plan and section following the excavation of Calf of Eday Long (Calder 1937, fig 3)

This excavation did not include any detailed examination of the junction of the two distinctive phases of these tombs. Having looked in detail at the plans it is suggested here that the smaller cell B was in fact the earlier phase of this monument; a detail that has been commented upon by other subsequent archaeologists (Davidson and Henshall 1986, 107). Figure 6.14 has been presented to detail the phasing that is now most likely phased chronologically 1 to 3. The original structure was a two stalled and somewhat rounded cell tomb and was surrounded by B a round cairn. There then followed a four cell stalled cairn surrounded by a rectangular cairn that cut into the original structure. Given the positioning it is possible both these monuments were in use simultaneously before the phase one structure was blocked and a passage and large near rectangular covering cairn built to cover both monuments.

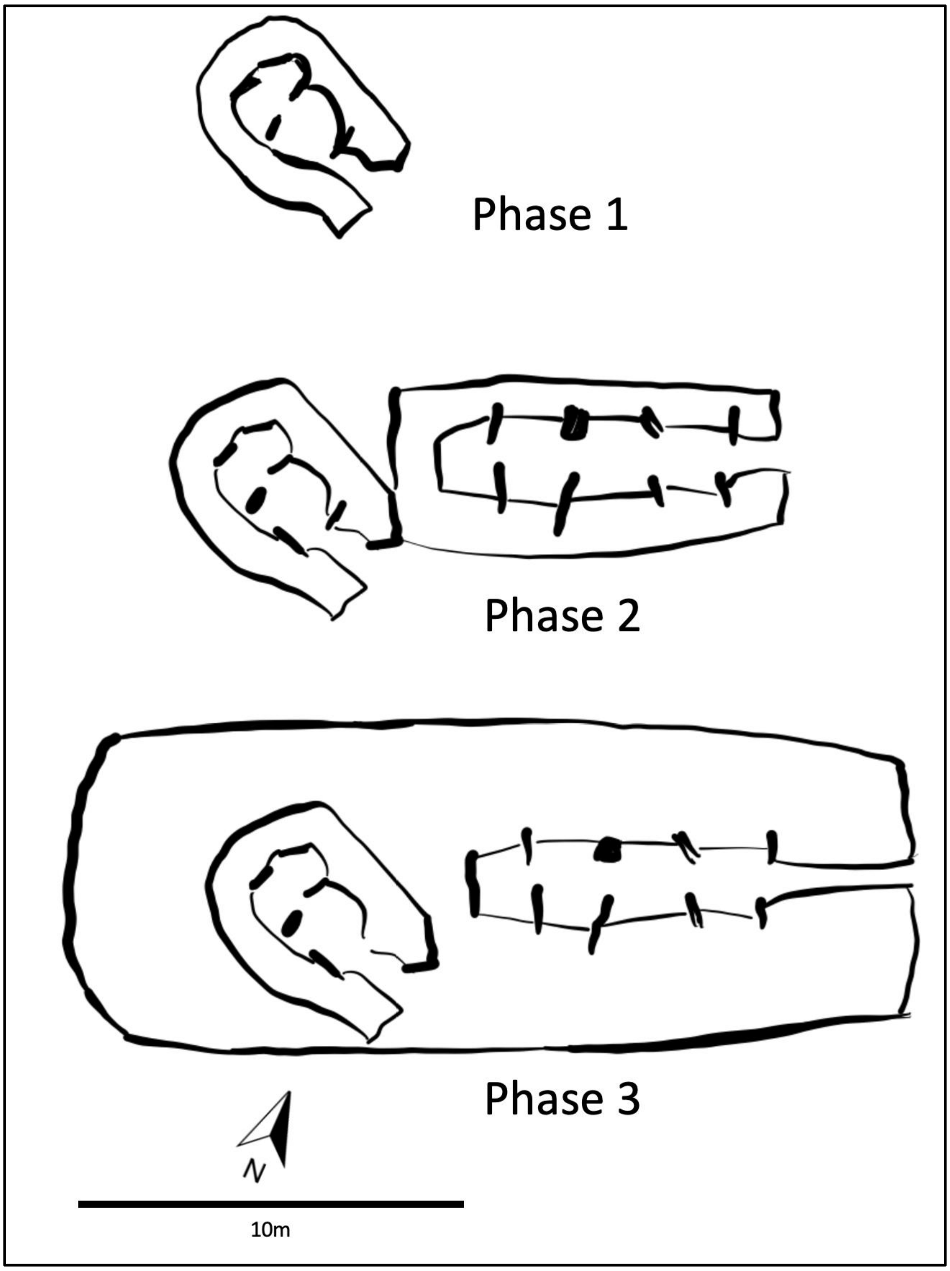


Figure 6.14. Proposed phasing plan following axil alignment analysis undertaken in this work (redrawn after Calder 1937, fig 3)

Here we see a construct that has two monuments at one site with the earlier structure being conjoined to the later stalled tomb. The association between the two is strengthened by the inclusion of an all-encompassing cairn at the latter stages of this build. One aspect of note here is that the axial alignment technique does not show any deviation in alignment per se. Structure A is aligned with itself as is structure B and this can be seen in the axes lines that were added in the original plan at Figure 6.13. This fact adds weight to the argument that tombs that display notable axial alignment deviation have been subjected to later building phases.

Midhowe

Whilst this monument (Figure 5.15) is today presented as being architecturally sophisticated it comes into the chronology time slices potentially early in the stalled cairn tradition (see chapter 5). Usefully, this monument has several extremely detailed 3D photogrammetry models (https://sketchfab.com/3d-models/mid-howe-chambered-cairn-rousay-orkney-5536762cb6fb4327a9479f30ddd184ef) which provides an opportunity to identify the asymmetrical nature of this elongated stalled cairn.

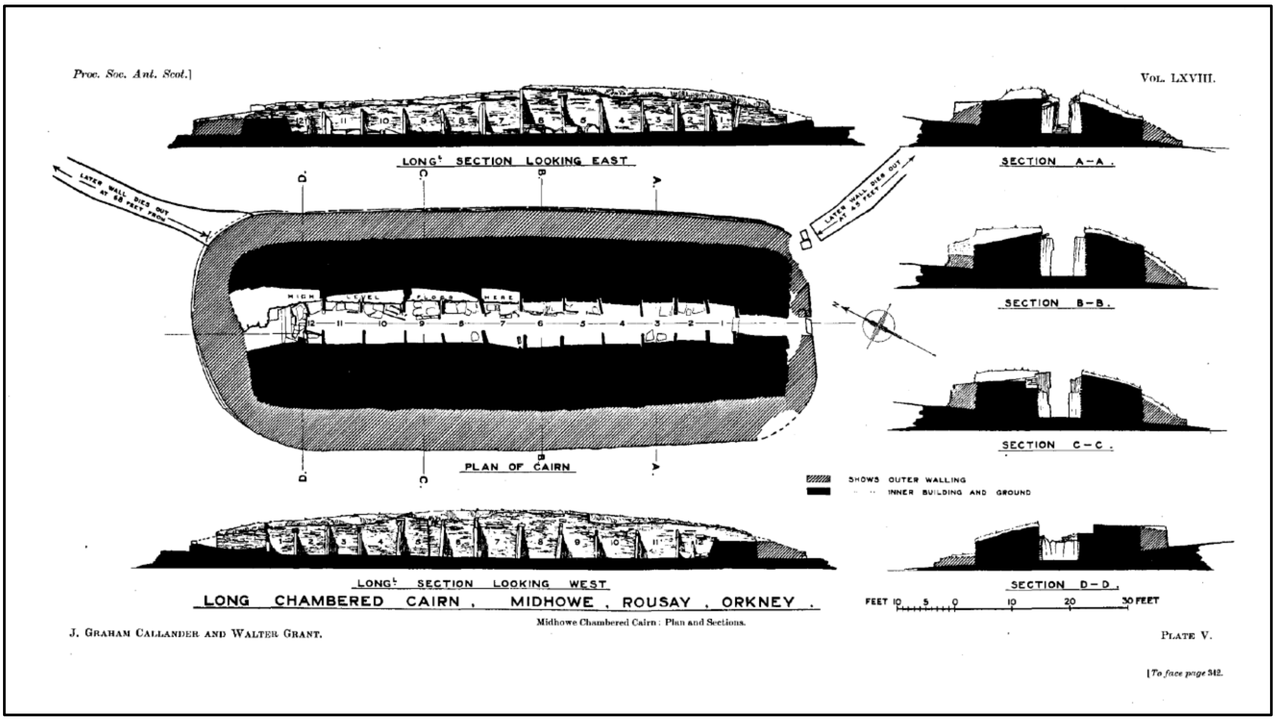


Figure 6.15. Drawings from early excavations at Midhowe (Callander *et al.* 1934, Plate V)

When closely examining the orthostats throughout the length of the structure (Figure 6.16) and when applying the axis alignment in conjunction with other observations it is possible to pick out nuances that may be suggestive of different phases. Compartments 1 to 4 are aligned on the same axis and contain notably smaller opposing orthostats; the diameter of the monument within this area is also visibly narrower. Compartments 5, 6 and 7 are situated in a wider segment of the tomb and as can be seen the three are set on a slightly different alignment. In the bottom portion of Figure 6.16 the height of the stalls are considerably higher and compartments 8 and 9 are again visually aligned and the smaller orthostats places in a narrow section of chamber can be seen and a different architectural style that presents as a concave bowing of the walls (Figure 6.16 highlighted oval a). The wall of compartment five was identified by Callander and Grant as having a notable break (Figure 6.16 highlighted oval b) in the stone walling that they tentatively suggested was due to an extension to the monument but immediately dismissed it as it fell in such a place (between a compartment) that they supposed was unlikely and not a place for an extension (Callander *et al.* 1934, 326). Beyond this the excavators made no further comment on sequencing.

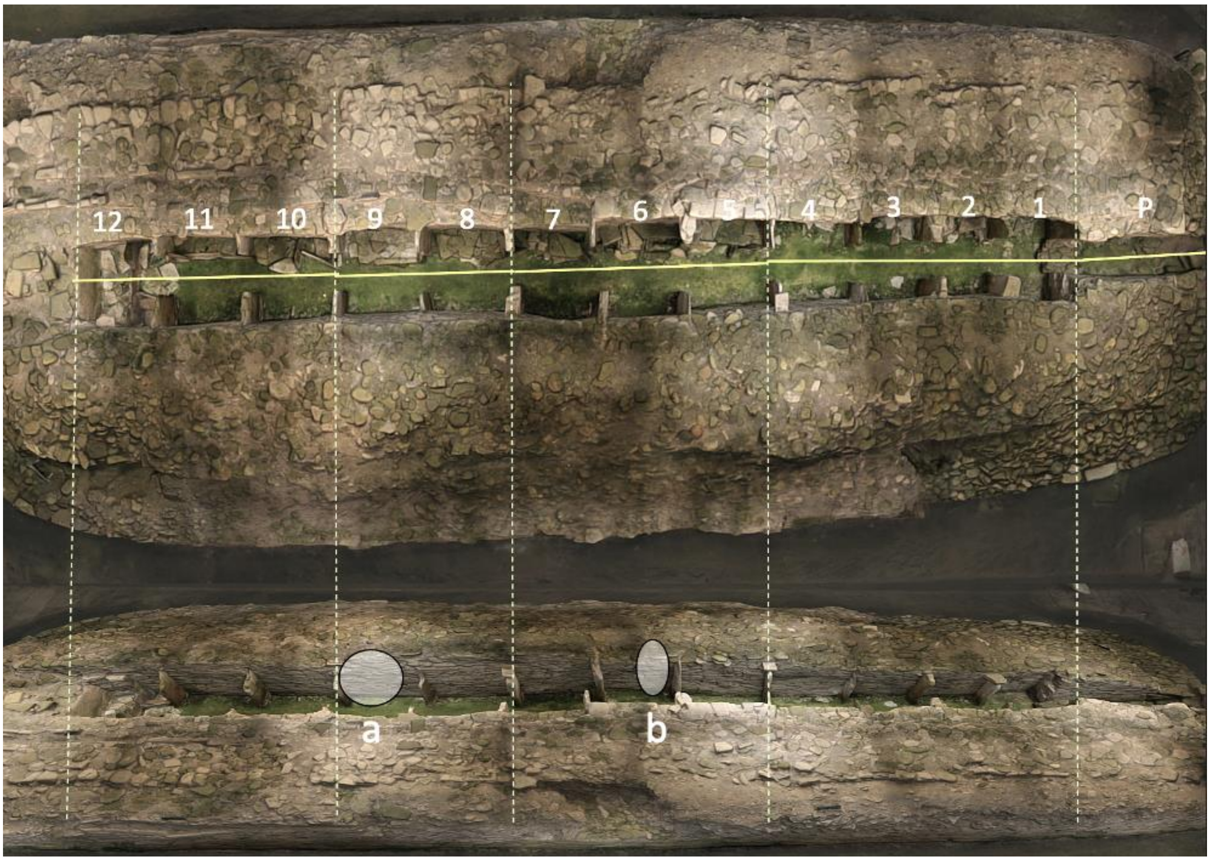


Figure 6.16. 3D photogrammetry model positioned in plan to identify potential early phase of the monument. The image is annotated with the axial alignment analysis (yellow line) and separated to identify changes in the symmetry of the structure (https://sketchfab.com/3d-models/mid-howe-chambered-cairn-rousay-orkney-5536762cb6fb4327a9479f30ddd184ef).

It is here argued that this break represents a different building stage and that the monument at Midhowe will have undergone structural changes within its biography. It may also be the case that joints for extensions were incorporated within the orthostat sockets. It is noted that any break in construction, say during the winter months or during an enforced change in labour recourses may account for the all the phases identified. This is something that is unlikely to be established definitively with the current archaeological record. It is appropriate to suggest that given the presence of a classic back slab in compartment 12 then this is the more likely location for a primary phase structure and this analysis suggest it would have been in the form of a tripartite stalled cairn (see Figure 6.17)

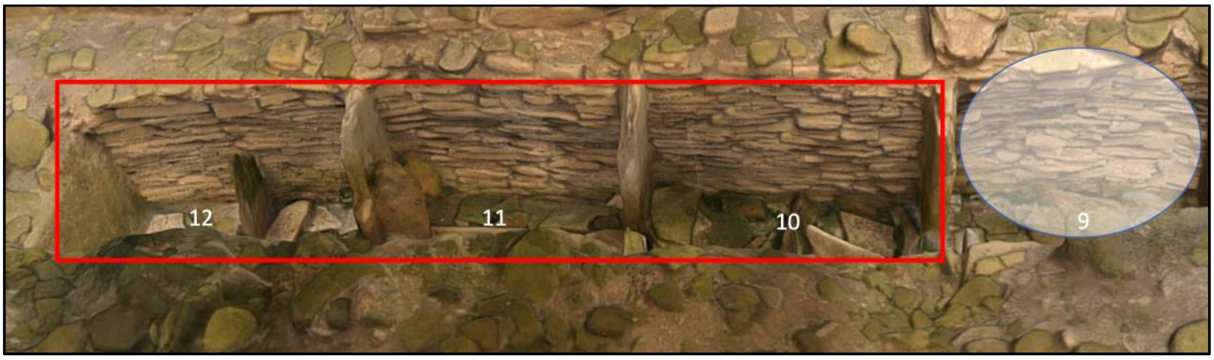


Figure 6.17. Photogrammetry image with highlighted early tripartite phase (chambers 10 to 12 inclusive) and the area around chamber 9 (highlighted) showing disruption to monument wall supporting architectural change (from https://sketchfab.com/3d-models/mid-howe-chambered-cairn-rousay-orkney-5536762cb6fb4327a9479f30ddd184ef).

Knowe of Ramsay

Nearby to Midhowe is the stalled cairn of Knowe of Ramsay which bears many similarities not least that they represent between them the two longest of the stalled cairns throughout the islands. There is less available modern evidence for the Knowe of Ramsay as today the monument has been reduced to insignificance (RCAHMS 1982d) and therefore any assessment must be based only on the early plans (Figure 6.18). This monument has reported to have notable joins within the exterior walling that correspond to the positioning of the opposing orthostats in the chamber (Davidson and Henshall 1986, 25) it has been supposed that this was indicative of a change in plan or intention of the builders in other words a different phase (Callander and Grant 1936, 410) adding weight to the suggestion that both these monuments' biography contain earlier and shorter iterations.

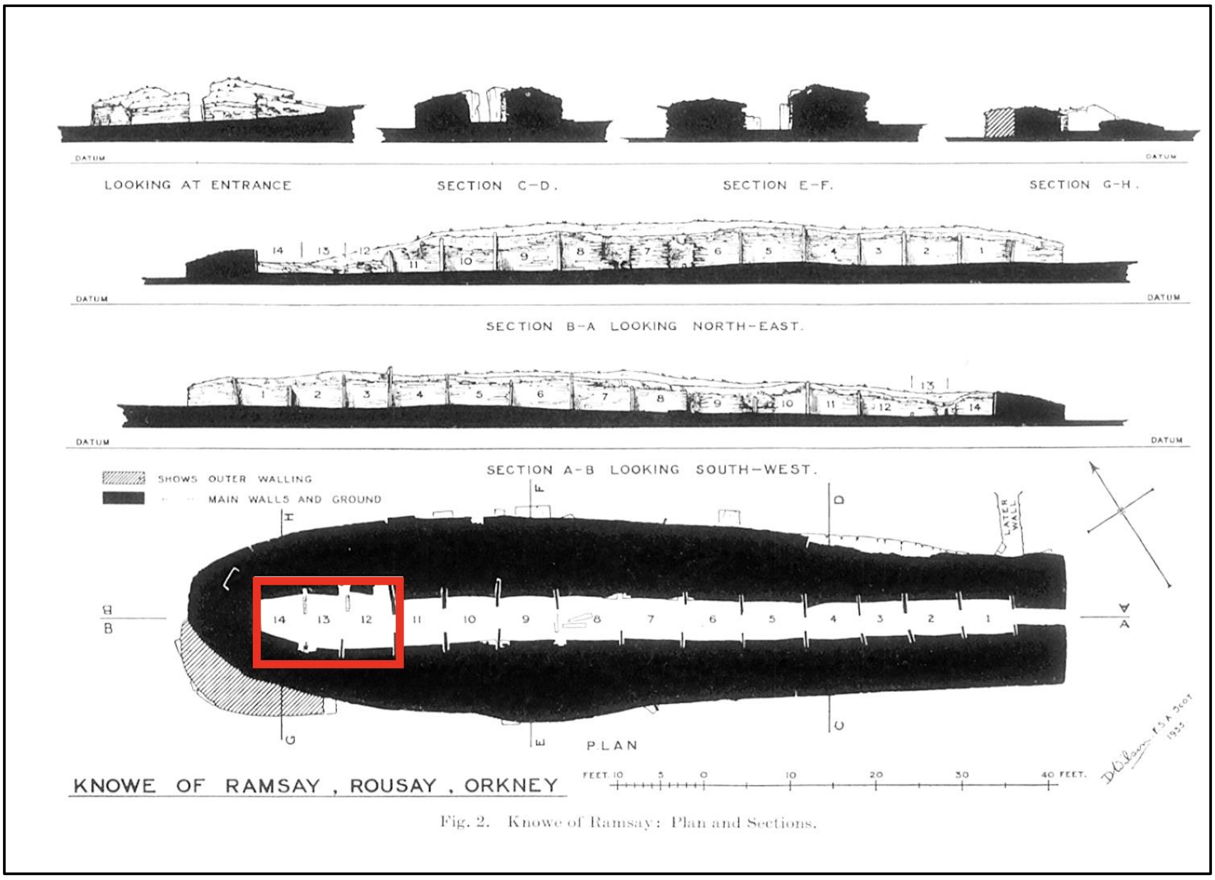


Figure 6.18. Plan of Knowe of Ramsay annotated with red box highlighting suggested primary phase of the structure. (Callander and Grant 1936, figure 2)

From a purely visual inspection in plan compartments 12-14 have less symmetric appearance, which could be attributed to a less sophisticated construction technique. This area contains the typical back slab and concave narrowing of the terminal compartment as seen in many stalled cairns, particularly the tripartite iterations.

In addition we only have early excavation reports to research but it was clearly noted by the excavators that compartments 3 to 11 have a basic paved flooring and signs of burning were observed in compartments six to eleven (Callander and Grant 1936, 413). This together with a slight axis alignment asymmetry and wider profile in plan for compartments 12-14 (red box Figure 6.18) may be suggestive of a different phase, perhaps primary construction of this elongated stalled cairn. It now opens the mind to this monument having an early tripartite stalled form.

Blackhammer

This monument is sited in the south of Rousay it is classified as a stalled cairn (Davidson and Henshall 1986, 102). It had been subject to major robbing by the time of its excavation in the mid 1930s (see Callander and Grant 1937) and therefore is challenging to interpret due to its complexity (Figure 6.19).

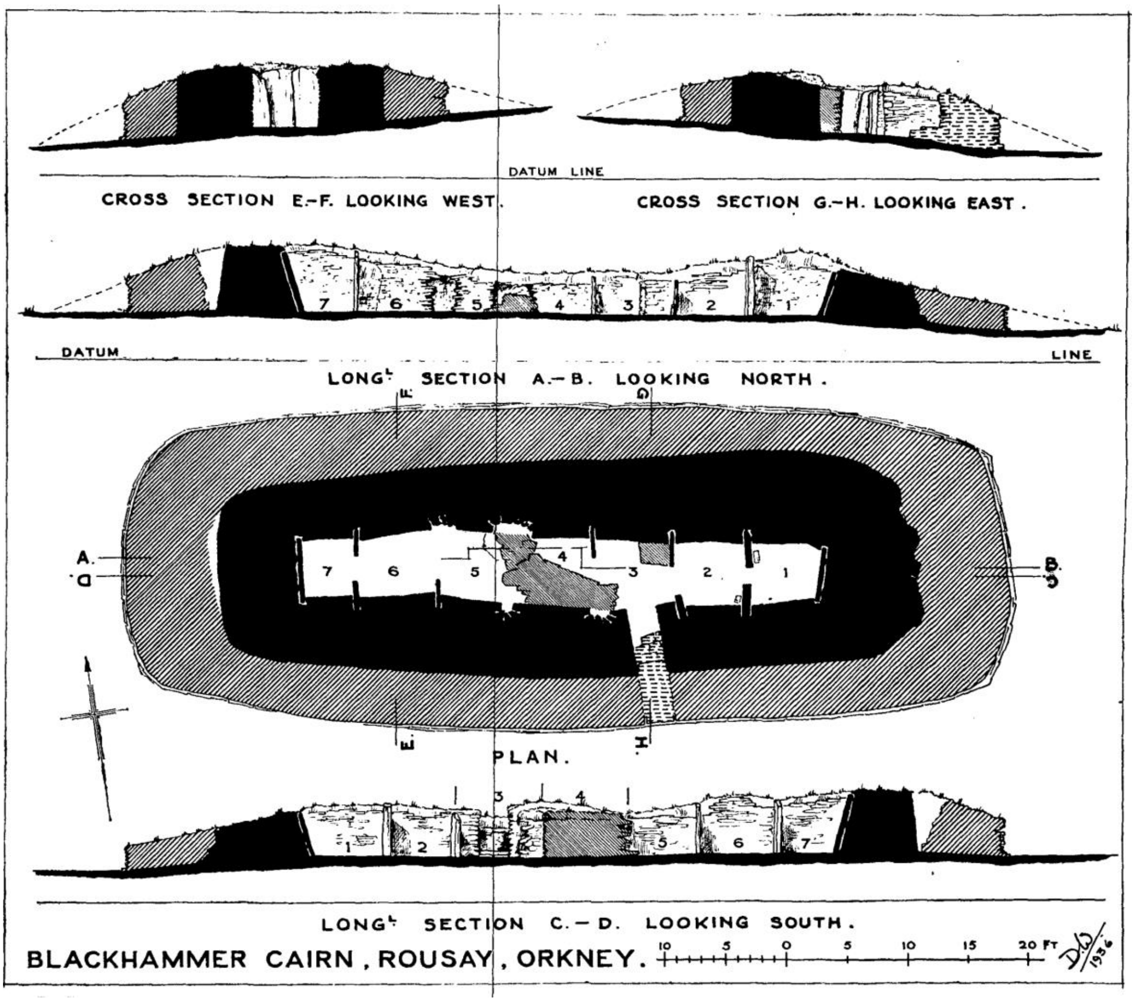


Figure 6.19. Plan of Blackhammer Cairn (Callander and Grant 1937, plate 5)

Around the centre of the tomb where the passage is situated as it is presented today there is an atypical and complex walling configuration that has been caused by the adaptation the structure in the past for unestablished reasons (Davidson and Henshall 1989, 103) though it has been tentatively suggested to be representative of a blocking event (Callander and Grant 1937, 303). When applying the axis analysis to this tomb (Figure

6.20) it is possible to conclude that the tomb is made up of two opposing stalled cairns that were joined at some stage when the passage was added.

Figure 6.20. Photogrammetry image rom model of Blackhammer tomb with the axis alignment technique applied (HES - https://sketchfab.com/3d-models/blackhammer-chambered-cairn-rousay-orkney-d9fef186f410481c9e6fdd8bc22530c7).

A peculiarity in the masonry noted by the original excavators supports this hypothesis when it was recorded that the masonry at either ends of the tomb are built with facing stones set horizontally as is typical in nearby Orcadian monuments. However, in the central sections the inner walls have been constructed by using an atypical method of laying the flagstones obliquely (see Figure 6.21) suggesting this area was built later when a different masonry tradition was operating. This supports the suggestion that the monuments here were once two opposing stalled cairns that has been joined together during later phasing. This unusual architectural feature was similar to the masonry style at other tombs on Orkney but also at horned cairns of Caithness on Mainland Scotland (Callander and Grant 1937, 298) and has also been associated with the observation that is shows similarities to the pattern on Unstan Ware ceramics (Callander and Grant 1937, 306).

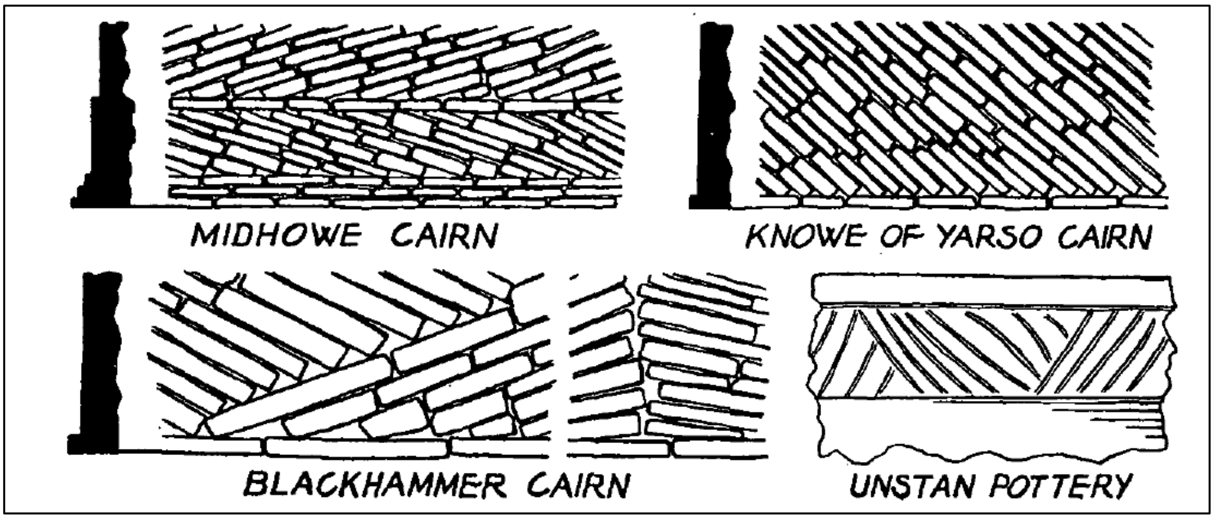


Figure 6.21. Designs of walling techniques at Blackhammer and others (Callander and Grant 1937, fig 9)

The two opposing stalled cairns configuration is also unconventional and not seen at any other site in Orkney though it is recorded at Langwell (Davidson and Henshall 1991, 122) and Tulloch of Assery A (Davidson and Henshall 1991, 158) both at Caithness. A phasing sequence has been suggested at Figure 6.22. It is not possible to unequivocally suggest that phase one was as depicted but is proposed here only as a possibility due to this tripartite element being aligned in the general direction of Braes O Ha'Breck settlement on Wyre. This phenomenon (alignment with settlement) will be discussed in detail in chapter 8. The later phase of this tomb is beginning to show signs of passage grave architecture with the passage entering the tomb from the side (Figure 6.22, Phase 3).

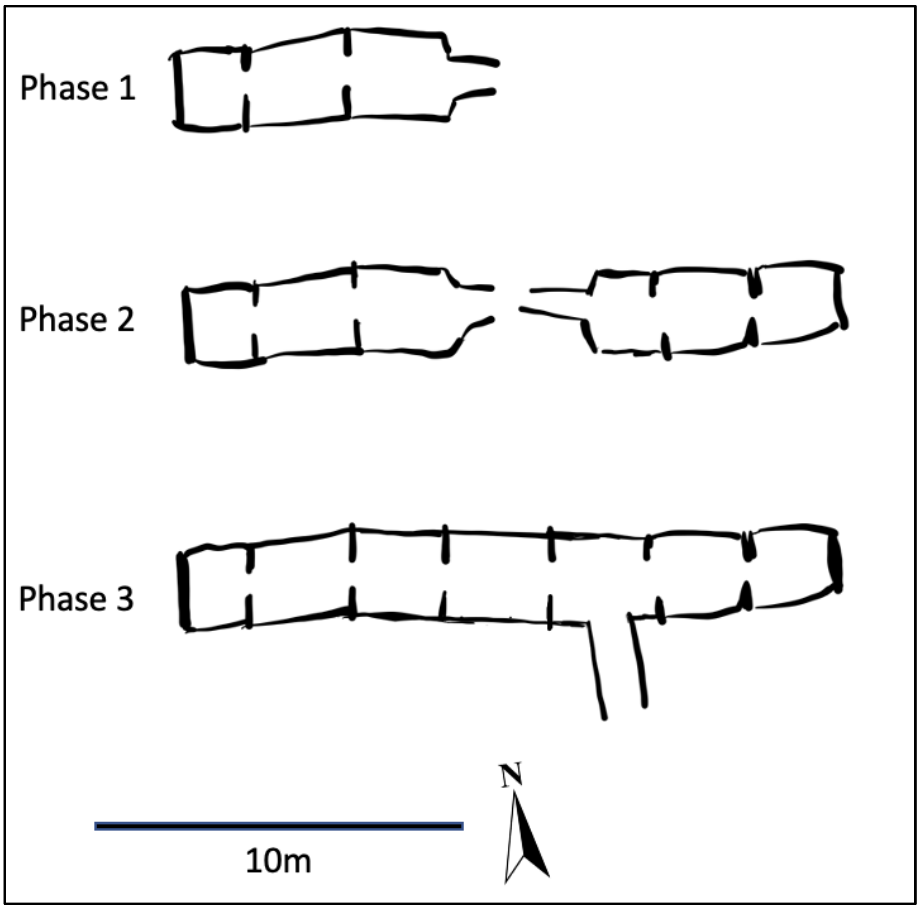


Figure 6.22. Proposed phasing sequence for Blackhammer cairn, Rousay (redrawn from https://sketchfab.com/3d-models/blackhammer-chambered-cairn-rousay-orkney-d9fef186f410481c9e6fdd8bc22530c7)

Monuments displaying both stalled and passage tomb features

Tresness

Figure 6.23. A 3D photogrammetry models from 2021 excavation at Tresness chambered cairn (https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

Tresness stalled cairn (Figure 6.23) is situated on the Tresness peninsular on the southern aspect of Sanday. It is thought to be a previously unexcavated until recently (see Anderson-Whymark and Cummings 2019; 2021; Cummings *et al.* 2017) and as much of the monument survives to roof height it presents itself as an appropriate test case to understand phasing. It provides an excellent opportunity to develop the axial alignment methodology given the availability of quality photogrammetry, plans and recent detailed archaeological evidence. Furthermore, this methodology was conceived whilst the author worked at this site between 2019-2022.

Figure 6.24. Photogrammetry model of Tresness annotated with the opposing disturbed area of stonework that may represent the limit of the primary phase of the tripartite stalled cairn; Top: west aspect; Bottom: East aspect (Model by Anderson-Whymark 2019, https://sketchfab.com/3d-models/tres-ness-stalled-cairn-excavation-week-4-5d1e3f56076b4cdbb3b68432f83522d7)

Upon close inspection of the drystone infill walling between the opposing orthostats of compartments one, two and three (see A and B at Figure 6.24) it is possible to identify differences in the building material with subtle colour changes when viewed in comparison to the walling style in the southern two compartments four and five (Anderson-Whymark and Cummings 2019, 19). Further, there is an absence of orthostat slots or cuts at the south end and a notable narrowing of the structure. The opaqued ovals at Figure 6.24 highlight a complicated opposing structural collapse or disturbance in the symmetry of the drystone walling that may be representative of the original entrance to phase one of a tripartite stalled structure prior to its extension. Conversely, it could be considered to represent later Early Bronze age round cairn phasing as it is in the exact position that the a round cairn that is likely associated with the terminal cell EBA cist structure identified early in the excavation (Anderson-Whymark and Cummings 2019, 13).

Figure 6.25: Photogrammetry models of the stages of excavation left 2018 Centre and right 2019. The 2018 model is highlighting the extent of the primary phase of the monument. (https://sketchfab.com/hugoandersonwhymark/collections/tres-ness-stalled-cairn)

Figure 6.25 shows several photogrammetry models produced as part of the Tresness excavations. The earliest model (Figure 6.25 left) shows a series of placed stones at exactly the place one would expect the open end of the primary phase tripartite monument to be situated. This is also at the precise point where the axis alignment changes (see figure 6.28 and 6.29). It can also be seen that the remains of the EBA round cairn do not continue down through to the chamber floor - which is to be expected – with earlier chamber fill being discovered under this later cairn feature. The structural disturbance in opposing positions does cover the entire section of the walling from remining height to the earliest ground surface (see Figure 6.26 and 6.27) suggesting the architectural adaptations that caused this disturbance occurred earlier in the tomb's biography. Moreover, the sockets as seen at 040 and 042 (Figure 6.26, C) are notably different from the neat placement sockets of the orthostats compartmenting cells 1, 2 and 3. These sockets are considerably wider. It is suggested that this may be as a result of a repositioning of the phase one monument to adjoin the second phase. The orthostats at this position were possibly removed and repositioned to align with the new phase of construction and this may be an explanation for the wider sockets with smaller infill of packer stones at the base – something that is not seen to this extent in the other orthostats sockets (027 028 and 005 and 051 in plan C at Figure 6.26) and Figure 6.24.

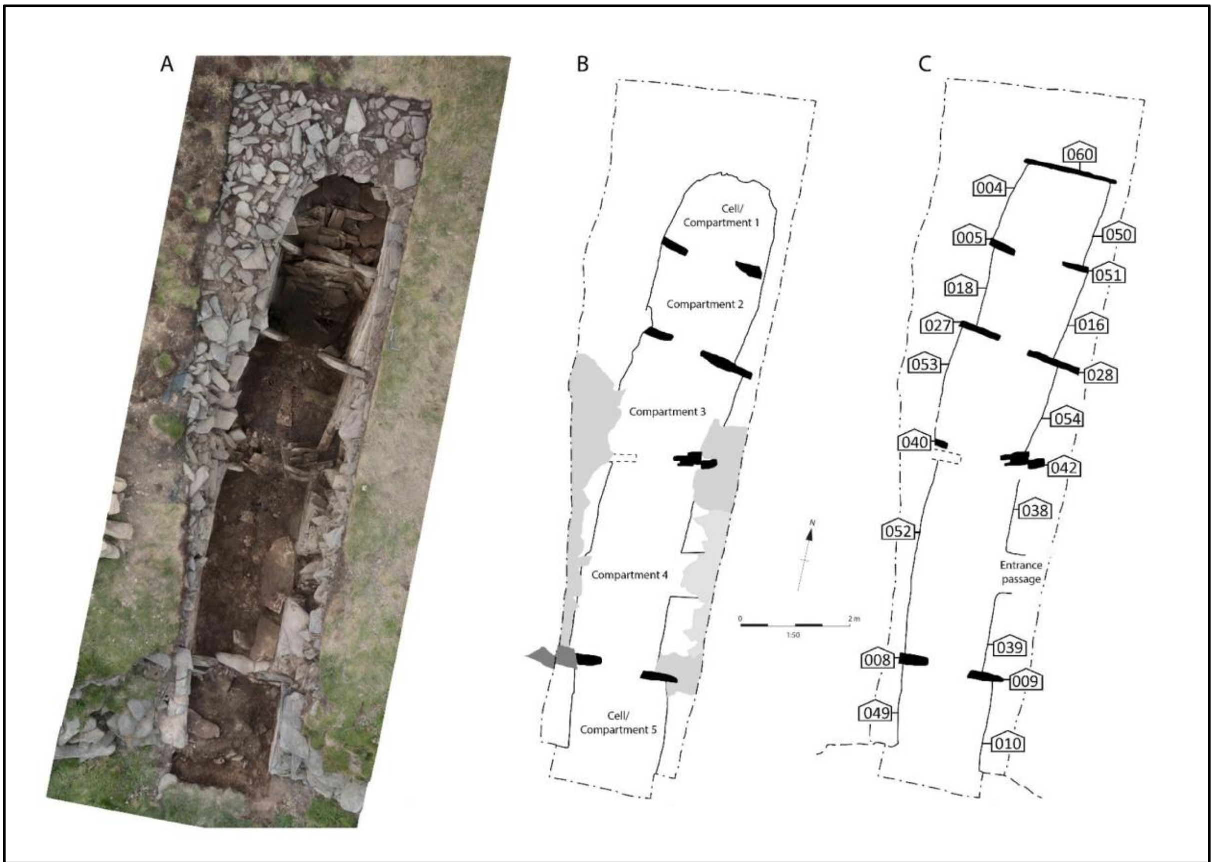


Figure 6.26. Tresness at the conclusion of 2021 excavation season, A: Orthophoto from 3D photogrammetry model; B: plan of stalled cairn surface with later disturbance in grey, and; C Plan at the base of tomb (Anderson-Whymark and Cummings 2019, Figure 4).

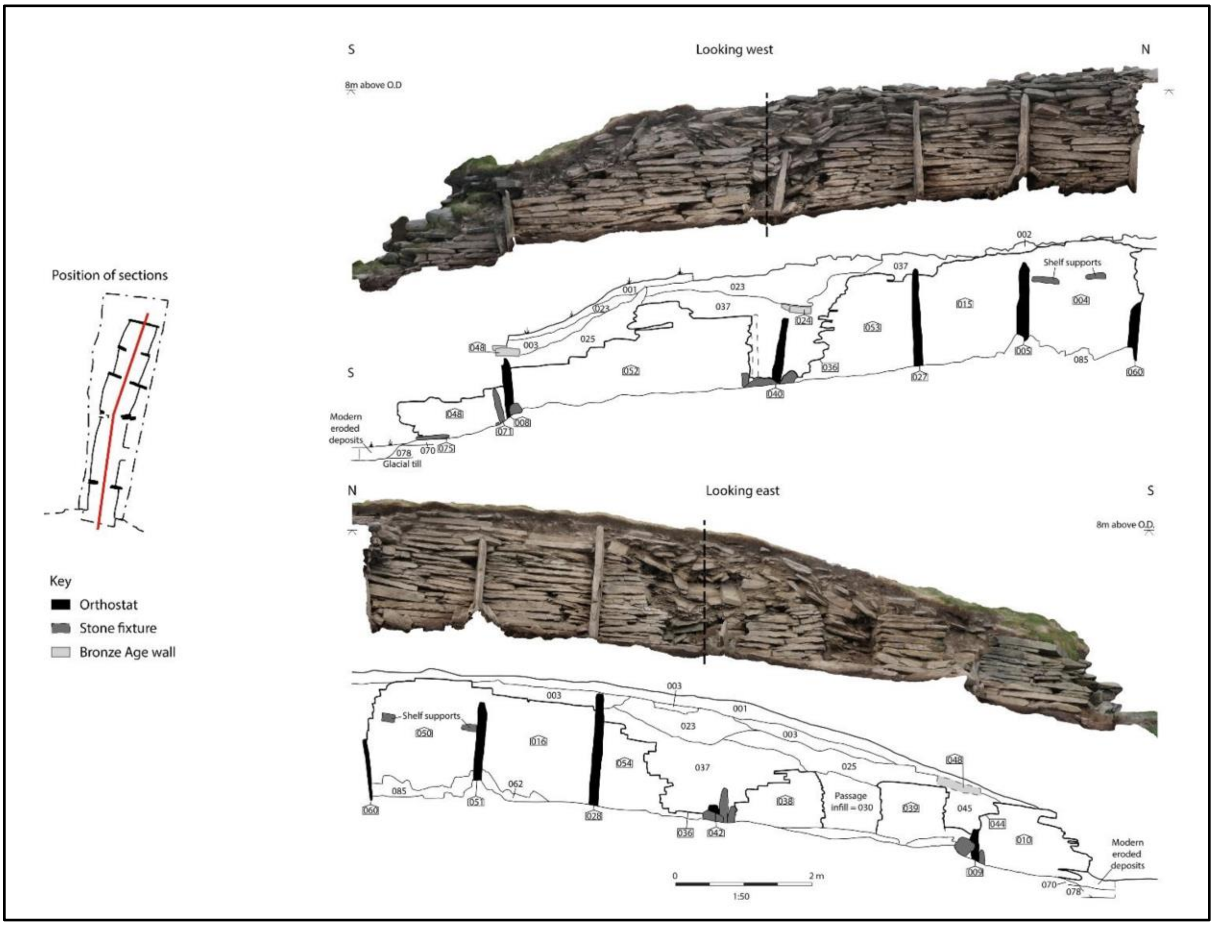


Figure 6.27. East and west elevations and sections of Tresness showing the disturbance in the architectural fabric of the drystone walling (Anderson-Whymark and Cummings 2021, figure 4)

Upon the application of the axis alignment analysis (Figures 6.28 and 6.29*)* it is now possible to add weight to the phasing sequence of this monument.

Phase one is representative of the stalled cairn construction built directly onto the original ground surface. Approaching the build utilising the typically encountered construction process, the orthostats and back slab features were laid out to create the skeleton of the tomb. It has been considered, though tentatively given the extremely early stage of post-excavation analysis, that the whole stalled cairn was intended to be built in one phase, five cells including a passage. If it is indeed the case that the builders were working to this intended plan from the outset, then it is proposed that it was built in stages. This being identified by a change of alignment and material changes in the building stone however the time separating these stages are currently archaeologically undeterminable

Figure 6.28. Axis alignment analysis applied to the final photogrammetry model 2021(https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

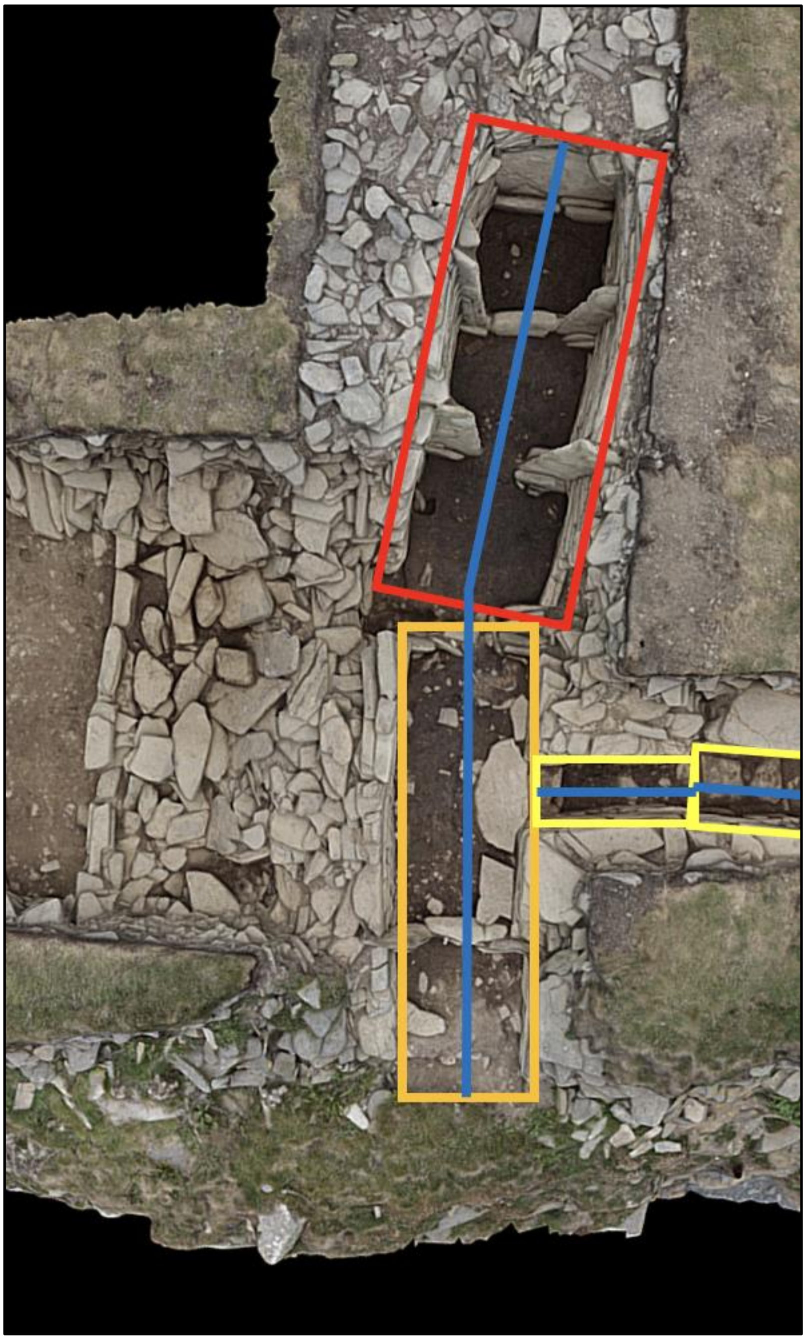


Figure 6.29. Axis alignment analysis applied to the final photogrammetry model 2021 with additions of potential Phase 1 - tripartite stalled cairn (Red); Phase 2 - extension (orange) and passage (yellow) and axial alignment analysis (blue) (Adapted from https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

The alignment of the chamber beyond compartments 1-3 was adjusted by c. 10 ° which as we have seen in other monuments have been thought to represent a later phase. It is of course possible that the Tresness change in alignment has been caused by a break in building work that could easily have occurred due to seasonal conditions or even a change in building teams. This phasing proposal is an important one as this would represent a monument built with the intention of mixing stalled and passage grave architectural features. Specifically, the fusion of the orthostats and back slab features of the early Neolithic stalled cairn tradition and the lateral passage seen in the later passage graves in Orkney and indeed Ireland. The investigations to date have returned a radiocarbon date on cremated remains within the monument 3334 to 2937 cal BC (2 sigma: SUERC-101132 (GU59186)). Further dates are expected but the early parameter of these determinations' places Tresness in the same chronological time slice as Isbister and Unstan typologically; monuments that as we will see also share these different classification features. Figure 6.30 shows three images of features at the south end of the Tresness structure. These images show the point at where the structure has been lost to coastal erosion. It is more than possible that this southern aspect contained a closed end incorporating a back slab feature. This is supported in the image at figure 6.30 (right) that does show a subtle narrowing and concave appearance to the walling. As discussed earlier in this chapter this is a typical end cell configuration where a back slab has been incorporated into the structure. The importance of this observation is that it opens the mind to the possibility that Tresness is a tomb that is architecturally similar to the Isbister and Unstan monuments. The final stage of construction and adaptation being in the Early Bronze Age round cairn and Bronze age cist formed because of a rework of the terminal cell (see Anderson-Whymark and Cummings 2019); a phenomenon also seen at Point of Cott.

Figure 6.30. Left - Photograph of the south end of the Tresness tomb (authors own); Centre – The same location prior to excavation showing remains of the EBA round cairn over the early phase chamber (authors own); Right – The location of the Tresness end cell showing a subtle narrowing of the walling (Photogrammetry image - https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

There is a now a cogent argument that the identified features and nuances as identified throughout this excavation correlate with the changes in axis alignment (Figures 6.28 and 6.29). Thus, adding weight to the suggestion this monument started with a tripartite stalled cairn before attracting further construction phases. It remains important to highlight that these stages of construction may only have been separated by short periods of time. Any temporal interlude between the phases could be days, weeks or months apart; and perhaps years (Vicki Cummings pers. comm.). Figure 6.31 shows the phases of construction of this monument during the Neolithic. There are later EBA stages that have not been included in this sketched model. This monument has been subject to considerable degradation due to coastal erosion and as such it is impossible to reconstruct the south aspect of the tomb with any confidence. Therefore, two possible suggestions have been included and can be seen at Phase 2 a and 2b in Figure 6.31. It is also possible that both could have occurred and are separate phases.

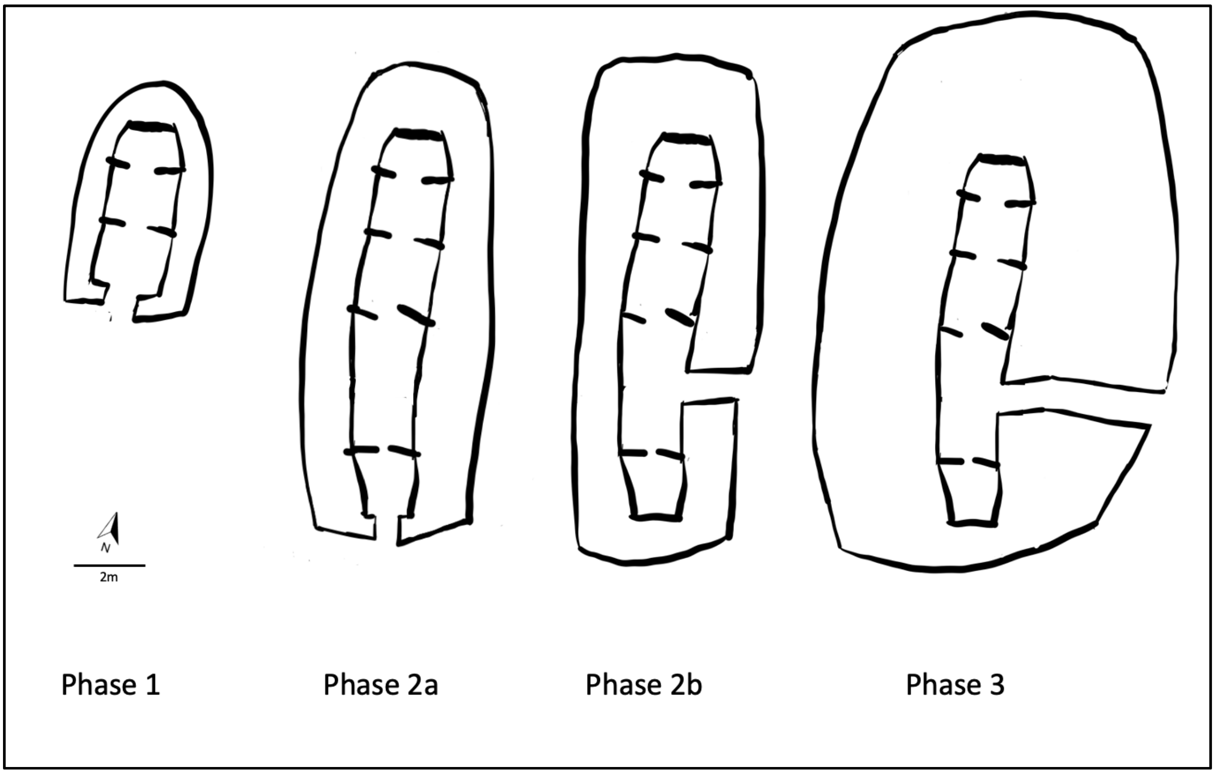


Figure 6.31. Proposed Tresness phasing sketches resulting from the axial and architectural analysis undertaken in this work (redrawn from https://sketchfab.com/3d-models/tresness-Neolithic-stalled-cairn-week-25-323a08015e934ce6a7fe57c9bd01beca).

Isbister and Unstan

These monuments have been described in the past as hybrid monuments (Renfrew 1979) and as such it has been intimated that they were built as single monuments that incorporated mixed characteristics. Phasing has not prior to this work been suggested. They are both stalled cairns that have had side cells of the type found typically in passage graves included. As can be seen in Figure 6.32 the main body of the monument at Isbister is a stalled cairn is made up of uniform and neat courses of stone which is angular in design. It contains typical opposing orthostats; however, it is noted that they are atypical in use. They are sat deeper into the drystone walling at this monument with only a small amount of the upright protruding into the chamber for contrast (see Figures 6.3 and 6.32). This certainly makes it less likely that any shelving would have been utilised here. Another possibility is that the infill walling has been completely rebuilt at a later phase where the stalled tradition was less important to the builders.

Figure 6.32. Internal image of Isbister depicting the minimal exposure of the orthostats (authors own photograph).

It also has two end cells, the one situated to the north has a typical back slab with drystone walling infill (Figure 6.33 right) and the one to the south (Figure 6.33 left) has an unusual second level but retains the back slab below the roofing slab (Ballin-Smith1990, 58). This double back slab configuration is again a feature that can be identified at the monument at Unstan, that also has three side cells and a long passage. The stalled element of the cairn and the passage both have non symmetric alignments. The central area of three cells is in line but both end compartments are set angles of about c. 8° in opposing directions.

Figure 6.33. Photographs of back slab orthostats situated at either end of the Isbister monument (authors own photograph)

The side cells at Isbister also take on this rounded architectural style. From examination of the earliest sketch plan (Figures 6.34 and 6.35) produced in 1977, the original cairn walling path (Figure 6.34 A) has been disrupted with the insertion of the southern cell highlighted in blue which provides evidence that this cell and likely all the cells were a secondary phase to the monument. From this analysis it is proposed that Isbister's primary phase was a stalled cairn with a central short passage, this being a configuration that is not typical but can be seen in both Tresness and Unstan. The later additions are the three side cells and an elongated passage. Again it is not possible to add any specific dates to this phasing though the phasing sequence is suggested in Figure 6.36. There are three options in respect of different construction phasing events.

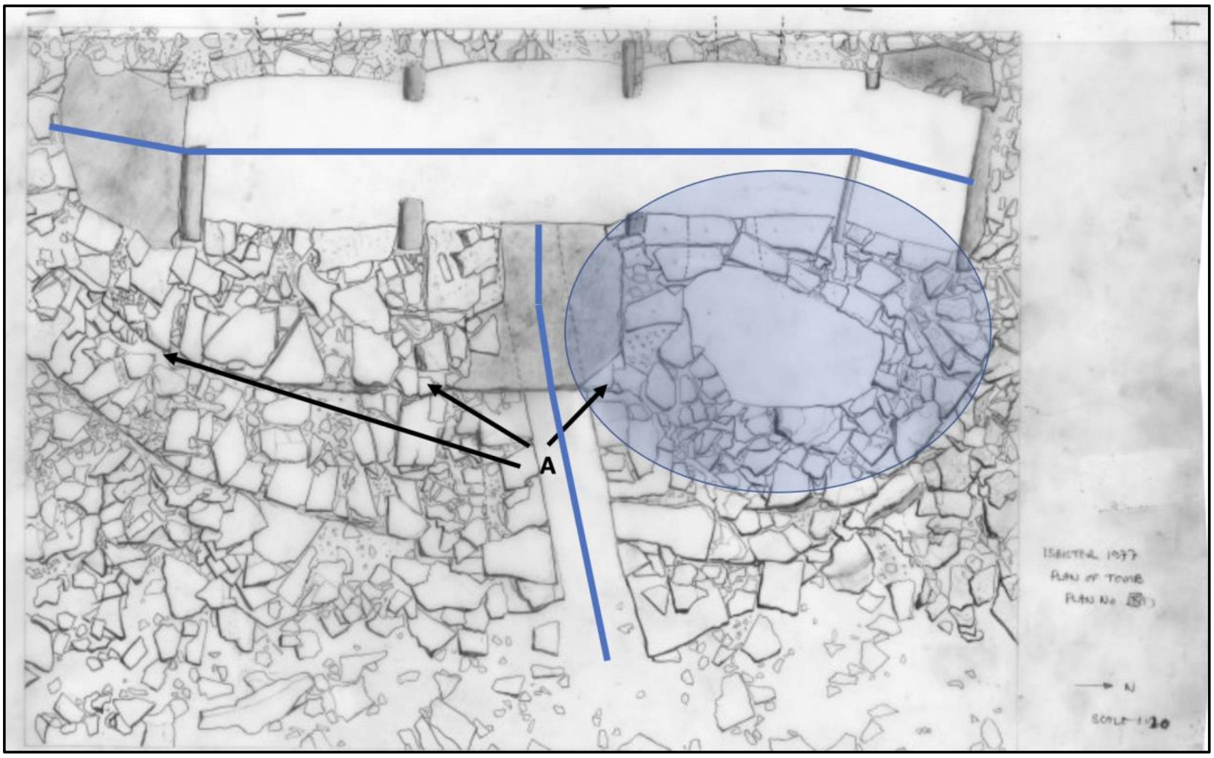


Figure 6.34. Base image is excavation plan drawing of Isbister 1977 (https://canmore.org.uk/collection/1131149) showing a stalled chamber; axial alignment analysis (blue lines) and east side cell (blue highlight) and suggested line of primary cairn A.

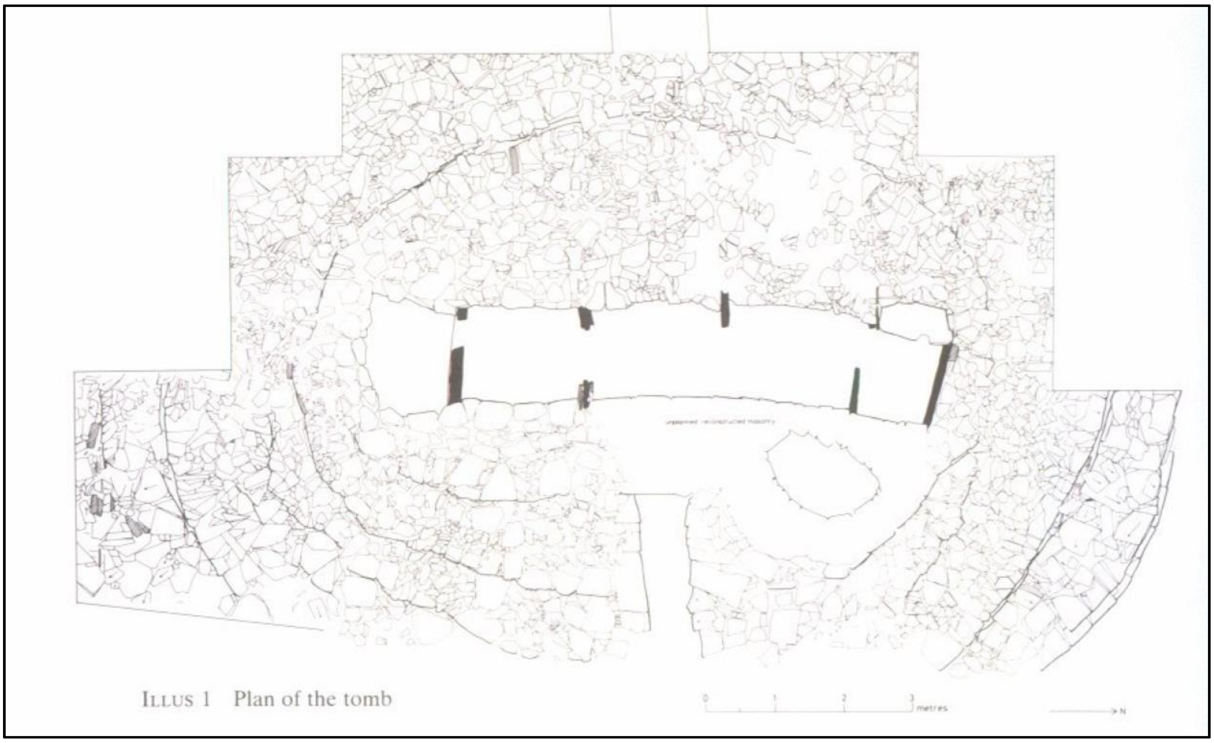


Figure 6.35. Sketch plan of Isbister tomb with clear delineation of 'onion skin' wrapped cairn phasing (Ballin-Smith 1990, illus 1)

First, it is the favoured hypothesis that phase 1 was a tripartite monument - the central portion of the stalled portion element visible today. Any back slab from phase one is no longer visible in its original position due to the reworking of the tomb. The north end of the monument provided the entrance as it can be subtly seen that there is a concave narrowing of the tomb at the distal end where the original back slab would have been positioned. Moreover, the opposing orthostats at the north end are considerably thinner and are set more to protrude deeper into the tomb.

Phase 2 saw the cairn extended with two end cells, both of which are furnished with back slab orthostats and the addition of a short central passage must have been added at the same time.

Phase 3 was the inclusion of three side cells were added the issue with this being access to the inner walling to have access to make a cell and break through with appropriate lintels given the extent and design of the considerable cairn surrounding the chamber.

The final Phase 4 was undertaken by the extending of the surrounding cairn and passage which is supported by the building lines within the wrap around onion skin type cairn surrounding the main structure.

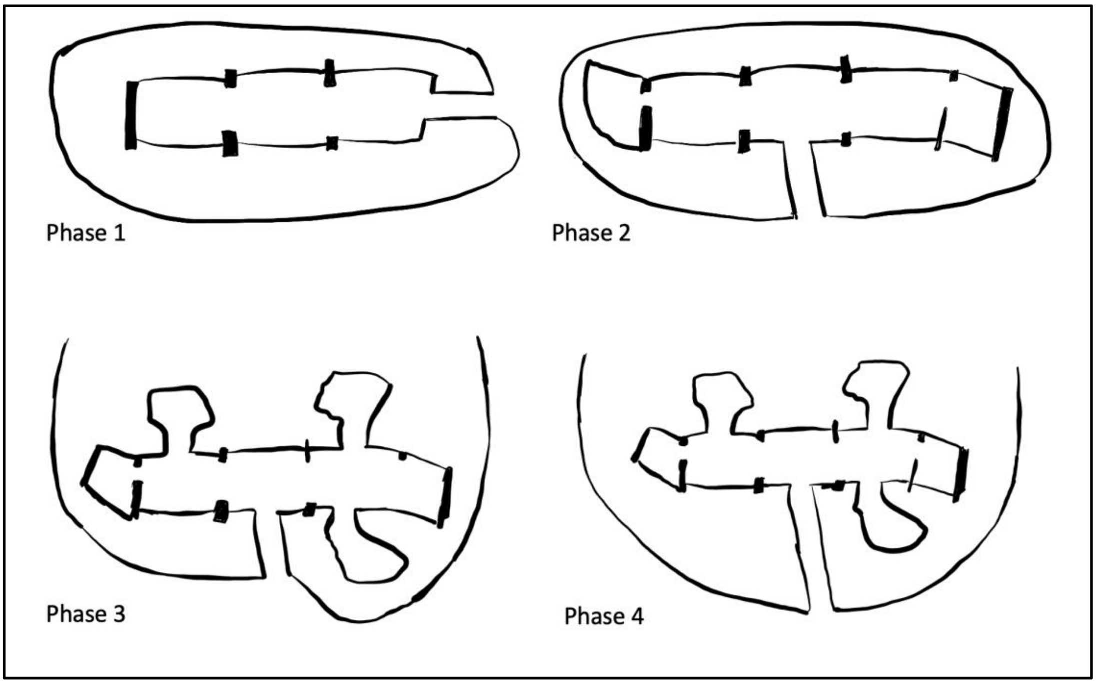


Figure 6.36. Hypothesised sketch of the four identified phases of Isbister taken from the sketch drawing at Figure 6.27 (redrawn from Ballin-Smith 1990, illus 1)

Second, the original stalled cairn with the included end cells amounts to an asymmetric five celled stalled cairn with centrally positioned short passage that deviates from the more frequent classification by having two back slabs at opposing ends of the chamber area. This architectural style is not without precedent. Unstan has the same composition, and it remains possible that Tresness may have been similar though this evidence has been lost to coastal erosion. Following the first option the passage grave elements, namely the elongated passage and side cells, were added as a later phase of construction. The interruption in the surrounding cairn build line supports this.

Third, there remains the possibility that this monument was constructed in one phase and the original design or intention of the builders was to incorporate, stalls, passages and side cells into one structure from the outset, though like Tresness over an undetermined timescale but nevertheless the builders had a design in mind upon commencement that did include the features as seen today. If this were to be the case then it would be correct to use Childe's term '*hybrid*' (Childe 1947) for this monument as it was constructed with the mixed features and not adapted later.

Analysis here is hindered by the lack of access and professional archaeological excavation surveys and reports and the axial alignment analysis suggests different phases within the stalled element. On balance it seems likely the primary phase was five stalled asymmetric design with later phases adding a longer passage side cells and comprehensive cairn layers.

This situation at Isbister was replicated at Unstan in many respects. Again, here we find a stalled cairn which has the inclusion of a passage grave styled side cell and a passage which are set in opposition to each other. Unstan has two back slab type orthostats at either end of the chamber as seen at Isbister it also has a back slab construction in the side cell a feature that is atypical within other monuments side cells.

Figure 6.37. Image taken from 3D photogrammetry model showing missing orthostats (a) in contrast to the well preserved and present stones throughout the remainder of the monument (b) (https://canmore.org.uk/site/1740/unstan)

It can be seen in Figure 6.37 that the typical opposing orthostats adjacent to the entrance of this side cell have been broken a likely consequence of the adaptions made to facilitate entrance to the side cell that was added at this phase of construction (Figure 6.37 a). The remaining orthostats (b) are complete and in a good state of preservation which adds to the suggestion that those adjacent to the cell entrance were broken at the time of side cell extension. The plan at Figure 6.38 (red box highlight) shows the likely primary phase stalled cairn element of this monument, there are signs of a smaller round cairn within the plan suggesting that the round cairn that surrounded this stalled phase was smaller. It consists of five cells which is the situation at Tresness and Isbister. Also present is the double back slab with one being present at either end of the monument (Figure 6.39).

Axial alignment at this tomb supports the suggestion here that the stalled cain aspect was built in one phase. Figure 6.40 is the sketch plan of the hypothesised two phases that have been identified by this analysis. The entrance at phase 1 is at the south side of the tomb as the back slab and concave curvature seen at the distal end is typologically similar to other stalled tombs. The passage at Phase two is built on the same axis and supports the suggestion here that the passage and cairn was not further extended once phase 2 was complete.

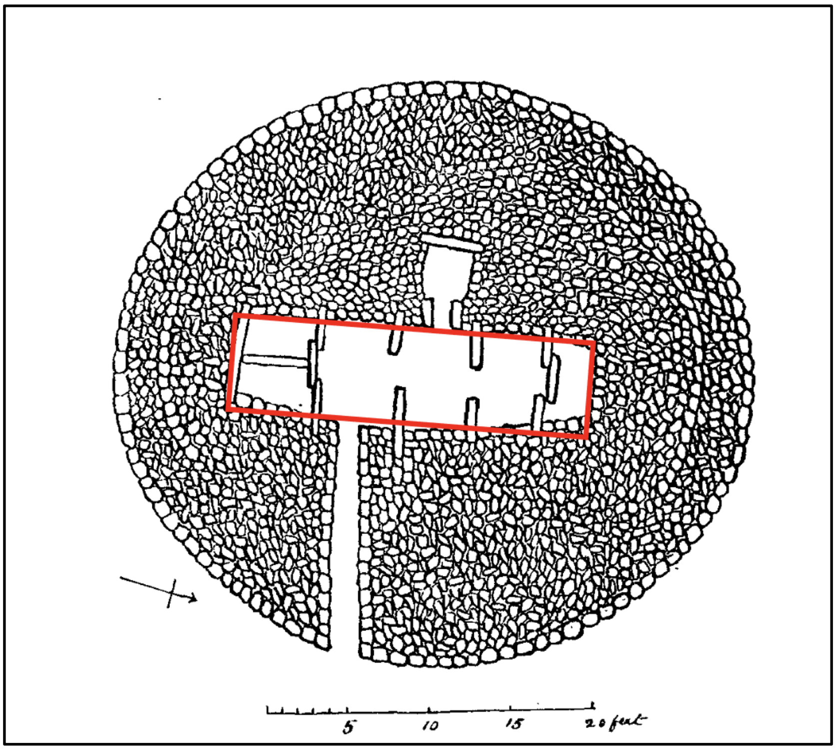


Figure 6.38. Sketch plan of Unstan chambered cairn showing suggested primary phase (red box) (Cloustan 1885, fig 1)

Figure 6.39. Photogrammetry images showing the back slab orthostat positioned either end of the chamber at Unstan (https://canmore.org.uk/site/1740/unstan).

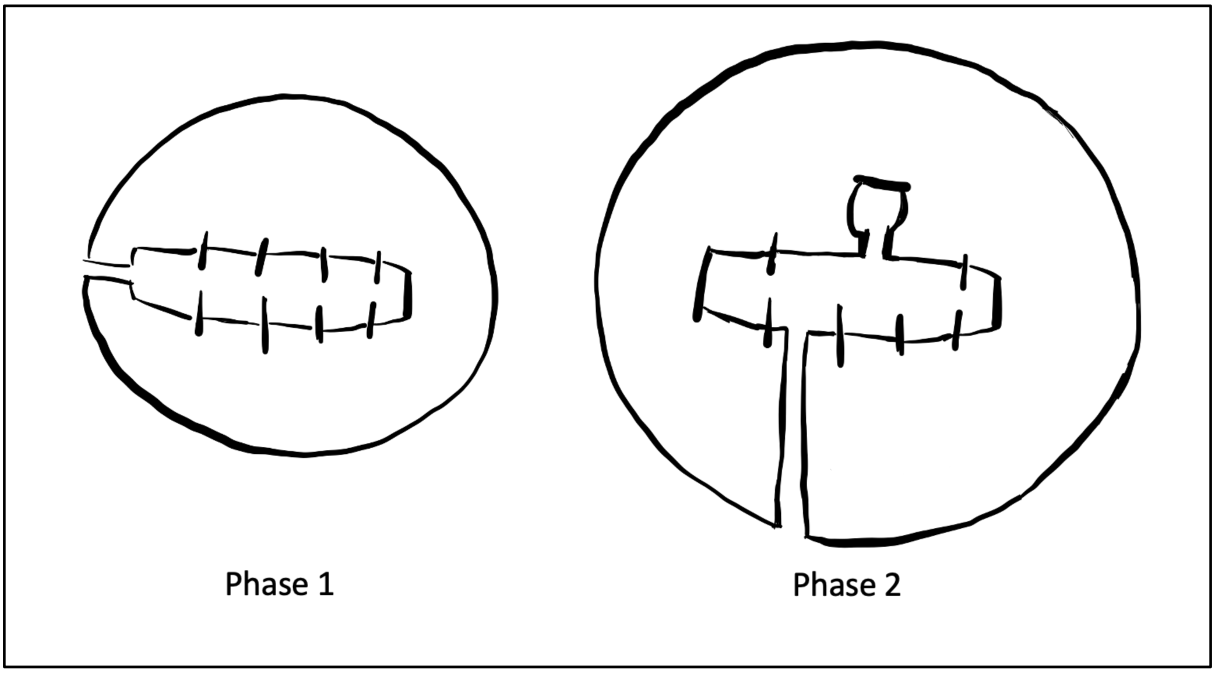


Figure 6.40. Proposed phasing sketches as a result of the axial and architectural analysis undertaken in this work (redrawn from https://canmore.org.uk/site/1740/unstan)

Discussions on architecture

In the absence of dating evidence, a more detailed study of phasing was required to understand the Orcadian tomb sequence. Critically, the aim here was to get beyond typology. The opposing orthostats and backslab features have been integral in identifying phases of the construction or a stage of a build project.

It has already been identified that the tripartite, stalled and passage grave monuments may have been in use at the same time. Midhowe and Knowe of Ramsay, which between them represent the two longest stalled cairns with twelve and fourteen compartments respectively, both have evidence to suggest they have been extended during their period of use. The fact they are in immediate proximity on the island of Rousay may show that the same community or at least group think was involved in this extension. The extent of the stalls within a monument may have been representative of the community needs at the time and not by virtue of evolving architectural practices.

The axis orientation analysis together with a comprehensive look at the nuances of masonry are suggestive **that many of the early Neolithic tombs have undergone architectural changes pointing to different phases of the tomb's biography.** It is evident that the methodologies employed are most effective when deployed in conjunction with detailed archaeology reports, surveys and observations – Tresness being a case in point. All alignment changes can be described as being minimal with changes of less that c. 10° being identified. They are equally likely to represent a break in building between stages and they are a new phase but nevertheless give a starting point for consideration of phasing. All passages investigated had a slight misalignment. This is around an c. 8° difference and has been identified as coinciding with the addition or adaptation of the surrounding cairns. Alignment of passage seems to be dictated by the creation of the 'onion skin' type wrapping of the monument throughout its use.

The back slab feature has been essential in establishing phasing and can be seen in all assessed save HPWN where a blocking wall for an earlier single cell monument replaces it. This feature has proved to present a starting point for identifying primary phase of stalled cairns and has been instrumental in identifying primary phase for the elongated versions on Rousay. The terminal cell to which it belongs typically takes the form of an isosceles trapezoidal shape with the side walling from the final opposing upright orthostats to the back slab being slightly concave in plan (see Figure 6.41 a). This is a special feature that has previously prompted theories of being a doorway or portal to another spiritual world (Colin Richards *pers comm.)* or as suggested here as possessing a likeness to a boat. It is highlighted that the key and universal features to the stalled cairn architecture is the opposing orthostats (see Figure 6.41 b) and the setting of the backslab (see Figure 6.41 a) at the distal end and at an angle that slightly away from the main chamber. These features are then incorporated into the monument with dry stone walling that takes on a concave narrowing in the distal end cell to join the back slab (see Figure 6.41 c). When these key characteristics are considered together the mind is drawn to examples of early sea-going boats (Figure 6.41 inset). The orthostats replicating the transverse timbers of the sea-going craft. The back slab and concave narrowing at the distal end of the tomb representative of the bow with the outward angle of the backslap strengthening this argument.

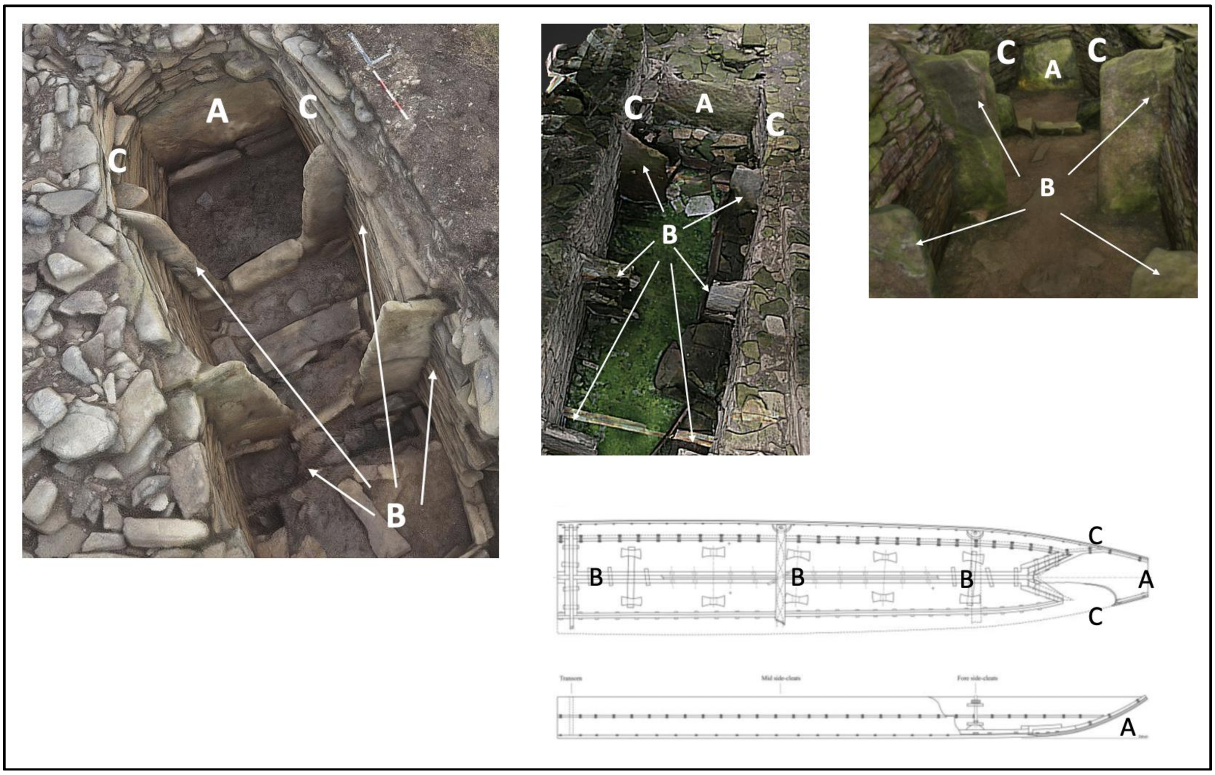


Figure 6.41. Photo images relate to stalled cairns already considered in this chapter Left Tresness, centre Midhowe and right Knowe of Yarso. The boat diagram is from the proposed reconstruction of Dover Boat 1 (Crumlin-Pedersen (2006) fig 4 from Roberts 2004, Fig 10.1)

Two back slabs one situated at each end of the structure and a lateral passageway have been clearly identified at Unstan and Isbister and tentatively suggested at Tresness. In respect of these monuments, we see significant lateral passages and five stalled compartments thereby clearly having features from stalled and passage grave traditions together. Unstan and Isbister go further with the addition of side cells something that is not seen at Tresness. Unstan and Isbister also share the unusual feature of double back slab situated either end of the chamber and it is not impossible that Tresness also contained this feature in the eroded side of the tomb. This is a phenomenon that is plainly different from most Orcadian stalled tombs and is supportive of the adaptation of these tombs as a time when traditions were transitioning.

Summary

This chapter introduced the new Axial Alignment methodology to demonstrate that many of Orkneys early Neolithic tombs, specifically in the northern isles, have undergone architectural changes throughout their life biographies. This work is particularly important as this area has attracted limited scholarly attention beyond descriptions of Isbister and Unstan as being 'hybrid tombs' – a long standing hypothesis that this thesis has challenged and offered an alternative view. This research has identified distinct phases of construction phases that is suggestive of extended periods of use for these tombs in contrast to other regions in Britain and Ireland. It's crucial to note that this conclusion is drawn from the architectural analysis (typological) alone and the lack of radiocarbon dates for construction (as opposed to contents) limits the absolute confirmation of this theory. Nevertheless, the findings emphasise interisland variations in the use and longevity of early Neolithic tombs, providing insights into the diverse practices and histories of Neolithic communities in different geographical areas.

In contrast understanding of the archaeological landscape on Mainland Orkney is obscured by a significant transitional period that occurred prior to the turn of the third millennium BC. This period marked a shift in traditions, characterised by the emergence of passage graves, larger settlements, and monumental stone circles, as documented in studies by (Bayliss *et al*. 2017; Richards and Jones 2016) and indeed today the record shows only seven confirmed stalled cairns on mainland. The lack of clarity in the picture on Mainland Orkney is attributed to the possibility that earlier tombs might exist but remain invisible in the archaeological record due to being situated beneath subsequent structures. This hypothesis is particularly relevant to the monuments as Quanterness, Cuween, and Wideford Hill, where the presence of earlier tombs has been theorised by Colin Richards (pers. comm). The passage Grave of The Howe provides additional evidence supporting this idea, excavation records show that a stalled cairn served as the original structure, with a passage grave constructed over it during later phases (Carter *et al*. 1984, 61; Davidson and Henshall 1989, 176). This intricate layering of structures underscores the complexity of the archaeological record on Mainland Orkney and emphasizes the need for specific further research of the early tombs be undertaken.

A new and noteworthy observation is also highlighted within this chapter by revealing the presence of smaller, simpler curvilinear structures that constituted the early phases of stalled cairns. These earlier structures as seen at Holm of Papa Westray North and Calf of Eday (see phase 1 at figure 9.2) do not currently appear within the Orcadian tomb classifications. It will also be recalled from chapter 5 that these tombs - both in the North

Isles - are likely among the earliest monuments across the whole of Orkney. Similar phenomena are identified in other tombs, such as Bigland Long, Mainland where a small rectangular chamber is associated with a stalled cairn, and at Taversoe Tuick, Rousay, where a miniature round chambered tomb is located within the footprint of the overall round cairn but distinct from the main structure. At Huntersquoy, the lower chamber is described as tripartite, though it is architecturally much simpler and could also possibly represent an earlier form of pre-stalled cairn funerary architecture. While these structures might potentially represent the earliest monuments on the island, the lack of sufficient archaeological dating evidence complicates a definitive conclusion.

This thesis will move on to consider alignment and landscape locations of the tombs.

Chapter 7 – Positioning of tombs and astronomical possibilities

Introduction

This chapter will analyse the position and location of the tombs and the orientation patterns and spatial relationship with various landscape features. Orientation by virtue of alignment with astronomical targets such as the sun and other celestial bodies is not something new (see Ruggles 1999; Ruggles and Whittle 1981) but will be reconsidered here considering fresh orientation data obtained during the fieldwork phase of this research. Other orientation themes will be reconsidered in chapter 8; such as tombs relationships with other monuments (Fraser 1983), landscape features (Cummings and Fowler 2004; Cummings and Whittle 2017; Tilley 1994) or created as a replication of the immediate surrounding landscape (Richards1996) have been subject to previous scholarly interest. Seascape relationships (Callagahan and Scarre 2009; Garrow and Sturt 2011; Noble 2006; Phillips 2004) are particularly relevant in the island scape of the North Isles of Orkney. Further territorial markers (Renfrew 1973a) and relationships with settlements have been frequently cited (Richards and Jones 2016; Richards 2013). It will be considered which of these findings have veracity. In this work they will **all** be assessed together as a method of interpreting the intentions of the prehistoric builders.

This chapter and the next will identify and analyse patterns in positioning and location choice for the early Neolithic chambered cairns of the North Isles of Orkney. It will specifically concentrate on each tomb's relationship with the following aspects which will form sections of this chapter:

- Orientation.
- Alignment with celestial bodies.

Orientation – The current narrative

The orientation of megalithic monuments has long been an aspect of archaeology particularly when considering astronomical relationships. Throughout Britain and Ireland early Neolithic tombs have been surveyed and recorded as having different alignments. Cotswold Severn monuments tend to be aligned north-west/south-east (Ashbee 1970, 162); Clyde cairns towards the north-east (Henshall 1972, 99; Scarre 2007, 21); the court cairns of Ireland appear to have a bias towards east or more specifically east-north-east (De Valera 1959, 29; Prendergast 2016, fig 5). Neolithic passage tombs of Ireland have been described on one hand as having wide ranging alignments across the east and westerly horizons such as to make it difficult to hypothesise an astronomically specific target (Prendergast, 2016, figure 5). Yet, on the midwinter solstice, minutes after sunrise, the chamber of Newgrange is illuminated with the assistance of a 'roof-box' construction making astronomical alignment virtually certain (Lockyer 1909; Ray 1989, 343). In Wales, Bryn Celli Ddu is aligned to the rising sun on the midsummer solstice (Burl 2000, 189; Pitts 2006, 6). These findings go to illustrate that there is no all-encompassing astronomical convention being followed geographically or temporally.

The early Neolithic funerary monuments of Orkney have been described as having propensity towards the outward orientation of the passage to the north-east and south-east (Davidson and Henshall 1989, 85; Fraser 1983, 364; Henshall 1963, 104) and an easterly alignment for Orcadian passage graves (Henshall 1963, 130) albeit the most studied example, Maeshowe, stands alone in Orkney as the only monument to align with the setting sun at the midwinter solstice (Moir 1981, 223). This monument allows the light from the setting sun to shine down the passage to lighten the chamber opposing the passage though as we will see there is some debate over the accuracy of this solar target. Figure 7.1 (Davidson and Henshall 1986, fig 30) shows the alignment diagram from assessing 29 monuments passage bearings of Orcadian tombs. In the years that have passed since its publication further information has entered the archaeological record from excavations plans and field surveys and will now be reassessed with the benefit of these additional data. The Orcadian south-east alignment has also been deduced from an archipelago-wide data set (Davidson and Henshall 1986; Fraser 1983) with little focus on the nuances of the architecture and the geographical location of the tombs.

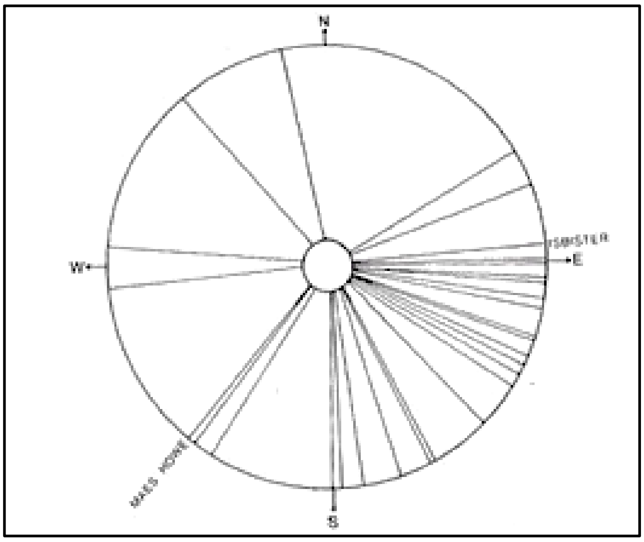


Figure 7.1. Wheel diagram of passage orientation of all classification of tombs on Orkney (after Davidson and Henshall 1986, fig 30).

Given the south-east alignment dominance it has been suggested that this was an intentional building decision by the builders (Davidson and Henshall 1985, 85) even if an exacting accuracy (by modern mathematical standards) was not as important or even achievable to the earliest tomb builders (see Ruggles and Barclay 2000, 67). Others suggest that the midwinter solstice was a key date for the first farmers (MacKie 1997, 340) of Orkney as it is representative of a time when the days begin to lengthen and could be seen as the start of the new year (Fraser 1983). Whilst the length of the day argument cannot be disputed others have challenged the accuracy of Maeshome's atypical (for Orkney at least) midwinter sunset alignment by presenting contrasting arguments. It has often been suggested that the passage at this monument is aligned to the setting sun at midwinter solstice in such a way that light illuminates the opposing chamber within the tomb (Parker Pearson 1993, 59; Ritchie 1985, 127). Others have countered this by reporting that the actual solstice misses the target by several weeks (Burl 1981, 251) with a more recent survey assisted with computer modelling places the illuminating light at as much as 40 days either side of the midwinter solstice (Ruggles and Barclay 2000, 68) meaning that it was not built to astronomical precision. In summary the alignment disparity of monuments across the British Isles is suggestive that there was no universal intention or motivation at play when aligning these funerary structures, but clearly there were preferences on a regional basis. It is too simplistic for this research to say the majority point to the southeast. This analysis will demonstrate that the southeast preference is not as clear as has been suggested previously (Davidson and Henshall 1989, 85; Fraser 1983, 364; Henshall 1963, 104).

General orientation analysis

There are 81 monuments recorded on Orkney that have varying degrees of archaeological data associated with them particularly in terms of alignment data. Of these 53 are confirmed early Neolithic stalled cairns, 36 of which have usable passage orientation data amounting to 68%. Some have two readings due to the multi levelled and dual passaged Taversoe Tuick, and Huntersquoy, with the upper and lower tiers having different passage orientation. Similarly, Calf of Eday Long and Bigland Long monuments have two separate and differently aligned monuments in close proximity. Of the 12 confirmed passage graves ten have passage orientation data, seven are located in the North Isles of which four have passage bearing data. The remaining 15 are of uncertain classification and one the Dwarfie Stane on Hoy does not sit in any current classification.

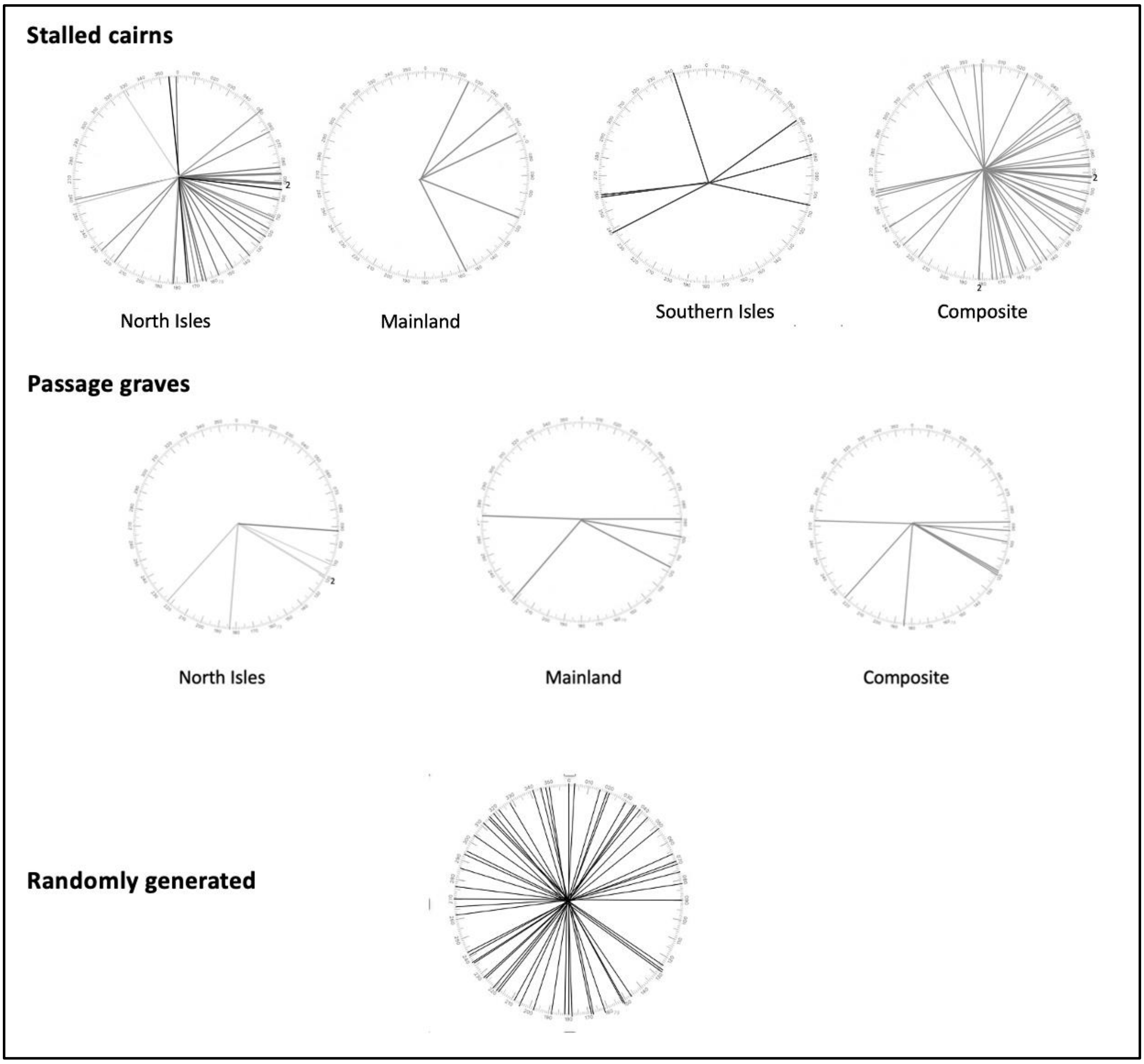


Figure 7.2. Orientation wheel diagrams created by the author from alignment data within the archaeological record or field surveys. Top - breakdown of stalled cairns (tripartite, stalled, Bookan and stalled with cells); Centre – a orientation wheel composed from random number generator software; Bottom - same for Orcadian passage graves

The orientation wheel diagrams in Figure 7.2 were created by analysing almost twice the data that was relied upon in previous analysis (Figure 7.1). For completeness a randomly computer-generated orientation wheel has been included for comparison, which supports arguments that the true alignments were an intentional building decision as they appear more than merely random. Despite this the stalled cairn diagrams do confirm a propensity for a southeast alignment both within the North Isles and the composite diagram, when assessing mainland and the South Isles of Orkney this preference is not as dominant. The passage grave data also show that there is some favour towards the south-east quadrant of the compass. Figure 7.3 demonstrates the orientation for the north islands of Orkney for stalled cairns (**A**), for stalled cairns in the North Isles excluding Rousay (**B**) and for the Orcadian passage graves (**C**).

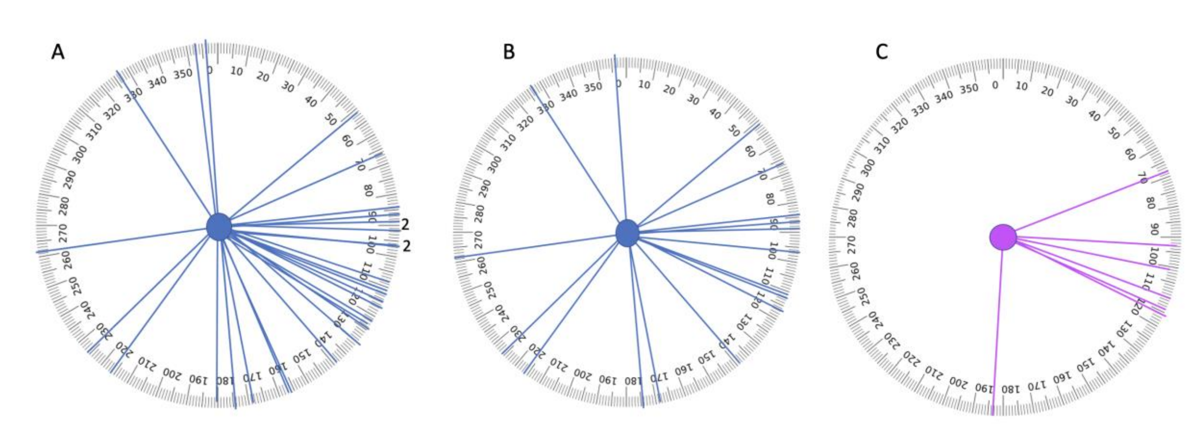


Figure 7.3. Orientation wheel models; **A**: Stalled cairns North Isles; **B**: Stalled cairns North Isles (without Rousay); **C:** Passage graves North Isles.

Orientation graph **A** again confirms previous findings for a southeast passage orientation. Given the wide variation that is broadly within the eastern portion of the compass it seems clear that an exacting alignment was not as important to the earlier monument builders when looked at in contrast to the well documented and more accurate alignments seen at the other tombs such as Newgrange (Patrick 1974). Graph **B** has been included as it was noted that there is a large number of tombs with a very high incidence of southeast alignment amongst the Rousay monuments the reason for which will be discussed in chapter 9. It is notable when these are excluded from the wheel diagram the south-east prevalence is lessened. A suggested reason for this will be discussed later in this chapter but it is noted here given its potential to have a biasing effect on the composite North Isles data.

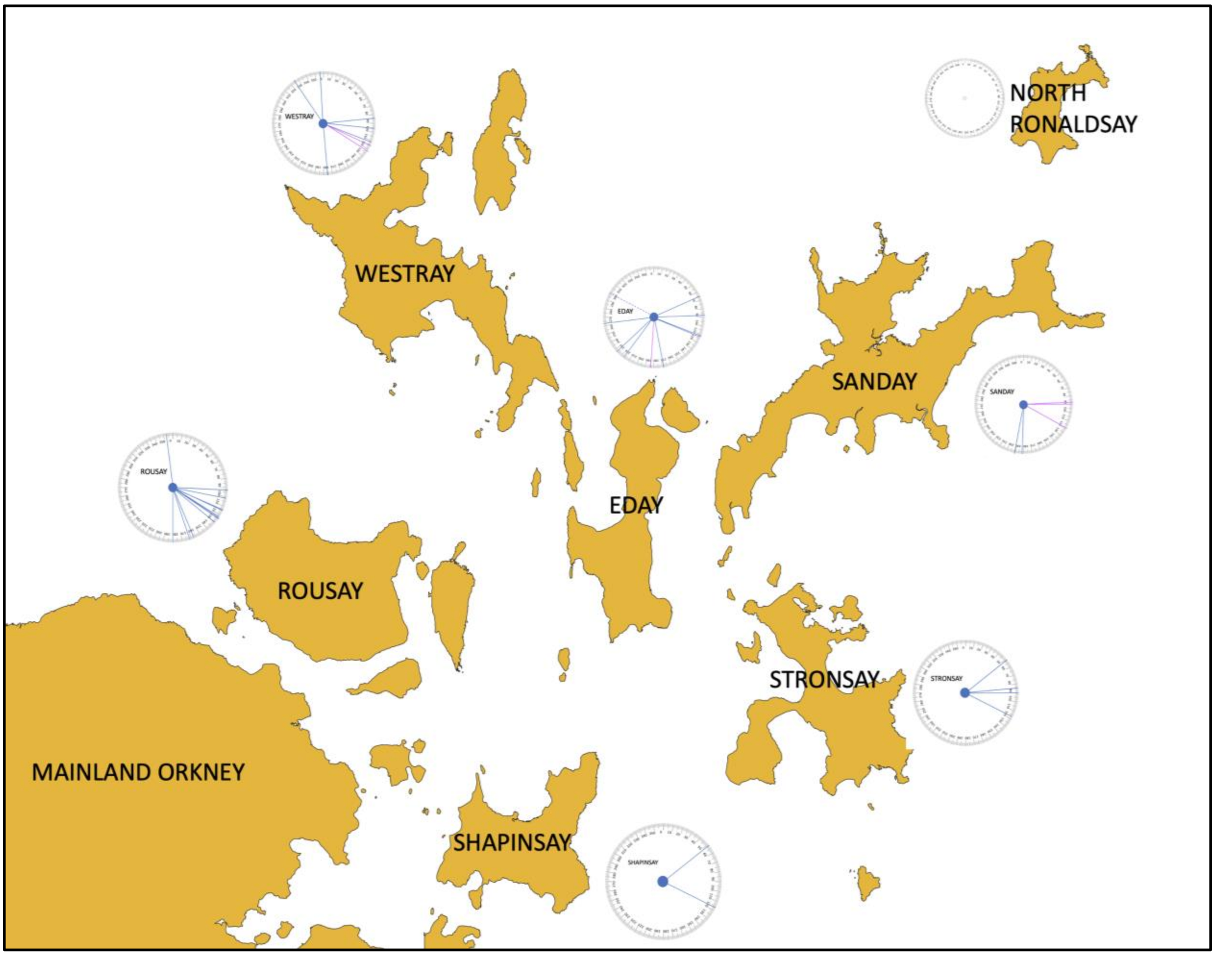


Figure 7.4. Orientation wheel models included in North Isles GIS map. Blue representing stalled cairns and pink representing Orcadian passage graves. Westray includes Papa Westray; Stronsay includes Papa Stronsay and Eday includes Calf of Eday. North Ronaldsay purposely left blank due to no tombs.

Figure 7.4 demonstrates the more localised orientation analysis when broken down on an island by island basis overlain on a GIS map. On Westray and Papa Westray there are nine stalled cairns (six with passage alignment data), two passage graves (one with passage alignment data) and two of uncertain classification (no data). Of the stalled cairns surveyed half have a southeast alignment and of the passage graves only Holm Papa Westray South has usable data and is aligned towards the south-east quadrant. This monument has an unsymmetrical passage alignment that has been assessed twice. On Sanday there is one confirmed stalled cairn at Tresness, two passage graves and three of uncertain classification. Of the five alignments available four are from the multiple phases of Tresness the other being Quoyness. All the Sanday passage tomb data point to the south-east with the tripartite and stalled element of Tresness aligned broadly due south. On Eday, including Calf of Eday, there are seven stalled monuments two passage graves and five of uncertain classification. Only 29% of Orcadian stalled cairns passages are aligned towards the southeast. This is a marked deviation from the previously reported prevalent direction. Vinquoy Hill, like the Tresness stalled element, is aligned almost due south which would mean that it is aligned with the midday sun on any given day. Eday geographically sits like the hub of the wheel of the North Isles. The central positioning of the island within the north islands of the archipelago may have a part to play in this deviation in alignment trend a point that will be revisited in discussion at chapter 9. On Rousay there are 15 stalled tombs and four of uncertain classification. There is an absence of passage graves here. Of the stalled orientation readings 93% are within the southeast quadrant and it is possible that this finding is having a biasing effect on the Orcadian alignment data. Later this chapter will explore a possible reason for this high prevalence for southeast alignment on Rousay. Stronsay**,** including Papa Stronsy and Shapinsay have eight and two stalled monuments respectively. Both show a 50% south east alignment percentage.

These data demonstrate that when the assessment has been broken down on more localised basis it can be seen that early monuments on Eday and to a lesser extent Westray the southeast alignment prevalence is no longer an appropriate narrative and may add weight to any argument that suggests that the southeast quadrant alignment was not an intention of the builders everywhere or at the very least be suggestive that not all monuments were built with the same alignment intention.

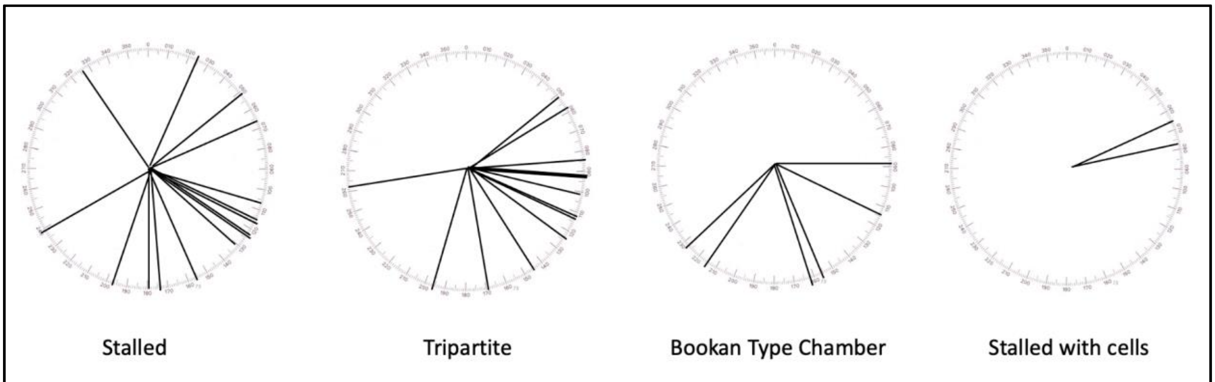


Figure 7.5. Orientation wheel models for the different classifications of monuments on Orkney.

There are 16 tripartite tombs across the archipelago of which 11 are confirmed and five are probable. There is a definite propensity towards the North Isles with 12 being located there, one on Hoy, two south Ronaldsay and one on mainland; 13 have associated orientation data. Stalled cairns are represented by 20 in total with 15 on the North Isles of which 14 have associated passage alignment data. It should be noted that Tresness being a multiphase monument appears in more than one category at Figure 7.5. There are six Bookan type chambered cairns with only one being located on mainland. Two others form part of the only multi-tiered structures at Huntersquoy on Eday and Taversoe Tuick on Rousay. Stalled cairns with side cells and passages are to be found at Isbister and Unstan and both have close alignments that that point to the northeast sector of the compass.

Astronomical orientation

The orientation of prehistoric structures with celestial bodies by astronomical alignment has long been studied. In the mid 20th century Alexander Thom - a mathematician- set the foundations for archeoastronomy. He carried out a detailed analysis of a diverse group of megalithic monument types and suggested that they were aligned to solar events and motivated by a prehistoric astronomical calendar (Thom 1955; 1967). These findings at the time were critiqued and largely dispelled as they involved a mathematical and scientific knowledge that required a level of accuracy that would not of have been accessible to the people of the Neolithic (Hughes 2005, 32; Ruggles 2015). Others were concerned that the choice of monuments used in the assessments did not take into account different classifications nor did they have temporality (Fleming 1975). Nevertheless, this prompted an interest in celestial body alignment.

Subsequently archaeologists began exploring Neolithic people's awareness of the alignment of monuments according to cosmological processes and this included astronomical awareness (Bradley 1993; Thomas 1991). The study of orientation has been often conjoined with archeoastronomy theories. It should be noted at this juncture that it is not intended that this work will be a scientific / mathematical astronomical study as this is beyond the scope of this work. Because there are strong arguments for celestial body alignment it does not mean – as often assumed – that the earliest farmers had a detailed perception of the astronomical year. It is highly unlikely that early Neolithic Orcadian North Isle occupants would have had the knowledge to understand astronomy to anywhere near the standards employed in later historic periods to a mathematical and scientific degree of accuracy (Hughes 2005; Ruggles 1997, 204; 2015). It has been discussed that the timescales required in terms of decades if not centuries of observations would have been required to formulate an accurate understanding of the solstices to a level where monuments could be accurately aligned to them (Hughes 2005, 32; Ruggles 1999, 80). What is known is that having considered matters of axial precession, obliquity and eccentricity it has been calculated that in Neolithic times there was only 1˚ difference between the rising sun of today (Ruggles 1999). Furthermore, and relevant to the Orcadian North Isles, the weather often prevents an observer from seeing any sunrise. In addition, whilst present on excavation for extended periods on Sanday it was only possible to see the distant Fair Isle at the extent of the horizon for a few days or even parts of days by virtue of a phenomena that means that observation on the horizon, particularly sea horizons the view suffers significantly from haze and atmospheric refraction (see Ruggles 1999, 139; Schaefer 1986). Consequently, regardless of intention, motivation and knowledge any specific azimuth may well have been unobtainable then as it is today. Further, it has been suggested that solar references are likely to have been used by people in the Neolithic but only in a more general or broad sense to determine direction (Ruggles and Barclay 2000, 67). Consequently, this analysis will follow the broad alignment suggestion when assessing the tombs of Orkney. As a consequence here a plus or minus 5˚ accuracy is used as detailed in chapter 4.

Astronomical year

Due to these issues discussed above and in chapter 4 the fact that detailed mathematical accuracy is not the intention of this research the methodology has incorporated a process which addresses this lack of contemporary astronomical knowledge or measuring capability. Any monument within 5˚ of one of the key points in the astronomical year have been included as being aligned at or about a specific date within the astronomical year (see Figures 7. 6 and 7.7). The parameter of 5˚ has been chosen as it is known that the sun rises at different points on the horizon every morning. This change is around 1˚ though any formula utilised today to make such calculations would, of course, be beyond the knowledge of Neolithic observers (Ruggles and Barclay 2000, 67). In the absence of this any comparable level of accuracy could only be achieved using visual pinpoint observations and it still may take several days identify these changes. This analysis was purposely designed not to be mathematically exact and so a variation of 5˚ (c. 5 days) was deemed appropriate to assess the relevance of the orientations.

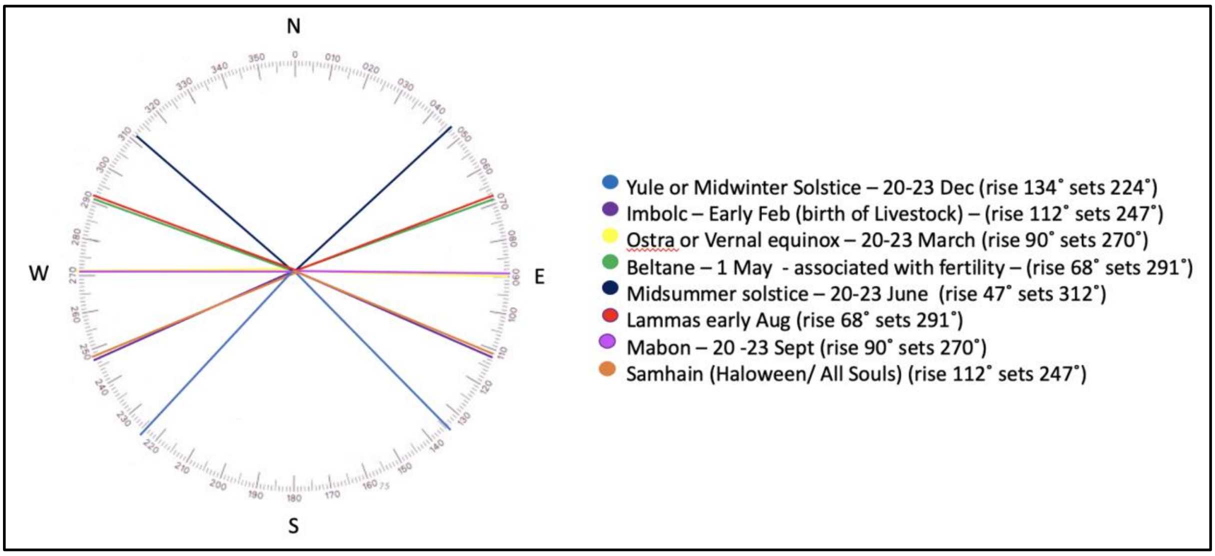


Figure 7.6. Wheel of the year with sunset and sunrise as relating the different Pagan/Celtic festivals points of the annual cycle – this is specifically for 59˚ degrees North latitude (Orkney) (produced from data obtained from https://www.suncalc.org – see methodology).

This reference year has been chosen as it observes cycles within the year that are coordinated with natural events that may have been important to ancient people. It is easy to suppose that a knowledge of the yearly cycle would have been critical for a Neolithic farmer but to be clear it is not suggested here that this Pagan / Celtic yearly cycle was part of Neolithic cosmology *per se* simply that these natural cyclical changes will have had an impact on farming strategies. They would require an understanding as to when to expect the breeding of livestock and the start of the growing season even if their knowledge was born out of observance of natural cycles by identifying the times that crops grow or animals breed. These events in modern times have been highlighted within a cross-cultural system called the Pagan or Celtic wheel of the year (see Hutton 1996; Ward 2007). It is certainly not suggested that this was a religious belief system that was in operation in the Neolithic. However, as a system that utilises natural and seasonal patterns it is likely it would have been both observable and important to early farmers as they hold importance to the seasons and therefore agricultural practices. The year is split into the two solstices and two equinox which are known as quarter days as they split the year into four parts. These segments are further split to form cross quarter dates at times midway between the main solstices and equinox. This means that the year can be split into eight (see Figure 7.7).

Figures 7.6 and 7.7. detail the name of these seasonal festivals with the dates and degrees of the rising and the setting sun at these times as they relate to the coordinates of Orkney. It has been argued by some that the ancient calendar events such as *'Beltane'* and '*Samhain*' together with the solstice and equinox dates may have operated in Neolithic times (Burl 1988, 197; Krupp 1994; MacKie 1997, 355). Conversely, this has been dismissed largely on the grounds of astronomical knowledge (Ruggles and Barclay 2000). It is arguable that this more pragmatic functional calendar will have been more important than the traditionally argued longest (midsummer solstice) and shortest (midwinter solstice) days. It is equally likely that these dates will have had ritual and cosmological meaning and indeed the two are intrinsically linked. This chapter will analyse on the basis that the natural seasonal changes of the quarter and cross quarter dates (figure 7.7) are both observable by coordination with natural processes that may have been influential upon the substance practices of the early farmers without proposing it was part of an ancient belief system, it is easier to argue for pragmatism over rituality.

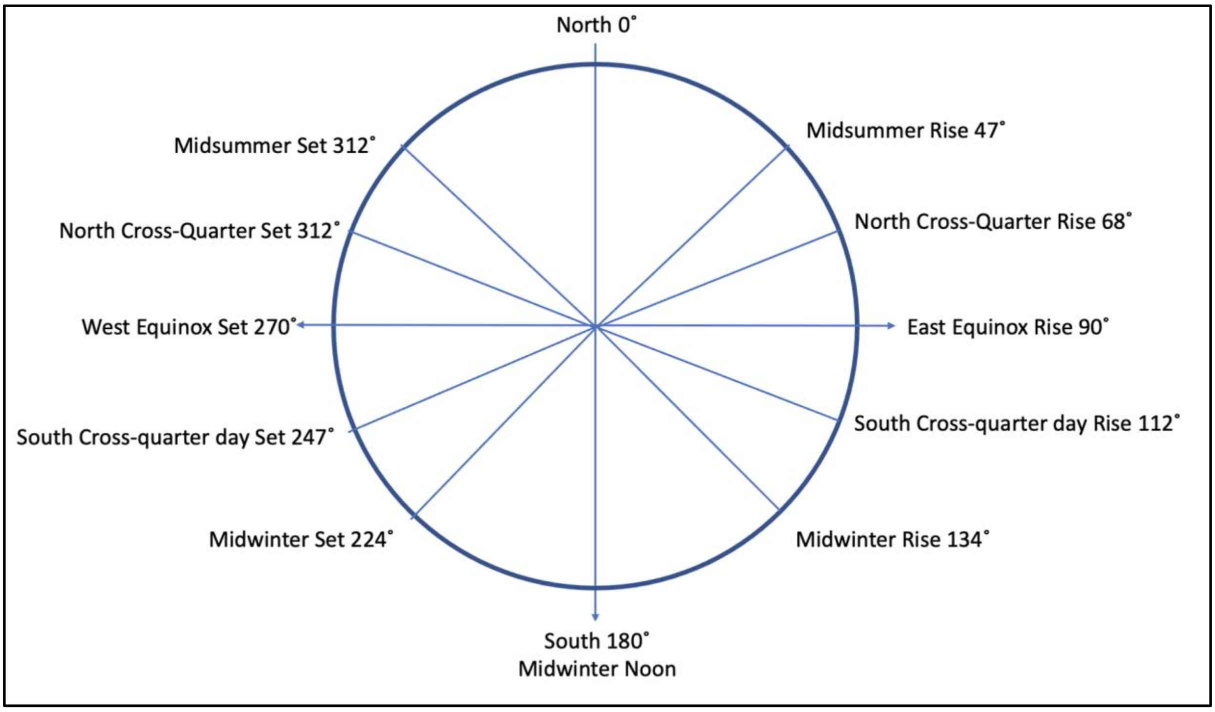


Figure 7.7. The astronomical cycle of the year with sunset and sunrise as relating the different points of the annual cycle – this is specifically for 59˚ degrees North latitude (Orkney) (produced from figures from https://www.suncalc.org)

Figure 7. 8 shows the different monuments in a colour coded format that are aligned on or near to (+/- 5˚). It was also noted that only passage type monuments have any

alignment on sunset events. A total of 57 passage orientation data measurements are available and have been used from a total of 52 different tombs have been included in this assessment as orientation data can be attributed to them, some having two ascribed. Of the stalled cairn classification there are 39 monuments if stalled with cells as at Isbister and Unstan are included of which 30 have attributable passage orientation data. Of the Bookan there are six recorded all of which have alignment measurements. Of the Orcadian passage grave classification 12 appear in the archaeological record to date of which 10 have passage orientation data attributed to them. The discrepancy in numbers as presented earlier in this chapter is due to the intended exclusion of monuments that are classified as 'tripartite **or** stalled' as it was felt without confirmation the use of this data may have a negative effect on the results.

The following analysis of the 30 Orcadian stalled monuments (tripartite, stalled and those with cells) with passage orientation data 17 (56.7%) and 10 (100%) of Orcadian passage graves can be said to have alignments on known astronomical targets within the discussed +/- 5˚ parameter and these are detailed at Figure 7.8 and 7.9. When presented in order of those which have alignment propensity the order from low to high is tripartite and Bookan (33.3%); stalled with cells (50%); stalled (84.6%) and passage graves (100%). The stalled with cells monuments have a difference of 7˚ which means whilst it its outside the 5˚ parameter set for this analysis it remains extremely close.

These data are presenting a picture that both stalled cairns and passage graves can be shown to have this broad alignment with quarter dates or cross quarter dates. It also suggests that for the builders of tripartite and Bookan type monuments such alignments were less important. The reasons for this will form part of the discussions later in this work but at this juncture it is safe to say that there is a marked difference in solar alignment of these monuments which may be linked to the chronological framework identified in chapter 5.

Sun Rise

Midwinter Solstice 134˚	South Cross-quarter day / Imbolc 112˚	Spring Equinox / Vernal 90˚	North Cross-quarter / Beltane 68˚	Midsummer Solstice 47˚	North Cross-quarter / Lammas 68˚	Autumnal Equinox / Mabon 90˚	South Cross-quarter / Samhain 112˚
Bigland Long	Sandhill Smithy	Earls Knoll	Unstan	Hacksness	Unstan	Earls Knoll	Sandhill Smithy
	Powdykes	Knowe of Craie	Calf of Eday Long	Redland South	Calf of Eday Long	Knowe of Craie	Powdykes
	Knowe of Yarso	Knowe of Lairo	Eday Manse		Eday Manse	Knowe of Lairo	Knowe of Yarso
	Helier Holm	Lambs Ness				Lambs Ness	Helier Holm
	Eday Church	Calf of Eday Long (B)				Calf of Eday Long (B)	Eday Church
	Bigland Long (Tri)	Tresness (passage)				Tresness (passage)	Bigland Long (Tri)
	Burray	Cuween				Cuween	Burray
	Holm of Papa Westray South	Quanterness				Quanterness	Holm of Papa Westray South
	Quoyness	Onziebist				Onziebist	Quoyness
	The Howe						The Howe

Sun Set

Midwinter Solstice 224˚	South Cross-quarter day / Imbolc 247˚	Sping Equinox / Vernal 270˚	North Cross-quarter / Beltane 291˚	Midsummer Solstice 312˚	North Cross-quarter / Lammas 291˚	Autumnal Equinox / Mabon 270˚	South Cross-quarter / Samhain 247˚
Calf of Eday North		Wideford Hill				Wideford Hill	
Maes Howe							

Stalled

Passage Graves

Stalled with Cells

Tripartite

Bookan

Figure 7.8. Monuments of Orkney orientated (within 5˚) of the rising sun (top) and setting sun (bottom) Tripartite in green; Stalled with cells in grey; Bookan in blue; stalled cairns in pink, passage graves in yellow.

	Tripartite	Stalled	Bookan	Stalled with cells	Passage
Orkney All	17	20	6	2	12
North Isles	13	15	5	0	7
With associated passage alignment data	15	13	6	2	10
Aligned to solar event	5 (33.3%)	11 (84.6%)	2 (33.3%)	1 (50%)	10 (100%)

Figure 7.9. Data representing the different classification of monuments and the percentages associated at or near a solar event.

The passage graves had a clear dominance for alignment on or close to a solar cyclical event. This may indicate that the builders of the passage monuments had a more refined understanding of the solar cycle or a different social/cosmological relationship with the sun. This may have been gained due to prolonged study of the movement of the sun or as a consequence of a more advanced incoming knowledge in the possession of migrants. Figure 7.10 reduces the likelihood of a coincidence by superimposing the actual alignments (left) onto the solar calendar wheel calibrated for Orkney with one generated by a random computer number generation tool (right). In summary this analysis demonstrates that stalled cairns (56.7%) and passage graves (100%) can be said to be aligned to or close to one of the solstices, equinox or cross - quarter days. These figures support any argument for intentional alignment.

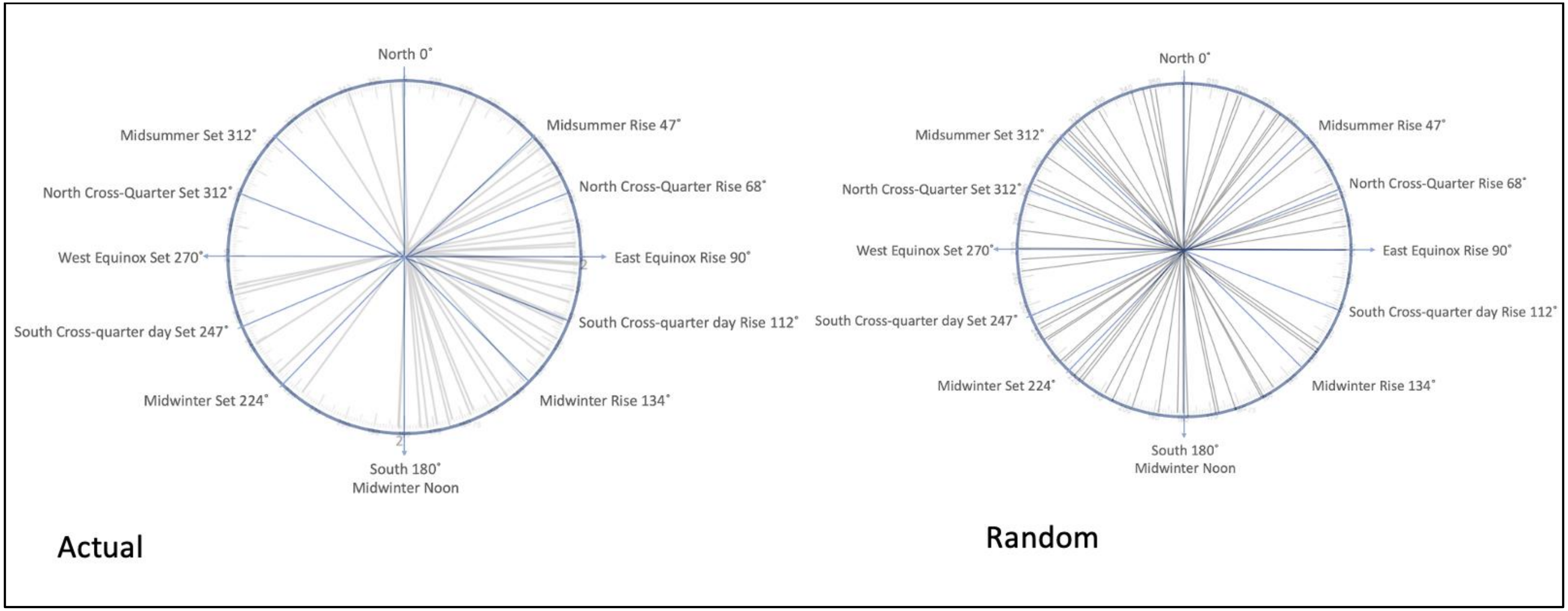


Figure 7.10. The actual composite (left) and random (right) orientation wheels superimposed with the astronomical year cycle (as at figure 7.7 above).

Figure 7.11 shows the extent of the annual sun rise and sunsets that occur throughout the annual cycle. The shaded area **A** (Figure 7.11 left) shows the total parameters where the sun goes down throughout the annual cycle and **B** (Figure 7.11 right) similarly for the sun rising. As due south is always midday a high percentage of monuments fall between the sunrise annual parameters and midday with a noticeable absence of alignments immediately west the midday point.

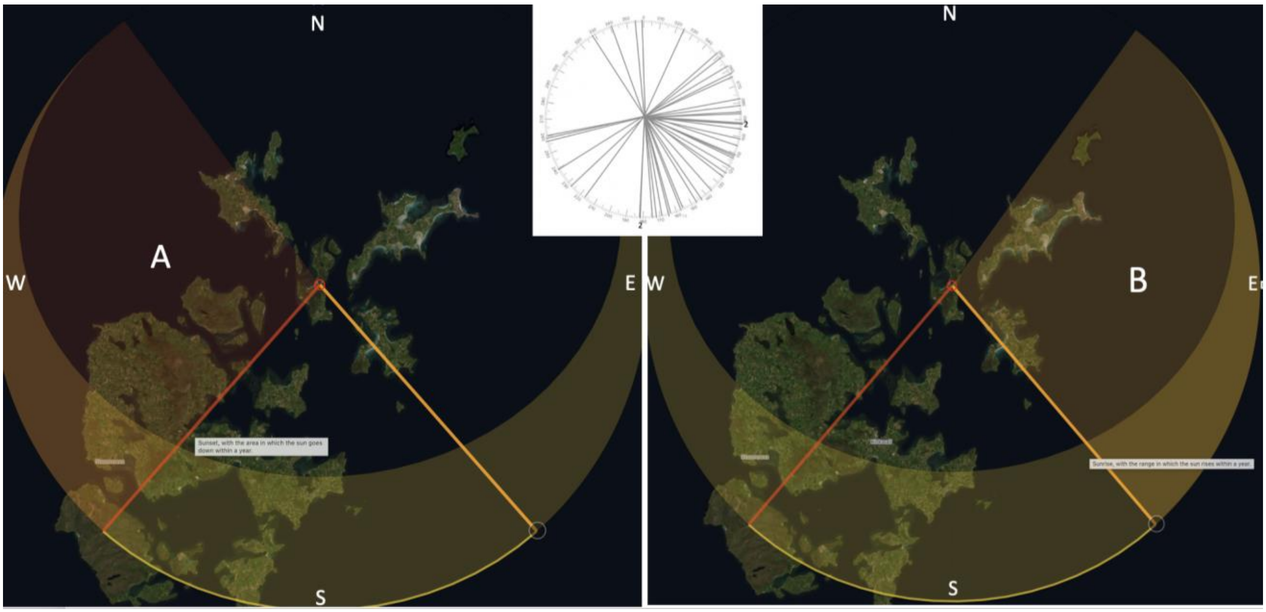


Figure 7.11. The parameter extent of the annual and sunsets (A) and sunrise (B) that occur throughout the annual cycle, imposed with the composite orientation diagram for ease of reference. (created from https://www.suncalc.org).

Given the error potential discussed due to lack of sophisticated knowledge and other matters above Figures 7. 8 and 7.9 represent all the monuments that are within +/- 5˚ of the solar targets and do present a case for intentional alignment for at least some of the monuments. At Tresness where the passage aspect of this multi-phased monument is aligned to the sun rise on or around the vernal or spring equinox which represents the time of the year when the lengths of day and night correspond. The passage alignment alters by 9˚ (Anderson-Whymark and Cummings 2021) for reasons that will be unpicked later, it is correct to say this is a phenomenon that has been noted at many of the Orcadian tombs site surveys undertaken for this research. The primary passage axis is on an alignment of 89˚ a point that corresponds with the vernal sun rise whilst the secondary phase passage axis is 9˚ difference at 98˚ (see Figure 7. 12). In terms of alignment for the secondary passage axis alignment this would correspond to a date approximately 10 days earlier than Vernal.

Figure 7.12. Plan of Tresness stalled cairn (Anderson-Whymark and Cummings, 2021, Figure 9) with adaptations and orientation of the different alignments throughout the monument. Right Photogrammetry model for clarity of alignment differences Sketchfab - Anderson-Whymark.

This could be explained by the obvious lack of a scientific knowledge in the possession of the extension builder's and alignment to the sunrise event was obtained on different days in the vicinity of the vernal equinox. It is also clear that when this multi-phase monument was adapted from its stalled to passage phase there was no continuity of alignment this being suggestive that some different intention was operating on the minds of the builders. Another observation is that if one accepts the *vernal* sunrise alignment theory then from Tresness the alignment on the setting sun that same day would traverse the Orcadian passage grave at Quoyness on the neighbouring westerly peninsular of Els Ness (Figure 7.13).

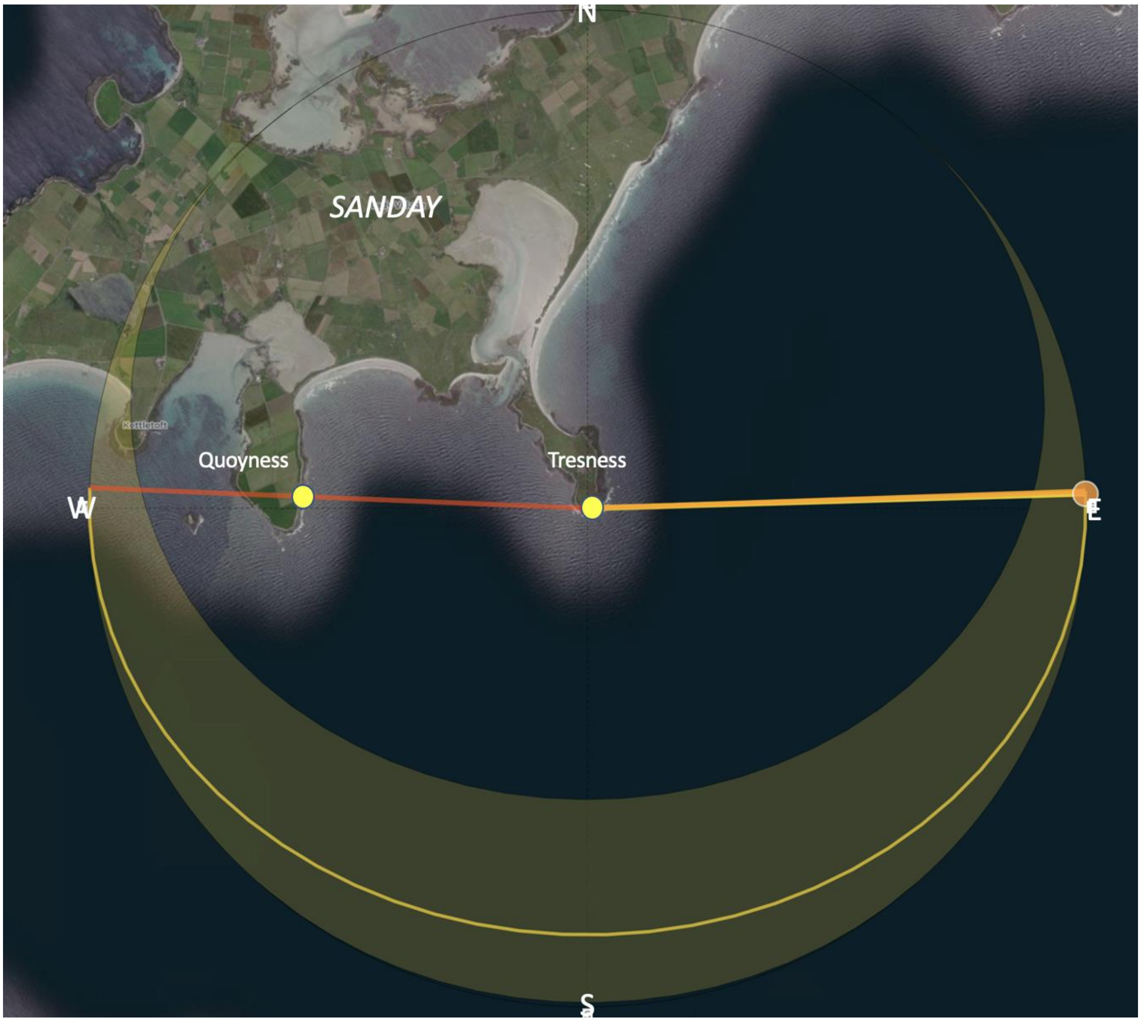


Figure 7.13. The alignment of Tresness as seen on Google maps with *Vernal* sunrise (orange) and sunset (red) plotted (https://www.suncalc.org).

Given the recent excavations at this location it is thought that the monument at Tresness had no identifiable astronomical alignment during its stalled or earlier phase of use. The only alignment at this time being towards of Stronsay and possibly linked to sea travel a (see chapter 8). Later the monument was reworked and re-established with features of a passage grave (Anderson-Whymark and Cummings 2021). This clearly demonstrates a mixing of monument traditions with the later phase being associated with the passage grave tradition. This may be representative of new ideas and knowledge influenced by diffusion or migration from Ireland. The Vernal target theory identified would support this as such alignments are common feature of Irish passage grave tradition.

As seen in Figure 7.8 Imbolc and Samhain (south cross quarter day) the sunrise target is particularly notable. The alignments to the rising sun on or around this date finds seven stalled cairns, one Bookan and three passage graves so aligned (Figure 7.4). The passage of Quoyness is aligned with the *Imbolc* quarter date a point that sits midway between the Winter and Spring equinoxes. The word Imbolc has its origins in the old Irish *i mbolg* meaning '*in the belly*, a time when sheep began to lactate in preparation for birth. *Imbolc* is a festival that falls astronomically between 2nd and 7th February each year. It is suggested that this would have been a time where these observable natural events will have been obvious to early farmers being associated with the conception and lactation prior to birth of livestock; a time to be noted.

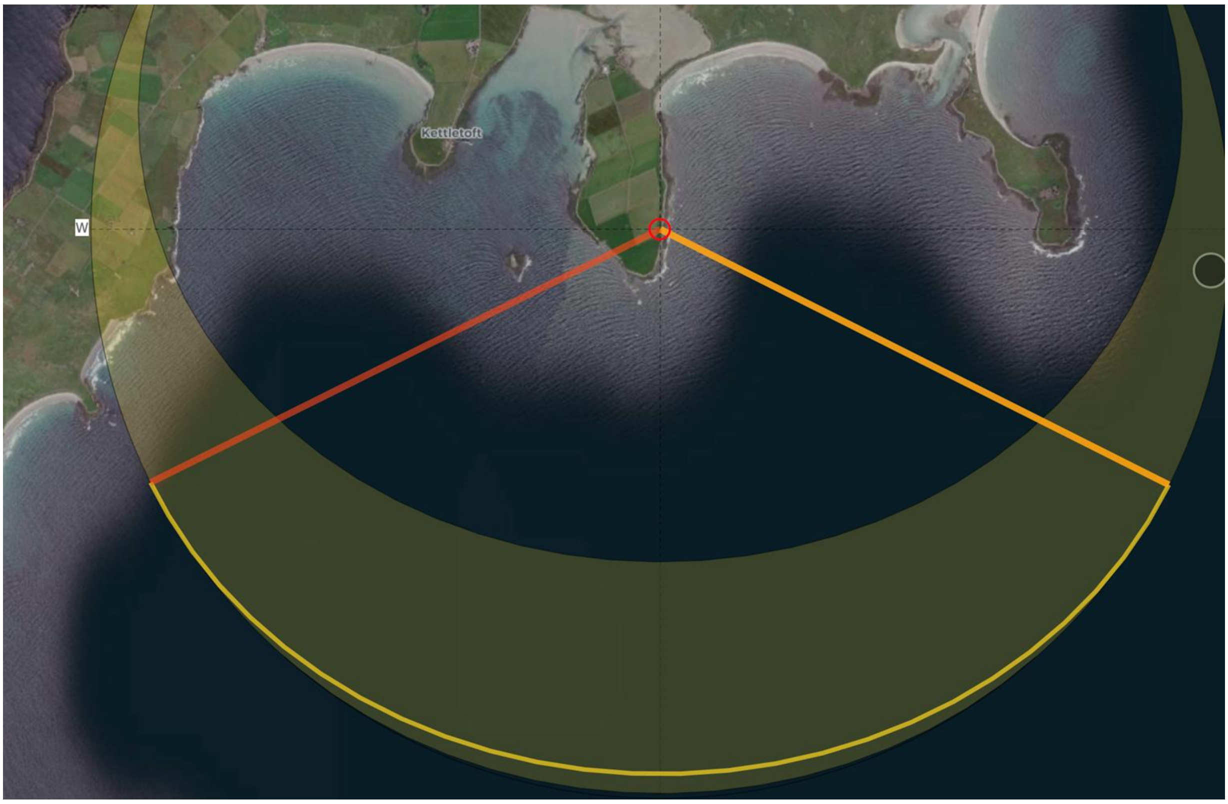


Figure 7.14. The alignment of Quoyness as seen on google maps with I*mbolc* sunrise (orange) and sunset (red) plotted (https://www.suncalc.org).

The Quoyness alignment (116˚) is not without president in the North Isles as identified in Figure 7.8 seven stalled monuments, one Bookan and three passage graves are also aligned to the sunrise about the time of Imbolc. Given that Quoyness is a monument from later in the Neolithic chronology as discussed in chapter 5 it is likely that the builders will have possessed a more refined knowledge of astronomical cycles. It may be no coincidence that passage graves from Ireland are similarly aligned. The Mound of the Hostages at Tara being broadly contemporary (or a little earlier) being one example. The passage alignment at Tara is such that it allows for the light of the rising sun of early February to enlighten the inner chamber (Lunan 2013, 54).

Summary

The research detailed in this chapter refines the prevailing south-east alignment narrative for Orcadian tombs. 56.7% of Stalled cairns and all passage graves exhibit alignments to or in proximity with solstices, equinoxes, or cross-quarter days, as illustrated in Figure 7.7. Notably, this alignment is not a mere coincidence, as demonstrated by the randomly generated wheel orientation diagram. The argument against the conventional south-east alignment is grounded in the limitations of prior studies, such as those by Davidson and Henshall (1989, 85) and Fraser (1983, 364), which adopted a methodology overlooking factors like location, chronology, and classification. Unpicking this general approach and looking at the monuments island by island alignments contrary to the south-east alignment begin to emerge. Here it has been highlighted that the tombs on Eday and Westray (to a lesser extent) deviate from this pattern allowing this work to challenge the established norm. The forthcoming chapters will delve into the implications of Eday's central position within the North Isles and explore alternative explanations for these deviations.

In contradiction the assertion that a pervasive cosmologically motivated alignment tradition was universally embraced during the early Neolithic era in Orkney, it can be contended that a significant number of monuments do not adhere to cardinal points, equinoxes, solstices, or cross-quarter days. This variance in alignment pattern implies the absence of a singular, overarching mandate directing the construction of these monuments. Nevertheless, a valid argument may be suggested in favour of the contention that a proportion of these tombs exhibited a deliberate intent to align with the sun during periods that would have held a pragmatic significance to early farmers. This alignment with solar positions suggests a genuine and purposeful interest in the delineation of seasonal changes. It suggests that early Neolithic inhabitants of Orkney possessed a real interest in seasonality, underscoring the agricultural context in which these monuments were conceived. Conversely, another subset of tombs diverges from this solar-centric alignment prompting questions into the motivation behind this situation. The exploration of the tombs that do not conform becomes imperative if we are to understand the multifaceted motivations that drove the construction of these tombs. The rationales behind these difference in alignments unveils an intricate and complex cultural and social tapestry that contributed to the diversity in tomb alignment practices. In essence, the absence of a universal astronomical motivated alignment tradition is clear in Orkney.

Chapter 8 – Positioning of tombs from a landscape perspective

Introduction

It has been established previously that vistas in Neolithic Orkney would have been broadly as we find them today and uninterrupted by tree cover (see chapter 3). This chapter discusses the findings of visibility surveys in relation to landscape features and other tombs. It will also consider relationships with settlements and the sea. All these matters have been discussed previously and this work will assess the validity of those works with the benefit of more recent findings, GIS analysis and field surveys. It will also offer new suggestions that may add to any interpretations in respect of tomb positioning decisions by Orkney's first farmers.

The current picture in Orkney

There have been several studies looking at Orcadian burial monuments relationship with various distinct themes that tended to be being considered and focussed upon in isolation. This work will reconsider the locations of these monuments in a new way by considering **all of those themes together** prompting the consideration that tombs were not located for the same reason following to any single blueprint or social mandate. Themes such as tomb intervisibility with other monuments (Fraser 1983) and landscape features (Cummings and Fowler 2004; Cummings and Whittle 2017; Tilley 1994) have been subject to previous scholarly interest. Seascape and spatial relationship with the sea have also attracted attention (Callagahan and Scarre 2009; Garrow and Sturt 2011; Noble 2006; Phillips 2004, Woodman 2000) and are inevitably relevant in the island scape of the North Isles of Orkney – with the sea being ever present feature. In addition, another study argued that the that the tombs were used as territorial markers for individual segmented farming communities and were placed on the landscape overlooking agricultural land (Renfrew 1973a, 1979). He continually worked to understand the social organisation of Neolithic Orkney and a key conclusion for the first time in tomb enquiries suggested they had a social function beyond simply burial structures. He proposed they were important territorial markers. Childe had previously argued that there appeared to be a connection between tombs and modern settlement pattern (Childe 1942). Renfrew went further and divided the islands into territories utilising a Thiessen polygons analytical methodology centred on the tombs as seen in Figure 2.38 (Renfrew 1973, 149-50) a model that was widely adopted (e.g. Fraser 1983; Hedges 1984; Richards 1998;

Sharples 1985). Later Davidson and others enhanced this debate by using spatial analytical techniques and developed this hypothesis further (Davidson *et al.*1976). He, like Childe and Renfrew, operated with an assumption of indivisibility between cairn locations and noted that the visible areas have some correlation with modern cultivated lands and known settlement as per the shaded areas at Figure 2.37 (Fraser 1980, 4; Renfrew 1979, 13).

Furthermore, tombs association with settlements have been frequently cited (Richards and Jones 2016; Richards 2013). This study will probe deeper into these findings - challenging some and concurring with others – though in a way that does not rely on a 'one size fits all approach'. It will argue the likelihood that not all tombs were raised on the landscape for the same universal reasons. Whilst these previous findings may have veracity some of the time, here this work will suggest that different communities made their tomb siting decisions autonomously according to their own needs and not to wider operating conventions or traditions.

Since the last comprehensive study of the chambered tombs (Davidson and Henshall 1989) there have been advancements in the settlement record (e.g. Beusing and Rassmann 2019; Brend 2010; Bond *et al*. 1995; Gibson 2008**;** Lee 2014; Lee and Desalle 2016; Lowe 2008; MacSween 2009; Mainland and Moore 2010a; Miles 2007a; 2008a; 2009a; Moore and Wilson 2015; Morrison 1995; Richards 1992c; Thomas 2011). In addition, there are several identified houses or segmented farmsteads. The Knap of Howar (Ritchie *et al.* 1983) and Cata Sand (Cummings and Richards 2016; Cummings *et al.* 2017) which means now there is rich information available that was not for those earlier researchers. It is undoubtably correct to say that the evidence across the archipelago remains incomplete and so this work is both critical and timely to refine narratives. Several chambered cairns are positioned **near to** known Neolithic settlement sites, something that has been commented upon in the archeological literature (Bayliss *et al.* 2017; Childe 1942; Davidson and Henshall 1986, 17; Fraser 1980, 1; Richards and Jones 2016). This will be examined and refined, and it will be argued that the tombs are intrinsically linked to settlements not merely by proximity but also by alignment .

Clearly the islands were populated with people and animals by sea (Glørstad 2013) and there is evidence that early Neolithic people were competent deep sea fishers with activities often many miles away from shore (Renfrew 1979; Sturt 2005). This is indicative that the earliest settled occupants of these islands were accomplished and skilled mariners. Travel around the islands will have been dependent on seafaring skills, local knowledge, craft technologies and likely daytime line of sight navigation (Noble 2006) and the use of 'mental maps' of distinctive landmarks (Broodbank 2000, 23). Do monuments have their part to play in these day-to-day activities? As noted previously – perhaps unsurprisingly on an archipelago - the dominating view from the predominance of monuments is that of a seascape and not landscape (Woodman 2000, 95). Always within sight of another island, weather permitting, it has been suggested that a Neolithic seafarer will have benefitted from mental maps utilising distant landmarks as navigational aids. This matter will be returned to in discussion but claims that **all** monuments are there to assist interisland travel is problematic.

At the turn of the millennium modelling calculated the range for small, paddled vessels (see Broodbank 2000, 102; Callahan and Scarre 2009; Nobel 2006, *fig 9*) and suggests that a journey from Brittany to Orkney could be completed between 16-20 days (dependent upon season) via the east coast route and between 13-17 days via the western British seaways (Callahan and Scarre 2009, 364). More recently, in 2016, the BBC documentary '*Britain's Ancient Capital: Secrets of Orkney*' undertook an experimental archaeology project to explore Neolithic seafaring using a hide boat. The project covered construction to voyage and saw an experienced eight person Orcadian crew paddled a large skin/ hide coracle craft across the Pentland Firth Hoy to Mainland. The 14.5 km crossing took 4 hours and 50 minutes which provides some tested evidence and therefore a basis for broadly assessing the distances that could be travelled at a time contemporary to the chambered cairns. This may call into question the previous travel times from Brittany to Orkney (Callahan and Scarre 2009, 364). Having travelled by sea to an appropriate landing point it is now time to look at the terrestrial routes that follow from these and assess if there is any identifiable relationship with the locations of the chambered cairns. It is arguable that within any group of closely dispersed of islands the sea routes could be seen as part of a conjoined terrestrial/marine transportation network that fuses together these more isolated communities. It has been said that '*human existence is not fundamentally place-bound…it unfolds not in places but along paths*' (Ingold

2009, 33; Schülke 2016; Tilley 1994, 25). These sea and land Germany has concluded that Neolithic routes conformed closely to later medieval roads (Raetzel-Fabian 2002).

It will be recalled from chapter 7 that will identify and analyse patterns in positioning and location choice for the early Neolithic chambered cairns of the North Isles of Orkney. As generic alignment and relationships with celestial bodies have already been examined this chapter will specifically concentrate on each tomb's relationship with the following aspects which will form sections of this chapter:

- Relationship with landscape features.
- Intervisibility and relationship with other monuments.
- An analysis of coastal landing places.
- The relationships with settlements.
- Land and sea routeways

Visibility with landscape features

The most prominent landscape feature throughout the archipelago is the sea. It may be unsurprising that all (100%) of the North Isles' monuments have a view of it to some extent, be that wide-ranging and uninterrupted views of expanses of the sea to limited visibility of narrow sounds between islands. Monuments are distributed in a range between sea level and 180m as displayed in Figure 8.1. There is a propensity of stalled cairn monuments in the 0–30-meter range (58%) in the North Isles and these tend to be situated on peninsulas such as Tresness or on low-lying smaller islands like Calf of Eday and Holm of Papa Westray or on coastal locations as with Point of Cott. Consequently, the sea is inevitably a constant feature. Further, and assisted by the low-lying nature of the isles the remaining stalled cairns, those above 30 metres (42%) also have a sight of the sea, even if at some distance.

Of the seven North Isles passage graves, five are located under that 30m line; two on Sanday (Quoyness and Mount Maesry) and Onziebist on Egilsay, Pierowall on Westray and one on Holm of Papa Westray. The passage graves on Eday (Vinquoy Hill and Eday Manse) occupy the most elevated locations that afford widespread views across island

and sea and this difference on this island will be explored below. The question remains: are these monuments positioned for a sea view or is sight of it merely a collateral feature of a location selected for other reasons? The sea as a landscape feature is a difficult one to assess given the geography of the islands. It is certainly possible to find locations within the North Isles that do not have such a view though some effort may be required. As none of the tombs are so located it is tempting to make an argument that they were located to take in a view of the sea per se by virtue of what the sea represents to the communities of the day.

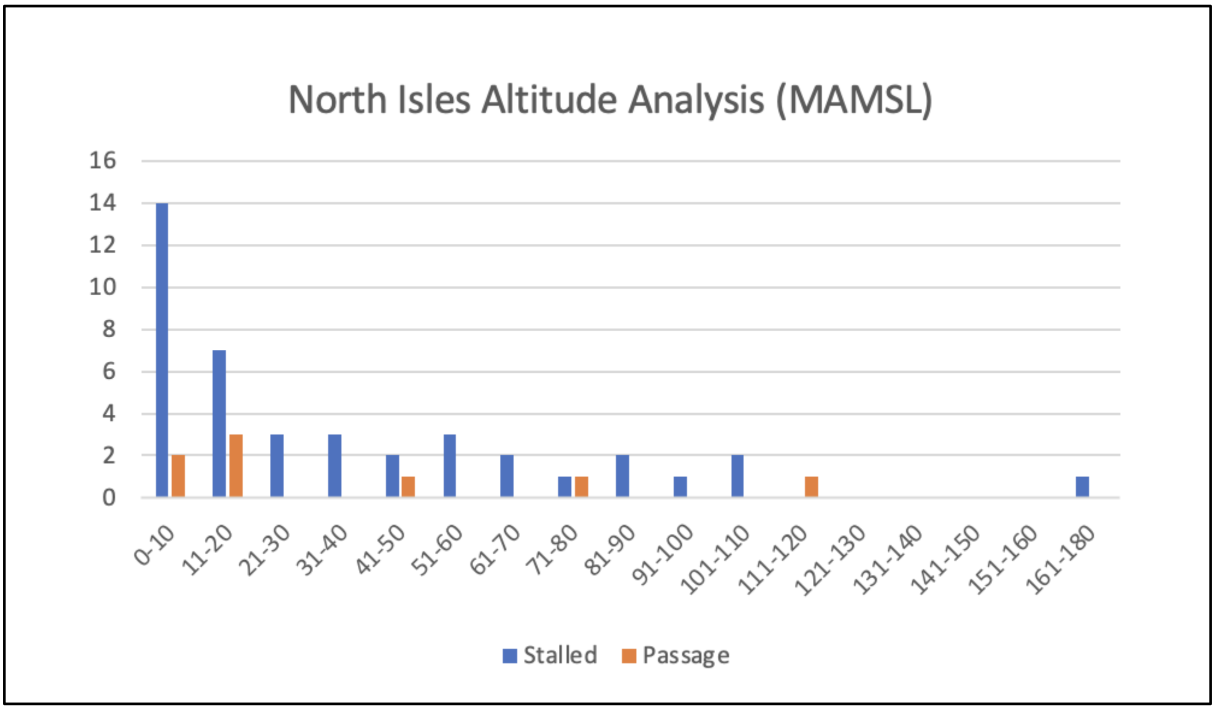


Figure 8.1. North Isles monument (stalled and passage) altitude analysis

Other landscape features include prominent hills. For example at Vinqouy Hill passage grave on Eday there are wide-ranging views of a number of notable and prominent hills across the archipelago. With some concentration and prevailing weather conditions it is possible to see the notable twin peaks of Ward Hill 481m, Cuilags 435m on Hoy; Blotchnie Fiold (250m) on Rousay; Wideford Hill (225m) on Mainland and Fitty Hill (169m) on Westray. That said any assessment that this was specifically placed to afford these specific views may be premature. It is more appropriate to say that they are so located to enable wide-ranging and long-reaching views other than to take in certain individual features.

Figure 8.2. Photograph (50mm prime lens replicating normal human vision) taken from the Vinquoy Hill chambered tombs showing the task required to identify distant hills (authors own photograph).

Figure 8.2 was taken with a lens to replicate normal sight. The hills mentioned are all present in the photo, but they can be difficult to identify as individual entities with the furthest being some 50km away. Furthermore, any position upon the hill would keep this far-reaching view but when we look at this tomb in detail later such a deviation would restrict other views such as the relationship with other close by and key monuments. It is for this reason it is more appropriate to say that this monument was positioned to afford a long-range view as opposed to be directed to an individual hill or hills. The twin peaks of Hoy have been observed given their association with Maeshowe and the midwinter solstice astronomical alignment and it is likely that they will have been a recognisable feature across the archipelago. Though as previously noted with the sea this may simply be another collateral advantage of placing a tomb on such a high location as Vinquoy Hill.

Kierfea Hill is a stalled cairn on Rousay located at the highest altitude of any monument in Orkney and as such one might expect this monument to have wide visibility across many islands and other landscape features. Having carried out a detailed survey of this location it is the very nuances of its siting that begins to provide clues as to the intentions of its builders. It is positioned near to the summit upon a small plateau on the south-east slopes of the Kierfea Hill from which it is named.

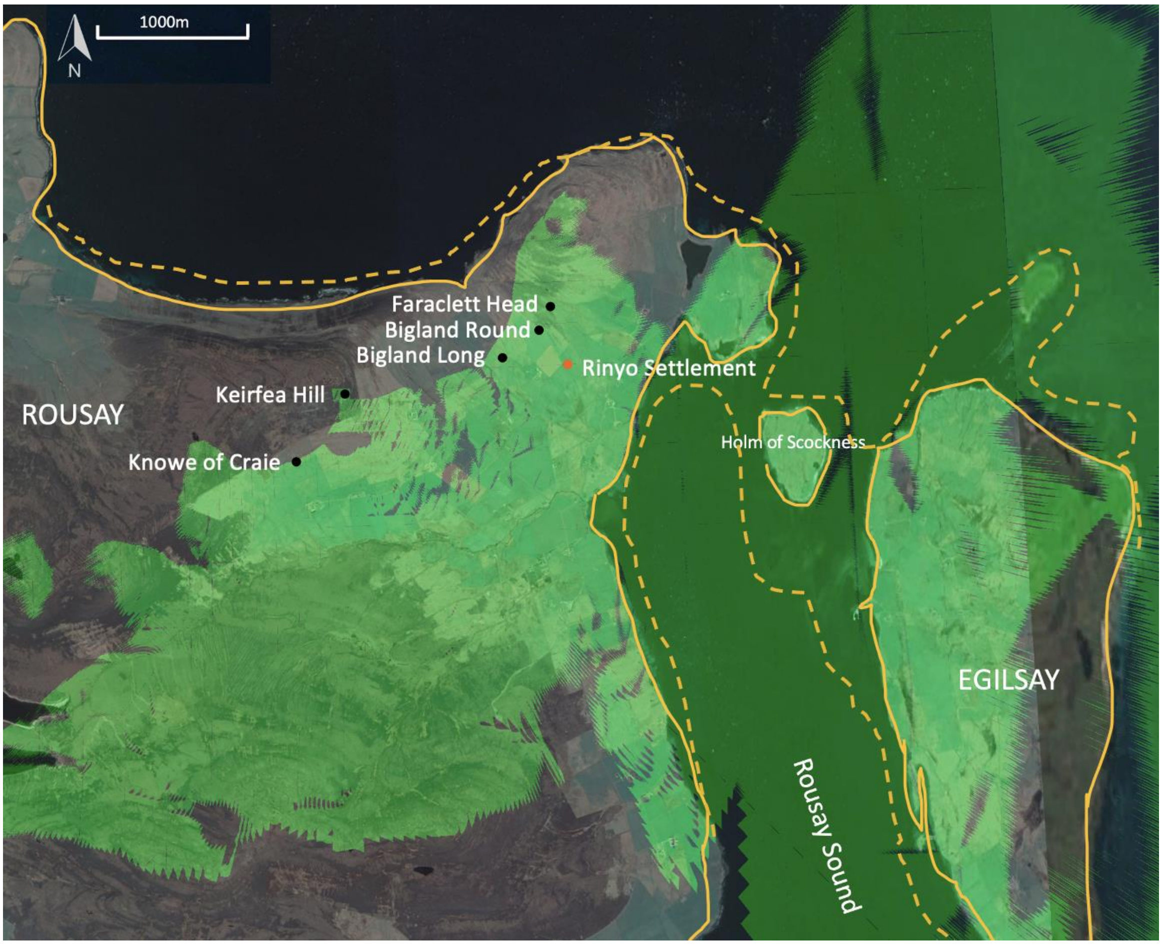


Figure 8.3. Computer generated viewshed analysis overlain on Google Earth Pro satellite images of the northwest corner of Rousay Orkney. This viewshed (in green) shows the view from Keirfea Hill stalled cairn. Other monuments are annotated accordingly.

The ground survey is supported by the subsequent viewshed analysis in Figures 8.3 and 8.4. From the site of Keirfea Hill stalled cairn intermediate views east are experienced that take in the lower lying land surrounding the Neolithic settlement of Rinyo (see below). What the location does not offer is perhaps the most telling. It presents extremely limited views elsewhere. On a clear day from this hill side one of the most wide-ranging views of the archipelago can be seen with the full extent of the North Isles set out before you. This is invisible from the specific chosen site (Figure 8.3). Whereas if this view was an intention of its creators then by building the same tomb some 20 meters away (see Surveyed Alternative Position in Figure 8.4 around the shoulder of the hill on the same plateau and contour line then the sweeping vista would have been achieved with no detriment to the current, more local view. This is compelling evidence a wide-ranging distant island view was not the intention of its builders in the case of this stalled cairn. Instead it was positioned to take in a more localised view over the low-lying land or indeed for the benefit of the inhabitants of that land to look up at this visually impressive hill (and tomb).

Figure 8.4. Computer generated viewshed analysis overlain on Google Earth Pro satellite images of the north-west corner of Rousay Orkney. This viewshed (in green) shows the view from The Surveyed Alternative Position, other monuments are annotated accordingly.

From a landscape perspective it can also be seen that these tombs are also positioned to have views of the natural bay at Holm of Scockness, Bay of Ham within the Rousay Sound and the North aspect of the island of Egilsay. Figure 8.5 demonstrates that with lower sea levels operating in the early Neolithic it is likely that Egilsay and Holm of Scockness were both connected or at least intertidal peninsulas making this Rousay Sound a large well sheltered bay perfect to support habitation and early farmers. Figure 8.5 shows a reconstruction using the 5m contour mark which is thought to be representative of the sea level change since the early Neolithic (Lambeck 1991).

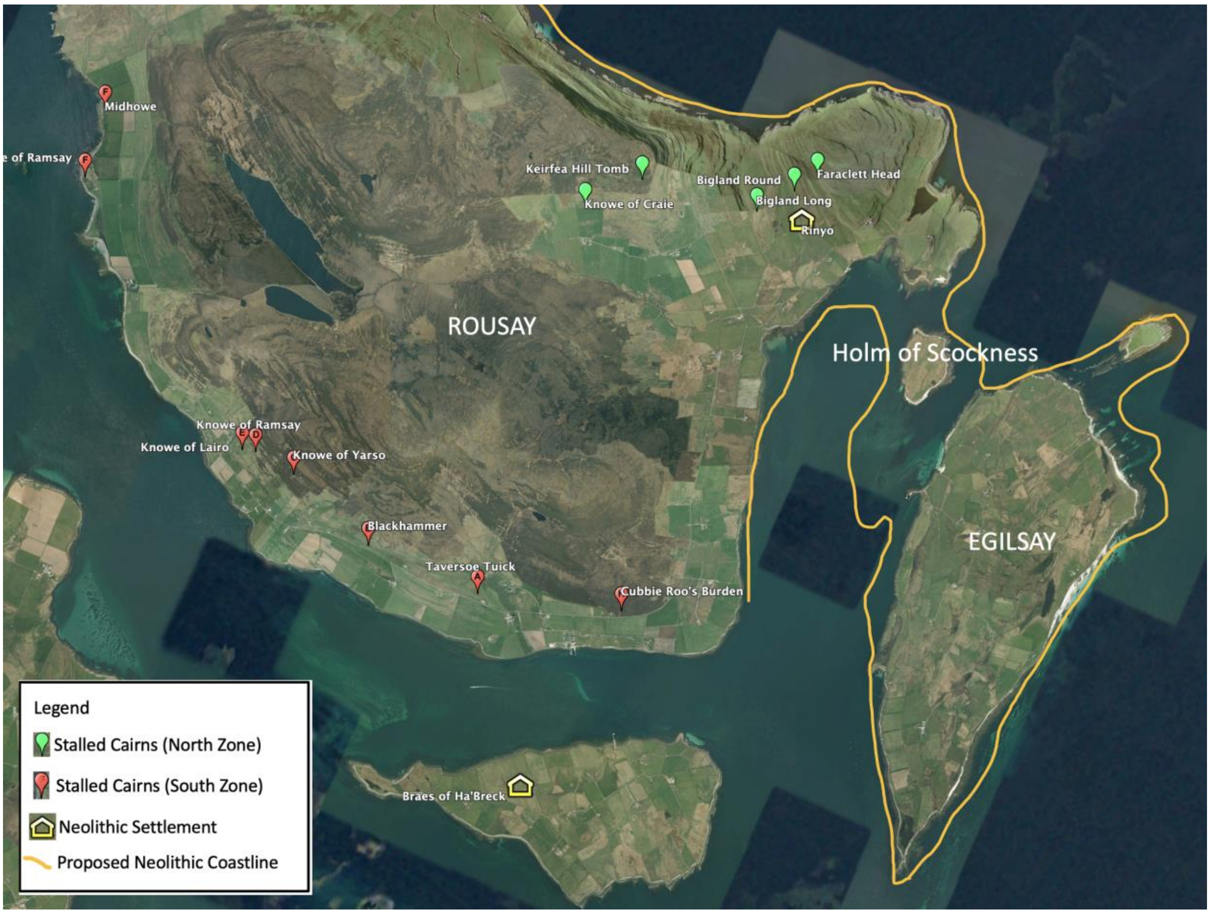


Figure 8.5. Extract from marine chart showing sea depth contours annotated with the mustard line that demonstrates how the island of Egilsay may well have been a peninsular of Rousay in the past (annotated Google Earth Pro image).

By contrast, the monuments of Vinquoy Hill (passage grave; Eday) and Withebier Uncertain; Eday) have considerable distant visibility across their own island and beyond and it seems likely, unlike Keirfea Hill, that they were positioned to have such views. This could mean here that the cairn builders favoured visually impressive locations on certain islands (Eday being different) and avoided places with limited views suggesting that certainly some of the monuments were positioned for such benefit. Further, it may be the case that the time of passage grave tradition had different cosmological or social conventions operating upon their builders. It is worth noting here that there are other large hills across the North Isles that have no evidence of tombs so it was not the case that all high and visually impressive locations benefitted from a tomb.

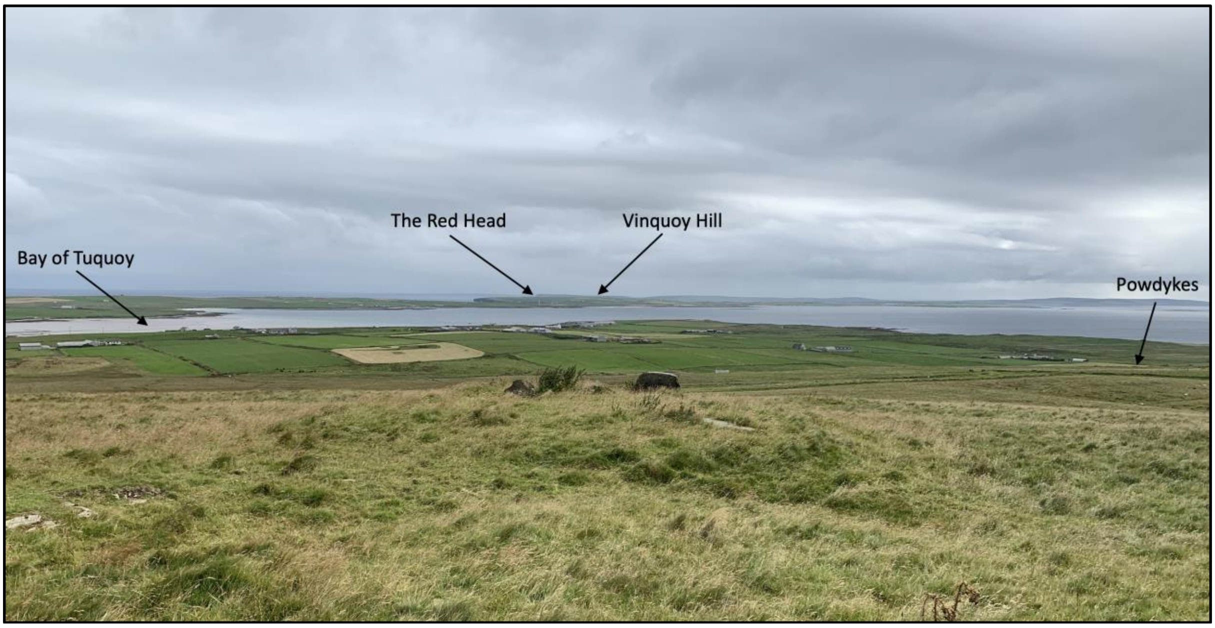


Figure 8.6. Photograph taken from Fitty Hill monument map annotated showing the alignment of monuments on Westray and Papa Westray (authors own photograph).

On Westray at the south of the island there are a cluster of monuments upon the western slopes of Fitty Hill, Powdykes, a stalled cairn, and some 800m away another stalled cairn named after the hill (Figure 8.6). Both these monuments are positioned as depicted in Figure 8.6 with a distant view of prominent natural and landscape feature of The Red Head Cliffs at the very north of Eday and the Vinquoy Hill. It is unlikely that there was any intervisibility between these monuments and the Vinquoy Hill tomb by virtue of distance c. 14.5km. One possibility may be that at certain times fire was utilised as part of a ceremony and should this have been the case then it is assessed that there will have been such intervisibility. More likely from visiting the site is the view it affords of the intermediate landscape over low lying cultivatable land and that of the Bay of Tuquoy and its beach site that would be beneficial to any Neolithic mariner. To date there is no evidence in the archaeological record of settlement at the Bay of Tuquoy. Taking precidents from other islands such as Rousay it is tempting to imagine an as yet unidentified Neolithic settlement and farming activity in this locale, particularly given the relationship with these two prominent tombs their positions and outlooks and the sheltered bay being an appropraite landing point maritime travelers.

Long-range views are not exclusive to the higher altitude tombs. The low-lying monument at Tresness has notable long-range views. Some 60 km away to the south-west where the twin peaks of Hoy can be seen and to the north-east where the island of Fair Isle is located. This is an interesting association as from having spent extended periods at the Tresness excavation between 2018 and 2021 it is notable that this view is only available on certain days with certain lighting conditions given its distance. The unexcavated tomb, Earls Knoll on Papa Stronsay on the day of survey also afforded a view of Fair Isle and given the orientation and shape of the cairn surrounding this monument it is likely also to be aligned upon this distant island. Fair Isle is a small island positioned between Shetland and Orkney and would have had an important part to play in any line-of-sight sea travel between these two northern archipelagos. This adds weight to any argument suggesting that the siting of both Tresness and Earls Knoll paid cognisance of Fair Isle. In summary, it is evident that at least some of the monuments have been positioned to have a view of landscape features such as the sea, islands, hill tops and other natural features. The sea views appear are less conclusive given they are almost inescapable by virtue of the geography of the archipelago, particularly in the North Isles. In summary it is suggested that the monuments were positioned to afford an impressive and long-range views and as opposed to be directly associated to any individual hill or hills any such views are entirely fortuitous.

Visibility with other tombs and monuments

As detailed in Tables 8.1, 8.2 and Figure 8.9 the overwhelming majority of Orcadian North Isles monuments do have a view of other monuments from their positioned location. Table 8.1 details visibility between the monuments with Figure 8.7 providing a visual representation of these data. Of the stalled cairns 92% are positioned in a place that affords views of other monuments. The passage graves in the North Isles are similarly enabled with 86% sharing a view of other tombs. These data are significant and upon initial assessment suggest unequivocal intention to have intervisibility with other tombs. Only four have no interrelationship with known monuments. Conversely, the passage grave at Vinquoy Hill and the uncertain classification monument at Withebeir can see 13 and 8 other monuments respectively and the stalled monuments on Mainland by virtue of their afforded view of the south coast of Rousay have seven intervisible tombs. Again, we see Eday standing out in this intervisibility assessment. Some of these tombs are distant from each other and would only be seen if fire was being used perhaps as part of ceremonies. Others despite being in extremely close proximity (less than 100 meters) are not visible from each other as with Calf of Eday Long and Calf of Eday south-east.

ORK no	Monument Name	Type	Island	Intervisible with
1	Bigland Long	Stalled	Rousay	2, 58, 59
2	Bigland Round	Stalled	Rousay	1, 58, 59
3	Blackhammer	Stalled	Rousay	6
5	Braeside	Stalled	Eday	23, 53, 55
8	Calf of Eday Long	Stalled	Calf of Eday	9, 53
9	Calf of Eday North-West	Stalled	Calf of Eday	8, 10, 53
10	Calf of Eday South-East	Stalled	Calf of Eday	9, 53
11	Cubbie Roo's Burden	Stalled	Rousay	49
14	Earl's Knoll	Stalled	Papa Stronsay	38, 44, 50, 55
15	Eday Church	Stalled	Eday	16, 20, 47, 53, 55
16	Eday Manse	Passage	Eday	15, 20, 47, 53, 55
17	Fara	Stalled	Fara	43, 53
19	Helliar Holm	Stalled	Shapinsay	18, 26,43
20	Holm of Huip	Uncertain	Stronsay	14, 16, 38, 47, 50, 53, 55,
21	Holm of Papa Westray North	Stalled	Holm of Papa Westray	22
22	Holm of Papa Westray South	Passage	Holm of Papa Westray	21
23	Huntersquoy	Stalled	Eday	5, 53, 55
24	Iphs (The Lum Head)	Stalled	Westray	33
26	Kierfea Hill	Stalled	Rousay	19, 55, 58, 58

27	Knowe of Craie	Stalled	Rousay	0
28	Knowe of Lairo	Stalled	Rousay	6, 30, 56, 57
29	Knowe of Lingro	Stalled	Rousay	42
30	Knowe of Ramsay	Stalled	Rousay	6, 28, 32, 65, 57
31	Knowe of Rowiegar	Stalled	Rousay	37, 56, 57
32	Knowe of Yarso	Stalled	Rousay	6, 30, 56, 57
33	Knucker Hill	Stalled	Westray	24, 41, 53
34	Korkquoy (Curquoy)	Stalled	Westray	0
35	Linkataing	Stalled	Eday	42, 60
37	Midhowe	Stalled	Rousay	31, 56, 57
38	Mount Maesry	Passage	Sanday	14, 20, 50
41	Point of Cott	Stalled	Westray	33, 52
42	Powdykes	Stalled	Westray	17, 29, 35, 53
44	Quoyness	Passage	Sanday	14, 50
47	Sandhill Smithy	Stalled	Eday	15,16,20,53,55
49	Taversoe Tuick	Stalled	Rousay	11
50	Tresness	Stalled	Sanday	14, 20, 38, 44
52	Vere Point	Stalled	Westray	41
53	Vinquoy Hill	Passage	Eday	5, 8, 9, 10, 15, 16, 17, 20, 23, 33, 42, 47, 55
55	Withebeir	Uncertain	Eday	14, 15, 16, 20, 23, 26, 47, 53
58	Faraclett Head East	Stalled	Rousay	1, 59
60	Fitty Hill	Stalled	Westray	17, 29, 35, 42

61	Grice Ness (Cutters Tooer)	Stalled	Stronsay	14, 20, 38, 44, 50
64	Holm of Papa Westray Centre	Stalled	Westray	21, 22
69	Lamb Ness	Stalled	Stronsay	0
71	Onziebist	Passage	Egilsay	1, 2, 26, 27
72	Pierowall	Passage	Westray	0

Table 8.1. Table showing the monuments name (alphabetic order), classification, island, and tombs that are visible from them (numbers correspond to the ORK classification number in Davidson and Henshall 1986 gazetteer

ORK no	Monument Name	Type	Island	Intervisible with
6	Burgar	Stalled	Mainland	3, 28, 30, 32
56	Quoys	Stalled	Mainland	28, 30, 31, 32,37,57, 73
57	Redland North	Stalled	Mainland	28,30,31,32,37,56, 73
73	Redland South	Stalled	Mainland	28,30,31,32,37,56,57

Table 8.2. Table showing the monuments name, classification, island and tombs that are visible from them (numbers correspond to the ORK classification number in Davidson and Henshall 1989 gazetteer. They are mainland monuments and are included here due to relationship with the Rousay tombs.

Rousay, the island with the densest Neolithic archaeology presents us with clusters of monuments in close proximity yet displays the least prevalent intervisibility with monuments on the same island. In the south there are a linear grouping of monuments very few of which share a view between each other. They do however share a view of tombs on Mainland. This may indicate an intention to show unity of social connection with the mainland across the Einhallow Sound.

Stalled Cairns - North Isles Of Orkney	
Number of other monuments visible	How many monuments (with %)
0	3 (8%)
1	6 (16%)
2	8 (22%)
3	8 (22%)
4	8 (22%)
5+	4 (11%)
Orcadian Passage Graves - North Isles Of Orkney	
Number of other monuments visible	How many monuments (with %)
0	1 (14%)
1	1 (14%)
2	1 (14%)
3	1 (14%)
4	1 (14%)
5+	2 (29%)

Table 8.3. The number and percentage of monuments of the North Isles of Orkney that can be seen from each other.

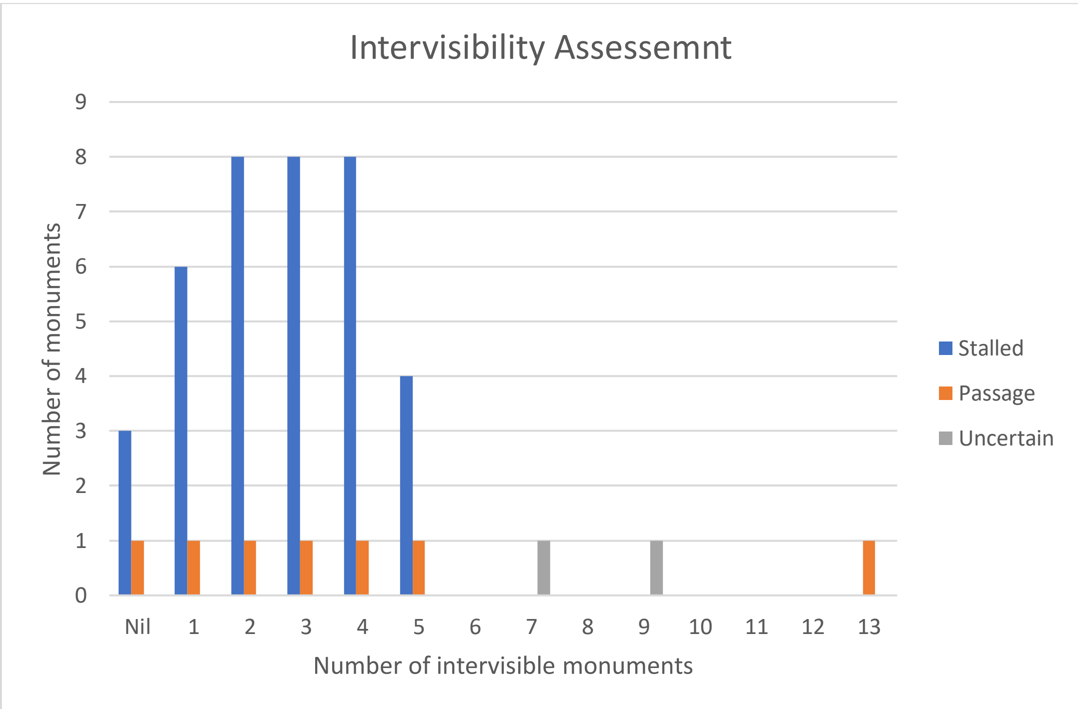


Figure 8.7 Bar chart graph showing the number of monuments by classification that have views of other tombs.

The Knowe of Craie is one of those monuments that does not have any visibility with other cairns and this is the case despite belonging to an apparent tight group of tombs in the north-east of the island and only a short distance from Keirfea Hill cairn as discussed previously. Only by visiting this site and general location does this become apparent, Figure 8.8 in a computer-generated viewshed analysis confirming this. One possible hypothesis explaining this will be discussed in chapter 9.

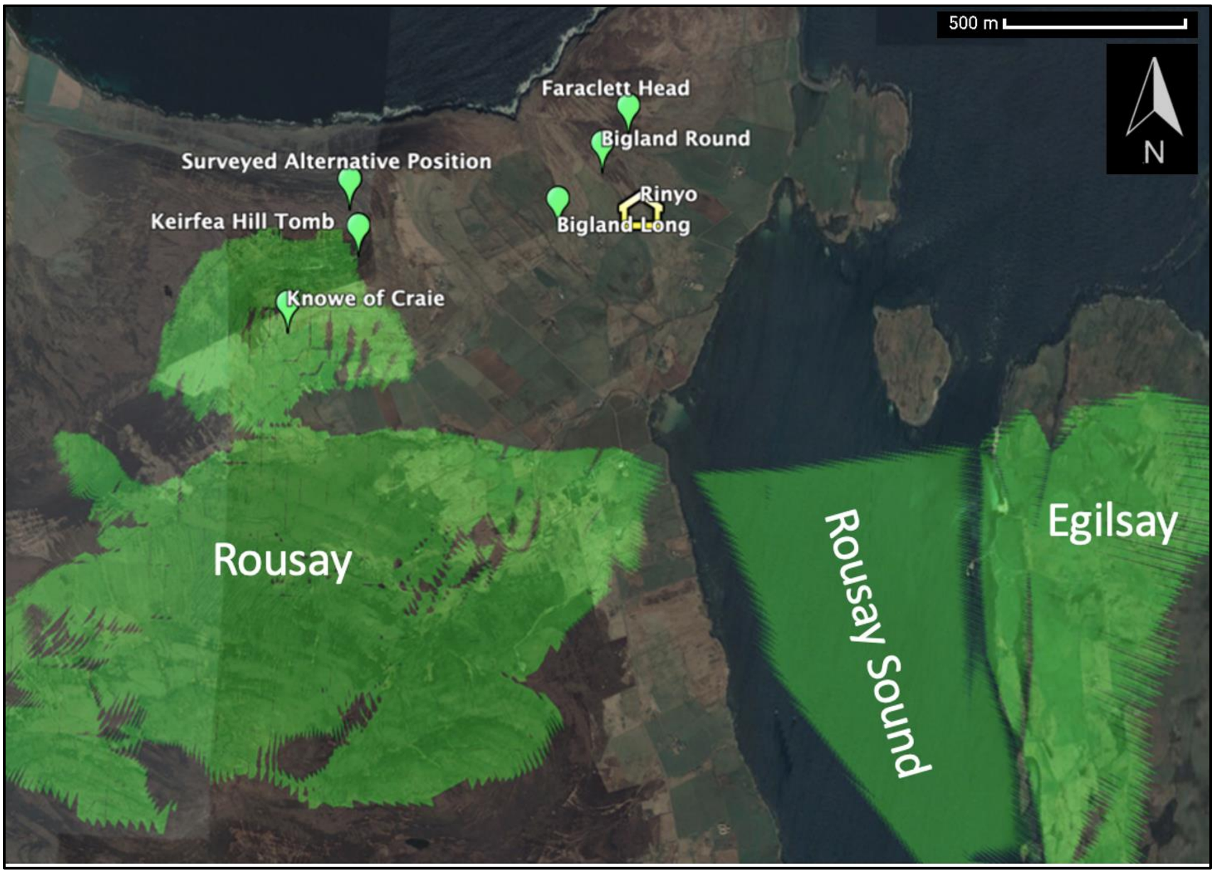


Figure 8.8. Viewshed analysis from Knowe of Craie, Rousay (annotated Google Esrth Pro viewshed image)

Of the lower altitude tombs Holm of Huip at only 18m is situated at the highest point on a small island adjacent to Stronsay. Today the top of the cairn is a sea marker and is utilised as a navigational aid within modern maritime charts. It is visible from several cairns on different islands from the closest at Earls Knoll (4.5 km) to the furthest at Mount Maesry (19.6km) and two of the Eday stalled monuments (Sandhill Smithy and Eday Church are aligned directly upon it.

Withebeir on Eday is a monument of unknown classification - this makes it difficult to date but could suggest a stalled cairn. This monument is visible from the stalled monuments (likely contemporary) at Eday Church (2 km), Sandhill Smithy (2.4 km) Huntersquoy (2.4 km) and Braeside (2.3km). Further, the passage graves Eday Manse (3 km), Vinquoy Hill (2.7km) and the Setter Stone (2.2km) can also be seen as outlined previously. It remains possible that these passage and stalled tombs were in use simultaneously. Withebeir is positioned in such a location that it clearly skylines Vinquoy Hill and noticeably from Vinquoy Hill (see Figure 8.10) the same can be said in reverse. It is very tempting to suggest that this was an intentional relationship. Both these monuments look over the area around the Setter Stone which is extremely rich with Neolithic archaeology. To add weight to any relationship the passage of the tomb at Vinquoy Hill is broadly aligned with Withebeir. Figure 8.9 presents the intervisibility assessment in diagram form.

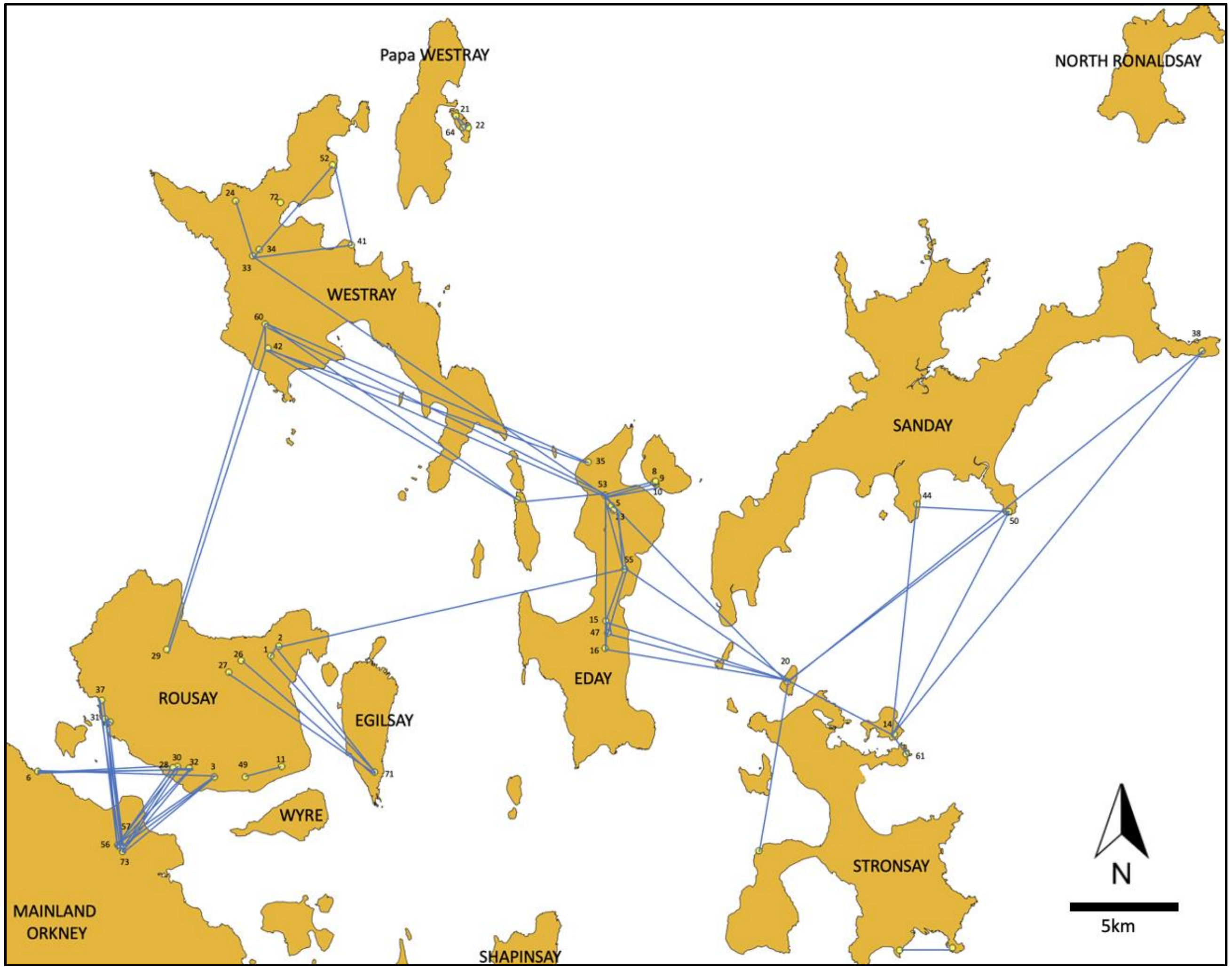


Figure 8.9. Diagram showing the intervisibility assessment of all the monuments of the North Isles utilising data from Table 8.1 and 8.2 above (annotated QGIS mgeberated map)

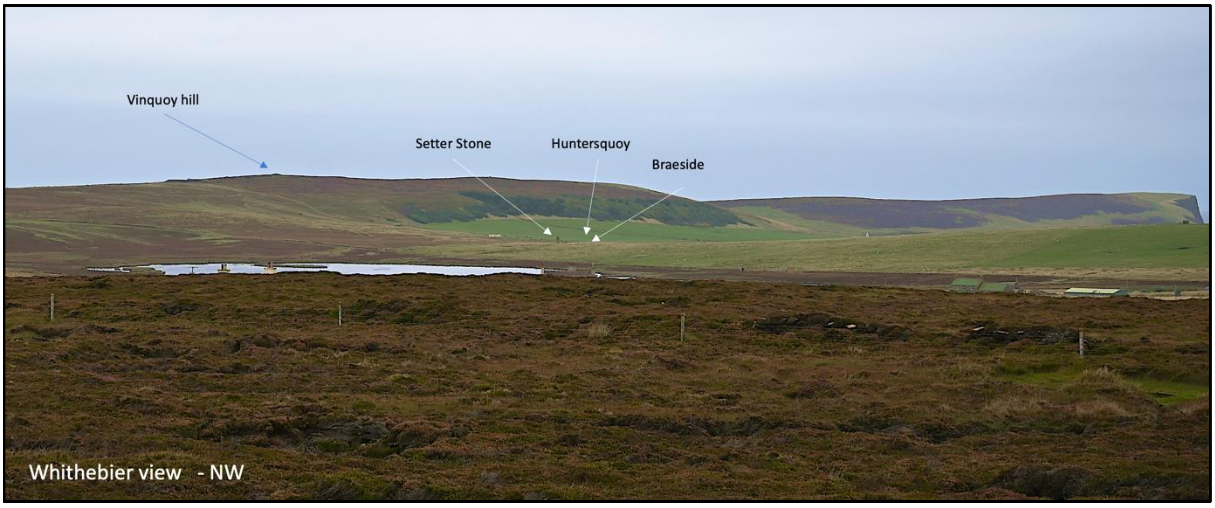


Figure 8.10. Photograph taken north-west facing from Withebier chambered cairn annotated to include other monuments landscape features (authors own photograph).

This may suggest that Withebeir was first and the passage grave at Vinquoy Hill was sited in relation to it, the former benefitting from later phases as traditions changed. Alternatively, there remains the possibility that they are indeed contemporary and were sited prominently to overlook the Eday north Neolithic monumental landscape around the Setter Stone. The latter is not dated though it is notable that the stalled cairn at Braeside which typologically would have been present at the earliest Neolithic activity in the area is aligned exactly upon the Setter Stone or vice versa. This of course does not prove definitively that it is contemporary it is merely suggestive. This impressive standing stone is sited prominently within the Eday monumental Neolithic landscape and marked as a focal point when viewed from the north possibly from the sea Calf of Eday Sound (Ritchie 1996).

Figure 8.11. Photograph taken east facing from Vinquoy Hill passage grave annotated to include other monuments, Islands and landscape features (authors own photograph).

Vinquoy Hill on Eday has one of the most widespread views. It is positioned below the peak overlooking the area around the Setter stone (Figure 8.11). On Eday it is sited to stand prominently over the north area of Eday with views of the Calf of Eday tombs, Braeside, Huntersquoy, all of which are from the stalled cairn tradition and potentially earlier than the Setter Stone and Withebier. There is no scientific dating for these monuments but typologically it is thought these monuments were in landscape contemporaneously. Similarities in masonry techniques have been noted at both Vinquoy Hill and Huntersquoy despite them being of completely different classification (Calder 1938, 197). This strengthens the arguments presented in chapter 5 (chronology) of this work which identified new phasing evidence and concluded that the tomb traditions in Orkney do not comply with an exacting chronology that has been presented previously. It supports any argument they were in use at the same time. Interestingly both are positioned on higher ground in locations chosen to be eminently visible by sky lining from the Neolithic landscape below. This phenomenon is not without precedent in Orkney. On Mainland high above the Bay of Firth two passage graves, Cuween and Wideford Hill are positioned to be aligned upon each other. Both are also positioned looking over several settlement sites in the Stonehall (see Richards and Jones 2016) and Smerquoy. Unlike the Eday example here the monuments are not sky lined and are notably less prominent when looking up from the settlement sites towards the tomb (V. Cummings *pers. comm.*) but the view the other way is all encompassing.

In summary a significant number of monuments have an unequivocal visual relationship with other monuments. Table 8. 3 shows there is little to separate the stalled cairns from the passage graves. The data presents an argument that it was a fundamental intention of the builders was to have sight of another tomb and this is the case for stalled and passage grave monuments. The only nuance to this being that tombs are often located in geographical clusters around certain places such as settlements or ritual places which incurs a certain inevitability of intervisibility given the landscape of Orkney. Furthermore, the distances between some of the tombs is restrictive with normal vision and may only be visible if there was an enhancing feature such as fire lighting at certain times. The case for conclusive intervisibility relationship is demonstrable at the four tombs previously - Withebeir / Vinquoy Hill and Wideford Hill / Cuween. With the exception of the potential multi-phase tomb at Withebeir all in this association are

Orcadian passage graves and this suggests that siting decisions were not universal between the different monument traditions.

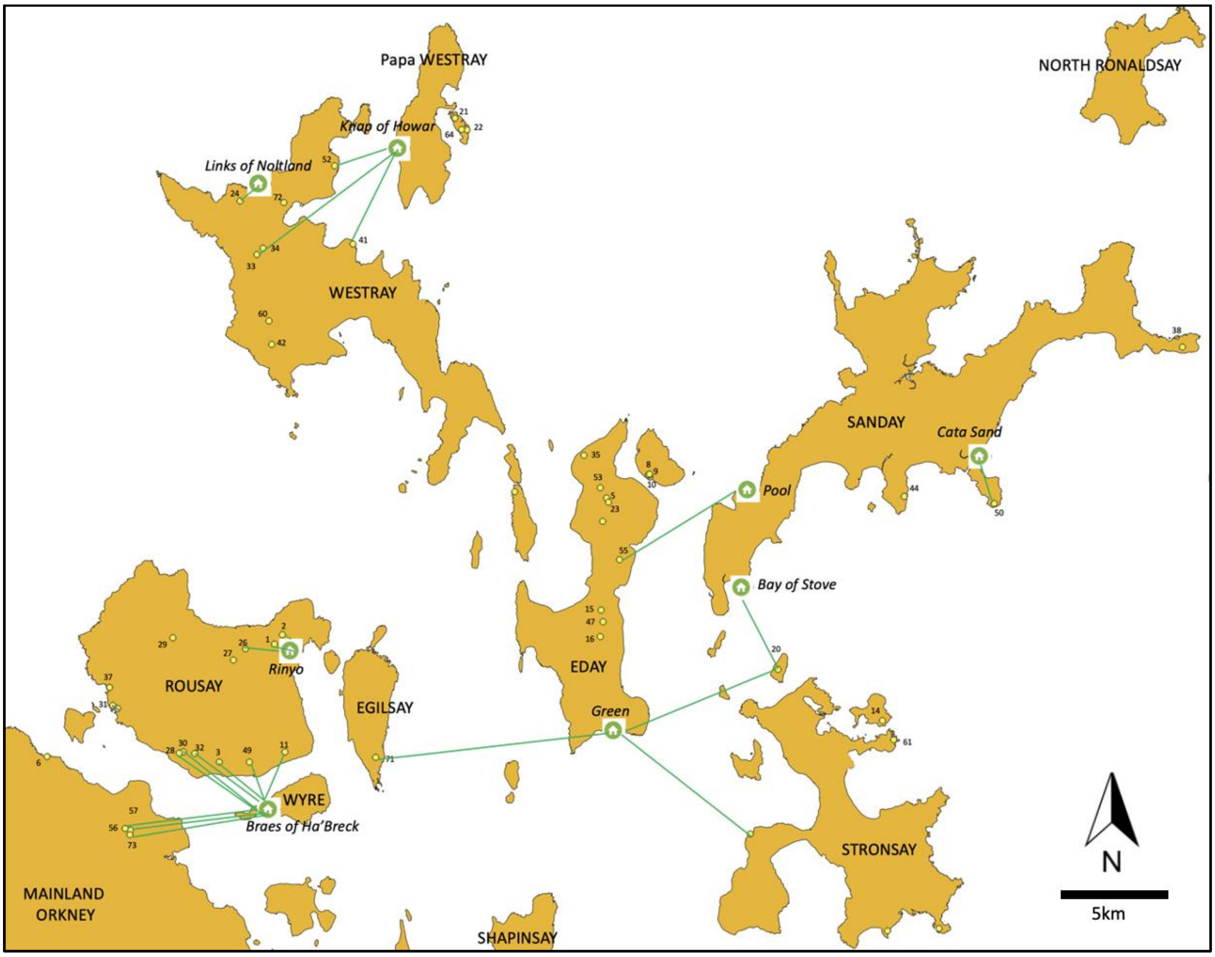


Figure 8.12. Diagram showing the intervisibility assessment of all the monuments and settlements of the North Isles (annotated QGIS generated map)

Relationships with settlements

Several chambered cairns are near known Neolithic settlement sites, something that has been commented upon in the archeological literature (Bayliss *et al.* 2017; Childe 1942; Davidson and Henshall 1986, 17; Fraser 1980, 1; Richards and Jones 2016). There are a number of known Neolithic settlements for the North Isles namely Links of Noltland on Westray (see Brend 2010; Clarke 1981b; Moore and Wilson 2015); Pool (see Lowe 2008; MacSween 2009) and Bay of Stove (see Bond *et al*. 1995; Gibson 2008; Morrison 1995) on Sanday; Green on Eday (see Miles 2007a; 2008a; 2009a); Rinyo on Rousay (see Childe and Grant 1939; 1949; Clarke 1983) and Braes of H'breck on Wyre (see Lee and Desalle 2016**;** Lee 2014; Thomas 2011).

In addition, there are several identified houses or farmsteads. The Knap of Howar (Ritchie *et al.* 1983) and Cata Sand (Cummings and Richards 2016; Cummings *et al.* 2017), Despite these it is correct to say that the evidence across the archipelago remains sparse and undoubtably incomplete. Many of the North Isle settlement sites have associations with chambered tombs which are considered contemporaneous. Virtually all the identified settlements can be associated closely with a chambered tomb as depicted in Figure 8.12. There are exceptions on Sanday at Pool and Eday at Green. In respect of Pool the Withebeir site on Eday is intervisible though at a distance and over sea some may have difficulty in suggesting they are interrelated. There are other possibilities. In 1928 reports by a local resident discovered and described two chambered tombs at Boloquoy, Sanday (RCAHMS 1946; 1980c). These have been reported upon though never confirmed and do not appear in Davidson and Henshall's gazetteer (Davidson and Henshall 1989). Had these tombs been confirmed they would conform with the settlement/monument model seen elsewhere. Having visited the location (no upstanding evidence exists today) these monuments would have been intervisible with the Pool site being situated on raised ground set above the settlement about a kilometer away.

With similar provenance, a chambered mound was reported at a location close to and intervisible at 600m distance with the Stove Bay settlement. It should be borne in mind that this settlement has been affected significantly by coastal erosion and this bay may well have benefitted from more land in Neolithic times; what today is seen on the coast is likely to have been an inland location. This was in 1911/12 and today no remains today can be discerned. It is possible that this would have been the related tomb for the Stove Bay settlement (RCAHMS 1946; 1980c).

Further, on Sanday the solitary house at Cata Sand has only a distant view of Tresness tomb though it should be recalled that due to the environmental factors outlined in chapter 3 this landscape has undergone considerable transformation since the Neolithic and with it the undoubted loss of archaeology. Nevertheless, this house does sit at the access point to the Tresness Peninsula that has the Tresness multi-phase monument located on it. Green on Eday is the further exception and by visiting this area and experiencing the landscape together with knowledge of similar relationship on patterns from other islands one does wonder the archaeological record on the distribution patterns for Eday are missing some early tombs especially on the eastern slopes of Ward Hill. Alternatively, Green may have acted as the southern port-like settlement given its North Isles strategic position a place the islanders and travelers utilised as part of a journey to the ritual landscape we have already discussed in the north of Eday. This was noted as an observation only.

A more straightforward settlement / cairn association is found on Westray with a probable tripartite stalled cairn at The Lum Head and its position in relation to the Links of Noltland site. It is both aligned (Figure 8.13) and intervisible with this settlement.

Figure 8.13. View east from Iphs (The Lum Head) on Westray overlooking the Neolithic settlement site of The Links of Noltland to the east (authors own photograph).

Similarly, neighbouring Papa Westray where the Knap of Howar farmstead is located and sits less that 2km from the Holm of Papa Westray and its trio of monuments of both the stalled and passage grave tradition. Today there are no identified burial monuments on Papa Westray though it seems likely these two islands were both one during the early Neolithic and have only become separated as a result rises in sea levels. The north and south tombs are only a matter of 700m apart and are thought to have had contemporaneous usage which has been borne out by the Unstan and Grooved Ware pottery assemblages found within both (Ritchie 2009, 27). This is thought to have been the burial site for the community that used the houses at Knap of Howar (Ritchie 2009, xix). Other monuments are visible from this Knap of Howar site across the Papa Sound. The two stalled monuments at Vere Point and Point of Cott will have been seen over the sea at a distance of 2.7 km and 4.6km respectively. It is worthy of note that having visited these sites this visibility is at its most enhanced when looking from the monuments towards the settlement. The converse view takes a little more concentration though it is acknowledged that the limited remains of these two sites today may have caused this situation. Withebeir tomb on Eday similarly has a commanding view of the Pool settlement site on Sanday a matter of 6km away across the Eday Sound from Pool this monument is very visible due to its sky lining (Figure 8.14).

Figure 8.14. View northeast from Withebeir, Eday overlooking the Neolithic settlement site of Pool on Sanday (authors own photograph).

Rousay provides the most compelling case study in relation to this. For the purpose of this assessment the island has been divided into two broad the zones - north zone and the south zone – and have been devised simply for descriptive reasons in presenting this analysis - it is not suggestive of any social or temporal differences. These zones have been segregated due to the topography of the island with gap between the Hills of Brown, Ward, Kierfea, Knitchen, Blotchnie creating a natural ravine between the two (Figure 8.14).

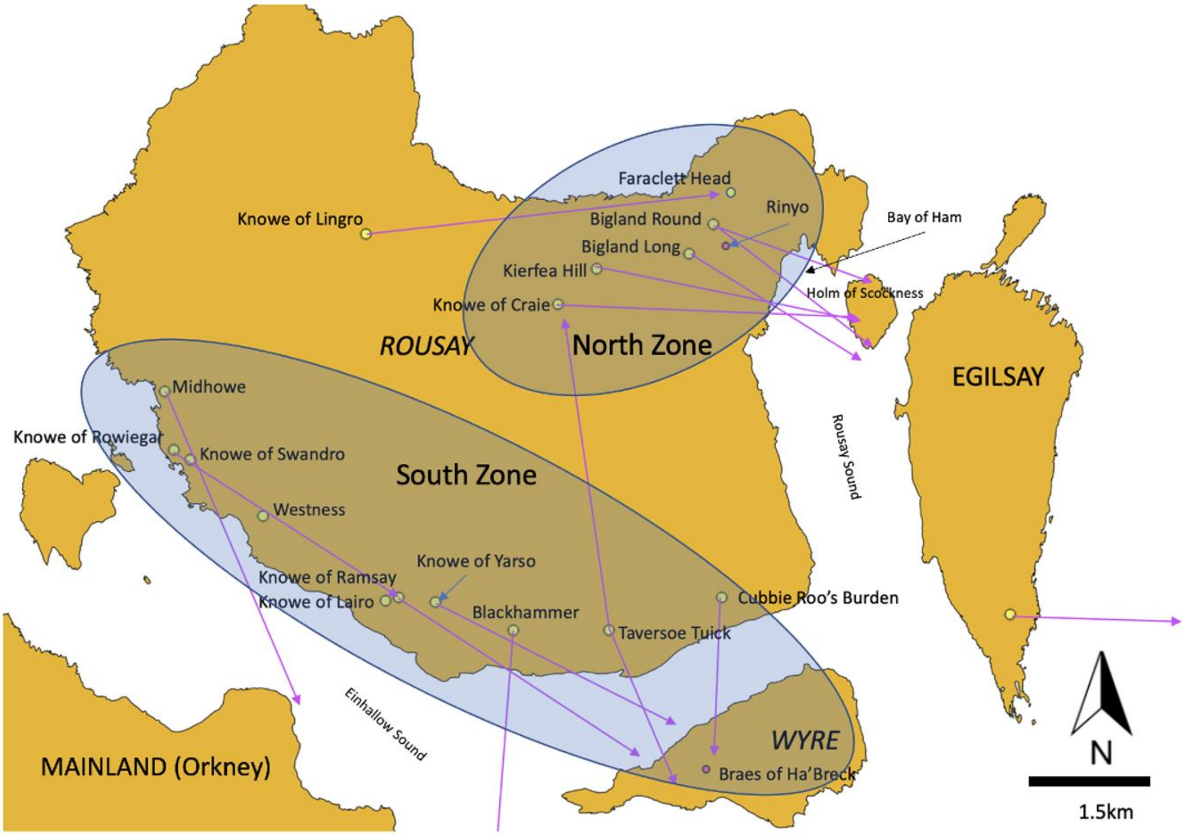


Figure 8.15. GIS produced map of Rousay and its surrounding islands which shows chambered cairns in yellow, settlements in red and alignments (where available) in pink and the descriptive zones North and South highlighted in opaque blue Anotated QGIS map).

In the north zone (see Figure 8.15) the stalled cairns at Bigland Round, Bigland Long, Kierfea Hill, Knowe of Craie and the Faraclett Head cluster form an identifiable group that are positioned in close proximity to the Neolithic settlement site at Rinyo (see Childe and Grant 1939; 1947). All these monuments are set on elevated ground orientated towards the south-east compass quadrant and towards the Neolithic settlement and its immediate surrounding area. The full extent of this settlement has not been established definitively though a recent geophysical survey has revealed that this site likely extended around the current site to at least c. 2000sq meters (Mainland and Moore 2010a). Whilst there is no current ground proofing of this finding it seems appropriate to argue this will cover a wide extent of the lower area surrounding Rinyo and towards Rousay Sound. Together they create an uncomplicated relationship by virtue of proximity. Additionally, typologically the tombs are likely contemporary to each other and following extensive excavations settlement pottery find analysis noted that the fabric of the ceramic recovered from the Rinyo site as being 'identical' to those found at Unstan and Kierfea Hill chambered tombs (Childe and Grant 1947, 36).

The highest altitude monument of this group (and in fact across the archipelago) Kierfea Hill is located near to the summit. This hill is of striking prominence when field surveying the area and affords far reaching spectacular views over the north-east of the island including the immediate view of the 'north zone'. Having visited the site it is positioned to have a view of the lower land that is occupied by the Rinyo settlement. It was noted that from the settlement there is no sky lining of the monument though there will have been little difficulty in identifying the tomb from the settlement given its proximity and the fact the hill itself is a visually prominent landscape feature in itself will have been ever present for the people that lived here. The in-person viewshed assessment ascertained an extensive view over the lower lying Rinyo settlement and its surrounding area. In addition, the other monuments in this 'North Zone' have outward passage alignment broadly with the area surrounding the settlement boundary (see Figure 8.16). This would take in the fields where the Rinyo community work as well as the houses where they lived. It is almost inconceivable that this cluster of monuments are not interrelated to the settlement of Rinyo.

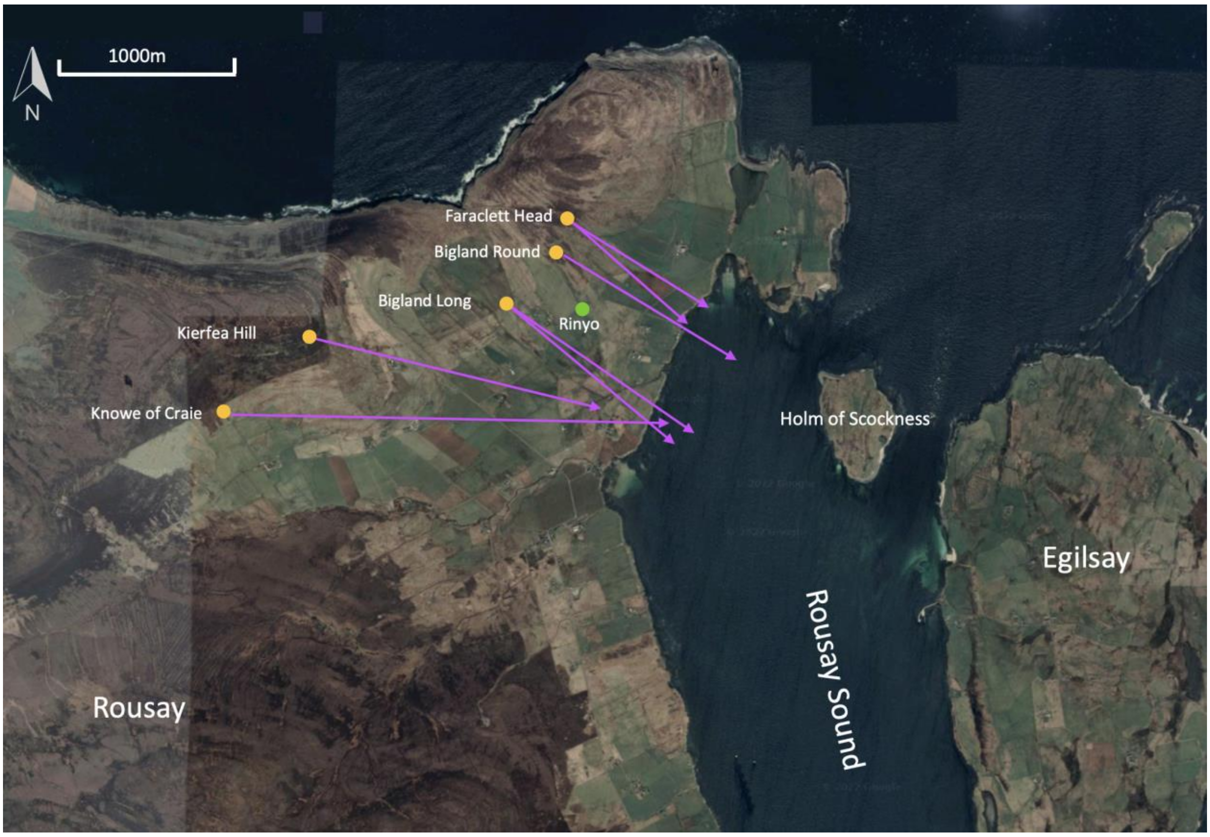


Figure 8.16. Google Earth Pro produced map of Rousay and its surrounding islands which shows chambered cairns in yellow, Settlements in green and the monuments alignments in pink where known (annotated Google Earth Pro).

Is this visibility towards settlement replicated within the 'south zone'? In the south of Rousay the passages of the stalled cairns at Cubbie Roos Burden, Knowe of Yarso and Taversoe Tuick (lower chamber) are all aligned in the direction of the point to the Braes of Ha'breck Neolithic settlement on the neighbouring island of Wyre which is less than 1km away (Figure 8.17). This early Neolithic settlement is also clearly visible from Blackhammer and the Knowe of Lairo tombs and has been dated c 3585–3375 cal. BC (Thomas and Lee 2012) contemporaneous with these 'south zone' monuments on Rousay. The 'south zone' monuments occupy natural platforms of rocky outcrops that sit above the agricultural land and the coast. The monuments are positioned along the very boundary between heathland and the land useful for farming as seen in Figure 8.17. It is not thought that the island of Wyre was physically connected to Rousay during the Neolithic but it will have been easily accessible by boat and given that there are no tombs on Wyre it follows that the communities of both island considered themselves as one or at the very least the smaller island was dependent on the Rousay people and utilised their tombs for funerary practices.

Figure 8.17. Viewshed analysis from the Braes of Ha'breck on Wyre showing visibility between itself and the monuments of Rousay and showing passage orientation (annotated Google Earth Pro viewshed map)

Having viewed the 'south zone monuments' from the sea in Einhallow sound and close to the island of Wyre it is notable that they appear elusive and tricky to identify. It is acknowledged that they will have taken a different form when in use and it could be imagined their appearance would afford slightly enhanced visibility. Nevertheless, the experience from visiting the locations points towards a preference of visibility from the monument towards the settlement as opposed to the other way around. This suggests that the settlement was chronologically earlier than the monuments, at least during its primary phase. The earliest dates for this site being within the 3600-3500 cal BC time slice detailed at chapter 5 (see Figure 5.9 a).

Furthermore, this work has identified that during the early Neolithic it is possible that Wyre was either a permanent or tidal addition to the modern island of Rousay. The 2m and 5m submarine contour obtained from modern admiralty charts as shown in Figure 18.8 demonstrates that there is only a short distance (c.30meters) between the islands of Wyre and Rousay when reconstructed from today's charts. However, given the high energy tidal action around Orkney and in particular within the Einhallow Sound the coastal morphology is likely to have been significantly affected by erosion as it was by sea level change (Leinert *et al.* 2000, 510) since the Neolithic. This adds weight to the argument for a connection between the two islands during the earliest Neolithic. In any event by the very least it would have been easily accessible and therefore strengthens the relationship between the monuments and the settlement at Braes of Ha'Breck. It is important to point out that this is included as a possible hypothesis and discussion point.

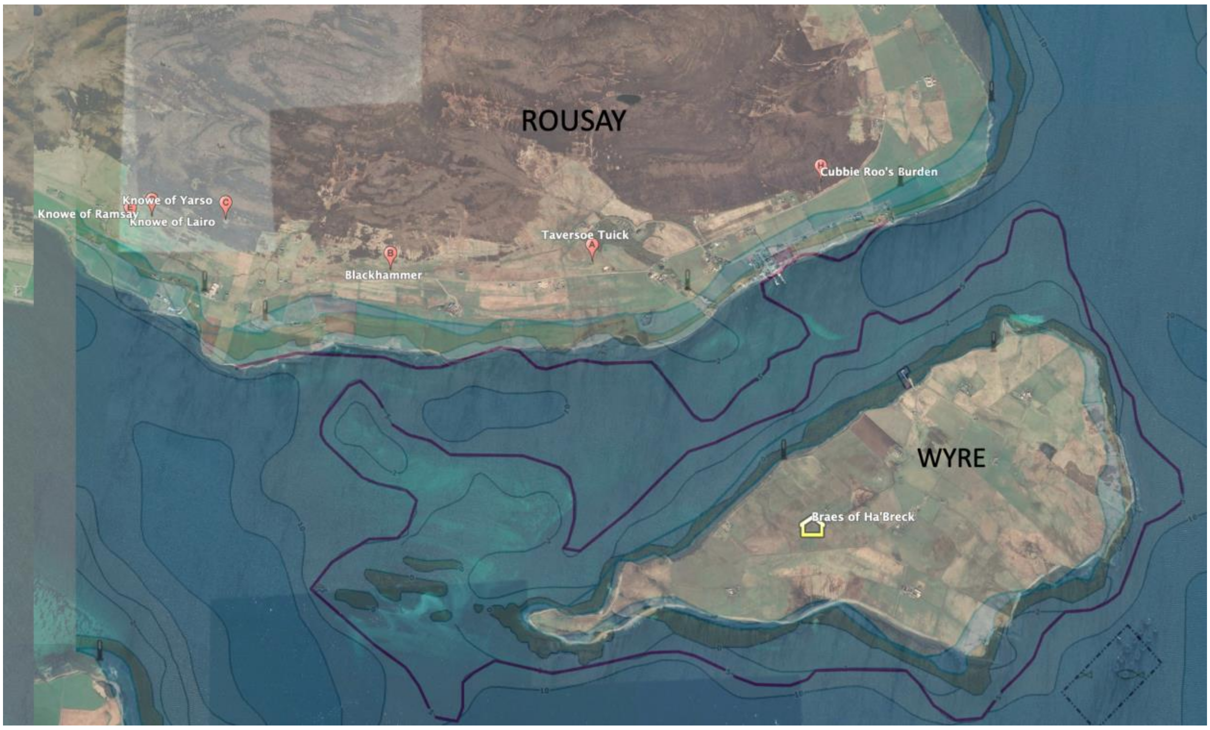


Figure 8.18. An overlay map showing the island of Wyre and the south of Rousay. The satellite image has been merged with a modern admiralty chart and the 5m contour highlighted in purple (annotated Google Earth Pro satalite image overlain upon https://digimap.edina.ac.uk/marine. under licence).

Moreover, it was clearly evident that from the lower agricultural land, coast, sea or the Mainland some detailed knowledge, concentration and visual assistance is required to identify any of these 'southern zone' tombs. Of course, they today consist of a grassy mound and certainly not how they would have appeared in the Neolithic. That said it remains very much the case that from the tombs themselves there is a commanding and dominating view of these same locations is undeniable.

This settlement relationship assessment demonstrates that there is a temporal and spatial relationship between stalled cairns and settlements. This is not replicated with the passage graves of the North Isles; there are none that can be said to be related to currently identified settlements. This suggests a change of beliefs and the accompanying siting decisions of monuments. The small, segmented houses at Cata Sand and Knap of Howar do have some interconnection with tombs though it is somewhat unambiguous and relies on their associated tombs being less conspicuous some distance away at the edge of the Tresness promontory as in Cata Sand and on the Holm of Papa Westray promontory (as was in the Neolithic) for Knap of Howar. This indicates that tombs associated with multi-house communities had a more important part to play in the day to day lives of their residents or indeed they were important for leaders of communities which are more likely to be found in the larger settlements and not single or isolated farmsteads. Rousay as a test study presents the most dominant argument for stalled cairn /settlement interrelationship with Westray also following this pattern with the Links of Noltland group. Conversely, on Eday the only known Neolithic settlement at Green has no known association with any tomb though it is unlikely that Green would have been the only settlement on the island in the Neolithic. In Sanday with Pool and Cata Sand settlements having a less discernible relationship we can see that different practices are playing out on different islands. For completeness Stronsay, Shapinsay and North Ronaldsay have no known settlements to date from which to make an assessment. Further observations to be made by this analysis are that settlements are positioned broadly east of their associated monuments and all those associated monuments are of the stalled tradition. Furthermore, they are all situated on elevated positions to be looking down on the settlement. Conversely, it could be argued the settlement dwellers are looking up to the tombs though issues with the discernability have been highlighted and experienced form field surveys. This phenomenon creates visions of an elevated monument being illuminated by the rising sun before the sun rise greets the settlement. Moreover, at certain times of the year the sun may be seen to fall behind the tombs or in the general direction. This directional relationship is the same form all the examples noted save perhaps the Knap of Howar/ Holm of Papa Westray which is a non-intervisible relationship. If the Knap of Howar community was 'linked' to Vere Point tomb then the same pattern would be achieved.

Relationship with the sea

There have been several studies that concern themselves with the relationship between burial monuments and the sea specifically in Orkney (Phillips 2003; Sturt 2005; Woodman 2000). This section will assess the landscape relating to marine communication routes between individual islands. As stated in the introduction It is not intended to be a detailed appraisal of individual island travel strategies more how people moved between the different islands. Assessments have also been made as to locations of suitable beaches for landing craft of a type utilised in the Neolithic, navigational aids for ancient mariners and how chambered tombs may relate and the routeways utilised by sea and land. Prehistoric marine voyages will have been precarious given the heightened risk posed by the treacherous seas surrounding Orkney. Regardless, sea voyages inevitably occurred. It has been well established that long-range voyages occurred were not beyond the abilities of the earliest farmers. Such travel being widespread throughout the western European seaways it has been suggested with good evidence that seafaring would have been integral to the daily routines of Neolithic Island dwellers (Garrow and Sturt 2011, 67).

There is scant evidence in the archaeological record concerning the technologies of Neolithic sea going boats (Garrow and Sturt 2011, 62). Therefore, we are not sighted on the exact nature of the craft used nor how they were used as in under paddle and/or sail power (McGrail 1983) or equally as likely both. At this time in Britain and Ireland it has been suggested that the vessels capable of undertaking sea voyages will have been hide or skin boats similar to the coracles that are capable and stable boats for the task

(Bowen 1972, 36; Case 1969, 178; Mercer 2003, 5; 2017; Robinson 2013). One study suggests that a journey from Brittany to Orkney could be completed between 16-20 days (dependent upon season) via the east coast route and between 13-17 days via the western British seaways (Callahan and Scarre 2009, 364). Clearly the islands were populated with people and animals by sea (Glørstad 2013) and there is evidence that early Neolithic people were engaged in deep sea fishing activities often many miles away from shore in deeper water (Renfrew 1979; Sturt 2005). This is indicative that the earliest settled occupants of these islands were accomplished and skilled mariners.

Travel around the island will have been dependent on seafaring skills, local knowledge, craft technologies and likely daytime line of sight navigation (Noble 2006) and the use of 'mental maps' of distinctive landmarks (Broodbank 2000, 23). Do monuments have their part to play in these day to day activities? As noted previously – perhaps unsurprisingly on an archipelago - the dominating view from the predominance of monuments is that of a seascape (Woodman 2000, 95). Always within sight of another island, weather permitting, it has been suggested that a Neolithic seafarer will have benefitted from mental maps utilising distant landmarks as navigational aids. This matter will be returned to in discussion but claims that **all** monuments are there to assist interisland travel is problematic.

Landing locations

Having assessed the capability of the craft likely to be utilised and the ranges concerned a detailed study of Imray Seafaring navigational chart C68 (Cape Wrath to Wick and the Orkney Islands) was carried out to assess the suitability for landing craft such as coracle skin and hide boats. Figure 8.19 shows in yellow the areas where it is assessed such a craft will have been able to land and the methodology used is detailed in Chapter 4. There is a definite correlation between the identified Neolithic settlements and these sandy and light shale landing locations befitting of boat users. The sea routes have then been superimposed upon a North Isle map taking into consideration the range and type of landing place these routes appear viable and appropriate. They only depict interisland travel and not individual island coastal 'bay hopping' type navigation.

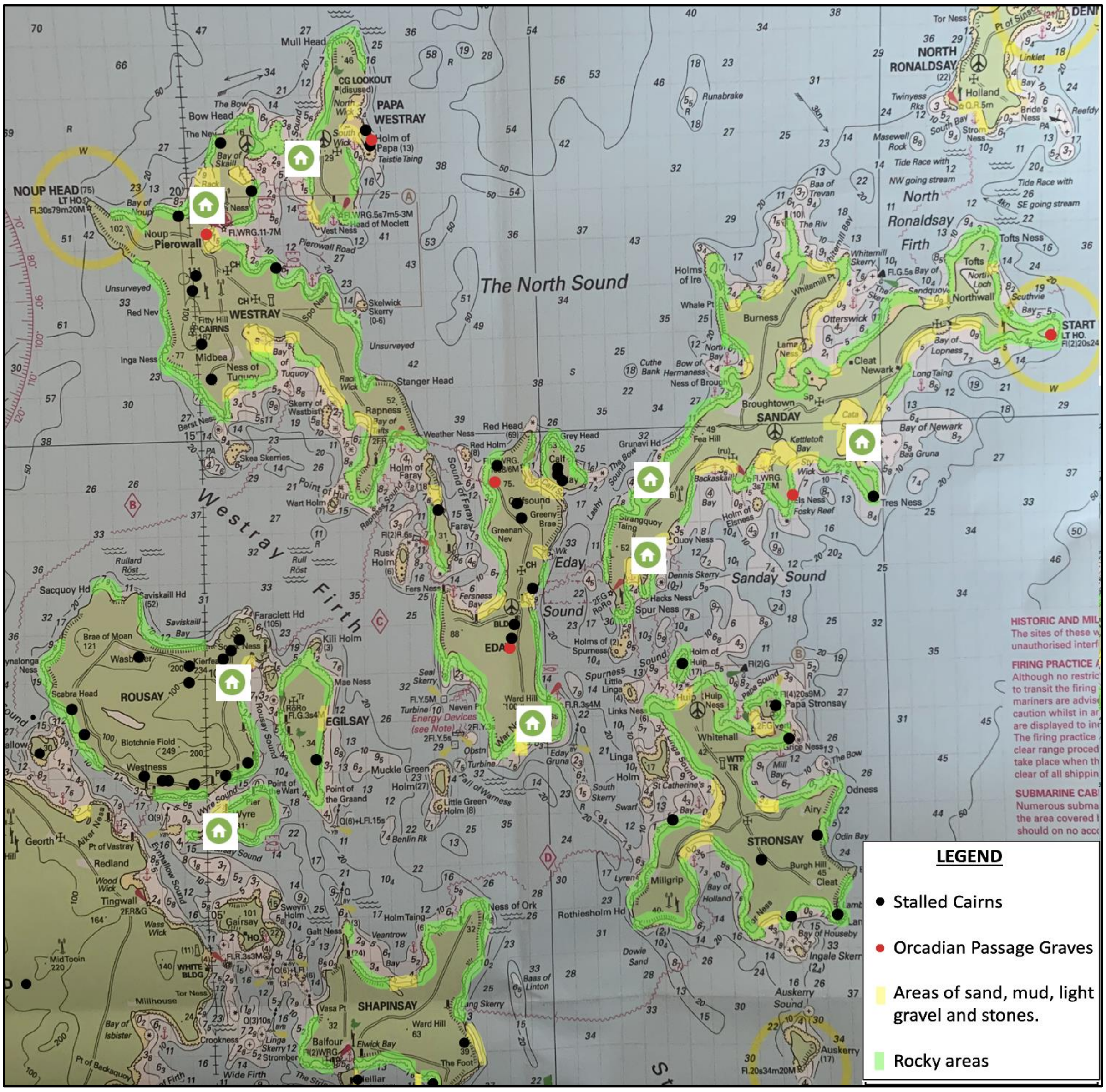


Figure 8.19. A photograph of a C68 Imray sea navigational chart with annotations showing the likely suitable landing points for hide and skin craft.

Tombs relationship with inter-island sea routes

At the turn of the millennium modelling calculated the range for small, paddled vessels (see Broodbank 2000, 102; Callahan and Scarre 2009; Nobel 2006, *fig 9*). More recently, in 2016, the BBC documentary '*Britain's Ancient Capital: Secrets of Orkney*' undertook an experimental archaeology project to explore Neolithic seafaring using a hide boat. The project covered construction to voyage and saw an experienced eight person Orcadian crew paddled a large skin/ hide coracle craft across the Pentland Firth Hoy to Mainland. The 14.5 km crossing took 4 hours and 50 minutes which provides some tested evidence and therefore a basis for broadly assessing the distances that could be travelled at a time contemporary to the chambered cairns. This may call into question the previous travel times from Brittany to Orkney (Callahan and Scarre 2009, 364).

It is acknowledged that there are features of the tides that include seasonal changes, spring and neap tide adjustments, localised rip tides and tidal races which may have affected any journey. This detail is out of the scope of this research, but it is suggested that these nuances and risks of travel will have been within the knowledge of the Neolithic mariners and therefore considered. The tidal streams within the confines of the North Isles are notably less treacherous than the Pentland Firth and given the manner of the ebb and flow of the central island tides easterly and westerly travel would have been favoured (Hydrographic Office 1899). Any experienced Neolithic mariner would have utilised these directional tide flows to enhance viability of inter-island journeys. Figure 8.20 shows the likely inter-island routes with distances annotated. It has been formulated from the results of the beach/landing place assessment and took cognisance of the achievable travel times. It is clear that any travel between the North Isles is comfortably accomplished within the range of several hours journey time.

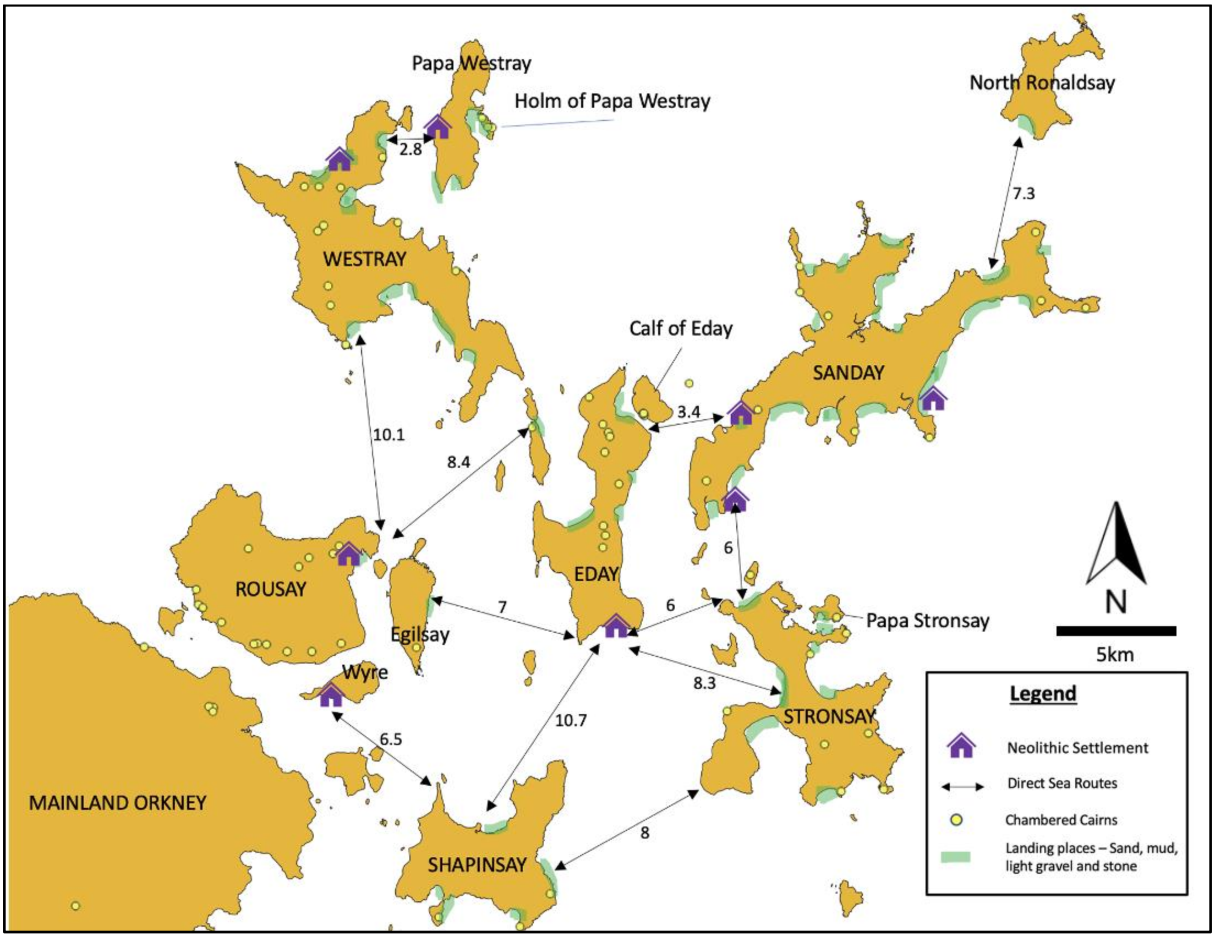


Figure 8.20. QGIS generated map of the North Isles with direct sea routes, settlements and chambered cairns. Direct sea routes are annotated with distance in kilometers.

We begin to see that transportation between the islands is achievable within a day and that the central position of Eday within this northern group of islands begins to elevate its geographic position and relationship with the other North Isles. It sits like a hub of a wheel and it is easily imagined that it will have been important in respect of inter-island communication and a convenient staging point for vessels making journeys around the archipelagos north realms. We have seen in the previous chapter that Eday has a tomb alignment pattern - one which takes in all the cardinal points of the compass. This situation is atypical in compassion to its neighbouring North Isles and it is possible it is linked to this hub status. Further, it has no settlement/monument interrelationship, and it can also be noted that the monuments have a coastal preference in Rousay, Shapinsay, Stronsay and Sanday whilst the Eday monuments are in an elevated position with the exception of the tombs within the northern basin that have only limited view of the sea.

It is also discernable that of the islands that are most exposed to the western Atlantic weather fronts *viz*, Westray Eday and Rousay there are no monuments located on their western face and those that are so positioned are below the peak of any high ground always facing to the east. The broadly north/south linear string of monuments on both Eday and Westray do not have any westerly viewpoint and could not be seen from any craft approaching from the west.

On Rousay the north and south zone groups of monuments similarly have no view west and there is a clear absence of Neolithic archaeology at the north-west of the island a place that would on first sight appear appropriate place to live for Neolithic farmers. It follows that the distribution of tombs confirms there would have been little travel along the exposed western flanks of the North Isles. It is suggested therefore that the cairns of the North Isles could be utilized as line-of-sight seafarer tools for inter-island a navigation round and Eday was at the hub of any such travel. This all said, it must be borne in mind that whilst the tombs would have been of use to contemporary mariners it does not necessary follow that their siting was solely intended for that purpose and that the use by Neolithic mariners was simply a collateral benefit.

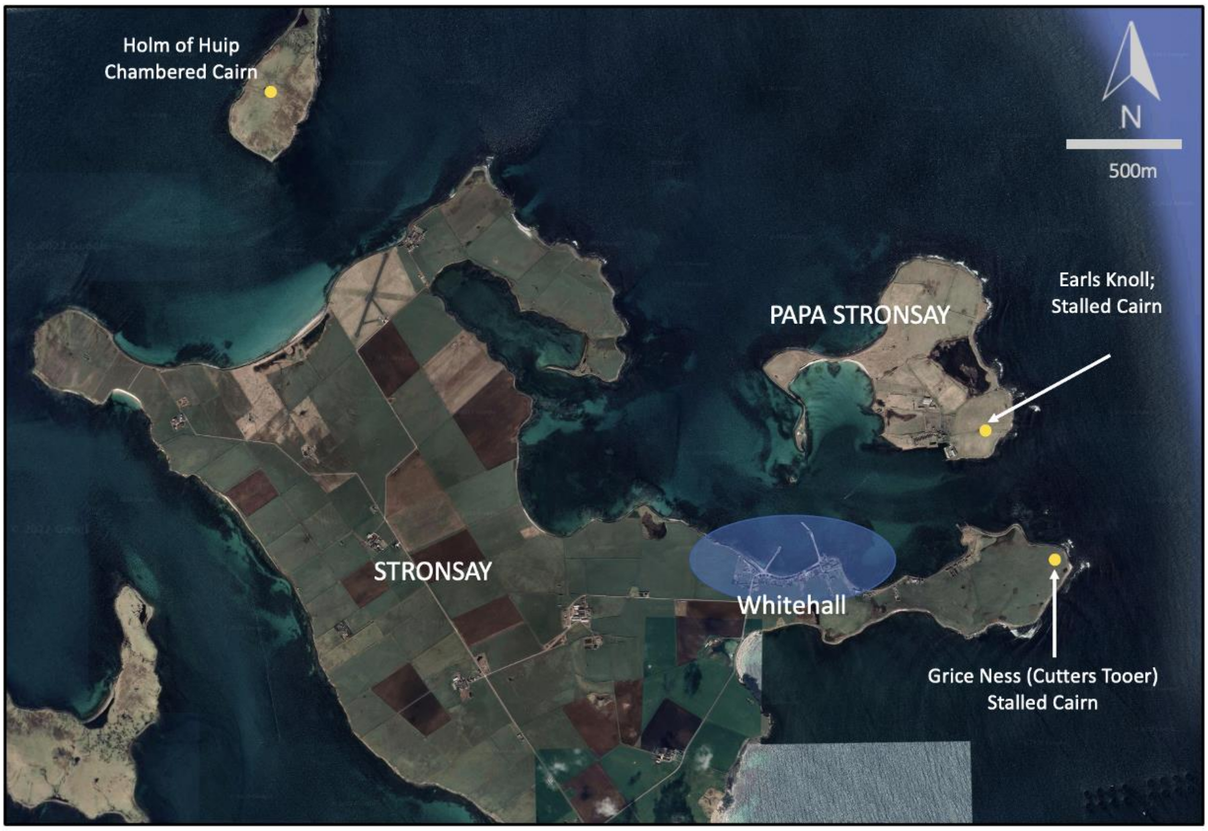


Figure 8.21. Google Earth image showing the stalled cairns in relation to the modern seaport in Stronsay

One notable feature of the chambered cairns today is that on several of the North Isles the tombs appear to be co-located with the modern quayside or island port. Earls Knoll and Cutters Tooer are located either side of Papa Sound just prior to the village and ferry port of Whitehall (Figure 8.21). This is a natural harbour used today as both the main town on Stronsay and the ferry terminal. Similarly, the Holm of Huip to the north of Stronsay is a prominent landmark when travelling between the islands by boat and notably visible landmark. This monument will certainly have navigationally aided anyone travelling by boat from the east (or indeed north) of the archipelago with the intention to land at Stronsay or Sanday. This situation is not without precedent across the islands.

Figure 8.22. Google Earth image showing the stalled cairns in relation to the modern seaport in Westray

At Westray, Point of Cott and Vere Point could be described as having a similar purpose to any mariner travelling into the Bay of Pierowall. Similarly, Trenbie and The Lum Head cairns would have afforded assistance to any craft intent on approaching the settlement of Links of Noltland (Figure 8.22). Closer to the Mainland Hellier Holm on Shapinsay and Head of Work on Mainland again seem to stand guard over the entrance the Bay of Kirkwall (*Figure 8.23*). On Sanday; Tresness and Quoyness can perform a comparable function. Whilst not co-located with the current quayside at Kettletoft they would have provided useful navigational reference point for craft aiming to enter Sty Wick (Figure 8.24) and its close proximity to the Cata Sand Neolithic house site. All these monuments with the exception of Quoyness are stalled cairns. Though it should be noted that Quoyness appears later in the chronology time slice in chapter 4 and the nearby monument at St Augmund Howe reported only as probable chambered cairn (Downes, 1998f; NSA 1834-1845; RCAHMS 1946; 1980c) may well have been of stalled classification and serving the same navigational purpose as the other examples. These findings suggest that any seafaring use or seascape prominence appears not to have been as important to the builders adopting the Orcadian passage grave tradition as those involved in the stalled cairn tradition.

Figure 8.23. Google Earth image showing the stalled cairns in relation to the modern seaport in Shapinsay and Mainland

Figure 8.24. Google Earth image showing the stalled cairns in relation to the modern seaport in Sanday. The blue shaded area representing the area suitable for landing and in close association with the known Neolithic settlement at Cata Sand.

Tombs relationship with interisland sea routes

Having travelled by sea to an appropriate landing point it is now time to look at the terrestrial routes that follow from these and assess if there is any identifiable relationship with the locations of the chambered cairns. It is arguable that within any group of closely dispersed of islands the sea routes could be seen as part of a conjoined terrestrial/marine transportation network that fuses together these more isolated communities. It has been said that '*human existence is not fundamentally place-bound…it unfolds not in places but along paths*' (Ingold 2009, 33; Schülke 2016; Tilley 1994, 25). These sea and land routeways become one and the same within the North Isles Island environment. Work has been undertaken in western Europe on the subject of routeways both local pathways and long-distance tracks within the Neolithic. This is new research, and little has been carried out specifically in Orkney in respect of the terrestrial routeways. By linking the sea routes as above with the landing beaches (or more accurately points where sea routes touch land) to 'special locations' on each island. These 'special locations' in this context may be ritual landscapes or areas of notable monuments or settlements. Detailed analysis utilising GIS, 1:25000 maps and field survey methodologies have identified a corelation between the linear alignment of monuments on three of the north islands that is indicative of critical way markers or signposts between landing points and central locations. Given the path of least cost effort principles of human behaviour it is suggested that amongst the smaller islands of Orkney the routes as we see them today, being born out of topographic constraints, will have been similar with prehistoric routes. One study in Germany has concluded that Neolithic routes conformed closely to later medieval roads (Raetzel-Fabian 2002). It follows that this same correlation on islands will have between prehistoric and modern times.

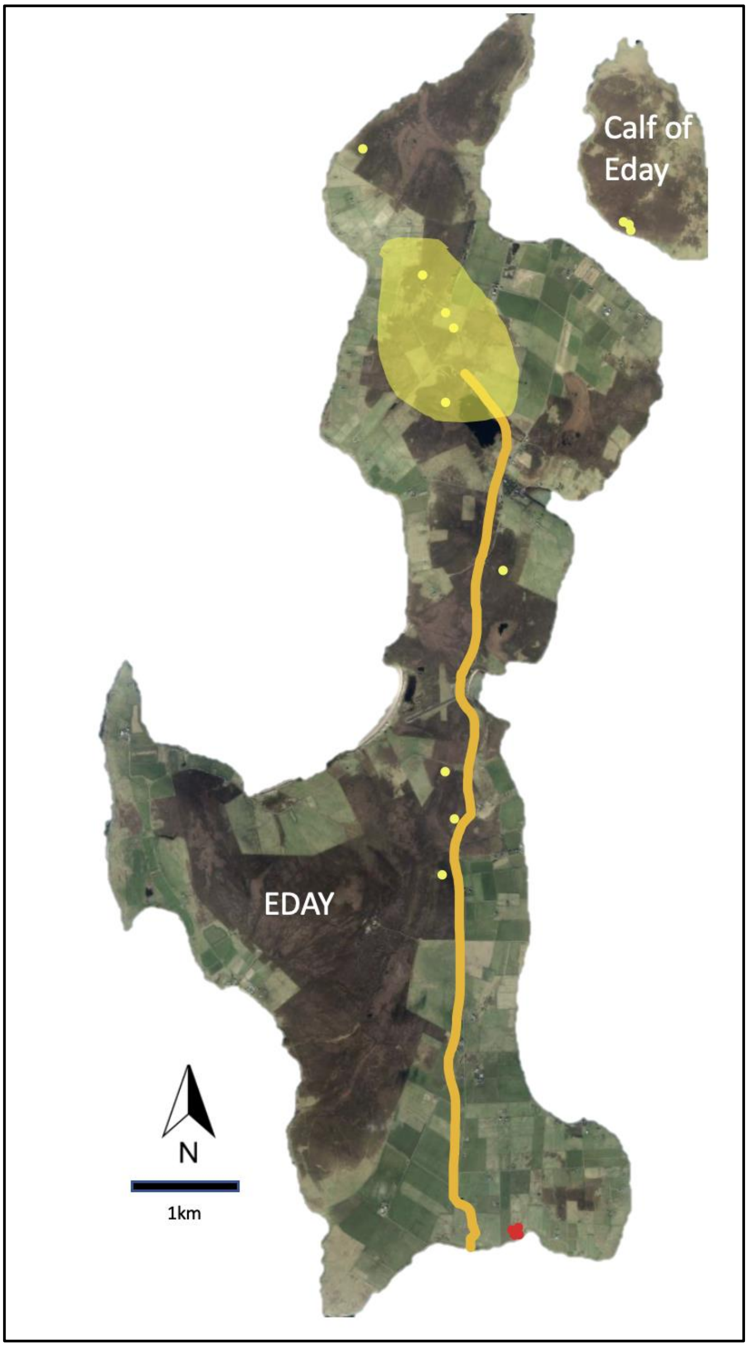


Figure 8.25. Google Earth image showing Eday with potential Neolithic routeway (mustard line) and its relationship with the chambered cairns of the island (yellow dots); Green Neolithic settlement (red dot) and Huntersquoy / Setter Stone monumental landscape (yellow shaded area).

Whilst driving/walking the routes during island surveys it is impossible not to notice the linear alignment of cairns on Eday. These monuments are arranged on the skyline as if guiding the progressing traveller from the south coast and the settlement of Green (Figure 8.25, red dot) towards the monumental landscape set in a natural basin at the north of the island (Figure 8.25, yellow shaded area). It is suggested that this will have been a place of some significance and any traveller to the island and the 'route' of monuments would have welcomed the sight to guide the way. The grass covered mounds of the cairns as they appear today perfectly allow for this experience as they appear sky lined; it will have been the case they appeared even more identifiable to the contemporary traveller. All the cairns that guide the way are positioned up high but by no means at the highest point and all have a view over the south/north running B9063 modern road which runs the length of Eday. Whilst travelling this road the cairns of Eday Manse, Sandhill Smithy, Eday Church and Withebeir (see Figure 8.26) are conspicuous by their presence and unmistakably visible from this road. Once the Bay of London is passed any traveller will be able to identify The Setter Stone which announces the arrival to the important Neolithic landscape. Any view to the west from all these monuments is non-existent due to their positioning and it is tempting to suggest that they had a specific role in directing island visitors to the ritual centre surrounding The Setter Stone.

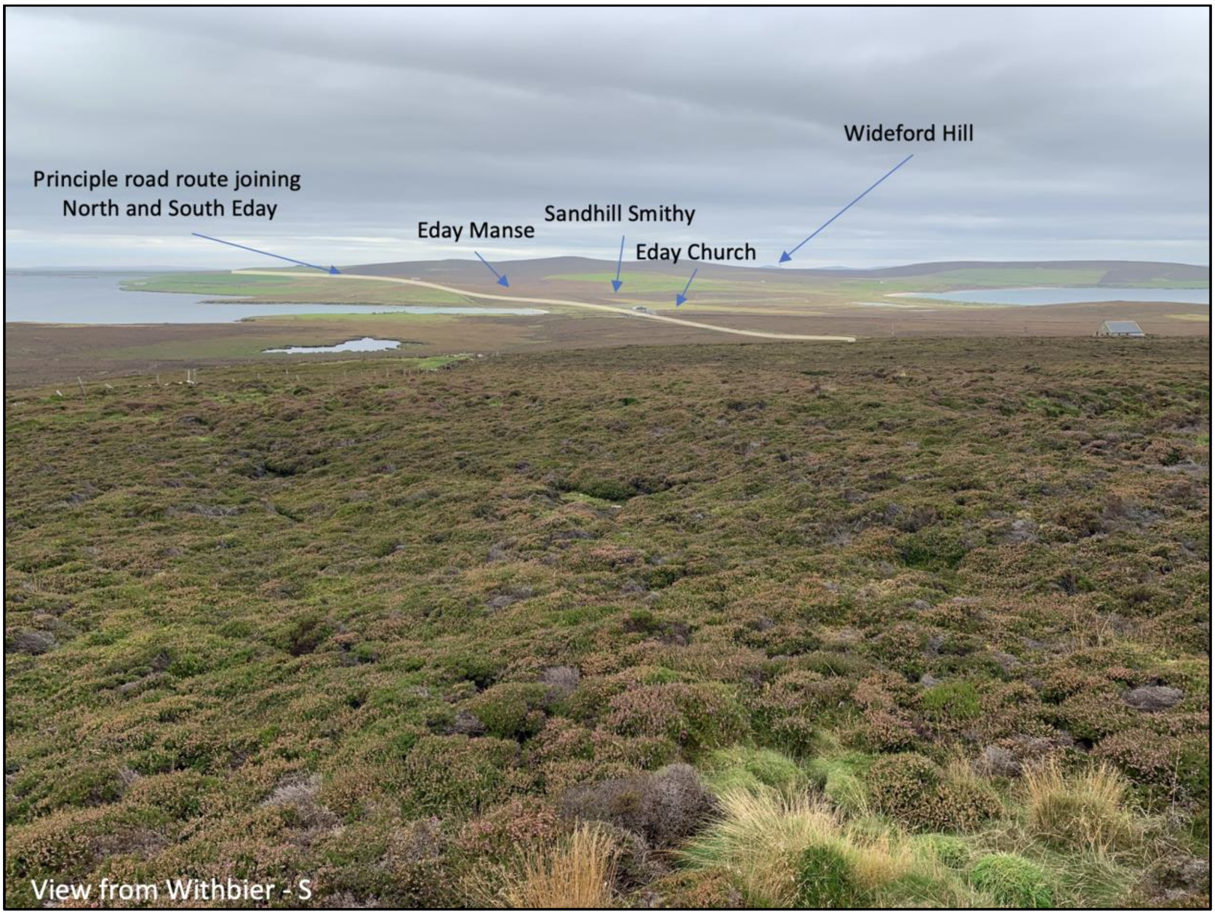


Figure 8.26. Photograph taken south facing from Withebier chambered cairn annotated to include other monuments landscape features and routeways (authors own photograph).

On Westray a similar situation can be identified. Here again a string of stalled cairns are aligned in prominent positions that would look down upon anyone using the routeways marked in mustard (right route) in Figure 8.27. This route broadly follows the modern roads and when travelling in these routes from the south the same phenomena as described for Eday is experienced – the monuments seem to be guiding you to the north of the island. This time the monuments of stalled cairns at Powdykes and Fitty Hill to the South of the island and Knucker Hill and Curquoy in the central area are degraded to such a state that they are more difficult to identify from the roadway today. Once the locations had been identified and the road surveyed it seems likely that these two would have represented a visible presence from the road at their time of their use. The route that these monuments are overlooking would take a traveller towards a centre of activity for the island of Westray those being the Links of Noltland Neolithic settlement and Pierowall passage grave. As with Eday these monuments sit below the peaks of the hillsides with an easterly outlook, it is clear when visiting these that a view to the west was not the intention of the builders here also. These routes would have been effective in joining the southern landing beaches that would have been used by any traveller coming from Rousay and Mainland to the centre of activity in the north and onwards to Papa Westray and its Holm another notable Neolithic tomb location. All these ‘route marking’ tombs are recorded as stalled cairns.

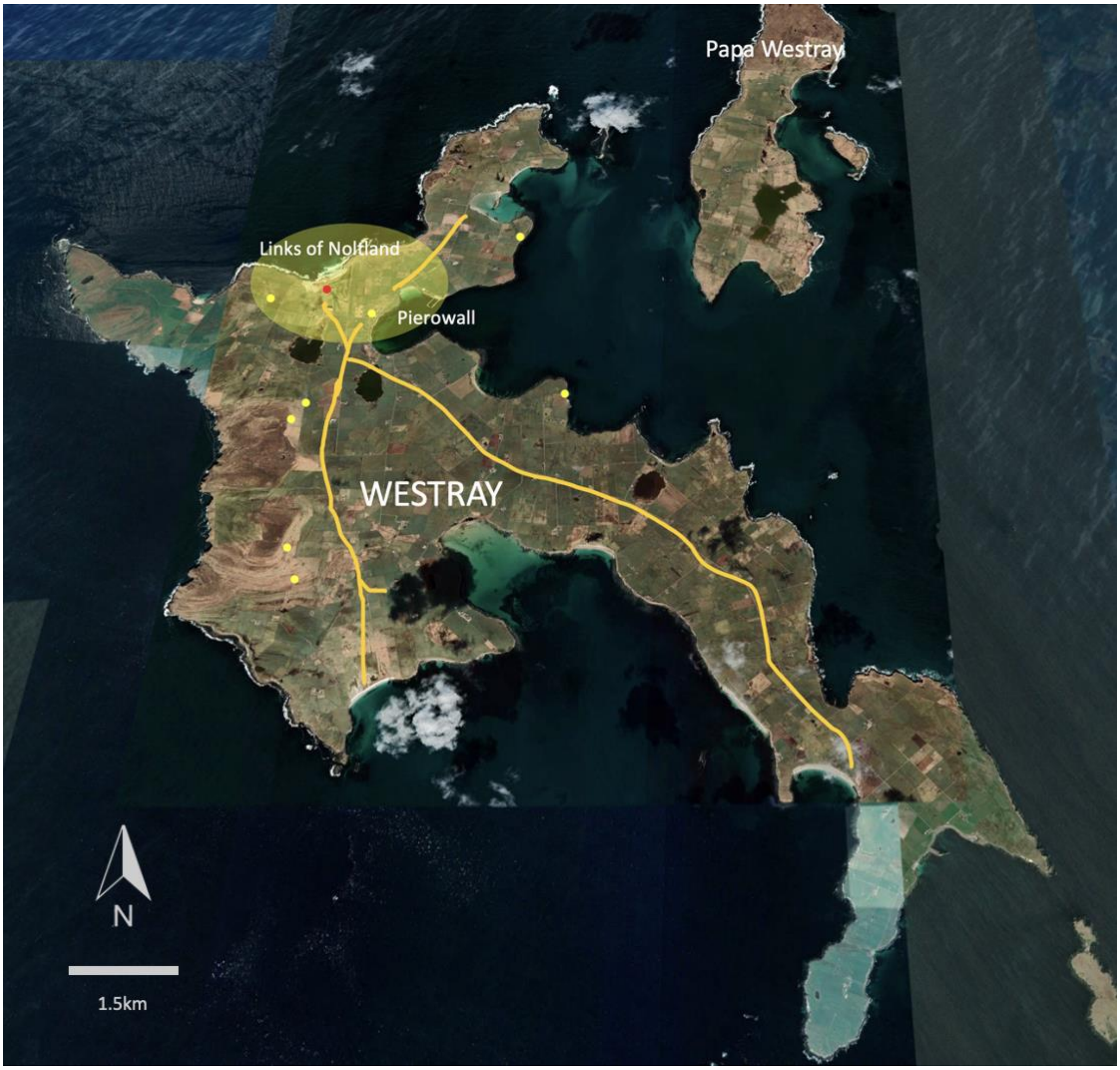


Figure 8.27. Google Earth image showing Westray with potential Neolithic routeway (mustard line) and its relationship with the chambered cairns of the island (yellow dots).

Another terrestrial route potential is Wick Bay. An island as seen today but in the early Neolithic would have been land (Brown 2003, 20; Ritchie 1983, 59). Figure 8.28 shows a satellite image of the Holm of Papa Westray with its monuments and coastline outline as it is assessed to have appeared in the Neolithic. It is annotated with the monuments' alignments and the recent sea level assessment (Sturt 2005, fig 7.4) showing a clear correlation suggestive that the two stalled cairns on this peninsular were orientated towards any coastal land route way that would have been used to approach the tombs. The coast of the Neolithic land mass is sketched out at Figure 8.28 in green.

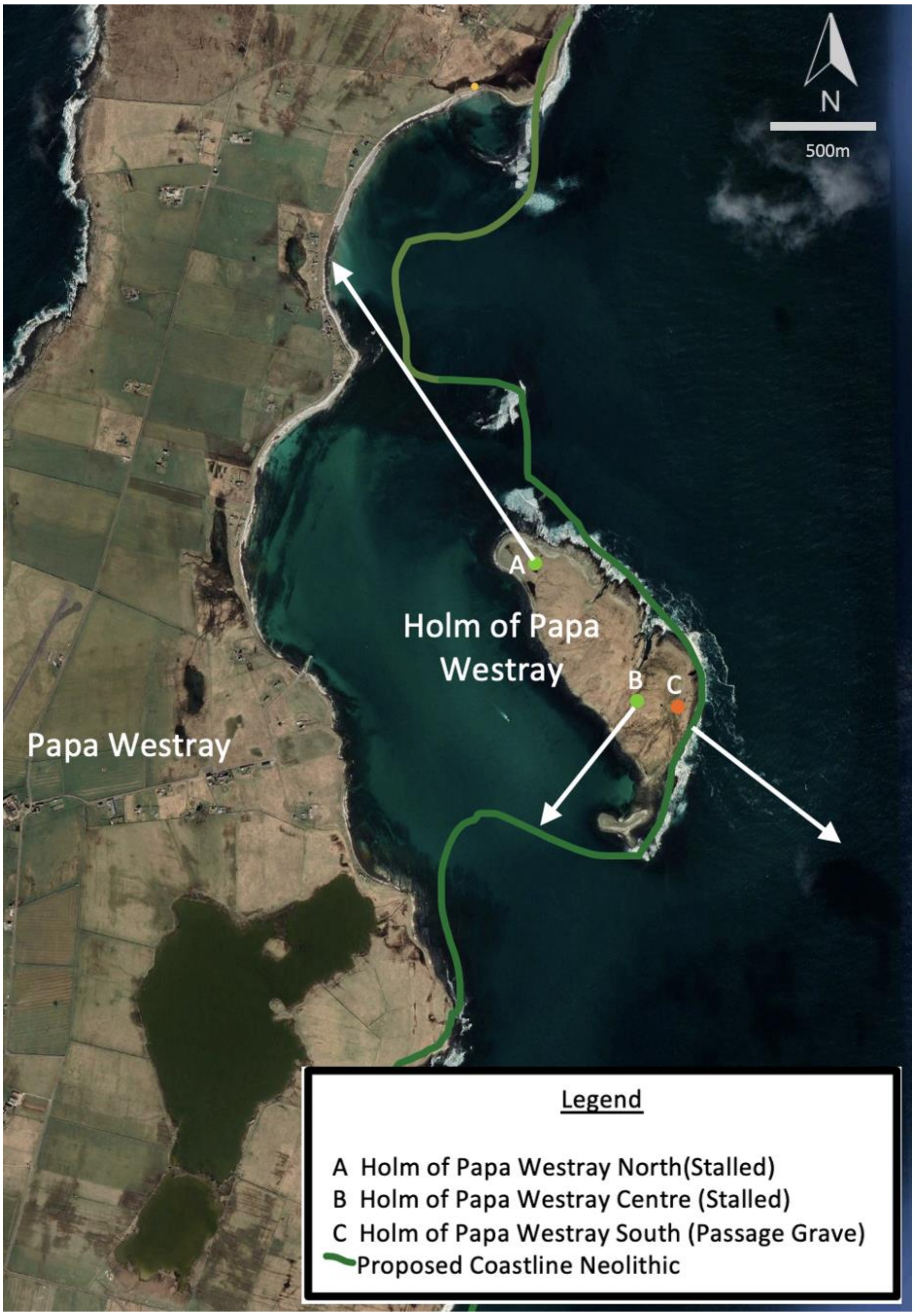


Figure 8.28. Google Earth photograph of the Holm of Papa Westray annotated with the coast as assessed in the early Neolithic.

On Rousay the B9064 broadly circumnavigates the island and it is correct to say that any major deviation from this route and travel becomes more difficult simply due to the geography of the island. The monuments of the 'south zone' of are positioned overlooking the natural routeway across the south of the island. When considering the coastline, the agriculturally viable land and the natural rocky plateau the path of the modern B9064 road and this would have been a route utilised in the Neolithic. It is suggested that these monuments are so located as a route guidance directing a traveller towards a centre of ritual activity from landing points and settlement activity in the south east of the island. With the impressive Midhowe and Knowe of Ramsay are situated the eastern extent of this routeway it is probable that when moving from the settlements at Rinyo and Braes of Ha'breck on Wyre these monuments would form a signpost system point a traveller towards a ritual centre; a potential processional way similar to that on Westray and Eday.

Figure 8.29. QGIS prepared image showing arial images of Rousay with potential Neolithic routeway highlighted (mustard line) and its relationship with the Chambered Cairns of the island (Red pointers for South Zone Green Pointers for North Zone), Settlement pf Rinyo. Insert is topographic relief map.

Of further note is a route surveyed whilst walking around the island. The potential route through the centre of the island is appropriate for foot traffic (see Figure 8.29). This routeway is created by the ravine between the higher hills on the island (see Figure 8.29 inset). This would be an appropriate route to be undertaken by any travelers moving from the south of the island to the Rinyo settlement area. Interestingly the Knowe of Craie whose positioning pays no cognisance to the Rinyo settlement area despite being part of a larger group of stalled cairns associated with. It does however look over this same routeway center island routeway (see Figure 8.30). It is possible that this served as a way marker for anyone walking from the south towards the rich settlement activity of the north-east of the island.

Figure 8.30. A Google earth generated viewshed analysis showing the view (in green) from the Knowe of Craie stalled cairn and annotated with a potential routeway in mustard.

Figure 8.31 is an amalgamation of the routeway assessments and may provide a broad insight into how inter-island physical communication networks operated. In addition to what is shown it is very likely that individual island bay hopping techniques will have been employed.

Summary

The dominant thematic threads that emerge from this chapter revolve around two prominent interpretations: alignment with settlements and the intricate relationship between Neolithic tombs and terrestrial and sea travel routes. The foundational groundwork for the former interpretation has been laid in prior studies, notably Renfrew (1973a, 1979), and this association with settlements has been consistently referenced in subsequent scholarly works (Richards and Jones 2016; Richards 2013; Phillips 2004; Woodman 2000). However, this broard understanding of this tenet has undergone significant refinement in this present work. Notably, work detailed in this chapter has convincingly argued that tombs exhibit demonstrable axial alignments with the specific settlement areas they were designed to serve.

Furthermore, a new assertion is introduced in the Orkney context, suggesting a direct correlation between tombs and routeways—both maritime and terrestrial. This study surpasses prior generalisations about relationships with the sea by delving into a more specific and pragmatic navigational connection with sea routes and landing places. The tombs in Orkney are revealed to have a tangible and demonstrable relationship with these routeways, aligning with recent and comparable findings from archaeological sites in Europe, Britain, and Ireland. Notably, it is posited that certain early Neolithic tombs across the North Isles of Orkney were deliberately situated as markers to provide practical or metaphorical support to early seafarers. A substantial majority, 70%, of North Isles tombs are identified as having a direct association with marine or terrestrial routeways.

In Chapter 9 the discussions will build on these findings and will apply the demonstrable alignment patterns identified herein to use these alignment pattern to locate hitherto unidentified early sites, particularly settlements and chambered tombs. The implications of this methodology for future research are highlighted, underscoring its potential to significantly contribute to the broader understanding of the Neolithic.

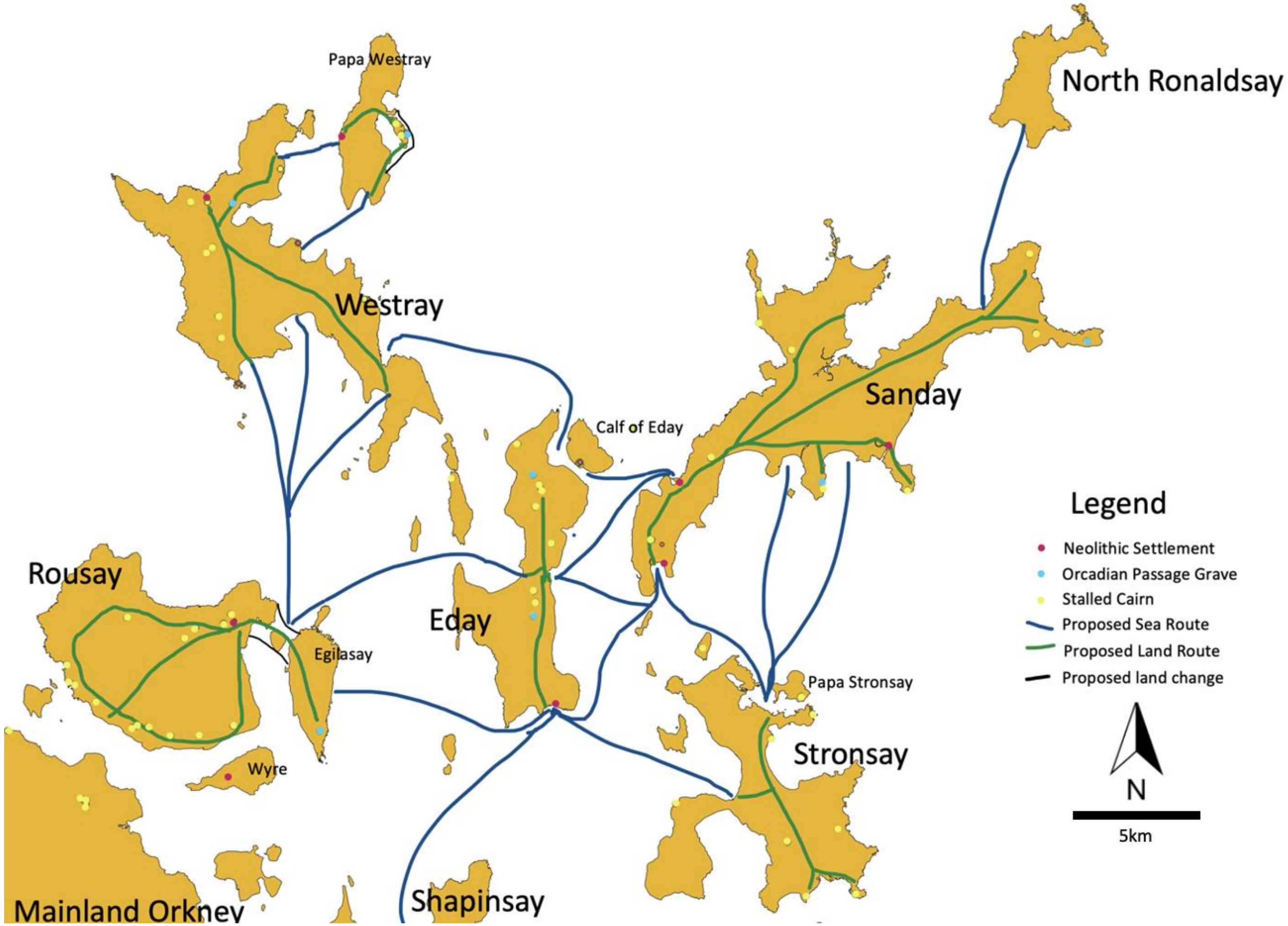


Figure 8.31: A GIS produced map of the North Isles of Orkney annotated with how land and sea routeways may have appeared in the Neolithic.

Chapter 9 - Discussion

Introduction

The basis of this thesis was to carry out a fresh investigation into the earliest of tombs in the peripheral North Isles of Orkney and to see how these findings could refine the early Neolithic narrative across the archipelago. Motivated in part by important recent observations "…*our images of a neatly ordered early Neolithic world are blurring and a new canvas is required*." (Richards and Jones 2016, 5). '*The emergent chronology… appears to present a more complex picture of extensive and overlapping activities, concurrences and discontinuities occurring at different sites throughout Orkney during the fourth and third millennia cal BC. This prompts a radical reassessment of this period*' (Bayliss *et al.* 2017, 1182) and "*attention needs to look at the periphery islands in order compliment the extensive Heart of Neolithic Orkney World Heritage Site (WHS) investigations*" (Downes *et al*. 2005, 37). The results of this work will be discussed in this chapter starting with a summary of the more generic research observations followed by detailed considerations in respect of two key findings that can be divided into distinct themes.

- Tombs and settlement relationships.
- Tombs and routeway relationships and wider lines of communication across the archipelago.

The narrative will conclude that the early Neolithic tombs are intrinsically linked to the very fabric and infrastructure of early farming life in ways not previously highlighted. They will also be placed into their wider context and provide an assessment as to how they may shape future investigation to viably move towards the identification of as yet unidentified important early Neolithic sites.

Results summary

There have been several themes explored in this study with two being dominant and influential to the thesis – the tombs relationships with settlements and routeways. Before going on to discuss these areas in detail it is helpful to summarise the other themes that were researched; chronology, structure and phasing, orientation and intervisibility. Figure 9.1 is provided for reference listing all sites discussed within this chapter.

The results in chapter 5 were presented in a new time slice assessment utilising data from recent dating studies (see Bayliss *et al.* 2017; Griffiths *et al.* 2016; Schulting *et al*. 2010). These results pose the question - Are the tombs at Point of Cott and Holm of Papa Westray North really the earliest or is there a dating bias? The point here is that with current data it is impossible to say with any degree of certainty though it does seem in part at least, that there is a potential for bias as there is more dating data available for these tombs. The oldest known Neolithic settlement site in the archipelago is the Knap of Howar which is in the vicinity of the earliest tombs identified. There is no doubt the north Isles had a part to play in the early Neolithic but as for being positioned as the first in this work could be as a consequence of the today's archaeological record. Nevertheless, the evidence does raise the very real possibility that the North Isles were occupied at the same time as Mainland Orkney from these potentially early dates.

The bias may also be operating due of a tradition change on Mainland Orkney which was assessed to have occurred in the centuries around the turn of the third millennium BC when passage graves, larger settlements and monumental stone circles began to appear (see Bayliss *et al.* 2017; Richards and Jones 2016). It is possible that if there were earlier tombs on Mainland which invisible to the record as they lie beneath later structures. This situation has been theorised in respect of the Bay of Firth Passage Graves, Quanterness, Cuween and Wideford Hill (Colin Richards *pers. comm*). The Howe presents further evidence concluding that a stalled cairn was the original structure before a passage grave was built over it during later phasing (Carter *et al*. 1984, 61; Davidson and Henshall 1989, 176).

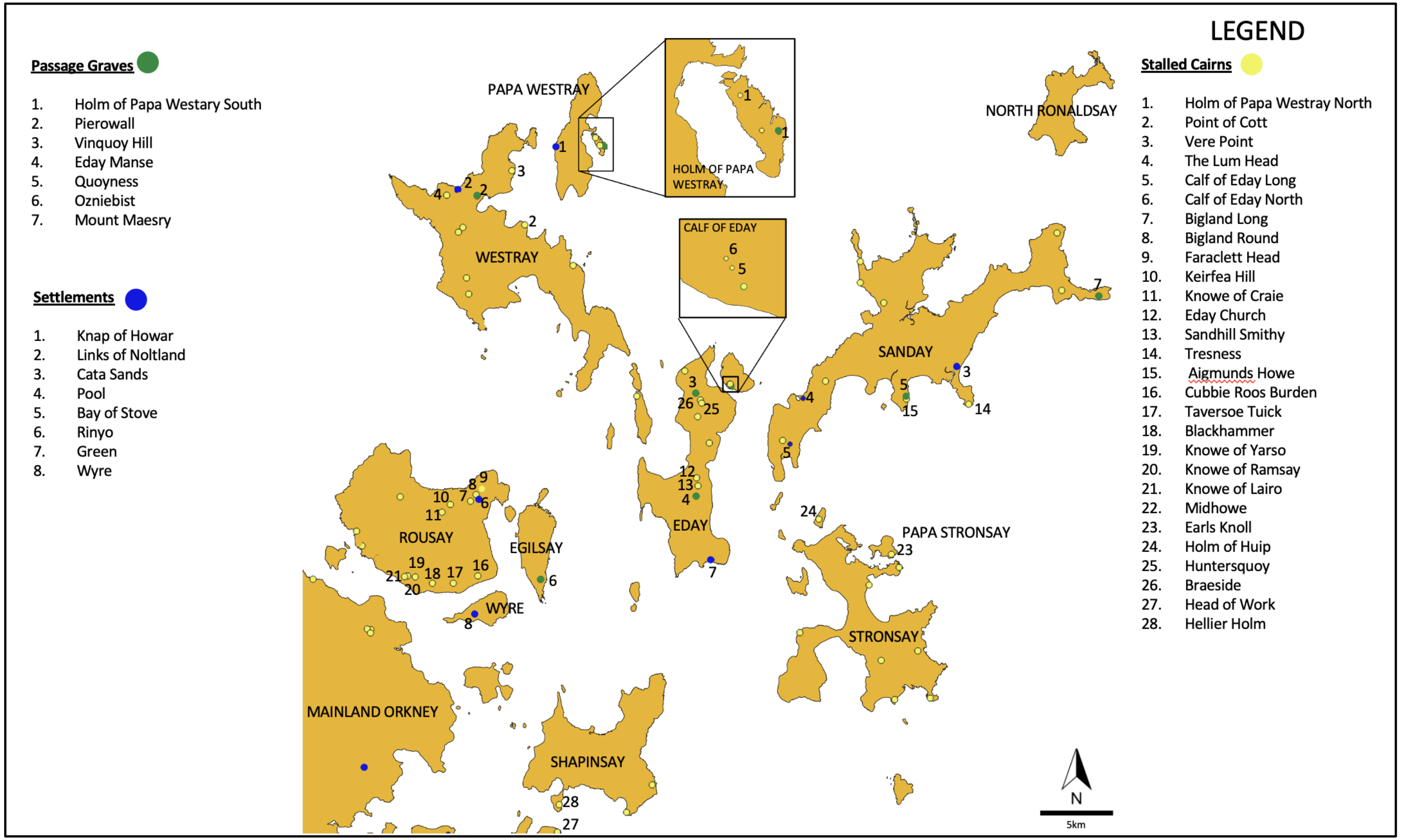


Figure 9.1. Reference GIS produced map of all sites discussed within this chapter.

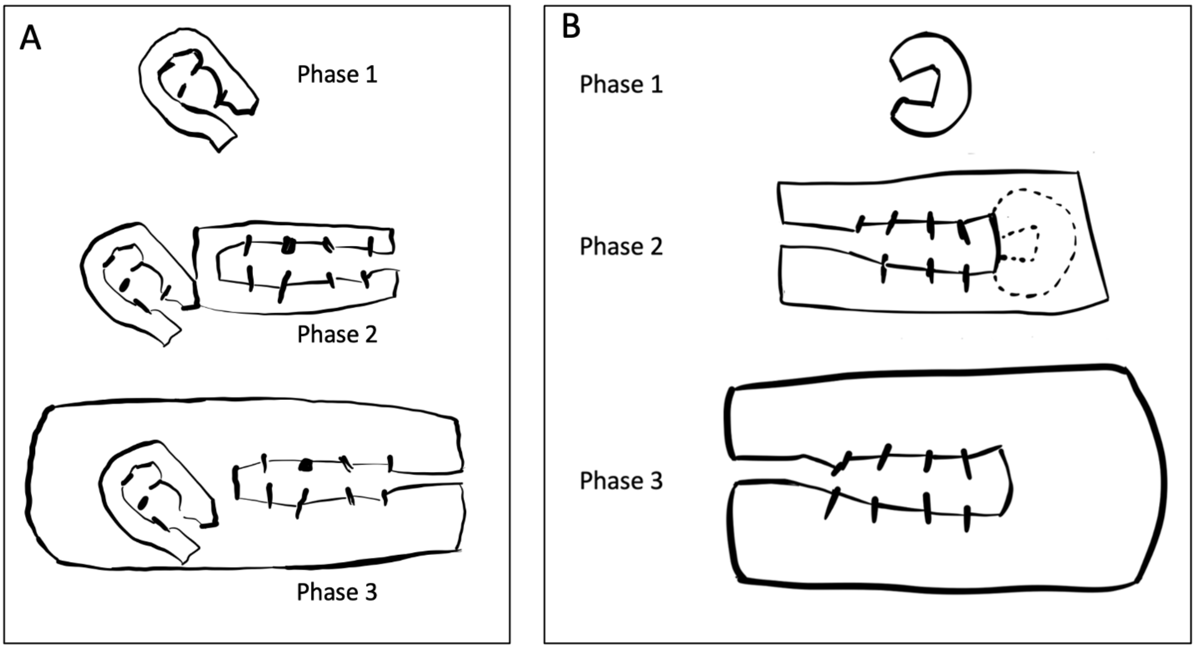


Figure 9.2. Proposed phasing sketches following the axial and architectural analysis undertaken in chapter six showing simple round funerary structures that are incorporated into later tombs. A - Calf of Eday Long and B - Holm of Papa Westray North

Another observation teased out in chapter 6 was the presence of smaller simple structures that formed the early phases of monuments that are recorded as more complex today. Such earlier structures (see Figure 9.2) do not currently appear in the chronological sequence of the Orcadian tombs. Other tombs may also have simple primary phases; at Huntersquoy the lower chamber is described as tripartite (Calder 1938; Davidson and Henshall 1989, 123) though it is much simpler architecturally and may well represent an earlier form of simple funerary architecture. Other tombs have these same phenomena with simple associated tombs such as Bigland Long (Davidson and Henshall 1989, 101; Henshall 1963, 183) with a small rectangular chamber co-located with a stalled cairn and at Taversoe Tuick (Davidson and Henshall 1989, 160) a miniature round chambered tomb is situated within the footprint of the overall tombs round cairn but separate from the main structure. Whilst it is possible these do represent the first monuments in the island there is insufficient archaeological evidence available presently particularly in respect of dating data for the earliest structures.

Another key finding of chronological research is that **stalled cairns and passage graves were demonstrably in use contemporaneously** (Bayliss *et al.* 2017; Griffiths *et al.* 2016; Schulting *et al*. 2010). The earlier traditions operating within the stalled tradition ‘era’ remained in use on North Isles after the introduction of passage graves on the Mainland. The previously so called ‘hybrid tombs’ (Davidson and Henshall 1989, 24; Schulting *et al.* 2011, 26) are more accurately described as multi-phase tombs; stalled cairns with passage grave features added later. The axial alignment methodology and structural analysis in chapter 6 was able to suggest that the passages and cells were later additions to a pre-existing stalled tomb. When this term hybrid is used in literature it tends to insinuate that these monuments - Isbister, Unstan and Tresness - were constructed as they are seen today with cross-classification features part of the original plan i.e. stalled with passages and side cells were all part of an original design intention. This work now suggests that the features are in fact a consequence of different sequences of construction and phasing and may have been built at a time when different monument traditions were available. It is likely relevant that the two confirmed multi-phased tombs are sited on Mainland and South Ronaldsay (virtually attached to mainland) where narratives are beginning to point to a more concerted and dominant cultural change occurring on the mainland. As such it is now possible to suggest the following sequence of development:

1. Arrival of farming and the use of timber houses
2. Soon after (if not concurrently) simple round tombs appeared and these structures will have predated the tripartite stalled variety as seen at Point of Cott, Calf of Eday North and Taversoe Tuick.
3. As settlements became established stone-built stalled cairns evolved and the architectural preference was for tripartite structures. These will have been adapted over time and chapter six demonstrated a methodology for proposing the different phases of such tombs. Chapter eight demonstrated alignments purposely set to oversee the settlements and its surrounding area of operation for work and farming.
4. Shortly thereafter a stone house tradition evolved (see Richards and Jones 2016) archipelago wide but saw the greatest impact and growth on the Mainland. Perhaps unsurprising given the extent of resources that would have been available to Mainland over the smaller North Isles. This will have been motivated in part by the scarcity of timber resources across the islands and the ready availability to suitable Orkney flagstone particularly suited to construction. Note: There is

always the possibility that this growth is as a consequence of excavation bias on the more accessible Mainland and only future settlement investigation across the North Isles (as suggested in chapter 8) has the potential of answering this dichotomy.

5. There was then a social and tradition change that brought with it the introduction of passage graves that will have been built contemporaneously to stalled cairns. In some instances, there were phased additions to stalled cairns which included passages and side cell architectural features.
6. There was an increase in settlement on Mainland and a considerable growth of activity around the Heart of Neolithic Orkney World Heritage site. This growth was not replicated on the North Isles the likely reason being the micro environmental and social factors were only capable of maintaining a smaller population.

This chronology theory is supported by recent dating studies as detailed elsewhere in this work (Bayliss *et al.* 2017; Griffiths *et al.* 2016; Richards and Jones 2016; Schulting *et al*. 2010) though these studies have not been able to complete the picture and it is suggested that the greatest priority moving forward is a comprehensive dating program (supported by aDNA and isotope analysis) to enhance chronological narratives. The recent work at Tresness (see Anderson-Whymark and Cummings 2019; Cummings *et al.* 2018) clearly demonstrates how the picture of individual monuments is enhanced when excavation is undertaken. To date there is simply not enough credible data to present a more precise chronological narrative.

In chapter 7 orientation and structural analysis was undertaken and reported upon. It was able to refine the currently accepted south-east alignment narrative (Davidson and Henshall 1989, 85; Fraser 1983, 364) and unpick the nuances of this by undertaking a more detailed analysis and breaking orientation models down island by island and by tomb classification. The analysis demonstrated that the tombs of Eday and Westray (to a lesser extent) do not follow the dominant south-east alignment, a finding that differs from the previously accepted convention. In its simplest form the finding is that there is no blueprint and that **different islands were making their own decisions by virtue of their own needs in relation to the siting of their tombs.** Furthermore, this work can now suggest that stalled cairns (56.7%) and passage graves (100%) can be said to be aligned to or close to one of the solstices, equinox or cross - quarter days, a finding that **shows there was a genuine interest in seasonality and this became more important as the Neolithic progressed**. Conversely, it can be argued that as a significant number of monuments are not aligned on the cardinals of the compass, equinox, solstices, or cross quarter days then there was not a universal cosmologically motivated alignment tradition that was adopted in early Neolithic Orkney. It is however legitimate to argue at least that a proportion of monuments had an intention to be aligned upon the position of the sun rise at times that would have been pragmatically of interest to early farmers. **Seasonality would have been as important to early farmers as it is today for effective subsistence strategies to be successful** and some tombs had their part to play in this**.**

Settlements

As a consequence of the results we can now begin to answer the question; just what influence did the location of settlements have on the siting decisions of early Neolithic tombs? This has often been the basis of scholarly comments albeit somewhat superficially particularly in relation to the North Isles of Orkney. One may assume that there is a certain inevitability in such a relationship as burying the dead is a fundamental aspect of settled human behaviour. I will suggest one which is intrinsically linked to the social and cosmological beliefs of the earliest of farmers that settled in their midst. At its basic level to identify an association the tombs must first have a physical correlation with the settlements, but this research has presented a much more intentional relationship with siting decisions of tombs being made purposely so as take on the status as a backdrop to daily life. The analysis has shown that many tombs (though not all) were intentionally created with an outward passage view or alignment towards the very communities where their builders lived and worked. This hypothesis will require a partial rejection (in some cases) of previous and often cited findings that the early Neolithic monuments are community territorial boundary markers (Childe and Grant 1939; 1949; Fraser 1983; Hedges 1984; Renfrew 1973a; Renfrew 1979; Richards 1998; Richards and Jones 2016; Richards 2013; Sharples 1985). Here I will suggest that the tombs were not representing individual territories but were each serving the same wider community neighbourhood.

As outlined in the results within the archipelago several chambered cairns are located near known Neolithic settlement sites. This is something that has been commented upon previously in the Orcadian archeological literature (Bayliss *et al.* 2017; Childe 1942; Davidson and Henshall 1986, 17; Fraser 1983, 277, 1; Richards and Jones 2016; Renfrew 1973a; Renfrew 1979) though has never been the subject of the specific thematic study essentially because the settlement evidence of recent years was not available to earlier scholars. With the benefit of this evidence this work was able to go further than a simple association by virtue of proximity. This thesis has identified a defined and purposeful alignment and intervisibility between early monuments and two Neolithic settlement settlements on Rousay and one on Westray. It goes further to utilize this identified pattern to identify potential locations of a number of as yet unidentified early Neolithic sites.

There are several Neolithic settlements for the North Isles that have seen attention in recent times, namely Links of Noltland on Westray (see Brend 2010e; Clarke 1981b; Moore and Wilson 2015); Pool (see Lowe 2008; MacSween 2009) and Bay of Stove on Sanday (see Bond *et al*. 1995; Morrison 1995); Green on Eday (see Miles 2007a; 2008a; 2009a); Rinyo on Rousay (see Beusing and Rassmann 2019; Childe and Grant 1939; 1949; Clarke 1983; Mainland and Moore 2010a; Richards 1992c) and Braes of Ha'Breck on Wyre (see Lee and Desalle 2016; Lee 2014; Thomas 2011). In addition, there are several identified smaller domestic structures manifesting themselves as single houses or small farmsteads; the Knap of Howar on Papa Westray (Ritchie *et al.* 1983) and Cata Sand on Sanday (Cummings and Richards 2016; Cummings *et al.* 2017). We now have a much fuller, albeit incomplete, understanding of settlement locations in the North Isles. Virtually all the identified North Isle settlement sites can be associated with stalled cairns to varying degrees of certainty with the exceptions of Pool and Green.

In Orkney it was previously thought that stone was the preferred building material to be utilised in Neolithic architecture in part due to relative dating assumptions of the Knap of Howar double house site (see Ritchie *et al*. 1983). Following recent extensive investigations in the Bay of Firth on Mainland (see Richards and Jones 2016) it is now thought the first domestic structures were of rectilinear timber form which appeared between 3445–3370 cal BC (Bayliss *et al.* 2017, 1181); other commentators suggesting earlier dates between 3520-3360 cal BC (Griffiths 2016, 287). The first stone houses followed a little later and were in use concurrently probably from between 3410– 3330 cal BC (Bayliss *et al.* 2017, 1181). Given the findings detailed in chapter 5 this broadly means that houses or both forms of materiality and stalled cairns and passage graves were utilised within the same temporal parameters (see Bayliss *et al.* 2017; Richards and Jones 2016). This sequence is important in assisting the findings of this work.

The Neolithic settlement site at Rinyo is an excellent candidate for further discussion here given the rich archaeological record regarding both tombs and settlement in this part of the island (see Figure 9.1). This is considered an important site in the context of this work as it has been the subject of earlier excavation (Childe and Grant 1939; 1949) and later review (Renfrew 1979) and was instrumental in establishing the long-standing finding that the early farmers used the chambered tombs as territorial markers and prompting the early Neolithic segmented society versus later Neolithic chiefdom arguments (Renfrew 1979, 206) that are often cited when discussing sequence narratives for Orkney. Childe, utilising a chrono-typological approach placed Rinyo as contemporary with Skara Brae - a site that has been radiocarbon dated as in use between 2900-2500 cal BC (Bayliss *et al.* 2017, *supp material,* 89) - due to its striking architectural resemblance (see Childe 1949). Additionally with sparse dating evidence and a propensity of Grooved Ware assemblages Rinyo has been currently chronologically positioned as a later Neolithic site. There is evidence that Rinyo - or at least the early phases of it - may have been considerably earlier to the time of the first farming settlers. Evidence supporting this such as the discovery of Unstan Ware ceramics early in the stratigraphic sequence of the floor of one of the Rinyo houses cannot be ignored (Chile and Grant 1949, 38; Richards 1992, 453). It points convincingly to earlier occupation and was supported by these early excavators *"thus insofar as chambered tombs and Unstan Ware define the early Neolithic, Rinyo itself must be thus qualified"* (Childe and Grant 1949, 38). Strengthening the temporal link to the surrounding tombs this early pottery was described as similar in fabric and style to pottery recovered from Keirfea Hill and Knowe of Craie tombs within sight of Rinyo together with ceramic finds from Sandhill Smithy on Eday and Unstan on Mainland (Childe and Grant 1949, 36) suggesting communication between other islands and this site.

Results have shown the location and configuration of the tombs point in a direction that can only be described as respecting the settlement and the associated surrounding areas such as field systems, paddocks and other houses (Figure 9.3). Recently, several geophysical surveys have been carried out in the surrounding vicinity of Rinyo and as such there is now data beyond the original excavation report (see Beusing and Rassmann 2019; Mainland and Moore 2010). These investigations have proposed that a wider settlement boundary is identifiable and may extend as much as 2000 m^2 beyond the original site. In the northwest of the original site evidence of field boundaries and ploughing was discovered together with an oval structure. In the south-east several features of similar size were assessed suggesting potential further settlement activity. A further cluster some 100m south-east of the modern Bigland Farm shows similar features again thought to be settlement. Additionally, CANMORE records several areas and findings that also add weight to the proposal here that there is a wider early settlement beyond the bounds of the currently recorded Rinyo site (Beusing and Rassmann 2019, 150). Pulling together all this evidence the mustard oval in Figure 9.3 shows the potential extent of community activity. Multi-phase settlement sites are seen at a number of locations in Orkney. In addition to those previously mentioned around the Bay of Firth similar chronological phases are to be found at the Ness of Brodgar (see Brend *et al.* 2020; Card *et al.* 2018; Card *et al.* 2020), Barnhouse (see Richards 2005) which went through a number of phases from c. 3115 BC until 2875 BC (Richards *et al.* 2016) and Skara Brae (Bayliss *et al.* 2017; Clarke 1976). The latter being a site - likened to Rinyo – that has a been the subject of recent geophysical survey which identified a significantly larger footprint than is currently observable (Brend *et al.* 2020, 55). At the Knowes of Trotty principally understood as a Bronze age cemetery but recent excavations have established the presence of an early Neolithic house build around 3400 cal BC which saw a number of phases over its centuries of use (Downes *et al.* 2016).

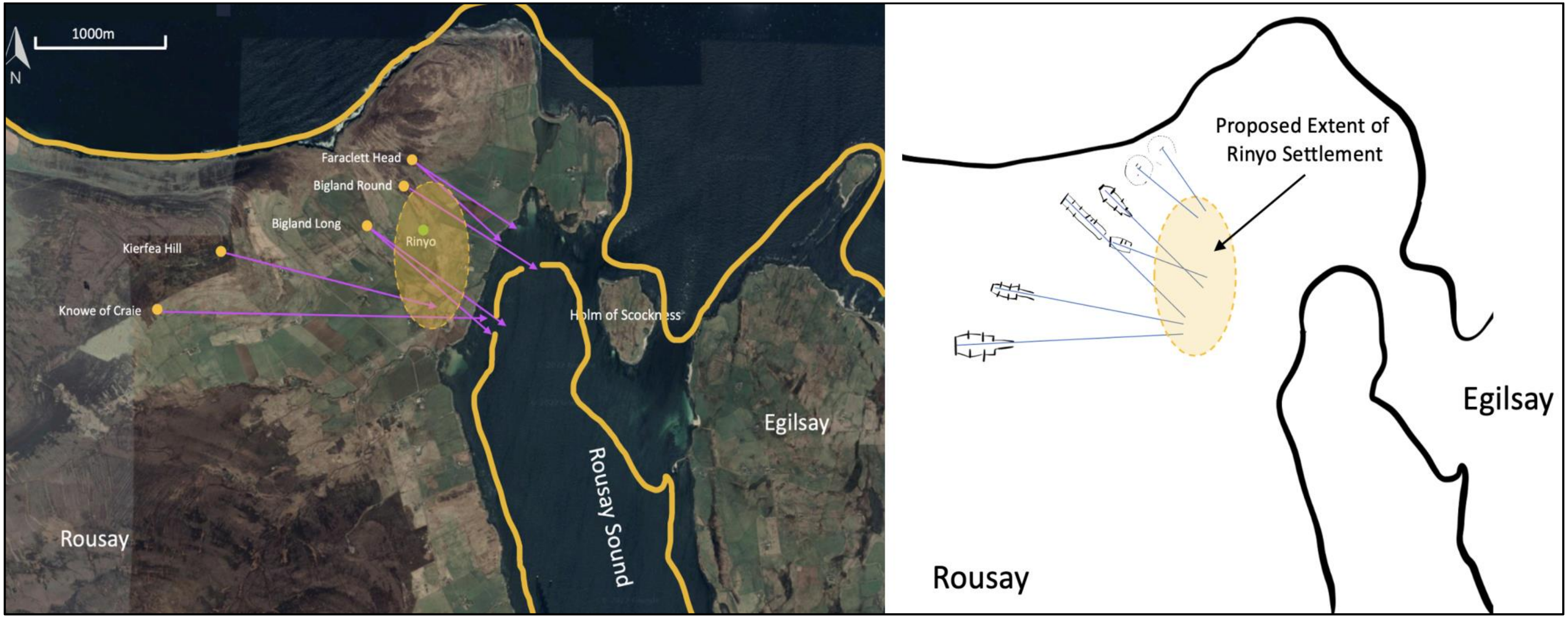


Figure 9.3. Left - Satellite image with monuments (mustard) and settlement (green) locations of the landscape at the northeast of the North Isle of Rousay. The outward passage alignment is demonstrated with the lilac arrows and the proposed coastline due to sea level change also included. The opaque mustard area in the dotted line represents the potential extent of the Neolithic activity around the known Rinyo site. Right – simplified image (monuments - not to scale, all tombs orientated to north) showing plans of tombs orientated to north, axial direction and probable Rinyo settlement extent (Tombs redrawn from Davidson and Henshall 1989, 101-186).

Figure 9.3 depicts the results of the analysis in chapter 6 that shows that all the stalled cairns in this area have an alignment towards the settlement and its immediate surrounding area and the alignments of the stalled cairns should not be looked with the requirement to point directly at the site as currently identified.

Having proposed that the settlement is likely larger than currently recorded there now needs to be consideration of Rinyo's seven associated stalled cairns – Knowe of Craie, Kierfea Hill, Bigland Round and Faraclett Head East and West (highlighted on Figure 9.3 with 1 marker due to them being only meters apart though the axis of both is recorded) and Bigland Long which is recorded as one monument though it is essentially two with separate stalled and tripartite structures contained within a trapezoidal cairn and aligned upon different axes. Finds from these monuments are limited save Keirfea Hill, arguably the most impressive and prominent amongst this group that contained round-based Unstan Ware bowls (Davidson and Henshall 1989, 131) like that found by Childe and Grant in Rinyo (Childe and Grant 1949, 38). In terms of distance Knowe of Craie and Kierfea Hill are located upon a prominent conical shaped hill 2.2 km and 1.6 km away respectively, but both are readily visible from the Rinyo settlement echoing the settlement/ tomb relationship seen the Bay of Firth which will be discussed shortly. The Faraclett and Bigland monuments are much closer (within 300m) and all are intervisible to the original Rinyo excavated site. If geographical positioning and intervisibility are considered alone then a reasonable argument can be presented for an interrelationship between this settlement and the seven tombs. When the orientation analysis in chapter 8 is added for consideration a striking commonality in respect of outward alignment of the passage / entrance of the stalled tombs can be seen. They all point towards the southeast compass quadrant or specifically the area surrounding Rinyo settlement (Figure 9.3) and one argues within the said recently identified 2000m^2 boundary (Beusing and Rassmann 2019; Mainland and Moore 2010). **Presented together this work is now able to suggest that the monuments are positioned to be purposely associated to the early phases of the Rinyo settlement. It follows that to be so associated the settlement must have predated the first phases of these tombs**. It is now proposed likely that given the new sequences of early timber domestic structures predating stone (Richards and Jones 2016) and the presence of Unstan Ware within the lower levels (Childe and

Grant 1949) and the alignments it follows that the Rinyo site was the home of the builders of these early stalled cairns and represented a very early settlement in the earliest part of the Neolithic in Rousay.

At the Braes of Ha'Breck settlement site on Wyre (see Thomas and Lee 2012) which has seen recent extensive excavation and radiocarbon dated to the early Neolithic (Griffiths 2016, 262), the earliest phases of occupation were rectilinear timber structures and stalled stone dwellings (Farrell *et al.* 2014; Lee and Thomas 2011). Radiocarbon dating here has indicated conncurrance of house types with dates of 3370-3090 cal BC for the timber dwellings and 3370-3100 cal BC for the stalled stone houses (Griffiths 2016, 262) though some dates do place occupation earlier than this (Figure 9.4) (Bayliss *et al.* 2017, Fig S12). Here it is not the tight chronology that matters it is the fact that this settlement is broadly contemporaneous with the tombs that this work proposes are associated with it.

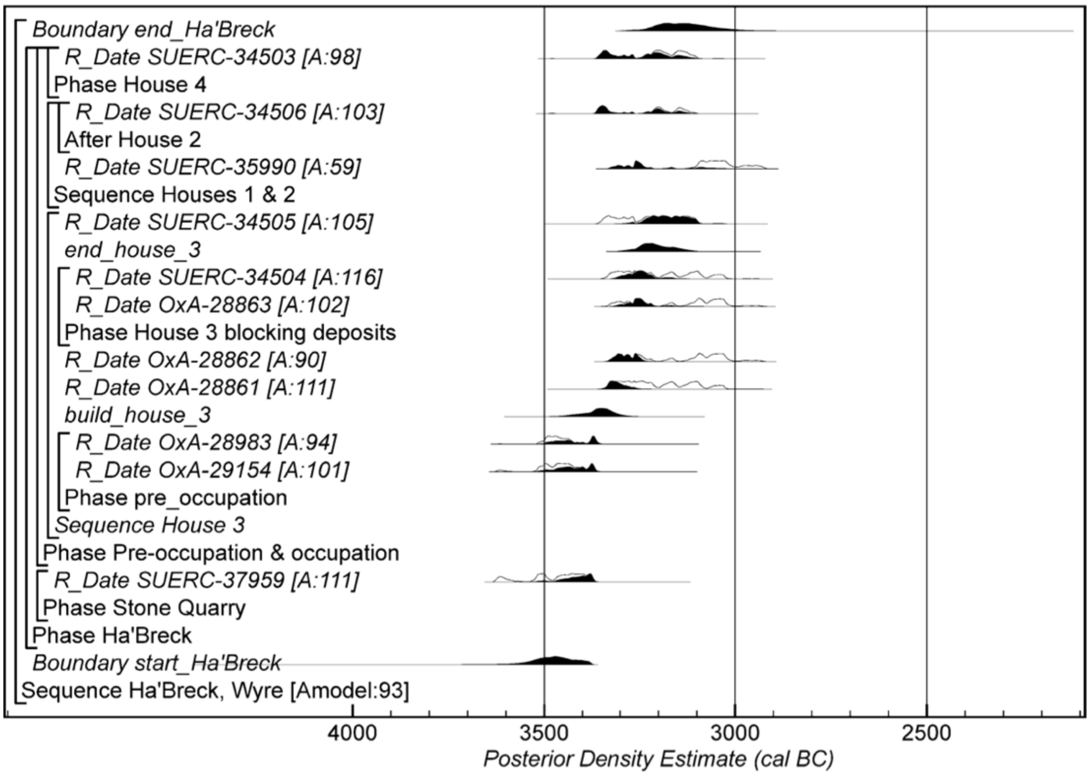


Figure 9.4. Probability distribution dates for Braes of Ha'Breck, Wyre (Bayliss *et al.*2017, fig S12)

Figure 9.5. Satellite image with viewshed analysis (green shading) from the early Neolithic settlement site at Braes of Ha'Breck, on Wyre. Monuments and outward passage alignment shown (annotated Google Earth Pro viewshed image)

Figure 9.5 shows that the viewshed from the settlement and four of the five cairns that are intervisible from the site have an outward passage alignment which broadly points to the site or its immediate surrounding area that may have contained working fields over an area of several hundred m^2 (Thomas 2008a). There is one exception – Blackhammer. Whilst intervisible its passage does not align with the known settlement. It will be recalled from chapter 6 that Blackhammer is a complex monument that has a biography spanning several phases with the current passage being part of a later phase. Phase 1 as aligned in Figure 9.6 does broadly align in the direction of this settlement boundary and may take in the point of any Neolithic crossing over to Rousay, land bridge or tidal island causeway.

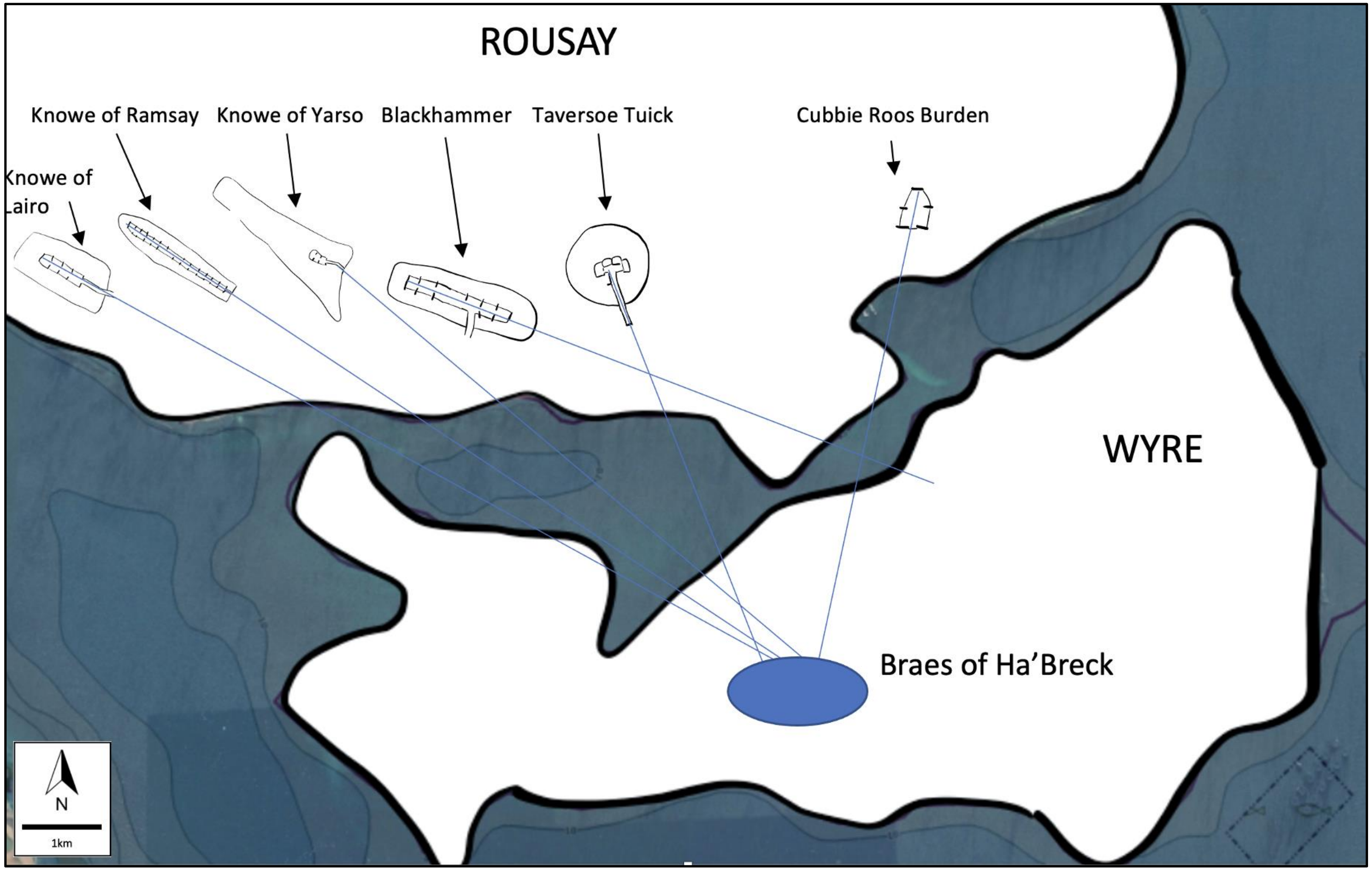


Figure 9.6. A theoretical diagram showing as a base the proposed landform during the early Neolithic. The map (to scale) is annotated with plans of the monuments (not to scale) all correctly orientated (Tombs redrawn from Davidson and Henshall 1989, 101-186).. Notes as follows left to right. Knowe of Lairo - Axis alignment used. Knowe of Ramsay – Axis alignment used; Knowe of Yarso – final passage phase alignment used; Blackhammer – The axis alignment of the proposed early phase (see chapter eight); Taversoe Tuick – The alignment of the early phase (lower compartment) and Cubbie Roo's Burden – The axis alignment used.

This is a pattern that shows accord with Rinyo in that all the intervisible monuments are aligned in the general vicinity of the settlement. The radiocarbon dates for these monuments show contemporaneity with the settlement with Knowe of Ramsay dating to 3270-2870 cal BC (Griffiths 2016, 270); Knowe of Lairo dating to 3370-3090 cal BC (Griffiths 2016, 271); Knowe of Yarso dating to 3360-3020 cal BC (Griffiths 2016, 270). Upon surveying these tombs the view towards the Braes of Ha'Breck is dominating and comparable to the one shown in Figure 9.7 from Taversoe Tuick. It is proposed that the builders of these tombs resided and worked at this settlement and these very tombs were built to take cognisance the bilateral relationship with the settlement in the same way as suggested for Rinyo above. This is as a consequence of specific social customs operating at the time, at the very least on Rousay.

Figure 9.7. Photograph showing the prominence of the Wyre peninsular containing the early Neolithic settlement Braes of Ha'Breck (midground) from Taversoe Tuick tomb (authors own photograph Aug 2022)

Here again it can be suggested the settlement (its wooden phase) came first. The anomaly here is that Wyre is today an island separated from the monuments which are sited on Rousay. However, during the initial stages of the Neolithic relative sea levels were up to 5m lower (Dawson and Smith 1997; De la Vega *et al.* 1996; 2000; Lambeck 1995; Morner

1980) and consequently there is possibility that these two islands were much closer together (Figure 9.8) with even a potential that they were conjoined if one factors in coastal erosive effects of the furious tides seen at Einhallow Sound. Even if they were not joined it is argued that they were close enough to complete the journey comfortably within the slack tide period of any given day. The fact that there are atypically no known tombs on Wyre associated with the settlement it may add weight to the Wyre/ Rousay conjoined hypothesis. Interestingly, the multi-tiered monument at Taversoe Tuick has two opposing alignments one that points to this settlement and the other that points towards Rinyo albeit they are not intervisible.

Figure 9.8 shows the alignment and association between these tombs and their associated settlement sites. **For the first time this work has demonstrated that the axis of the early Neolithic monuments of Rousay were built with a purposeful alignment with two main sites of occupation where the early farmers lived and worked.** All these monuments are stalled cairns which confirms that this relationship was in place from the early Neolithic. Furthermore, the experience from visiting the locations points towards a preference of visibility from the monument towards the settlement as opposed to the other way around. This suggests that the settlements were chronologically earlier than the monuments, at least during their primary phases. The only passage grave that is in the relative vicinity is Onziebist on Egilsay and this is not closely interrelated with any known settlement site. It is neither aligned nor intervisible with Rinyo or the Braes of Ha'Breck settlements which suggest that different traditions were operating when choosing the site for this later tomb.

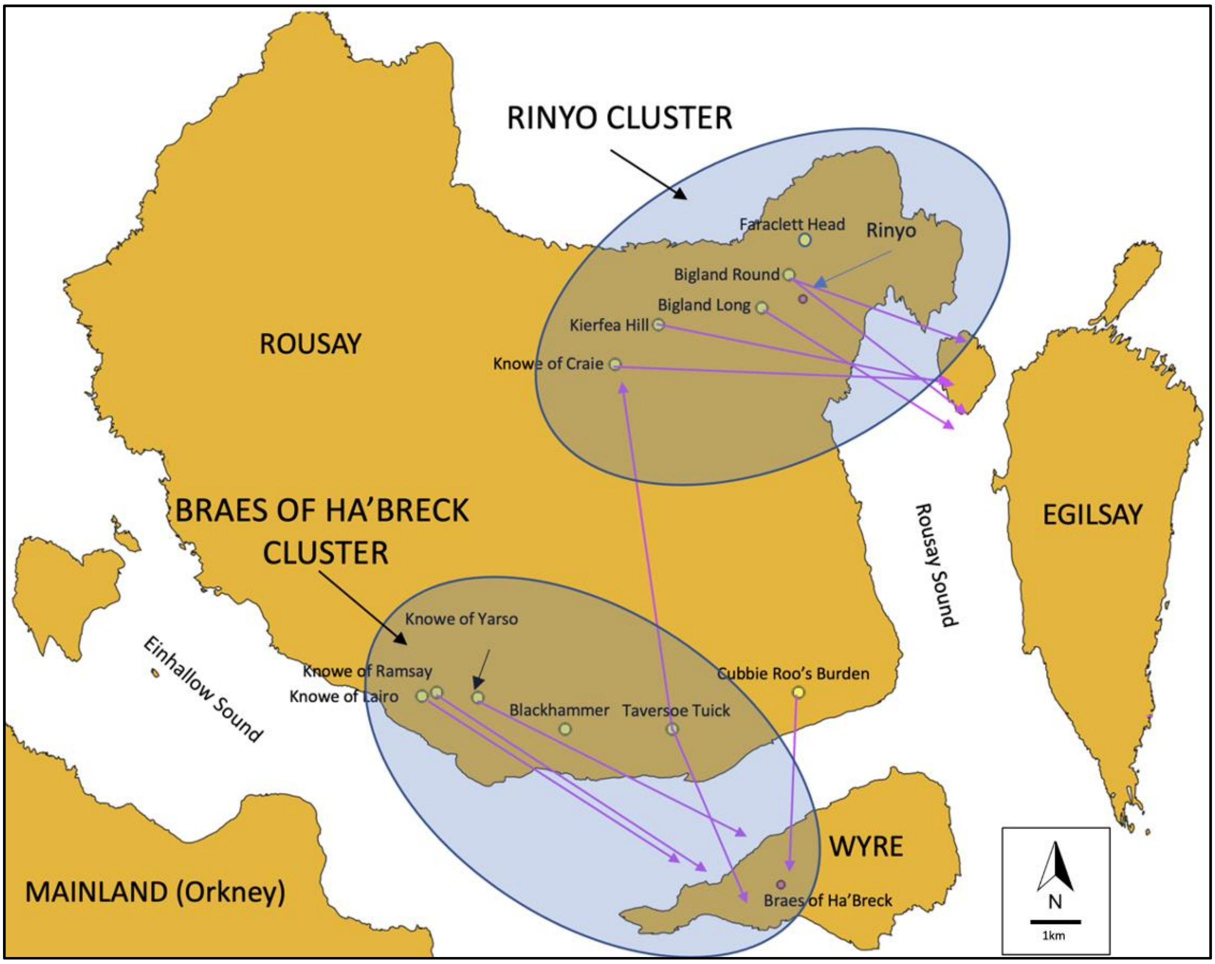


Figure 9.8. GIS produced Map of Rousay and its surrounding islands which shows chambered cairns in yellow, settlements in red and alignments where available in pink and the descriptive zones North and South highlighted in opaque blue (annotated QGIS generated map).

These two examples have been able to present a case that monuments are purposely sited to be associated with their builder's community. Settlement evidence is more scarce on the other North Isles but settlement / cairn association is evidenced on Westray with a probable tripartite stalled cairn at The Lum Head being positioned intervisible with a passage alignment with the Links of Noltland (Figure 9.9) and it is suggested that this monument like the ones associated with Rinyo and Braes of Ha'Breck were was located to have an intentional correlation with the place the builders called home.

Figure 9.9. Photograph showing relationship between The Lum Head (along its passage alignment) and Links of Noltland site in the northwest of Westray. (Authors own photograph, 2021)

Two other relevant sites are the segmented farmsteads at Knap of Howar and Cata Sand that also have association with nearby tombs, but the relationship is less conspicuous. The Holm of Papa Westray tombs have been suggested to be the burial monuments for the people from the Knap of Howar (Ritchie 2009, 27). They are not intervisible like the previous examples but given the proximity and the likely accessibility in the early Neolithic this is not argued. The connection with the island of Westray is also noted with an intervisibility between the Knap of Howar and Vere Point and Point of Cott stalled cairns that was noted during field surveys of the sites though there is no alignment of passages present here.

The early Neolithic single domestic structure recently excavated at Cata Sand in Sanday has identified the early stone phases are preceded by wooden structures a situation that is replicated at the other sites across the islands (Vicki Cummings *pers. comm*). Importantly, the nearby early Neolithic chambered cairn at Tresness (see Anderson-Whymark and Cummings 2019; Cummings *et al.* 2018) is likely contemporary to the Cata Sand house and appears to have also undergone significant remodelling with several phases from early Neolithic to Bronze Age being identified (see Anderson-Whymark and Cummings 2021). These more peripheral case studies demonstrate that the small islands at the outer reaches of the archipelago were doing something different. This may suggest that tombs associated with multi house or larger communities had a more important part to play in the day of day lives of their residents or indeed they were important for leaders of communities which are more likely to be found at the larger settlements and not the single or isolated farmsteads. Rousay as a test study presents the most dominant argument for stalled cairn /settlement interrelationship with Westray also following this pattern with the Links of Noltland group. Conversely, on Eday the only known Neolithic settlement at Green has no known association with any tomb though it is unlikely that Green would have been the only settlement on the island in the Neolithic. **What this identifies is that different practices were played out on different islands or there is a temporal aspect at play with the focus shifting across the islands with the tomb orientation being the key as they are foci for settlements.** In summary if we can identify a tomb then we can locate the houses of its builders. This will be explored shortly. For completeness Stronsay, Shapinsay and North Ronaldsay have no known settlements to date from which to make an assessment.

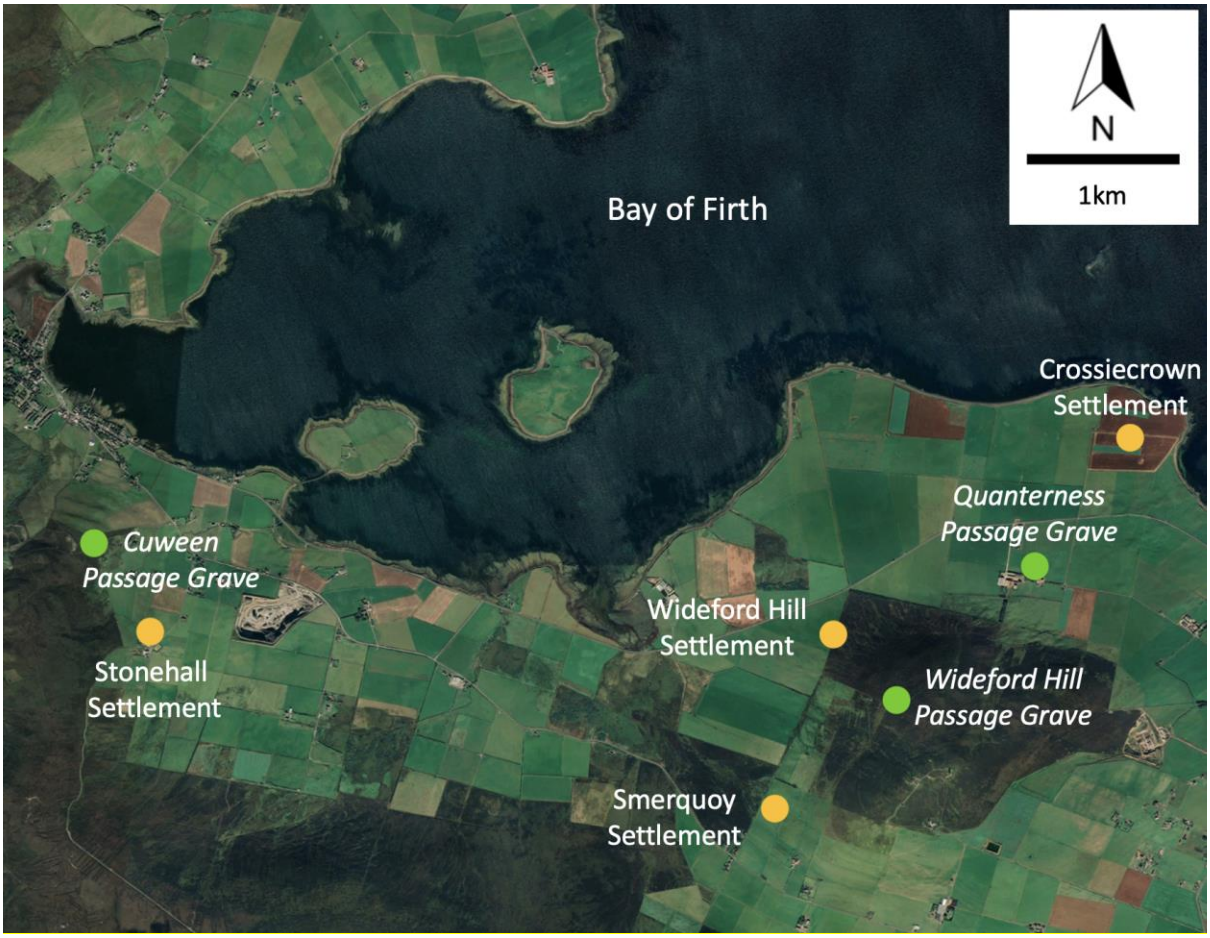


Figure 9.10. The Bay of Firth Neolithic Landscape on Mainland Orkney annotated with relevant settlement and tomb sites (annotated Google Earth Pro satalite image).

One of the key realisations of this work is that the operating traditions are not only temporally different but also spatially with notable diversity between different islands - the different communities were doing things differently. On Mainland the Cuween-Wideford Landscape Project at the Bay of Firth has refined our understanding of settlements in that area that share the landscape with three prominent chambered cairn - Quanterness, Wideford Hill and Cuween all of which are classified as Orcadian passage graves (Richards and Jones 2016, 16) (Figure 9.10). This work introduced a new and important sequence for domestic architecture, a material transition from timber to stone that has a direct impact of how we view settlement and tomb correlation. The findings of the superimposition of stone architecture over timber structures evidences this transition (see Gee *et al.* 2016, 64; Richards and Jones 2016, 16). The architecturally analogous passage graves at Wideford Hill and Cuween are sited below the peak of hills and have passages aligned upon one and other and not settlements which notably become prominently skylined when viewed from their associated settlements namely Smerquoy and Stonehall respectively. This suggests that these two tombs are not only linked together by alignment but also intrinsically linked to the people of these communities who were instrumental in building these tombs. Unlike the island examples presented above these tombs seem to be part of a larger neighbourhood or group of communities and serve the whole landscape. This strong association is only blurred by current thinking around chronology. The early phases of settlements are firmly within the early Neolithic whilst it is often cited that the passage graves are later. Cuween has been interpreted as being constructed sometime after the Stonehill settlement c. 3100-3000 cal BC (Richards *et al.* 2014). It prompts the possibility that these passage graves were either adapted from earlier stalled monuments or built upon the same footprint as a consequence of developing social practices and traditions as the early farming era came to an end (Colin Richards *pers. comm*). The community structures developed so too did the tombs evolving into larger more impressive communal tombs serving the larger more populated Neolithic community in the Bay of Firth landscape. This prompts the question why this area did so evolve whilst the Rousay settlements remained loyal to the earlier stalled tomb traditions. The answer is twofold. First this work has demonstrated in chapter 5 that phasing and adaptation of tombs was taking place and second one size does not fit all, size of community, societal make up and migratory influences are all viable reasons and whilst no single one can be relied upon (at this time) the only conclusive finding must be that **different practices were employed at different places within Neolithic Orkney and importantly at the same time.**

Settlements in their wider context

The association pattern between tombs and the habitation locations is something that has been commented upon before in a wider context, although less so in respect of early Neolithic Orkney. In Western Europe there is evidence that early farmers of the Linearbandkeramik culture (LBK) practiced inhumation burials within the settlements in pits or within ditched surrounding the places where they lived (Bentley *et al.* 2003; Bickle *et al.* 2014, 38; Hofmann and Bickle 2011). The LBK connection goes further with early rectilinear houses being the foundation for the long barrow tradition (Bradley 2001a) and houses being the inspiration for passage graves in northwest Fran0e (Laporte *et al.* 2004) and in the Denmark (Bradley 2012, 62). Though given these obvious geographic differences they demonstrate an early broad tradition of interrelationship between the living and the dead manifesting itself through its architecture. This association begins to become more defined in the Cotswold-Severn region where the practice of living in places later used for funerary architecture is often evidenced. At Hazleton North a hearth, midden deposits and postholes suggestive of a pre-cairn timber structure and were identified (Saville 2013, 17). This was assessed as being a sequence indicative of an early farming group, settlement buildings being situated directly under the later funerary monument (Saville 20O'13, 40). Similarly, evidence strongly suggestive of domestic activity was uncovered at the long barrows at Gwernvale (Britnell 1884a, 140), Sales Lot (Darvill 1982, 60; O'Neill 1966) and Ascott-under-Wychwood (Evans 1971; Selkirk 1971,10). To a lesser extent wooden postholes and pottery sherds were found during excavation of the pre cairn phase at West Kennet (Piggott 1962, 11) and Nympsfield tomb (Saville 1979b, 72). In Ireland several court cairns show the same pattern with evidence of habitation structures on the same site as early Irish megalithic tombs (Eogan 1963, 6; Ó Nuallain 1972). It therefore quite clear that the practice of building tombs at locations previously associated with settlement is not something new, albeit the pattern identified particularly relates to a close intimate interrelationship by quite literally using the same footprint.

In Orkney the association broadly follows this social tradition of tomb and settlement association but manifests itself differently. Here the early Neolithic narratives have been refined by identifying that the tombs are directly aligned upon the pre-existing settlement and its associated surrounding area – an area that we can say with some confidence will have supported subsistence in the form of crop cultivation and the management of domesticated livestock. The example at Rinyo, Braes of Ha'Breck and the Links of Noltland provide strong evidence of this. Having identified these Orcadian community configurations it follows that the presence of tombs, their intervisibility and alignment and may now be considered as diagnostic indicators for settlements yet undiscovered.

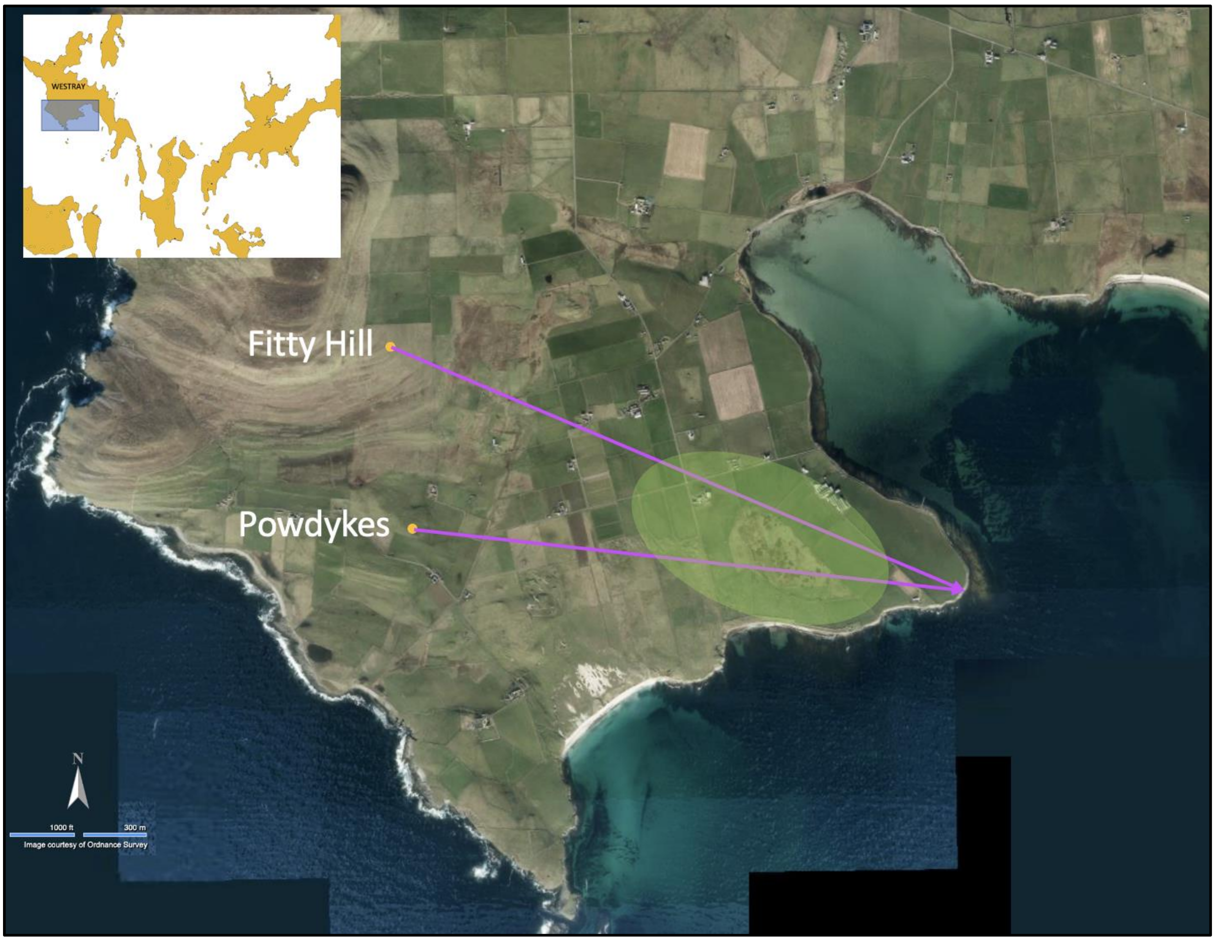


Figure 9.11. Satellite image on the south-west of Westray (see inset) it demonstrates the assessed alignment of the two stalled cairns located on higher ground. The green oval broadly corresponds with the viewshed area of intervisibility for these monuments and is accordingly assessed as an area suitable for future settlement potential (annotated Google Earth Pro satellite image with QGIS generated map inset).

Figure 9.12. Photograph taken from Fitty Hill stalled cairn. There is no current alignment information available though from survey the axis likely run between the standing orthostat that are visible above ground. The mid ground area in the photograph corresponds with the green area on Figure 9.9 above (Authors own photograph Aug 2021)

Implications for predictive analysis.

For this work to have longevity consideration has been made as to what implications the identified practices could have on future landscape archaeological investigations. Here tomb orientation and location have been identified as a clear model of association in three case studies across the North Isles. **It is now possible to identify areas of the landscape prime for further investigation – put simply in the early Neolithic of Orkney tombs can help us locate settlements**. Results have shown that the first settlements are predominantly positioned to the east of their associated tombs of the stalled tradition potentially by virtue of shelter from Atlantic weather fronts. Furthermore, they are all situated on elevated positions (though not on top of hills) to look down on the settlement. This phenomenon creates visions of the monuments being illuminated early in the day by the rising sun before the sun rise greets the settlement and its dwellers. Moreover, at certain times of the year the sun may be seen to set behind the tombs or in their general direction. It underlines the important aspect the tombs – and ancestors within them – had on the early farming societies daily rituals and cosmology. By reverse analysis of this model is it possible to identify new settlements within the landscape? In the south of Westray there are a two stalled cairns (Fitty Hill and Powdykes) which follow the pattern identified on Rousay namely sat above settlements broadly east, intervisible and feature a passage alignment to a specific area within the landscape a possible site of early Neolithic settlement (Figure 9.11 and 9.12).

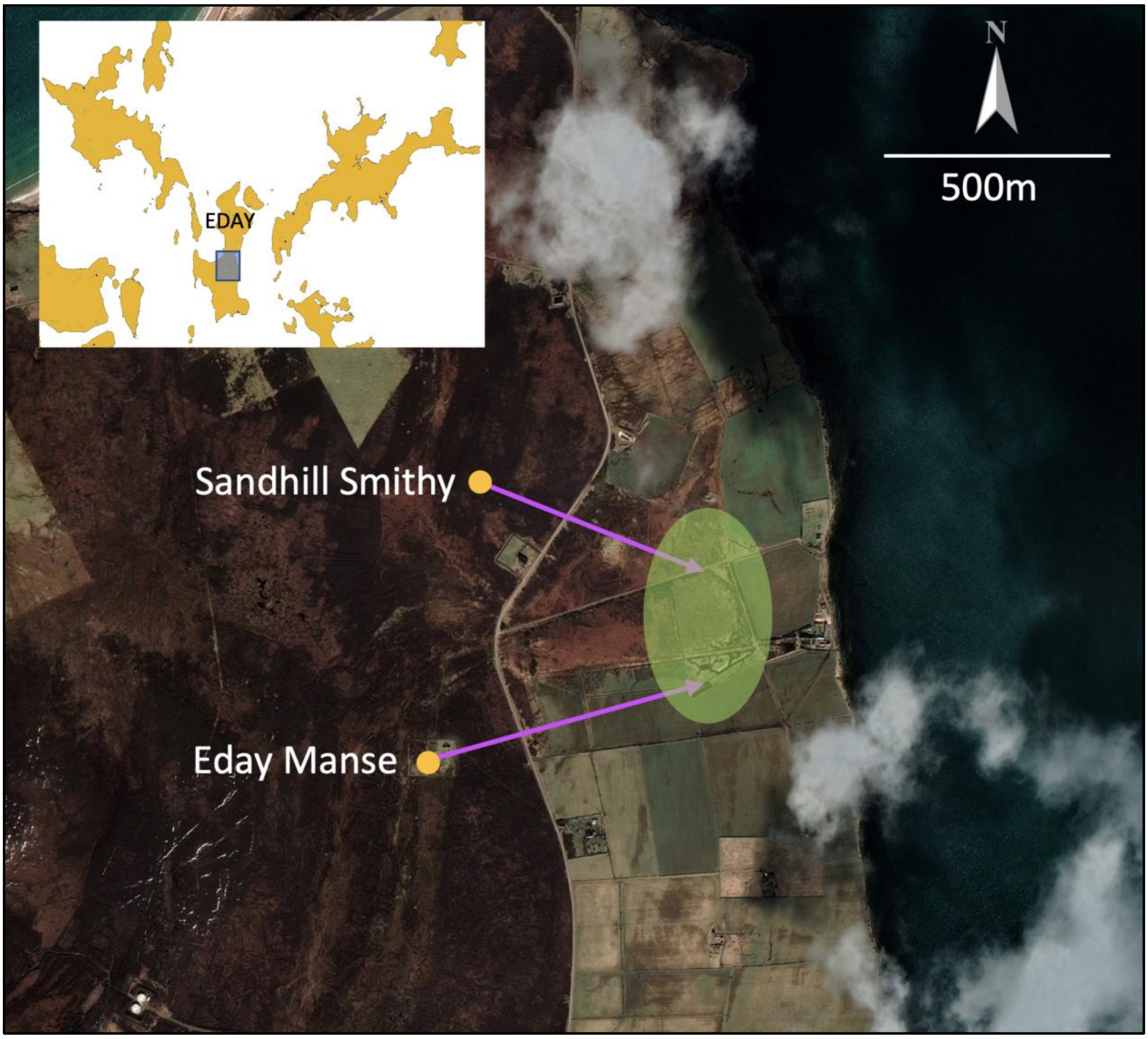


Figure 9.13. Satellite image of the central eastern area of Eday (see inset) it demonstrates the assessed alignment of the two stalled cairns located on higher ground. The green oval broadly corresponds with the viewshed area of intervisibility for these monuments and is accordingly assessed as an area suitable for future settlement investigation see also Figure 9.14 (annotated Google Earth Pro satellite image with QGIS generated map inset).

On Eday a similar situation presents itself. Eday Manse and Sandhill Smithy are identically situated with passages aligned to an area of land close to the east coast of central Eday (Figure 9.13 and 9.14).

Figure 9.14. Photograph taken from Eday Manse stalled cairn. The mid ground area in the photograph corresponds with the green area on Figure 9.11 above (Authors own photograph Sept 2021)

In summary, by applying the pattern identified in this work it is proposed that there are as yet unidentified early Neolithic settlement and farming activity in these areas. Conversey, a deatiled look at the landscape involving known settlements may provide similar results in identifying locations of tombs. There are no known associated monuments associated with the settlement site at Green on Eday. If the model is applied it points towards that the the eastern slopes of Ward Hill which is elevated land to the east of Green as a likley location for associated tombs (see Figure 9.15). Today this area is difficuly to assess due to extensive peat formation which formed after the early Neolithic period (Fraser 1983, 20; Davidson and Jones 1985, 23). As we will see shortly in this discussion the relationship with landing points and routeways simply adds weight to these suggested possibilities.

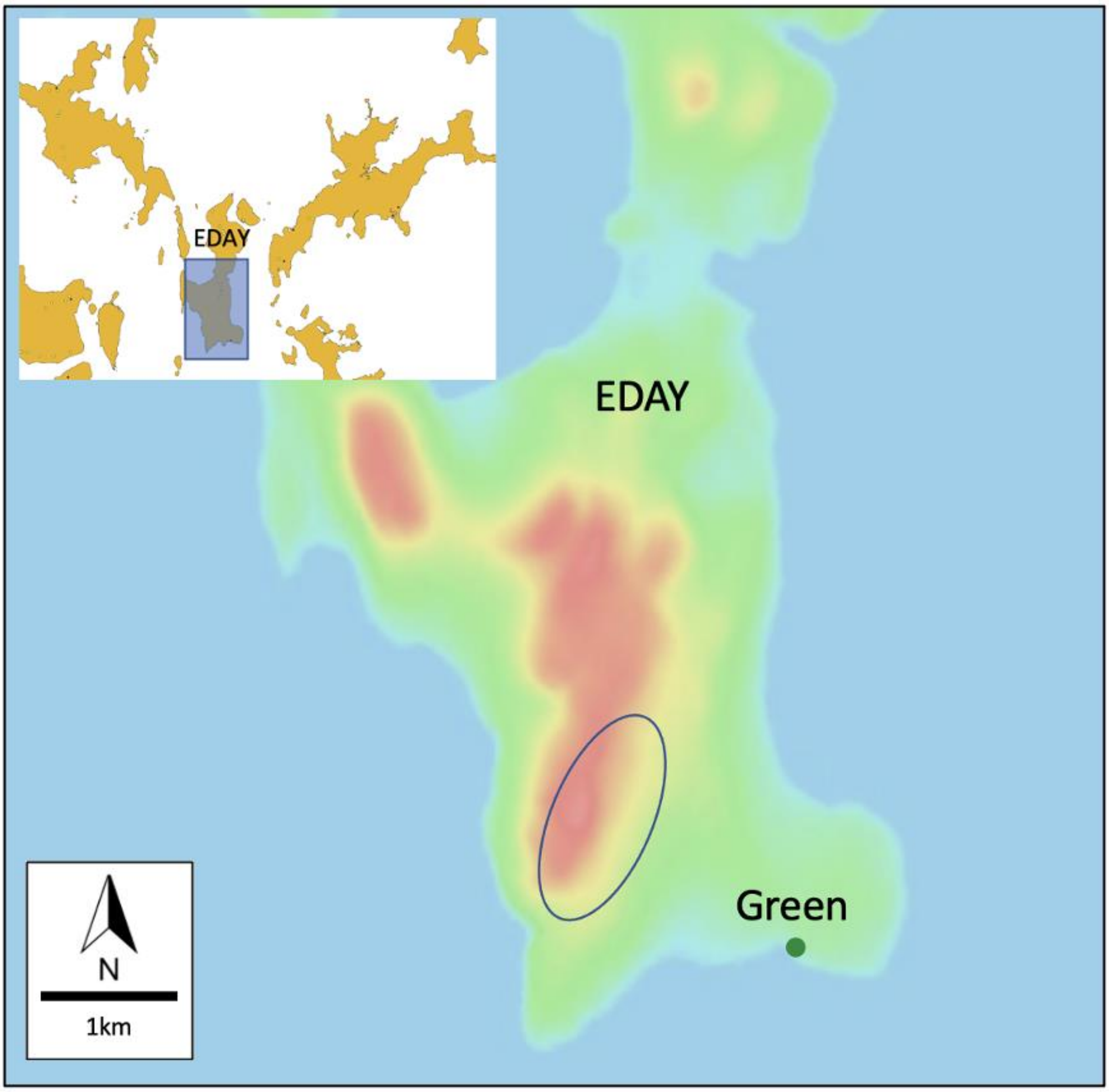


Figure 9.15. Topographical elevation map showing the potential area for stalled cairns location having applied the model identified by this research.

In conclusion it is now proposed that early tombs were intentionally associated and therefore sited directly to be aligned to their builders' settlements. It follows that the early phases of these settlement were established before they invested time in tomb creation. Both stalled monuments and passage graves have associations with the communities with multiple houses. That said, it is very clear that different traditions were at play at the same time as only the stalled variety that have that broad alignment with settlement. Conversely, the individual houses or more isolated farmsteads (on Sanday and Papa Westray) have some distance between them and were not as readily visible from their associated tomb. This finding may have more to do with the evidence currently available in the archaeological record. It may point to the fact that these monuments that have a less intimate relationship with the settlements because other single houses of farmsteads - as yet unidentified - utilised these same tombs. The tombs had a presence that meant that an importance was placed upon the part they played in day to day lives of the early farmers. Finally, this settlement association was not a blueprint, other monuments were sites with different intentions and it is these that will now be discussed further.

Routeways

It has been noted 'human existence is not fundamentally place-bound…. but in being mobile, fluid and directional, it unfolds not in places but along paths' (Ingold 2011, 148; see also Schülke 2016). In Orkney there is a rich archaeological record yet scant attention has been given to local routeways, roads and paths that that would have interlaced the islands across the archipelago. Both marine and terrestrial routeways have been neglected in Orkney a situation that perpetuates throughout wider Britain (Bell and Leary 2020, 1349; Leary 2014). Discussions concentrate on narratives surrounding migration and the long range regional and international connections that come with this thematic (see Garrow and Sturt 2011, 62). Here we will see how local networks may have looked and what part the early tombs had to play in these critical communication lines. With the results of this research, we can now begin to add mobility into the Orcadian Neolithic narratives and consider how people moved around beyond the previous studies linking tombs with the sea in this island group (Phillips 2003; Sturt 2005; Woodman 2000).

These considerations are not without challenges as past routeways are ephemeral either due to lack investigation beyond the immediate bounds of a monument or they are invisible from view due to degradation over time or, as argued here, they are beneath modern routeways. Today when moving through the North Isles arterial island route landscapes it is perhaps unsurprising that the least cost path is in harmony with topographic elements of the island, meaning that the modern routes may well overlay the pathways of the prehistoric. Furthermore, the sparse tree cover in the Neolithic (see Bunting *et al.* 2022; Farrell *et al*. 2014) will have meant that views of monuments from routeways are much as we experience today. This creates an opportunity to travel the modern roadways of the islands and to have an experience and view of island tombs and their surrounding landscapes that is, on balance, one which closely replicates that of the Neolithic traveller.

In addition to these terrestrial roads the early farmers will have relied on corresponding sea-borne routes that will have been integral to the day to day patterns of life that connect people and places. To navigate these routes people relied upon word of mouth and memory accompanied by directions and supported by landmarks (Broodbank 2000, 23; Noble 2006). Pragmatically there must have been markers on the landscape that aided any travellers progress from place to place and controlled movement throughout the landscape (see Cummings 2017, 83). It will now be suggested that these markers were the early tombs and that they were intrinsic to the very fabric and infrastructure of the islands and that they were specifically sited to be associated with routeways and to support mobility critical for social and economic interaction.

Marine routeway findings

Over the years several Orcadian studies have suggested a tomb/ seascape relationship with some going further by proposing that a view of the sea was a key consideration when siting tombs (see Phillips 2003; Sturt 2005; Woodman 2000). The first observation is that any relationship with the sea is unescapable across the archipelago, in particularly within its North Isles with a sea view almost a given from virtually all locations given the size and geomorphology of these islands. Here it is suggested that whilst it remains possible some tombs were sited with sea navigation in mind it is unlikely all were. This work now extends these previous hypothesis (see Phillips 2003; Woodman 2000) by suggesting those that were not located to aid mariners may have held a similar navigatory function within terrestrial landscapes and the people that travelled through them.

It will be recalled from chapter 8 that a comprehensive assessment was undertaken in respect of the landscape relating to marine communication routes between individual islands. This concerned itself with interisland travel and not the shorter coastal voyages in the form '*bay hopping'* from one part of an island to another (see Waddell 1992, 29). This is mentioned only to acknowledge what is likely to have occurred as part of local travel strategies and sea fishing subsistence (Renfrew 1979; Sturt 2005). It can be seen that some tombs were situated at coastal locations and they would have been useful landmarks for sea navigation be that local island movement (perhaps in low visibility situations) or interisland travel for wider connectivity. The analysis considered suitable beaches or landing points as appropriate for Neolithic craft (see Bowen 1972, 36; Callagahan and Scarre 2009; Cummings 2009; Garrow and Sturt 2011; McGrail 1983). This work was able to conclude that the spatial analysis points to the early Neolithic tombs being purposely sited in locations that would provide pragmatic assistance as seaway markers for early mariners – but not all of them! As outlined in chapter 8 a seaborne survey was carried out from Einhallow sound between Mainland Orkney and Rousay and particularly attention was paid to the linear arrangement of tombs located on the south coast of Rousay. Whilst it is acknowledged the monuments are today grass covered and have a contradistinctive appearance to their original form it is nevertheless suggested that the task required to pick out these tombs from the sea is not a simple one. They are sited high on ridges (and not skylined) above lower lying land planes which would have presented a far more appropriate location for a sea navigation marker. Further, this survey was undertaken on a clear day with binoculars with the benefit of a calm sea. Its solitary focus was to pick out the tombs from the sea and was undertaken on a steady deck without the distraction of rowing and managing Neolithic craft yet it presented an onerous task. Given these conditions it adds weight to the critique made here of the hypothesis that this linear arrangement of tombs were so sited to be a marine route guidance system. From the Einhallow sound it would not be practical to rely on the tombs as navigation aids. In stark contrast the same day a terrestrial survey was carried out by walking from Cubbie Roos to Knowe of Lairo and it became abundantly clear that this arrangement of tombs could serve as a marker system signposting any traveller moving through the southern coastal landscape of Rousay. This terrestrial route will be discussed shortly.

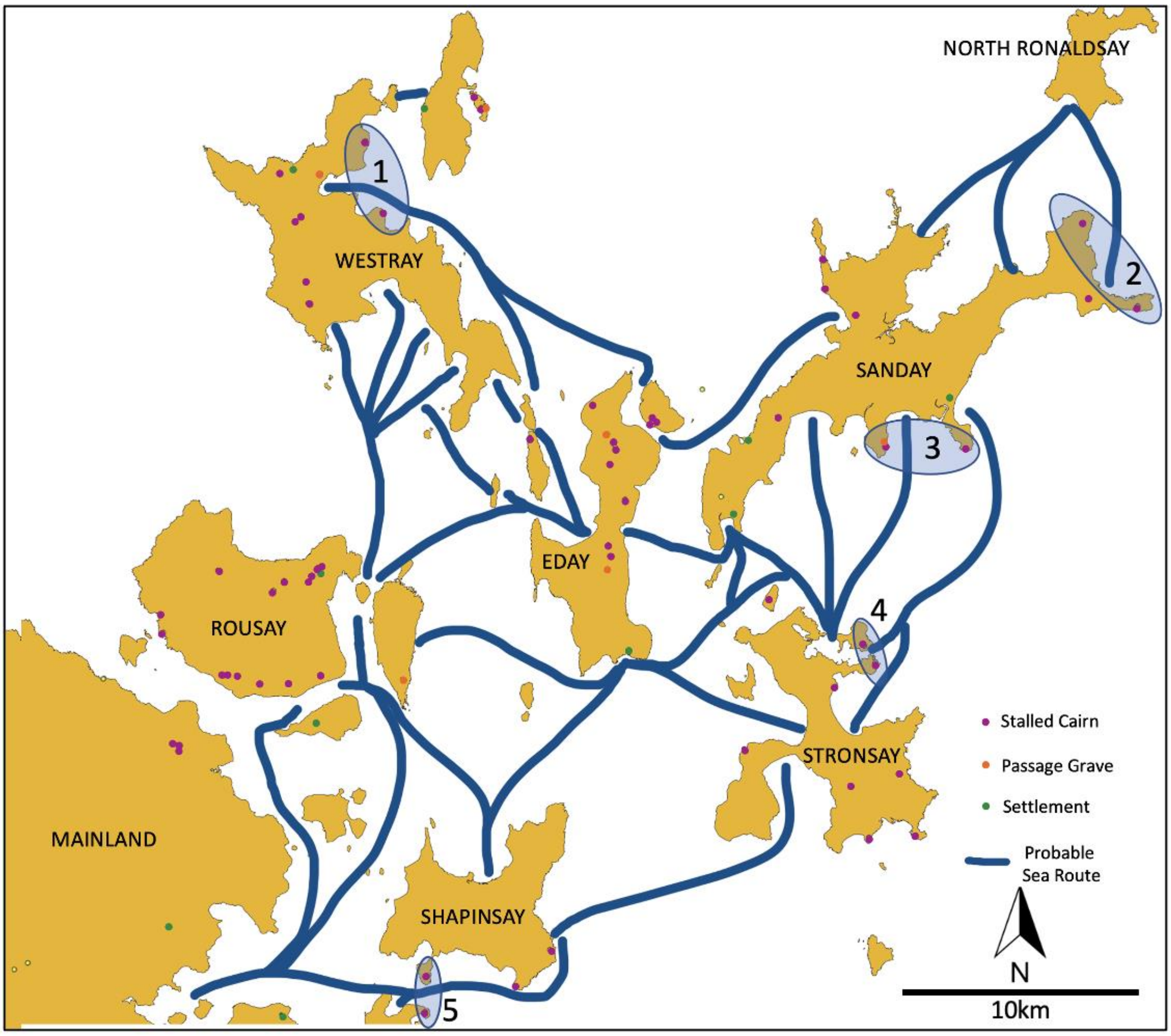


Figure 9.16. GIS produced map annotated stalled cairns, passage graves and settlements together with probable sea routes as taken from analysis in chapter eight. Also, blue shaded areas as reference for discussion - Area 1. Westray shows Vere point and Point of Cott sitting astride the natural bay of Peirowall; Area 2. showing the Tofts Ness settlement with the tombs Tofts Ness and Mount Maesry; Area 3. the early neolithic settlement site Cata Sand with Tresness, Quoyness and Augmund Howe in the vicinity; Area 4. entry point to the natural bay at Whitehall bound by Earls knoll and Cutters Tuo; and Area 5. entrance to Kirkwall and the Bay of Firth area with Head of Work and Hellier Holm sited at the approach (annotated QGIS generated map).

The analysis in chapter 8 also discovered five locations where stalled cairns were located at coastal locations and positioned either side of prime landing sites that are in proximity to settlements (Figure 9.16. areas 1-5). Interestingly these same locations correspond precisely with modern mooring points and principle modern settlements for their respective islands with only one minor diversion. On Sanday the identified location (Figure 9.16, zone 3) is one bay to the east away from the principal island port, Kettletoft. The matters discussed in chapter three concerning environmental change in this area of Sanday may well be an explanation for this. All these monuments that are sited as if a gateway to their respective ports and the associated stalled cairns are positioned so close to the sea that they would have been clearly visible. It is suggested these are positioned to provide a clear navigational aid for anyone travelling to the associated landing point. They could have also held other metaphorical functions such as providing ancestorial oversight of sea travellers and fishing points or viewed as territorial markers indicating that these landing points were already occupied. This is something that may well have been more important to early migrants and less so to later ones and may offer an explanation as to why these marker tombs are all the earlier stalled variety. There is only one passage grave (Quoyness) within this theory, but this is co-located a matter of meters away with a probable stalled cairn (Augmund Howe). The positioning of these early tombs points to this hypothesis not being relevant to later passage graves structures that were built in times where different social and cosmological systems were in play. For completeness another possibility is worthy of discussion though unlikely to ever be resolved. It is possible that these tombs only remain today due to their usefulness by later people through the prehistoric and historic periods. The tombs recorded within the archaeological record today may not fully represent a complete picture of all the monuments used in Neolithic times by virtue of loss anthropogenic reason such as robbing out for their valuable resources or because of being invisible from the record due later sites being superimposed upon their footprint. Tombs were robbed out as seen often. The Knowe of Ramsay had much the same appearance before excavation in 1935, when it was found that it had already been severely robbed and disturbed (See Callander and Grant 1936, 407; Davidson and Henshall 1989, 135). It certainly was not the only one with many tombs of the North Isles notable for the entropic state cannot be simply down to natural decay that is not only as a result of natural collapse and must include robbing out for stone to be re used in other buildings. Eday Manse has a cup marked lintel (Figure 9.17, left) noted during surveys for this work supports the suggestion that the tomb was heavily robbed and used as a quarry for the building of a United Presbyterian church in the early 19th century (Figure 9.17) (MacKelvie 1873; RCAHMS 1983c; 1984d)

Figure 9.17. Left - possible cupmarked red sandstone lintel within the fabric of the United Presbyterian church (right) built n 1831 from stone believed quarried from the Neolithic tomb at Eday Manse - the remains of which can be noted in the foreground of right image (Authors own images).

In support of this it has been noted by Petrie when taking of tombs *"a few years ago, about a hundred were to be seen …. But these interesting memorials of the past are everywhere fast disappearing before the agricultural improvements of the present age which appropriate and swallow up the materials of which these old sepulchral monuments are constructed and what is provoking still without any attention being given to preserve a record of their construction and contents"* (Wilson Collection MS Davidson and Henshall 1989, 15). If the resource robbing was occurring, it may follow then only tombs that served a purpose (to later people) may have been spared. Additionally, monuments that were positioned closest to the sea on low lying planes may well have been lost to the sea as a consequence of environmental change that was discussed in chapter three. Monuments degraded by coastal erosion such as Pont of Cott, Tresness, Augmund Howe paying testament to this. Also, the stalled cairn at Holm of Huip is so well positioned for sea navigation that atop of it today sits a modern sea navigational marker and this tomb was found to be intervisible from seven other monuments making the strategic siting for sea travel more acceptable. **On balance it is suggested here that several early Neolithic tombs across the North Isles of Orkney were purposely positioned as markers to provide pragmatic or metaphoric support to early sea farers.** To further this hypothesis attention will now be turned to terrestrial routeways.

Terrestrial routeway findings

In chapter 8 it was proposed that the southern coast tombs of Rousay were not positioned to support sea navigation. Instead it is argued that they are to assist travel by land. The walkover survey determined that when walking from Cubbie Roo's Burden to Knowe of Lairo it was only when you had left the zone of visibility for one tomb did the next one come into sight as though acting as a way point of a route traversing the south of the island - an area which has an extremely rich Neolithic record.

Today this route is the B9064 which is a road that circumnavigates the island and given the island terrain is unsurprisingly the most appropriate path of least resistance and likely to have been as attractive for a roadway in the Neolithic as it is today for these reasons. This is a pattern that replicates itself across many of the islands with the path of least resistance forming the route taken by modern roads. It is also proposed here that the Knowe of Craie a monument in the Rinyo cluster (see Figure 9.7) may be related to movement across the centre of the island from the southern coast to the settlement of Rinyo (Figure 9.18). It sits in a prominent position above and intervisible from a trackway and foot route through the centre of the island (that was walked) and represents topographically the path of shortest distance and least resistance from the north of the island to the south and would be situated in an ideal place to guide any traveller to and from the Rinyo settlement. As can be seen in Figure 9.18 (inset) viewshed analysis the Knowe of Craie monument does not have a view to the settlement unlike the others in the cluster but instead has one upon this routeway.

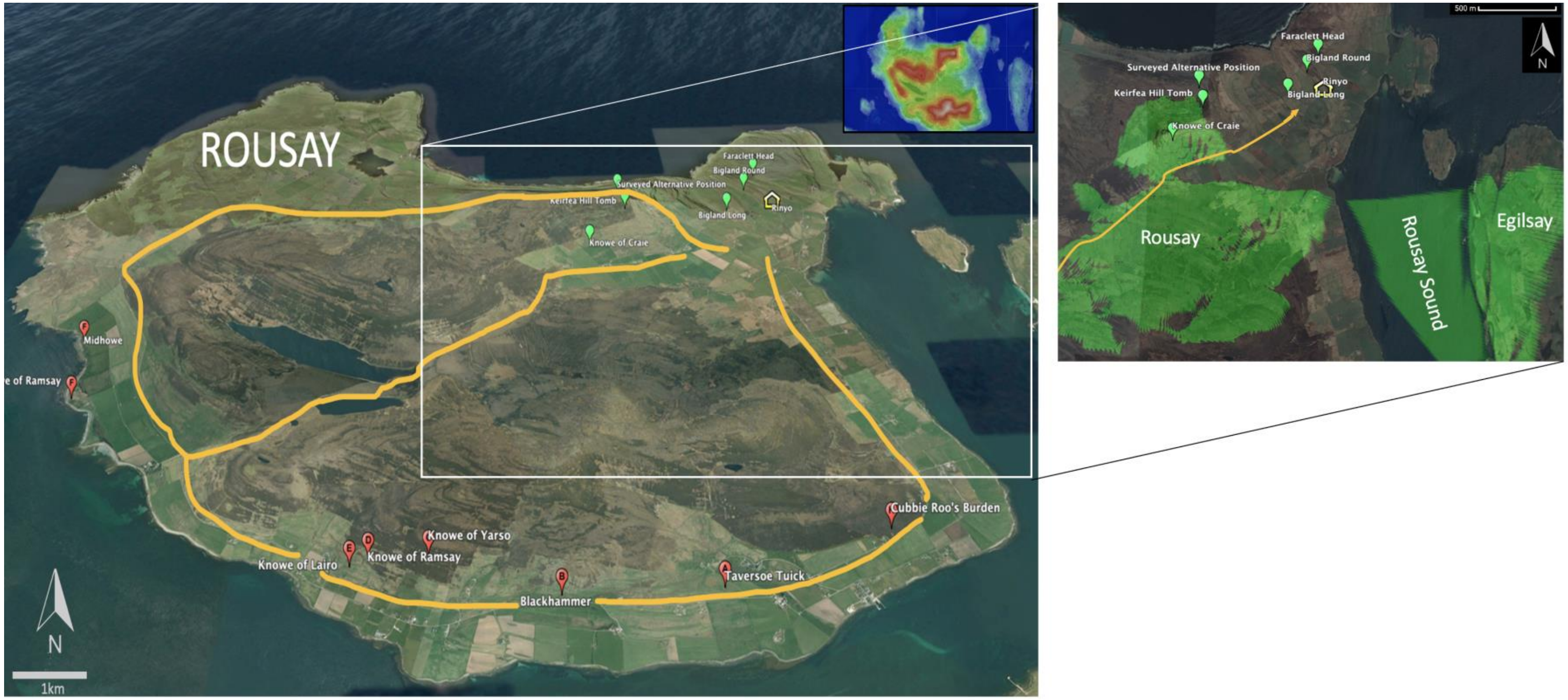


Figure 9.18. Satellite imagery of Rousay (Google Earth pro). Left - the whole island with possible Neolithic routeways marked in mustard and inset with the island's elevation map showing how the topography dictates the path of least cost effort. Right - a viewshed analysis taken from Knowe of Craie depicting how the tomb can see this proposed pathway but not the Rinyo settlement (annotated Google Earth Pro satellite image and viewshed image).

Eday is situated in the centre of the North Isles, one could describe it as a hub for this part of the archipelago (Figure 9.19). We have learnt previously that the orientation of the tombs on this island are presented differently with a wider variation of orientations marking this island out as different and therefore cementing the finding that not all island communities treat their tombs the same way particularly in respect of siting. Because of this central hub position of the island, it could be described as having an important role in sea travel. Any mariners journeying from the south will first have touched land in the south of the island at the Neolithic settlement of Green. Broadly speaking, from here the modern road B9063 starts and continues north. The start of it is marked by the presence of a standing stone (Figure 9.20) (RCAHMS 1946, 54; 1984d, 11).

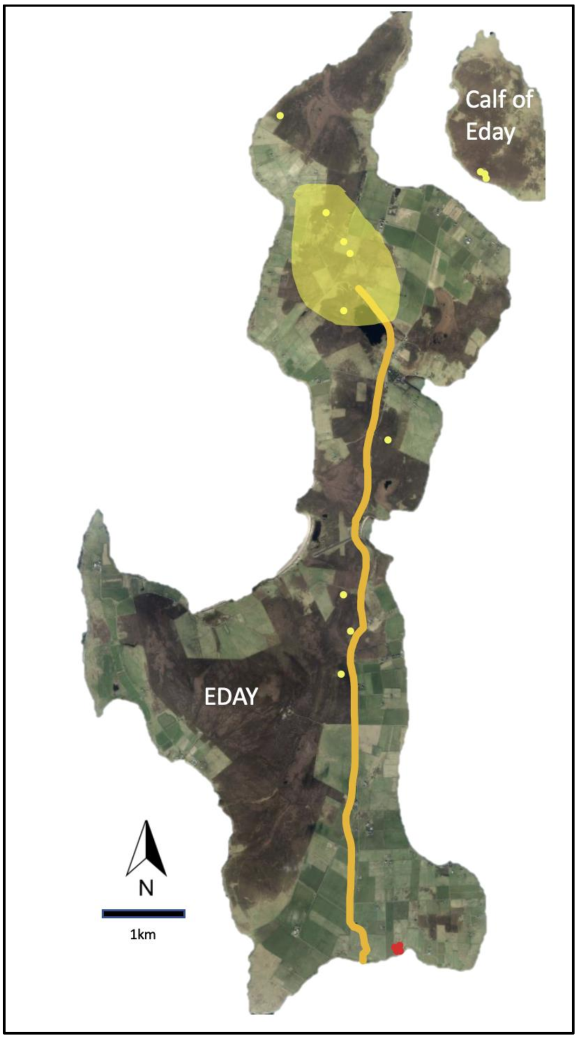


Figure 9.19. Google Earth image showing Eday with potential Neolithic routeway (mustard line) and its relationship with the chambered cairns of the island (yellow dots); Green Neolithic settlement (red dot) and Huntersquoy / Setter Stone monumental landscape (yellow shaded area) (annotated Google Earth Pro satellite image).

This the only road to run the extent of the island south to north and is occupying the most convenient route as to its west are undulating upland slopes and to its east there is a steep drop down to the coastal planes (Figure 9.19 and 9.22). This road would provide any Neolithic traveller the most appropriate terrestrial route to the impressive monumental landscape found in the north of the island.

Figure 9.20. The standing stone located at the side of the B9063 close to Green Neolithic settlement (Authors own photo)

This is an area that can be described as having much significance given the presence of several Neolithic tombs and the impressive Setter Stone that sits as a focal point and entrance to this monumental landscape for travellers from the south (Figure 9.21) as well as impressive landscape feature the Red Head cliffs there is a sheltered bay that will have provided a perfect landing / setting off point for sea travellers taking the short journey to Sanday, Westray or North Ronaldsay and beyond.

Figure 9.21. A panoramic and annotated photograph of the Neolithic monumental landscape at the north of Eday, Orkney (authors own photograph)

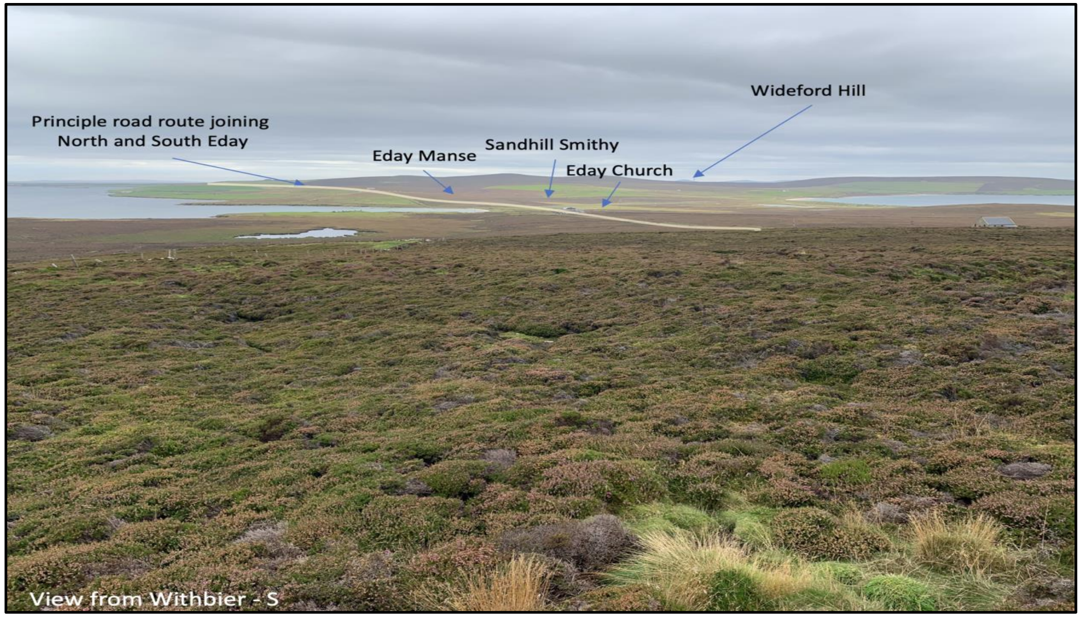


Figure 9.22. Photograph taken south facing from Withebier chambered cairn annotated to include other monuments landscape features and B9063

In short this was an extremely important place in the Neolithic and it is suggested here that it was connected to the mainland via sea routes entering the island at Green and onward via prehistoric terrestrial routes today occupied by the B9063. This fact alone may be somewhat indisputable given the island topography but it is when this road is travelled and the landscape views experienced that the theory proposing a relationship to that route develops. The tombs are skylined markers within the landscape pointing to the next tomb. This guides you to the north to south and vice versa. If one was to travel upon the lower ground close to the coast this skylining effect would not be present and therefore the guiding effect be diminished. It is this that opens the mind to the fact that these tombs have been specifically placed along this road to guide people to the centre of activity in the north of Eday. This is the same phenomenological experience as witnessed on Rousay meaning again it can be suggested that the stalled tombs of Eday are evidently of use to travellers moving from Green to the Setter Stone area.

On Westray yet again we see the same situation (Figure 9.23). Anyone arriving at the island from the south would arrive at the Bay of Turquoy. Here again we see four early stalled cairns placed high above the routeway and are easily identifiable from it as progress north along the route is made. Like Rousay and Eday here when a monument is passed another is seen effectively guiding any traveller to the north of Westray and the areas of Neolithic activity at Pierowall, Links of Noltland and onwards to Papa Westray.

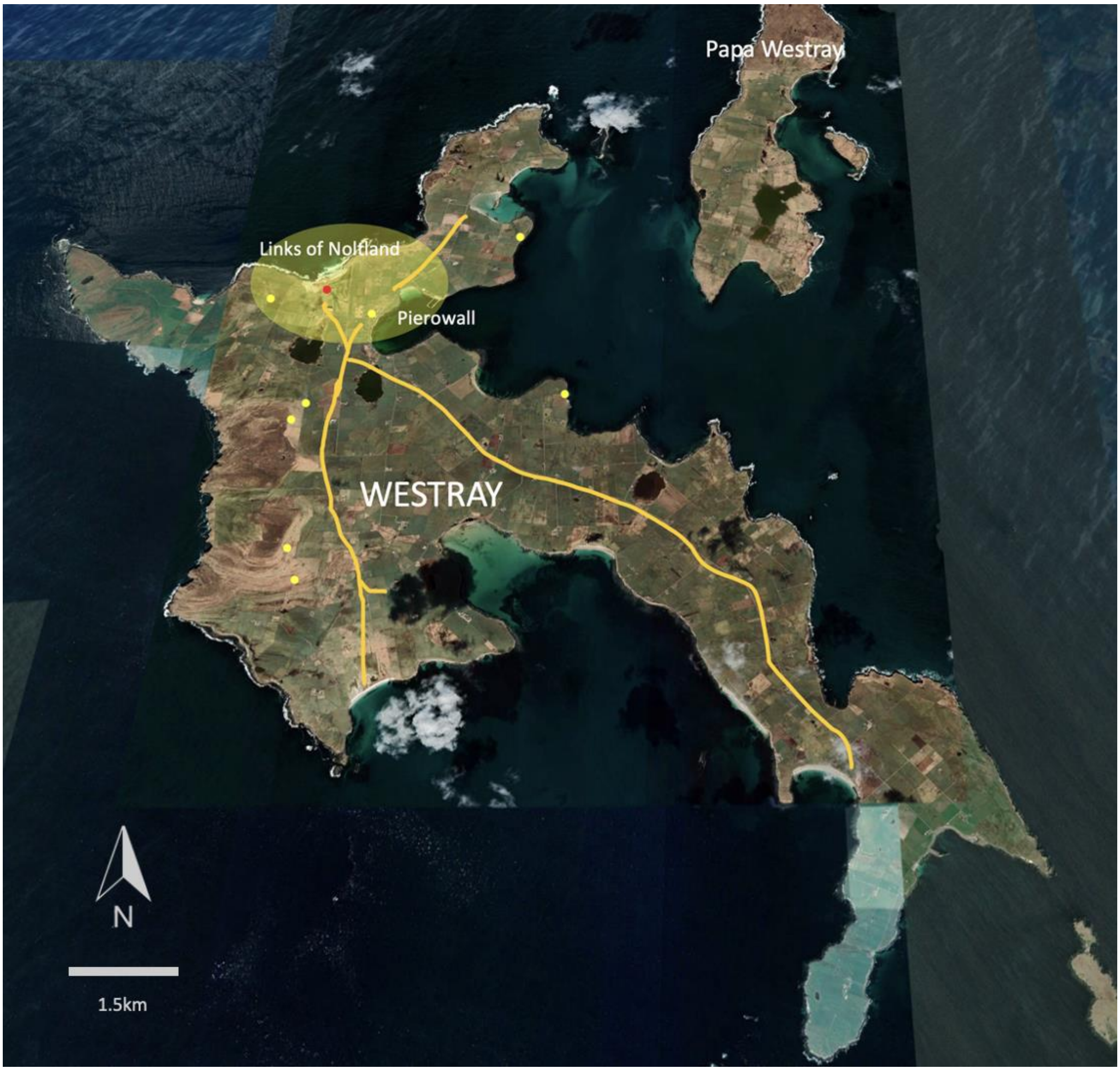


Figure 9.23. Google Earth image showing Westray with potential Neolithic routeway (mustard line) and its relationship with the chambered cairns of the island (yellow dots) (annotated Google Earth Pro satellite image).

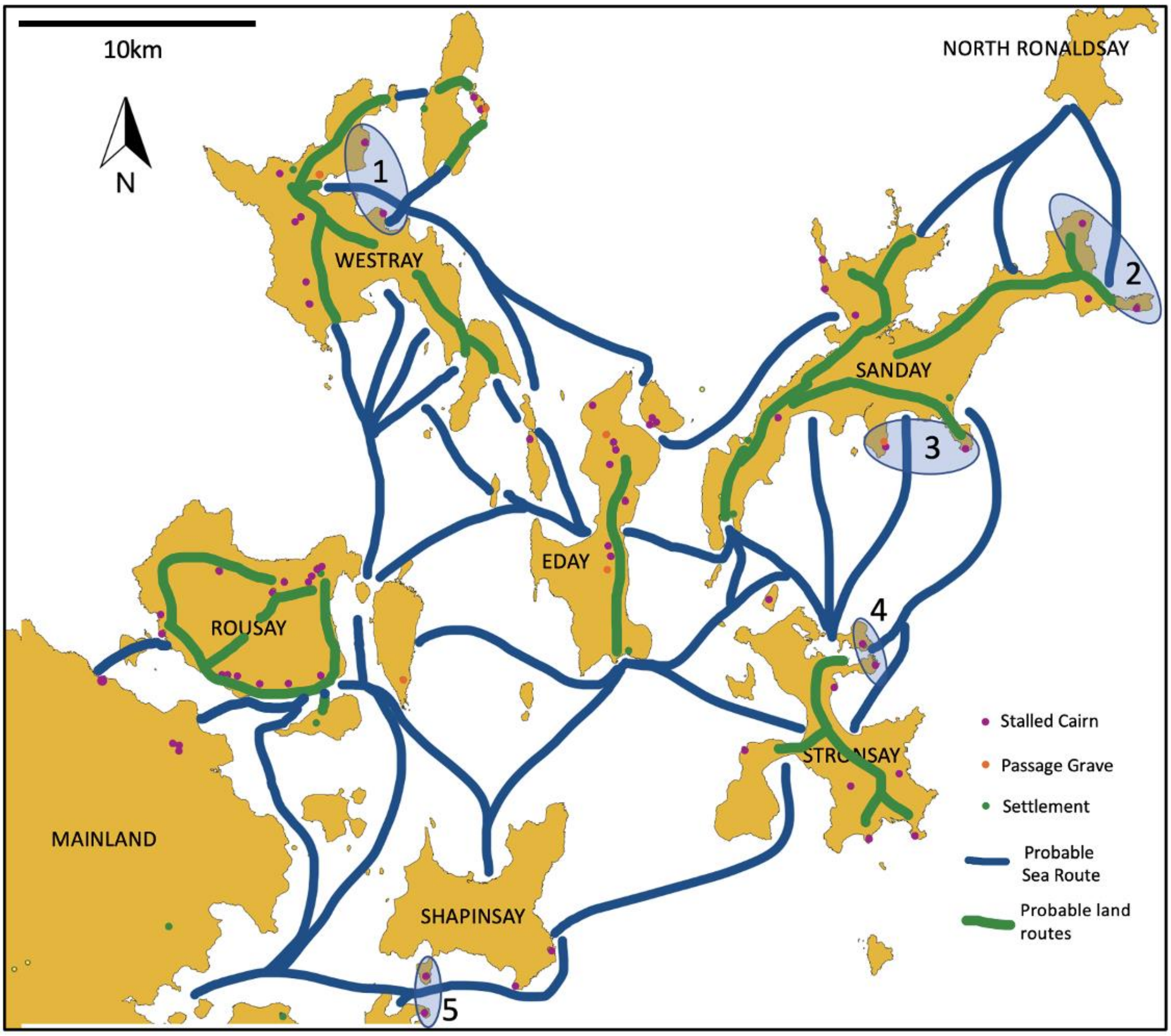


Figure 9.24. GIS produced map annotated stalled cairns, passage graves and settlements together with probable sea and terrestrial routes as taken from analysis in chapter eight. Also blue shaded areas as figure 9.16 for description (annotated QGIS map).

Building on the maritime route proposals (Figure 9.24) by adding the land routes for the North Isles it creates a model for beginning to predict and interpret local mobility across the archipelago. As such **There is a demonstrable association between tombs and marine or terrestrial routeways with 37 (70%) of North Isles tombs capable of being described as having a direct association**.

Routeways in the wider context

The primary reason the Neolithic paths and roads have little presence within archaeological literature is they are so ephemeral. Yet they did exist and must have been a fundamental enabler of economic, social and political networks throughout the

Neolithic (Tilley 1994, 30). The very earliest throws of the European Neolithic saw people expending important resources producing considerable timber trackways (see Brunning and McDermott 2013; Malmros 1986; Raftery 1996). The impressive walkways at Bohlenweg XV in Germany (Achterberg *et al.* 2015) are replicated in Britain by the oak built Sweet Track that runs some 2 km across the Somerset wetlands (Coles and Coles 1986; Ray and Thomas 2018, 292-5; Thomas 2013, 248-51). These wooden walkways allowed for movement through wetlands tracks appeared to from the very beginning of the Neolithic across mainland Europe Britain and Ireland (Coles and Coles 1992; Farrell *et al.* 2020, 278; Metzler 2006; Raftery 1996). Around the same time first stone-built monuments began to appear in the form of dolmens. Recent comprehensive research has concluded there is convincing evidence to suggest that many of the Scandinavian and northern European dolmens were sited adjacent with routeways thereby marking formal routes through the landscape (see Cummings and Richards 2021; Schülke 2014, 340) and that the monuments were purposely focussed on interaction with routeways rather than their prominence within the wider landscape (Cummings and Richards 2021, 141).

Moving closer to home in Neolithic Britain at the the Brú na Bóinne a recent study utilising lidar-derived topographic data identified a continuous routeway moving between and punctuated by the monuments. The use of this technique enabled the revelation of previously unidentified routes that were punctuated with the monuments for 3km connecting the Brú na Bóinne monumental landscape (Brady *et al.* 2013, 237). Frustratingly unavailable for this work it is for future research to utilise Orcadian LiDAR survey data (planned 2023) to refine the findings of this thesis in respect of potential terrestrial routeways.

Given the title of this thesis it would be amiss not to apply the North Isles findings to the key locations on the mainland. Recently new evidence began to emerge suggesting long range networks at the Ness of Brodgar site manifesting itself through material culture turning up at the site. It is suggestive of the location as having had great significance throughout Britain with pitchstone artefacts found only on the Isle of Arran, mace heads from the Western Isles of Scotland, stone axe blanks from the Langdale axe factories in Cumbria, ceramics from southern Britain and comparative art forms seen in Ireland (*Nick Card pers. comm*).

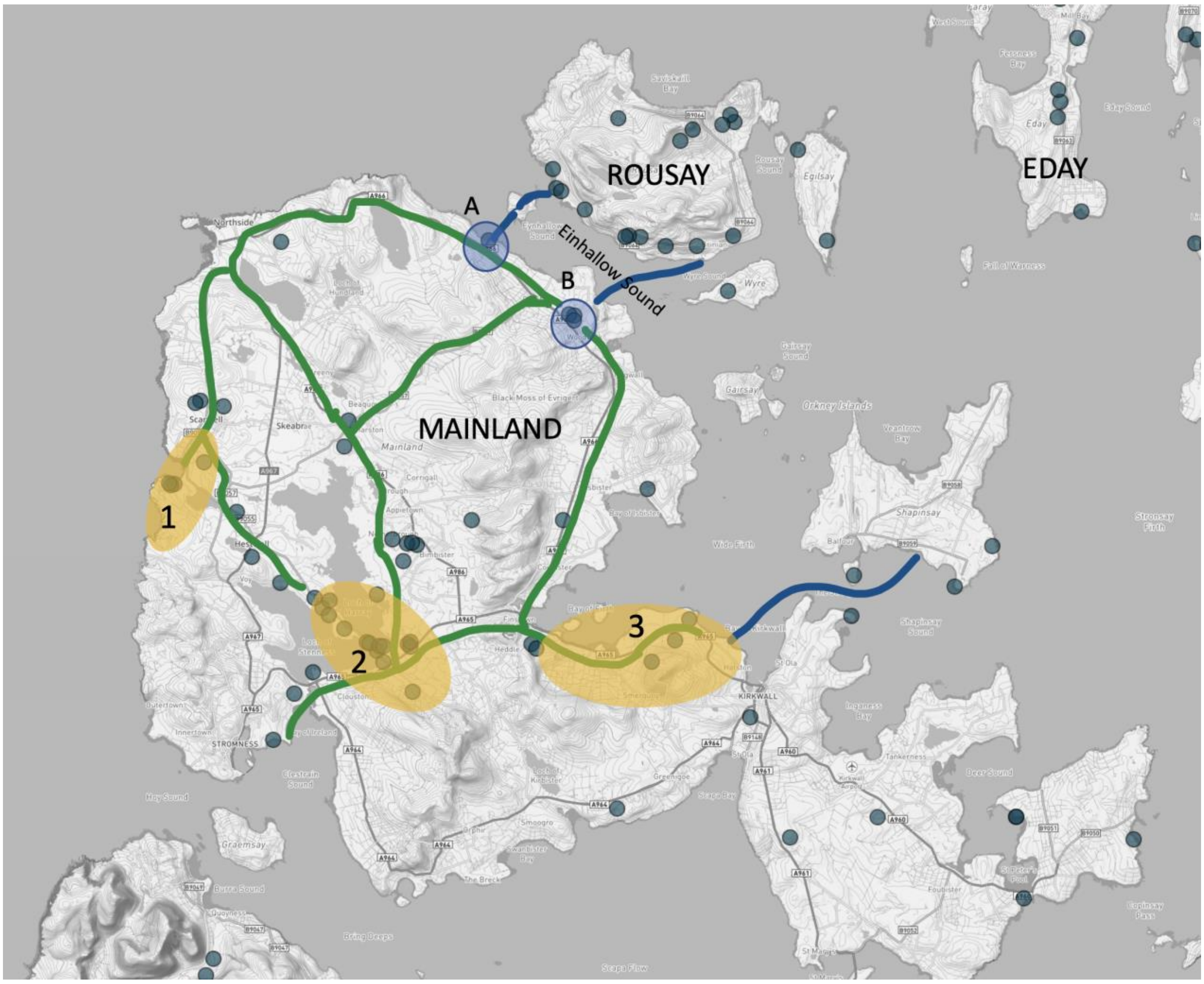


Figure 9.25. GIS produced map annotated routeways, stalled cairns, passage graves and settlements on Mainland. Skara Brae (zone 1); The Ness of Brodgar / Barnhouse landscape (zone 2) and The Bay of Firth concentration of Passage Graves and settlements sites (zone 3)

These findings are confirming other conclusions that these seaways were so influential in prehistoric migration (see Garrow and Sturt 2011; Cummings 2009; Sheridan *et al.* 2004). On a more local basis there are indications that different communities throughout Orkney had responsibility to build aspects of the Ness of Brodgar buildings to pay their part in this core of Neolithic Orkney (Nick Card *pers. comm*). Despite this work on the local picture has received no previous attention even though the peripheral North Isles needed to be connected. This analysis has been able to map probable local roads paths and sea routes across the islands and this work has begun to enhance narratives concerning interisland mobility.

Again, we see that if the modern roads are examined there is a distinct correlation with these and Neolithic sites (Figure 9.25). It suggests how these connections were made. Here again it is seen that the modern roads are punctuated by Neolithic sites and there is a clear interconnection between Skara Brae (zone 1); The Ness of Brodgar / Barnhouse landscape (zone 2) and The Bay of Firth concentration of Passage Graves and settlements sites (zone 3). Furthermore, this may also point to the mainland stalled cairns clusters that sit overlooking Rousay and The Einhallow Sound having performed the function of marking (and possibly metaphorically protecting) the best crossing routes between Rousay and Mainland see Figure 9.25 (A and B). It is also notable that these two areas represent the densest clusters of stalled cairns of the mainland. Whilst it is noted that this analysis is concerning itself with later Neolithic activity it is open to a suggestion that the relationship between monuments and routeways is something that endured throughout the Neolithic in Orkney.

Summary

One of the key findings of this work is that **not all tombs were located according to a universal tradition; they meant different things to different communities** and where therefore sited appropriately according to their specific requirements. Just as there is no architectural blueprint for the tombs it follows that siting decisions were also made for different reasons.

We have seen that there is a clear association with settlements with the new findings of this work that many of the **tombs are axially aligned to the settlement areas**. It is also suggested that there is a **direct correlation between tombs and routeways, with marine and terrestrial routes conjoining to create one mobility network**. This work has spatially unpicked previous findings and been able to progress beyond superficial statements concerning relationships with the sea to a very much more specific and pragmatic navigational relationship with sea routes and landing places. It has gone further in introducing movement and mobility into the Neolithic narratives. Tombs on Orkney have a demonstrable relationship with these routeways which follows findings from other sites in Europe Britain and Ireland. In Orkney and beyond funerary structures have been positioned purposely adjacent to routeways because of a broader tradition that was present in the minds of people of the Neolithic.

Chapter 10 – Conclusion

Conclusion

The basis of this thesis was to carry out a fresh investigation into the earliest of tombs of the peripheral North Isles of Orkney with the aim of refineing the early Neolithic narrative and to broaden our understanding of how people constructed and used the first tombs across the archipelago. It considered recent advancements in archaeological narratives, reviewed older interpretations, and carried out new desk-based analysis and fieldwork research. The motivation was simple and was born out of comments from influential Orcadian Archaeologists "…*our images of a neatly ordered early Neolithic world are blurring and a new canvas is required*" (Richards and Jones 2016, 5) and "*attention needs to look at the periphery islands in order compliment the extensive Heart of Neolithic Orkney World Heritage Site (WHS) investigations"* (Downes *et al*. 2005, 37).

This thesis has presented evidence that suggests that any distinct core and periphery relationship between the mainland and the North Isles was not evident in the early Neolithic. Conversely, it is possible to present arguments for Rousay or Eday being the core of the earliest farming activity on the islands, Rousay due to its abundance of tombs and settlements and Eday by virtue of its central position within the North Isles where it sits as a hub of a wheel of travel networks.

Here we will consider the conclusions specifically in respect of each of the research questions that formed the basis of this work.

Are there similarities or nuances between the individual island's environments and geomorphologies? - (Aim 1 and Chapter 3)

Chapter 3 highlighted a **distinctiveness of these peripheral islands**, emphasising their diversity and in doing so created a foundational geographical and environmental facet early in the thesis. This diversity is essential for informing interpretations about how early farmers lived their lives an intrinsic part of which is how they interrelated with their tombs. While Rousay and Shapinsay are closest to Orkney Mainland and therefore closer to the core of Neolithic activity, they remained distinctly peripheral. The North islands did have something in common; **all have environments conducive to arable and pastoral farming,** very much as seen today – but their activities could not occur in isolation. Socio-economic and geo-political networks beyond individual islands would have been critical to the continuation of their way of life. As farming took hold on the islands of Orkney, the dynamics of social relationships linked to farming strategies brought about new ways of thinking. Allegiances must have been made and upheld with neighbouring islands, while retaining an individuality that was reflected in the way these people of these smaller communities constructed and used their burial monuments.

What dating evidence is available and is this sufficient to establish a chronological framework of construction and use early Neolithic monuments in the North Isles of Orkney? - (Aim 1 and Chapter 5).

The first of the three main themes of this research was chronology. Comprehensive analysis of the most recent chronological evidence was carried out and has revealed a **significant gap in the understanding of early Neolithic tombs in Orkney**. While there is a wealth of Neolithic dating evidence in the broader Orcadian context, the evidence is more barren when it comes to early Neolithic tombs. Only 5% (one) tripartite tomb and 18% (six) stalled cairns in this region have provided determinable dates. Moreover, these dates are almost exclusively related to the contents of the tombs; the human and animal remains, as well as material culture, rather than actual construction processes or indeed phasing events. The practice of the early Orcadians engaging in primary, secondary and tertiary burial rites adds to the challenge with the re depositing of contents across tombs being highly likely. The lack of these absolute dating determinations, specifically for construction and phasing dates hinders the formulation of a reliable sequencing framework. The absence of construction dates is particularly noteworthy as it impedes the ability to understand the chronological progression of tomb construction and use over time. This research also has emphasised the urgent need for a targeted dating research addressing this issue. Narratives would benefit to fill the existing data gap and facilitate a more nuanced understanding of the temporal dynamics of tomb construction and phasing.

Nevertheless, the findings of this research were able to demonstrate that, **the earliest Neolithic activity across the archipelago was in the North Isles** (according to currently available data) was at Point of Cott, Holm of Papa Westray North at Knap of Howar on Westray, and Midhowe on Rousay, and this is supported by radiocarbon dating evidence and from a typological viewpoint. It's important to note that this situation has the potential to change with more robust dating projects in the future. Moreover, the study confirmed that stalled cairns and passage graves were in use contemporaneously and this is a considerable departure from the previously accepted evolutionary model that saw a trajectory from tripartite tombs to stalled cairns to passage graves.

Can architectural nuances within building methodologies be unpicked to identify different phases of construction for Neolithic monuments and if so what does this imply about longevity of tomb use? - (Aim 1 and 2, Chapter 6).

Addressing this question, the thesis utilised a new methodology and has identified that **many early Neolithic tombs underwent architectural changes** during their biographies, **indicating different phases of construction**. These adaptations involved the incorporation of archaeological classification features from both stalled cairns and passage graves into a single tomb, as observed at Tresness, Isbister, and Unstan. Rather than being constructed as single-phase tombs with mixed features - these changes likely reflect shifts in traditions with tombs being adapted over time to reflect the new ideas as they arrived at the archipeligo. As a result, it is proposed that the term "hybrid" be replaced with "multi-phased" to describe these monuments more accurately. This shift in terminology suggests that the early Neolithic tombs in this region might have been **in use over a more prolonged period**, a perspective that contrasts with other regions in Britain and Ireland. However, due to a lack of comprehensive dating evidence, this can only be theorized in this context. Additionally, the thesis introduces the argument that **small curvilinear cell-like structures are potential candidates for the earliest tombs.** This is exemplified by structures incorporated into monumental footprints at Point of Cott, Calf of Eday Long, and Taversoe Tuick. This nuanced understanding of the coexistence and potential diversity in tomb structures during the early Neolithic period adds complexity to prevailing models of tomb evolution in the Orcadian archaeological context.

What is the spatial and temporal relationship between the tombs, settlements, and the landscape more broadly? Were the tombs aligned upon specific targets such as astronomical bodies, landscape features, other tombs or settlements? - (Aim 1 and 2, Chapter 7, 8 and 9)

This thesis has refined the currently accepted south-east alignment narrative for the Orcadian tombs by providing a more detailed examination of the subject. The research demonstrates that stalled cairns (56.7%) and passage graves (100%) can be considered as aligned to or close to the rising sun at the solstices, equinox, or cross-quarter days. **These alignments suggest a pragmatic interest in seasonality**, indicating a genuine concern among early farmers for subsistence strategies. Furthermore, the study suggests that alignments acknowledging seasons appear more significant in the later Neolithic passage graves.

Notably, the research suggests that the tombs of Eday and to a lesser extent Westray do not follow the south-east alignment convention, which differs from the previously accepted understanding. The reasons for this deviation may be linked to Eday's central position for travel and connectivity within the North Isles. It is suggested that Eday functions as a hub, facilitating practical inter-North Isles sea travel. Contrary to the notion of a universal cosmologically motivated alignment tradition, this finding indicates that **not all monuments adhere to the same alignment principles**.

The overarching result of this assessment on the siting locations of the North Isles tombs is that their builders were not working from a common cultural mandate or positioning customs. Throughout the thesis, the argument has been presented that there is **no blueprint for tomb construction,** and it follows that and different island communities made decisions based on their own specific needs. This challenges previous interpretations that have attempted to argue for a "one size fits all" approach to explaining why tombs were located where they were.

Can settlements contemporary with the early Neolithic chambered tombs be identified? If so, what is the relationship between settlements and tombs? - (Aim 2 Chapter 8 and 9)

Can terrestrial and maritime routeways be identified by analysis the locations of tombs and settlements and suitable landing points? - (Aim 1, Chapter 8 and 9).

For the first time this work has demonstrated that the axis of the early Neolithic monuments of Rousay were built with a **purposeful alignment with the islands two main sites of multi-occupation** where the early farmers lived and worked. They were positioned to be associated with the early phases of settlements (and surrounding fields) at Rinyo and Braes of Ha'Breck; the latter is located on the island of Wyre today though it was likely attached, a tidal island or easily accessible in the early Neolithic and as such is considered here to be part of any Rousay community. It follows that to be so associated these **settlements must have predated the first phases of their associated tombs**. This adds weight to any argument that Rousay was the core of Orcadian early Neolithic activity.

On balance it is also suggested that several early Neolithic tombs across the North Isles of Orkney **were purposely positioned as markers to provide pragmatic or metaphoric support to early travellers**. There is a demonstrable association between tombs and marine or terrestrial routeways with 37 (70%) of North Isles tombs capable of being described as having this direct association.

It is not difficult to argue that the neolithic North Isles Orcadians will have been skilled mariners and will have used the sea as both a source of food but also to maintain socio-economic relations with other close by islands. All too often, narratives are born out of dots on maps but when pathways are included to connect those dots movement and mobility can be envisaged and introduced into the Neolithic narratives. **Tombs on Orkney have a relationship with routeways** which follows recent findings from other sites in Europe, Britain and Ireland – but never before in Orkney. Suggesting that Neolithic funerary structures were positioned purposely in proximity to routeways (terrestrial and marine) by virtue of a broader tradition that was present in the minds of people of the Neolithic.

Can potential locations of yet unidentified tombs or settlements be proposed by analysing the spatial arrangements of known monuments? - (Aim 1, chapter 7, 8 and 9)

Moving forward

It was evident during the chronological research that the picture is far from complete. This will only be addressed when more robust dating evidence is available from archaeological investigations; a point that was discussed at Scotland's Island Research Framework for Archaeology (*SIRFA*) Symposium for Orkney in March 2023. Moreover, given the findings of this thesis the early **Neolithic tomb orientations are *foci* for settlements** it has been possible to identify areas in the landscape prime for further investigation. The evidence is particularly strong in the south of Westray around the Bay of Turquoy and central east Eday on the low-lying land below the Eday Manse, Eday Church and Sandhill Smithy cluster of tombs. The work on marine and terrestrial routeways and the demonstrable association between them and the early Neolithic tombs would also benefit from further work. It would bring to life the Neolithic picture adding mobility beyond dots on maps. The rescue excavation work undertaken recently at Tresness considerably enhanced the narrative not only for this monument but in its wider settlement and tombs contexts. It clearly demonstrates the effect modern excavations can have on the archaeological record. The methodologies employed herein with regards to phasing are clearly most effective when deployed in conjunction with detailed archaeology reports, surveys and observations – Tresness being a case in point.

Did the individual island communities operate under the same social processes as the mainland or indeed each other? Were they segmented or part of a wider community (chiefdom)? - (Aim 2 chapter 7, 8 and 9)

In pursuance of this question this thesis has presented evidence challenging the notion of a distinct core / peripheral relationship between the mainland and the North Isles during the early Neolithic. Instead, arguments are made for Rousay or Eday as potential cores of early farming activity on the islands. Rousay is highlighted for its abundance of tombs and settlements, while Eday's central position within the North Isles is considered a key factor. The **diversity among the islands is acknowledged**, whilst emphasizing the importance of alliances and interactions facilitated by sea travel.

Island inhabitants will have needed to form connections, viewing themselves as part of a boarder community which included the mainland and other islands. Social and cultural relations were crucial for survival, leading to shared ideas. The fundamental intrinsic purpose of the tomb had its origins in cosmology and tradition it seems the fineries of positioning and alignment decisions were left to those individual island communities. Nevertheless, these tombs would have served as familiar landmarks, fostering a sense of belonging and comfort for travellers by land and by sea. Exchange of livestock, crops, social interactions, and the dissemination of ideas and cultural traditions from Britain, Ireland, and the Western Isles were integral to these interactions.

The research shows that both stalled cairns and later passage graves were in use contemporaneously. This suggests that while new ideas may not have been as crucial for smaller island communities, obligations to bonds between neighbours, communities, and ancestors had longevity within these segmented, though not isolated, island populations. In answering this research question the work demonstrates that **tombs were noy universally located according to a single tradition**; they held different meanings for different communities and were situated based on individual requirements. Just as there is no architectural blueprint for the tombs, the decisions on their positioning and alignment within the landscape was equally diverse.

In summation, this thesis has reviewed and enhanced current thinking by challenging established hypothesis. It brings the early Neolithic narratives of Orkney up to date by leveraging an archaeological record not fully available to previous comprehensive studies. New interpretations, such as the alignment of monuments on settlements and the purposeful association of chambered tombs with marine and terrestrial routeways, have enriched and enlivened the Orcadian early Neolithic.

References

References

Achterberg, I., Bauerochse, A., Giesecke, T., Metzler, A. and Leuschner, H. 2015. Contemporaneousness of Trackway construction and environmental change: a dendrochronological study in Northwest-German mires. *IANSA*, *6*(1), 19-29.

Ambrose, H. 1993. Isotopic analysis of paleodiets: methodological and interpretive considerations, in M.K. Sandford [*ed*.], *Investigations of ancient human tissue: chemical analyses in anthropology:* 59-130. Langhorne: Gordon & Breach Science Publishers.

Ammerman, A.J. and Cavalli-Sforza, L.L. 1984. *The Neolithic transition and the genetics of populations in Europe. Princeton* (NJ): Princeton University Press

Andersen, S. 1987. Mesolithic Dug-Outs and Paddles from Tybrind Vig, Denmark. *ActaArchaeologica,* Issue 57, 87–106.

Anderson-Whymark, H. and Cummings, V. 2019. *Tresness chambered tomb, Sanday: Excavations in 2019 Data Structure Report*.

Anderson-Whymark, H. and Cummings, V., *Tresness chambered tomb, Sanday: Excavations in 2021 Data Structure Report.*

Anderson-Whymark, H., Garrow, D. and Sturt, F. (eds) 2015. *Continental connections: exploring cross-channel relationships*. Oxbow Books.

Anderson, J. 1866. *On the horned cairns of Caithness: their structural arrangement, contents of chambers. Proceedings of the Society of Antiquaries of Scotland*, 7: 480–512.

Arnold, J.R. and Libby, W.F. 1949. Age determinations by radiocarbon content: checks with samples of known age. *Science* 110 (2869), 678–80.

Arnold, J.R. and Libby, W.F. 1951. Radiocarbon dates. *Science* 113(2927), 111–20.

Ashbee, P. 1966. The Fussell's Lodge long barrow excavations 1957. *Archaeologia* 100, 1–80.

Ashbee, P. 1970. *The Earthen Long Barrow in Britain.* London: Dent.

Ashbee, P. 1984. *The earthen long barrow in Britain*. Cambridge: Cambridge University Press.

Ashmore, P. J. 1996. *Neolithic and Bronze Age Scotland*. B. T. Batsford Ltd/Historic Scotland.

Ashmore, P. J. 2000. Dating the Neolithic in Orkney, in A. Ritchie (ed.) *Neolithic Orkney in its European context*: 299–308. Cambridge: McDonald Institute for Archaeological Research.

Atkinson, R. J. C. 1961. Parc le Breos Cwm. *Archaeology in Wales* 1, 5.

Atkinson, R. J. C. 1965. Wayland's Smithy. *Antiquity*, *39*(154), 126-133.

Atkinson, R. J. C. 1978. *Chronicle, Essays from Ten Years of Television Archaeology*. British Broadcasting Corporation.

Bailey, G. N. and N. J. Milner. 2002. Coastal hunter-gatherers and social evolution: marginal or central? *Before Farming, the Archaeology and Anthropology of Hunter-Gatherers* 3-4: 1-15.

Ballin-Smith, B. 1990. Isbister, an Orkney Islands Council Guardianship Monument. In *Proceedings of the Society of Antiquaries of Scotland* (Vol. 119, 55-58).

Ballin, T. B., Ellis, C. and Baillie, W. 2018. Arran pitchstone–different forms of exchange at different times. *CIfA Scottish Group Newsletter*, 3-11.

Barber, C. 2017. *Megaliths of Wales: Mysterious sites in the landscape*. Stroud: Amberley Publishing.

Barber, J. 1997. *The excavation of a stalled cairn at the Point of Cott, Westray, Orkney*. Edinburgh: Star Monograph I.

Barber, J. 1984b *'Point of Cott (Westray p), chambered cairn.', Discovery and Excavation Scotland,* 1984, 21-2

Barber, J. 1997. *The excavation of a stalled cairn at the Point of Cott, Westray, Orkney*. Edinburgh: Scottish Trust for Archaeological Research.

Barber, J., 2000. Death in Orkney: a rare event. *Neolithic Orkney in its European context*, 185-8.

Barber, J. and Coy, J., 1997. *The excavation of a stalled cairn at the Point of Cott, Westray, Orkney*. Edinburgh: Scottish Trust for Archaeological Research.

Barclay, G.J., and Brophy, K. 2021. 'A veritable chauvinism of prehistory': nationalist prehistories and the 'British' late Neolithic mythos, *Archaeological Journal,* 178:2, 330-360,

Barker, G. 1985. *Prehistoric farming in Europe*. Cambridge: Cambridge University Press.

Barrett, J. C. 1988. The Living, the Dead, and the Ancestors: Neolithic and Early Bronze Age Mortuary Practices. In *The Archaeology of Context in the Neolithic and Bronze Age: Recent Trends*, Barrett J C. and Kinnes, I (eds). 30–41. Sheffield: University of Sheffield Press.

Barry, G. 1805. *History of the Orkney Islands*. Edinburgh: D. Willison.

Bates, M. R., Nayling, N., Bates, R., Dawson, S., Huws, D. and Wickham-Jones, C. 2013. A multi-disciplinary approach to the archaeological investigation of a bedrock-dominated shallow-marine landscape: an example from the Bay of Firth, Orkney, UK. *International Journal of Nautical Archaeology*, *42*(1), 24-43.

Bauerochse, A. 2003. Environmental change and its influence on trackway construction and settlement in the south-west Dümmer area. In: Bauerochse, A., Haßmann, H. (eds.): *Peatlands – archaeological sites, archives of nature, nature conservation, wise use.* Rhaden/Westf. 68–78.

Baxter, M. I. 2001. *Human Remains from the British Neolithic: A Taphonomic Perspective*. Unpublished PhD thesis, University of Cambridge.

Bayliss, A. 2009. Rolling out revolution: using radiocarbon dating in archaeology. *Radiocarbon*, *51*(1), 123-147.

Bayliss, A., Benson, D., Galer, D., Humphrey, L., McFadyen, L. and Whittle, A. 2007. "One Thing After Another: the Date of the Ascott-under-Wychwood Long Barrow," *Cambridge Archaeological Journal*. Cambridge University Press, 17(S1), 29–44.

Bayliss, A., Bronk Ramsey, C., van der Plicht, J. and Whittle, A. 2007. "Bradshaw and Bayes: Towards a Timetable for the Neolithic," *Cambridge Archaeological Journal*. Cambridge University Press, 17(S1), 1–28.

Bayliss, A., Marshall, P., Richards, C. and Whittle, A. 2017. Islands of history: the late neolithic timescape of Orkney. *Antiquity* 91, 1171–1188.

Bayliss, A. and Whittle, A. (eds) 2007. Histories of the dead: building chronologies for five southern British long barrows [special issue]. *Cambridge Archaeological Journal* 17(Supplement S1).

Bayliss, A., Whittle, A. and Wysocki, M. 2007. “Talking About My Generation: The date of the West Kennet Long Barrow,” *Cambridge Archaeological Journal*. Cambridge University Press, 17(S1), 85–101.

Beckett, J. and Robb, J. 2006. Neolithic burial taphonomy, ritual, and interpretation in Britain and Ireland: a review. *Social archaeology of funerary remains*, 57-80.

Bentley, R.A., Krause, R., Price, T.D. and Kaufmann, D. 2003. Human mobility at the early Neolithic settlement of Vaihingen, Germany: strontium isotope analysis. *Archaeometry* 45:471–486.

Bell, M. 2020. Making one's way in the world: the footprints and trackways of prehistoric people. *Making One's Way in the World*, 1-304.

Bell, B. and Haigh, D.1981.*'Howe of Howe (Stromness p). Chambered tomb, broch, Pictish settlement etc.', Discovery and Excavation Scotland, 1981*, 25.

Bell, M. and Leary, J. 2020. Pathways to past ways: a positive approach to routeways and mobility. *Antiquity*, *94*(377), 1349-1359.

Bell, M. and Walker, M. J. 2014. *Late Quaternary environmental change: physical and human perspectives*. London: Routledge.

Bellwood, P. S. and Renfrew, C. 2002. *Examining the farming/language dispersal hypothesis*. Cambridge: McDonald Institute for Archaeological Research.

Bender, B. 1993. Stonehenge-contested landscapes (medieval to present-day). *Landscape: Politics and perspectives*, 245-279.

Bender, B., Hamilton, S., and Tilley, C. 1997. Leskernick: stone worlds; alternative narratives; nested landscapes. *Proceedings of the Prehistoric Society* 63, 147-178.

Bergh, S. and Hensey, R. 2013. Unpicking the Chronology of Carrowmore. *Oxford Journal of Archaeology*, *32*(4), 343-366.

Berry, R. J. 2000. *Orkney Nature.* London: T&AD Poyser Natural History.

Beusing, R. and Rassmann, K. 2019. *Westside and Rinyo, Rousay, Gradiometer survey,* in Paula Milburn*, Discovery and Excavation Scotland, New, vol. 19, 2018*. Cathedral Communications Ltd, Wiltshire, England, 152.

Bickle, P., Bentley, R.A., Dočkalová, M., Fibiger, L., Griffiths, S., Hamilton, J., Hedges, R., Hofmann, D., Mateiciucová, I. and Whittle, A. 2014. Early Neolithic lifeways in Moravia and Western Slovakia: comparing archaeological, osteological and isotopic data from cemetery and settlement burials of the Linearbandkeramik (LBK). *Anthropologie (1962-)*, *52*(1), 35-72.

Binford, L.R. 1962. Archaeology as anthropology. *American antiquity*, *28*(2), 217-225.

Binford, L.R. 1964. A consideration of archaeological research design. *American antiquity*, *29*(4),425-441.

Binford, L.R. 1965. Archaeological Systematics and the Study of Culture Process 1. *American antiquity*, *31*(Part1), 203-210.

Blankshein, S.L. 2021. (Sea)ways of Perception: an Integrated Maritime-Terrestrial Approach to Modelling Prehistoric Seafaring. *J Archaeol Method Theory* 29, 723–761.

Bond, J. M.1995. *'Stove Bay: a new Orcadian grooved ware settlement', Scot Archaeological Review, vol. 9/10, 1995,* 125-130.

Bondevik, S., Løvholt, F., Harbitz, C., Mangerud, J., Dawson, A. and Svendsen, J.I. 2005. The Storegga Slide tsunami—comparing field observations with numerical simulations. In *Ormen Lange–an Integrated Study for Safe Field Development in the Storegga Submarine Area*. Elsevier.

Bondevik, S., Mangerud, J., Dawson, S., Dawson, A. and Lohne, Ø. 2005b. Evidence for three North Sea tsunamis at the Shetland Islands between 8000 and 1500 years ago. *Quaternary Science Reviews*, 24(14-15), 1757–1775.

Bondevik, S., Mangerud, J., Dawson, S., Dawson, A., qnd Lohne, Ø. 2003. Record-breaking height for 8000-year-old tsunami in the North Atlantic. *Transactions American Geophysical Union*, 84(31), 289–293.

Bonsall, C., Cook, G.T., Pickard, C., McSweeney, K. and Bartosiewicz, L. 2009. Dietary trends at the Mesolithic–Neolithic transition in northwest Europe. *Chronology and evolution in the Mesolithic of northwest Europe*, 539-62.

Bowen, E. G. 1972*. Britain and the western seaways.* London: Thames and Hudson.

Brace, S., Diekmann, Y., Booth, T.J., van Dorp, L., Faltyskova, Z., Rohland, N., Mallick, S., Olalde, I., Ferry, M., Michel, M. and Oppenheimer, J. 2019. Ancient genomes indicate population replacement in Early Neolithic Britain. *Nature ecology & evolution*, *3*(5), 765.

Bradley, R. 1998. *The significance of monuments: on the shaping of human experience in Neolithic and Bronze Age Europe*. London: Routledge.

Bradley, R. 2000a. *An archaeology of natural places*. London: Psychology Press.

Bradley, R. 2000b. *The good stones: a new investigation of the Clava cairns*. Edinburgh: Society of Antiquaries of Scotland.

Bradley, R. 2001. 'Orientations and origins: a symbolic dimension to the long house in Neolithic Europe', *Antiquity* 75, 50–6.

Bradley, R. 2012. *Ritual and domestic life in prehistoric Europe*. London: Routledge.

Brady, C., Davis, S., Megarry, W. and Barton, K. 2013. *Lidar survey in the Brú na Bóinne world heritage site*. In: Interpreting Archaeological Topography: Lasers, 3D Data, Observation, Visualisation and Applications. Occasional Publication of the Aerial Archaeology Research Group, 225-239. Barnsley: Oxbow Books.

Brend, A. 2010e. *'The Braes of Ha'Breck, Wyre, Orkney (Rousay and Egilsay parish), geophysical survey', Discovery and Excavation Scotland, New, vol. 11, 2010*, 121. Wiltshire: Cathedral Communications Limited.

Brend, A., Card, N., Downes, J. and Edmonds, M (eds) .2020. *Landscapes Revealed: Geophysical Survey in the Heart of Neolithic Orkney World Heritage Area.* Oxford: Windgather/Oxbow Press.

Britain, G. 2009. Vision and Design: Approaches to Ceremonial Monument Typology Author (s): Andrew Fleming Source : *Man*, New Series, Vol . 7, 57-73

Britnell, W. J. 1984a. The Gwernvale long cairn, Crickhowel, Brecknock, In Britnell and Savory 1984, 41-154. *Gwernvale and Penywyrlod: two Neolithic long cairns in the Black Mountains of Brecknock.* Cardiff: Cambrian Archaeological Monograph, 2.

Britton, K., Muldner, G and Bell, M. 2008. 'Stable isotope evidence for salt-marsh grazing in the Bronze Age Severn Estuary, UK: implications for paleodietary analysis at coastal sites', *Journal of Archaeological Science* 35, 2111-2118.

Bronk Ramsey, C., Higham, T., Bowles, A. and Hedges, R. 2004. Improvements to the pretreatment of bone at Oxford. *Radiocarbon* 46/1, 155-63.

Broodbank, C. 2000. *An Island Archaeology of the Early Cyclades*. Cambridge: Cambridge University Press.

Brown, J. F. 2003. 'Geology and Landscape', In Ormund, D. (ed.) *The Orkney Book*, 1-23. Edinburgh: Birlinn.

Brück, J. 2005. Experiencing the past? The development of a phenomenological archaeology in British prehistory. *Archaeological dialogues*, *12*(1), 45-72.

Brumm, A. 2004. An axe to grind: Symbolic considerations of stone axe use in ancient Australia. In Boivin N, Owoc MA (eds) *Soils, Stones and Symbols: Cultural Perceptions of the Mineral World*. London: UCL Press, 143–164.

Brunning, R. and MacDermott, C. 2013. Trackways and roads across the wetlands. In: Menotti, F. and O'Sullivan (eds.): *The Oxford Handbook of Wetland Archaeology.* Oxford: Oxford University Press.

Buck, C. E., Cavanagh, W. G. and Litton, C. D. 1996. *Bayesian approach to interpreting archaeological data.* Chirchester: Wiley.

Bunting, M. J. 1994. Vegetation history of Orkney, Scotland; pollen records from two small basins in west Mainland. *New Phytologist*, *128*(4), 771-792.

Bunting, M. J. 1996. The development of heathland in Orkney, Scotland: pollen records from Loch of Knitchen (Rousay) and Loch of Torness (Hoy). *The Holocene*, *6*(2), 193-212.

Bunting, M. J., Farrell, M., Bayliss, A., Marshall, P. and Whittle, A. 2018. Maps from mud—using the multiple scenario approach to reconstruct land cover dynamics from pollen records: a case study of two Neolithic landscapes. *Frontiers in ecology and evolution*, *6*, 36.

Bunting, M. J., Farrell, M., Dunbar, E., Reimer, P., Bayliss, A., Marshall, P. and Whittle, A. 2022. Landscapes for Neolithic People in Mainland, Orkney. *Journal of World Prehistory*, *35*(1), 87-107.

Burl, A., 1981. By the light of the cinerary moon: chambered tombs and the astronomy of death. in Ruggles & Whittle (eds), *Astronomy and Society in Britain During the Period 4000–1500*, 243-74.

Burl, A. 1988. ‘Without sharp north’: Alexander Thom and the great stone circles of Cumbria, in C.L.N. Ruggles (ed.),*Records in stone*: 175-205. Cambridge: Cambridge University Press.

Burl, A. 2000. *The stone circles of Britain, Ireland and Brittany*. New Haven: Yale University Press.

Burrow, S. 2006. *The Tomb Builders in Wales 4000–3000 BC*. Cardiff: National Museum Wales Books.

Burrow, S. 2010. Bryn Celli Ddu passage tomb, Anglesey. *Proceedings of the Prehistoric Society* 76: 249–70.

Cain, G., Goff, J. and McFadgen, B. 2019. Prehistoric Coastal Mass Burials: Did Death Come in Waves?. *Journal of Archaeological Method and Theory*, *26*(2), 714-754.

Calder, C. 1937, November. A Neolithic double-chambered cairn of the stalled type and later structures on the Calf of Eday, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 71,115-154.

Calder, C. 1938. Excavations of Three Neolithic Chambered Cairns-One with an Upper and a Lower Chamber-in the Islands of Eday and the Calf of Eday in Orkney. *Proceedings of the Society of Antiquaries of Scotland*. Volume 72, 1937-38.

Callaghan, R. 1999. Computer Simulations of Ancient Voyaging. *The Northern Mariner/Le Marin Du Nord,* Issue 1, 24–33.

Callaghan, R. and Scarre, C. 2009. Simulating the western seaways. *Oxford Journal of Archaeology*, *28*(4), 357-372.

Callander, J. G. 1918b. *'Three food-vessel urns, a cup-marked stone, and other objects discovered at Sheriffton, near Perth', Proc Soc Antiq Scot, vol. 52, 1917-18,* 407-19.

Callander, J., Grant, W. and Low, A. 1933. A long stalled chambered cairn or mausoleum (Rousay type) near Midhowe, Rousay, Orkney. *Proceedings of the Society of Antiquaries of Scotland* 68, 320-350.

Callander, J. and Grant, W. 1935. November. A Long, Stalled Cairn, the Knowe of Yarso, in Rousay, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 69, 325-351.

Callander, J. G. and Grant, W.G.1936. *'A stalled chambered cairn, the Knowe of Ramsey, at Hullion, Rousay, Orkney', Proc Soc Antiq Scot, vol. 70, 1935-6,* 407-19.

Callander, J. and Grant, W. 1937, November. Long stalled cairn at Blackhammer, Rousay, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 71, 297-308.

Campbell, M. 2001. *Settlement and landscape in late prehistoric Rarotonga, Southern Cook Islands*. Unpublished PhD thesis, University of Sydney.

Card, N. 2005. History of prehistoric research. *The Heart of Neolithic Orkney World Heritage Site Research Agenda,* (eds) Downes, J., Foster, S., Wickham-Jones, C. and Callister, J. 40-45.

Card, N. 2005. Part 2. Resource assessment. History of prehistoric research. In j. Downes, S. Foster and c. Wickham-Jones (eds) *The Heart of Neolithic Orkney World Heritage Site Research Agenda.* Edinburgh: Historic Scotland, 40-46.

Card, N., Downes, J., Gibson, J. and Ovenden, S. 2007. Bringing a landscape to life? Researching and managing "The Heart of Neolithic Orkney" World Heritage Site. *World Archaeology*, *39*(3), 417–435.

Card, N., Edmonds, M. and Mitchell, A. (eds). 2020. *The Ness of Brodgar: As it stands*. University of the Highlands and Islands, Archaeology Institute.

Card, N., Mainland, I., Timpany, S., Towers, R., Batt, C., Ramsey, C.B., Dunbar, E., Reimer, P., Bayliss, A., Marshall, P. and Whittle, A. 2018. To cut a long story short: formal chronological modelling for the Late Neolithic site of Ness of Brodgar, Orkney. *European Journal of Archaeology*, *21*(2), 217-263.

Carter, S. and Smith, B. 1980. *'Howe of Howe (Stromness p). Pre-broch, broch, Pictish settlement', Discovery and Excavation Scot, 1980*, 24.

Carter, S. P., Haigh, D., Neil, N. R. J. and Smith, B. 1984. Interim report on the structures at Howe, Stromness, Orkney. *Glasgow Archaeological Journal*, *11*(1), 61-73.

Casana, J., Wiewel, A., Cool, A., Hill, A. C., Fisher, K. D. and Laugier, E. J. 2017. Archaeological aerial thermography in theory and practice. *Advances in Archaeological Practice*, *5*(4), 310-327.

Case, H. 1969. Neolithic explanations, *Antiquity* 43,176-86.

Case, H. 1986. The Mesolithic and Neolithic in the oxford region. In G. Briggs, J. Cook and T. Rowley (eds), *The archaeology of the Oxford region*. Oxford: Oxford University Department of External Studies, 18-37.

Cassen, S. 1993. Material culture and chronology of the Middle Neolithic of western France. *Oxford Journal of Archaeology*, *12*(2), 197-208.

Cassidy, L. M., Maoldúin, R.Ó., Kador, T., Lynch, A., Jones, C., Woodman, P.C., Murphy, E., Ramsey, G., Dowd, M., Noonan, A. and Campbell, C. 2020. A dynastic elite in monumental Neolithic society. *Nature*, *582*(7812), 384-388.

Chenery, C., Muldner, G., Evans, J., Eckardt, H., Lewis, M. 2010. 'Strontium and stable isotope evidence for diet and mobility in Roman Gloucester, UK'. *Journal of Archaeological Science* 37, 150-163.

Chesterman, J.T., 1979. Investigation of the human bones from Quanterness. *Investigations in Orkney*, 97-111.

Chesterman, J. T. 1983. Human skeletal remains: pathology'. *Hedges, JW Isbister: a chambered tomb in Orkney, Oxford*, pp.114-24.

Childe, V. G. 1925. *The dawn of European civilisation.* London: Kegan Paul.

Childe, V. G. 1934. Neolithic Settlement in the West of Scotland. *Scottish Geographical Magazine* 50, 18–25.

Childe, V. G. 1935. *The Prehistory of Scotland.* London: Kegan Paul.

Childe, V. G. 1940. *The Prehistoric Communities of the British Isles.* London: Kegan Paul.

Childe, V. G. 1942. *Prehistoric communities of the British Isles*. London: W. & R. Chambers, Limited.

Childe, V. G. 1942. *What Happened in History.* London: Book Club Associates.

Childe, V.G.1950a. *Ancient dwellings at Skara Brae, Orkney*. 3rd. Edinburgh. RCAHMS Shelf Number: D.9.3.SKA.P.

Childe, V.,1954. Re-Excavation of the Chambered Cairn of Quoyness, Sanday, on behalf of the Ministry of Works, 1951-2 Notes by Wells, L.H and Zeuner, F.E. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 86, 121-139.

Childe, V. G. 1957. *The dawn of European civilisation*. London: Routledge and Kegan Paul.

Childe, V.G. and Grant, W.G. 1939. *'A Stone-Age settlement at the Braes of Rinyo, Rousay, Orkney. (First Report)', Proceedings of the Society of Antiquaries Scotland, vol. 78, 1938-9*, 6-31.

Childe, V.G. and Grant, W.G 1949. *'A Stone-Age settlement at the Braes of Rinyo, Rousay, Orkney', Proceedings of the Society of Antiquaries Scotland, vol. 81, 1946-7*, 16-42.

Childe, V. G. and Grant, W. 1949. A Stone Age Settlement at the Braes of Rinyo, Rousay, Orkney.(Second Report). In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 81, 16-42.

Clarke, A. 2006. Stone tools and the prehistory of the Northern Isles. *British Archaeological Reports,* Vol. 406

Clarke,D. V. 1983. *'Rinyo and the Orcadian Neolithic'*, In O'Connor, A. and Clarke, D. V*. From the Stone Age to the 'Forty-Five': Studies presented to R B K Stevenson, Former Keeper, National Museum of Antiquities of Scotland*. Edinburgh.

Clarke, D. V. 1976a. *The Neolithic Village at Skara Brae, Orkney, Excavations 1972-3: An Interim Repor*t. Edinburgh, HMSO.

Clark, P. (ed.) 2004. *The Dover Bronze Age boat*. London: English Heritage. Archaeological Monograph.

Cleal, R. and A. MacSween (ed*.).* 1999. *Grooved Ware in Britain and Ireland*. Oxford: Oxbow.

Cloustan, R., 1885. November. Notice of the Excavation of a Chambered Cairn of the Stone Age, at Unstan, in the Loch of Stennis, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 19, 341-351.

Clouston, J.S. 1927. *The Orkney Parishes, containing the Statistical Account of Orkney, 1795–1798, drawn up from the communications of the Ministers of the Different Parishes by Sir John Sinclair, Bart*. Together with a General Introduction and Notice of Each Parish.

Cody, E. 2002. A complex of prehistoric monuments at Banagher, County Cavan. *The Journal of the Royal Society of Antiquaries of Ireland*, 77-98.

Cody, E. 2002. *Survey of the megalithic tombs of Ireland. Vol. VI*. County Donegal: Dublin. Stationary Office.

Coles, B. and Coles, J. 1986. *Sweet Track to Glastonbury: the Somerset levels in prehistory*. London: Thames and Hudson.

Coles, B. and Coles, J. 1992: Passages of time. *Archaeologische Mitteilungen aus Nordwestdeutschland* 15, Oldenburg 1992, 29–44.

Collard, M., Edinborough, K., Shennan, S. and Thomas, M. 2010. Radiocarbon evidence indicates that migrants introduced farming to Britain. *Journal of Archaeological Science* 37, 866–70

Colley, S. 1983. The marine faunal remains. In *Isbister: a chambered tomb in Orkney* (*ed.*) J. Hedges, 151- 8. (British Series 115). Oxford: British Archaeological Reports.

Collins, A. E. P. 1973. A re-examination of the Clyde-Carlingford tombs. *Megalithic graves and ritual*, 93-103.

Colt Hoare, R. 1812, *The ancient history of Wiltshire Vol. II.* Devizes: Privately printed.

Colt Hoare, R. 1821. An Account of a Stone Barrow, in the Parish of Wellow, at Stoney Littleton in the County of Somerset, which was opened and investigated in the Month of May 1816. Communicated by Sir Richard Colt Hoare, Bart. F.S.A. *Archaeologia*. Cambridge University Press, 19,43–48.

Conneller, C. 2011. The Mesolithic. In Insoll, T. (ed.) *The Oxford handbook of the archaeology of ritual and religion*. Oxford: Oxford University Press, 131-153.

Conolly, J. and Lake, M. 2006. *Geographical information systems in archaeology*. Cambridge: Cambridge University Press.

Conroy, G.C., Anemone, R.L., Regenmorter, J.V., Addison, A. 2008. Google Earth, GIS and the Great Divide: A new and simple method for sharing paleontological data. *J. Hum. Evol*. 55, 751–755.

Consultant, L. U. 1998. Orkney landscape character assessment. *Scottish National Heritage Review*, 100.

Cooney, G., 1979. Some aspects of the siting of megalithic tombs in County Leitrim. *The Journal of the Royal Society of Antiquaries of Ireland*, *109*, 74-91.

Cooney, G., 2000. *Landscapes of neolithic Ireland*. Taylor & Francis US.

Cooney, G. 2004. Neolithic Worlds: Islands in the Irish Sea. In: V. Cummings and C. Fowler, (eds). *The Neolithic of the Irish Sea: Materiality and Traditions of Practice.* Oxford: Oxbow Books, 145-59.

Cooney, G., Bayliss, A., Healy, F., Whittle, A., Danaher, E.., Cagney, L, Mallory, J., Smyth, J., Kador, T. and O'Sullivan, M. 2011. 'Ireland', In A, Whittle., F, Healy and A. Bayliss (eds), *Gathering Time: dating the early Neolithic enclosures of southern Britain and Ireland,* 562–669. Oxbow, Oxford.

Cooper, A., Garrow, D., Gibson, C., Giles., M and Wilkin, N., 2022. *Grave goods: objects and death in later prehistoric Britain*. Oxford: Oxbow.

Corcoran, J. X. W. P. 1966. *Excavation of three chambered cairns at Loch Calder, Caithness. Proceedings of the Society of Antiquaries Scotland* 98, 1–75.

Corcoran, J. X. W. P. and Powell, T.G.E., 1969. The Cotswold-Severn Group. *Megalithic enquiries in the west of Britain*, 13-104.

Corcoran, J. X. W. P. 1969a. The Cotswold Severn group. In Powell, T. G. E., Corcoran, J. X. W. P., Lynch, F. and Scott, J.G. *Megalithic enquiries in the west of Britain*, 13-72. Liverpool: Liverpool University Press.

Corcoran, J. X. W P. 1969b. Excavation of two chambered cairns at Mid Gleniron Farm, Glenluce Wigtownshire. *Transactions of the Dumfries and Galloway Natural History & Antiquarian Society* 46, 31-90.

Corcoran, J. X. W. P. 1972. Multi-period construction and the origins of the chambered long cairn in western Britain and Ireland. *Prehistoric Man in Wales and the West.* Bath: Adams & Dart, 31-63.

Crawford, O. G. S. 1925. *The long barrows of the Cotswolds*. Gloucester: John Bellows.

Crema, E. R. 2012. Modelling temporal uncertainty in archaeological analysis. *Journal of Archaeological Method and Theory*, *19*, 440-461.

Crozier, R. 2014. Exceptional or conventional? Social identity within the chamber tomb of Quanterness, Orkney. In *Exploring Prehistoric Identity in Europe: Our construct or theirs?* pp. 22-33. Oxford: Oxbow Books.

Crozier, R. 2016. Fragments of death. A taphonomic study of human remains from Neolithic Orkney. *Journal of Archaeological Science: Reports*, *10*, 725-734.

Crozier, R. 2016. *Reorientating the dead of Crossiecrown: Quanterness and Ramberry Head*. In Richards, C. and Jones, R. (eds) *The Development of Neolithic House Societies in Orkney: Investigations in the Bay of Firth, Mainland, Orkney (1994–2014)*. Oxford: Windgather Press, 196-223.

Crumlin-Pedersen, O. 2006. The Dover Boat—a Reconstruction Case-Study, *International Journal of Nautical Archaeology*, 35:1, 58-71.

Cummings, V. 2002. Between mountains and sea: a reconsideration of the Neolithic monuments of south-west Scotland. In *Proceedings of the Prehistoric Society* , Vol. 68, 125-146. Cambridge University Press.

Cummings, V. 2002. Experiencing texture and transformation in the British Neolithic. *Oxford Journal of Archaeology*, *21*(3), 249-261.

Cummings, V. 2003. Building from memory. In *Archaeologies of Remembrance* (25-43). Boston, MA: Springer.

Cummings, V. 2003. Monuments and landscape. *Dumfriesshire and Galloway Natural History*, 23.

Cummings, V. 2008. Virtual reality, visual envelopes, and characterizing landscape. *Handbook of landscape archaeology*, 285-290.

Cummings, V. 2009. *A view from the west: the Neolithic of the Irish Sea zone*. Oxford: Oxbow Books.

Cummings, V. 2012. What lies beneath: thinking about the qualities and essences of stone and wood in the chambered tomb architecture of Neolithic Britain and Ireland. *Journal of Social Archaeology*, *12*(1), 29-50.

Cummings, V. 2016. Very real shared traditions? Thinking about Similarity and Difference in the Construction and Use of Clyde Cairns in the Western Scottish Neolithic. *Neolithic of Mainland Scotland*, 41.

Cummings, V. 2017. *The Neolithic of Britain and Ireland*. London: Routledge.

Cummings, V.2020. *Tresness, Evaluation*, in Jennifer Thoms*, Discovery and Excavation Scotland, New, vol. 20, 2019*. Cathedral Communications Ltd, Wiltshire, England, 146.

Cummings, V., Downes, J., Gee, C. and Richards, C. 2016. Preliminary investigations at Cata Sand, Sanday, Orkney.

Cummings, V., Downes, J., Gee, C. and Richards, C., 2017. *Tres Ness chambered tomb, Sanday: Excavations in 2017*. Data Structure Report.

Cummings, V., Downes, J., Gee, C. and Richards, C. 2018. *Tresness chambered tomb, Sanday : Excavations in 2018*, Data Structure Report. 2018, 1–19.

Cummings, V., Downes, J., Gee, C. and Richards, C. 2018. *Tres Ness Chambered Tomb, Excavation, Discovery and Excavation Scotland, New, vol. 18, 2017*. Cathedral Communications Limited, Wiltshire, England, 145.

Cummings, V. and Harris, O. 2011. Animals, people and places: the continuity of hunting and gathering practices across the Mesolithic–Neolithic transition in Britain. *European Journal of Archaeology*, *14*(3), 361-393.

Cummings, V., Jones, A. and Watson, A. 2002. Divided places: phenomenology and asymmetry in the monuments of the Black Mountains, Southeast Wales. *Cambridge Archaeological Journal*, *12*(1), 57-70.

Cummings, V. and Morris, J. 2018. Neolithic Explanations Revisited: Modelling the Arrival and Spread of Domesticated Cattle into Neolithic Britain. *Environmental Archaeology*.

Cummings, V. and Pollard, J. 2008. The architecture of monuments. *Blackwell Studies in Global Archaeology, 11*, 135.

Cummings, V. and Richards, C. 2016. Data Structure Report: Preliminary investigations at Cata Sand, Sanday, Orkney.

Cummings, V. and Richards, C. 2021. *Monuments in the Making: raising the great dolmens in Early Neolithic Northern Europe*. Oxford: Windgather Press.

Cummings, V. and Robinson, G. 2015. *The Southern Kintyre Project: exploring social interaction across the Irish Sea from the Mesolithic to the Bronze Age*. Oxford: British Archaeological Reports 618.

Cummings, V. and Whittle, A. 2003. Tombs with a view: landscape, monuments and trees. *Antiquity*, *77*(296), 255-266.

Cunliffe, B. 2001. *Facing the Ocean: the Atlantic and its peoples 8000 BC – AD 1500.* Oxford: Oxford University Press.

Cursiter, J. W. 1923. *'The Orkney Brochs', Proceedings of Orkney Antiquaries Society, vol. 1, 1922-3,* 50.

Cuthbert, G. S. 2019. *Enriching the Neolithic: the Forgotten People of the Barrows*. PhD thesis, University. of Exeter

Daniel, G. 1937. The 'Dolmens' of Southern Britain, *Antiquity*. Cambridge University Press, 11(42), 183–200.

Daniel, G. 1963. *The megalith builders of western Europe*. Hutchinson University Library.

Daniel, G. E. and Powell, T. G. E. 1949. The distribution and date of the passage-graves of the British Isles. In *Proceedings of the Prehistoric Society*, Vol. 15,169-187. Cambridge University Press.

Darvill, T., 1982. *The megalithic chambered tombs of the Cotswold-Severn region: an assessment of certain architectural elements and their relation to ritual practice and Neolithic society* (Vol. 5). Highworth, Wiltshire: Vorda Publications.

Darvill, T. 2002. White on blonde: quartz pebbles and the use of quartz at Neolithic monuments in the Isle of Man and beyond. In: A. Jones and G. MacGregor (eds.), *Colouring the past. The significance of colour in archaeological research* (Oxford 2002) 73–92.

Darvill, T., 2004. *Long barrows of the Cotswolds: and surrounding areas*. Stroud: Tempus.

Darvill, T. 2010. *Prehistoric Britain (second edition*). Abingdon: Routledge

Darvill, T., 2010. Megaliths, monuments and materiality. *jungsteinSITE*.

Davidson, D. A. and Jones, R.L. 1985. The environment of Orkney. In Renfrew, C. (ed.)*The prehistory of Orkney*. Edinburgh: Edinburgh University Press, 10-35.

Davidson, D. A., Jones, R.L. and Renfrew, C. 1976. Palaeoenvironmental reconstruction and evaluation: a case study from Orkney. *Transactions of the Institute of British Geographers*, 346-361.Davidson, D.A., Richer, S. and Rogers, A., 1976. A simulation program for the analysis of archaeological distributions'. *Newsletter of Computer Archaeology*, *11*(4), 1-10.

Davidson, D. A. and Jones, R. L. 1990. The environment of Orkney. In C. Renfrew (ed.) *The prehistory of Orkney*, Edinburgh: Edinburgh University Press, 10-35.

Davidson, J. L. and Henshall, A. S. 1989. *The Chambered Cairns of Orkney: an inventory of the structures and their contents*. Edinburgh: Edinburgh University Press.

Davidson, J. L. and Henshall, A. S. 1991. *The chambered cairns of Caithness: an inventory of the structures and their contents*. Edinburgh: Edinburgh University Press.

Dawson, A. 2018. *Introducing Sea Level Change*. Edinburgh: Dunedin Academic Press Ltd.

Dawson, A. G., Dawson, S. and Bondevik, S. 2006. A late Holocene tsunami at Basta Voe, Yell, Shetland Isles. *Scottish Geographical Journal*, 122(2), 100–108.

Dawson, A., Elliott, L., Noone, S., Hickey, K., Holt, T., Wadhams, P. and Foster, I. 2004. Historical storminess and climate 'see-saws' in the North Atlantic region. *Marine Geology*, *210*(1-4), 247-259.

Dawson, S. and Smith, D. E. 1997. Holocene relative sea-level changes on the margins of glacio-isostatic uplifted area: an example from northern Caithness, Scotland. *The Holocene* 7, 59–77.

Dawson, S., Bates, R., Wickham-Jones, C. and Dawson, A. 2017. Northern North Sea and Atlantic Northwest Approaches. *Submerged Landscapes of the European Continental Shelf: Quaternary Paleoenvironments*, 187-209.

De la Vega, A. C., Smith, D. E. and Dawson, S. 1996. Holocene relative sea-level and coastal changes in Scapa Bay, Orkney, in A. M. Hall (ed.), *The Quaternary of Orkney. Field Guid*e, 69–83, Cambridge: Quaternary Research Association UK.

De la Vega-Leinert, A. C., Keen, D. H., Jones, R. L., Wells, J. M. and Smith, D. E. 2000. Mid-Holocene environmental changes in the Bay of Skaill, mainland Orkney, Scotland: an integrated geomorphological, sedimentological and stratigraphical study. *Journal of Quaternary Science* 15, 509–28.

De Valera, D. 1960. The court Cairns of Ireland. *Proceedings of the Royal Irish Academy 60*, 1-139.

De Valéra, R. 1959. The court cairns of Ireland. *Proceedings of the Royal Irish Academy. Section C: Archaeology, Celtic Studies, History, Linguistics, Literature*, *60*, 9-140.

Dennell R. 1987. Accelerator dating: the first years re- viewed. *Antiquity* 61(231),137–8.

Dennison, W. T. 1891. Orkney Folklore. Sea Myths. *The Scottish Antiquary, or, Northern Notes and Queries*, *5*(20), 167-171.

Dickson, C. 2000. The decline of woodland in Orkney: early Neolithic to late Iron Age. In: Nicholson, R.A., O'Connor, T.P. (eds.), *People as an Agent of Environmental Change*. Oxbow, Oxford, 37-44.

Dockrill, S. J., Bond, J. M., Milles, A., Simpson, I. and Ambers, J. 1994. Tofts Ness, Sanday, Orkney. An integrated study of a buried Orcadian landscape. In *whither environmental archaeology* (Vol. 7, 115-132). Oxbow Books Oxford, UK.

Dockrill, S.J., Bond, J.M., Nicholson, R.A. and Smith, A.N. 2007. *Investigations on Sanday. Vol 2. Tofts Ness: An island landscape through 3000 years of Prehistory Orcadian.* Kirkwall: The Orcadian Ltd.

Downes, J. 1998f. *Elsness, Sanday (Lady parish), survey of burial mounds, Discovery and Excavation Scotland, 1998*, 71.

Downes, J., Foster, S. M., Wickham-Jones, C. R. and Callister, J. 2005. *The Heart of Neolithic Orkney World Heritage Site Research Agenda.* Edinburgh: Historic Scotland.

Downes, J., Richards, C., Shaw, L. and Torres, F. 2017. Survey and Assessment of the Ara Metua (Ara Nui o Toi) and associated sites and monuments of Rarotonga, Cook Islands. *Unpublished report accessed online https://www. uhi. ac. uk/en/t4-media/one-web/university/archaeology-institute/Survey-of-Ara-Metua-Raratonga-report% 2D% 2D-final. pdf*.

Downes, J., Sharman, P., Challands, A., Guttman-Bond, E., McKenzie, J., Towers, R. and Voke, P.D. 2016. *Place in the Past: an early Neolithic house at the Knowes of Trotty barrow cemetery, Harray, Mainland, Orkney*. In Richards, C. and Jones R. (eds) *The Development of Neolithic House Societies in Orkney*. 41-63. Oxbow: Oxford.

Eckardt, H., Chenery, C., Booth, P., Evans, J.A., Lamb, A. and Müldner, G. 2009. Oxygen and strontium isotope evidence for mobility in Roman Winchester. *Journal of Archaeological Science*, *36*(12), 2816-2825.

Edmonds, M. 2002. *Ancestral geographies of the Neolithic: landscapes, monuments and memory*. London: Routledge.

Edmonds, M. 2012. *Stone Tools & Society*. London: Routledge.

Edmonds, M., Anderson-Whymark, H., Clarke, A. and Thomas, A. 2021. Working Stone, Making Communities–Technology and Identity in Prehistoric Orkney. In *Communicating Archaeology: Case studies in the use of, and engagement with, archaeological collections.* Society for Museum Archaeology, 59-65.

Edwards, K. J., Whittington, G. and Ritchie, W. 2005. The possible role of humans in the early stages of machair evolution: palaeoenvironmental investigations in the Outer Hebrides, Scotland. *Journal of archaeological science*, *32*(3), 435-449.

Eogan, G. 1983. Bryn Celli Ddu. *Antiquity* 57. 135–36.

Eogan, G. 1986. *Knowth and the passage-tombs of Ireland*. London: Thames and Hudson.

Eriksen, P. and Andersen, N.H. 2016. *Dolmens in Denmark. Architecture and Function*. Jutland Archaeological Society Publications 95. Højbjerg: Jutland Archaeological Society.

Evans, J., Chenery, C. A. and Fitzpatrick, A. P. 2006b. Bronze age childhood migration of individuals near Stonehenge, revealed by strontium and oxygen isotope tooth enamel analysis', *Archaeometry* 48, 309-321.

Evans, J A., Montgomery, J and Wildman, G 2009. Isotope domain mapping of Sr-87/Sr-86 biosphere variation on the Isle of Skye, Scotland, *Journal of the Geological Society* 166, 617-631.

Evans, J. A., Parker Pearson, M., Madgwick, R., Sloane, H. and Albarella, U. 2019. Strontium and Oxygen Isotope Evidence for the Origin of Movement of Cattle at Late Neolithic Durrington Walls, UK. *Archaeological and Anthropological Sciences*. 5081-5197.

Evans, J., Stoodley, N and Chenery, C. 2006a. A strontium and oxygen isotope assessment of a possible fourth century immigrant population in a Hampshire cemetery, southern England, *Journal of Archaeological Science* 33, 265-272.

Evans, J. G. 1971. Habitat change on the calcareous soils of Britain: the impact of Neolithic man. *Economy and settlement in neolithic and early bronze age Britain and Europe*, 27, 75.

Farrell, M. 2009. *The environmental context of the prehistoric human occupation of Orkney, Scotland*. PhD thesis, Hull: University of Hull.

Farrell, M., Bunting, M. J., Lee, D. H. and Thomas, A. 2014. Neolithic settlement at the woodland's edge: palynological data and timber architecture in Orkney, Scotland. *Journal of archaeological science*, *51*, 225-236.

Farrell, M., Bunting, M. J., Sturt, F., Grant, M., Aalbersberg, G., Batchelor, R., Brown, A., Druce, D., Hill, T., Hollinrake, A. and Jones, J. 2020. Opening the woods: towards a quantification of Neolithic clearance around the Somerset Levels and Moors. *Journal of Archaeological Method and Theory*, *27*(2), 271-301.

Field, D. 2006. *Earthen long barrows: the earliest monuments in the British Isles*. Stroud: Tempus Publication Ltd.

Finlay, N. 1997. The lithic assemblage. In: J. Barber (ed.), *The Excavation of a Stalled Cairn at the Point of* Cott*, Westray, Orkney.* Edinburgh: Scottish Trust for Archeological Research. 30-34.

Firth, J. 1920. *Reminiscences of an Orkney Parish* (Stromness: WR Rendall, 1920, 1974); William Alexander. Johnny Gibb o'Gushetneuk.

Flannery, K. V. 1967. *Culture history v. cultural process: A debate in American archaeology*. Scientific American.

Fleming, A. 1972. Vision and design: approaches to ceremonial monument typology. *Man*, 7, 57-72.

Fleming, A., 1975. Megalithic astronomy: a prehistorian's view. *Nature*, *255*, 575-575.

Fleming, A. 1999. Phenomenology and the Megaliths of Wales: A Dreaming Too Far?, *Oxford Journal of Archaeology* 18. 119–25.

Fleming, A. 2005. Megaliths and post-modernism: the case of Wales, *Antiquity*, vol. 79.

Fletcher, T. P. 1996. A review of the lithostratigraphy of the Old Red Sandstone Supergroup in Scotland north of a line from Fort William to Aberdeen. *BGS Technical Report* WA/96/39R.

Fowler, P. 2004. *Landscapes for the World: Conserving a Global Heritage*, Macclesfield: Windgather Press.

Fowler, C. 2008. Landscape and personhood. *Handbook of landscape archaeology*, 291-299.

Fowler, C. 2010. Pattern and diversity in the Early Neolithic. Mortuary practices of Britain and Ireland: contextualising the treatment of the dead. *Documenta Praehistorica* 41, 1–22.

Fowler, C. 2022. Social arrangements. Kinship, descent and affinity in the mortuary architecture of Early Neolithic Britain and Ireland. *Archaeological Dialogues*, *29*(1), 67-88.

Fowler, C., and Cummings, V. 2018. Places of Transformation : Building Monuments from Water and Stone in the Neolithic of the Irish Sea. *The Journal of the Royal Anthropological Institute* , Vol . 9 ,1–20.

Fowler, C. and Harris, O.J. 2015. Enduring relations: Exploring a paradox of new materialism. *Journal of material culture*, *20*(2),127-148.

Fowler, C., Olalde, I., Cummings, V., Armit, I., Büster, L., Cuthbert, S., Rohland, N., Cheronet, O., Pinhasi, R. and Reich, D. 2022. A high-resolution picture of kinship practices in an Early Neolithic tomb. *Nature*, *601*(7894), 584-587.

Fraser, D. 1980. Investigations in Neolithic Orkney. *Glasgow Archaeological Journal*, *7*(7), 1-14.

Fraser, D. 1983. Land and Society in Neolithic Orkney. *British Archaeological Reports*, Series 117.

Fraser, D. 1983. *Land and society in Neolithic Orkney* (Vol. 1). Oxford: BAR Publishing.

Fraser, D. 1983. *Land and Society in Neolithic Orkney, Parts i and ii*. Oxford: BAR Publishing.

Garrow, D., Griffiths, S., Anderson-Whymark, H. and Sturt, F. 2017. Stepping stones to the Neolithic? Radiocarbon dating the Early Neolithic on islands within the 'western seaways' of Britain. *Proceedings of the Prehistoric Society* (Vol. 83, 97-135). Cambridge University Press.

Garrow, D. and Sturt, F. 2011. Grey waters bright with Neolithic argonauts? Maritime connections and the Mesolithic–Neolithic transition within the 'western seaways' of Britain, c. 5000–3500 BC. *Antiquity*, *85*(327), 59-72.

Gee, C., Richards, C. and Robertson, M. 2016. *Local histories of passage grave building communities: Brae of* Smerquoy. In Richards, C. and Jones, R. 2016. *The Development of Neolithic House Societies in Orkney: Investigations in the Bay of Firth, Mainland, Orkney (1994–2014)*. Oxford: Windgather Press.

Gemmell, A. M. D. and Kesel, R. H. 1979. Developments in the study of the Buchan flint deposits. In *Scottish Archaeological Forum* Vol. 9, 66-77.

Gibson, A. 2002a. *Prehistoric pottery in Britain and Ireland*. Stroud: Tempus.

Gibson, J. 2008. *Rising tides: the loss of coastal heritage in Orkney*. 89-90 RCAHMS Shelf Number: D.9.1.ALL

Gigleux, C., Richards, M.P., Curtis, N., Hutchison, M. and Britton, K. 2017. Reconstructing diet at the Neolithic stalled cairn of the Knowe of Rowiegar, Rousay, Orkney, using stable isotope analysis. *Journal of Archaeological Science: Reports*, *13*, 272-280.

Gili, S., Lull, V., Micó, R., Rihuete, C. and Risch, R. 2006. An island decides: megalithic burial rites on Menorca. *Antiquity*, 80(310), 829-842.

Glørstad, H. 2013. Where are the Missing Boats? The Pioneer Settlement of Norway as Long-term History. *Norwegian Archaeological Review* 46 (1): 57–80.

Gosden, C. 1994. *Social being and time*. Oxford: Wiley- Blackwell.

Greenwell, W. 1877, *British barrows, a record of the sepulchral monuments in various parts of England*. London: Macmillan.

Griffiths, S. 2015. Beside the ocean of time: a chronology of Neolithic burial monuments and houses in Orkney, in C. Richards and R. Jones (eds.) *The development of Neolithic house societies in Orkney*. Oxford: Windgather. Chapter 10.

Griffiths, S. 2016. Beside the ocean of time: a chronology of Neolithic burial monuments and houses in Orkney.

Grimes, W. F. 1939, July. The excavation of Ty-isaf long cairn Brecknockshire. In *Proceedings of the Prehistoric Society*. Vol. 5, No. 1, 119-142. Cambridge University Press.

Grinsell, L. V. 1953. *The ancient burial mounds of England (second edition*). London: Methuen.

Grinsell, L. V. 1957. Archaeological Gazetteer. In R. B Pugh and E. Crittall (eds), *A history of Wiltshire vol 1, part 1.* London: Institute of Historical Research (Vistoria History of the Counties of England). 21-279.

HabMos Sand Dune vegetation survey 2012.

Haflidason, H., Lien, R., Sejrup, H. P., Forsberg, C. F., and Bryn, P. 2005. The dating and morphometry of the Storegga Slide. *Marine and Petroleum Geology*, 22(1-2), 123–136.

Haglund, D. and Sorg, M. H. 1997. *Forensictaphonomy: the postmortem fate of human remains*. Boca Raton (FL): CRC Press.

Hansom, J. D . and Angus, S. 2001 Tir a'Mhachair (Land of the Machair): sediment supply and climate change scenarios for the future of the Outer Hebrides machair. In J. E. Gordon and K. F.Lees *(*eds.) *Earth Science and the Natural Heritage: Interactions and Integrated management* (eds), Natural Heritage of Scotland Series, No. 9, Edinburgh: The Stationery Office, Edinburgh, 68-81.

Hansom, J. D. and Hall, A. M. 2009. Magnitude and frequency of extra-tropical North Atlantic cyclones: A chronology from cliff-top storm deposits. *Quaternary International* 195(1–2), 42–52.

Hardy, K. and Wickham-Jones, C. 2002. Scotland's First Settlers: the Mesolithic seascape of the Inner Sound, Skye and its contribution to the early prehistory of Scotland. *Antiquity*, *76*(293), 825-833.

Hardy, K., Wickham-Jones, C., MacSween, A., Cressey, M., Barrett, J., Edwards, K., Ashmore, P., Heald, A., Finlay, N., Milner, N. and Schulting, R. 2009. Mesolithic and later sites around the Inner Sound, Scotland the work of the Scotland's First Settlers project 1998-2004. *Scottish Archaeological Internet Reports*, 31.

Harris, O. 2010. Emotional and mnemonic geographies at Hambledon Hill: texturing Neolithic places with bodies and bones. *Cambridge archaeological journal*, *20*(3), 357-371.

Harris, O. J. and Cipolla, C. 2017. *Archaeological theory in the new millennium: introducing current perspectives*. Abingdon: Routledge.

Haswell-Smith, H., 2008. *The Scottish Islands: The Bestselling Guide to Every Scottish Island*. Edinburgh: Canongate Books.

Hawkey, E. and Meres, C. F.1995. Activity-induced musculoskeletal stress markers (MSM) and subsistence strategy changes among ancient Hudson Bay Eskimos, *International Journal of Osteoarchaeology* 5: 324-38.

Hedberg, H.D. (ed.) 1976. A guide to stratigraphic classification, terminology and procedures. New York: Wiley & Sons, 200.

Hedges, J. 1983. *Isbister: a chambered tomb in Orkney*. Oxford: British Archaeological Report 115.

Hedges, J. 1984. *Tomb of the eagles: a window on stone age tribal Britain*. London: John Murray.

Hedges, R.E.M. 2004. Isotopes and red herrings: comments on Milner *et al.* and Lide´n *et al. Antiquity* 78: 34-7.

Hedges, R., Saville, A. and O'Connell, T. 2008. Characterizing the diet of individuals at the Neolithic chambered tomb of Hazleton North, Gloucestershire, England, using stable isotopic analysis. *Archaeometry* 50, 114–128.

Heidegger, M., 1962. *Being and time (J. Macquarrie & E. Robinson, trans.)* (Vol. 10). New York: Harper & Row.

Heidegger, M. and Brokmeier, W. 1962. Chemins qui ne mènent nulle part. *Les Etudes Philosophiques*, *17*(4).

Hemp, W. 1930. The chambered cairn of Bryn Celli Ddu. *Archaeologia* 80, 179-214.

Henley, C. 2003. *The Outer Hebrides and the Hebridean world during the Neolithic: an island history*. Unpublished PhD dissertation, Cardiff University.

Hensey, R. 2015. *First Light: The Origins of Newgrange*. Oxford: Oxbow Books.

Hensey, R., Meehan, P., Dowd, M. and Moore, S. 2014. A century of archaeology – historical excavation and modern research at the Carrowkeel passage tombs, County Sligo. *Proceedings of the Royal Irish Academy* 114C, 57–87.

Henshall, A. S. 1963. *The chambered tombs of Scotland* (Vol. 1). Edinburgh: Edinburgh University Press.

Henshall, A.S. 1963a. *The chambered tombs of Scotland, vol. 1*. Edinburgh. 212, ORK.30 RCAHMS Shelf Number: E.7.1.HEN

Henshall, A. S. 1972. *The chambered tombs of Scotland* (Vol. 2). Edinburgh: Edinburgh University Press.

Henshall, A.S. 2004. Scottish passage-graves: Some confusions and conclusions. *From Sickles to Circles: Britain and Ireland at the time of Stonehenge*, 78-91.

Henshall, A.S., Ritchie, J. N. G. and Ritchie, G. 1995. *The chambered cairns of Sutherland: an inventory of the structures and their contents*. Edinburgh: Edinburgh University Press.

Henshall, A. S. and Ritchie, J. N. G. 2001. *The chambered cairns of the central Highlands: an inventory of the structures and their contents*. Edinburgh: Edinburgh University Press.

Herndon, K.E., Griffin, R., Schroder, W., Murtha, T., Golden, C., Contreras, D.A., Cherrington, E., Wang, L., Bazarsky, A., Van Kollias, G. and Firpi, O.A., 2023. Google Earth Engine for archaeologists: An updated look at the progress and promise of remotely sensed big data. *Journal of Archaeological Science: Reports*, *50*, 104094.

Hiroa, Te Ro. 1927. *The material culture of the Cook Islands (Aitutaki)*. New Plymouth: Thomas Avery & Sons.

Hodder, I. (ed.) 2012. *Archaeological theory today*. Cambridge: Polity.

Hodder, I. and Hodder. 1990. *The domestication of Europe: structure and contingency in Neolithic societies*. Oxford: Blackwell.

Hofmann, D. 2015. What have genetics ever done for us? The implications of aDNA data for interpreting identity in Early Neolithic Central Europe. *European Journal of Archaeology*, *18*(3), 454-476.

Hofmann, D. and Bickle, P. 2011. Culture, tradition and the settlement burials of the Linearbandkeramik (LBK) culture. In *Investigating Archaeological Cultures*, 183-200. New York: Springer, NY.

Hope, R. and Wickham-Jones, C. 1977b. *Noltland. Cairn, Discovery and Excavation Scot,* 25

https://www.orkneystonetools.org.uk

Hughes, D. W. 2005. Neolithic and Early Bronze Age skywatchers and the precession of the equinox. *Journal of the British Astronomical Association*, *115*, 29.

Hunter, J. R. 2000. Pool, Sanday and a sequence for the Orcadian Neolithic. *Neolithic Orkney in its European context*, 117-25.

Hunter, J. R., Bond, J. M. and Smith, A. N. 2007. *Investigations in Sanday, Orkney* (Vol. 1). Kirkwall: Orcadian Limited.

Hunter, J. R. and MacSween, A., 1991. A sequence for the Orcadia Neolithic?. *Antiquity*, *65* (249), 911-914.

Hunter, J., Roberts, C. and Martin, A. 1996. *Studies in crinie: an introduction to forensic archaeology*. London: Routledge.

Huntley, B. and Prentice, I.C. 1993. Holocene vegetation and climates of Europe. *Global climates since the last glacial maximum*,136-168.

Hutton, R. 1996. *The stations of the sun: a history of the ritual year in Britain*. Oxford University Press, USA.

Hydrographic Office. 1899. *Tidal Streams: Coasts of Scotland*. London: Admiralty.

Ingold, T. 2007. Materials against materiality. *Archaeological dialogues*, *14*(1), 1-16.

Ingold, T. 2009. Against space: Place, movement, knowledge. *Boundless worlds: An anthropological approach to movement*, 29-43.

Ishizawa, T., Watanabe, M., Goto, K., Ikehara, K., Walls, S., and Iryu, Y. 2016. Traces of paleotsunamis in the Shetland Islands. *Geology Magazine*, 122, 1-2.

Johnson, M. 2019. *Archaeological theory: an introduction*. Chichester: John Wiley & Sons.

Johnstone, P. 1988. *The Seacraft of Prehistory.* London: Routledge.

Jones, A. 1998. Where eagles dare: landscape, animals and the Neolithic of Orkney. *Journal of Material Culture* 3, 301-24.

Jones, A. 1999. Local colour: megalithic architecture and colour symbolism in Neolithic Arran. *Oxford Journal of Archaeology*, *18*(4), 339-350.

Jones. A. 2002. *Archaeological Theory and Scientific Practice.* Cambridge University Press, Cambridge

Jones, C. 2007. Temples of stone: exploring the megalithic tombs of Ireland. Cork: The Collins Press.

Jones, A. 2004. Archaeometry and materiality: materials-based analysis in theory and practice. *Archaeometry*, *46*(3), 327-338.

Kahn, M. 1990. Stone-faced ancestors: The spatial anchoring of myth in Wamira, Papua New Guinea. *Ethnology* 29, 51–66.

Keatinge, T. H. and Dickson, J. H. 1979. Mid-Flandrian changes in vegetation on mainland Orkney. *New Phytologist*, *82*(2), 585-612.

Kinnes, I. 1984. Isbister: A Chambered Tomb in Orkney. By John W. Hedges.

Kinnes, I. A. 1985. Circumstance not context: the Neolithic of Scotland as seen from outside. Proceedings of the Society of Antiquaries of Scotland 115, 15–57.

Knapton, S. 2019. "'Neolithic Brexit' Unearther at Stonehenge Shows British Identity Began 5,000 Years Ago, Archaeologisat say" Daily Telegraph 14 March 2019. Hhtps://wwwtelegraph.co.uk/science/2019/03/13/ british-identity-began-5000-years-ago-late-neolithic-brexit/.

Kruppe, C. 1994. *Echoes of the ancient skies: The astronomy of lost civilizations*. Oxford: Oxford University Press.

Kytmannow, T. 2008. Portal Tombs in the Landscape: The Chronology, Morphology and Landscape Setting of the Portal Tombs of Ireland, Wales and Cornwall. *BAR British Series* 455, Oxford: Archaeopress.

Lacaille, A. D. 1954. *The stone age in Scotland* (No. 6). Oxford: Oxford University Press.

Lamb, R. G. 1980. Sanday and North Ronaldsay, an Archaeological Survey of Two of the North Isles of Orkney. *Royal Commission on the Ancient and Historical Monument of Scotland.*

Lamb, R. G. 1980. The Archaeological Sites and Monuments of Sanday and North Ronaldsay, Orkney. *Royal Commission on the Ancient and Historical Monuments of Scotland.*

Lambeck, K. 1991. Glacial rebound and sea-level change in the British Isles. *Terra Nova,* 3, 379–89.

Lawrence, D. 2006. Neolithic mortuary practice in Orkney. *Proceedings of the Society of Antiquaries of Scotland*, *136*, 47–60.

Lawrence, D. M. 2012. *Orkney's First Farmers. Reconstructing Biographies from Osteological Analysis to Gain Insights into Life and Society in a Neolithic Community on theEdge of Atlantic Europe*. Unpublished PhD thesis. University of Bradford.

Leach, S. 2008. Odd one out? Earlier Neolithic deposition of human remains in caves and rock shelters in the York- shire Dales. In E. Murphy (ed.), Deviant burial in the archaeological record. Oxbow, Oxford: 35–56.

Leary, J. 2014. Past mobility: an introduction, in J. Leary (ed.) *Past mobilities: archaeological approaches to movement and mobility*: 1–20. Farnham: Ashgate.

Lee, D. 2014. *Rousay and Egilsay, The Braes of Ha'Breck, Wyre, Excavation, Discovery Excav Scot, New, vol. 14, 2013*. Cathedral Communications Limited, Wiltshire, England. Page(s): 141.

Lee, D. and Desalle, T. 2016. *Braes of Ha'Breck, Wyre, Geophysical survey, Discovery Excav Scot, New, vol. 16, 2015*, Wiltshire: Cathedral Communications Limited, 130

Lillie, M. 2005. Deconstructing Reconstruction: The Bronze Age Sewn Plank Boats from North Ferriby, River Humber, England, UK and their context. *Journal of Wetland Archaeology*, *5*(1), 97-109.

Lockyer, Sir N. 1909. *Stonehenge and other British stone monuments astronomically considered*. London: Macmillan and Company.

Long D., Stevenson A. G.,Wilson C. K., and Bulat J. 2003. Slope failures in the Faroe—Shetland channel. In Locat, J., Mienert, J. and Boisvert, L. (eds.*), Submarine mass movements and their consequences, Advances in natural and technological hazards research,* vol. 19. Dordrecht: Springer. 281–289.

Løvholt, F. S., Bondevik, S., Laberg, J. S., Kim, J. and Boylan, N. 2017. Some giant submarine landslides do not produce large tsunamis. *Geophysical Research Letters*, 44(16), 8463–8472.

Lowe, J. J. and Walker, M. J. 2014. *Reconstructing quaternary environments*. London: Routledge.

Lubbock, J. 1871. Description of the Parc Cwm tumulus. *Journal of the Ethnological Society of London 1,* 416.

Lubbock, J. and Douglas, D. M. 1871. Description of the Parc Cwm tumulus. *Archaeologia Cambrensis* (4th ser.) 2, 168-72.

Lubbock, J., Douglas, D. M. and Vivian, H. H. 1887. Description of the Pare Cwm tumulus. *Archaeologia.*

Lynch, F. and Scott, J.G. Megalithic Enquiries in the West of Britain, 72-104. Liverpool: University Press

MacKie E. W. 1997. Maeshowe and the winter solstice: ceremonial aspects of the Orkney Grooved Ware culture, *Antiquity* 71: 338-59.

MacKelvie, W.1873. *Annals and statistics of the United Presbyterian Church*. Edinburgh and Glasgow. 556 RCAHMS Shelf Number: C.3.2.MAC

MacSween, A. 1992. Orcadian grooved ware. *Vessels for the Ancestors*, 259-71.

Macsween, A., Hunter, J., Sheridan, A., Bond, J., Ramsey, C. B., Reimer, P., Bayliss, A., Griffiths, S., and Whittle, A. 2015. Refining the chronology of the Neolithic settlement at Pool, Sanday, Orkney: implications for the emergence and development of grooved ware. *Proceedings of the Prehistoric Society*, 81, 283–310.

Madgwick, R., Lamb, A.L., Sloane, H., Nederbragt, A.J., Albarella, U., Pearson, M.P. and Evans, J.A. 2019. Multi-isotope analysis reveals that feasts in the Stonehenge environs and across Wessex drew people and animals from throughout Britain. *Science Advances*, *5*(3), 6078.

Mainland, I., Card, N., Saunders, M.K., Webster, C., Isaksen, L., Downes, J. and Littlewood, M. 2014. 'SmartFauna': a microscale GIS-based multi-dimensional approach to faunal deposition at the Ness of Brodgar, Orkney. *Journal of Archaeological Science*, *41*, 868-878.

Mainland, I. and Moore, J. 2010a. *'Rinyo, Orkney (Rousay and Egilsay parish), geophysical survey', Discovery and Excavation Scotland, New, vol. 11, 2010*. Cathedral Communications Limited, Wiltshire, England, 121

Malmros, C. 1986. A Neolithic road built of wood at Tibirke, Zealand, Denmark. Contribution to the history of coppice management in the Sub-Boreal period. *Striae*, *24*, 153-156.

Marshall, P., Clarke, D., Sheridan, A. and Ramsey, C.B. 2016. *Links of Noltland, Westray, Orkney: radiocarbon dating and chronological modelling.*

Martinková, N., R. Barnett, T. Cucchi, R. Struchen, M. Pascal, M.C. Fischer, T. Higham, S. Brace, S.Y. Ho, J.P. Quere, P. O'Higgins, L. Excoffier, G. Heckel, A.R. Hoelzel, K.M. Dobney and J.B. Searle. 2013. Divergent evolutionary processes associated with colonization of offshore islands. *Molecular Ecology* 22, 5205–20.

McGrail, S. 1993. Prehistoric seafaring in the channel, in C. Scarre and F. Healy (ed.), *Trade and exchange in prehistoric Europe*: 199-210. Oxford: Oxbow. Monograph 3 3.

McGrail, S. 2001. *Boats of the World: From the Stone Age to Medieval Times.* Oxford: Oxford University Press.

McKurdy, A. 2010. *Orkney and Shetland: a landscape fashioned by geology*. Edinburgh: Scottish Natural Heritage.

Meadows, J., Barclay, A. and Bayliss, A. 2007. A short passage of time: the dating of the Hazleton long cairn revisited. *Cambridge Archaeological Journal*. 17, 45–64.

Melton, N. D. 2009. Shells, seals and ceramics: an evaluation of a midden at West Voe, Sumburgh, Shetland, 2004–2005. In McCartan, S. Schulting, R. J., Warren G. & Woodman P. (eds*.), Mesolithic Horizons. Papers Presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005, Volume 1*, 184-189. Oxford: Oxbow.

Mercer, R. 2017. The First Farmers in Britain and Ireland – Whence and Whither and How? Some Reflections*. In Economic Zooarchaeology*, edited by P. Rowley-Conwy, D. Serjeantson, and P. Halstead, 208–220. Oxford: Oxbow.

Metzler, A. 2003. Early Neolithic peatland sites around lake Duemmer. In Bauerochse, A. and Hassmann, H. (eds). Peatlands. Archaeological sites, archives of nature, nature conservation, wise use. *Proceedings of the Peatland Conference 2002 in Hannover, Germany*. 62–67.

Metzler, A. 2006. Moorarchäologie in Niedersachsen. In Fansa, M. and Both, F. (eds). *Archäologie, Land, Niedersachsen: 25 Jahre Denkmalschutzgesetz – 400.000 Jahre Geschichte.* Archäologische Mitteilungen aus Nordwestdeutschland 43, Landesmuseum Natur und Mensch Oldenburg, 471–475.

Miles, M. J. 2007a. *Green, Orkney (Eday parish), trial excavation, Discovery and Excavation Scotland, vol. 8, 2007*. Wiltshire: Cathedral Communications Limited, 140.

Miles, M. J. 2008a. *Green, Orkney (Eday parish), excavation, Discovery and excavation Scotland, New, vol. 9, 2008*. Wiltshire: Cathedral Communications Limited,128-129.

Miles, M. J. 2009a. *Green, Orkney (Eday parish), excavation, Discovery and Excavation Scotland, New, vol. 10, 2009*. Wiltshire: Cathedral Communications Limited,129.

Miller, R. 1976. *Orkney*, London: Batsford.

Milner, N., Craig, O. E., Bailey, G.N., Pedersen, K. and Andersen, S.H. 2004. Something fishy in the Neolithic? A re-evaluation of stable isotope analysis of Mesolithic and Neolithic coastal populations**,** *Antiquity*, 78, 9-22

Mithen, S., Pirie, A., Smith, S. and Wicks, K. 2007. The Mesolithic-Neolithic transition in western Scotland: a review and new evidence from Tiree. *Proceedings British Academy,* Vol. 144, 511.

Moir. G. 1981. Some archaeological and astronomical objections to scientific astronomy in British prehistory. In Ruggles, C. and Whittle, A. (eds), Astronomy and Society during the Period 4000-1500 B.C. *British Archaeological Reports*, 88,342.

Montgomery, J., Beaumont, J., Jay, M., Keefe, K., Gledhill, A.R., Cook, G.T., Dockrill, S.J. and Melton, N.D. 2013. Strategic and sporadic marine consumption at the onset of the Neolithic: increasing temporal resolution in the isotope evidence. *Antiquity*, *87* (338), 1060-1072.

Moore, H. and Wilson, G.1998a. Orkney Coastal Survey 1998, Westray, Papa Westray, Mainland*, Discovery and Excavation Scotland,* 69.

Morrison, J. 1995. *Bay of Stove (Cross & Burness parish), Late Neolithic settlement site, Discovery and Excavation Scotland, 1995*, 103

Morner, N. A. 1980. Late Quaternary sea-level changes in north-western Europe: a synthesis. Geologiska Foreningens I Stockholm. *Forhandlingar* 100, 381–400.

Mortimer, N. 2014. *Stukeley Illustrated: William Stukeley's Rediscovery of Britain's Ancient Sites*. Stathe: Green Magic Publishing.

Müller, J. and Peterson, R. 2015. Ceramics and society in northern Europe. In C. Fowler, J. Harding and D. Hofmann (eds), *The Oxford handbook of Neolithic Europe*, 573-604. Oxford: Oxford University Press.

Mykura. W. 1976. *British Regional Geology: Orkney and Shetland*. Edinburgh: HMSO.

Neil, S., Evans, J., Montgomery, J. and Scarre, C. 2016. Isotopic evidence for residential mobility of farming communities during the transition to agriculture in Britain. *R. Soc. Open Sci.* 3, 150522.

Neil, S., Montgomery, J., Evans, J., Cook, G.T. and Scarre, C., 2017. Land use and mobility during the Neolithic in Wales explored using isotope analysis of tooth enamel. American Journal of Physical Anthropology 164(2): 371-393.

Noble, G. 2006. Harnessing the waves: Monuments and ceremonial complexes in Orkney and beyond. *Journal of Maritime Archaeology*, *1*(1), 100-117.

Noble, G., 2006. *Neolithic Scotland: timber, stone, earth and fire*. Edinburgh University.

NSA. (1834-1845) *The new statistical account of Scotland by the ministers of the respective parishes under the superintendence of a committee of the society for the* *benefit of the sons and daughters of the clergy, 15v. Edinburgh. Page(s): Vol.15, 136 RCAHMS Shelf Number: B.2.2.STA.*

Ó Nualláin, S. Ó. 1972. A Neolithic House at Ballyglass near Ballycastle, Co. Mayo. *The Journal of the Royal Society of Antiquaries of Ireland*, *102*(1), 49-57.

Ó Nualláin, S. 1976. The central court-tombs of the north-west of Ireland. *The Journal of the Royal Society of Antiquaries of Ireland*, *106*, 92-117.

Ó Nualláin, S. 1989. *Survey of the megalithic tombs of Ireland, volume V, Co. Sligo*: Dublin. Stationary Office.

O'Kelly, C. 1969. Bryn Celli Ddu, Anglesey. *Archaeologia Cambrensis* 118, 17–48.

O'Kelly, M. 1982. *Newgrange, archaeology, art and legend.* London: Thames and Hudson.

O'Neil, H. E. 1966. Sale's Lot long barrow, Withington, Gloucestershire, 1962-1965, *Trans Bristol Gloucestershire Archaeol Soc*, 85, 5-35.

O'Sullivan, M. 1993. Recent investigations at Knockroe Passage Tomb, *Journal of the Royal Society of Antiquaries of Ireland* 123, 94–107.

Orme, L.C., Reinhardt, L., Jones, R.T., Charman, D.J., Barkwith, A. and Ellis, M.A. 2016. Aeolian sediment reconstructions from the Scottish Outer Hebrides: Late Holocene storminess and the role of the North Atlantic Oscillation. *Quaternary Science Reviews*, *132*, 15-25.

Palsson, H. and Edwards, P. 1978. *Orkneyinga saga, the history of the earls of Orkney (Translated),* London: Hogarth Press.

Parker Pearson, M., 1993. Bronze Age Britain. London: Batsford/English Heritage.

Parker Pearson, M. 2012. *Stonehenge: exploring the greatest Stone Age mystery*. London: Simon & Schuster.

Parker Pearson, M., Pollard, J., Richards, C., Thomas, J., Tilley, C., Welham, K and Albarella, U. 2006. Materializing Stonehenge. The Stonehenge Riverside Project and new discoveries. *Journal of Material Culture* 11, 227-61.

Pearson, M.P., Pollard, J., Richards, C., Thomas, J., Tilley, C. and Welham, K. 2008. The Stonehenge riverside project: exploring the Neolithic landscape of Stonehenge. *Documenta Praehistorica*, *35*, 153-166.

Parker Pearson, M. and Ramilisonina. 1998a. Stonehenge for the ancestors: the stones pass on the message. *Antiquity* 72, 308– 26.

Parker Pearson, M. and Ramilisonina. 1998b. Stonehenge for the ancestors: part two. *Antiquity* 72, 855–6.

Patrick, J. 1974. Midwinter sunrise at Newgrange. *Nature*, *249*(5457), 517-519.

Peers, C. R. and Smith, R. A. 1921. Wayland's Smithy, Berkshire. *The Antiquaries Journal*, *1*(3), 183-198.

Prendergast, F. 2016. Interpreting megalithic tomb orientation and siting within broader cultural contexts. In *Journal of Physics: Conference Series*, Vol. 685.

Peterson, R. and Muller, J. 2015. Ceramics and society in northern Europe. In: *The Oxford Handbook of Neolithic Europe. Oxford handbooks in Archaeology*. Oxford University Press, Oxford, 573-604

Petrie, G. 1856. *Description of Antiquities in Orkney recently examined, with Illustrative Drawings.* In *Proceedings of the Society of Antiquaries of Scotland* Volume 2, 1855-56.

Phillips, T. 2002. Landscapes of the living, landscapes of the dead: the location of chambered cairns of Northern Scotland. *BAR British Series* 328. Oxford: BAR.

Phillips, T. 2004. Seascapes and landscapes in Orkney and northern Scotland. *World Archaeology*, *35*(3), 371-384.

Piggott, S. 1954. *The Neolithic cultures of the British Isles*. Cambridge: Cambridge University Press.

Piggott, S. 1958. The Excavation of the West Kennet Long Barrow: 1955–6, *Antiquity*. Cambridge University Press, 32(128), 235–242.

Piggott, S. 1962. *The West Kennet Long Barrow, Excavations 1955-56*, London: HMSO.

Piggott, S. and Powell, T. 1949. The excavation of three Neolithic chambered tombs in Galloway. *PSAS* 83, 103- 61.

Pitts, M. 2006. Sensational new discoveries at Bryn Celli Ddu. *British Archaeology*, *89*(6).

Plog, F. T. 1973. Diachronic anthropology. In C. L. Redman (ed.), *Research and theory in current archeology*, 181–198. New York: Wiley.

Plunkett, G., MacDermott, C., Swindles, G. T. and Brown, D. 2013. Environmental indifference? A critique of environmentally deterministic theories of peatland archaeological site construction in Ireland. *Quaternary Science Reviews* 61, 17–31.

Pollard, T. 2000. Marine mollusca. In *The good stones: a new investigation of the Clava cairns* (*ed.)* R. Bradley, 151-4. Edinburgh: Society of Antiquaries of Scotland.

Powell, T. G. E. 1969. The Neolithic in the west of Europe and megalithic sepulture: some points and problems. In Powell, T.G.E., Corcoran, J.X.W.P., Lynch, F. and Scott, J.G. *Megalithic Enquiries in the West of Britain*, 247-72. Liverpool: University Press.

Raetzel-Fabian, D. 2002. Absolute chronology and cultural development of the Neolithic Wartberg Culture in Germany. *Journal of Neolithic Archaeology*.

Raftery, B. 1996. Trackway excavations in the Mountdillon bogs, Co. Longford 1985-1991*. Irish Archaeological Wetland Unit Transactions*, *3*.

Rasmussen, M., Li, Y., Lindgreen, S., Pedersen, J.S., Albrechtsen, A., Moltke, I., Metspalu, M., Metspalu, E., Kivisild, T., Gupta, R. and Bertalan, M. 2010. Ancient human genome sequence of an extinct Palaeo-Eskimo. *Nature*, *463*(7282), 757.

Ray, T.P. 1989. The winter solstice phenomenon at Newgrange, Ireland: accident or design?. *Nature*, *337*(6205), 343-345.

Ray, K. and Thomas, J. 2018. *Neolithic Britain: the transformation of social worlds*. Oxford: Oxford University Press.

RCAHMS 1946. *Twelfth Report with an Inventory of the Ancient Monuments of Orkney and Shetland.* Vol. 1. Edinburgh: HMSO.

RCAHMS. 1946. *The Royal Commission on the Ancient and Historical Monuments of Scotland. Twelfth report with an inventory of the ancient monuments of Orkney and Shetland, 3v*. Edinburgh. Page(s): 214-6, No.576 RCAHMS Shelf Number: A.1.1.INV/12.

RCAHMS. 1980c. *The archaeological sites and monuments of Sanday and North Ronaldsay, Orkney, The archaeological sites and monuments of Scotland series no 11*. Edinburgh. Page(s): 16, No.70 RCAHMS Shelf Number: A.1.2.ARC/11

RCAHMS. 1982d. *The archaeological sites and monuments of Rousay, Egilsay and Wyre, Orkney Islands Area, The archaeological sites and monuments of Scotland series no 16*. Edinburgh. Page(s): 15, No. 9 RCAHMS Shelf Number: A.1.2.ARC/16

RCAHMS. 1983c. *The archaeological sites and monuments of Papa Westray and Westray, Orkney Islands Area, The archaeological sites and monuments of Scotland series no 19*. Edinburgh. Page(s): 38, No.154 RCAHMS Shelf Number: A.1.2.ARC/19

RCAHMS. 1984d. *The archaeological sites and monuments of Eday and Stronsay, Orkney Islands Area, The archaeological sites and monuments of Scotland series no 23*. Edinburgh. Page(s): 15, No.50 RCAHMS Shelf Number: A.1.2.ARC/23

Renfrew, C. 1973. Monuments, mobilization and social organization in Neolithic Wessex. In Renfrew, C. (ed.) – *The explanation of culture change*. London: Duckworth, 539-58.

Renfrew C. 1973. *Before Civilization: The Radiocarbon Revolution and Prehistoric Europe*. New York: A.A. Knopf.

Renfrew, C. 1976. Megaliths, territories and populations. In *Acculturation and continuity in Atlantic Europe* (Vol. 16, 198-220). Brugge: De Tempel.

Renfrew, C. 1979. Transformations. In *Transformations* (3-44). Academic Press.

Renfrew, C. 1979. *Investigations in Orkney, Society of Antiquaries of London, Research Report No. 38*. London. RCAHMS Shelf Number: E.7.11.REN

Renfrew, C, 1983. The social archaeology of megalithic monuments. *Scientific American*, *249*(5),152-163.

Renfrew, C. 2011. *Before Civilization*. New York: Random House.

Renfrew, C. and Boyle, K. (eds) 2000. *Archaeogenetics: DNA and the Population Prehistory of Europe*. Cambridge: McDonald Institute for Archaeological Research.

Renfrew, C., Harkness, D. and Switsur, R. 1976. Quanterness, radiocarbon and the Orkney cairns. *Antiquity*, *50* (199–200), 194–204.

Renfrew, C., Todd, I. and Tringham, R. 1974. Beyond a subsistence economy: the evolution of social organization in prehistoric Europe. *Bulletin of the American Schools of Oriental Research. Supplementary Studies*, (20), 69-95.

Renner, R. D., Hemani, Z. Z., Tjouman, G. C., 2009. Extending advanced geospatial analysis capabilities to popular visualization tools. *Technol. Rev. J.*17, 89–106.

Rennie, A. F, 2006. *The role of sediment supply and sea-level changes on a submerging coast, past changes and future management implications*. Doctoral dissertation, University of Glasgow.

Richards, C. 1988. Altered images: a re-examination of Neolithic mortuary practices in Orkney, In Barrett, J. and Kinnes, I. (eds) *The Archaeology of Context in the Neolithic and Bronze Age: Recent Trends*, 42–55. Sheffield: Department of Archaeology and Prehistory, Sheffield University.

Richards, C. 1991. Skara Brae: revisiting a Neolithic village in Orkney. *Scottish archaeology: new perceptions*, 24-43.

Richards, C 1992, Excavations at Skara Brae and Rinyo: research and redemption, *Proceedings of the Society of Antiquaries of Scotland*, 121, 452-4.

Richards, C. 1993. *An archaeological study of Neolithic Orkney: architecture, order and social classification*. Doctoral dissertation, University of Glasgow.

Richards, C. 1998. Centralising tendencies? A re-examination of social evolution in Later Neolithic Orkney, in M. Edmonds and C. Richards (eds) *Understanding the Neolithic of north-western Europe*: 516–532. Glasgow: Cruithne Press.

Richards, C. 2004. Labouring with monuments: constructing the dolmen at Carreg Samson, south-west Wales. In V. Cummings and C. Fowler (eds) *The Neolithic of the Irish Sea: materiality and traditions of practice*, 72-80. Oxford: Oxbow.

Richards, C. (ed.) 2005. *Dwelling among the monuments: the Neolithic village of Barnhouse, Maeshowe passage grave and surrounding monuments at Stenness, Orkney*. Cambridge: McDonald Institute for Archaeological Research.

Richards, C. 2013. *Building the great stone circles of the north*. Oxford: Windgather Press.

Richards, C., Brophy, K., Carruthers, M., Jones, A., Jones, R. and Jones, S. 2016. *Good neighbours: Stonehall Knoll, Stonehall Meadow and Stonehall Farm*. In Richards, C. and Jones, R. (eds) *The Development of Neolithic House Societies in Orkney: Investigations in the Bay of Firth, Mainland, Orkney (1994–2014)*. Oxford: Windgather Press, 91-127.

Richards, C., Brown, J., Jones, S., Hall, A. and Muir, T. 2013. Monumental risk: megalithic quarrying at Staneyhill and Vestra Fiold, Mainland, Orkney. In *Building the great stone circles of the North*, 119-48.

Richards, C., Downes, J., Ixer, R., Hambleton, E., Peterson, R. and Pollard, J. 2013. Surface over substance: the Vestra Fiold horned cairn, Mainland, Setter cairn, Eday, and a reappraisal of late Neolithic funerary architecture. In Richards, C. *Building the great stone circles of the north*. Oxford: Windgather Press*,* 149.

Richards, C. and Jones, R. (eds) 2015. *The development of Neolithic house societies in Orkney*. Oxford: Oxbow.

Richards, C. and Jones, R. 2016. *The Development of Neolithic House Societies in Orkney: Investigations in the Bay of Firth, Mainland, Orkney (1994–2014)*. Oxford: Windgather Press.

Richards, C., Jones, A. M., Sheridan, A., Dunbar, E., Reimer, P. J., Bayliss, A., Griffiths S. and Whittle, A. 2016a. Settlement duration and materiality: formal chronological models for the development of Barnhouse, a Grooved Ware settlement in Orkney. *Proceedings of the Prehistoric Society* 82, 193–225.

Richards, C., Jones, A.M., MacSween, A., Sheridan, A., Dunbar, E., Reimer, P., Bayliss, A., Griffiths, S. and Whittle, A. 2016. *Settlement duration and materiality: formal chronological models for the development of Barnhouse, a Grooved Ware settlement in Orkney*. In *Proceedings of the Prehistoric Society*, Vol. 82, 193–225. Cambridge: Cambridge University Press.

Richards, M.P. 2000 Human consumption of plant foods in the British Neolithic: direct evidence from bone stable isotopes. In A.S. Fairbairn (ed.) *Plants in Neolithic Britain and Beyond*, 123–35. Oxford: Oxbow.

Richards, M.P. and Hedges, R. E. M. 1999. A Neolithic revolution? New evidence of diet in the British Neolithic. *Antiquity* 73: 891–7.

Richards, M.P. and P. Mellars. 1998. Stable isotopes and the seasonality of the Oronsay middens. *Antiquity* 72, 178-84.

Richards, M.P. and Schulting, R.J. 2006. Against the grain? Response to Milner et al. *Antiquity*, *80*, 444-456.

Richards, M.P., Schulting R.J. and Hedges, R.E.M. 2003a. Sharp shift in diet at onset of Neolithic. *Nature* 425, 366.

Ritchie, A. 1983. *Holm of Papa Westray North – Orkney-Cromarty stalled cairn. Discovery and Excavation Scotland.*

Ritchie, A. (ed.) 1996. *Orkney, 'Exploring Scotland's Heritage'* Edinburgh: RCAHMS Shelf Number: A.1.4.HER, 41.

Ritchie, A. 2009. *On the fringe of Neolithic Europe: excavation of a chambered cairn on the Holm of Papa Westray, Orkney*. Edinburgh: Society of Antiquaries of Scotland.

Ritchie, A., Bramwell, D., Collins, G.H. and Dickson, C. 1983. Excavation of a Neolithic farmstead at Knap of Howar, Papa Westray, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 113, 40-121.

Ritchie, J. N. G. 1985. Ritual monuments, in Renfrew (ed.):118-130.

Ritchie, P. 1961. A chambered cairn at Isbister, south Ronaldshay, Orkney. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 92, 25-32.

Ritchie, W. 1979. Machair development and chronology in the Uists and adjacent islands. *Proceedings of the Royal Society of Edinburgh, Section B: Biological Sciences*, *77*, 107-122.

Robert, C.P. and Casella, G. 2004. *Monte Carlo Statistical Methods (2nd Ed.),* New York: Springer.

Robinson, D, 2004. The mirror of the sun: Surface, mineral applications and interface in California rock-art. In: Boivin N, Owoc MA (eds) *Soils, Stones and Symbols: Cultural Perceptions of the Mineral World*. London: UCL Press, 91–106.

Robinson, G. 2013. "'A Sea of Small Boats': Places and Practices on the Prehistoric Seascape of Western Britain." *Internet Archaeology* 34.

Roe, D. and Taki, J. 1999. Living with stones: People and the landscape in Erromango, Vanuatu. In: Ucko P, Layton R (eds) *The Archaeology and Anthropology of Landscape*. London: Routledge, 411–422.

Rogers, J. *et al*. in Hazleton North, Gloucestershire, 1979-82: The Excavation of a Neolithic Long Cairn of the Cotswold-Severn Group (ed. A. Saville) 182–198 (Historic Buildings & Monuments Commission for England, 1990).

Routledge, K. 2005. *The Mystery of Easter Island*. New York: Cosimo, Inc.

Ruggles, C. 1984. Megalithic astronomy: A new archaeological and statistical study of 300 western Scottish sites. Oxford: *British Archaeological Reports*. British series 123.

Ruggles, C. 1999. Astronomy in prehistoric Britain and Ireland. New Haven (CT] and London: Yale University Press.

Ruggles, C. 2015. Calendars and astronomy. *Handbook of Archaeoastronomy and Ethnoastronomy*, 15.

Ruggles, C. 2015. Basic concepts of positional astronomy. *Handbook of Archaeoastronomy and Ethnoastronomy*, 459.

Ruggles, C. and Barclay, G. 2000. Cosmology, calendars and society in Neolithic Orkney: A rejoiner to Euan MacKaie. Antiquity, 74 (283), 62-74

Ruggles, C. and Whittle, A.W.R. (eds) 1981. Astronomy and society in Britain during the period 4000-1500 BC. Oxford: *British Archaeological Reports*. British series 88.

Russell, M. 2002. *Monuments of the British Neolithic*. Stroud: Tempus.

Griffiths, S., Edwards, B., Wilson, A., Reynolds, F. and Stanford, A. 2016. Bryn Celli Ddu passage tomb revisited. *Antiquity* Project Gallery 90(349).

Saville, A. 1990. Hazleton North, Gloucestershire, 1979–82. London: English Heritage.

Saville, A., 2013. *Hazleton North: The excavations of a Neolithic long cairn of the Cotswold-Severn group* (No. 13). English heritage.

Savory, H.N. 1984. The Penywyrlod long cairn, Talgarth, Brecknock In Britnell, W.J. and Savory, H.N. (eds) Gwernvale and Penywyrlod: *Two neolithic long cairns in the black mountains of Brecknock,* 13–39. Cardiff: Cambrian Archaeological Association.

Savory, H.N. 1950. *Tinkinswood and Long Cairns, Glamorgan*. Department of the Environment on behalf of the Secretary of State for Wales. HMSO.

Savory, H.N. 1971. *Tinkinswood and St Lythans long cairns.* London and Cardiff: Department of the Environment.

Scarre, C. 1992. The Early Neolithic of western France and megalithic origins in Atlantic Europe. *Oxford Journal of Archaeology*, *11*(2), 121-154.

Scarre, C. 2002a. A pattern of islands: the Neolithic monuments of north-west Brittany. *European Journal of Archaeology*, 5, 24-41

Scarre, C. 2004. *Displaying the stones: the materiality of 'megalithic' monuments.* Cambridge: McDonald Institute for Archaeological Research.

Schaefer, B.E. 1986. Atmospheric extinction effects on stellar alignments. *Journal for the History of Astronomy*, *17*(10), S32-S42.

Scheib, C.L., Hui, R., D'Atanasio, E., Wohns, A.W., Inskip, S.A., Rose, A., Cessford, C., O'Connell, T.C., Robb, J.E., Evans, C. and Patten, R. 2019. East Anglian early Neolithic monument burial linked to contemporary Megaliths. *Annals of human biology*, *46*(2), 145-149.

Schülke, A. 2016. Refining landscape archaeology–a study of the social relations between humans and their surroundings as embedded in megalithic tombs. *Praehistorische Zeitschrift*, *91*(2), 317-352.

Schulting, R., Mcclatchie, M., Sheridan, A., Mclaughlin, R., Barratt, P. and Whitehouse, N. 2017. Radiocarbon Dating of a Multi-phase Passage Tomb on Baltinglass Hill, Co. Wicklow, Ireland. *Proceedings of the Prehistoric Society, 83*, 305-323.

Schulting, R. J., Murphy, E., Jones, C. and Warren, G. 2012. New dates from the north and a proposed chronology for Irish court tombs. *Proceedings of the Royal Irish Academy. Section C: Archaeology, Celtic Studies, History, Linguistics, Literature*, 1-60.

Schulting, R., Ramsey, C., Reimer, P.J., Eogan, G., Cleary, K., Cooney, G. and Sheridan, A., 2017. November. Dating the Neolithic human remains at Knowth. *Royal Irish Academy.*

Schulting, R., Sheridan, A., Crozier, R. and Murphy, E. 2011, November. Revisiting Quanterness: new AMS dates and stable isotope data from an Orcadian chamber tomb. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 140, 1-50.

Schulting, R.J., Vaiglova, P., Crozier, R. and Reimer, P.J. 2017. Further isotopic evidence for seaweed-eating sheep from Neolithic Orkney. *Journal of Archaeological Science: Reports*, *11*, 463-470.

Schulting, R. J. and Wysocki, M. 2005. In this chambered tumulus were found cleft skulls…: an assessment of the evidence for cranial trauma in the British Neolithic. In *Proceedings of the Prehistoric Society* (Vol. 71, 107-138). Cambridge: Cambridge University Press.

Schultz Paulsson, B. 2017. *Time and Stone. The Emergence and Development of Megaliths and Megalithic Societies in Europe*. Oxford: Archaeopress.

Schwarcz, H. and Schoeninger, M. 1991. Stable isotope analyses in human nutritional ecology, *Yearbook of Physical Anthropology.*

Scott, J. G. 1969. The Clyde cairns of Scotland. In Powell, T.G.E *Megalithic Enquiries in the West of Britain, Liverpool*, 175-222.

Scott, J. 1970. A Note on Neolithic Settlement in the Clyde Region of Scotland. *Proceedings of the Prehistoric Society, 36*, 116-124.

Selkirk, A.1971. Ascott-under-Wychwood, *Current Archaeology,* 3, 7-1.

Senior, W. H. and Swan, W. B. 1972. *The Report of a Survey of Agriculture in Caithness, Orkney and Shetland*. Highlands and Islands Development Board.

Shackleton, N. J. and Hall, M. A., 1989. Stable isotope history of the Pleistocene at ODP site 6771. In *Proceedings of the Ocean Drilling Program: Scientific results*, Vol. 111, 295-316.

Sharples, N. 1985. Individual and community: the changing role of megaliths in the Orcadian Neolithic. *Proceedings of the Prehistoric Society* 51, 59–74.

Shepherd, A. 1996. Skara Brae, n Hall, A.M. 1996. *The Quaternary of Orkney: Field Guide.* Cambridge: Quaternary Research Association, 97-121.

Sheridan, J.A. 1986. Megaliths and megalomania: an account, and interpretation, of the development of passage tombs in Ireland. *Journal of Irish Archaeology 3*, 17–30

Sheridan, A. 2000. Achnacreebeag and its French connections: Vive the 'auld alliance. *The prehistory and early history of Atlantic Europe*, 1-15.

Sheridan, A. 2003. French connections I: Spreading the marmites thinly. In Armit, I., Murphy, E.M., Nelis, E. and Simpson, D.D.A. (eds) *Neolithic settlement in Ireland and western Britain*. Oxford: Oxbow Books, 3-17.

Sheridan, J. A. 2004a. Neolithic connections along and across the Irish Sea, In V. Cummings and C. Fowler (eds) *The Neolithic of the Irish Sea: Materiality and Traditions of Practice*,. Oxford: Oxbow, 9–21.

Sheridan, A. 2007. From Picardie to Pickering and Pencraig Hill? New information on the 'Carinated Bowl Neolithic'. In A. Whittle and V. Cummings (eds), *Going Over: The Mesolithic–Neolithic transition in north-west Europe*, 441–92. Proceedings of the British Academy 144. Oxford: Oxford University Press.

Sheridan, A. 2010. Revisiting Quanterness: new AMS dates and stable isotope data from an Orcadian chamber tomb. *Proc. Soc. Antiquaries Scotland*, 140, 1-50.

Sheridan, A. 2010b. The Neolithization of Britain and Ireland: the 'big picture', in B. Finlayson and G. Warren (eds), *Landscapes in Transition*, 89–105, Oxford: Oxbow.

Sheridan, A. 2012. Neolithic Shetland: a view from the 'mainland'. *The border of farming and the cultural markers*, 6-36.

Sheridan, A. 2012. Review of A. Whittle, F. Healy & A. Bayliss 'Gathering Time: Dating the Early Neolithic enclosures of Southern Britain and Ireland'. *Antiquity* 86, 262–4

Sheridan, A. 2014. Shetland, from the appearance of a 'Neolithic' way of life to c. 1500 BC: a view from the 'mainland.' Northern Worlds - Landscapes, Interactions and Dynamics. *Proceedings of the Northern Worlds Conference, Copenhagen*, 28-30

Sheridan, A., Cummings, V. and Fowler, C. 2004. Neolithic connections along and across the Irish Sea. *The Neolithic of the Irish Sea*, 9-21.

Sheridan, A. and Higham, T. 2007. *The re-dating of some Scottish specimens by the Oxford Radiocarbon Accelerator Unit (ORAU): results receiving during 2007. Discovery and Excavation in Scotland* 8, 225.

Sheridan, J.A. 2010. The Neolithization of Britain and Ireland: the 'big picture'. In B. Finlayson & G. Warren (eds), *Landscapes in Transition*, 89–105. Oxford: Oxbow Books/Council for British Research in the Levant 8.

Simpson, I.A., Dockrill, S.J., Bull, I.D. and Evershed, R.P. 1998. Early anthropogenic soil formation at tofts Ness, Sanday, Orkney. *Journal of Archaeological Science*, *25*(8), 729-746.

Smith, M. and Brickley, M. 2009. *People of the long barrows: life, death and burial in the Earlier Neolithic*. History Press Ltd.

Smith, I.F. and Darvill, T. 1990. The prehistoric pottery. *Hazleton North. The excavation of a long cairn of the Cotswold-Severn group, Gloucestershire, 1979–82,* 141-152.

Sommerville, A. A., Hansom, J. D., Housley, R.A. and Sanderson, D.C.W. 2007. Optically stimulated luminescence (OSL) dating of coastal aeolian sand accumulation in Sanday, Orkney Islands, Scotland. *The Holocene*, 17, 627-637.

Sommerville, A.A., Hansom, J.D., Sanderson, D.C.W. and Housley, R.A. 2003. Optically stimulated luminescence dating of large storm events in Northern Scotland. *Quaternary Science Reviews*, *22*(10-13), 1085-1092.

Startin, B. and Bradley, R. 1981, Some notes on work organisation and society in prehistoric Wessex. In C.L.N Ruggles and A. W.R Whittle (eds), *Astronomy and Society in Britain during the period 4000-1500BC.* Oxford: *British Archaeological Reports* British Series 88. 289-96.

Sturt, F. 2005. Fishing for meaning: lived space and the early Neolithic of Orkney. In Cummings, V. and Pannett, A. (eds.) *Set in Stone: New approaches to Neolithic Monuments in Scotland,* 68-60. Oxford: Oxbow Books.

Tauber, H., 1981. 13C evidence for dietary habits of prehistoric man in Denmark. *Nature*, *292*(5821), 332-333.

Tate, C., 2011. Orkney Guide Book. Great Britain, Charles Tait Photographic.

Thom, A. 1955. A statistical examination of the megalithic sites in Britain. *Journal of the Royal Statistical Society* A118: 275-91.

Thom, A. 1967. *Megalithic sites in Britain.* Oxford: Oxford University Press.

Thomas, A. 2011. *The Braes of Ha'Breck, Wyre, Orkney (Rousay and Egilsay parish), excavation, Discovery and Excavation Scotland, New, vol. 12, 2011*. Wiltshire: Cathedral Communications Limited, 134-136

Thomas, A. and Lee, D. 2012. Orkney's first farmers: early Neolithic settlement on Wyre. *Current Archaeology* 268: 12–19.

Thomas, J. 1991. *Rethinking the Neolithic*. Cambridge: Cambridge University Press.

Thomas, J. 1998. An economy of substances in early Neolithic Britain. In J. Robb (ed.), *Material Symbols: Culture and Economy in Prehistory*. Carbondale: Southern Illinois University Press, 70-89.

Thomas, J. 2013. *The birth of Neolithic Britain*. Oxford: Oxford University Press.

Thomas, J. 2003. Thoughts on the 'repacked' Neolithic revolution. *Antiquity* 77, 67–74.

Thomas, J. 2004. Recent debates on the Mesolithic–Neolithic transition in Britain and Ireland, *Documenta Praehistorica* 31, 117–30.

Thomas, J. 2007. Mesolithic–Neolithic transitions in Britain: from essence to inhabitation. In A. W. R. Whittle and V. Cummings (eds), *Going Over: The Mesolithic–Neolithic Transition in North-West Europe*. Oxford: British Academy and Oxford University Press, 423–39

Thomas, J. S 2008. The Mesolithic–Neolithic transition in Britain. In J. Pollard (ed.), *Prehistoric Britain*. Oxford: Blackwell, 58–89.

Thomas, J. 2010. The return of the Rinyo-Clacton folk? The cultural significance of the Grooved Ware complex in later Neolithic Britain. *Cambridge archaeological journal*, *20*(1), 1-15.

Thomas, J. 2013. *The Birth of Neolithic Britain*, Oxford: Oxford University Press.

Thomas, J. 2022. Neolithization and Population Replacement in Britain: An Alternative View. *Cambridge Archaeological Journal*, 32(3), 507-525.

Thompson, V.D., Jefferies, R.W. and Moore, C.R. 2019. The Case for Radiocarbon Dating and Bayesian Analysis in Historical Archaeology. *Historical Archaeology* 53, 181–192.

Thurman, J. 1869. On ancient British barrows, especially those of Wiltshire and the adjoining counties (Part 1: long barrows). *Archaeologia*, *42*, 161-244.

Tilley, C. 1994, *A phenomenology of landscape : places, paths and monuments*, Oxford: Berg.

Tilley, C. 2004. *The materiality of stone: explorations in landscape archaeology*. Oxford: Berg.

Timpany, S., Crone, A., Hamilton, D. and Sharpe, M. 2017. Revealed by Waves: A Stratigraphic, Palaeoecological, and Dendrochronological Investigation of a Prehistoric Oak Timber and Intertidal Peats, Bay of Ireland, West Mainland, Orkney. *The Journal of Island and Coastal Archaeology*, *12*(4), 515-539.

Tipping, R. 1994. The form and fate of Scotland's woodlands. *Proceedings of the Society of Antiquaries of Scotland*. 124, 1-54.

Tisdall, E. W., McCulloch, R. D., Sanderson, D. C. W., Simpson, I. A. and Woodward, N.L. 2013. Living with sand: A record of landscape change and storminess during the Bronze and Iron Ages Orkney, Scotland. *Quaternary International*, *308*, 205-215.

Toulmin-Smith, L. (ed.)1964. *The itinerary of John Leland, in or about the years 1536-1539 part VI*, Vol.3, London: Centaur Press.

Trigger, B.G. 1989. *A history of archaeological thought*. Cambridge: Cambridge University Press.

Van de Noort, R. 2004a. An ancient seascape: the social context of seafaring in the early Bronze Age*. World Archaeology* 35(3), 404–415.

Van de Noort, R. 2004b The Humber, its sewn-plank boats, their Roberts, O., 2004, Reconstruction and performance, in Clark, P. (ed.), 2004a, *The Dover Bronze Age Boat*. London.189–210.

Van de Noort, R. Middleton, R, Foxon, A. and A. Bayliss. 1999. "The 'Kilnsea-boat', and some implications from the discovery of England's oldest plank boat remains'. *Antiquity* 73: 131–5.

Viner, S., Evans, J., Albarella, U. and Parker Pearson. M. 2010. Cattle Mobility in Prehistoric Britain: Strontium Isotope Analysis of Cattle Teeth at Durrington Walls (Wiltshire, Britain). Journal of Archaeological Science 37: 2812-2820.

Waddell, J. 1992. The Irish Sea in prehistory. Journal of Irish Archaeology 6, 29–40.

Waddington, C. and Wicks, K. 2017. Resilience or wipe out? Evaluating the convergent impacts of the 8.2 ka event and Storegga tsunami on the Mesolithic of northeast Britain. *Journal of Archaeological Science*, 14, 692–714.

Ward, J. 1915. Tinkinswood Burial Chamber, Vale of Glamorgan. *Archaeologia Cambrensis* 15(6),253.

Ward, T. 2007. *The Celtic Wheel of the Year: Celtic and Christian Seasonal Prayers*. Winchester: John Hunt Publishing.

Wheeler, A. 1979. The fish bones. In *Investigations in Orkney* (ed.) C. Renfrew, 144-9. London: Society of Antiquaries.

Whitehouse, N.J., Schulting, R.J., McClatchie, M., Barratt, P., McLaughlin, R., Bogaard, A., C olledge, S., Marchant, R., Gaffrey, J. and Bunting, M.J. 2014. Neolithic agriculture on the European western frontier: the boom and bust of early farming in Ireland. *Journal of Archaeological Science* 51, 181–205

Whitley, J. 2002. Too many ancestors. *Antiquity*, *76*(291), 119-126.

Whittle, A. 1991. Wayland's Smithy. *Oxfordshire: excava*.

Whittle, A. W. R. 1996. *Europe in the Neolithic: The creation of New Worlds*. Cambridge: Cambridge University Press.

Whittle, A. 2000. ‘Very like a whale’: menhirs, motifs and myths in the Mesolithic-Neolithic transition of north-west Europe. *Cambridge Archaeological Journal* 10, 243-59.

Whittle, A. 2004. Stones that float to the sky: portal dolmans and their landscapes of memory and myth. In V. Cummings and C. Fowler (eds) *The Neolithic of the Irish Sea: materiality and traditions of practice,* 81-90. Oxford: Oxbow.

Whittle, A., Barclay, A., Bayliss, A., McFadyen, L., Schulting, R. and Wysocki, M. 2007. Building for the dead: Events, processes and changing worldviews from the thirty-eighth to the thirty-fourth centuries cal. bc in Southern Britain. *Cambridge Archaeological Journal*, *17* (Suppl.1), 123–147.

Whittle, A. and Bayliss, A. 2007. The times of their lives: From chronological precision to kinds of history and change. *Cambridge Archaeological Journal*, *17*(1), 21–28.

Whittle, A., Healy, F. and Bayliss, A. 2011. *Gathering time: dating the early Neolithic enclosures of southern Britain and Ireland*. Oxford: Oxbow Books.

Whittle, A., Bayliss, A. and Wysocki, M. 2007. Once in a lifetime: The date of the Wayland’s Smithy long barrow. *Cambridge Archaeological Journal*, *17*(SUPPL.1), 103–121.

Whittle, A., Brothwell, D., Cullen, R., Gardner, N. and Kerney, M.P. 1991. Wayland's Smithy, Oxfordshire: Excavations at the Neolithic Tomb in 1962–63 by RJC Atkinson and S. Piggott. In *Proceedings of the Prehistoric Society* (Vol. 57, No. 2, 61-101). Cambridge University Press.

Whittle, A.W.R., Healy, F.M.A. and Bayliss, A. 2011. *Gathering time: dating the early Neolithic enclosures of southern Britain and Ireland*. Oxford: Oxbow Books.

Whittle, A., Wysocki, M., Richards, M., Rouse, A., Walker, E. and Zienkiewicz, L. 1998, January. Parc le Breos Cwm transepted long cairn, Gower, West Glamorgan: date, contents, and context. In *Proceedings of the Prehistoric Society* (Vol. 64,139-182). Cambridge University Press.

Whittle, A., Wysocki, M., Richards, M., Rouse, A., Walker, E. and Zienkiewicz, L. 1998. Parc le Breos Cwm Transepted Long Cairn, Gower, West Glamorgan: Date, Contents, and Context. *Proceedings of the Prehistoric Society, 64*, 139-182.

Wickham-Jones, C. 1986. The procurement and use of stone for flaked tools in prehistoric Scotland. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 116, 1-10.

Wickham-Jones, C., 2013. *Orkney: a historical guide*. Edinburgh: Birlinn.

Wickham-Jones, C. R., Bates, R., Dawson, S., Dawson, A. and Bates, M. 2018. The Changing Landscape of Prehistoric Orkney. In Persson, P., Reide, F., Skar, B., Breivik, H. M. and Jonsson, L. (eds*.) The Ecology of Early Settlement in Northern Europe*. Sheffield: Equinox Publishing, 393 – 414.

Wickham-Jones, C. and Collins, G. H. 1977. The sources of flint and chert in northern Britain. In *Proceedings of the Society of Antiquaries of Scotland*, Vol. 109, 7-21.

Wilson, G. V., Edwards, W. Knox, J. Jones, R. C. B. and Stephens, J. V. 1935. The Geology of the Orkneys. *Mem Geol Surv Gt Brit Scot.*

Windows to the Universe. 2009. URL http://www.windows2universe.org/earth/Water/ocean_tides.html

Wood, J., Dykes, J., Slingsby, A., Clarke, K., 2007. Interactive visual exploration of a large spatio-temporal dataset: Reflections on a geovisualization mashup. *IEEE Trans. Vis. Comput. Graph*. 13, 1176–1183.

Woodman, P.E. 2000. Beyond significant patterns towards past intentions: the location of Orcadian chambered tombs. *BAR International Series*, *844*, 91-105.

Woodman, P.C., Andersen, E. and Finlay, N. 1999*. Excavations at Ferriter's Cove, 1983–95: last foragers, first farmers in the Dingle Peninsula*. Bray: Wordwell

Woodman, P.C., Finlay, N. and Anderson, E. 2006. *The Archaeology of a Collection: the Keiller-Knowles Collection of the National Museum of Ireland*. Dublin: Wordwell

Wright, E., Hedges, R., Bayliss, A. and Van de Noort, R. 2001. New AMS radiocarbon dates for the North Ferriby boats—a contribution to dating prehistoric seafaring in northwestern Europe. *Antiquity, 75*(290), 726-734.

Wyatt, S. 2009. Soul music: instruments in a animistic age, in *The Sounds of Stonehenge*, ed. S. Banfield. Oxford: Archaeopress, 11-6.

Wyatt, S. 2010. Psychopomp and circumstance or shamanism in context. An interpretation of the drums of the southern Trichterbecher-Culture, in *Musical Perceptions - Past and Present. On Ethnographic Analogy in Music Archaeology. Studien zur Musikarchäologie* VI, eds. R. Eichmann, E. Hickmann & L.-C. Koch. Rahden: Leidorf, 129-50.

Wymer, J.J. 1966. Excavations at Lambourne Long Barrow. *Berkshire Archaeological Journal* 62, 1-16.

Wysocki, M., Bayliss, A. and Whittle, A. 2007. Serious Mortality: the Date of the Fussell's Lodge Long Barrow, *Cambridge Archaeological Journal*. Cambridge University Press, 17(S1), 65–84.

Wysocki, M., Griffiths, S., Hedges, R., Bayliss, A., Higham, T., Fernandez-Jalvo, Y. and Whittle, A. 2013. December. Dates, diet, and dismemberment: Evidence from the Coldrum megalithic monument, Kent. In *Proceedings of the Prehistoric Society* (Vol. 79, pp. 61-90). Cambridge University Press.

Wysocki, M. and Whittle, A. 2000. Diversity, lifestyles and rites: New biological and archaeological evidence from British earlier Neolithic mortuary assemblages. *Antiquity, 74*(285), 591-601.

Yu, L., Gong, P., 2012. Google Earth as a virtual globe tool for Earth science applications at the global scale: Progress and perspectives. *Int. J. Remote Sens*. 33, 3966–3986.

Zappa, G., Shaffrey, L.C., Hodges, K.I., Sansom, P.G. and Stephenson, D.B. 2013. A multimodel assessment of future projections of North Atlantic and European extratropical cyclones in the CMIP5 climate models. *Journal of Climate*, *26*(16), 5846-5862.

Zvelebil, M. and Rowley-Conway, P. 1984. Transition to farming in northern Europe: a hunter-gatherer perspective. *Norwegian Archaeological Review* 17, 102-28.

Zvelebil, M. 2009. *Hunters in transition: Mesolithic societies of temperate Eurasia and their transition to farming*. Cambridge: Cambridge University Press.