COWBOYS AND INDIANS?

A BIOCULTURAL STUDY OF VIOLENCE AND CONFLICT IN SOUTH-EAST SCOTLAND

c. AD 400 TO *c.* AD 800

By

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Volume 1 of 2

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LAY SUMMARY

This thesis considers the skeletal evidence for violence in south-east Scotland during the early medieval period and includes analysis of human remains not previously examined alongside scientific analyses of selected skeletons. South-east Scotland experienced several dramatic events in this period including the end of Roman rule, the Anglian invasion and the commencement of Viking attacks.

The primary aim of this research is to utilise skeletal data alongside other strands of evidence to explore if the period was conflict-ridden or not. Other avenues of research incorporated into this thesis include burial practice, the evidence for weaponry and the depictions on carved stones. Human remains provide the most direct evidence of violence in the past yet regional studies continue to be relatively uncommon. This is the first major synthesis of human remains of the period in south-east Scotland and it includes the first analysis of several important assemblages from the region.

Osteological analysis has demonstrated notable concentrations of skeletal evidence for violence in and around the Firth of Forth, in addition to isolated examples within other parts of the study area. This has important implications for our understanding of the relationships between Angles, Britons and Picts and the nature of conflict in the area. It seems likely that the main focus of aggression was on the Pictish frontier.

ABSTRACT

This thesis considers the skeletal evidence for violence in south-east Scotland during the early medieval period and includes analysis of human remains not previously examined alongside biomolecular analyses of selected skeletons. South-east Scotland experienced several dramatic events in this period, including the end of Roman rule, the Anglian invasion and the commencement of Viking attacks. The traditional view held by some archaeologists in the relatively recent past was that the anglicisation of post-Roman Britain was akin to Hollywood cowboys and Indians and that the Anglo-Saxon conquest was a form of ethnic cleansing.

The primary aim of this research is to utilise bioarchaeological data alongside other strands of evidence, such as new radiocarbon dates, isotope and DNA analysis alongside XRF and SEM analysis of injuries, to explore if the period was conflict-ridden or not. Other avenues of research incorporated into this thesis include burial practice, the evidence for weaponry and the iconography of carved stones. Human remains provide the most direct evidence of violence in the past yet regional studies remain relatively uncommon, particularly in Scotland. This is the first major synthesis of human remains in south-east Scotland and includes the first bioarchaeological analysis of several important assemblages from the region, i.e. 19-century discoveries from Lundin Links in Fife, the assemblage from Parkburn Quarry, Lasswade in Midlothian and the recently rediscovered mass burial from the Roman fort at Cramond in Midlothian.

Osteological analysis of more than 300 skeletons, many of which were excavated in the 19th and first half of the 20th century, has demonstrated notable concentrations of skeletal evidence for violence in and around the Firth of Forth, in addition to isolated examples from elsewhere in the study area. Significant advances in the bioarchaeology of trauma in recent years have facilitated the identification of important cases of peri-mortem trauma previously unrecorded. In addition, isotope analysis has provided important data on origins and mobility

while DNA analysis has proved useful in confirming the sex of poorly preserved adult skeletons as well as providing data on likely origins and familial relationships.

This has important implications for our understanding of the relationships between Angles, Britons and Picts, the nature of conflict in the area and for political and social interaction both within and on the fringes of the study area. Conclusions have been reached on the nature, function and impact of violence more generally. It seems likely that the main focus of aggressive action was on the Pictish frontier.

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CHAPTER 1: INTRODUCTION TO THE THESIS

'Violence was endemic in the early medieval Latin West, and evidence relating to it abounds in the texts pertaining to northern Britain from the 6th to the 11th century' (Fraser 2012, 65).

'A cursory look at history shows the enormity of suffering caused by male violence…male violence may even outrank disease and famine as the major source of human suffering' (Gilbert 1994, 352).

1.1 INTRODUCTION

The subject of this research is the evidence for violence within south-east Scotland during the early medieval period. Violence here is taken to mean any violent act or acts committed against another person whereas warfare can be defined as continuous acts of violence between groups. As Gilbert's quote (ibid.) suggests, violence, particularly male violence, is a major cause of widespread pain and suffering with a lengthy history from the Palaeolithic era up to the present day with the 20th century being described as perhaps the bloodiest in human history (Carmen 1997, 2). This is *contra* Pinker (2011) who argues that we may in fact be living in the most peaceful period in our species' history and that violence of all kinds has been decreasing over time.

The title of this thesis is a reference to the traditionally held view of some archaeologists like Brian Hope-Taylor who excavated the famous Anglian settlements at Yeavering and Bamburgh and suggested that the anglicisation of [parts of] post-Roman Britain was akin to Hollywood cowboys and Indians (Hope-Taylor 1977, 294). At the same time he cited evidence at Yeavering for a harmonious relationship between the native population and a small, governing Anglo-Saxon elite (ibid., 282). Koch (1999, 202-3) recently advocated the rejection of the 'Anglo-Saxon conquest' as a dark-age ethnic cleansing along lurid Gildesian terms (e.g. 'De Excidio Britanniae' § 24) believing that the more important division in the 6th century was the ancient one between the ethnically mixed extramural north beyond Hadrian's Wall (the precursor of Scotland) and an ethnically mixed intramural south (the old Roman province). The idea of ethnic cleansing was in part the result of an uncritical acceptance of the veracity of the historical sources up until the end of the 1970s. Although the dearth of native documentary sources for Scotland, at least in the early period covered by the analysis, is acknowledged (see for example Maldonado 2011a) a variety of sources from further afield will go some way to providing a backdrop to periods of conflict, if not to actual historical events within the geographical area.

While the primary focus of this research is on the identification of skeletal markers of violence, other strands such as the archaeological evidence for burial practices in the period, material culture, depictions on carved stones and historical sources are incorporated in order to achieve a truly biocultural approach. The biocultural approach can be defined as one that views biology and culture as being inextricably intertwined and explicitly emphasises the dynamic interaction between humans and their larger social, cultural and physical environments (Zuckerman and Martin 2016). Individuals do not live and die in a biological bubble. Nonetheless, the physical evidence of injury, whether healed or unhealed, is the most direct evidence of violence, the *sine qua non* of warfare and its results (Knüsel 2005, 49). Therefore, skeletal analysis forms the cornerstone of any study of non-accidental trauma. In order to understand the causes and consequences of violence it is essential that spatial and temporal prevalence data for skeletal injuries is acquired.

The artefactual record (both 'native' and Anglian) is notably sparse for Scotland in the early medieval period (e.g. Blackwell 2018), however, given the scale of Anglian involvement within the study area it is justifiable to draw on evidence from further afield, particularly for weaponry (e.g. Davidson 1998; Dickinson and Hárke 1992). Depictions on carved stones are likely to have served multiple symbolic and political functions and recent work on the early possibly 5th or 6th century stones such as Tulloch and Rhynie 3 has demonstrated an association with the monumental cemeteries of north-east Scotland (Hall *et al.,* 2020).

Weapons and combat scenes appear on many of the stones and can supplement the meagre artefactual record.

This research presents the first regional synthesis of the osteological evidence for non-accidental trauma in south-east Scotland during the early medieval period and is complemented by a range of biomolecular and scientific studies alongside new radiocarbon dates (see Appendices 5.2-5.6 below). The study group comprises 306 skeletons from across the study area (see Figures 1.1-2 below), all of which have been subjected to full osteological analysis. Significant quantities of disarticulated human bone are also incorporated. Later medieval assemblages from Captain's Cabin and the Isle of May were also fully recorded for comparative purposes. Much of the material was recovered during the 19th and early 20th centuries and often only skulls were retained. This is a direct consequence of the antiquarian preoccupation with cranial morphology (e.g. Turner 1864-66; 1903; 1914-15). From the osteological point of view, it is therefore expedient that the head tends to be the main focus of non-accidental trauma often with lethal intent (Wakely 1997).

This chapter sets out the context in which this research has been carried out. It then explains why the early medieval period in south-east Scotland was chosen as a focus for the work. This is followed by a discussion of the research aims, objectives and hypotheses. The chapter concludes by detailing the structure of the thesis.

1.2 CONTEXT OF THE RESEARCH

The 1st millennium AD in northern Britain was marked by huge social transformation, not least the end of Roman rule (e.g. Collins 2011), the conversion to Christianity (e.g. Carver 2003; Maldonado 2011a; Richards 2003), the arrival of the Anglo-Saxons (e.g. Petts and Turner 2011; Wood 2011), the commencement of Viking attacks (e.g. Carver *et al.,* 2016) and the emergence of early kingdoms (e.g. Noble and Evans 2019; Woolf 2007).

Across Scotland burial becomes more visible in the 5th and 6th centuries (Maldonado 2013, 1), yet regional syntheses of burial practice are largely absent (Mitchell and Noble 2017, 1) although there are some notable exceptions (Dunwell and Ralston 2008; Heald and Barber 2015; Henshall 1955-6; Winlow 2011). Several authors (e.g. Edwards 2010, 10; Maldonado 2013, 1; Williams 2007) in recent years have criticised the omission of Scotland from studies of early medieval death and burial (e.g. Hadley 2001; Lucy and Reynolds 2002; Thompson 2004), this in spite of the region's long history of detailed studies and excavations (e.g. Alcock 1992; Ashmore 1980; Close-Brooks 1984; Proudfoot 1996, 1998; Wainwright 1955). A similar discrepancy has recently been highlighted in the field of Anglo-Saxon material culture within Scotland (Blackwell 2018), even though for a time Anglian control reputedly extended at least as far as the Firth of Forth. In contrast, much recent historical scholarship has focussed on a radical revision of the traditional frameworks for the early medieval period in Scotland, where it is now argued that many writers of 'primary' sources were reconstructing the past in anticipation of the outcomes they desired (e.g. Fraser 2009, 1-11) and that therefore the sources can no longer be taken at face value.

Both regional and chronological syntheses of human remains are still largely absent from the osteological record in Scotland during the early medieval period. There are manifold reasons for this. Much of the extant material was recovered in the 19th or early 20th century, often unpublished beyond the craniometry, which was fashionable at the time, and therefore its very existence is largely unknown. In the case of earlier assemblages, it was common practice to retain only skulls and animal based consolidants were often applied, making biomolecular sampling and radiocarbon dating problematic though not impossible. Bone survival in large parts of Scotland is poor although not across the entire country. In southern Scotland the study of early medieval burial has been stalled by the absence of a clearly developed cemetery archaeology, in large part due to the absence of large well-preserved cemeteries such as exist in England, for example, West Heslerton, Spong Hill and Cannington (SCARF 2012, 80). An apparent absence of skeletal evidence for violence in

Scotland before the 9th century has been highlighted (Maldonado 2013, 11) but this observation is not based on data from a population-based osteological study such as the one presented here. This study aims to use the osteological data as the baseline for a clearer understanding of the actual scale and prevalence of non-accidental trauma as evidenced by the injuries themselves.

The work of Maldonado on early Christianity and on burial practice in early medieval Scotland represents a significant contribution to our current understanding of the period (e.g., 2011a and b; 2013; 2016). The current multi-disciplinary research on Whithorn includes a comprehensive programme of scientific analyses as yet unpublished (Maldonado pers. comm.). A variety of large-scale biomolecular studies are ongoing in Scotland and are already starting to reveal important new information about existing assemblages of human remains, some of which has been incorporated into this thesis (see Appendices 5.3-5.4 below). It is important that biomolecular results are combined with, but do not replace, osteological analyses and the interrogation of archaeological evidence. DNA can often confirm the osteological sexing of a skeleton but it cannot determine if he or she showed any signs of injury and whether or not it was deliberately inflicted. The predominant tradition of unaccompanied burial in Scotland necessitates the inclusion of radiocarbon dating in all projects. There is, nonetheless, evidence for considerable variety in burial type including log coffins, long cists, cists reusing Roman masonry, cists made with carefully worked slabs, square-ditched graves and post-defined graves, often in a single cemetery (Maldonado 2011a, 2011b, 2013, 2016).

Following the creation of a national Scottish Archaeological Research Framework in 2012, the current stage of the ScARF project has been to focus on creating regional frameworks for the whole of Scotland. There are currently five regional research frameworks either completed or ongoing. These have been part-funded by Historic Environment Scotland and are being co-ordinated through ScARF. When complete they will all be available and searchable as part of the ScARF website and will tie directly into the national framework. The regional research frameworks will complement the national ScARF but will focus on assessing the state of knowledge in each region and how it differs from the national picture and changes in our knowledge since it was launched in 2012. They will highlight key regional differences and future research priorities in each geographical area. These research frameworks are a key part of Scotland's Archaeology Strategy (Historic Environment Scotland 2015). The south-east Scotland Archaeological Research Framework (SESARF) covers the archaeology of the local authority areas of the City of Edinburgh, East Lothian, Midlothian and the Scottish Borders which broadly equates to the study area. Therefore, this research is highly compatible with the aims and objectives of the regional framework.

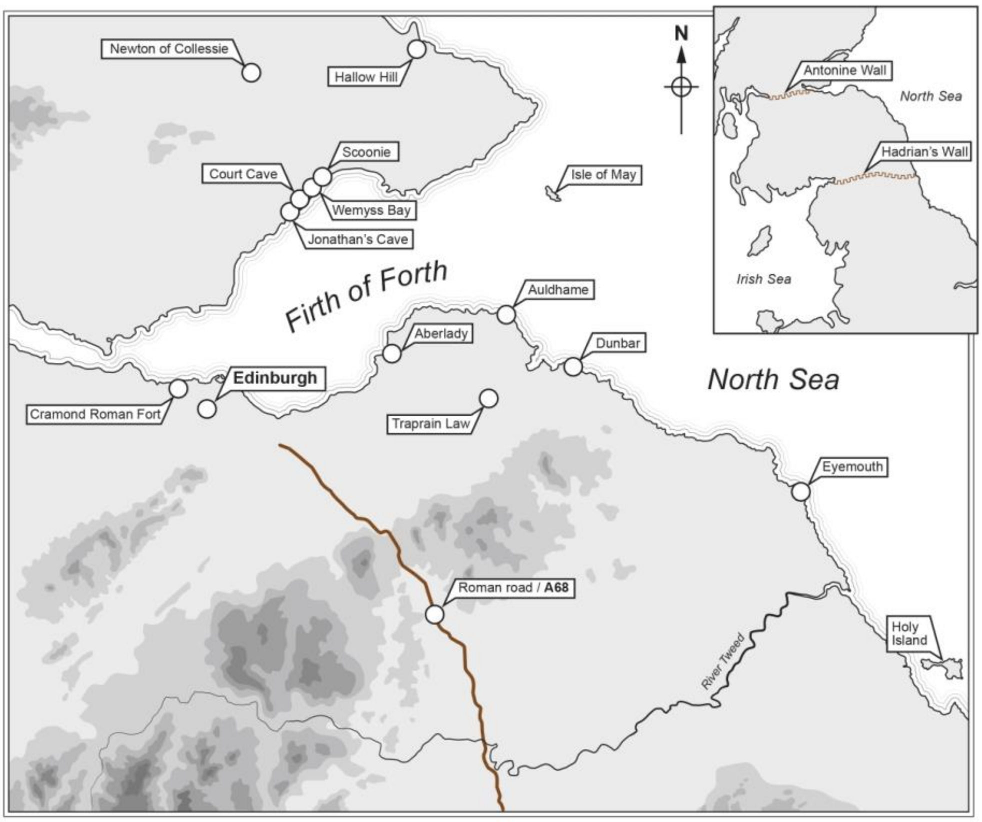
The information in the following section derives from an unpublished working document for the early medieval period in south-east Scotland, which arose out of a series of working parties and consultations. The study of conflict was identified as one of the core themes of SESARF. Further period-specific objectives include the investigation of the relationship between the inhabitants of south-east Scotland with the Anglian incomers and the integration of historical and archaeological records where possible. The original ScARF medieval period range included the last 500 years of the 'Long Iron Age', which has been dropped by SESARF in favour of the chronological system applied by English archaeologists, which identifies clear and easily definable breaks between the Iron Age, Roman and early medieval periods. This makes a lot of sense in the region, traditionally controlled by the Goddodin in the 5th and 6th century (Fraser 2008) prior to the expansion of first Bernician and later Anglian/Northumbrian influence into the Lothians during the 7th century. Centres of population are difficult to place although Bede refers to *Dun Bair* (Dunbar), *Dun Ethin* (Edinburgh) and the unlocated stronghold of *Iudeu* located somewhere close to the Firth of Forth (Fraser 2008). The spread of Christianity within the region during the early medieval period has been traditionally associated with the long cist burial tradition. Further research on long cist cemeteries and the (re-) examination of human remains held in museum collections was also recommended as part of the regional framework. Virtually all human remains available from the SESARF region have been incorporated into this research.

1.3 RESEARCH PARAMETERS

1.3.1 The study area

The geographical focus of this research is south-east Scotland from the Scottish Borders to the northern shore of the Firth of Forth (see Figure 1.1 below). The study group derives from 35 sites across the region, which are mainly long cists (see Figure 1.2 below). The study group also incorporates the monastic site on the Isle of May in the Firth of Forth and the Pictish cemetery at Lundin Links in Fife on the north shore of the Forth.

Figure 1.1: The study area (©Peter Lorimer, Pighill Graphics)



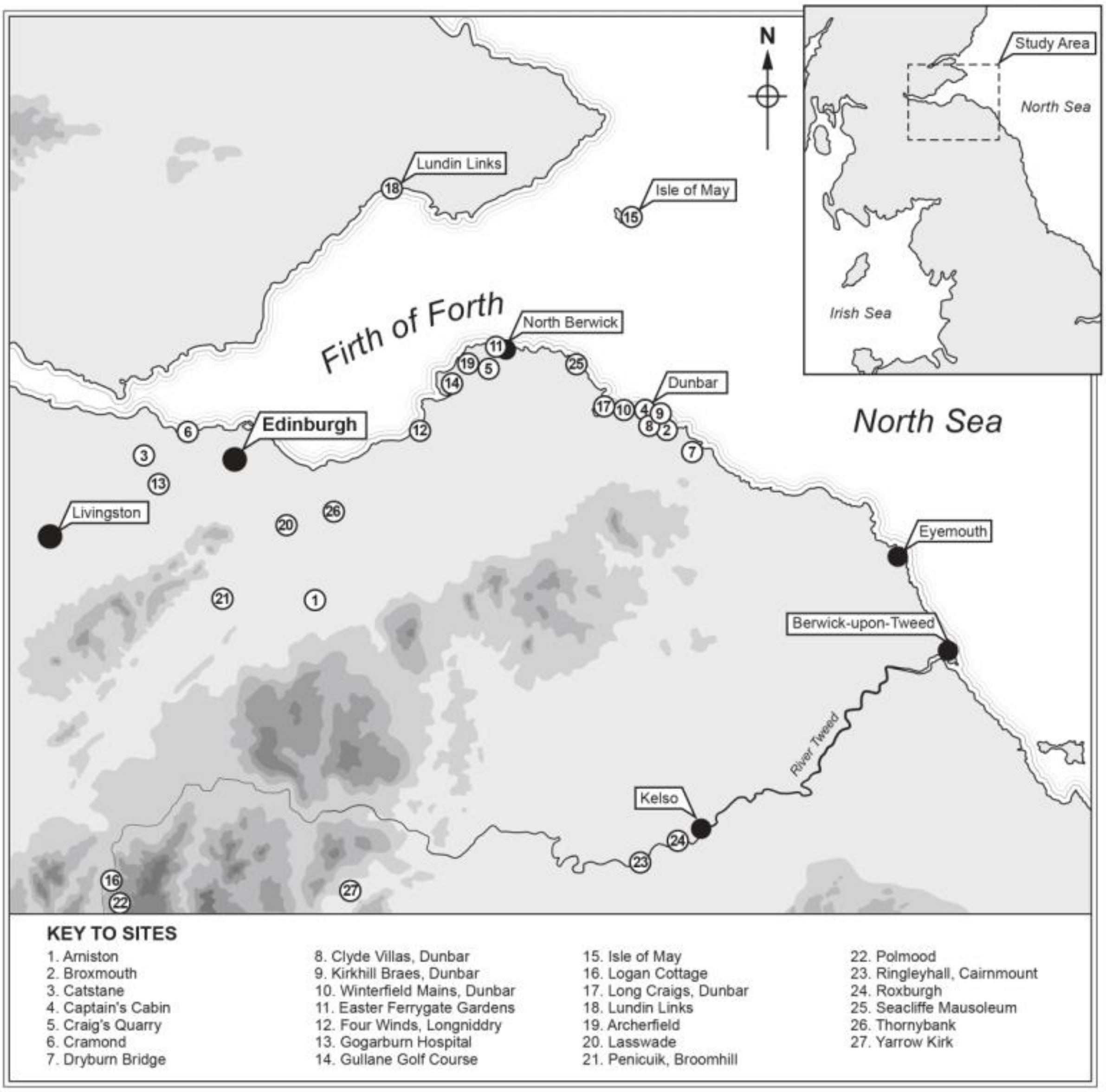
More than three and a half centuries of Roman military occupation created a frontier zone, which was a significant factor in the establishment of the dynastic kingdoms of Bernicia and

Deira (Collins 2011,15). The *limitanei* were the frontier soldiers of the later empire and it has been argued that the northern frontier never collapsed but rather its soldiers ceased to be professional fighters and instead became warriors tied to local elites, before Anglian settlement (ibid.). Broadly speaking, this is the area inhabited by the Votadini during the Roman Iron Age and subsequently by the people of the Gododdin who are commemorated in a series of controversial elegies, which reputedly depict violent confrontation (e.g. Koch 1997; 1999).

The transition from a Roman-dominated frontier zone at the beginning of the 5th century to an Anglian kingdom by the early 7th century represents a period of great change and complexity where the current state of knowledge is limited and unsatisfactory (Wood 2011, 15). During the Roman period the study area was distinctive from other parts of Roman Britain, bounded as it was by Hadrian's wall to the south and the Antonine wall to the north marking out its inhabitants as distinctive from those beyond the walls, essentially creating a tribal zone. What was the nature of the relationship between the Romans and the native Votadini? Was it a friendly and/or mutually beneficial one? During the post-Roman period the study area was occupied by the kingdom of Bernicia, which allied with Deira to form a Northumbrian superpower. The kingdom expanded northwards and at the height of its powers, reached beyond the Firth of Forth, and into Pictish territory in the north-east. Was the relationship between Bernicians and natives in south-east Scotland also a friendly and/or mutually beneficial one?

The study area encompasses two overlapping and related sets of mortuary practices which appear to have developed out of preceding Iron Age traditions that became widespread between the 5th and 8th centuries (Ashmore 1980; Carver 2005; Foster 1996; Smith 1996; Williams 2007, 147). The main intention is to demonstrate whether or not skeletons who exhibit evidence of traumatic events received normative or non-normative burial treatment. A total of 306 skeletons from 35 sites across south-east Scotland have been examined (see Figure 1.2 below).

Figure 1.2: The distribution of sites within the study area (© Peter Lorimer, Pighill Graphics)



1.3.2 Chronological range

The period commences with the end of Roman occupation in *c* 400 AD and ends with the commencement of Viking attacks evidenced by the sacking of Lindisfarne in AD 793 and Iona in AD 795. In the main, this research is concerned with how a comprehensive analysis of the skeletal evidence for violence might inform our understanding of the major changes of the period.

1.4 RESEARCH AIMS, OBJECTIVES AND HYPOTHESES

The traditional view is that conflict and violence was endemic in the early medieval Latin west and textual references to northern Britain are well-known (e.g. Fraser 2012; Halsall 1998) although lacking for the foundation and expansion of Bernicia. It has been argued that the survival of British place-names for what were to become Anglian centres of power, for example Dunbar, is evidence of a take-over of existing power structures, along with their associated administrative, political and social networks, which was much more peaceful than implied by Bede (Alcock 2003, 45).

David Rollason provided a comprehensive discussion of the archaeological, historical and linguistic evidence relating to the genesis of Northumbria (Bernicia and Deira), which he presented in a series of three models (2003, 65-109). Model 1 essentially involved a peaceful handover of political power from the Roman rulers of Britain to the English with a change in the ruling elite but not in the make-up and organisation of the populations as a whole. In model 2 the transition was also seen as more or less peaceful <u>but</u> in this case political power came directly from distinctively native British kingdoms to Northumbrian rulers without involvement of the Roman Empire. Such kingdoms would have existed north of Hadrian's wall both during and after the Roman period, organised along native British lines. The rulers of these kingdoms would have handed over power to incoming English who, as in model 1, created Northumbria with themselves as the ruling elite and the basis of native society was unchanged. The third model involved conquest of the area of Northumbria by incoming English with consequent destruction or degradation of the native British population and removal of its organisational structures. According to this third model there was no peaceful transition with Northumbria being a creation of the English, which owed little to either a Roman or a British past.

Rolleson concluded that the evidence for models 1 and 2 was equivocal and that '…it is not unreasonable to accept that the population of Northumbria was predominantly composed of English incomers who had killed, displaced or degraded the native British inhabitants making Northumbria English by those means…' (2003. 109).

The main aim of this research is to determine to what extent this view can be validated or invalidated by the osteological record. To what extent were the indigenous population and the invaders assimilated? What was the nature of their relationship? A series of hypotheses have been evaluated through direct reference to the osteological data.

1.4.1 Research aims

The research aims can be defined as follows:

- To identify, describe, and quantify the evidence for non-accidental and accidental trauma within the study group.
- To combine other categories of archaeological, iconographic and historical evidence with the skeletal data.

1.4.2 Research objectives

The research objectives can be defined as follows:

- To provide a review of existing evidence for non-adult and adult trauma within and beyond the study area.
- To assess the reliability of identified cases of non-accidental trauma according to published osteological and forensic criteria.
- To provide a full written and photographic record of all skeletons within the study group.
- To identify any patterns linked to age, sex, location and frequency of injuries.
- To identify any geographical patterns in the distribution of the skeletal evidence for trauma, e.g., at the Anglian-Pictish border.
- To utilise available biomolecular data on the origins, mobility and relatedness of victims of non-accidental trauma.

- To identify the scale of non-accidental trauma.
- To identify ‘special’ treatment of victims of violent behaviour.
- To identify likely causes of violent behaviour and its consequences.
- To interpret and discuss the results within a broader social and cultural context.

1.4.3 Research hypotheses

The research hypotheses are as follows:

- Violence is mostly carried out by adult males (e.g. Archer 1994).
- Women and children are rarely affected due to a prevailing ‘warrior ethos’ (Fraser 2012, 64; Hall *et al.,* 2020; McCarthy 1994).
- The victims are mainly society’s elite.
- Levels of violence are high and directly linked to the social upheavals of the period.
- Violence is concentrated in specific locations, e.g. frontiers.
- Healed injuries are more prevalent than unhealed injuries.
- After the departure of the Roman legions, native tribes were fighting for dominance.
- The Picts fought against the tribes of southern Scotland.
- The Anglian take-over of south-east Scotland was largely peaceful.

Further specific questions have also been considered in this thesis and are outlined below.

- Did victims of violence receive normative or non-normative burial?
- Can evidence of organised violence (warfare) be identified?
- Were the defeated buried in mass graves outside of formal cemeteries?
- Were the losers left on the battlefield?
- Is there any evidence for domestic abuse, child abuse or elder abuse?

1.5. STRUCTURE OF THE THESIS

The thesis is presented in two separate volumes. Volume 1 comprises chapters 1 to 8 and a bibliography. Chapter 2 is a survey of the anthropological and archaeological approaches to the study of violence in the past. Chapter 3 presents a summary of burial evidence alongside depictions of weaponry on carved stones and cave walls, followed by a consideration of the limited artefactual record. Materials and methods are described in Chapter 4. Chapter 5 presents the osteological data covering aspects such as demography, stature, non-metrics, skeletal pathology other than trauma and dental pathology. The skeletal evidence for trauma is presented in Chapter 6. A detailed discussion of the results forms Chapter 7 with an outline of future research directions and concluding remarks in Chapter 8.

Volume 2 consists of a detailed catalogue of the burials examined with appendices covering scientific analyses comprising radiocarbon dating, DNA analyses, isotope analyses, XRF and SEM analysis, along with computed tomography and facial reconstruction.

The ongoing Covid-19 pandemic made it impossible to consult primary archive material relating to individual sites, which are held at the RCAHMS. Final checking and photography of material at the National Museum of Scotland’s storage facility at Granton was also not possible.

CHAPTER 2: THE BIOARCHAEOLOGY OF VIOLENCE

'If we had no other sources and possessed only the evidence from human burials, what would we know about the development of conflict over time?' (Knüsel and Smith 2013, 6).

2.1 INTRODUCTION

Bioarchaeological research has demonstrated that interpersonal violence has been prevalent throughout the history of our species in both the Old and New Worlds (Walker 2001, 573) with violence being identified as the leading cause of premature death among young adults in modern times (Cornwall *et al.,* 1995; Whitman *et al.,* 1996). Most human violence is committed by men, whether against other men, against women or against children (Archer 1994, xii), therefore, bioarchaeology can provide essential demographic data (in addition to identification, recording and interpretation of non-accidental trauma), which is crucial to any meaningful investigation of violence in the archaeological past. Modern data demonstrates that some women do in fact commit acts of violence; for example, they accounted for 14% of aggravated assaults in a United States crime survey (Wilson and Herrnstein 1985). Nonetheless, it is still the case that most acts of aggression which result in death or injury are carried out by males, and in particular young males (Archer 1994, 4).

Until the publication of Lawrence Keeley's 'War Before Civilisation' in 1996, it was widely believed that prehistoric warfare was a rare, harmless and unimportant activity and that it was solely a product of civilisation (Keeley 1996). The aim of Keeley's work was to demonstrate that warfare does occur in ethnographically documented small-scale societies, and often with demographic consequences as bad as, if not worse than, historically documented states (ibid.). Keeley gave prominence to ethnographic studies when re-creating his prehistoric narrative on violence, rejecting the image of a past that was peopled by peaceful savages although he struggled to find synthesised accounts of the physical evidence for violence in the archaeological literature but rather, relied on anecdotal accounts (Knüsel 2005, 50). Indeed, the origins of war are controversial in part because evidence for the nature of the relationships among groups is scarce and most models are dependent on ethnographic data from small-scale societies (Lahr *et al.,* 2016).

Studies appearing shortly after the work of Keeley did present convincing physical evidence of non-accidental trauma extending back tens of thousands of years with a distribution across both the Old and New Worlds (Guilaine and Zammit 2000; Walker 2001). The criticism of Knüsel and Smith (2013, 9) that such wide-ranging studies do not assist in determining the frequency and scale of violent encounters is a valid one. Nor do they encourage narratives which are chronologically, regionally or site-specific.

2.2 THE PALAEOLITHIC

The Palaeolithic is a vast time period which extends from approximately 2.6 million years ago up to the end of the last glacial, *c.* 10,000 BP (Orschiedt 2020, 58). There is a long history of inferring interpersonal violence from Palaeolithic human remains (McCall and Shields 2008) although examples are few in number and fragmentary, usually comprising only skulls and/or mandibles. The earliest examples of interpersonal violence are exhibited by *Homo erectus* and *Homo heidlebergensis* during the Middle Palaeolithic (780,000–126,000 BP) (e.g. Wu *et al.,* 2011). These are mainly depressed fractures, which are not in themselves conclusive evidence of violence.

A convincing example of Middle Pleistocene date was recently identified at Sima de los Heusos, Atapuerca, Spain (Sala *et al.,* 2015); cranium 17 exhibits two penetrating peri-mortem lesions with oblique fracture angles, radiating fracture lines and a smooth fracture surface. The complete absence of remodelling indicates a lethal scenario (Orschiedt 2020, 60).

The unequivocal identification of interpersonal violence among Neanderthal human remains is often problematic as injuries regularly demonstrate bony remodelling and therefore healing, generally without complications (Wu *et al.,* 2009). One study suggests encounters with larger game as a possible explanation (Berger and Trinkhaus 1995). In contrast, analysis of an assemblage of *c.* 900 skeletal elements of Neanderthal date from Krapina in Croatia demonstrates that both trauma frequency and location on the skull and post-cranial skeleton are similar to recent hunter-gatherer groups where violence is usually seen as the cause of cranial trauma (Estabrook and Frayer 2014).

Six late Pleistocene examples which are probable cases of interpersonal violence linked to wounds inflicted by lithic implements have been identified (Soficaru and Trinkhaus 2019, 1) and many cases of ante-mortem trauma among humans, including Upper Palaeolithic modern humans, are known (Hutton Estabrook 2014; Wu *et al.,* 2011). There is a European Earlier Upper Palaeolithic case of a serious cranial injury from Crânes des Eyzies, Perigord, France which exhibits limited evidence of healing and was therefore not survived for long (Lartet 1868). A Middle Upper Palaeolithic 'red ochre' burial known as Sunghir 1 from Russia exhibits a peri-mortem incision in the ventral-lateral 1st thoracic vertebra, probably inflicted by a sharp blade or point, which was the likely cause of death although it cannot be clearly linked to an incidence of interpersonal violence and may rather be the consequence of a hunting accident (Trinkhaus and Buzhilova 2012, 655). It was recently suggested that this seems to be the first reliable evidence of a person being killed by a projectile weapon (Orschiedt 2020, 65). There have been many attempts at both direct radiocarbon dating and dating of associated faunal remains and the emerging consensus is that Sunghir 1 dates to the middle or earlier phases of the Upper Palaeolithic (op. cit., 655-656).

A recent re-assessment of an earlier Upper Palaeolithic neurocranium, Cioclovina1 from Romania mistakenly identified fatal non-accidental blunt-force cranial trauma (Kranioti *et al.,* 2019). The 'injury' was subsequently shown to be a misidentification of post-mortem damage or pseudo-trauma caused by bombing during WWII and demonstrates the importance of assessing all available documentation prior to diagnosis (Soficaru and Trinkhaus 2019) as well as recording and analysis of the likely skeletal evidence for pseudo-trauma.

Evidence of injuries caused by projectiles from the Final Palaeolithic include an adult female from San Teodoro, Sicily with a broken flint projectile embedded in the pelvic bone although remodelling indicates the injury was survived for many years (Bachechi *et al.,* 1997).

2.3 THE MESOLITHIC

The Mesolithic period (10,000-5000 BP) begins at the end of the last glaciation and is usually linked to the Holocene hunter-gatherers of Europe (Orschiedt 2020, 58). It is often described as a period when evidence of violence is on the increase (Frayer 1997; Keeley 1996; Orschiedt 2020, 67; Thorpe 2000; Vencl 1999). Possible reasons for this include a higher level of organised inter-group violence in general, combined with a rise in population in some areas, resulting in increased territoriality and potential for conflict (Meiklejohn *et al.,* 1984; Orschiedt 2020, 68). Definitive evidence of inter-group violence among prehistoric hunter-gatherers is rare, with the notable exceptions of Jebel Sabaha, Sudan and Nataruk, West Turkana, Kenya (Lahr *et al.,* 2016).

A total of 23 out of 58 skeletons from Jebel Sabaha exhibit evidence of violence and were buried individually or in small groups, presumably by their own people, which suggests a level of sedentism (Lahr *et al.,* 2016, 394; Wendorf 1968).

In contrast, the human remains from Nataruk provide evidence of the intentional killing of a small group of foragers indicative of an act of warfare (Lahr *et al.,* 2016, 394) and therefore the assemblage has the potential to contribute to the controversial debate over the nature of inter-group relationships among prehistoric hunter-gatherers (e.g. Fry and Söderberg 2013; Wrangham and Glowacki 2012). A total of 10 out of 12 *in situ* male and female skeletons, who had not been formally buried, show evidence of major traumatic events that would have been lethal in the immediate- to short-term and include blunt-force, sharp-force and projectile injuries (Lahr *et al.,* 2016, 395, tab. 1). The human remains were embedded in sediment from an ancient lagoon which has been dated to around 9,500 to 10,500 years BP. A major difference to Jebel Sahaba is that these bodies are described as being impiously deposited, lying on their backs, sometimes face down or in unnatural crouched positions (Orschiedt 2020, 67). However, doubts have been raised about the existence of some of the peri-mortem skull trauma, the dating of the site and the claim that the bodies were not formally buried (Stojanowski *et al.,* 2016).

The number of traumatic injuries recorded in the Mesolithic is higher than in any previous phases of prehistory, and, according to a recent study, a total of 77 examples have been recorded (Estabrook 2014).

2.4 THE NEOLITHIC

A considerable body of recent work over the past 20 years has focussed on the study of violence in later prehistory, in particular, the Neolithic period in the UK and Europe (e.g. Fibiger 2009, 2011; Fibiger *et al.,* 2013; Schulting and Fibiger 2011; Schulting and Wysocki 2005). In the main, these are regional or national syntheses.

A study of 378 individuals from Neolithic Denmark and Sweden (3900-1700 BC) found that significantly more males are affected by healed injuries while males and females are equally affected by peri-mortem injuries, suggesting habitual male involvement in non-fatal violence but similar risks for both sexes in sustaining fatal injuries (Fibiger *et al.,* 2013, 190). The authors conclude that violence in the region was endemic and predominantly non-fatal (op. cit., 200).

Schulting and Wysocki's survey of cranial trauma in the British earlier Neolithic found that 31 out of 350 crania show healed or unhealed injuries providing a conservative estimate of 2% fatal injuries and 4-5% healed injuries, with the sexes being approximately equally affected by both lethal and non-lethal violence (2005, 107).

There has also been a lot of focus on ‘unusual’ sites (e.g. Meyer *et al.,* 2015; 2018; Meyer 2020). These deviant depositional contexts, which are mainly characterised by the lack of recognisable post-mortem care, usually are either disorganised mass graves or sites of conflict where the victims’ bodies have not been collected in one place but rather left unburied where they had fallen (Meyer *et al.,* 2014).

One such example is the Neolithic mass burial at Talheim, Germany (Wahl and Trautman 2012). A group of 34 early Neolithic men, women and children, many exhibiting peri-mortem blunt-force trauma were found during 1983-84. Traces of multiple instrument impact have been identified and the majority of the injuries are located on the back and right sides of the skull which may suggest the victims were attacked from behind by right-handed aggressors (ibid., 85). The location of skull wounds and assumed angle of impact for the stone axes made it possible to construct a victim-aggressor geometry, in which the attackers were located behind the running, walking, or standing (possibly even sitting) victims. In the case of individuals with multiple traumas, it is probable that the primary blow hit the victim while in an upright position. The subsequent blows were then aimed at the (possibly unconscious) victim, lying on the ground.

At Talheim, an absence of sediment layers between the skeletons demonstrated that the bodies were not deposited successively into the pit but placed there during a single event. Orientation was haphazard, some extremities abducted in atypical directions, intertwined with one another, upper bodies luxated at unnatural angles, often on left or right side or face down (ibid., 81, fig. 5.2). The arms of one women (skeleton 83/22A) were stretched up and behind her, giving the impression that she may have been held by her hands and feet as she was thrown into the pit.

The postulated sequence of events (attack and massacre) at Talheim expects a certain amount of hectic, uncoordinated, spontaneous actions and confrontations which is unlikely to be due to kidnap and ritual slaughter; multiple traumas often inflicted using different weapons also argue against the latter interpretation (Wahl and Trautman 2012, 87). In the case of a (probably methodologically standardised) sacrifice, execution, or ritual death, more regularity concerning the wounds and weapons used would be expected. Furthermore, the distribution of identified defects do not speak for classic 'face-to-face', arms, chest and shoulders patterning (ibid., 89). The feature in which the individuals were buried was a re-used refuse pit, and the same debris was used to cover the bodies. An absence of personal artefacts suggests that the bodies were robbed, possibly stripped before being discarded. These features suggest a lack of emotional ties and therefore that the attackers probably disposed of the bodies.

2.5 THE BRONZE AGE

Conflict and warfare during the Bronze Age has been extensively studied (e.g. Harding 2007; 2016; Smith 2017). The transformation of warfare during the period has been described as perhaps one of the most profound in human history, characterised by the invention or the widespread use of weapons such as swords, shields, lances, battle-axes, helmets and body armour across Europe (Molloy and Horn 2020, 117) although others have argued that there is no conclusive evidence that conflict was on anything more than a local scale (Thorpe 2013).

Skeletons exhibiting a range of evidence for interpersonal violence are known from sites across Europe and include males of warrior age and children from Tormarton in England (Osgood 2006), alongside men, women and children from Sund in Norway who had been attacked using a range of weaponry (Fyllingen 2003). The use of weapons such as arrowheads is demonstrated by their direct association with skeletons from sites including

Tollense, Poulnabrone and Armenoi (e. g. Detlef Jantzen *et al*., 2011; Haak *et al.*, 2008; Osgood and Monks 2000).

Within the UK few Early Bronze Age barrow, cairn or cist cemeteries contain skeletons who exhibit evidence for conflict; possible exceptions include Court Hill round barrow in Somerset which covered the primary burial of a young adult male whose left upper arm has been chopped through (Grinsell 1971, 120); and an older adult male from Cnip, Isle of Lewis in Scotland with extensive, but healed, facial trauma (Dunwell *et al.*, 1995).

The middle to later Bronze Age is characterised by the construction of defended sites and far greater control over land connected to direct evidence of conflict on a larger scale (Thorpe 2006) in spite of a decrease overall in the size of the burial record. At Dorchester-on-Thames a spearhead broken off in the victim's pelvis as it was pulled out is suggestive of considerable force (Knight *et al.,* 1972); the burial has been dated to *c.* 1100 BC (Osgood 1998, 21). A plausible massacre site at Tormarton in Gloucestershire comprises the bodies of five men and children dumped in a boundary ditch, two of whom were killed by spearheads (Knight *et al.,* 1972; Osgood 2006).

Occasional discoveries of worked human bone have been recovered from settlement sites, for example, at Green Park in Berkshire, part of a perforated skull disc or roundel was found in a waterhole (Brossler *et al.*, 2004). The degree of wear is suggestive of either a memento of an ancestor or a trophy of a victim (Thorpe 2019, 264). At Sculptor's Cave in north-east Scotland, evidence of a variety of ritual activities included the defleshing of a child's skull in the Later Bronze Age has been identified (Armit *et al.*, 2011).

2.6 THE IRON AGE

The Iron Age is traditionally seen as a period that was 'suffused by war' and characterised by the emergence of 'warrior burials' (Collis 1973). Around 100 examples have been identified, approximately half of whom come from East Yorkshire (Inall 2016). Recent work on the osteoarchaeology of Iron Age Britain (*c.* 700 BC – 1st century AD) has begun to highlight regional variation with little evidence for violent trauma in the extensive barrow cemeteries of East Yorkshire where whole communities appear to be buried (King 2009; 2010a; 210b; 2014). This is in marked contrast to the Iron Age of southern England where high levels of peri-mortem trauma have been identified (Armit 2011, 11). A possible exception comes from Acklam Wold in Yorkshire where the burial of an adult male exhibited evidence of two peri-mortem blows to the head; he was buried in a prominent location in the landscape and with a bent sword (Giles 2015). At Maiden Castle the work of Redfern (2009; 2011) has demonstrated very high levels of lethal violence and evidence for the direct involvement of females in combat. This is likely to be a reflection of the contrasting types of deposits excavated in these regions. It has also been suggested that those who died in warfare were only rarely formally buried as warriors and there is further evidence that the cause of trauma was different in the two areas with possible slingstone injuries being confined to Hampshire (Cunliffe 2003, 171; Thorpe 2019, 265).

2.7 THE ROMAN PERIOD

A vast body of evidence is available for the study of violence in the Roman world (e.g., tombstones, weaponry and historical documents) and as a consequence bioarchaeological evidence has often been under-utilised (Redfern 2013, 203), and often dismissed as a reliable source of data (e.g., Scheidel 2010), perhaps with the notable exceptions of infanticide and decapitation burials (see below). Recent work by Redfern (ibid.) employed the World Health Organisation’s (2002) ecological model of violence as a framework for her discussion of violence in the Roman period. This model identifies four areas of relevance: individual (biological and personal history factors); relationship (family, partners and peers); community (workplaces and neighbourhoods); and societal (larger factors that create an acceptable climate for violence to occur, such as politics, economic and structural violence) all of which are governed by age, sex, gender, ethnicity, status, socio-economic variables and hierarchies (ibid.).

Both inhumation and cremation were practised across the Roman world in a variety of forms resulting in a diverse assemblage of material from across the period (e.g. Pearce *et al.*, 2000). Most publications are concerned with British and Italian samples whose focus is on general health and mortality rather than trauma (e.g. Capasso *et al.*, 2003; Redfern 2013, 204).

Few examples of human skeletal assemblages linked to military violence are known and it has been suggested that this may be because the dead were buried in locations outside cemeteries, and furthermore may have been cremated (e.g., James 2011). A notable example is Maiden Castle in Dorset, the re-examination of which has demonstrated that locals were killed during the Roman conquest of Britain in 43 AD (Redfern 2011). It has been argued that the multiple trauma suffered by men, women and children is evidence of battle and post-battle killings of the type reported in, e.g., Caesar's Gallic Wars where native combatants and their families were massacred by the army and were not enslaved (Joshel 2010).

Evidence from an Iron Age battle at Alken Enge, Jutland, Denmark suggests that an army lay on the battlefield for around six months after which they were gathered together and their bodies de-fleshed. Researchers have identified bones bearing marks of cutting and scraping, crushed skulls and a wooden stick bearing the pelvic bones of four different men (Holst *et al.,* 2018). The battles were waged when Roman expansion was putting pressure on Germanic tribes which resulted in wars between the Romans and the Germanic tribes, and between the Germanic peoples themselves. Records kept by the Romans describe the macabre rituals practised by the Germanic peoples on the bodies of their vanquished enemies, and this assemblage seems to be the first recorded example of such activity (Holst *et al.,* 2018).

While it is known that a wide range of judicial executions occurred across the Roman Empire (Bauman 1996) the skeletal evidence is limited (Redfern 2013, 205). Similarly, only a single example of a gladiator cemetery has been excavated at Ephesus in Turkey (Curry 2008). It has long been argued that infants in the Roman world were at risk from the practice of infanticide (e.g., Bennett 1923), but this is often contested in the recent literature (e.g., Gowland and Chamberlain 2002).

The practice of decapitation, a minority burial form in Romano-British cemeteries, has recently been re-appraised by Tucker (2013; 2015) who concludes that it was a varied practice where examples of post-mortem cuts and incisions were in the minority in contrast to what was previously thought (e.g., Harman *et al.,* 1981; Philpott 1991). Tucker identifies skeletal evidence that suggests a large number of individuals were killed in this manner, either as victims of live sacrifice or as judicial execution (2013, 231).

2.8 THE MEDIEVAL PERIOD

The concept of deviant or non-normative burial in the early medieval period is well attested outside Scotland (e.g. Dickinson 1974; Reynolds 2009) and there are a number of recognisable attributes including unusual burial postures such as prone burial, variable burial alignments, shallow graves, multiple interment, evidence for restraint (bound hands), burial in 'special cemeteries', evidence for decapitation, displaced skulls, and mutilation (e.g. absence of hands). Execution cemeteries are a specific category of deviant burial and examples within Northumbria include Walkington Wold, Yorkshire, which has recently received detailed re-assessment (Buckberry 2008; Buckberry and Hadley 2007). Execution cemeteries further afield which are well recorded include Chesterton Lane Corner, Cambridge (Cessford *et al.,* 2007) and Old Dairy Cottage, Hampshire (Cherryson 2005; 2008; Reynolds 2009). These are exceptional since many of the skeletons from execution cemeteries have received limited osteological analysis largely as a result of having been excavated from prehistoric sites in the 18th and 19th centuries (Loe *et al.,* 2014, 8). By the later medieval period friaries in England and Wales seem to have served as resting places for the executed dead, particularly where they were of high standing (O'Sullivan 2013, 11). See for example, the burial of Richard III of England (Buckley *et al.,* 2013). To date, no examples of execution cemeteries have been identified in Scotland.

Some of the best known medieval examples of violent death in the archaeological record are those that are associated with multiple, or mass, burial and these are few in number (Loe *et al.,* 2014, 9). There is disagreement as to the number of individuals required to define a mass grave (Schmitt 2002; Skinner 2002) but agreement on the defining characteristics of a mass burial. These include the presence of a body mass or masses within a grave cut or cuts; the presence of disorder in the orientation of the bodies indicating an apparent disregard for the manner of deposition that is often outside the bounds of normative practice; bodies that are in contact with one another, the presence of traumatic injuries; and a common pattern of a trait or traits related to cause and manner of death (Knüsel 2005, 58). Simultaneous burial of multiple individuals does suggest that a violent end for all those involved was the intended outcome (Schulting and Fibiger 2012, 14).

A mass grave from Heronbridge, Chester, contained a total of 34 males or probable males consisting of two rows of skeletons, aligned west to east, with the upper row along the eastern edge of the grave overlying the feet and lower legs of the lower row skeletons to the west. Approximately 20 skeletons were excavated and analysed (Davies 1933). A further two skeletons were excavated by the Chester Archaeological Society in 2004 (Holst 2009, 1). The excavated burials have been radiocarbon dated to between 530 to 660 AD and subsequently linked to the Battle of Chester AD 613, between King Ethelfrith of Northumbria and the forces of Gwynedd and Powys, rather than a possible association of the grave with a later battle near Chester in AD 905, between Norse-Irish settlers, led by Ingimund and the inhabitants of Chester (ibid.). Some of these men had fought in previous battles. They met their end principally via a number of blade injuries inflicted to the skulls, probably through swords or similar weapons (Holst 2009, 14). Notably, nine of the skulls analysed by Davies (1933, 47) exhibit evidence for injury, thought to have been inflicted using bladed weapons

‘...of long leverage…’ such as long-swords. Because the injuries occur on the top of the skull, Davies suggests that the attackers may have been on horseback (ibid.). The orderly deposition of the dead in this mass grave and Portbury below is in marked contrast to the assemblages from Ridgeway Hill and St John’s described below.

Excavation at Portbury near Bristol in 2005 revealed a multiple grave which contained three skeletons. The grave was part of a larger cemetery of 14 inhumations. The skeletons in the multiple grave had been buried with some care in a single depositional event. All three have yielded radiocarbon dates in the 6^{th}-7^{th} centuries. Two skeletons are male and the third is an unsexed adolescent. The skeletons exhibit clear skeletal evidence of peri-mortem cranial and post-cranial sharp-force trauma (Boyle in preparation) which was probably inflicted by a bladed weapon such as a sword. The location of the multiple grave within a formal cemetery combined with the orderly position of the bodies suggests that the men were buried not by their attackers but by the group of which they were a part. Skeletal injuries suggest that one of these men was decapitated (ibid.).

The cemetery at Walkington Wold in Yorkshire was excavated in the 1960s and was characterised by careless burial on a variety of alignments with an absence of crania in most cases. The cemetery has been variously described as the result of an early post-Roman massacre, as evidence of a ‘Celtic’ head cult, or an Anglo-Saxon execution cemetery (Bartlett and Mackay 1973; Buckberry and Hadley 2007, 309).

More recently, radiocarbon dates have placed the cemetery in the mid to late Saxon period (Buckberry 2008, 148). A total of 13 skeletons and 11 skulls have been re-assessed (Buckberry and Hadley 2007) and a number of them exhibit evidence of peri-mortem sharp-force trauma. One injury to the front of an upper thoracic vertebrae is considered to be consistent with bloodletting, throat slitting or decapitation from the front (Buckberry 2008, 155, fig. 9.3). The position of two of the skeletons was suggestive of hurried, careless interment. Four disassociated crania had been buried with mandibles articulated which indicates deposition before the soft tissue holding the different bones together had decayed.

There is also evidence for variation in the manner of decapitation. Buckberry suggests that in two cases of repeated blows to the back of the head the victims may have been struggling, the executioner misaimed or a combination of both of these situations occurred (2008, 164). It is not inconceivable that the blade of the weapon was blunt. The injuries to the Ridgeway Hill skulls discussed below provide evidence of multiple blows from the front, back and left sides. The weapons used were probably heavy swords or axes. In contrast both skeleton 7 and skull 8 at Walkington Wold appear to have been decapitated from the front. Skeleton 7 displays two parallel cut marks to the anterior of the first thoracic vertebra and skull 8 exhibits sharp-force trauma to the front of the third and fourth cervical vertebra, both inflicted by a thin blade such as a dagger, knife or sword. No other injuries were present on the front of the crania or elsewhere on any of the skeletons from Walkington Wold suggesting that they had not died in battle (Buckberry and Hadley 2007, 322) but rather were the victims of judicial execution.

Excavations at Repton, Derbyshire, in the 1970s and 1980s revealed evidence of a 9th-century Viking army camp, alongside a mass grave thought to contain the group's battle dead. The main burial deposit comprised the jumbled remains of a minimum of 264 individuals, which has been variously interpreted as a high-status kingly burial which included individuals from the Viking Great Army who had wintered at Repton in AD 873-4 and had died during the season. An entry in the Anglo-Saxon Chronicle for AD 865 records the arrival of the Great Army (*micel here*). A subsequent entry names Repton as the site of the Great Army winter camp in AD 873-874. The original set of radiocarbon dates were problematic but a recent dating programme has produced dates which are 9th century and therefore the charnel dead could have come from the Viking Great Army (Jarman *et al.,* 2018). In addition, strontium results show a diverse group with very mixed origins, few of whom could have grown up locally.

Osteological analysis indicates that, where sex can be determined, 80% are men and 20% are women, mostly aged between 18 and 45 years old (Jarman *et al.*, 2018). Peri-mortem trauma is rare, however, leading to the conclusion that this is not a battle grave (ibid.). Other burials at Repton linked with the Viking Great Army include a male aged 35 to 40 years buried with weapons, who has extensive cuts to the skull, lower vertebrae, left leg and arm (Biddle and Kjølbe-Biddle 1992; Richards 2003). He had probably been killed by the point of a blade which has fully penetrated his eye socket through to his brain; the trauma to the femur probably removed his genitals and that to the vertebrae may suggest that the individual had been disembowelled (Richards 2003, 4). According to Richards (ibid.) the individual had sustained horrific injuries from '…Christian defenders of a Mercian royal monastery'. The current evidence fully supports the idea that the Repton mass grave did contain Viking battle dead who had been given a temporary burial elsewhere and were subsequently moved to a communal grave (Jarman 2019). DNA analysis has demonstrated that the individual described above was related to the second burial interred in this double grave. They are either father and son or half-brothers. It has been suggested that marks across the skull of the older man could indicate that he was wearing a helmet when he died. It is now suggested that the trauma to the vertebrae described above is not evidence of disembowelling but rather of evisceration (removal of the internal organs), possibly carried out after death in order to prepare his corpse for transportation, as removing the intestines helps delay decomposition (see Curry and Foard 2016 for historically documented examples of this practice from the later medieval period). These new results demonstrate the value of multi-disciplinary approaches to the re-analysis of older evidence (Jarman *et al.*, 2018).

At St John's College, Oxford at least 35 skeletons had been buried, up to four deep, in a disorganised manner, in the ditch of a partially infilled Neolithic henge (Falys 2014). The skeletons are all males or probable males, with the exception of two unsexed adolescents. All the individuals had met a violent death, many have been mutilated and some partially burned. The evidence suggests that these men were Danish victims of the St Brice's Day Massacre of 13th November 1002 (Wallis 2014). An alternative explanation is that they are more likely to represent a captured Scandinavian raiding party than a group of residents of Danish extraction who were rounded up and executed (Pollard *et al.,* 2012, 98).

The St Brice's Day Massacre is recorded in both the Anglo-Saxon Chronicle for 1002 (Swanton 2000, 134-5) and in a charter granted by Ethelred to St Frideswide's monastery in Oxford dated 7th December 1004 (ibid.). The decree instructed that all the Danish men who were among the English race were to be killed on St Brice's Day. It would not have been possible to do this literally in a single day but there is likely to have been considerable loss of life (Wallis 2014, 37). Osteological analysis of the assemblage concluded that all the men died violent deaths, almost certainly not in face-to-face combat and many had suffered multiple serious injuries (Falys 2014, 41). Some individuals were found in positions suggestive of falling or being pushed into the 'grave', while one demonstrated a pose suggestive of being carried by two individuals and being placed in the 'grave' (ibid., 42). There were no personal items suggesting that these were removed prior to deposition, a situation which is mirrored at Ridgeway Hill, Weymouth (see below). The greatest proportion of wounds at St John's are located on the back (49%) followed by the legs (13.2%) and it has been suggested that the individuals had little chance to defend themselves, nor were they wearing any protective clothing (Falys 2014, 128).

The mass grave at Ridgeway Hill was discovered in a quarry pit at the end of a long-running project by Oxford Archaeology during 2009 (Boyle 2013, 2016; Loe and Boyle 2014; Loe *et al.,* 2014).The remains comprise 50 men, all of whom had been decapitated. Skulls were piled one on top of another while the headless bodies were thrown in with little care (see Plate 2.1 below).

There was no evidence of personal items so it Is likely that they were stripped prior to execution and/or burial. The discovery represents what is arguably the most dramatic example of the physical evidence for violence in early medieval Britain. Wounds were concentrated in the region of the neck indicating that, in most cases, it had taken several attempts, from a variety of angles, to remove the head, probably with a sword. Possible defence injuries are present on the hands, arms, tops and sides of heads suggesting that some of the men did not go quietly. The pattern and extent of the injuries, however, are not consistent with examples from other battle or massacre related contexts. The incorporation of radiocarbon dating at an early stage in the excavation provided a date in the late 10th or 11th century AD for the deposit while isotope analysis indicates that the men were a disparate group with a general emphasis on Arctic and sub-Arctic Scandinavia, northern Iceland, the Baltic States, Belarus and Russia (Chenery 2014). It is likely that these were ‘Vikings’ executed by the English although the possibility that they were mercenaries fighting for the English who were killed by ‘Vikings’ cannot be ruled out. A link to the St Brice’s Day massacre discussed above seems a less likely possibility.

Plate 2.1: Ridgeway Hill, Viking mass burial (©Dorset County Council/Oxford Archaeology)

The most recently excavated example of an Anglo-Saxon execution, or punishment, cemetery is from Weyhill Road, Andover in Hampshire (Walker *et al.,* 2020). The remains of

124 individuals, mostly male adults, include many with their hands tied behind their backs in a prone position with a number of decapitations. Unlike other examples of such cemeteries, there is evidence for a long period of use from at least the 10th century, possibly as early as the 8th, into at least the 13th and possibly 14th century. At least one female appears to have been decapitated, representing an unusual example of a female outlaw (Walker *et al.,* 2020, 166, fig. 8.5).

The mass burial at Towton is perhaps the best known example of a mass grave in the UK and is linked to the battle which took place in AD 1461 during the War of the Roses (Fiorato *et al.,* 2000, 2007). The grave (purposefully dug and not a pit) was filled from the west to the east. 'One thing is certain; the dead were certainly laid in the grave, as opposed to being simply thrown in, as their regular orientation – approximately along the axis of a compass – is consistent throughout.' (Sutherland 2000, 40). The bodies were mostly east-west or west-east, prone or supine, all fully articulated at time of burial, tightly packed in a rectangular pit – one man wide and three men long indicating a conscious effort to fill all space. At Towton, hands and feet from different individuals lay above or next to those of others in a very loose fashion and many such bones became part of the disarticulated assemblage (Sutherland 2000, 38).

Among the group multiple head wounds are common with far fewer injuries elsewhere on the skeleton (Novak 2000, 90). The majority of post-cranial injuries are located on the arms and hands, suggesting defensive wounds, sustained in an attempt to ward off an attacker's blow or protect other body parts during face-to-face combat. Cuts on the left anterior-lateral neck and left clavicle suggest face-to-face attack by a right-handed assailant. Conversely, cuts and a blow to the posterior neck are the result of a posterior attack. Novak (2000, 93, tab. 8.1) has determined that 33% (13/39) of the individuals at Towton display peri-mortem post-cranial injury of which 19% affect the neck region (clavicles and cervical vertebrae). Nine out of the 28 have well-healed cranial trauma equating to 16 separate injuries, presumably from previous fighting. The direction from which the bladed weapon injuries were delivered was predominantly from the front and the rear with fewer from the sides. The location of these wounds on the frontal and left parietal indicate that more than half the blows with a bladed weapon were directed from the front suggesting face-to-face combat by a right-handed assailant (Novak 2000, 96).

Examples of non-accidental trauma from individual 'normative' graves and cemeteries are comparatively rare (Reynolds 2009, 41). A notable exception is St Andrew's, Fishergate, York (Stroud and Kemp 1993). A group of 29 male skeletons recovered from discrete graves have peri-mortem injuries sustained as a result of inter-personal violence and consistent with the effects of projectiles such as arrows, cross bolts and/or blades. Some of the individuals date to the 11th century and may have died in one event, perhaps a battle, while others date between the 12th and 14th centuries and may have sustained their injuries as a result of trial by combat (Daniell 2001, 220). Saxon evidence from Portchester Castle in Hampshire comprises a male aged between 20 and 25 years who exhibits a cut to the left ramus of the mandible which was interpreted as a sword blow (Hooper 1976, 241-2).

Virtually all of the examples cited above comprise fatal non-accidental sharp-force trauma caused by bladed weapons. While interpretation of these injuries is not unproblematic, their identification is more straightforward than for fatal blunt-force trauma and, in particular, whether or not such injuries were deliberately inflicted. This is a particular problem in, for example, the Neolithic. As suggested above, detailed description of location and frequency for individuals and groups is important. In some examples from the period it is clear from the context (when combined with the injuries) that all those buried met a violent end.

Injuries to soft tissues cannot be identified when examining skeletal material. For example, injuries to the scalp tend to provoke considerable bleeding and increase the likelihood of infection spread to the skull but are not necessarily identifiable on the skeleton (Boylston 2000). Cranial fractures are not always a feature of potentially fatal head injuries (Jennett 1996). For example, an injury that presents as bruising or cutting of the scalp may lead to intracranial bleeding and concussion or bleeding in the brain (Malojcic *et al.,* 2008).

Bleeding and the internal collection of blood into a haematoma is one of the most frequent and potentially dangerous consequences of both closed and open head trauma as they result in increased pressure on the brain (Ortner 2003). Therefore, any attempt to record frequencies of traumatic injuries in human skeletal remains will always be an under-representation. Determining the cause of death in skeletonised remains – without knowledge of the damage to soft tissue – is always a matter of probability, estimated from the likelihood of immediate deadly effects arising from any one injury (Knüsel 2005, 53).

One of the most popular, yet increasingly controversial publications of recent years is *The Better Angels of Our Natures* by evolutionary psychologist Steven Pinker (2011). He employed a range of evidence, most notably quantitative historical data, to demonstrate an overall qualitative decline during recent centuries in the breadth and severity of violent behaviours that were once commonplace. He used this to argue a general decline in violence since prehistory culminating in a much more peaceful present. This begs the question, what would be the result of a large-scale and longitudinal quantitative study of the proportions of violent assaults apparent in human remains over time? (Knüsel and Smith 2013, 14). Pinker's work has provoked a number of recent critiques of its statistical and other inferences by academics from a range of disciplines (e.g. Butler 2018; Cirillo and Taleb 2016; Falk and Hildebolt 2017; Fibiger 2018). Fibiger employs data from archaeology and bioarchaeology/physical anthropology to explore Pinker's 'oversimplified cross-disciplinary use of bioarchaeological data' (2018, 6) and argues amongst other criticisms that the skeletal sample employed to demonstrate the scale of violence in prehistory is a far from coherent one (ibid., 8). For the medieval period, Butler demonstrates, on the basis of documentary evidence that, 'while the medieval world was violent, we cannot demonstrate just how violent it actually was, and whether it was any more or less violent than we are today' (Butler 2018, 29). In a forthcoming volume fifteen historians further argue that the history of human violence is much more complex and interesting than Pinker's sweeping, simplified narrative (Dwyer and Micale in press).

2.9 INTERPRETATIVE ISSUES

The archaeological evidence for the study of violence can be drawn from a wide range of sources which include artefactual evidence, armour, burials with weapons, settlement patterning, defensive sites, literary references, iconography (Armit 2011, 1) and elusive battlefield locations (Foard and Morris 2012) but these are not without their complications and Knüsel (2005, 49, 50) has pointed out that many such strands cannot be interpreted as unequivocal evidence of warfare, in part because it is difficult to distinguish the archaeological evidence of warfare from that relating to the threat of violence (Earle 1997, 106). 'The threat of violence, where no superstructure exists to mediate it, creates the opportunity for local leaders to gain strong authority through offers of protection (op. cit., 109)', thus an atmosphere of violence and/or warfare is created without any violence occurring.

The long-standing anthropological and ethnographic concern with violence (e.g. Ferguson 2001; Haas 1990) has not been matched by a similar interest amongst archaeologists until recently. The place of warfare in social relations and societal change remains a minor, muted concern or [is], quite simply, omitted [and there is a] lack of syntheses of the physical evidence of violence with broader archaeological interpretation…despite growing literature on violence and violence-related injuries (Knüsel and Smith 2013, 3).

There is no standardised definition of warfare and this has a direct bearing on defining exactly how much evidence there is for its occurrence. The scale of aggression seems important to some in attempting a definition. Fry (2007, 13-17) comments that acts of aggression involving small groups of only a few individuals who target even smaller groups are not acts of war but rather should be labelled as 'homicide' or 'feuding'. This does not take into account the frequency of such activities and implies that warfare only occurs in more complex societies and larger groups which fails to take account of the widespread prehistoric evidence (Knüsel and Smith 2013, 12). Bioarchaeology is in a position to provide a quantitative rather than an anecdotal view. Kelly argues that war is defined by its social context and premeditation rather than by its scale (2000, 3-5). Definitions of warfare do not tend to incorporate other types of aggressive behaviour such as judicial violence and interpersonal disputes, which are small in scale.

The issue of scale and the nature of aggressive acts is very relevant to the interpretation of the frequency and distribution of the skeletal evidence for non-accidental trauma in south-east Scotland during the early medieval period. Scale is of little significance, where for example, a group of individuals ambushing and killing a perceived criminal might behave in the same way as a war band ambushing a member of an opposing group (Knüsel and Smith 2013, 12).

Beyond providing support for violence in textual sources, skeletal remains were rarely, until recently, subjected to further intense scrutiny even though contemporary written sources are often far from impartial, usually incomplete and littered with cultural and social biases (Knüsel and Smith 2013, 7).

Skeletal analysis of fatal and healed injuries are the most direct evidence that we have of violence in the past (e.g. Knüsel 2005; Larsen 1997; Walker 2001). In most cemeteries there is only occasional evidence of fatal and healed trauma. In the latter case, these are mostly the people who having sustained weapon-related injuries, recovered and returned to their normal lives before dying of other causes. Victims of fatal trauma, in many cases, will not be associated with formal burial grounds unless recovered by their own group, or by assailants inclined to bury their victims. These latter examples tend to be mass graves and/or non-normative burials. The lack of association with formal burial grounds means that such examples are often unexpected discoveries in unusual locations. The nature of mass graves makes them difficult to record and excavate archaeologically and there is a growing body of specialist literature dealing with this subject (e.g. Cox *et al.,* 2008; Loe *et al.,* 2014; Sutherland 2000).

Identification and interpretation of wounds is reliant on a familiarity with the forensic literature and an understanding of the fracture mechanics of bone (Boylston 2000; Knüsel 2005; Loe 2017). Studies which concentrate on weapon-related injuries to skeletons are far from abundant and most are focussed on specific sites with little spatial or temporal depth (e.g. Fiorato *et al.,* 2007; Loe *et al.,* 2014; Redfern 2011). In order to understand patterns of violence and attempt to answer the bigger questions about the scale and frequency of violence, syntheses are necessary. Non-normative burials are of particular value when trying to determine the social circumstances that exposed individuals to violence and the scale of its occurrence, since they derive from a point in time (often a single event) when social norms governing the treatment of the dead were suspended in the aftermath of conflict (Knüsel and Smith 2013, 4).

In addition to the technical problems relating to the interpretation of injuries, the issues inherent in distinguishing between accidental and intentional injuries are significant concerns (Walker 2001, 575), In a modern context epidemiologists typically include accidental deaths with homicides and suicides in their classificatory schemes under the heading of violent injuries (e.g. Murray and Lopez 1996). The concept of violence has been defined in multiple ways, e.g. as a harmful interaction between people (interpersonal violence); behaviour of people relative to each other in ways that are likely to cause injury or harm (United Nations 1993); any unjust or cruel state of affairs or maltreatment of another human being (Strauss 1999). It also means different things in different cultural contexts, e.g. the sanctioning of wife and child beating in some societies (see Archer 1994 for a variety of discussions). Walker suggested (2001, 575) that there is room for argument over the degree of intentionality required for an act of violence to have occurred. This is where the contribution of bioarchaeology is crucial although Walker suggested that the use of the term violent injury in bioarchaeology should be restricted to skeletal injuries for which there is strong circumstantial evidence of malevolent intent (e.g. the presence of several arrow points embedded in the skeleton of a man in a mass grave with other injured young men whose skulls show cutmarks consistent with scalping) and to reserve the term accidental injury for cases lacking such clear evidence of malevolent intent (2001, 576).

This is an interesting point to consider in relation to some of the 'ritual' interpretations advanced for prehistoric monuments such as Neolithic enclosures in spite of evidence for attack, burning and killing (e.g. Whittle 1996, 268). At Cadbury Castle in Somerset, the human remains described by the original excavator as belonging to massacre levels were attributed to four possible human ritual behaviours rather than to violence (Barrett *et al.,* 2000, iv, 114-5, 117, 235ff).

A recent volume considered the physical evidence for violence-related trauma within its social context in order to provide the groundwork for distinguishing warfare from individual acts of violence and to address the scale and frequency of violent encounters based on the physical traces left in the remains of human bodies and their depositional context (Knüsel and Smith 2013, 4). The volume incorporated a vast body of data which covered a wide spatial and temporal area. In the introduction to the volume it was argued that the presumed lethality of specific injuries is not necessarily a good reflection of intent where the occurrence of fatal injuries is seen as indicative of premeditated armed aggression (ibid., 10). Fatal accidental injuries are not unknown. This assumption also confuses cause of death with the mode or mechanism of death (Rogers 2004). Cause of death involves the identification of fatal injury that answers the question of which injury caused death but this is problematic in the case of skeletal material since potentially fatal, soft-tissue injuries are no longer apparent. The mode or mechanism of death is the method by which death is achieved (for example, stabbing, projectile trauma, sharp-force trauma, blunt-force trauma). Answers to the question of how death was caused can be determined from the appearance of skeletal traumatic injuries. Finally, manner of death relates to the circumstances of death (e.g. suicide, homicide, accidental, natural or unknown) and here contextual information relating to method of disposal can contribute alongside location, type and number of wounds. In other words, the problematic nature of skeletal trauma (accidental, violent, domestic, interpersonal, warfare) can be addressed through the recording of wound patterning, especially when combined with contextual evidence (e.g. mass graves linked to a single event) (Schulting and Fibiger 2012). The assertion that premeditated violence as reflected in weapon use, rather than presumed intent, is a more secure way of assessing the context of injuries (Knüsel and Smith 2013, 11).

It is only relatively recently that archaeologists have acknowledged that bioarchaeology has the potential to establish a broader context for its study (Walker 2001; Knüsel 2005). Walker recommended population-based studies of skeletal trauma for testing theories of warfare and violence as they are independent of the interpretative difficulties inherent in historical sources and ethnographic accounts (2001, 573). However, it can now be demonstrated that there is an increasing pre-occupation among both archaeologists and bioarchaeologists with the evidence for violence in all its forms (Antony *et al.,* 2020; Edwards *et al.,* 2020; Fagan *et al.,* 2020; Gordon *et al.,* 2020; Knüsel and Smith 2013; Schulting and Fibiger 2012; Schulting and Wisocki 2005). A location map of recent osteoarchaeological studies of conflict demonstrates both the distribution of evidence but more importantly, the distribution of bioarchaeologists involved in the research (Knüsel and Smith 2013, 17, figs 1.1-2).

There are no bioarchaeological studies of violence specific to Scotland in either the 'Routledge Handbook of the Bioarchaeology of Human Conflict' (Knüsel and Smith 2013) or in volume 3 of the mighty four-volume 'Cambridge World History of Violence' which covers the period AD 500-1500 (Antony *et al.,* 2020). There are, however, a number of site-specific studies on mass graves (e.g. Boyle 2013, 2016, in preparation; Falys 2014; Fiorato *et al.,* 2000; Holst 2009; Jarman 2019; Loe and Boyle 2014; Loe *et al.,* 2014) from beyond the study area which are relevant to this research. A further category of site, which is broadly contemporary with this research, is the Anglo-Saxon execution cemetery (Buckberry 2008; Buckberry and Hadley 2007; Cherryson 2007, 2008; Walker *et al.,* 2020). Such studies contribute little to our understanding of the prevalence of non-accidental trauma in the wider population although they do contribute much to the study of judicial violence in the period.

2.10 SUMMARY

In order to reach an understanding of interpersonal conflict in the archaeological record it is important to consider the number and composition of the people involved, the nature of the injuries and the possible motivation of opponents or reasons for conflict. The former are much more straightforward than the latter. Possible motivations are touched upon by Wahl and Trautmann (2012, 100) and range from internal family conflicts or neighbourhood disagreements, which are usually rather straightforward, to fights between individual clans or tribes that have to do with disagreements concerning territories or conflicts, which are carried out on the backs of hundreds or thousands of warriors and have far-reaching consequences. In addition, there is the exclusive classification of terms such as skirmish, battle and war, all of which follow the same goal: implementation or expansion of power, influence and wealth. Possible additional motives include so-called honour killings, border conflicts, revenge, or genocide, whereby attackers and victims usually cite completely different reasons for the specific conflict.

In reference to recent osteoarchaeological studies of the Iron Age in England, Armit comments that such studies form an important platform for further investigation and highlight the impact that osteoarchaeological approaches are beginning to make when considered as part of the broader contextual analysis of these societies (2011, 12). I would suggest that osteoarchaeological studies must be regarded as the basic building blocks in any attempt to understand the scale, frequency and severity of violence in the archaeological record. It is inevitable that researchers are drawn to the unusual (e.g., Curry and Foard 2016) and often such discoveries are unexpected and require immediate excavation but this does not undermine the importance of regional osteoarchaeological syntheses to enable the identification of chronological and temporal trends alongside variations in levels of violence across different parts of the country and in different time periods. Significant variations have been identified for the Iron Age in England and are also suggested by the apparent absence of Anglo-Saxon execution cemeteries in Scotland and much of northern England. The most profitable regional syntheses are likely to be those with an interdisciplinary approach incorporating a range of scientific analyses alongside available archaeological evidence. In this way the broad brush studies which promote a simplistic pseudo-historical approach (e.g. Pinker 2012) can be countered with hard data

CHAPTER 3: BURIAL CONTEXT, CARVED STONES AND ARTEFACTS

3.1 INTRODUCTION

The first section of this chapter considers the burial context of the skeletons within the study group, the aim of which is to determine whether or not victims of violence received normative or non-normative treatment in death. The presence of skeletons who exhibit evidence of peri-mortem or ante-mortem trauma are highlighted in the relevant sub-sections. This is followed by an appraisal of the depictions of weapons on carved stones. The chapter concludes with a consideration of the (albeit limited) artefactual evidence for weaponry.

3.2 BURIAL EVIDENCE WITHIN THE STUDY GROUP

As already referenced the study area encompasses two overlapping and related sets of mortuary practice which appear to have developed out of preceding Iron Age traditions that became widespread between the 5th and 8th centuries (Ashmore 1980; Carver 2005; Foster 1996; Maldonado 2011a and b; Smith 1996; Williams 2007, 147). The first of these is the long cist cemetery, which is defined by the burial of unaccompanied inhumations who are supine extended and orientated broadly W-E in well organised rows. Often the burials are in long cists, which are rectangular structures constructed of stone slabs; less often they are placed in earth-cut graves. Monuments such as four-post timber structures and rectangular enclosures are occasionally associated as at Thornybank (Rees 2002, fig. 3) and stones with Latin inscriptions are known from Yarrow Kirk and Catstane (Cowie 1980).

The second mortuary tradition is located in eastern Scotland beyond the Firth of Forth. It too is typified by W-E orientated supine extended inhumation in long cists or earth-cut graves. What distinguishes this tradition from the first, however, is the presence of square, rectangular and circular low cairns and low-mounds (Williams 2007, 148). The association with Pictish Class 1 symbol stones is less clear (Clarke 2007). The cemetery at Lundin Links is a good example of a cemetery which displays characteristics connected to both traditions and it is located in a region where long cists and low-cairns are known and broadly contemporaneous yet, is located at the southernmost limit of the distribution of Class 1 symbol stones (Greig *et al.,* 2000, 608-610; Williams 2007, 150).

Traditionally, the appearance of long cist cemeteries has been linked to the spread of Christianity (e.g. Lowe 1999), however, recent research argues for a more complex belief system where long cist burials largely originate in the Iron Age, reaching the peak of their popularity in the 5th-7th centuries (Lucy 2000; Maldonado 2013).

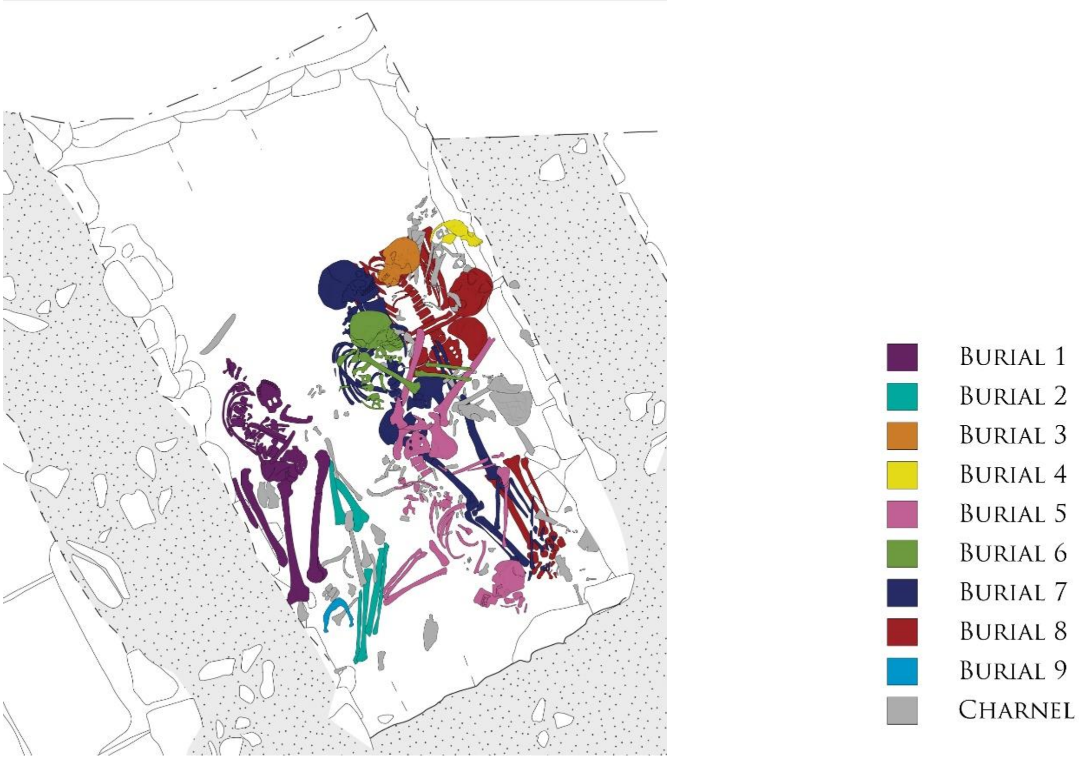
With the exception of the unusual deposit in the bath-house at Cramond Roman Fort and the so-called Seacliffe Mausoleum, all the burials within the study group conform to the mortuary traditions described above and can therefore be described as normative. A brief summary of each of the cemeteries, and isolated burials will be presented here. This will be followed by a study-wide summary of aspects of burial practice such as body position, orientation, type of burial, re-use of long cists and presence of grave goods.

3.2.1 Cramond

Cramond Roman Fort is situated to the south of the Firth of Forth estuary, in close proximity to the River Almond and was established during the Antonine invasion of Scotland in 142 AD. A deposit of human remains was revealed in a latrine associated with the bathhouse during excavations in 1975. At the time the remains were believed to be medieval in date due to the association of the deposit with pottery sherds of the period (Holmes 2003). The non-normative location of the skeletons was explained by their being probable victims of bubonic plague. The bathhouse had been largely destroyed by medieval and later occupation alongside stone robbing in the post-medieval period. The uppermost layer of human remains displayed evidence of surface erosion suggesting that they were exposed for a period of time, possibly as a consequence of later disturbance which may also account for disarticulation of some of the human remains.

A recent radiocarbon dating programme (see Appendix 5.2 below) has demonstrated that the deposit of human remains is in fact of 6th to 7th century date and the application of Bayesian modelling suggests that the bodies were likely to have been deposited in the second half of the 6th century probably over quite a short time span. Two phases of burial have been identified. Phase 1 is represented by burials 2, 4, 7 and 8 while phase 2 comprises burials 1, 3, 5, 6 and 9 (see Figure 3.1 below).

Figure 3.1: Cramond, plan of burials in Roman latrine, (not to scale) (©Edinburgh City Council)



Unfortunately, it is only now possible to associate the skulls and/or mandibles with their original burial numbers. The associated post-cranial skeletons were mixed at some point after excavation and these are treated here as a disarticulated deposit (see Appendix 5.1 below). In addition, the disarticulated remains of a minimum of five neonates have also been identified as part of the current analysis, although no further contextual information is available. It is conceivable that these are contemporary with the Roman occupation of the fort and radiocarbon dates would be desirable. A neonatal cranial element exhibits evidence of fatal blunt force trauma. Among the adults, Cramond skull 1, a prime adult male, has ante-mortem sharp force and blunt force cranial trauma. Cramond skull 5, a young adult probable female, has fatal blunt force cranial trauma which is associated with dental trauma in the form of forced occlusion. Cramond skull 6, an older adult female, has an ossified cranial haematoma and a possible healed fracture of the right mandible. Cramond 9, a possible male prime adult has a peri-mortem cranial injury; a cut has bisected the right parietal. A second small incision is also present. There is no skeletal evidence of trauma among the phase 1 skeletons although any injuries sustained could have affected the soft tissue only. The post-cranial bones were closely examined to look for further evidence of trauma and defensive wounds but none was identified.

The unusual location of this deposit combined with the variable orientations and body positions and the clear evidence of fatal peri-mortem injuries in two cases does strongly suggest that, at the very least, the phase 2 individuals were victims of lethal violence.

3.2.2 Seacliffe Mausoleum

Information relating to the so-called Seacliffe Mausoleum in East Lothian (NGR NT 609 843) is limited. The following description is taken from Stuart (1867, 155). 'A curious burial ground has recently been discovered near to the house of Seacliffe at a depth of about five feet under the surface. It consisted of a square chamber [subterranean structure], formed of stones vaulted like a 'Pict's House' and containing seven or eight skeletons.'

The so-called mausoleum was discovered in 1865 at Seacliffe House, North Berwick, in the course of excavating a deep pit for an ice-house (Turner 1914-15, 222-225, fig. 30). 'In the course of the excavation the bones of six skeletons – four male adults, a young woman and a child – were recognised on the floor of the chamber…mingling of the bones with the compacted sand, and their softened and fragmented condition made it impossible to disengage the separate skeletons…it seemed as if the bodies had been laid in the transverse diameter of the chamber side by side in a row, alternately heads and feet…conditions under which the skeletons were found did not enable me to say whether the bodies had been buried in the bent [flexed] or the extended position. The dimensions of the chamber were not taken, but it was sufficient to accommodate the adults and the child lying side by side at full length.' It has been suggested that this feature is of later prehistoric or Roman date (Crone and Hindmarch 2016, 5) although this is as yet unproven.

Turner examined five skulls from Seacliffe Mausoleum (A, B, C, D and E, 1914-15, tab. VI). He stated that four were male and one was female though made no mention of a non-adult. A total of nine skulls and mandibles are stored at NMS Granton and are unlabelled. The skulls and mandibles almost certainly belong together but this cannot be demonstrated conclusively by osteological analysis. There was a predominance of males and probable males (6/9, 65.6%) over probable females (1/9, 11.1%). Prime adults and adults were equally represented. There was also a single non-adult. Adult male skull C exhibits evidence of possible peri-mortem blunt force trauma to the right parietal.

3.2.3 Thornybank

The substantial field cemetery at Thornybank, Midlothian was discovered in the first half of the 19th century when more than 50 long cists were revealed (New Statistical Account 1845, vol. 1, 277-8). Excavation in 1996 uncovered more than 100 graves, many of which had no surviving human remains. The cemetery is important as it contained a range of burial types which included long cists, dug graves with evidence of log coffins, pebble-lined or long-cist infant burials, a four-post structure around a dug grave and two-square-ditched graves, the latter being the most southerly examples in the country (Rees 2002, 313). An extensive programme of 30 radiocarbon dates demonstrated that for the most part burial activity was concentrated in the middle of the 1st millennium AD (ibid., 342-344, illus. 39, tab. 6; see Appendix 5.2 below), although significantly a number of graves are dated to the early 5th century. The cemetery is generally well organised with a uniform SW-NE orientation.

This assemblage accounts for a substantial percentage of the study group (62/306, 20.3%) but preservation and completeness of skeletons is generally poor. Seven skeletons have been sampled for DNA analysis and 29 for isotope analysis although three of these failed due to poor preservation (see Appendices 5.3 and 5.4 below). Further results are awaited.

Skeleton 44, a prime adult male, exhibits evidence of a possible penetrating wound from a projectile or pointed weapon such as a crossbow. A small circular perforation with a maximum diameter of 2.71 mm is located on the right parietal. This skeleton was buried in a SW-NE aligned long cist in a supine extended position.

3.2.4 Parkburn Quarry, Lasswade

The long cist cemetery at Parkburn Quarry, Lasswade, Midlothian, was discovered by workmen in 1954 and subsequent excavation revealed a total of 116 graves (Henshall 1955-56). Approximately 58 burials were either not opened or not fully exposed. The skeletons from Lasswade account for a substantial proportion of the study group (49/306, 16%). The excavated graves contained SW-NE oriented long cists and body position was supine extended. A further discovery in 1967 was a long cist constructed with dressed sandstone slabs of Roman date (Henshall 1967). Five radiocarbon dates have been obtained (see Appendix 5.2 below) and include one of the skeletons from re-used long cist 8 and from a burial associated with an armlet made of cannel coal/shale. Both skeletons have been sampled for DNA analysis as part of the GENSCOT project but results are not yet available (see Appendix 5.3 below). Twelve skeletons have been sampled for isotope analysis and two further radiocarbon dates have been obtained as part of the Leverhume funded project, 'People and Place' (Sarah Semple, Janet Montgomery, Andrew Millard and Lauren Walther) but results are not yet available.

Two skeletons from Lasswade exhibit evidence of possible ante-mortem penetrating post-cranial injuries. Lasswade 14, a mature adult male, had a small perforation in the left ilium, while Lasswade 53, an older adult male, had a small perforation on the visceral surface of a rib shaft fragment. Both were buried in SW-NE orientated long cists in a supine extended position.

3.2.5 The Isle of May

The monastic site on the Isle of May in the Firth of Forth was excavated during the 1990s and evidence was uncovered of an early Christian cemetery with its origins in the 5th or 6th centuries AD (James and Yeoman 2008).

The excavated site consisted of two main areas, the monastic precinct, and the cemetery to the north (James and Yeoman 2008, 10, illus. 3.4-5). The cemetery had been dug into the pebbles and stones of the raised beach, and this was explored to a maximum depth of about 1.9 m. Some burials were visible as soon as the overburden was removed and others were more deeply buried within the raised beach. The surface of the raised beach cemetery area was sealed by about 0.5 m of medieval and post-medieval garden deposits.

The burials within the cemetery were divided into six groups, based on several criteria, including stratigraphic relationships, burial type, spatial location, orientation and radiocarbon date, although the burial groups did not fit neatly into specific phases of the site as they tended to span the monastic structural phases (James and Yeoman 2008, 13, illus. 3.7). Burials spanned the whole of the medieval period (ibid., 30-32, tab. 3.10, illus. 3.17). In the main the current study is focussed on burials in groups 1-3 although those burials from groups 4-6 have been analysed for comparative purposes. A variety of grave types were identified and were classified according to O'Brien (1996, 163) and Proudfoot (1996, 400). The range of grave types comprised long cists, stone- or pebble-lined graves and unprotected dug graves (James and Yeoman 2008, 17).

Group 1 burials were located in the northern part of the cemetery and were carefully laid out in two rows; there were at least 18 WSW-ENE burials in 9 long cists and two pebble-lined cists which appeared to be carefully laid out in two parallel rows (ibid., illus. 3.1-3.2). All of these skeletons are male. Group 2 burials were located in the north of the cemetery and there was a particularly dense concentration to the south of group 1 (ibid., illus. 3.1 and 3.3). This concentration comprised eight substantially constructed cists laid in three parallel rows N-S, and in lines, head to toe, roughly W-E. Most of these cists contained multiple burials and appeared to form a coherent, planned group, in some cases with adjoining graves sharing side and end slabs. Group 1 and 2 cist burials were sealed with white shell sand, rich in periwinkles. Both the edible and the non-edible flat and rough periwinkles were present in the sand and are present today in the beach at Kirk Haven, suggesting graves were sealed with locally available sand, probably because of lack of soil on the island, and possibly as a ritual and actual purifier given the proximity of most burials to the surface (James and Yeoman 2008, 17).

Group 3 burials were dug graves which were quite dispersed and had the widest date range of all the groups (ibid., illus 3.1 and 3.3). In the main they were orientated SW-NE and were found in a variety of locations within the cemetery, beneath the foundations of the church, the chapter house and cloister. The graves were dug through loosely compacted stones which formed part of the raised beach.

Skeleton 859, an older adult male, was buried in a group 1 long cist, aligned WSW-ENE in a supine extended position. He exhibits evidence of an ante-mortem sharp-force injury. Skeleton 959, a prime adult male, is a disarticulated skull in group 2 long cist 940 which contained multiple burials. There is no information on body position or orientation. Skeleton 1022, a young adult male, was buried in group 2 long cist 983 which contained multiple skeletons. The cist was aligned WSW-ESE but no data on body position is available. Skeleton 1022 exhibits evidence of an ante-mortem blunt-force injury to the left maxilla. Skeleton 1211, a prime adult male, from a later phase of burial, has an ante-mortem injury to the right frontal.

A total of 22 radiocarbon dates have been obtained (see Appendix 5.2 below). Isotope analysis was undertaken on skull 959 and skeleton 859 by Dr Janet Montgomery of Durham University (see Appendix 5.3 below) and demonstrates that neither man was local to the Isle of May. They have also been sampled for DNA analysis as part of the GENLAB project and results are awaited (see Appendices 5.3 and 5.4 below). At the time of writing further work on dietary isotopes by Orsolya Czére of Aberdeen University is delayed by Covid-19.

3.2.6 Lundin Links

The cairn cemetery at Lundin Links, Fife, was revealed during a storm in 1965 (Greig *et al.,* 2000, 585). Numerous discoveries were made through the course of the 19th- and early 20th-century some of which have been published (Durham 1860, 76-7). There are descriptions of long cists 'having been arranged in parallel rows, from east to west, at regular distances from each other' (Turner 1917, 228).

A number of 19th-century discoveries by workmen were recorded as 'close to the sea [just above the high water mark] and about a quarter of a mile west from Largo Station' (Durham 1862). There is a reference to at least 20 long cists although detailed information is only provided on the last two discoveries, one of which was said to contain a very large skeleton whose head had been cloven by a wound (ibid.). This has not been identified. Largo Station was at NGR NO 4179 and thus the discoveries will have been at approximately NGR NO 414 024 (Greig *et al.,* 2001, 586, illus. 2).

The excavation of 1965 uncovered a group of five scattered long cists, three single round cairns sealing long cists, three rectangular cairns sealing long cists, and two cairn complexes also overlying long cists (Greig *et al.,* 2000, 588-600, illustrations 3-16). The dumb-bell complex consisted of two round cairns linked by a flat, roughly rectangular kerbed area, each of which sealed a long cist. The adjacent horned cairn complex comprised a round cairn linked to an oval setting of rounded boulders. The latter had two curved horn-like appendages at its eastern end. Six long cists were sealed by this complex. Orientation was broadly W-E. All burials were in a supine extended position and all were female.

With the exception of skull ET1, the precise provenance of the skulls described below is uncertain. Lundin Links skull and mandible IB212B, an older adult male, has a broken nose. An associated label says ‘from long cist, donor Professor Chiene(?)…other parts of skeleton in cave marked X.’ Lundin Links skull and mandible IB212C (12), a prime adult male, has a probable ante-mortem depressed fracture of the occipital. This was also donated by Professor Chiene. Lundin Links skull and mandible IB212D, a mature adult female, has a probable haematoma on the right occipital. Lundin Links skull and mandible IB225, a prime adult male, has an ante-mortem depressed fracture on the right frontal bone. An associated card says ‘skull from long cist at Largo, Fife, found *c.* 1845, presented by Dr Lungair in 1864’. Lundin Links skull ET1, an adult male, exhibits evidence of decapitation affecting both occipital condyles. This is recorded as one of the skulls donated by Mrs Durham.

Lundin Links 3, a mature adult male, excavated in 1965, exhibits evidence of multiple fatal sharp force injuries affecting the left and right parietals and the occipital. There is also evidence of dental trauma in the form of forced occlusion. It is unfortunate that the post-cranial skeleton is now lost. This skeleton was buried in a supine extended position in a long cist (E) which was aligned SW-NE. The cist was sealed by the western circular cairn that formed part of the ‘dumb-bell’ complex which also contained the burials of a mature adult male (LL5) and an adult female (LL15). The former has been radiocarbon dated (OxA-8895; 1560 +/- 40 BP, 420-600 cal AD, 95.4% probability). A further nine radiocarbon dates have been obtained on skeletons from the 1965 excavation (see Appendix 5.2 below). Comprehensive isotope and DNA analysis has also been undertaken (see Appendices 5.3-4 below).

3.2.7 Catstane

Limited excavation of the area around the inscribed standing stone known as the Catstane in Midlothian was carried out during 1977 (Cowie 1980, 166). The associated long cist cemetery was first investigated in 1864 (Hutchison 1866; Simpson 1862, 122) and one of the skulls examined by Turner forms part of the study group (Turner 1864-66). The excavation in 1977 revealed long stone cists assumed to have contained skeletons laid on their backs and, with only a few exceptions, orientated W-E (Cowie 1980, 172). Long cists were constructed predominately with shale, predominantly with sandstone or a combination of the two. Most of the long cists were empty and where human bone survived it was uniformly extremely poor.

The attribution of Kirkliston skull ET34 to the cemetery at Catstane was previously uncertain, however, the present analysis confirmed that it is Turner's skull D, now fragmented (Hutcheson 1868; Turner 1917, 226, tab. 8), which was removed from grave 49, a west-east oriented long cist in row H of the cemetery. The whereabouts of three other skulls A, B and C from similarly oriented long cist graves 12, 34 and 35 are unknown. Skull ET34 is a prime adult male who was buried in a supine extended position. Evidence of possible peri-mortem sharp-force trauma was present on the left parietal. The skull has been sampled for DNA analysis and results are awaited (see Appendix 5.4 below). XRF and SEM analysis of the cut edge was unsuccessful (see Appendix 5.5 below).

3.2.8 Four Winds, Longniddry

The long cist cemetery at Four Winds, Longniddry, East Lothian, was excavated in 1989 (Dalland 1992). A total of 18 out of 25 identified burials were investigated and all but one was contained in a long cist. Long cists were constructed out of local sandstone, or occasionally oil-shale slabs, both of which occur locally. The predominant orientation was SW-NE. No evidence of trauma was identified.

3.2.9 Gullane Golf Course

A group of five long cists was discovered during the removal of sand on No. 3 Golf Course (Henshall and Mountain 1969, 24). There were four adult long cists aligned WSW-ENE, arranged in a row side by side and a fifth grave aligned W-E. An exploratory trench to the west of the graves produced the capstones of a sixth grave. Whilst the cemetery did not extend further to the east it may have continued to the north and south of the graves examined. There was evidence of at least one more row of graves to the west. Four well-preserved adult skeletons, and that of a baby, were recovered. A quernstone of the type found at Parkburn Quarry, Lasswade (Henshall 1955-56, 276) was found nearby. No evidence of skeletal trauma was identified.

3.2.10 Dryburn Bridge

A group of three long cists was discovered by workmen, alongside a fourth which had been destroyed (Close-Brooks 1979, 7). The adult burials were supine extended, two were aligned NW-SE and one was WNW-ESE. The cists were constructed with yellow sandstone. No evidence of skeletal trauma was identified.

3.2.11 Isolated burials from Dunbar

A total of seven burials with variable levels of information were found in and around Dunbar and four of them exhibit skeletal evidence for trauma. Dunbar, 2 Clyde Villas (no number, ex. 1972) was a supine extended burial within a long cist orientated W-E. This prime adult skeleton exhibits a fracture of the right 7th rib and the left distal fibula. Dunbar EUAD 55.2 is recorded as coming from a long cist but no further contextual information is available. The skeleton is an adult probable male with peri-mortem sharp-force trauma to the right parietal. Dunbar IB226 is an older adult male said to have been buried in a ‘stone coffin’ (long cist). There is evidence of an ante-mortem blunt-force depressed fracture of the left parietal. Dunbar, Kirkhill Braes, is a prime adult female with possible healed sharp-force trauma to the right mandible. This woman had been buried in a W-E orientated long cist in a supine extended position. There is a reference to the discovery of about 12 long cists close to Dunbar Parish Church in 1951, one of which was little disturbed (Calder and Feacham 1953, 179, figs 10-11). It is not clear if skull Dunbar, Kirkhill ET36 is related to the aforementioned group. This prime adult male is believed to have been buried in a long cist. Evidence for peri-mortem sharp-force trauma is present on the left parietal and the occipital.

Dunbar, Kirkhill Braes IB262 has been sampled for DNA analysis and results are awaited. Radiocarbon dating of the skeletons discussed above is desirable given the context of Dunbar as a Gododdin stronghold and then a probable Anglian *urbs regis*. Second molars are available for isotope analysis in the case of Dunbar IB262 and Dunbar, Kirkhill ET36.

3.2.12 Seacliffe

A group of eight skeletons are derived from Seacliffe (distinct from Seacliffe Mausoleum) and are believed to be part of the cemetery at Auldhame (Crone and Hindmarch 2016). Seacliffe 1954 '1 fragmented skull', a prime adult male, whose sex was confirmed by DNA analysis, exhibits evidence of ante-mortem sharp-force trauma affecting the right parietal. A radiocarbon date is awaited and this will determine whether the skull is earlier or later medieval. Seacliffe S56/11, a young adult probable male, has an ante-mortem blunt force injury to the left maxilla.

3.2.13 Ringleyhall

A young adult male skeleton from Ringleyhall was discovered in 1972 (Ritchie *et al.,* 1975). He was buried in a W-E orientated long cist in a supine extended position. The skeleton exhibits evidence of probable peri-mortem sharp-force injury to the occipital.

3.2.14 Stonelaws

Three skulls were recovered from long cists somewhere in Stonelaws (precise location unidentified) during the 19th century. Skull ET8, a mature adult male, has evidence of a broken nose. Skull ET10, a prime adult probable male, has an ante-mortem sharp-force injury to the left frontal.

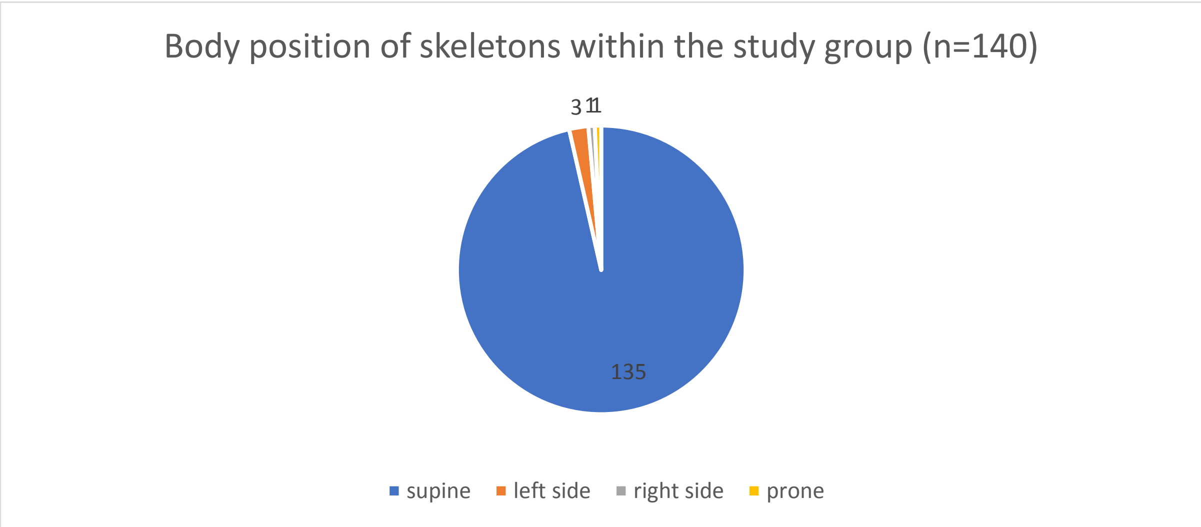
3.2.15 Burial characteristics across the study group

Burial characteristics across the study group have been quantified and are summarised below.

3.2.15.1 Body position

Data on body position is available for 140 burials within the study group and the overwhelming majority were supine extended (135/140, 96.43%). Three skeletons were buried on their left side, Cramond 6 and 7 and Isle of May 987. The only prone burial in the study group was Isle of May skeleton 981, an older adult male associated with white quartz pebbles. Cramond 3, a possible male aged 25-35 years was buried on his right side (see Figure 3.2 below).

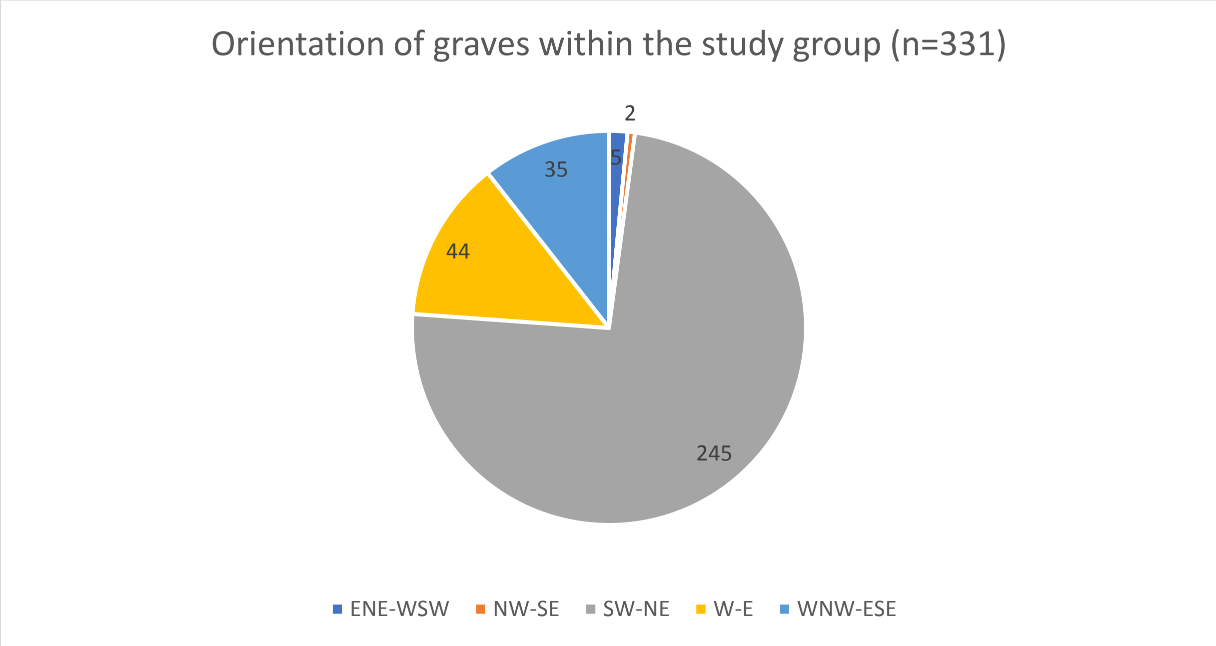
Figure 3.2: Body position of skeletons within the study group (n=140)



3.2.15.2 Orientation

It has been possible to determine orientation for a total of 331 graves (see Figure 3.3 below). This figure includes 'empty' graves from the well-organised cemeteries at Thornybank and Lasswade. The most common orientation is SW-NE (245/331, 74%) and virtually all examples come from Thornybank and Lasswade. There is limited intra-site variability with the exception of the Isle of May, presumably because available space for burial was limited.

Figure 3.3: *Orientation of graves within the study group (n=331)*

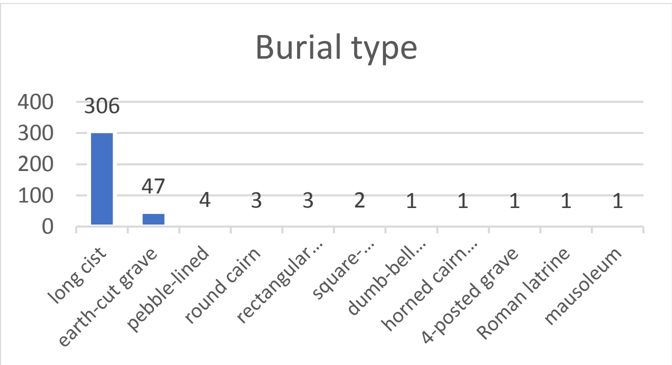


3.2.15.3 Burial type

Data on burial type was available for 370 graves across the study group (see Figure 3.4 below). This number includes 'empty' graves from Lasswade and Thornybank. The vast majority of burials were long cists, a small number of which were associated with, or sealed by, other structures as at Lundin Links and Thornybank.

A number of the earth-cut graves at Thornybank contained evidence for the use of log coffins (Rees 2002). Roman masonry was re-used as cist material at both Thornybank and Lasswade and presumably derived from the nearby fort at Inveresk, while three quern fragments were incorporated into long cists at Lasswade (Maldonado 2013, 15).

Figure 3.4: *Burial type within the study group (n=370)*



A fragment of a dressed stone disc, possibly a pot lid was re-used in Cist R at Lundin Links which was sealed by a rectangular cairn (Greig *et al.,* 2000, 592).

3.2.15.4 Re-use of long cists

There was considerable evidence for re-use of long cists on the Isle of May, presumably because of restricted availability of space for burial. Cist 8 at Lasswade contained the remains of two adult individuals. The remains of a mature adult female (skeleton 8b) had been pushed aside to accommodate an older adult male (skeleton 8a).The two bones used for radiocarbon dating (namely a long bone, possibly a humerus for 8b and a left femur for 8a) were used to date these two separate individuals (Sheridan *et al.,* 2010), but the DNA analysis of a petrous temporal and a tooth revealed that both of the samples selected for DNA analysis belong to the man (skeleton 8a) (Sheridan *et al.,* 2018, 21). The date SUERC-31296 applies to this individual.

Burial 16 at Four Winds, Longniddry contained fragments of a second skull located south-west of an extended fully-articulated skeleton and it was suggested that the fragmented skull belonged to a primary burial disturbed by insertion of the second (Dalland 1992, 201) although disturbance of the cist means that it could have entered at a later date. Burial 17 was said to contain a non-adult and an adult female but only non-adult remains were located during the current analysis.

3.2.15.5 Grave goods

There is a reference to an iron spearhead found in disturbed soil at the east end of the long cist containing Easter Ferrygate skeleton 4 which is now lost (Henshall 1960, 27). During analysis a bag of limpet shells and charcoal was found in association with Lundin Links skeleton 14 while Lundin Links skeleton 18 was associated with a shell of unidentified type. During analysis a scallop shell was identified in association with the boxed remains of Thornybank skeleton 5 (see Plate 3.1 below). It was not referred to in the publication (Rees 2002).

Plate 3.1: Scallop shell found in association with Thornybank skeleton 5 (©Angela Boyle)

In the EUAD entry 25.2.33 for North Berwick Beach Road 33.1 there is a reference to an associated ring. No further information is available and the location of the ring is unknown. A fragment of a shale or cannel coal armlet (Henshall 1955-56, 277) was found in cist 27 at Parkburn Quarry, Lasswade, in association with a very incomplete non-adult skeleton. A fragment of iron was found in Lasswade cist 48, which contained an adult of indeterminate sex. According to the published description it is between two layers of what appears to be wood preserved by iron oxide from the corroding iron inside, suggesting that it was part of an iron blade inside a wooden sheath (ibid.).

Skeleton 1211, a prime adult male from the Isle of May, was located below the cloister and was accompanied by a number of small red and blue naturally coloured stones within the grave fill and within the mouth of the skeleton (James and Yeoman 2008, illus. 3.7). This skeleton has an ante-mortem sharp-force injury to the skull. White quartz pebbles were found in the fills of eight cists at the Isle of May (James and Yeoman 2008).

3.3 DEPICTIONS OF WEAPONRY AND WARFARE

3.3.1 Introduction

This section explores the evidence for depictions of weapon, armour, violence and combat which appear on carved stones and cave walls in Scotland. It is, however, acknowledged that many of these examples extend beyond the geographical area and the chronological range of the current study. It is further acknowledged that this evidence along with the existence of defensive sites, burials with weapons and isolated discoveries of weapons is ambiguous and can be interpreted as a social statement about the prestige of the builder or buriers, or even a prophetic warning against attack, as much as secured evidence for violence or warfare (Knüsel 2005, 49).

Most relevant depictions appear among Scotland's significant assemblage of carved stones, all located in the north and east, areas which were once part of Pictland (Hall *et al.,* 2020, 4). The stones were erected from at least the 5th century and as early as the 3rd or 4th centuries AD (ibid.) with an artistic peak evidenced by elaborate Christian cross-slabs in the 8th and 9th centuries (Noble *et al.,* 2018, 1341-42). The list here is not exhaustive and at the time of writing it has not been possible to obtain permission for the reproduction of images due to the impact of Covid-19.

Here the term 'weaponry' includes swords, spears, axes, daggers, shields (both square and circular), clubs, knives, crossbows and longbows, staffs, scabbards, chapes and armour (helmets, chain mail, and leather tunics). Although axes and knives, crossbows, staffs and clubs are designed primarily for everyday tasks, they can also be employed with lethal intent (*contra* Anderson 2012).

3.3.2 Carved stones in Scotland

Nearly 2000 carved stone monuments and architectural fragments survive from early medieval Scotland (AD 500–1100). Their study has been the focus of numerous academics since the 18th century (Allen and Anderson 1903; Angus-Butterworth 1967; Chalmers,1848;

Close-Brooks and Stevenson 1982; Cordiner 1780, 1788; Cruden 1964; Curle 1940; Galloway 1878; Gordon 1726; Henderson 1960, 1967, 1982, 1983; Jervise 1859; Lang 1986; Pennant 1774; Rhind 1839; Stuart 1856, 1867) and work continues apace into the 21st century (Fisher 2001; Foster 2005; Foster et al., 2016; Fraser 2008; Maldonado and Buckham 2016). Much of the work has focussed on the meaning of the enigmatic Pictish symbols (e.g. Jackson 1987; Carver 2005; Mack 1987; Ritchie 1985), on Christian iconography (e.g. Henderson 1986; Maclean 1985) and on significant individual pieces such as the St Andrew's sarcophagus (Foster 1998), the Aberlemno Cross (Cruickshank 1991; 2000; Fraser 2002), the Ruthwell Cross (e.g. Farrell 1978) and Sueno's Stone (Buchanan 2005; Farrell 2003; Jackson 1993; Sellar 1993). Pictish symbols are found on over 250 stones, both unworked pillar-stones and elaborate cross-slabs and comprise around three dozen designs. A small proportion of these are recognizable objects including weapons, human figures, animals including horses (Beck 1992) and hounds but most are abstract geometric motifs.

3.3.2.1 Geographical distribution and dating

Most surviving Pictish designs and symbols are found on symbol-incised stones and symbol-bearing cross slabs and are predominantly located in the fertile lowlands of the east coast, with the former largely confined to the north of the Mounth (the range of hills on the southern edge of Strathdee in north-east Scotland), and the latter mainly to the south (Foster 2004, 73, fig. 62).

Symbol-bearing cross-slabs can be fairly reliably dated on art-historical and historical grounds to around the 8th century onwards (op. cit., 74). The dating of the symbol-incised stones is less straightforward as few have been recovered from their original locations under scientific archaeological conditions. Their absence in Argyll led to the belief that they post-date AD 500, the traditional date for the arrival of the Dal Riata in the west, however, there is no archaeological evidence for any such migration at this time (Campbell 2001) and 'sources of Dalriadic origins cannot be held to be worthy of acceptance as history' (Dumville 2000).

Where monumental examples have been recovered there is often an association with types of burial broadly dating to between the 4th and 8th centuries (Foster 2004, 74). Pictish designs are not found on 8th-century silver metalwork and during the second half of the 8th/early 9th century they were no longer used on sculpture (Graham-Campbell 2002). Hunting scenes were replaced with militaristic scenes (e.g. the Dupplin Cross) (Foster 2004, 96, 102, fig. 93). Sometime in the 9th century, the characteristic Pictish symbols and what Alcock (2003, 47) justifiably describes as 'lively depictions of warriors and riders' were replaced by 'static, highly stylized figures.' Traditionally, these changes were linked to the destruction of the Picts after the accession of Kenneth macAlpin in AD 840, however, recent work on a worn inscription which appears on the Dupplin Cross has shown that these changes in style took place around or before AD 820 (Forsyth 1995).

3.3.2.2 Description and quantification

Depictions of weapons, conflict, interpersonal violence and hunting appear in upwards of 55 early medieval carved stone monuments, architectural fragments and cave walls (see Table 3.1 below for summary details of these). Although there are concentrations in Angus and Perthshire, the carvings discussed here are found across north-east Scotland. No reference is made to other elements of the carvings. The examples have been identified by reference to the seminal work of Allen and Anderson (1903, reprinted in 1993) and a preliminary search of Canmore (the National Record of Historic Environment Scotland). A gazetteer of relevant carved stones, architectural fragments and cave art forms Appendix 3.1. Stones of particular interest are discussed below.

Table 3.1: Summary of carvings with depictions of conflict, warfare, interpersonal violence and hunting scenes

Name	Type of stone	Canmore ID:	Find location	Grid reference	Approximate date	Summary of relevant imagery	Current location
Aberlemno 2	Cross-slab	34806	Angus	NO 52239 55554	Early 8th century	Battle scene	Aberlemno churchyard
Aldbar	Cross-slab	35067	Angus	NO 5945 6010	8th-9th century	Man on horse with shield	Brechin Cathedral
Balblair	**Carved stone**	269922	Invernesshire		5th century	Walking figure with club or staff	
Barochan	Cross-slab	43098	Renfrewshire	NS 4058 6937	Early 8th century AD	Man on horse with spear; man on foot with axe;	Paisley Abbey

Name	Type of stone	Canmore ID:	Find location	Grid reference	Approximate date	Summary of relevant imagery	Current location
						man with unidentified object who appears to be attacking man with axe; 3 men on foot with spears	
Benvie	Cross-slab	72530	Angus	N) 3283 3145	9th century	2 men on horses with circular shields and spears	McManus Gallery, Perth
Brough of Birsay	Pictish symbol stone fragments	1797	Orkney	HY 2398 2850	7th or 8th century	3 men on foot armed with swords, shields and square shields	National Museum of Scotland
Bullion	Stone slab	32006	Perth and Kinross	NO 3433 3054	undated	Man on horse with sword and circular shield	National Museum of Scotland
Court Cave	Cave wall carvings	53973	East Wemyss, Fife	NT 3427 9694	6th-7th century	Man on foot with club	In situ
Drainie 8	Cross-slab	16507	Moray	NJ 223 696	9th-10th century	Man on foot with spear and circular shield.	Elgin Museum
Drainie 13	Shrine panel fragment	16486	Moray	NJ 223 696	9th-10th century	Man on horse; 5 on foot. Interpreted as horseman and foot soldiers	Elgin Museum
Dull 1	Architectural panel	78165	Perth and Kinross	NN 806 492	8th-9th century	4 men on foot with circular shields; 2 men on horses with spears; interpreted as horsemen and foot soldiers	National Museum of Scotland
Dunblane	Cross-slab	24673	Stirling	NN 7817 0139	9th-10th century	Man on horse with spear, accompanied by dog, man on foot with club. Interpreted as hunting scene	Dunblane Cathedral
Dunkeld 1	Probable architectural fragment	27158	Perth and Kinross	NO 0104 4273	9th-10th century	Man on horse with spear.	Dunkeld Cathedral
Dunkeld 2	Cross-slab	79388	Perth and Kinross	NO 0237 4259	10th century	At least 22 severed heads in a row	Dunkeld Cathedral
Dupplin	Cross	26594	Perth and Kinross	NO 0505 1896	Early 9th century	Man on horse with sceptre or spear; 4 men on foot with spears and shields. Interpreted as army scene.	St Serf's Church, Dunning
Eassie	Cross-slab	32092	Angus	NO 3526 4745	8th century	Man on foot with square shield and spear; 3 men on foot with spears	St Brandon Church, Eassie
Edderton	Cross-slab	14743	Ross and Cromarty	NH 7190 8420	8th-9th century	Unarmed man on horse; 2 men on horses with spears, swords and circular shields	Edderton Churchyard
Fordoun	Cross-slab	36458	Aberdeenshire	NO 7261 7841	8th-9th century	Man on horse with sword and spear; 2 men on horses with spears	National Museum of Scotland
Forteviot 4	Cross-slab	26541	Perth and Kinross	N0 0514 1747	Undated	Man on horse with spear. Possible hunting scene	Forteviot Church
Fortingall	Recumbent slab	24998	Perth and Kinross	NN 7416 4701	7th-9th century (by association)	Axe	Fortingall graveyard
Glamis 2	Cross-slab	32067	Angus	N) 3858 4685	8th century	2 men on foot with axes who are fighting one another; possible	Glamis Manse

Name	Type of stone	Canmore ID:	Find location	Grid reference	Approximate date	Summary of relevant imagery	Current location
						drowning of 2 figures in a chariot	
Glenferness	Cross-slab	15498	Highland	NH 93651 42602	8^{th}-9^{th} century	2 men wrestling or embracing; 1 crouching archer with cross-bow	Near Glenferness House
Golspie	Cross-slab	6564	Highland	NC 837 002	8^{th}-9^{th} century	Man on foot with knife and axe	Dunrobin Museum
Hilton of Cadboll	Cross-slab	15261	Ross and Cromarty	NH 8730 7688	9^{th} century	2 men on horses with circular shields and spears. Woman riding side-saddle and wearing a brooch. Noble lady with an escort.	National Museum of Scotland and Seaboard Centre, Balintore
Inchbrayock 1	Cross-slab	36230	Angus	NO 7093 5675	9^{th} century	Man on ?donkey with spear, circular shield, sword and club; man on foot with sword menacing a cleric; ?prone figure with shield	Montrose Museum
Inchbrayock 2	Cross-slab	36231	Angus	NO 7093 5675	9^{th} century	Man on horse with circular shield, sword and possible dagger	Montrose Museum
Jonathan's Cave	Cave wall carvings	53979	East Wemyss, Fife	NT 3456 9723	6^{th}-8^{th} century	Rowing boat with 5 oars	In situ
Kirreimuir 2	Cross-slab	32300	Angus	NO 3895 5448	9^{th} century	2 men on horses with square shields and spears. Slaughtered deer, bird of prey and three dogs suggests hunting scene	Meffan Museum and Gallery
Kirriemuir 3	Cross-slab	32301	Angus	NO 3895 5448	9^{th}-10^{th} century	Man on horse with circular shield, sword and spear. Dog present.	Meffan Museum and Gallery
Logierait	Cross-slab	26341	Perth and Kinross	NN 9679 5201	9^{th} century	Man on horse with spear	Logierait Churchyard
Meigle 2	Cross-slab	30849	Perth and Kinross	NO 2872 4459	Undated	5 men on horses; 2 dogs; man on foot with club; centaur with 2 axes. Hunting scene	Meigle Museum
Meigle 3	Cross-slab	30860	Perth and Kinross	NO 2872 4459	8^{th} or 9th	Man on horse with spear and sword in a scabbard with a chape	Meigle Museum
Meigle 4	Cross-slab	30860	Perth and Kinross	NO 2874 4467	8^{th} or 9^{th} century	Man on horse with circular shield, sword and spear	Meigle Museum
Meigle 6	Cross-slab	30866	Perth and Kinross	NO 2872 4459	8^{th} or 9^{th} century	Man on horse with circular shield and sword; accompanied by a dog	Meigle Museum
Meigle 10	Architectural fragment	30839	Perth and Kinross	NO 2872 4459	8^{th} or 9^{th} century	3 men on chariot pulled by 2 horses; 1 crouched archer with a bow; 2 possible dogs	Lost
Menmuir 1	Cross-slab	35132	Angus	NO 5343 6436	9^{th} century	Man on horse with circular shield and sword; man on horse with circular shield, sword and spear; man on horse with a club	Meffan Museum

Name	Type of stone	Canmore ID:	Find location	Grid reference	Approximate date	Summary of relevant imagery	Current location
Mugdrum	Cross-shaft	30065	Perth and Kinross	NO 2263 1819	10th century	Man on horse with spear; 3 unarmed men on horses; fallen deer being attacked by dogs	In situ
Murthly 1	Architectural panel	26982	Perth and Kinross	NO c 093 392	9th century	2 men on foot with swords and circular shields who are fighting;	National Museum of Scotland
Murthly 3	Architectural panel	79898	Perth and Kinross	N0 0860 3905	Mid-8th-mid 9th century	2 unarmed men fighting	Perth Museum and Art Gallery
Newton of Collessie	Pictish symbol stone	30156	Fife	NO 2927 1324	7th century	Man on foot with large rectangular shield and spear	In situ
Rhynie 3	Pictish symbol stone	17813/17815	Aberdeenshire	NJ 4985 2702	7th century	Man on foot with small square shield and spear	Rhynie Square
Rhynie 7	Pictish symbol stone	17218	Aberdeenshire	NJ 4976 2636	7th century	Man on foot with an axe	Woodhill House, Aberdeen
Rossie Priory	Cross-slab	73071	Perth and Kinross	NO 2915 3080	undated	Man on foot with axe; 4 unarmed men on horses; 1 man on horse with a spear; 2 dogs.	Rossie Church
Ruthwell Cross	Cross	66586	Dumfries and Galloway	NY 10059 68219	Early-mid 8th century	Man on foot with bow and arrow	Ruthwell Church
Scoonie	Cross-slab	31328	Fife	NO 3840 0167	9th century	3 unarmed horsemen; 2 dogs; stag slain by javelin. Hunting scene	National Museum of Scotland
Shandwick	Cross-slab	15278	Ross and Cromarty	NH 8555 7471	9th century	2 men on foot with circular shields and swords; man on horse with spear; crouching man with bow and arrow	In situ
St Blane's 6	Cross-shaft	301992	Argyll and Bute	NS 0949 5344	Undated	Man on foot with short sword, spear and circular shield	Lost
St Blane's 7	Cross-shaft	301993	Argyll and Bute	NS 0949 5344	Undated	Man on horse with spear	St Blane's Churchyard
St Orland's Stone	Cross-slab	33868	Angus	NO 4008 5002	9th century	4 men on horses; 2 dogs; rowing boat carrying 6 people	In situ
St Vigean's 1	Cross-slab	35560	Angus	NO c 6384 4289	8th-9th century	Crouching archer with bow and arrow facing a boar. Hunting scene	St Vigean's Museum
St Vigean's 11	Cross-slab	35562	Angus	NO c 6384 4289	Undated	2 men on foot, each with a staff in hand, confronting one another.	St Vigean's Museum
St Vigean's 17	Cross-slab	35568	Angus	NO c 6384 4289	8th-9th century	Man on horse with spear	St Vigean's Museum
St Vigean's 22	Cross-slab	35574	Angus	NO c 6384 4289	8th or 9th century	Man on horse with spear	St Vigean's Museum
St Vigean's cross slab	Cross-slab	35587	Angus	NO 6383 4294	Undated	Crouched man with knife at throat of bull. Hunting scene.	St Vigean's Museum
Sueno's Stone	Cross-slab	15785	Moray	NJ 04655 59533	9th century		In situ
Tullibole 1	Cross-slab	26515	Perth and Kinross	NO 0545 0080	10th century	2 unarmed men on foot, wrestling	National Museum of Scotland
Tulloch	Carved stone		Perth			Man holding a spear	

Of relevance to this analysis are the scenes which depict details of everyday life, such as hunting scenes showing use of weapons (e.g. Dunblane, Kirriemuir 2), overt depictions of violence and warfare (e.g. Aberlemno 2, the Dupplin Cross, Sueno's stone), armed men, either alone or in groups (e.g. Aldbar, Benvie, Eassie) and scenes of interpersonal violence between small numbers of individuals (e.g. Barochan, Inchbrayock 1). Evidence for decapitation is illustrated on two examples (Dunkeld 2 and Sueno's Stone) with a single example that may be interpreted as an illustration of the Pictish practice of drowning enemies (Glamis 2). Depictions of boats (Jonathan's Cave and St Orland's stone) and a two-wheeled vehicle (Meigle 10) may be interpreted as depictions of military capacity.

In form the carvings range from fragments which are worn and barely legible (this has obvious implications for definitive interpretations) to the detailed story of warfare on Sueno's Stone which is one of the most elaborately carved medieval sculpture in Scotland. The types of scene are quantified in Table 3.2 below. More than one type of scene may be depicted on a single stone.

Table 3.2: Quantification of types of scene depicted

Type of scene depicted	Identification	No. of examples
Hunting scene	Dunblane, Kirriemuir 2, Kirriemuir 3, Meigle 2, Meigle 6, Meigle 10, Mugdrum, Rossie Priory, Scoonie, St Vigean's 1, St Vigean's	11
Weapon (object only)	Fortingall	1
Interpersonal violence usually involving two men	Barochan, Glamis 2, Glenferness, Inchbrayock 1, Murthly 1, Murthly 3, St Vigean's 11, Tullibole 1	8
Armed escort protecting noble lady	Hilton of Cadboll	1
Armed man or men	Aldbar, Barochan, Benvie, Brough of Birsay, Bullion, Court Cave, Drainie 8, Dunkeld 1, Forteviot 4, Golspie, Inchbrayock 1, Inchbrayock 2, Logierait, Meigle 3, Meigle 4, Menmuir 1, Newton of Collessie, Rhynie 3, Rhynie 7, Ruthwell Cross, Shandwick, St Blane's 6, St Blane's 7, St Vigean's 17, St Vigean's 22	25
Group of armed men interpreted as possible depiction of a fighting force	Drainie 13, Dull 1, Dupplin, Eassie, Edderton, Fordoun,	6
Battle scenes	Aberlemno 2, Sueno's Stone	2
Decapitation	Dunkeld 2, Sueno's Stone	2
Drowning	Glamis 2	1
Boat	Jonathan's Cave, St Orland's	2
Chariot	Meigle 10	1

3.3.2.3 Hunting scenes

The identification of hunting scenes is based on the presence of men on horseback and/or foot, usually with at least one spear and one or more dogs. A few examples also depict the animal being hunted, sometimes being killed. It is probable that the presence of a crouched figure with bow and arrow is indicative in most cases of a hunting scene. Eleven examples have been identified and these are useful for their depictions of weaponry which comprises mainly spears but also includes swords, shields, knives/daggers and bows.

3.3.2.4 Interpersonal violence

Eight carvings fall into this category and some are unusual. The Barochan cross-slab shows a man with an unidentified object who appears to be attacking a man with an axe and Glamis 2 depicts two men with axes who are fighting one another. The Glenferness cross-slab depicts two men who are either wrestling or embracing. Two unarmed men are also seen wrestling on Tullibole 1. Inchbrayock 1 depicts a man on foot who is armed with a sword and appears to be menacing a cleric. Murthly 1 depicts two men on foot with swords and circular shields who are fighting. On Murthly 3 there are two unarmed men fighting. St Vigean’s 1 depicts two men on foot each holding a staff who are confronting one another.

3.3.2.5 Armed figures

There are numerous depictions of one or more armed men, often on horseback, sometimes on foot. The example from Inchbrayock 1 shows an armed man on horseback with what appears to be the standard warrior kit of sword, spear and circular shield. It is quite possible that he would also have had a knife or dagger worn about his person

3.3.2.6 Fighting forces

Six examples have been identified and include the Dupplin Cross which is discussed in detail below. Drainie 13 shows two galloping horses one with a rider mounted on a saddle cloth. Below the horses are five figures on foot, all in profile facing left, with prominent eyes, full beards, flowing hair and tunics, but their lower legs are missing. This could be a depiction of horsemen and infantry.

An architectural panel known as Dull 1 appears to depict men on horses following behind ranks of foot soldiers. On the lower left are four warriors in descending order of height, who are wearing striped tunics with decorated borders and carrying circular shields. The shields have distinct central roundels with pairs of roundels on either side, perhaps denoting the central handgrip. The foremost horse rider is seated on a saddle cloth and is carrying a spear in his right hand, and the horseman behind, of which only the front portion survives, appears to have been similar. Both horsemen are accompanied by collared hunting dogs. The panel is dated to the 8th or 9th century.

The Dupplin cross was erected a few miles away from the Pictish royal centre at Forteviot (NGR NO 0505 1896) and was first recorded in the 1830s by James Skene. It is now located at St Serf's Church, Dunning. The cross has been described as presenting a clear statement about the composition of a national army in the early 9th century (Alcock 2003, 149). There are two military panels on the main face of the cross: The upper panel shows a mounted warrior with a substantial moustache who is carrying a spear; the lower panel shows four foot-soldiers armed with spears and small round shields who do not have moustaches and are therefore identifiable as young men. Two foot-soldiers on a side panel have heavy moustaches and decorated tunics. Alcock (ibid.) interprets these as the three ranks of an army: its commander on horseback; his senior officers on foot; and the body of his army also on foot. The image of a king and two senior leaders also appears on a fragment of chancel arch from Forteviot. A badly worn inscription on the cross has been identified as CUST ANTIN FILIUS FIRCUS, or Constantine, son of Fergus (Forsyth 1995). The latter became king of the Picts in AD 789, and later of Dál Raita, possibly in AD 811. The death of Constantine is recorded as AD 819 (actually AD 820) in the Annals of Ulster.

3.3.2.7 Battle scenes

Depictions of battle scenes (whether realistic or not) are extraordinarily rare (Alcock 2003, 171) and if examples of single combat are excluded (which may be illustrations for lost heroic legends) there are few examples to consider: for the Angles there is the Franks Casket (op. cit., fig 171, see below); among the Picts, there is the cross-slab known as Aberlemno 2 and the so-called Sueno's Stone.

The Pictish cross-slab known as Aberlemno 2, remains in situ within Aberlemno Churchyard (NGR NO 52239 55554). It was first recorded in 1726 (Gordon 1726, pl. 53). Battle scenes appear on the reverse of the stone and are set out in three registers or rows. The following description of the relevant elements is taken from Alcock (2003, 172):

> "In the top row, a mounted warrior, sword held vertically in his right hand, advances in pursuit of a helmeted horseman who retains his spear, but has discarded his own sword and targe [shield]. His horse, very unusually in a Pictish context, is moving in a 'false gallop'. In the middle row, what appears to be the same warrior, distinguished by his helmet, advances with his spear held high and his targe on his left arm, against three foot-soldiers. In the bottom row, a mounted spearman advances from the left to meet a helmeted rider, with spear and targe as in the middle row. But on the extreme right, a helmeted man lies on the ground, his spear discarded behind his head, his targe falling from his hand, and in a stock image of death, a bird of prey is about to attack his unprotected face and throat. In the words of one of the interpolations in *Y Gododdin,* 'the head of Domnall Brecc [a historical king of Dál Raita], ravens gnawed it."

It is tempting to suggest that the depiction of a corpse being eaten by a bird is an allusion to the way the dead of the vanquished were treated after battle. Were their bodies left to rot on the battlefield?

How might the story-line depicted on the stone be interpreted? There are three significant strands of argument and a fourth which is more speculative. It is generally agreed that the helmeted warrior is not a Pict, since helmets are uncommon on Pictish carvings (though see below); the helmeted warrior is probably Northumbrian since his headgear compares well with the 8th-century Anglian helmet from Coppergate, York; the helmeted warrior is likely to be a king as helmets are extremely rare discoveries, and further, in early Germanic society they were particularly associated with the inauguration of kings (Nelson 1986, 356-8); finally, and speculatively, it could be assumed that the bare-headed horseman was a Pictish king (Alcock 2003, 172).

The reverse of the slab at Aberlemno churchyard has been interpreted as a depiction of the battle of Dunnichen or Dun Nechtan which took place in AD 685 (Anglian Nechtansmere, Pictish Linn Garan) in Angus (Cruickshank 1991; 2000). Between AD 653 and 685 Pictland was under Anglian domination, mainly through the rule of puppet kings. The expulsion of one of these, Drest, in AD 672 led the Anglian king Egfrith to massacre a Pictish army which included many of the Pictish aristocracy. Bridei became king of the Picts at this time and in the five years before Dunnichen he attacked forts at Dunnottar in Aberdeenshire and Dundurn in Perthshire and Kinross (Foster 2004, 36, pl. 21). Egfrith attacked Pictland because Bridei had stopped paying tribute to Northumbria. Egfrith is the only Northumbrian king known to have been slain by the Picts and this battle was the only outstanding Pictish victory over the Angles. Alcock (2003) argues persuasively that the carvings are in fact a generalised statement about the conflict between Picts and Angles and the erection of the stone may have been linked to the publication in AD 731 of Bede's account of the victory in the Ecclesiastical History (HE iv, 26). The view that the link with the Battle of Nechtansmere is incorrect has been recently re-asserted.

Sueno's stone is the tallest surviving cross at *c.* 6.5 m and is elaborately decorated. A date in the 10th century has been suggested although there is no good reason for excluding a date in the later 9th century (Alcock 2003, 176). The carving is of high quality although the figures impart a certain rigidity especially when compared with the Aberlemno Cross (see above). Observations of the detail on the stone can often be conflicting due its weathered condition. Although many recent interpretations read the carvings as a continuous narrative of a battle from the initial mustering of the army to the final defeat and scattering of the enemy, it has been argued that the four unequal panels divided by horizontal ribs are in fact intended to indicate a series of events (ibid.). This is supported by the fact that the supposed continuous battle narrative is twice interrupted by scenes of decapitation, with headless bodies being laid out in rows together with piles of severed heads. There is ample evidence to suggest that decapitation was a favoured means of dispatching the defeated (see below) and indeed the criminal but this is unlikely to have taken place during the battle and would not have resulted in neat rows of corpses and tidy piles of severed heads. Decapitation is undoubtedly the main theme of the carvings on Sueno's Stone: an actual beheading is also depicted. It seems straightforward to agree with Alcock's interpretation of a depiction of a great ceremony clearly practiced by both pagans and nominal Christians which served as the conclusion to a successful campaign.

3.3.2.8 Decapitation

Decapitation is referenced most graphically on Sueno's Stone and also on a cross-slab fragment known as Dunkeld 2, which depicts a minimum of 22 severed heads, some bearded. Below the severed heads are two rows of six figures who have been traditionally interpreted as the apostles. Alcock suggests (2003, 177) that the references to decapitation, bracketed as they are by lines of men and horses, conjure a picture of a great ceremonial occasion.

Documentary references to the practice of decapitation include the *Canu Urien*, in a series of 14 stanzas which are devoted to Urien of Rheged (an early medieval kingdom in southern Scotland) as follows: 'I carry a head on my side,…or belt,…or shoulder', the head being that of Urien and the narrator being Urien's cousin and a member of his warband with the account being interpreted as the rescue of a king's head (Alcock 2003, 177; Rowland 1990, 76-84, text 420-22, translation 477-78).

The 8th or 9th century North Cross from Ahenny, County Tipperary, depicting a procession led with an ecclesiastic holding a processional cross, has as its central element a headless corpse carried on a horse, the head being held by a man at the rear of the procession (Richardson and Scarry 1990, 29, pls 2 and 4).

After the slaying of Oswald of Northumbria by Penda of Mercia in AD 642, his body was reputedly dismembered and his head and hands were hung on stakes, although in AD 643 Oswald's remains were rescued by his successor Oswiu who buried the head at Lindisfarne (*HE* iii, 12). These references demonstrate that the capture and recovery of the heads of kings and other figures of authority was an important element of war and remained so, certainly in northern Britain into the early modern period (Alcock 2003, 177).

3.3.2.9 Drowning

If death did not take place on the battlefield it may have taken the form of drowning, a ritual practice first attested in Gaul (Foster 2004, 101). According to the Annals of Tighernach, the Pictish king Oengus son of Uurgist drowned his enemies in a large tank filled with water: in AD 734 the victim was Talorgan son of Congus (Talorgan mac Congussa) who was handed over to the Picts by his brother; in AD 739 he drowned Talorgan, son of Drostan, the king of Atholl (Anderson 1990, 232, corrigenda p. xviii). Bede described Oengus as 'a tyrannical murderer, who from the beginning to the end of his reign, persisted in the performance of bloody crime (*HE*).

The cross-slab known as Glamis 2 portrays two men each armed with an axe in his right hand, engaged in hand-to-hand combat. Above them is a cauldron with the buttocks and legs of two distinct individuals protruding. This has been interpreted as a depiction of death by drowning (Walker and Ritchie 1995, 143-4, no. 77). A centaur in the top right-hand corner of the slab is holding an axe in each hand. It would not be possible to identify victims of drowning in the osteological record.

3.3.2.10 Boats

It has been suggested that combat is likely to have taken place away from the power centres, where the space was available for set-piece battles, whether at sea or on land, both of which are documented (Foster 2004, 99, fig. 91).

The earliest specific reference to a sea battle in the British Isles refers to a battle between the Cenél Loairn and Cenél nGabráin of Dalriada in AD 719. Depictions of boats appear at Jonathan's Cave, East Wemyss, Fife and on St Orland's Stone, Angus. Symbols carved on the walls at Jonathan's Cave include a boat with a high prow and stern, a rudder and five oars. The carvings have a date range from the 6th to the 8th century. The St Orland's example appears to be a plank-built vessel again with a high prow and stern carrying five figures. A rudder is shown and there are traces of possible oars with the boat standing on a knoll which overlooks water or an area of marsh. It has been suggested that the figures are transporting a cross-slab with a pointed top (Laing and Laing 1993, 63) which appears similar in form to stones from Nigg and Aberlemno. There are references to the Pictish fleet in the Annals of Tighernach and coastal promontory forts such as Portknockie and Burghead could be associated with its operation. The stone has been assigned a date in the 9th century. When battles took place at sea it is very unlikely that bodies would have been recovered.

3.3.2.11 Chariot or cart?

The only possible example of a vehicle on Pictish sculpture appears on the now lost stone known as Meigle 10, Perthshire. It is a two-wheeled vehicle with spoked wheels and railed sides, drawn by two horses with braided tails. One man is driving the vehicle and there are two passengers. The presence of a possible awning over the vehicle has led to the suggestion that it was not a chariot but more likely something closely related to a Roman processional cart or 'carpentum' (Laing and Laing 1993, fig. 42).

3.3.2.12 Battles on land and sea

Little is known about the form that fighting took on land in the period. Very little detail about battle tactics or the handling of weapons is found in The Goddodin, for example, although there is a reference to the heroes scattering spears, apparently from horseback. The carved stones, with their images of spears, axes, decorated shields (both square and circular) and swords are therefore of considerable importance. Bows also appear but are probably confined to hunting scenes. A stone arch found at the Water of May beneath 'Holy Hill' known as the Forteviot arch (Canmore ID: 68535) is presumed to have been part of an ornate chapel. It has been suggested that the main figure may be holding a sword across his knees (Close-Brooks and Stevenson 1982, 40). Most soldiers probably fought on foot, with horses reserved for kings and noblemen**.**

3.3.2.13 Range and number of weapons depicted

An attempt has been made to quantify the type and number of weapons and armour as well as the number of human figures on foot and on horseback for each of the stones described here (see Tables 3.3-3.4 below). Unsurprisingly, the greatest number of weapons appear in the battle scenes and in those interpreted as depictions of armies.

Table 3.3: Range and number of weapons and armour depicted

Weapon type	Number identified
Armour	4
Sword	26
Spear	53
Axe	9
Club	8
Knife or dagger	2
Bow and arrow	5
Circular shield	37
Square shield	9
Scabbard	1
Chape	1
Staff	2
Total	159

3.3.2.14 Armour

If the interpretation of the Aberlemno Stone is correct then the same individual is seen wearing the same helmet twice. The warrior on the lower portion of the Benvie slab appears to be wearing a helmet with a nose guard. He is on horseback and is armed with a circular shield slung on his left side and is carrying a spear in his right hand.

The Pictish warriors on the Aberlemno stone appear to be wearing stiff leather tunics which would have afforded some protection. One of the dead who may be an Anglo-Saxon seems to be wearing chain mail. It is likely that high-ranking Anglo-Saxons, Picts and Scots wore chain mail in battle and pieces of mail have been recovered from Anglo-Saxon contexts.

3.3.2.15 Swords

A total of 26 examples are depicted. They are shown with scabbards which had metal chapes (e.g. Meigle 10) either expanded and crescentic, or moulded to the scabbard. Meigle 3 is of interest as the sword is depicted with a broad scabbard which has a rounded chape or protective tip. Silver chapes were found among the treasure from St Ninian’s Isle, Shetland (Clarke *et al.,* 2012, 25-26, 125-126; Small *et al.,* 1973). Also of interest is the fact that the foot of this warrior appears to be braced in a slipper-like pocket at the point of his saddlecloth, instead of a stirrup, unknown in Scotland at this time.

3.3.2.16 Spears

The spear is the most commonly depicted weapon (53 examples) though this number is possibly artificially inflated by the inclusion of the hunting scenes. Spears are depicted as having leaf-shaped blades and no butts. They are normally interpreted as javelins to be thrown from horseback, or occasionally they appear as pikes for foot soldiers (Alcock 2003, 165). It is likely that this was far more than a hunting weapon and had some significance on the battlefield (Alcock 2003, 178).

3.3.2.17 Shields

Shields are of two types. The first is square or oblong, probably derived from the Roman scutum but smaller and hand-held (nine examples). The second type, which is small and round (37 examples), seems to have been the most popular and figures not only on stones but also in the Book of Kells. When not in use it appears to have been carried on a strap around the neck and must have been used in hand-to-hand combat.

3.3.2.18 Axes, clubs, knives/daggers and staffs

These four weapons are all types which would have been readily available to individuals who were not (aristocratic) warriors and could have served many functions. The axes shown on Glamis 2 and Rhynie 3 appear similar to axe-hammers, a type of axe of Roman derivation, similar in form to an example from Cadbury Castle, Somerset (Alcock 1995, fig. 5.4). The example from Golspie shows a woodman's T-axe, a useful hafted blade for warfare, and probably a remote ancestor of some of the Scottish medieval and later warrior's axes (Caldwell 1981).

3.3.2.19 The Franks Casket

The Franks casket is a reliquary casket which was carved out of whalebone, probably in Northumbria in the 8th century. It is known as the Franks casket after its donor, Augustus Wollaston Franks. A range of themes can be identified in the imagery on the casket though of relevance here is the siege of Egil the archer in his fortified homestead (Webster 1982, pls 21-26; Wilson 1984, pls 34-37). Egil is defending the gate with a bow and arrow, and in the air above the gate there is a (supernatural) figure with a spear and a shield. There are a minimum of six assailants, one of whom has been hit with an arrow. Alcock suggested (2003, 172), however, that some, or all of the details have been derived from some totally exotic source, although he acknowledged that the weapons and the military dress are appropriate for the area and period. He further cited the depiction of a crenelated enclosure (possibly based on a Mediterranean picture), and the fact that the assailants are attacking a fortified location with hand-held weapons against a medium-range weapon as tactically flawed. Table 3.4 below presents a detailed quantification of weapon types and the number of figures, whether on foot or on horseback, depicted on individual stones.

Table 3.4: Weapon quantification (by type) and number of figures depicted (on foot or on horse).

Name	Sword	armour	Shield (circular)	Shield (square)	Spear	Axe	Club	Knife or dagger	Scabbard	Chape	Bow	Staff	Total no. of weapons	0n foot	On horse	Total no. of figures
Aberlemno 2	5	3	5		5								17	4	5	9
Aldbar			1				1						2	2	1	3
Barochan cross slab					4								4	3	1	4
Benvie		1	2		2								4		2	2
Brough of Birsay	3			3	3								9			0
Bullion	1		1										2		1	1
Court Cave							1						1	1		1
Drainie 8			1		1								2	1		1
Drainie 13													0	3	2	5
Dull			4		2								6	4	2	6
Dunblane					1		1						2	1	1	2
Dunkeld 1					1								1		1	1
Dunkeld 2													0			0
Dupplin			6		7								13	4	1	5
Eassie				1	4		1						6	5		5
Edderton	2		2		2								6		3	3
Fordoun	1				3								4		3	3
Forteviot 4					1								1		1	1
Fortingall 7						1							1			0
Glamis 2						4							4		2	2
Glenferness											1		1			0
Golspie						1		1					2	1		1
Hilton of Cadboll	2		2	2									6		2	2
Inchbrayock 1	2		2		1		1						6	5	1	6
Inchbrayock 2	1		1					1					3		1	1
Jonathan's Cave													0			0
Kirreimuir 2				1	1								2	1		1
Kirriemuir 3	1		1		1								3		1	1
Logierait					1								1		1	1
Meigle 2						2	1						3	4	5	9
Meigle 3	1				1				1	1			4		1	1
Meigle 4	1		1		1								3		2	2
Meigle 6	1		1										2		1	1

Name	Sword	armour	Shield (circular)	Shield (square)	Spear	Axe	Club	Knife or dagger	Scabbard	Chape	Bow	Staff	Total no. of weapons	0n foot	On horse	Total no. of figures
Meigle 10											1		1			0
Menmuir 1	2		2		1		1						6	1	2	3
Mugdrum					1								1		4	4
Murthly 1	2		2										4	3		3
Murthly 3													0	2		2
Newton of Collessie				1	1								2	1		1
Rhynie 3				1	1								2	1		1
Rhynie 7						1							1	1		1
Rossie Priory					1		1						2	1	5	6
Ruthwell Cross											1		1			0
Shandwick	1		2		1						1		5	1	2	3
Scoonie Stone					1								1		3	3
St Blane's 7					1								1		1	1
St Blane's 6			1		1								2	1		1
St Orland's													0		4	4
St Vigean's 1											1		1	1		1
St Vigean's 11												2	2	2		2
St Vigean's 17					1								1	1		1
St Vigean's 22					1								1		1	1
St Vigean's cross slab								1					1	1		1
Tullibole 1													0			0
Total	26	2	37	9	53	9	8	2	1	1	5	2	159	56	63	119

*Sueno's Stone is excluded from this table.

3.4 ARTEFACTUAL EVIDENCE

3.4.1 Introduction

This section considers the artefactual evidence for weaponry of the period in northern Britain. As discussed there are frequent depictions of warriors and weapons on sculptured stones. In general, however, the artefactual evidence of weaponry for northern Britain is limited, apart from the furnished male graves of the Anglians in the sub-kingdom of Bernicia, which later became part of the kingdom of Northumbria.

3.4.2 Weapon evidence from Bernicia

Weapon burials are most prominent in areas of early Saxon settlement but only become common in northern Britain as a consequence of Scandinavian incursion and settlement from the 8th century onwards (Alcock 2003, 161). When compared to other areas of Anglo-Saxon settlement, furnished graves have been considered rare in the northern sub-kingdom of Bernicia (Miket 1980). When Alcock was writing (2003) the only cemeteries available for discussion comprised six burials at Darlington (Miket and Pocock 1976) and *c.* 120 from Norton, Cleveland (Sherlock and Welch 1992). A recent Leverhume funded project known as 'People and Place: The making of the Kingdom of *Northumbria* 300-800') has made available all of the burial records for the county of Durham which broadly equates to the southern part of Bernicia. There has not, however, been a significant increase in the data available. Table 3.5 below quantifies all the evidence of weapons of the period from cemeteries in the county of Durham.

Table 3.5: Quantification of weaponry from cemeteries in southern Bernicia (data from http://www.mappingnorthumbria.com/county-durham-data*)*

Weapon type	Stobcross Field, Thistleton	Greenbank, Darlington	Andrew's Hill, Easington	Morton Walk, South Shields	Fernie Road, Norton	Mill Lane, Norton	St Andrew's, Auckland	Total
Spearhead	2	2			3	12		19
Shield boss		2				6	1	9
Sword		1						1
Knife			4	1	1	44		50
Ferrule*			1			3		4
Shield grip						4		4
Seax						1		1
Axehead							1	1
Total	2	5	5	1	4	70	2	89

*A ferrule a ring or cap, typically a metal one, which strengthens the end of a handle, stick, or tube and prevents it from splitting or wearing. In this context it is likely to be part of a spear.

Virtually all the weaponry derives from the cemetery at Norton. Knives are unsurprisingly most common as these were primarily a utilitarian tool. Knives are followed by spearheads, which again, would have been used for other activities such as hunting. There are only nine shields and a single sword.

The artefactual record in Northumberland is even more sparse. An online search of the Historic Environment Record combined with data from Miket (1980) resulted in the information which appears in Table 3.6 below.

Table 3.6: Quantification of weaponry from cemeteries in northern Bernicia (data from http://www.keystothepast*)*

Weapon type	Bamburgh Bowl Hole	Barrasford, Chollerton	Corbridge	Galewood	Great Tosson	Hepple	Howich Heugh	Millfield South	Yeavering	Total
Spearhead				2	1		1			4
Shield boss		1								1
Sword		1								1
Sword scabbard mount			1							1
Knife	4	1				2	5	1	3	16
Ferrule										0
Shield grip										0
Seax*										0
Axehead										0
Total	4	3	1	2	1	2	6	1	3	23

*The division between large knives and seaxes is fairly arbitrary. Härke has suggested that the blade length of a seax should be at least 180 mm (1989, tab. 1).

The only recent excavation in the region is of the cemetery at the Bowl Hole, Bamburgh (originally partially excavated in the early 19th century), which revealed graves of 6th-8th century date (Groves *et al.,* 2009). The paucity of evidence may in part be due to the date of the cemetery, covering as it does the period known as the Final Phase when weapon burial was no longer the norm (e.g. Geake 1997) largely due to the spread of Christianity.

The Bamburgh sword was excavated by Hope-Taylor in 1960s during excavations at Bamburgh Castle and was forgotten until its rediscovery in 2010. The castle is located on a large outcrop of rock in the North Sea and the site has been occupied continuously since the Bronze Age. It is first mentioned as an Anglian stronghold in AD 543 (Hunter-Blair 1947) and by the 7th century it was the capital of the kingdom of Northumbria. After its rediscovery the sword was sent to the Royal Armouries in Leeds for analysis, which demonstrated that it was pattern-welded which means it was manufactured from several strands of metal twisted together and forged. Such swords were far from common in the period. What makes the Bamburgh sword extremely significant, however, is the fact that it is the only example to have been forged from six strands rather than the customary four (Albert and Gething 2010, 5). The blade is a single-handed weapon and was originally *c.* 76 cm in length. It was forged in the 7th century and buried in the 10th or 11th century. For 3-400 years, therefore it is likely to have been handed down from father to son (ibid.). Only a king or a nobleman would have been able to acquire such a sword.

Although Anglian expansion in south-east Scotland reached at least as far as the Firth of Forth there is an apparent absence of Anglian graves in the area. None of the large cremation or pagan inhumation cemeteries known in Yorkshire has ever been found. This lack of evidence is usually attributed to the fact that the initial Anglian invasions only just predate the conversion of the kingdom to Christianity (Lowe 1999, 31).

3.4.3 Weapon evidence from Scotland

Evidence of weapons is largely derived from defended sites such as Dunadd, Mid Argyll, quasi-defended sites such as Buiston crannog, Ayrshire (Alcock 2003), and two hoards of silver, from St Ninian's Isle, Shetland and Norrie's Law, Fife. This small assemblage has been expanded by chance discoveries of isolated objects. Weapon burial was not practiced in those areas outside of Anglian influence.

3.4.3.1 Swords

Swords are evidenced at Dunadd where two iron blade fragments were recovered; both tapered towards quite blunt tips and one had a pronounced mid-rib (Craw 1930, 118; Duncan 1982, fig. 7). A pair of probable silver scabbard chapes (object nos 178a and b) formed part of the treasure from St Ninian's Isle (Laing and Laing 1993, 61). The treasure is a large hoard of Pictish silver which also includes brooches, bowls and other items. It was discovered in 1958. A silver gilt sword pommel (object no. 177) was also recovered. The 'cocked hat' shape of the pommel is derived from late 7th-century one-piece Anglo-Saxon pommels such as the example from Crundale (Wilson 1973, nos 11, 15 and 16). Three objects which look like pepper pots have been interpreted as possible belt adjusters for a sword harness (Laing and Laing 1993, fig. 121).

This meagre collection is supplemented by a small assemblage of chance finds. A fine bronze sword pommel decorated with double strand interlace was found at Culbin Sands, Moray. Dated to the late 6th or early 7th century, it shares some features with Anglo-Saxon and Continental pommels although it is without precise parallel and is almost certainly Pictish (Laing and Laing 1993, fig. 40). Another sword fitting was found at West Craigie Farm near Dalmeny, West Lothian, some time before 1853 (Lowe 1999, 31). Previously attributed to Dalmeny Churchyard, it is assumed to have been part of a rich Anglo-Saxon warrior grave but equally could represent a casual loss. It is now in the National Museum of Scotland. It is a decorative garnet and gold filigree pyramid (Alcock 2003, fig. 15; Dickinson 1974, no. 101) which has a suggested date in the late 7th-century (Bruce-Mitford 1974, 127-9). Another example was found at Luffness, Aberlady. The pommel is a lobed copper alloy Anglo-Saxon type of late 9th- to early 10th-century type (Fraser 2002, 34). The enamelled disc mount is an insular type of 8th-9th centuries date (ibid.). A gold and garnet cloisonné stud, part of a sword harness, was recently found near East Linton, East Lothian. Probably dating to the early 7th century, this is a fine example of cloisonné work; thin strips of metal, usually gold, are formed into small cells (cloisons), soldered onto a metal base and filled with enamel, glass or precious stones, in this case garnets (Lowe 1993, 32 and image on page 31). This is one of only a small group of such objects (Blackwell 2018, 190). Typically associated with the Anglo-Saxon archaeology of Kent and East Anglia, similar objects were also found in the Sutton Hoo ship burial and were mounted on a sword sheath (Bruce-Mitford 1978, fig. 208). Possible traces of re-use are indicated by replacement of the attachment (Spearman 1991, 48) or it may have been reused as a brooch. Similarities between the East Linton mount and the examples from Sutton Hoo suggest an early 7th-century date of manufacture for the former (Blackwell 2018, 192). This item was declared Treasure Trove and is now in the National Museum of Scotland.

A silver pyramidal mount reputed to be from Freswick Links in Caithness, is of uncertain provenance though it is a type which was most common during the late 6th and early 7th centuries (Blackwell 2018, 194). The only comparable fittings known from early medieval Scotland are three cone-shaped mounts from the 8th-century St Ninian's Isle hoard, which also contained a decorated pommel cap and two scabbard chapes. which have been variously described as Anglo-Saxon (Webster 2012, 144-5) or Pictish (Henderson and Henderson 2004).

A further three metal detector finds comprise a sword belt fitting from Burghead, Moray (TT NO. 200/12), a sword pommel from Hawick (TT No. 49/13) and another from Sandhead (TT NO. 073/15). A sword found at Torbeckhill, Dumfries and Galloway (Curle 1913-14), is the most common type in 9th-century England with a date of 875-950 AD (Wheeler 1927). In a recent experiment using swords to injure synbone spheres it was common for the pommel to fall off (Kranioti pers. comm.). Despite the paucity of artefactual evidence for the use of swords the osteological data is compelling.

3.4.3.2 Spears

Spears are depicted on carved stones as having leaf-shaped blades and no butts. An example of this type was found at Dunadd (Lane and Campbell 2000). A minimum of eight spearheads were found during excavations at Dunadd, ranging in length from 95-180 mm. Mostly they have leaf-shaped blades with either split or closed sockets and narrow cross sections, although two examples have a strong triangular section.

A spear from Buiston Crannog (Munro 1882, fig. 233) has a leaf-shaped blade with a mid-rib. A long cist containing a partial skeleton was found at Easter Ferrygate Gardens, North Berwick, but is now lost. Fragments of a second skeleton and an iron spearhead were found in disturbed soil at the east end of the cist (Henshall 1960, 27). A possible Anglo-Saxon spearhead of 6th- or 7th-century type, now in Selkirk Museum, is said to have been found near Catslack Burn in the valley of the Yarrow, Scottish Borders (Lowe 1999, 32).

A recent survey tentatively identified 11 spearheads from Scotland as possibly Anglo-Saxon (Blackwell 2018, 278). They comprise one from Scalloway in Shetland, two from Castlehill in Ayrshire, two from Craw's excavations at Dunadd, two from Traprain Law and one javelin or small spearhead, and one from a burial in a pit at Newstead. A Viking Age grave, 751, from Auldhame, contained a variety of items including an iron spearhead and a set of iron spurs with buckles (Heald and Paterson 2016, 65-68).

3.4.3.3 Knives

A fragment of iron was found in Lasswade cist 48, which contained an adult of indeterminate sex. According to the published description it was found between two layers of what appears to be wood preserved by iron oxide from the corroding iron inside, suggesting that it was part of an iron blade inside a wooden sheath (Henshall 1955-56, 277). A knife with a bone handle was found at Dunadd (Lane and Campbell 2000), while from Gurness there is an iron knife set in a bone handle. The ogham inscription on the handle may identify the owner of the knife or it may have a talismanic meaning (Ritchie 1999, 48). Band-shaped mounts with linear ornament (Anderson no. 12) from Norrie's Law were tentatively identified by Stevenson (1964; 1976, 248) as deriving from knife handles. A knife was recovered from phase 7 of the Anglian occupation at Castle Park, Dunbar (Cox 2000, 181).

3.4.3.4 Bows

Although Picts are shown carrying bows on sculptures there is no certain evidence for their use in battle except possibly on Sueno's Stone. A carved object of antler from Buiston Crannog (Munro 1882, 190-239) has been identified as a rather roughly fashioned nut from the trigger mechanism of a crossbow (Alcock 2003, 169, fig. 51.7). The main period of occupation of the crannog is the late 6th to the early 7th century AD.

Three socketed iron arrowheads were also recovered at Buiston. One of these has a heavy tapering head with a square cross-section and has been interpreted as a possible crossbow bolt (Alcock 2003, 169, fig. 51. 5). A socketed missile head from Norton was interpreted as a small spearhead (Sherlock and Welch 1992, grave 42.5) but the rhomboidal cross-section though not as massive as the Buiston example, may suggest a cross-bow bolt (Alcock 2003, 169, fig. 51.6). A possible crossbow nut (used for catching the string and holding it back prior to release) has been found at Castle Urquhart, Inverness. Crossbows appear on three carved stones (St Vigean's 1, Shandwick and Glenferness) and a long bow is depicted on Sueno's Stone.

3.4.3.5 Slingshots

Slingshots are not depicted on carved stones although some of the painted pebbles recovered from brochs at Keiss and Jarlshof may be slingshot. The painted designs have been likened to the messages and designs put on Greek and Roman lead slingshot (Laing and Laing 1993, 62).

3.4.3.6 Armour

No helmets or body armour have been recovered from Scotland though silver hooks in the Norrie's Law hoard may be from *lorica squamata,* a type of scale armour used by the Romans (Laing and Laing 1993). The account of the original discovery mentions silver armour, a helmet and a shield. Unless a small piece of beaten silver in the hoard comes from a helmet constructed with plates on a frame in the manner of continental helmets, nothing survives of the helmet (ibid.).

3.4.3.7 Shields

In her recent survey of Anglo-Saxon objects in Scotland, Blackwell (2018, 283) excluded a lost shield boss from Ballindoch, a lost group of weapons from Hunthills in the Scottish Borders and part of an angon (a type of heavy javelin) from Brodick in Arran. A shield boss from Millhill, near Lamlash on the Isle of Arran has been interpreted as an Anglo-Saxon influenced type (Blackwell 2018, 285).

Pieces of a large roundel of silver from Norrie's Law may have been the facing for a small round composite shield. Many fragments from this hoard are thin silver plate, which is unornamented apart from a border of repoussé oblong bosses (Way No. 11). These were interpreted as 'possibly the remains of the coating of a shield,' on the grounds of its possible resemblance to 'the bronze plating of ancient British bucklers: the curve of one portion suffices to show that the circle measured 21 or 22 inches in diameter, which is only 3 or 4 inches less than the ordinary dimensions of the tarian.' It has subsequently been suggested that they represent the remains of a Roman dish, 400 mm in diameter, but as Stevenson has pointed out (1976, 249), they are too thin to have served this purpose and, anyway, seem to have been flat; in addition, two discs (45 mm in diameter) had been rivetted to them, but these no longer exist. The overall nature of this artefact does indeed suggest the covering of a parade shield (Ritchie 1989, 54). That some Picts possessed silver embellished weaponry is demonstrated by the eighth-century sword pommel and scabbard chapes in the St Ninian's Isle hoard (discussed above).

With few exceptions all the objects discussed are examples of valuable weapons and fittings which were certainly not the fighting gear of the ordinary soldier.

CHAPTER 4: MATERIALS AND METHODS

4.1 INTRODUCTION

This chapter present the details of the material analysed as part of this research and the osteological methods employed. A total of 306 skeletons were examined from 35 sites, the vast majority being long cist burials. Notable exceptions to this include the ‘mass burial’ in a re-used latrine from Cramond Roman Fort in Midlothian and the so-called ‘Seacliffe Mausoleum’. Selected long cists at Lundin Links were associated with stone cairns while two at Thornybank were associated with earth-cut rectangular structures. Earth-cut graves were present alongside long cists at the Isle of May; and a small number of log coffins were identified at Thornybank. Burials from later phases at the Isle of May, the assemblage from Captain’s Cabin and two skeletons from East Barns have also been recorded in full for the purpose of comparison with the study group. Captain’s Cabin also serves as part of a time slice through burial activity at Dunbar. Dunbar is of particular interest because the settlement played an important role during the Anglian occupation of south-east Scotland.

4.2 LOCATION OF THE HUMAN REMAINS

The vast majority of the human remains incorporated into this research are stored at the National Museums Collection Centre in Granton (n=273). The assemblage from the excavations at Lundin Links (n=23) in the 1960s is housed at the McManus Art Gallery and Museum in Dundee while earlier discoveries of human remains from Lundin Links (n=11) are part of the NMS collection at Granton. A single skull from Lundin Links (IB212 A) is on display in the Surgeons Halls Museum at the University of Edinburgh. The assemblage from Cramond (n=9) is curated at Murrayburn, Edinburgh, by the City of Edinburgh Council.

4.3 QUANTIFICATION

A total of 19 isolated burials (Arniston, Broxmouth, Dunbar 2 Clyde Villas, Dunbar 44.1, Dunbar 54.2, Dunbar IB226, Dunbar Winterfield Mains, Gogarburn, Gullane Sands, Logan Cottage, Long Craigs (Dunbar), Longniddry Golf Course, Marine Villa Archerfield, North Berwick Beach Road, Northfield Farm Cousland, Penicuik, Polmood, Ringleyhall and Yarrow Kirk) made up 4.21% (19/306) of the total number of burials examined.

There were eight assemblages of two to five burials (Craigs Quarry, Dryburn Bridge, Dunbar Kirkhill Braes, East Fortune, Easter Ferrygate Gardens, Longniddry, Milton Tranent and Stonelaws). There were four assemblages of six to ten burials (Cramond, Gullane Golf Course, Seacliffe and Seacliffe Mausoleum). At Catstane, 13 graves out of a total of at least 42 contained human remains; human remains from two graves could not be located (FN7 and FN14 – it is likely that these remains were used for radiocarbon dating). A total of 21 graves at Four Winds contained skeletons; three were not excavated (burial 13, burial 21 and burial 27); six skeletons from five graves could not be located (skeleton 11 from burial 11, burial 12, skeleton 13, burial 14, burial 15, burial 16a, skeletons 17a and 17b from burial 19). Thirty six skeletons were excavated at Lundin Links though two have been missing for a number of years and could not be located during this research (Lundin Links 17 and 22) and at least one skeleton had become mixed (Lundin Links 11). A total of 49 skeletons from Parkburn Quarry, Lasswade, were analysed; 51 graves did not contain human remains or were unexcavated. A total of 55 skeletons from the early phases at the Isle of May have been analysed; three could not be located (384, 831, 1021). A total of 62 skeletons from Thornybank were analysed and there were 42 empty graves; a further four were not excavated. It appears that 12 deposits of human remains were recovered from environmental samples taken at Thornybank and these are not included in the publication (Rees 2002).

Significant post-excavation mixing has occurred in the case of both Cramond and Lundin Links. The post-cranial adult skeletons from Cramond were mixed during post-excavation processing (John Lawson pers. comm.). The mixed remains of a minimum of five neonatal skeletons were identified during the current analysis of this material. The latter have not been radiocarbon dated and it is conceivable that they pre-date the deposition of the adults. A fragment of neonatal right parietal exhibits probable peri-mortem blunt-force trauma. This raises the issue of infanticide and the possibility that the neonatal remains are Roman.

Human remains excavated at Lundin Links in 1965-6 were osteologically analysed soon after their recovery but remained unpublished until 2000 (Lorimer 2000; Smart and Campbell-Wilson 2000; Lorimer 2000). During the period between the original report and a second completed in 1999 (Lorimer 2000) some of the material had been mixed up and some skeletons could no longer be located. The report by Lorimer was designed primarily to assess possible family relationships and to identify bones which could be reliably radiocarbon dated (Greig *et al.,* 2000, 601).

4.4 PREVIOUS OSTEOLOGICAL ANALYSES

The publications by Sir William Turner (1903; 1914-15) represent some of the earliest osteological analyses of human remains from the study area. Turner's stated aim was to 'form a collection with the view of studying the character of the skull in Scottish people…' (Turner 1903, 547). The first publication focuses on metric measurements and skull morphology while the second provides more detailed contextual information.

Turner examined a total of 176 skulls from across Scotland, predominantly from south of the Clyde and the Tay (Turner 1903, 548). Of that number three isolated skulls were from East Lothian (an adult male from Dunbar, HT41; an adult male from North Berwick, HT44; and an adult female also from North Berwick, HT 43). Turner also examined five skulls (A, B, C, D, E) from the so-called Seacliffe Mausoleum (1914-15, tab. VI). These five skulls are incorporated into the current analysis though the former have not been identified.

Four skulls from the cemetery at Parkburn Quarry, Lasswade, (an adult male, L HT 66; an adult male L HT383; an adult male, L HT386; and an 'aged' adult female, L HT566) were also examined by Turner who noted that they formed a part of the Henderson Trust collection, obtained about 40 years ago (1914-15). It has not been possible to locate any of these skulls. Few of the skulls in Turner's study group were associated with mandibles. One of the male skulls from Lasswade was described as 'a musician in his 67th year' (op. cit., 561), which indicates that he died recently enough to have been documented and post-dated the chronological range of the current study.

Other long cist burials from the study area were also examined by Turner (1914-15, 226-232, tab. VIII) and comprised discoveries from Arniston, Dunbar, Kirkliston, Lundin and Largo. Kirkliston is an alternative name for the Catstane and had been reported on in two earlier publications (Hutchison 1864-66; Turner 1864-66). This skull has been identified as Kirkliston skull ET34 and is significant as probable peri-mortem trauma has been identified. The remaining four skulls have not been located.

Further data on long cist burials was published by Wells (1957) and comprised Arniston, Dunbar B and C, Lasswade skeletons 1, 2, 4a, 8a, 8b, 12, 30, 34 and 49, Craig's Quarry (Dirleton) skeletons I and III, Longniddry skeletons I, II, III, IV, Dunbar Links, Kirkhill, Dunbar (possibly skull ET36 included in the current analysis, Winterfield Dunbar, Stonelaws and Milton, Tranent. Again the focus was on metric and morphological analysis.

More recently, osteological reports have been published on skeletons from Broxmouth (Armit and Mackenzie 2013), Catstane (Lunt and Young 1980), Cramond (Barnetson 2003), Lundin Links (Lorimer 2000), the Isle of May (Battley *et al.,* 2008), Four Winds (Lorimer 1992), Parkburn Quarry, Lasswade (Inkster 1967; cist 4 and cist with dressed stones), Thornybank (Sinfield 2002) and Captain's Cabin (Roberts 2001).

4.5 OSTEOLOGICAL METHODOLOGY

All skeletal remains have been analysed in accordance with national guidelines (Brickley and McKinley 2004; Mays *et al.,* 2002; Mitchell and Brickley 2017).

4.5.1 Surface preservation, completeness and fragmentation

Surface preservation was recorded by reference to the scoring criteria of McKinley (2004, 16) which are summarised in Table 4.1 below.

Table 4.1: Scoring criteria for surface preservation (after McKinley 2004, 16)

Score	Scoring criteria
0	Surface morphology clearly visible with fresh appearance to bone and no modification
1	Slight and patchy surface erosion
2	More extensive erosion of surface
3	Most of the bone surface affected by some degree of erosion, general morphology maintained but detail of parts of surface masked by erosive action
4	All of bone surface affected by erosive action; general profile maintained and depth of modification not visible across the whole surface
5	Heavy erosion across whole surface, completely masking normal surface morphology with some modification of profile
5+	As for grade 5 with extensive penetrating erosion resulting in modification of profile (includes near destroyed bone)

Assessment of preservation considers the severity of erosion/abrasion to bone surfaces but does not consider completeness. Surface preservation can have an impact on both the quality and the quantity of information that can be recovered. Completeness of individual skeletons was expressed as a percentage: less than 20%, 21-40%, 41-60%, 61-80% and 81-100%. Five categories were used for scoring the degree of fragmentation of the skeletons, comprising minimal (little or no fragmentation), slight, moderate, severe and extreme (extensive fragmentation with bones in multiple small fragments).

4.5.2 Sex determination

Sex determination was carried out using standard osteological techniques for assessment of the pelvis and the skull (Buikstra and Ubelaker 1994). Greater weight is assigned to the pelvis as its features are more sexually dimorphic from an earlier age than those of the skull. The development of features of the skull are highly dependent upon when puberty occurs and may be influenced by genetics, cultural practices and disease, among other factors (Mays and Cox 2000). An individual exhibiting female skull characteristics and male pelvic characteristics is not unusual (Walker 1995). Metric measurements were used where possible to supplement assessment of the skull and pelvis (Bass 1987). Skeletons were assigned to one of the following categories: male, male?, unsexed, female?, female, and indeterminate.

4.5.3 Assessment of age

This research employs the age categories as recommended by Falys and Lewis (2010). Non-adult age categories comprised foetus (f: below 38-40 weeks in utero), neonate (N - birth to 1 month), infant (I - 1 to 12 months), younger juvenile (YJ – 1 to 6 years), older juvenile (OJ – 7 to 12 years) and adolescent (adol. – 13 to 17 years). Adults were assigned to one of the following categories: young adult (YA – 18 to 25 years), prime adult (PA – 25 to 35 years), mature adult (MA – 35 to 45 years), and older adult (OA – 46+ years). A category of adult (A) was assigned to adult skeletons who could not be more precisely aged than 18 years or older. A category of non-adult (N-A) was assigned to skeletons who could not be more precisely aged than less than 18 years.

Adult age estimates were based on observation of late fusing epiphyses (Scheuer and Black 2000), dental attrition (Miles 1962; Brothwell 1981), pubic symphysis (Brooks and Suchey 1990) and the auricular surface (Lovejoy *et al.,* 1985; Buckberry and Chamberlain 2002).

Non-adult age estimates were based on dental development and eruption (Moorrees *et al.,* 1963; Van Beek 1983), long bone length and epiphyseal fusion (Black and Scheuer 1996; Hoppa 1992; Maresh 1970; Scheuer *et al.,* 1980).

4.5.4 Stature

Stature was calculated using the regression formula developed by reference to adults of known stature (Trotter 1970).

4.6 METHODOLOGY FOR THE RECORDING OF TRAUMA

4.6.1 Introduction

The osteological methodology for the recording of trauma is based on published guidelines, case studies and forensic literature from the UK and beyond (e.g. Kranioti 2015; Loe 2017). Comparative material will be drawn from examples distributed widely both geographically and chronologically.

Traumatic lesions have been classified as ante-mortem or peri-mortem, healed or unhealed, blunt-force, sharp-force or penetrating from a projectile or pointed weapon. The detailed description of injuries includes directionality, measurements, number of skeletal elements affected and classification of defects. A drawn record has also been produced of each affected skeleton and these have been used to produce composite figures of all cranial trauma (see Figures 6.1-6.4; Novak 2007; Stroud and Kemp 1993; Novak 2007). A photographic record of injuries has also been created. Other important features are the location on the skeleton, the distribution of injuries where there is more than one and the number of skeletal elements affected.

Much of the focus of this analysis, perhaps inevitably and in keeping with previous studies (e.g. Fibiger *et al.,* 2013; Schulting and Wysocki 2005) is on the recording and analysis of cranial trauma as the head has remained a prime target for assault at close range, probably for strategic as well as psychological reasons (Fibiger 2012, 186). Several modern studies on homicidal blunt-force trauma identify the head as the most frequently injured location (Clark *et al.,* 2015; Mohanty *et al.,* 2005), considering the explanation that the perpetrator believes that it will delay or impede identification (Ruchonnet *et al.,* 2019, 350).

4.6.2 The distribution of injuries

In order to better understand the distribution of injuries the skull has been divided into 15 separate elements (left mandible, right mandible, left nasal, right nasal, left zygomatic, right zygomatic, left maxilla, right maxilla, left temporal, right temporal, occipital, left parietal, right parietal, left frontal and right frontal). Potential injuries were not scored if less than 50% of the cranial element was present.

Vertebrae have been scored using the zonation system of Knüsel and Outram (2004, 88, fig. 2a) which divides each vertebra into four zones (body, right transverse process, left transverse process and spinous process). The major long bones have been recorded as five separate zones comprising proximal, middle and distal thirds, and proximal and distal epiphyses (after Buikstra and Ubelaker 1994, 8).

4.6.3 The timing of injuries

It is crucial to attempt to determine whether injuries or fractures occurred during the life of an individual, around the time of death, or after death. Any injury directly associated with manner of death is considered a peri-mortem injury. Ante-mortem injuries are those that precede the death event whereas post-mortem injuries follow it (Sauer 1998, 321). Post-mortem changes can occur as a result of depositional processes or through damage during excavation handling and post-excavation processing (Boylston 2000; Fibiger 2012, 180).

While modern forensic approaches provide clear criteria for the identification of peri-mortem trauma (see, for example, Berryman and Haun 1996; Lovell 1997; Sauer 1998) archaeological material often presents unique challenges due to the degree of completeness of individual skeletons, level of fragmentation, surface preservation and because of extensive post-depositional damage (Schulting and Fibiger 2012, 1). While this is particularly true for Scottish human remains these issues are not insurmountable and are discussed at relevant points in this thesis.

Trauma, in particular peri-mortem trauma, was not universally considered to be a priority in older reports (ibid., 6). The analysis of interpersonal trauma is one of the most challenging and rapidly advancing fields of osteoarchaeology with regular refinement of diagnostic criteria and methodologies for understanding the biomechanics of fracture (Loe 2017, 50), and the increasing use of experimental approaches (e.g. Downing and Fibiger 2017; Dyer and Fibiger 2017; Ruchonnet *et al.,* 2020). One recent development is the observation that fractures initiate at the point of impact and radiate away from it (Kroman *et al.,* 2011). Therefore, a re-evaluation of older published assemblages from the study area has been undertaken alongside new analysis of material excavated in the 19th and early 20th centuries. This has led to the recognition of previously unknown examples of deliberate injury.

Sauer (1998, 330) provided a detailed framework for distinguishing ante-mortem, peri-mortem and post-mortem trauma in a forensic context which can readily be applied to archaeological material as follows: identify and describe the nature of all bone surface disruptions; attempt to identify the agent/weapon that caused an injury (e.g. a knife), and mechanisms of delivery of any traumatic lesions; examine the margins of the lesions for indications of an osteogenic response, paying particular attention to evidence of periostitis, callus formation and the etched lines that denote the extent of uplifted periosteum; look for patterns that might suggest animal activity; evaluate the lesion for differential staining that may reflect damage that occurred following a period of deposition and contact with soil, water or organic material (see section 5.4 below).

Peri-mortem trauma is an insult to the body which occurs around the time of death. Bone which has an intact organic matrix (known as ‘green bone’) presents a response to fracturing which is different from bone that has a partial organic matrix ('dry bone') (Loe 2009; Loe *et al.,* 2014; Raul *et al.,* 2008). Therefore, fractures which affect green bone can be identified by their sharp, smooth margins, radiating fracture lines and fracture lines that are straight. In addition peri-mortem fracturing can also be indicated by features such as irregular fracture margins (splintering), fragments that tend to stay attached to one another (hingeing), peeling or lifting of fracture margins, bending and margins that are usually discoloured, or the same colour as the surrounding bone (Berryman and Haun 1996; Brothwell 1981; Kanz and Grossschmidt 2005). 'Spalling' or the removal of chips of cortical bone in association with a peri-mortem parry fracture from Towton skeleton 30 is described by Knüsel and Outram (2006, 255, fig. 17.1). Differential diagnosis and inclusion of a lesion as peri-mortem trauma is based on the morphological criteria listed below (see Table 4.2 below). High probability peri-mortem injuries displayed unambiguous, well-preserved features such as a regular rounded or linear fracture outline, patinated internal bevelling and radiating or concentric secondary fractures.

Table 4.2: Common characteristics of peri- and post-mortem skeletal trauma

Fracture feature	Peri-mortem	Post-mortem
Overall appearance of fracture	Splintered Cracked Dented	Shattered
Fracture shape and outline	Rounded Linear	Linear/straight Irregular
Secondary fractures	Frequent Radiating/Concentric	Rare
Fracture margin	Sharp Acute/oblique angle Endocranial bevel Endocranial flaking No remodelling	Irregular Right-angled No remodeling
Fracture surface	Smoother texture Colour similar to surrounding bone	Irregular/rougher/spiculated texture Colour dissimilar to surrounding bone
Fracture colour	Patinated Homogenous	Lighter Distinct from surrounding bone
Fracture fragments	Hinging/adhering Regular Larger	Separate Irregular Smaller

(After Bennike 2008a; Byers 2008; Fibiger 2009, 6; Galloway 1999; Knüsel 2005; Oh 1983; Quatrehomme & Işcan 1997; Sauer 1998)

Additional criteria for identifying green bone fractures refer to taphonomic signatures on surrounding bone surfaces (Barker *et al.,* 2008 a & b; Raul *et al.,* 2008) and, for long bones, fracture margin texture, fracture angle (created by the fracture surface and the cortical surface) and fracture outline (in relation to the longitudinal axis) (Knüsel and Outram 2006; Villa and Mahieu 1991).

Criteria employed to differentiate timing of injuries in a study of Neolithic skulls from Germany (Fibiger 2012, 180) included: signs of healing such as remodelling and rounding of wound margins for ante-mortem injuries; depressed but adhering bone, secondary linear and concentric radiating fractures, oblique angles on fracture margins, and characteristic bevelling or flaking on the primary defects for peri-mortem fractures (Galloway 1999; Polson *et al.,* 1973); and more irregular fracture patterns with right-angled fracture margins for post-mortem defects. In the latter, adhering bone and internal bevelling are rare and colour differences (patination) between fracture surfaces and surrounding bone tend to be quite pronounced. Early signs of healing (of one or two weeks duration) in the form of woven, porous bone around the site of injury may sometimes only be visible through microscopic analysis (Barber 1929, 1930; Knüsel and Outram 2006, 255). If any remodelling is associated with a skeletal lesion then the injury occurred at least a week before death (Sauer 1998, 322).

Sledzek and Barbian (1997) described the sequence of events which characterise the early healing process in cranial injuries from people with known medical histories. The earliest visible change is denoted by rounding of the cut edge of the bone at the site of the wound. This commences between one and two weeks after the injury has occurred. Once an injury has healed completely it is very difficult to estimate the interval between its occurrence and the demise of the individual. It is important to record the extent of the injury, the bone or bones affected and the extent of the healing process. If a roundel of bone is removed by an edged weapon and healing has taken place, it may be difficult to differentiate the end result from a trepanation. Trepanations are often found in association with cranial injuries and may indicate that treatment of a head injury has been attempted, in some cases quite successfully (e.g. Wells 1982).

4.6.4 Distinguishing types of trauma

Injuries can be subdivided into three main categories: sharp-force, blunt-force and projectile trauma, a nomenclature devised by Spitz (1980) (Boylston 2004, 40). Other types of weapon trauma resulting from explosive munitions may be identified by multiple, extensive, comminuted fractures, an absence of fractures associated with a point of impact, decapitation, amputation, penetrating wounds, embedded fragments of bone and/or metal debris, blunt-force injuries, acceleration and deceleration injuries and burns (Browner *et al.,* 2015; Loe 2017, 49; Ramasamy *et al.,* 2010).

4.6.4.1 Sharp-force trauma

The term sharp-force trauma refers to penetrating injuries (complete or incomplete) caused by a sharp-edged instrument. Sharp-force injuries are described with reference to the criteria set out by Byers (2005, 340-341), Kimmerle and Barayaber (2008, 268) and Reichs (1998). These refer to shape (whether straight or irregular), cross-sectional appearance (for example, 'V' or 'U' shaped), surface texture (smooth or serrated), depth, and presence of associated fractures (including hinge fractures). The presence of any striations on the walls of the defect and evidence for bone wastage have also been recorded. Injuries have been further classified as cuts (or incisions); chops; peeling or shaved defects; scoops; point insertions or notched defects; and slot fractures (Byers 2005; Kimmerle and Barayaber 2008; see Table 4.3 below).

Table 4.3: Classifications of sharp-force defects employed in the analysis (after Byers 2005, 340-341; Kimmerle and Barayaber 2008, 284; Reichs 1998) (reproduced from Loe et al., 2014, 125)

Sharp force defect	Features
Cuts or incisions	Fine, linear striations that tend to have 'V'-shaped cross-sections. Usually caused by sharp instruments drawn across the cortical surface of bone. Vary in width – very thin or strongly 'V'-shaped. Dimensions vary depending on size of instrument, amount of energy in delivering it and size of bone. Generally, long instruments contacting bone over a large area will cause long incisions; short instruments contacting bone over a small section will cause short incisions. Thickness depends on instrument, but re-expansion of bone after withdrawal of instrument means that width is not informative. Depth depends on force – generally instruments delivered forcefully will cause deep striations. Wastage and associated fractures

	are rare (force directed across rather than down). Hinge fractures (peeled away bone) can occur. Striations are usually present parallel to the cut.
Chops (clefts or notches)	Usually caused by long or thick bladed instruments with at least one cutting edge. Cause complete interruption of the bone. Usually sever a bone and cause chattering. Sharp and blunt injuries. Caused by vertical or near vertical forces applied by heavy instruments with long, sharp edges. Usually results in a V-shaped wound that can penetrate the interior of the bone. Can be accompanied by extensive fracture lines, reflecting the power required to create them and the heaviness of the instrument causing them. May also be associated with hinging, and, if there is enough force, wastage where sections of bone break away from the impacted bone. Can be short or long, depth depends on force applied. Generally associated with a downward force which results in striations vertical to the surface of the bone.
Scoops	Small concave defect with multiple facets, where small 'flakes' of bone are removed. Results in the blade create a fragment or wedge on removal. Generally associated with long-bladed weapons. Usually associated with complete fractures/deep penetration with blade held at similar angle as that causing the peeling or shaving described below.
Peeling or shaving	A sleeve or bone fragment is lifted or peeled from the surface when the blade strikes bone at an angle or when the bone is twisted due to torsion. The fragment is not completely removed. Width and depth vary depending on penetration of the blade.
Point insertions or notches	The point or tip of the instrument is directed perpendicular to the grain or surface of the bone – i.e. a stab wound. Indentation at point of impact, usually accompanied by small sections of bone breaking inward. Usually deep (extent depends on force and nature of instrument) and elongated with triangular or v- or cone-shaped cross-section. Striations (usually only visible microscopically) associated fractures and hinge fractures can occur. Bone wastage is rare.
Slot fractures	Chopping wounds tend to fragment or penetrate the cranium resulting in multiple fractures as the blade is removed. Appears as a wide groove with one straight edge and an associated curved or concentric fracture resulting from rotational movement of the blade as it is removed from the skull.

These classifications reflect differences in force and angle of the insult and assist in identifying the attributes of the causative instrument. For example, chops are associated with a heavy force and may cause complete or incomplete fractures that are broad and have a width that is similar to the depth. Cuts are associated with lighter injuries that result when a sharp instrument is drawn across the bone surface, rather than through it, causing narrow fine striations (e.g. the vertebrae). They may also result from a forceful stabbing action (Byers 2005, 343).

Instrument attributes have been explored further by consideration of the placement of injuries and features such as their size. For example, defects that crossed adjacent bones or bone regions will suggest the use of a long instrument (such as a sword), and striations with internal micro-striations indicate the use of an instrument with a serrated edge (Byers 2005, 348; Kimmerle and Barayaber 2008). There are several studies in the forensic and archaeological literature dealing with the identification of specific weapons or tools using features observed on dry bone (e.g. Humphrey and Hutchinson 2001; Smith and Brickley 2004Tucker *et al.,* 2001). Experiments using fresh bone and employing high powered microscopy (for example, SEM analysis) have generally been more successful at correctly attributing specific weapons to injuries than those that have relied on macroscopic analysis alone (Blumenschine *et al.,* 1996; Tucker *et al.,* 2001). Others have found that even microscopy cannot distinguish between specific instruments *(*Bartelink *et al.,* 2001), highlighting the fact that fine distinctions are obscured by variations in the biomechanical responses of different bones (Kimmerle and Barayaber 2008, 267). A recent experimental study which utilised Bronze Age replica weapons and synbone spheres found that the latter does not register the microscopic striations created by a blade passing through bone (Downing and Fibiger 2017, 546).

For archaeological bone, distinctions are further blurred because of taphonomic processes, in particular erosive action from surrounding soil and other objects coming into contact with the bone in the burial environment and during excavation and post-excavation processes.

The direction of sharp-force injuries has been explored with references to the features described by Boylston (2000, 361), Byers (2005, 348) and Knüsel (2005, 55). At a general level, injuries are concluded to have been delivered from behind if they are only seen on the posterior of the skeleton, and vice versa for those seen on the anterior. Where the same injury involves the anterior and posterior, direction has been determined based on the principle that entry wounds are usually larger than exit wounds (Byers 2005, 348). More detailed observations have been undertaken to explore the angle at which the instrument has travelled through the bone (Boylston 2000, 361). For example, horizontal cuts suggest blows delivered perpendicular to the long-axis of a bone (Kimmerle and Barayaber 2008, 270). In addition, a roughened margin, opposite to the polished/smooth margin, suggests the end point of a blow causing incomplete fracture, while a peeled bone surface can be interpreted as the far margin of a blow in bone that has been bisected. Lifting or a bony spall can be interpreted as the end point in bone that has been nicked by a blow (Armit *et al.,* 2011).

The position of the attacker has been considered with reference to the location, angle and distribution of injuries. However, interpretations must be made with caution because unless angle is clear, injuries sustained to the back of the neck, for example, could have been made by an attacker standing behind, to the front or the side of the victim. Identifying direction, number, position and sequencing of injuries is complicated by other factors which include bone loss caused by the trauma (e'g. Lundin Links skull 3), wounds that overlap, the context in which the injury occurred (e.g. formalised fighting or surprise attack), taphonomy and preservation issues. This level of interpretation has also been attempted for blunt-force trauma.

Multiple injuries have been estimated by totalling the minimum number of discrete primary injuries, based on points of impact and by reconstruction. This achieves an approximation at best, because it does not account for injuries sustained only to soft tissues and, where chops are concerned, is unable to account for defects that have been obliterated by subsequent blows. It is also not possible to distinguish between injuries received as the result of a fall onto a sharp object and an insult received as the result of a blow.

In contrast with blunt-force injuries, sequencing sharp-force injuries can only be attempted on rare occasions where there is a relationship between fractures and there is sufficient bone preservation. This has been undertaken using the principles set out by Rhine and Curran (1990) for projectile trauma and by Kimmerle and Barayaber (2008, 157).

The identification of cut marks from edged weapons on the skull and on the post-cranial skeleton is relatively straightforward. The nature of the cut depends on whether the weapon has (1) passed cleanly through the bone; (2) come into contact with bone and glanced off; (3) made contact and produced a deeper wound (sometimes removing a roundel of bone which may traverse both outer and inner tables (see Plate 4.1 below) or just penetrated the diplöe (see Plate 4.2 below); or (4) merely create an incised wound known as a skip lesion (Novak pers. comm. in Boylston 2004, 40).

Plate 4.1: Ridgeway Hill, skull 3738, left parietal, large sharp-force scoop lesion, left lateral view (© Dorset County Council/Oxford Archaeology)

The scoop lesion measures 68.7 mm (inferior-superior) and 44.7 mm (posterior to anterior). The upper edge of the injury was smooth and highly polished while there was some flaking of bone on the inferior ragged margin. The blow made contact, completely penetrating through the endocranial surface and removing a roundel of bone. Post-mortem damage is probably masking radiating fractures. This injury would have caused immediate and severe trauma to the brain.

Plate 4.2: Ridgeway Hill skull 3759, peri-mortem sharp-force defect on the posterior right parietal bone resulting from the removal of a roundel of bone. The diplöe was exposed but the injury did not penetrate the endocranial surface (© Dorset County Council/Oxford Archaeology)

Soft tissues would have held the bones together at the time of interment only for them to fall apart as the body decomposed. So there may be taphonomic variability with colour differences between separated pieces. This has been carefully recorded. A large portion of the vault of Lundin Links 3 who suffered at least three fatal blows from a sharp-bladed weapon, was missing. This is difficult to explain given the manner of his burial. Isle of May skull 959 who also suffered two fatal blows from a similar weapon was highly fragmented and incomplete.

The first category of injury, where the blade has passed cleanly through the bone, will produce a wound with straight clean-cut edges, which may be almost perpendicular with the bone surface. Examples from the study group include Isle of May skull 959, Kirliston ET34, Lundin Links 3 and Ringleyhall. These lesions can be seen clearly on the cranium and sometimes on the post-cranial skeleton, for example, if a limb is amputated with a sword in battle. The left leg of skeleton 3805 from Ridgeway Hill had been removed in such a fashion in the region of the midshaft of the femur (Loe *et al.,* 2014, 124, fig. 3.84). There may also be terminal fractures at the end of a cranial wound, e.g. Lundin Links 3. The second category will produce a gutter fracture where the weapon has grazed the bone. By contrast, in the third scenario the diagnostic criteria (after Wenham 1989) are more complicated and consist of a linear wound with a well-defined edge, a flat, smooth, polished' cut surface on the oblique side of the injury, flaking and roughening on the acute side, and the possibility of terminal fractures. An incised wound will create a linear cut which may have small flakes of bone chipped off its edges.

4.6.4.2 Blunt-force trauma

The biomechanics of the skull affect the way in which it responds to injury with a blunt weapon (Berryman and Haun 1998). The outer table of the cranium comes under compression and the inner table under tension (except in the case of a projectile exit wound when the situation is reversed). If the force of the blow exceeds the elastic limit of the bone, the inner table fractures in the immediate area of the blow forcing a cone of bone to break away from around the entrance wound. The outer table is more likely to separate in a concentric fashion around the affected region (Boylston 2004, 41). Berryman and Symes (1998) emphasised that it is actually the trabecular bone of the diplöe which fractures before the breaking of the inner and outer tables.

A study of blunt-force trauma presented in great detail the types of fracture that can occur (Wedel and Galloway 2014). Blunt-force trauma has been recorded by stating the type of fracture, e.g. depressed (pond), depressed (stellate), depressed (comminuted), expressed etc, attempting to identify the point of impact, describing (with illustrations) the presence of concentric or radiating fractures, identifying whether there is internal bevelling, and looking at the edges of wounds to see if there are any flakes of bone adhering to them.

In order to interpret cranial blunt-force trauma the basics of fracture formation must be thoroughly understood (Berryman and Symes 1998, 337). Blunt-force trauma can normally be identified by the presence of concentric or radiating fractures, depending upon the force with which the blow is delivered (Gurdjian *et al.,* 1950a). Blunt-force trauma may dent, crack or splinter bone in contrast to the incised nature of sharp force injury. A number of studies have been carried out on deformation patterns and mechanisms by which radiating fractures form when blunt trauma is applied. Gurdjian *et al.,* (1950a, 1950b) used intact cadaver skulls covered with brittle lacquer to do this. These experiments showed inbending at the site of an impact with accompanying areas of outbending peripherally. With enough magnitude a linear fracture may occur in the area of outbending. The fracture initiates at one or more points distant to the impact site and then progresses both towards the impact site and then progresses in the opposite direction.

Vance noted (1927, 1026) that an expanse of skull with gradual curvature is less resistant to violence than an area of bone with steep curvature, and the fracture most often seeks out the former unless other factors are present which modify its course. A fracture will take the path of least resistance and will propagate until its energy is dissipated (Berryman and Symes 1998, 337). Normal suture lines especially on the vault are also involved in many fractures because they are naturally weaker than the rest of the bone. These paths of least resistance are defined by six reinforcing buttresses that rise from the base as tapering bony thicknesses (mid-frontal, mid-occipital, anterior and posterior temporal) (Moritz 1954, 345). These areas of buttressing tend to direct fractures to their respective fossae. The relative areas of strength in the facial skeleton are along alveolar ridges, malar eminences and naso-frontal processes of the maxilla. These areas are best characterised by Le Fort fractures (Le Fort Rogers 1982, 244). A Le Fort 1 pattern separates the alveolar portion of the maxilla from the maxillary antra and nasal fossa and is the product of either an anterior to posterior or a laterally directed blow. Le Fort 2, sometimes known as a pyramidal fracture separates the midportion of the face from the cranium and is produced by a centrally or slightly downwardly directed blow to the midface. Le Fort 3 also involves a centrally or downwardly directed blow to the upper face and separates the face from the vault. Facial trauma often results in a composite of Le Fort 2 and Le Fort 3 fracture patterns. Therefore complex patterns should not be forced into Le Fort classifications (Berryman and Symes 1998, 388).

4.6.4.3 Projectile/penetrating trauma

This type of trauma includes injuries produced by slow moving weapons as well as wounds caused by missiles such as arrows, bullets and javelin-type weapons. Differences in velocity of the projectile may produce varying patterns in the affected cranium (Berryman and Symes 1998). Such wounds may be distinguished from other holes in the cranium by the diagnostic criteria of Kaufman *et al.,* (1997): the size and shape of the hole, whether the bevelling is internal or external (as on the exit wound from a gunshot), whether there are radiating fractures and their extent, and the appearance of the perimeter of the hole created by the weapon (are there adherent flakes or peeling).

It can be difficult to distinguish between a penetrating injury that has been caused by a projectile and one that has been delivered by the point of a weapon such as a pole-axe or a battle-axe (Boylston 2000, 374).

4.6.4.4 Dental trauma

Dental trauma can occur in both ante-mortem and post-mortem contexts and it is often difficult to distinguish peri- from post-mortem trauma in the dentition (Ortner and Putschar 1981, 453). Most literature on this topic derives from modern studies in living people (Holst and Coughlan 2000, 85; though see Merbs 1989). Most dental injuries in modern populations occur roughly between one and six years of age and are generally due to falls and bumps (Andreasen 1981, 24). With increasing age, blows, sports injuries and traffic accidents become the major cause of dental trauma (Ortner and Putschar 1981, 452).

While the difficulties of distinguishing causes of dental trauma – falls and bumps as opposed to direct violence – are acknowledged, in some cases the association of other traumatic injuries exhibited by an individual can assist in determining likely causation. At Ridgeway Hill, 34 decapitated individuals exhibited varying levels of dental trauma. Two basic types of dental trauma could be distinguished and these were complete crown and/or root fractures (see Plate 4.3 below) and small chips and/or cracks in the dental enamel (see Plate 4.4 below). Chips/cracks were common within this group and it has been reported that chips/cracks are relatively common in archaeological populations generally (Mulner and Larsen 1991, 370). Nonetheless, the association with decapitation and the fact that 33 out of the 34 individuals with dental trauma had chips/cracks does rather favour the argument that the trauma occurred as a result of forced occlusion caused by the blows to the neck (Boyle 2014, 64). A similar problem applies to the complete crown and/or root fractures to a lesser degree. Skull 3709 had a lower right first premolar which had fractured into two pieces in a near vertical plane; the distal root of the lower right third molar had broken off in response to sharp-force trauma to the right side of the mandible which had removed a portion of bone extending from the gonial angle to the anterior mandible. In addition, the upper right first and second molars had chipped buccal surfaces which are likely to be linked to the same injury.

Plate 4.3: Ridgeway Hill, skull 3751, sheared upper right 1st premolar (© Dorset County Council/Oxford Archaeology)

Plate 4.4: Ridgeway Hill, skull 3709, upper right 1st and 2nd molars with chipped surfaces (© Dorset County Council/Oxford Archaeology)

At Towton, dental trauma was identified amongst 14 individuals and a number of these were clearly associated with weapon trauma. The trauma comprised crown infractions (a crack in the enamel without loss of tooth structure/chipping of the dental enamel), crown and root fractures, weapon-induced cuts, avulsion fractures and post-mortem trauma (Holst and Coughlan 2000, 85). One of these (Towton 16) had a crown infraction which could be linked to a peri-mortem blunt-force injury to the left maxilla (ibid.).

The recording of dental trauma is a significant part of this analysis with detailed information on type of trauma, tooth affected and location on the tooth.

4.6.4.5 Soft tissue trauma

Skeletal trauma only exhibits a small proportion of the total range of injuries that could potentially affect an individual. Cuts, abrasions and bruises leave no skeletal indicator. However, it is possible in some cases to recognise soft tissue injuries in skeletal remains if calcification or new bone formation has occurred within the soft tissue (Roberts and Manchester 1995, 66-67). Occasionally, muscle attachments and tendons may ossify in response to trauma, for example where a haematoma has been generated in the vicinity of injured periosteum (Aufderheide and Rodgriguez-Martin 1998, 26). The resulting mass of woven bone is known as myositis ossificans traumatica. This can occur without obvious skeletal injury and after only minor muscle trauma.

4.6.4.6 Post-mortem changes and taphonomy

Taphonomy is the study of the circumstances and events involving an organism from the time of its death until it is studied (Simpson 1984). It is important to distinguish traumatic lesions, in particular peri-mortem trauma, from post-depositional changes such as animal activity, the effect of the burial environment and post-mortem breakage. Carnivores puncture bones with their canines or crush them, while rodents scrape the surface of an exposed bone and these often occur as a series of distinctive parallel grooves. While the scraping marks left by rodents' teeth differ from cut marks made by a knife it is possible to confuse a single tooth scrape with peri-mortem trauma (Sauer 1998, 324). Rodents may carry the small bones of the hands and feet short distances away (Hagland *et al.,* 1998, 1999; Sledzik 1998, 114), which means that defensive wounds to the former are likely to be missed.

Bone surfaces that have been buried (virtually all archaeological material) eventually become stained and, although surfaces are differentially affected there is usually a sharp gradient of colour from the surface to internal bone after staining, therefore, newly broken bone, perhaps damaged during recovery often presents a dramatic colour differential when compared to the original exposed surface (Sauer 1998, 325).

4.6.4.7 Pseudo-trauma

It is always necessary to exclude the artefactual when making palaeopathological diagnoses (Boylston 2000, 359; Boylston 2000, 359). The difference between peri-mortem and post-mortem cranial fractures is well described by Buikstra and Ubelaker (1994, 103-6) who drew attention to the squareness of the breakage pattern that affects dry bone once the collagen element has decreased leaving a brittle framework. At Ridgeway Hill, Weymouth, Dorset (Loe *et al.,* 2014, 125, fig. 3.87, tab. 3.48), 11 skeletons had lesions that shared some characteristics with peri-mortem wounds but were ultimately classified as probable post-mortem changes which could have occurred soon after deposition and before the organic matrix of the bones had completely decomposed. In part this conclusion was based on a study of the location of the lesions as many were not in anatomically plausible locations (for example in the hip and on the front of the spine).

4.6.4.8 The aetiology of injuries

The identification of osteological evidence for interpersonal violence as distinct from accidental injuries is not necessarily as straightforward as some have suggested (see e.g. Jurmain 1997, 187, quoting Merbs 1989, 187). Merbs takes a cautionary approach to behavioural interpretation of skeletal trauma: 'Serious problems may arise in distinguishing between intentional and accidental bone damage, and even when damage is convincingly intentional, the actual intent may not be obvious.' Yet Merbs lists without comment, a variety of different types of fractures with names which ostensibly imply behavioural associations including boxer's (metacarpal), grenade thrower's (humerus), hangman's (first cervical vertebra), parry (ulna) and sprinter's (anterior superior and inferior iliac spines). Jurmain comments (ibid.) that 'these imaginative proposals should be treated with scepticism.' Lesions produced through acts of violence may in fact be very similar to those produced by accident (Ferguson 1997, 321-355; Krener and Sauvageau 2009).

Cranial trauma is more likely to be the result of violence than post-cranial fractures. Even when considering that not every violence-related injury will result in osseous changes, cranial trauma patterns remain a very good indicator of interpersonal violence within a population (Fibiger 2012, 186; Jennet 1996; Murray *et al.,* 1996). Post-cranial violence-related injuries may characteristically affect the ribs, scapula blade and forearm (Brickley and Smith 2006; Judd 2008).

Fibiger (2012, 180) highlighted the wealth of clinical and forensic data from documented cases of violent and accidental trauma which assist in the recognition of distinct blunt-force, sharp-force and projectile trauma patterns typical for, or associated with, intentional violence and assault (Bostrum 1997; Brink *et al.,* 1998; Brown and Civil 1993; Danielsen *et al.,* 1989; Kjaerulff *et al.,* 1989; Shepherd *et al.,* 1990). These can be compared with archaeological cases to help determine the aetiology of a given archaeological traumatic lesion (Fibiger 2012, 181).

Cut marks on bone are definitive and direct evidence of human involvement or interference (Houck 1998, 413; Shipman and Rose 1983) since ‘no process has yet been discovered which produces marks that mimic slicing, chopping or scraping marks on a microscopic level’ (Shipman 1982, 577).

CHAPTER 5: RESULTS: THE OSTEOLOGICAL DATASET

"The cemetery [Parkburn Quarry, Lasswade] must represent the burial ground of a nearby civilian settlement [settlements], living under peaceful conditions, and presumably agriculturalists." (Henshall 1957, 260).

5.1 INTRODUCTION

This chapter presents a detailed synthesis of the results of the osteological analysis of the study group which incorporates quantification, MNI, assemblage composition, demography, age, sex, metric and non-metric analysis. Appendix 5.1 is a detailed catalogue of all available osteological and archaeological data for the human remains in the study group. The main focus of this research is on the osteological evidence for violence, therefore, while all the human remains have been subjected to full osteological and pathological analysis, all other pathological evidence is discussed in summary form. Future work will focus on detailed publication of this dataset.

5.2 SCIENTIFIC ANALYSES

Scientific applications in osteoarchaeology are not new and continue to advance rapidly. For example, the introduction of next generation sequencing in aDNA which has presented greater opportunities to sex skeletons (eg non-adults) that cannot be osteologically sexed, to identify 'invisible diseases and to explore genetic ancestry and relatedness' (Loe 2020, 7). All sampling, however, is destructive and therefore raises ethical issues (APABE 2013). There is a pressing need for clear and readily available documentation of which skeletons have been sampled, whatever the purpose, to avoid duplication by multiple researchers. The recent publication on aDNA sampling in Scotland has gone some way to resolving this issue (Sheridan *et al.,* 2019).

5.2.1 Radiocarbon dating

A total of 86 skeletons from within the study group have been radiocarbon dated at various different times over the years, many under the auspices of the NMS dating programme. Dated skeletons are identified in the relevant catalogue entries and details can be found in Appendix 5.2. It is clear that in some cases significant quantities of human bone were destroyed for radiocarbon dating in the past, e.g., Catstane, Four Winds and Thornybank. Now it is possible to acquire radiocarbon dates with much smaller quantities of bone. At the time of writing radiocarbon dates are awaited for the Isle of May skull 959 and Ringleyhall ex. 1972. Both skulls exhibit peri-mortem sharp-force trauma and samples have been taken for aDNA analysis. Skull EUAD IB250 from one of the caves at Wemyss was radiocarbon dated as part of this research because it exhibits severe ante-mortem blunt-force trauma and the results were unexpected (see below).

5.2.2 aDNA analyses

A total of 26 skeletons from the study group have been sampled for aDNA analyses by several different researchers. Sampled skeletons are identified in the relevant catalogue entries (Appendix 5.1). Very little in the way of detailed results has been published to date. However, an important summary round-up of all Scottish samples up to January 2019 has been published online (Sheridan *et al.,* 2019). Since then, and in collaboration with this research, a further 10 skeletons have been sampled by Dr Tom Booth as part of his ‘A thousand ancient genomes project’. Appendix 5.3 contains a summary table of all the skeletons that have been sampled and results where they are available. Preliminary aDNA results have demonstrated that the Easter Ferrygate skeleton 2 is a prime adult male (it was osteologically unsexed), Lasswade skeleton 8b is an adult female (it was osteologically indeterminate), and Yarrow Kirk is an adult female (it was osteologically male). Cramond 1 has been confirmed as genetically male while Cramond 2 has been confirmed as genetically female.

5.2.2 Isotope analyses

A total of 60 skeletons have been sampled for isotope analysis. This includes nine adults from Cramond as part of this research (Czére *et al.,* forthcoming). Details can be found in Appendix 5.4 and are discussed in relevant sections of the thesis.

5.2.4 XRF and SEM analyses

As part of this research, three fragments of skulls with sword cuts from the Isle of May (skeleton 859 with ante-mortem sharp-force trauma and Isle of May skeleton 959 and Kirkliston Catstane with peri-mortem sharp-force trauma) were subjected to compositional analysis using X-ray fluorescence spectrometry and electron microprobe analysis at the National Museums Scotland science laboratory (by Dr Lore Troalen, NMS) to investigate whether there are traces of iron left on the cut surfaces from the weapons used in the attack.

The results were inconclusive. While there were minor differences in the iron level between the cut surfaces and elsewhere on the skull fragments, there was no significant difference. Iron is a notoriously mobile element, and an iron signal can come from more than one source: it can be present in the soil within the grave, for example, and so its presence does not necessarily relate to residue left by a weapon. While the results were disappointing, it was deemed to be worthwhile to carry out the analysis, since a positive signal would have been significant. Further details can be found in Appendix 5.5.

5.2.5 Computed tomography and 3-D printing

CT scanning has been carried out on two skulls (Wemyss Cave and Lundin Links 3) details of which can be found in Appendix 5.5.

5.2.6 Facial reconstruction

Digital facial reconstructions were made of four skulls from Cramond (1, 4, 5 and 7) as part of an exhibition entitled ‘Dark goings on in Cramond’ which ran from October 2015 to February 2016 at the Museum of Edinburgh under the auspices of John Lawson, Edinburgh City Archaeologist. The reconstructions were created by Hayley Fisher, a former student at the University of Dundee, now a forensic artist. A facial reconstruction of Lundin Links skull IB212A was produced by Liselotte Hartcamp as part of a dissertation for the MSc in Forensic Art and Facial Reconstruction at the University of Dundee (Hartcamp 2019). Further details can be found in Appendix 5.7.

5.3 OSTEOLOGICAL ANALYSIS

5.3.1 Introduction

The osteological and palaeopathological data for the entire study group is summarised in Table A5.1 (see Appendix 5.1). A full record for each individual skeleton can be found in the catalogue which forms Appendix 5.1. The osteological evidence for violence and trauma is presented in Chapter 7. This is followed by a summary discussion of all other pathological evidence.

5.3.2 Minimum number of individuals (MNI)

A count of the ‘minimum number of individuals’ (MNI) recovered from a cemetery is carried out as standard procedure in osteological reports on inhumations to establish how many individuals are represented. The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements recovered. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons which would have been interred, rather, it represents the minimum number of individuals which can be scientifically proven to be present.

It was common practice in the 19th century, and to a lesser extent the early 20th, to retain only skulls from archaeological contexts (e.g. Turner 1903; 1914-15). This is a reflection of the preoccupation with metric analyses and skull morphology. For this reason the MNI count is based on the right occipital which gives a total for the study group of 173. The MNI count for individual sites appears in Table 5.1 below.

Table 5.1: MNI for individual sites within study group

Site name	MNI	% of total MNI (n=173)
Arniston skeleton IB202 (1863)	1	0.58
Broxmouth skeleton 4	1	0.58
Catstane (Kirkliston) skull ET34	1	0.58
Craig's Quarry skeletons 56/9 IB265A	2	1.16
Cramond skulls 1, 3, 4, 5, 6, 7, 8	7	4.05
Dryburn Bridge skeletons 1, 2, 3	3	1.73
Dunbar, 2 Clyde Villas skeleton ex. 1972	1	0.58
Dunbar skull 44.1	1	0.58
Dunbar skull 55.2	1	0.58
Dunbar skull IB226	1	0.58
Dunbar Kirkhill Braes skull IB262	1	0.58
Dunbar Kirkhill skull ET36	1	0.58
Dunbar Winterfield Mains skull IB210	1	0.58
East Fortune skeletons 2, 3	2	1.16
Easter Ferrygate Gardens skeleton 4	1	0.58
Four Winds skeletons 1, 2, 3, 4, 10, 14, 15, 16	8	4.62
Gogarburn Hospital skull 55.22	1	0.58
Gullane Golf Course 37.1, skeletons 1, 2, 3, 4, 5	6	3.47
Isle of May skeletons 815, 820, 832, 859, 864, 867, 885, 887, 888, 955, 957, 959, 967, 970, 971A, 975, 980, 981, 985, 987, 997, 999, 1022, 1030	24	13.87
Logan Cottage skeleton ex. 1968	1	0.58
Longniddry skeletons 34/1 (x 2)	2	1.16
Longniddry Golf Course skull 48/4	1	0.58
Lundin Links/Lundy (pre-1960s) skulls IB212 (14), IB212B, IB212C (12), IB225, ET1, ET2, ET3, Lundy no number	8	4.6
Lundin Links (1960s) skeletons 1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 18, 19, 20, 21, Puff	18	10.4
Marine Villa skeleton DB 1990/36	1	0.58
Milton, Tranent skull ET11	1	0.58
North Berwick Beach Road skeleton 33.1	1	0.58
Parkburn Quarry, Lasswade skeletons 1, 2, 4, 6, 7, 8a, 8b, 10, 12, 13, 14, 15, 16, 19, 24, 26, 29, 30, 31, 33, 34, 35, 37, 39, 43, 44, 45, 46, 49, 53, 55, 59, 60, 62, 79, sk. Associated with Roman stones, sk. 0	37	21.39
Polmood skeleton no number	1	0.58
Ringleyhall skeleton ex. 1972	1	0.58
Seacliffe 56/11 x 3 (2 skeletons, 1 skull), 1954 1 fragmented skull, skulls S56/11, S56/11A, skull and mandible no number, skull ET81	8	4.62
Seacliffe Mausoleum skulls A, B and C	3	1.73
Stonelaws skulls ET8, ET9, ET10	3	1.73
Thornybank skeletons 2, 4, 9, 10, 18, 25, 27, 33, 35, 37, 44, 45, 46, 47, 53, 54, 55, 60, 67, 68, 72, 99	22	12.72
Yarrow Kirk skull ET40	1	0.58
Total	173	100.01

A breakdown by age and sex for all the remains within the MNI count appears in Table 5.2 below. Adults are the most commonly represented age group (155/173, 89.6%) with only a small proportion of non-adults (18/173, 10.4%). The non-adults comprise two neonates, one infant, two younger juveniles, four older juveniles, two older juveniles or adolescents, six adolescents and one non-adult. Adult males (73/173, 42.19%) are the most commonly represented sub-group followed by adult females (44/173, 25.43%) probable male adults (16/173, 9.25%), unsexed adults (12/173, 5.94%), probable females (8/173, 4.62%) and adults of indeterminate sex (2/173, 1.16%).

Table 5.2: Breakdown by age and sex, entire study group (n=173)

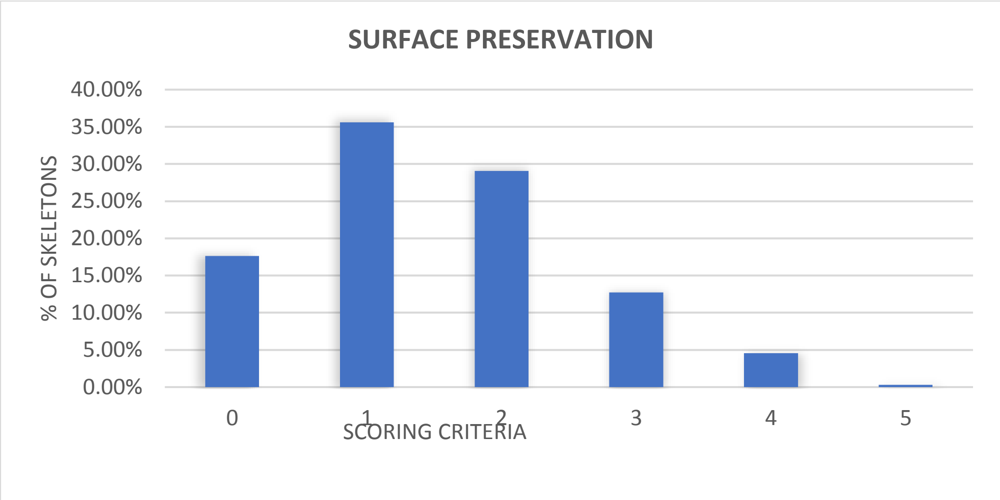
Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	N-A	%	Total	%
N.	0	0	0	0	0	0	0	0	0	0	0	0	2	1.16	2	1.16
In.	0	0	0	0	0	0	0	0	0	0	0	0	1	0.58	1	0.58
YJ	0	0	0	0	0	0	0	0	0	0	0	0	2	1.16	2	1.16
OJ	0	0	0	0	0	0	0	0	0	0	0	0	4	2.31	4	2.31
OJ/adol.	0	0	0	0	0	0	0	0	0	0	0	0	2	1.16	2	1.16
Adol.	1	0.58	0	0	0	0	0	0	0	0	0	0	5	2.89	6	3.47
NA	0	0	0	0	0	0	0	0	0	0	0	0	1	0.58	1	0.58
YA	10	5.78	2	1.16	9	5.2	3	1.73	0	0	0	0	0	0	24	13.87
PA	27	15	2	1.16	13	7.5	0	0	0	0	0	0	0	0	42	24.28
MA	11	5.36	0	0	7	4.05	0	0	0	0	0	0	0	0	18	10.4
OA	13	7.51	0	0	4	2.31	0	0	0	0	2	1.16	0	0	19	10.98
A	11	5.94	12	5.94	11	5.94	5	2.89	12	8.09	0	0	0	0	52	30.05
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	73	42.19	16	9.25	44	25.43	8	4.62	12	8.09	2	1.16	17	9.83	173	100

Key: N = neonate (birth-1 month); In. = infant (1-12 months); YJ = younger juvenile (1-5 years); OJ = older juvenile (6-12 years); Adol. = adolescent (13-17 years); NA = non-adult (<18 years); YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

5.3.3 Surface preservation

The scores for the study group are presented in Figure 5.1 and Table 5.3 below. Where surface preservation was variable throughout an individual skeleton, the condition of most of the skeleton was taken as the preservation grade for the entire skeleton.

Figure 5.1: Surface preservation by percentage for the study group (n=306)



Just over half of the skeletons exhibited good surface preservation, scored as either grade 0 (54/306, 17.65%) or grade 1 (109/306, 35.62%). Most of these came from Lundin Links and the Isle of May although completeness was compromised at the latter site by the extent of intercutting and grave re-use.

Table 5.3: Surface preservation expressed as a percentage (n=306)

Surface preservation	Skeletons affected
0	54 (17.65%)
1	109 (35.62%)
2	89 (29.08%)
3	39 (12.75%)
4	14 (4.58%)
5	1 (0.32%)
Total	306 (100%)

Inter-and intra-site variability was identified, particularly among the larger assemblages such as the Isle of May, Lundin Links, Parkburn Quarry, Lasswade, Thornybank and Four Winds (see Table 5.4 below). Preservation at Catstane was particularly poor. Reasonable surface preservation among much of the study group, however, enabled the observation of subtle changes such as periostitis and abnormal porosity.

Table 5.4: Surface preservation by site (n=306)

Surface preservation	0	%	1	%	2	%	3	%	4	%	5	%	Total	%
Arniston (n=1)	0	0	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Broxmouth (n=1)	0	0	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Catstane (n=13)	0	0	2	0.66	5	1.63	6	1.96	0	0	0	0	13	4.25
Craig's Quarry (n=2)	1	0.33	1	0.33	0	0	0	0	0	0	0	0	2	0.66
Cramond (n=9)	2	0.66	4	1.32	2	0.66	1	0.33	0	0	0	0	9	2.94
Dryburn Bridge (n=3)	0	0	1	0.33	1	0.33	0	0	1	0.33	0	0	4	1.32
Dunbar, 2 Clyde Villas (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	0	0
Dunbar 44.1 (n=1)	0	0	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Dunbar 55.2 (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Dunbar IB226 (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Dunbar, Kirkhill Braes (n=2)	0	0	0	0	2	0.66	0	0	0	0	0	0	2	0.66
Dunbar, Winterfield Mains (n=1)	0	0	1	0.33	0	0	0	0	0	0	0	0	1	0.33
East Fortune (n=3)	0	0	0	0	2	0.66	1	0.33	0	0	0	0	3	0.98
Easter Ferrygate Gardens (n=2)	0	0	2	0.66	0	0	0	0	0	0	0	0	2	0.66
Four Winds (n=21)	3	0.98	5	1.63	13	4.25	0	0	0	0	0	0	21	5.86
Gogarburn (n=1)	0	0	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Sands (n=1)	0	0	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Golf Course (n=6)	1	0.33	2	0.66	1	0.33	2	0.66	0	0	0	0	6	1.96
Isle of May (n=55)	12	3.92	36	11.76	6	1.96	0	0	1	0.33	0	0	55	17.97
Logan Cottage (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Long Craigs, Dunbar (n=1)	0	0	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Longniddry (n=2)	0	0	2	0.66	0	0	0	0	0	0	0	0	2	0.66
Longniddry Golf Course (n=1)	0	0	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Lundin Links (n=33)	11	3.59	17	5.55	4	1.31	1	0.33	0	0	0	0	33	10.78
Marine Villa, Archerfield (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Milton, Tranent (n=2)	0	0	1	0.33	1	0.33	0	0	0	0	0	0	2	0.66
North Berwick, Beach Road (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Northfield Farm, Cousland (n=1)	0	0	0	0	0	0	0	0	1	0.33	0	0	1	0.33
Parkburn Quarry, Lasswade (n=49)	5	1.63	10	3.27	22	7.19	10	3.27	2	0.66	0	0	49	15.01

Surface preservation	0	%	1	%	2	%	3	%	4	%	5	%	Total	%
Penicuik (n=1)	0	0	0	0	1	0.33	30	9.8	0	0	0	0	1	0.66
Polmood (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.66
Ringleyhall (n-1)	0	0	0	0	1	0.66	0	0	0	0	0	0	1	0.66
Seacliffe (n=10)	5	1.63	2	0.66	3	0.98	0	0	0	0	0	0	10	3.27
Seacliffe Mausoleum (n=10)	5	1.63	5	1.63	0	0	0	0	0	0	0	0	10	3.27
Stonelaws (n=3)	0	0	3	0.98	0	0	0	0	0	0	0	0	3	0.98
Thornybank (n=62)	1	0.33	11	3.59	22	7.19	18	5.88	9	2.94	1	0.33	62	20.26
Yarrow Kirk (n=1)	1	0.33	0	0	0	0	0	0	0	0	0	0	1	0.33
Total	54	17.65	109	35.62	89	29.08	39	12.75	14	4.58	1	0.33	306	100

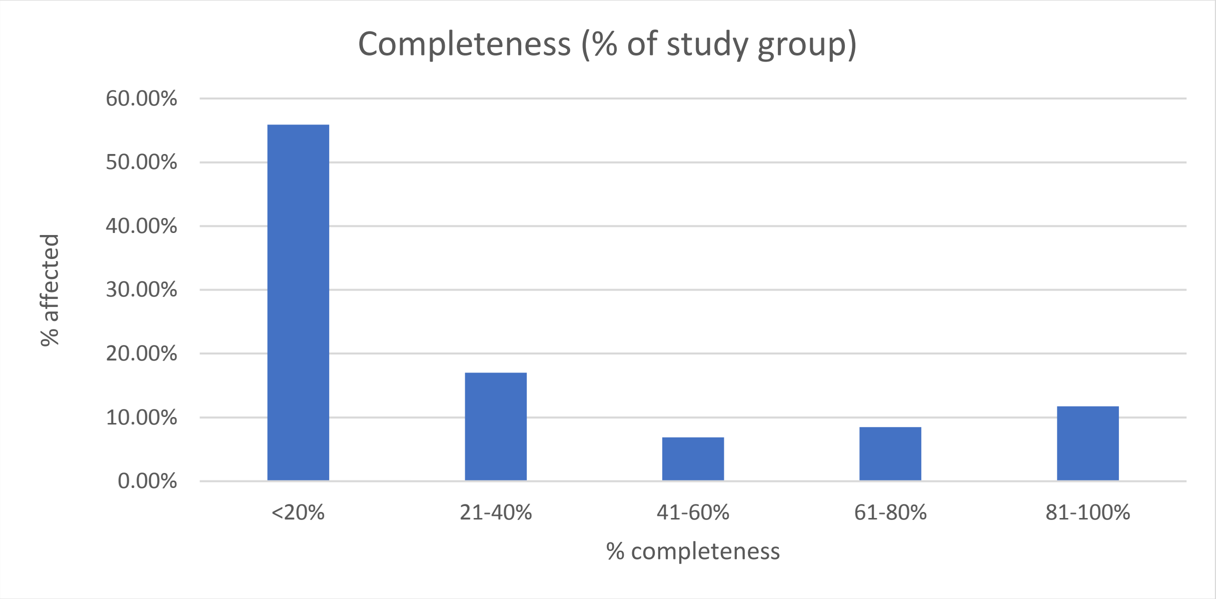
It was common practice in the 19th century, and to a lesser extent the early 20th century, to apply consolidant, which was often animal–based, and on occasion applied over unwashed bone surfaces and on dentition. This has implications for scientific analyses such as radiocarbon dating, aDNA, and isotope analysis. Most of the skeletons in the study group are unwashed with a small number of skulls remaining in soil blocks. Excavation was attempted where possible, although it was not possible to wash human remains. Reconstruction of skulls from Lundin Links and Cramond had been attempted with questionable results. Skulls and mandibles at Cramond were also glued together.

Much of the material recovered in the 19th century is better preserved than that which was more recently excavated. This raises potential questions about the effects of recent environmental pollution on buried archaeological remains. A similar variation in preservation has apparently been observed in some metal artefacts (Fraser Hunter pers. comm.). There is scope for future consideration of this observation.

5.3.4 Completeness

Data on completeness of individual skeletons appears in Figure 5.2 and Table 5.5).

Figure 5.2: Completeness expressed as a percentage of the study group (n=306)



The figure for the less than 20% category (171/306, 55.88%) is skewed by the predilection in the 19th and early 20th century for retaining only skulls and mandibles so is not an accurate reflection of bone survival in many cases. The number of skeletons in this category is further inflated by the fact that the post-cranial remains of the adult skeletons and the neonatal skeletons from Cramond Roman bath-house, alongside selected skeletons from Lundin Links had become mixed at some point after excavation and were therefore treated as disarticulated for the purposes of this research.

Table 5.5: Completeness of the entire assemblage (n=306)

% completeness	No. of skeletons
<20%	171 (55.88%)
21-40%	52 (15.99%)
41-60%	21 (5.86%)
61-80%	26 (8.5%)
81-100%	36 (11.76%)
Total	306 (100%)

Completeness of skeletons has obvious implications for the level of information that can be recovered, particularly when combined with the general level of fragmentation and of surface preservation. Data on completeness by individual site within the study group appears in Table 5.6 below.

Table 5.6: Completeness by individual site (n=306)

Site name	<20%	%	21-40%	%	41-60%	%	61-80%		81-100%	%	Total	%
Arniston (n=1)	0	0	0	0	1	0.33	0	0	0	0	1	0.33
Broxmouth (n=1)	0	0	0	0	0	0	0	0	1	0.33	1	0.33
Catstane (n=13)	13	4.25	0	0	0	0	0	0	0	0	13	4.25
Craig's Quarry (n=2)	1	0.33	0	0	0	0	1	0.33	0	0	2	0.66
Cramond (n=9)	9	2.94	0	0	0	0	0	0	0	0	9	2.94
Dryburn Bridge (n=3)	0	0	1	0.33	1	0.33	0	0	1	0.33	3	0.98
Dunbar, 2 Clyde Villas (n=1)	0	0	0	0	0	0	0	0	1	0.33	1	0.33
Dunbar 44.1 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar 55.2 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar IB226 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar, Kirkhill Braes (n=2)	1	0.33	1	0.33	0	0	0	0	0	0	2	0.66
Dunbar, Winterfield Mains (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
East Fortune (n=3)	0	0	0	0	1	0.33	2	0.66	0	0	3	0.98
Easter Ferrygate Gardens (n=2)	0	0	0	0	2	0.66	0	0	0	0	2	0.66
Four Winds (n=21)	13	4.25	7	2.29	1	0.33	0	0	0	0	21	5.86
Gogarburn (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Sands (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Golf Course (n=6)	1	0.33	0	0	0	0	0	00	5	1.63	6	1.96
Isle of May (n=55)	19	5.2	11	3.59	4	1.31	9	2.94	12	3.92	55	17.97
Logan Cottage (n=1)	0	0	0	0	0	0	1	0.33	0	0	1	0.33
Long Craigs, Dunbar (n=1)	0	0	0	0	1	0.33	0	0	0	0	1	0.33
Longniddry (n=2)	0	0	1	0.33	1	0.33	0	0	0	0	2	0.66
Longniddry Golf Course (n=1)	0	0	0	0	0	0	1	0.33	0	0	1	0.33
Lundin Links (n=33)	18	5.88	2	0.66	1	0.33	1	0.33	11	3.59	33	10.78
Marine Villa, Archerfield (n=1)	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Milton, Tranent (n=2)	2	0.66	0	0	0	0	0	0	0	0	2	0.66
North Berwick, Beach Road (n=1)	0	0	0	0	1	0.66	0	0	0	0	1	0.33
Northfield Farm, Cousland (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Parkburn Quarry, Lasswade (n=49)	29	9.48	11	3.59	6	1.96	2	0.66	1	0.33	49	15.01
Penicuik (n=1)	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Polmood (n=1)	0	0	0	0	0	0	0	0	1	0	1	0.33

Site name	<20%	%	21-40%	%	41-60%	%	61-80%		81-100%	%	Total	%
Ringleyhall (n-1)	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Seacliffe (n=10)	7	2.29	0	0	0	0	1	0.33	2	0.66	10	3.27
Seacliffe Mausoleum (n=10)	10	3.27	0	0	0	0	0	0	0	0	10	3.27
Stonelaws (n=3)	3	0.98	0	0	0	0	0	0	0	0	3	0.98
Thornybank (n=62)	38	12.42	14	4.58	1	0.33	8	2.61	1	0.33	62	20.26
Yarrow Kirk (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Total	172	55.21	51	15.66	21	5.86	26	8.49	36	11.76	306	100

5.3.5 Element representation

Table 5.7 provides a summary of skeletal elements present within the study group.

Table 5.7: Summary table of elements present (n=306)

Elements present	No. of skeletons	% of study group
Skull and post-cranial skeleton	127	41.5%
Skull and/or mandible only	105	34.31%
Post-cranial	72	23.53%
Nothing identifiable	2	0.65%
Total	306	100%

The figure for skull and/or mandible only is artificially inflated by the retention policies of the 19th century. A detailed breakdown of cranial element representation appears in Table 5.8 below. The bones of the cranial vault are most commonly represented.

Table 5.8: Cranial element representation (includes mandible, thyroid and hyoid)

Cranial element	Total present	Total possible	% TPR
r. frontal	150	306	49.02
l. frontal	148	306	48.37
r. orbit	97	306	31.70
l. orbit	95	306	31.05
r. parietal	167	306	54.58
l. parietal	166	306	54.25
r. occipital	173	306	55.54
l. occipital	171	306	55.88
r. temporal	158	306	51.63
l. temporal	159	306	51.96
r. nasal	65	306	21.24
l. nasal	63	306	20.59
r. maxilla	116	306	37.91

Cranial element	Total present	Total possible	% TPR
l. maxilla	111	306	35.27
r. maxillary sinus	85	306	27.78
l. maxillary sinus	81	306	25.47
r. zygomatic	90	306	29.41
l. zygomatic	87	306	28.43
r. palatine	72	306	23.53
l. palatine	70	306	22.88
r. sphenoid	106	306	34.64
l. sphenoid	104	306	33.99
r. ethmoid	41	306	13.40
l. ethmoid	38	306	12.42
r. lacrimal	40	306	13.07
l. lacrimal	38	306	12.42
r. mandible	147	306	48.04
l. mandible	145	306	47.39
r. hyoid	24	306	7.84
l. hyoid	24	306	7.84
r. thyroid	5	306	1.63
l. thyroid	5	306	1.63
Total	3041	9792	31.06

Data on post-cranial element representation appears in Table 5.9 below. The remains of nine post-cranial skeletons and five neonates from Cramond are excluded along with Lundin Links 11 because of mixing at some point after excavation.

Table 5.9: *Post-cranial element representation, crude prevalence rate (CPR)*

Bone	No. present	% present
r. scapula	73/306	23.86
l. scapula	69/306	22.55
r. clavicle	64/306	20.92
l. clavicle	69/306	22.55
Manubrium	34/306	11.11
Sternum	37/306	12.09
Xiphoid	15/306	4.9
r. humerus	92/306	30.07
l. humerus	86/306	28.10
r. radius	89/306	29.08
l. radius	80/306	25.14
r. ulna	84/306	27.45
l. ulna	79/306	25.82
r. capitate	38/306	12.42
l. capitate	36/306	11.76

Bone	No. present	% present
r. hamate	33/306	10.78
l. hamate	36/306	11.76
r. lunate	37/306	12.09
l. lunate	32/306	10.46
r. pisiform	14/306	4.58
l. pisiform	20/306	5.54
r. scaphoid	33/306	10.78
l. scaphoid	43/306	14.05
r. trapezoid	26/306	8.5
l. trapezoid	33/306	10.78
r. trapezium	22/306	7.19
l. trapezium	27/306	8.82
r. triquetral	21/306	5.86
l. triquetral	24/306	7.84
r. 1st metacarpal	47/306	15.36
r. 2nd metacarpal	47/306	15.36
r. 3rd metacarpal	44/306	14.38
r. 4th metacarpal	44/306	14.38
r. 5th metacarpal	42/306	13.73
l. 1st metacarpal	51/306	15.67
l. 2nd metacarpal	47/306	15.36
l. 3rd metacarpal	46/306	15.03
l. 4th metacarpal	45/306	14.71
l. 5th metacarpal	39/306	12.75
r. 1st proximal phalanx	44/306	14.38
r. 2nd proximal phalanx	42/306	13.73
r. 3rd proximal phalanx	45/306	14.71
r. 4th proximal phalanx	42/306	13.73
r. 5th proximal phalanx	38/306	12.42
l. 1st proximal phalanx	40/306	13.07
l. 2nd proximal phalanx	44/306	14.38
l. 3rd proximal phalanx	47/306	15.36
l. 4th proximal phalanx	50/306	15.34
l. 5th proximal phalanx	42/306	13.73
r. 2nd intermediate phalanx	37/306	12.09
r. 3rd intermediate phalanx	34/306	11.11
r. 4th intermediate phalanx	39/306	12.75
r. 5th intermediate phalanx	33/306	10.78
l. 2nd intermediate phalanx	36/306	11.76
l. 3rd intermediate phalanx	34/306	11.11
l. 4th intermediate phalanx	33/306	10.78
l. 5th intermediate phalanx	42/306	13.73
r. 1st distal phalanx	24/306	7.84
r. 2nd distal phalanx	20/306	5.54
r. 3rd distal phalanx	27/306	8.82
r. 4th distal phalanx	26/306	8.5
r. 5th distal phalanx	23/306	7.52

Bone	No. present	% present
l. 1st distal phalanx	26/306	8.5
l. 2nd distal phalanx	20/306	5.54
l. 3rd distal phalanx	23/306	7.52
l. 4th distal phalanx	21/306	5.86
l. 5th distal phalanx	23/306	7.52
r. pelvis	95/306	31.05
l. pelvis	94/306	30.72
r. femur	122/306	39.87
l. femur	113/306	35.93
r. tibia	106/306	34.64
l. tibia	100/306	32.68
r. fibula	83/306	27.12
l. fibula	76/306	24.84
r. calcaneus	79/306	25.82
l. calcaneus	71/306	23.20
r. talus	74/306	24.18
l. talus	68/306	22.22
r. cuboid	50/306	15.34
l. cuboid	45/306	14.71
r. navicular	56/306	18.30
l. navicular	53/306	17.32
r. medial cuneiform	55/306	17.97
l. medial cuneiform	53/306	17.32
r. intermediate cuneiform	43/306	14.05
l. intermediate cuneiform	42/306	13.73
r. lateral cuneiform	45/306	14.71
l. lateral cuneiform	41/306	13.40
r. 1st metatarsal	51/306	15.67
r. 2nd metatarsal	44/306	14.38
r. 3rd metatarsal	47/306	15.36
r. 4th metatarsal	44/306	14.38
r. 5th metatarsal	38/306	12.42
l. 1st metatarsal	43/306	14.05
l. 2nd metatarsal	37/306	12.09
l. 3rd metatarsal	39/306	12.75
l. 4th metatarsal	38/306	12.42
l. 5th metatarsal	38/306	12.42
r. 1st proximal phalanx	39/306	12.75
r. 2nd proximal phalanx	31/306	10.13
r. 3rd proximal phalanx	28/306	9.15
r. 4th proximal phalanx	33/306	10.78
r. 5th proximal phalanx	29/306	9.48
l. 1st proximal phalanx	43/306	14.05
l. 2nd proximal phalanx	20/306	5.54
l. 3rd proximal phalanx	22/306	7.19
l. 4th proximal phalanx	22/306	7.19
l. 5th proximal phalanx	19/306	5.21

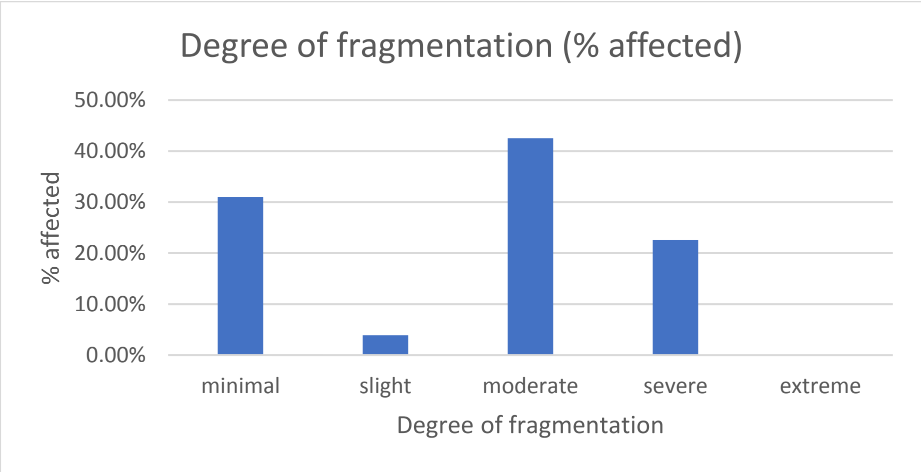
Bone	No. present	% present
r. 2nd intermediate phalanx	14/306	4.58
r. 3rd intermediate phalanx	15/306	4.9
r. 4th intermediate phalanx	15/306	4.9
r. 5th intermediate phalanx	14/306	4.58
l. 2nd intermediate phalanx	14/306	4.58
l. 3rd intermediate phalanx	12/306	3.92
l. 4th intermediate phalanx	14/306	4.58
l. 5th intermediate phalanx	12/306	3.92
r. 1st distal phalanx	26/306	8.5
r. 2nd distal phalanx	11/306	3.59
r. 3rd distal phalanx	9/306	2.94
r. 4th distal phalanx	13/306	4.25
r. 5th distal phalanx	12/306	3.92
l. 1st distal phalanx	22/306	7.19
l. 2nd distal phalanx	9/306	2.94
l. 3rd distal phalanx	9/306	2.94
l. 4th distal phalanx	10/306	3.27
l. 5th distal phalanx	10/306	3.27
CV1	76/306	24.84
CV2	78/306	25.49
CV3	58/306	18.95
CV4	55/306	17.97
CV5	58/306	18.95
CV6	52/306	15.99
CV7	51/306	15.67
TV1	49/306	15.01
TV2	46/306	15.03
TV3	47/306	15.36
TV4	47/306	15.36
TV5	50/306	15.34
TV6	53/306	17.32
TV7	54/306	17.65
TV8	52/306	15.99
TV9	55/306	17.97
TV10	59/306	19.28
LV1	66/306	21.57
LV2	67/306	21.90
LV3	67/306	21.90
LV4	69/306	22.55
LV5	68/306	22.22
S1	79/306	25.82
S2	65/306	21.24
S3	56/306	18.30
S4	52/306	15.99
S5	47/306	15.36
Coccyx	19/306	5.21
r. ribs	602/3672	15.39

Bone	No. present	% present
l. ribs	583/3672	15.88
Total	8043/54774	14.68%

5.3.6 Fragmentation

Data on fragmentation appears in Figure 5.3 and Table 5.10 below.

Figure 5.3: Fragmentation, entire assemblage (n=306)



The majority of skeletons had moderate fragmentation (130/306, 42.48%); almost one third of skeletons fell into the minimal category (95/306, 31.05%) with almost a quarter severely fragmented (69/306, 22.55%).

Table 5.10: Fragmentation (n=306)

Degree of fragmentation	No. of skeletons
Minimal	95 (31.05%)
Slight	12 (3.92%)
Moderate	130 (42.48%)
Severe	69 (22.55%)
Extreme	0 (0%)
Total	306 (100%)

Fragmentation was most severe at Thornybank (33/62, 10.78%) followed by Parkburn Quarry, Lasswade (17/49, 5.55%), Catstane (9/13, 2.94%), and Four Winds (7/21, 2.29%). The lowest level of fragmentation was at Lundin Links (27/33, 8.82%) and the Isle of May (20/55, 5.54%) (see Table 5.11 below).

Table 5.11: Fragmentation by individual site (n=306)

	Minimal	%	Slight	%	Moderate	%	Severe	%	Extreme	%	Total	
Arniston (n=1)	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Broxmouth (n=1)	0	0	1	0.33	0	0	0	0	0	0	1	0.33
Catstane (n=13)	1	0.33	0	0	3	0.98	9	2.94	0	0	13	4.25
Craig's Quarry (n=2)	2	0.66	0	0	0	0	0	0	0	0	2	0.66
Cramond (n=9)	1	0.33	1	0.33	6	1.96	1	0.33	0	0	9	2.94
Dryburn Bridge (n=3)	0	0	0	0	3	0.98	0	0	0	0	3	0.98
Dunbar, 2 Clyde Villas (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar 44.1 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar 55.2 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar IB226 (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Dunbar, Kirkhill Braes (n=2)	1	0.33	0	0	1	0.33	0	0	0	0	2	0.66
Dunbar, Winterfield Mains (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
East Fortune (n=3)	0	0	2	0.66	1	0.33	0	0	0	0	3	0.98
Easter Ferrygate Gardens (n=2)	0	0	0	0	2	0.66	0	0	0	0	2	0.66
Four Winds (n=21)	2	0.66	0	0	12	3.92	7	2.29	0	0	21	5.86
Gogarburn (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Sands (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Gullane Golf Course (n=6)	6	1.96	0	0	0	0	0	0	0	0	6	1.96
Isle of May (n=55)	20	5.54	2	0.66	33	10.78	0	0	0	0	55	17.97
Logan Cottage (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Long Craigs, Dunbar (n=1)	0	0	0	0	1	0.33	0	0	0	0	1	0.33

	Minimal	%	Slight	%	Moderate	%	Severe	%	Extreme	%	Total	
Longniddry (n=2)	2	0.66	0	0	0	0	0	0	0	0	2	0.66
Longniddry Golf Course (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Lundin Links (n=33)	27	8.82	0	0	6	1.96	0	0	0	0	33	10.78
Marine Villa, Archerfield (n=1)	0	0	0	0	1	0.33	0	0	0	0	1	0.33
Milton, Tranent (n=2)	1	0.33	0	0	1	0.33	0	0	0	0	2	0.66
North Berwick, Beach Road (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Northfield Farm, Cousland (n=1)	0	0	0	0	0	0	1	0.33	0	0	1	0.33
Parkburn Quarry, Lasswade (n=49)	1	0.33	4	1.31	27	8.82	17	5.55	0	0	49	15.01
Penicuik (n=1)	0	0	0	0	1	0.33	0	0	0	0	1	0.33
Polmood (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Ringleyhall (n-1)	0	0	0	0	0	0	1	0.33	0	0	1	0.33
Seacliffe (n=10)	4	1.31	1	0.33	5	1.63	0	0	0	0	10	3.27
Seacliffe Mausoleum (n=10)	10	3.27	0	0	0	0	0	0	0	0	10	3.27
Stonelaws (n=3)	1	0.33	0	0	2	0.66	0	0	0	0	3	0.98
Thornybank (n=62)	4	1.31	0	0	25	8.17	33	10.78	0	0	62	20.26
Yarrow Kirk (n=1)	1	0.33	0	0	0	0	0	0	0	0	1	0.33
Total	95	31.05	12	3.92	130	42.48	69	22.55	0	0	306	100

5.3.7 Sex determination

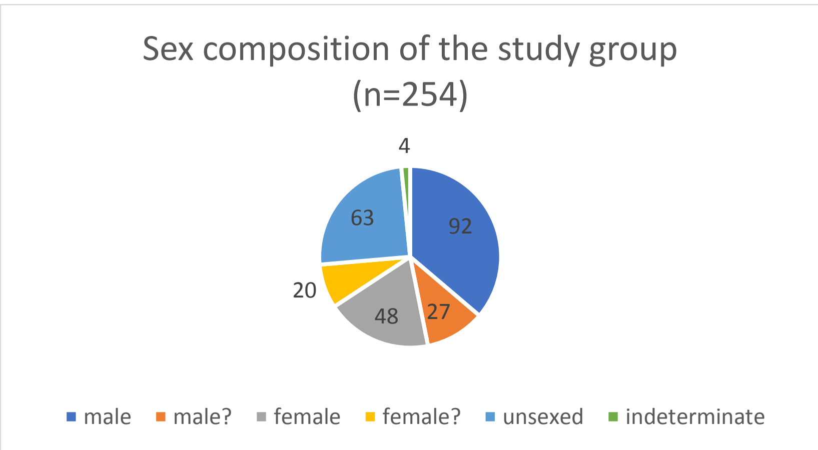
Skeletons were assigned to one of the following categories: male, male?, unsexed, female?, female, and indeterminate. The sex distribution of the adults appears in Figure 5.4 and Table 5.12 below).

Table 5.12: Sex distribution of the adults (n=254)

Sex	No. of skeletons	% of study group
Male	92 (35.2%)	30.06
male?	27 (10.63%)	8.82
Female	48 (18.89%)	15.69
female?	20 (7.87%)	5.54
unsexed	63 (24.8%)	20.58
indeterminate	4 (1.57%)	1.31
Total	254 (83%)	

Males and probable males are in the majority (119/306, 38.89%), followed by females and probable females (68/306, 22.2%). Given the number of unsexed (63/306, 20.58%) and indeterminate skeletons (4/306, 1.31%) this is unlikely to be statistically significant. A clear male bias has been introduced by the inclusion of the largely male monastic community at the Isle of May. Nonetheless, the Fisher exact test statistic value is 0.0015 and the result is significant at $p < .05$. Recent research highlighted the possibility that the Isle of May was a place of pilgrimage for the purpose of healing (Willows 2016). If this were so one might expect to see more females and non-adults within the assemblage.

Figure 5.4: Sex composition of the adults in the study group (n=254)



The male total includes one adolescent from Lundin Links (skull ET2) who displayed definite male characteristics. A total of 22 skeletons could not be aged or sexed and are excluded from Table 5.13 (Catstane FN15, FN42, FN45(A), FN52, FN53; Four Winds sk. 20, burial 22, sk. 21; Lasswade 22; Thornybank 26, 28. 29, 32, 40, 50, 58, 62, 73, 75, 94, 96, 109).

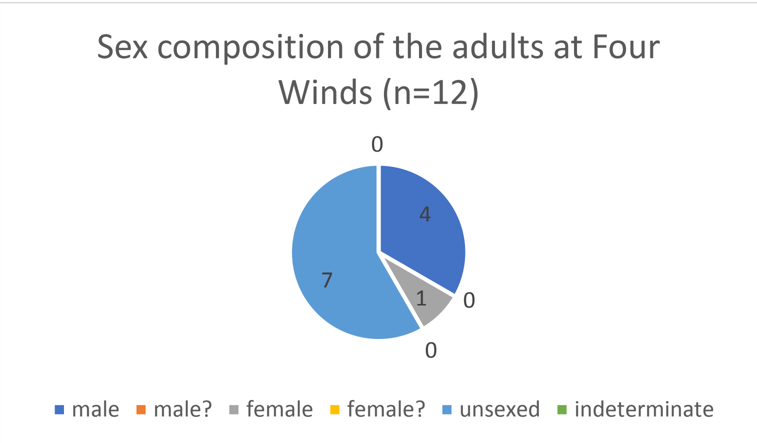
Table 5.13: Breakdown for individual sites of adult sex estimation (n=254)

	M		M?		F		F?		I		U		Total	
Arniston (n=1)	0	0	0	0	0	0	0	0	1	0.39	0	0	1	0.39
Broxmouth (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Catstane (n=13)	1	0.39	1	0.39	0	0	0	0	0	0	6	2.36	13	5.12
Craig’s Quarry (n=2)	2	0.79	0	0	0	0	0	0	0	0	0	0	2	0.79
Cramond (n=9)	2	0.79	2	0.79	4	1.57	1	0.39	0	0	0	0	9	3.54
Dryburn Bridge (n=3)	1	0.39	0	0	2	0.79	0	0	0	0	0	0	3	1.18
Dunbar, 2 Clyde Villas (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Dunbar 44.1 (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Dunbar 55.2 (n=1)	0	0	1	0.39	0	0	0	0	0	0	0	0	1	0.39
Dunbar IB226 (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Dunbar, Kirkhill Braes (n=2)	1	0.39	0	0	1	0.39	0	0	0	0	0	0	2	0.79
Dunbar, Winterfield Mains (n=1)	0	0	0	0	1	0.39	0	0	0	0	0	0	1	0.39
East Fortune (n=3)	2	0.79	0	0	0	0	0	0	0	0	0	0	2	0.79
Easter Ferrygate Gardens (n=2)	2	0.79	0	0	0	0	0	0	0	0	0	0	2	0.79
Four Winds (n=21)	4	1.57	0	0	1	0.39	0	0	0	0	7	2.76	12	4.72
Gogarburn (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Gullane Sands (n=1)	0	0	0	0	0	0	0	0	0	0	1	0.39	1	0.39
Gullane Golf Course (n=6)	3	1.18	0	0	2	0.79	0	0	0	0	0	0	5	1.97
Isle of May (n=55)	34	13.38	3	1.18	3	1.18	2	0.79	1	0.39	7	2.76	50	19.69
Logan Cottage (n=1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long Craigs, Dunbar (n=1)	0	0	0	0	0	0	1	0.39	0	0	0	0	1	0.39
Longniddry (n=2)	0	0	1	0.39	1	0.39	0	0	0	0	0	0	2	0.79
Longniddry Golf Course (n=1)	0	0	0	0	1	0.39	0	0	0	0	0	0	1	0.39
Lundin Links (n=33)	13	5.12	0	0	13	5.12	4	1.57	0	0	2	0.79	32	12.59

	M		M?		F		F?		I		U		Total	
Marine Villa, Archerfield (n=1)	0	0	0	0	1	0.39	0	0	0	0	0	0	1	0.39
Milton, Tranent (n=2)	0	0	1	0.39	0	0	1	0.39	0	0	0	0	2	0.79
North Berwick, Beach Road (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Northfield Farm, Cousland (n=1)	0	0	0	0	0	0	0	0	0	0	1	0.39	1	0.39
Parkburn Quarry, Lasswade (n=49)	7	2.76	11	4.33	7	2.76	5	1.97	1	0.39	13	5.12	44	17.71
Penicuik (n=1)	0	0	0	0	0	0	0	0	0	0	1	0.39	1	0.39
Polmood (n=1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Ringleyhall (n-1)	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
Seacliffe (n=10)	5	1.97	1	0.39	1	0.39	0	0	0	0	1	0.39	8	3.15
Seacliffe Mausoleum (n=10)	4	1.57	2	0.79	0	0	1	0.39	0	0	2	0.79	9	3.54
Stonelaws (n=3)	1	0.39	1	0.39	0	0	1	0.39	0	0	0	0	3	1.18
Thornybank (n=62)	2	0.79	3	1.18	9	3.54	4	1.57	1	0.39	22	8.66	41	15.14
Yarrow Kirk (n=1)	0	0	0	0	1	0.39	0	0	0	0	0	0	1	0.39
Total	92	35.2	27	10.63	46	18.1	20	7.87	5	1.97	64	25.19	254	100

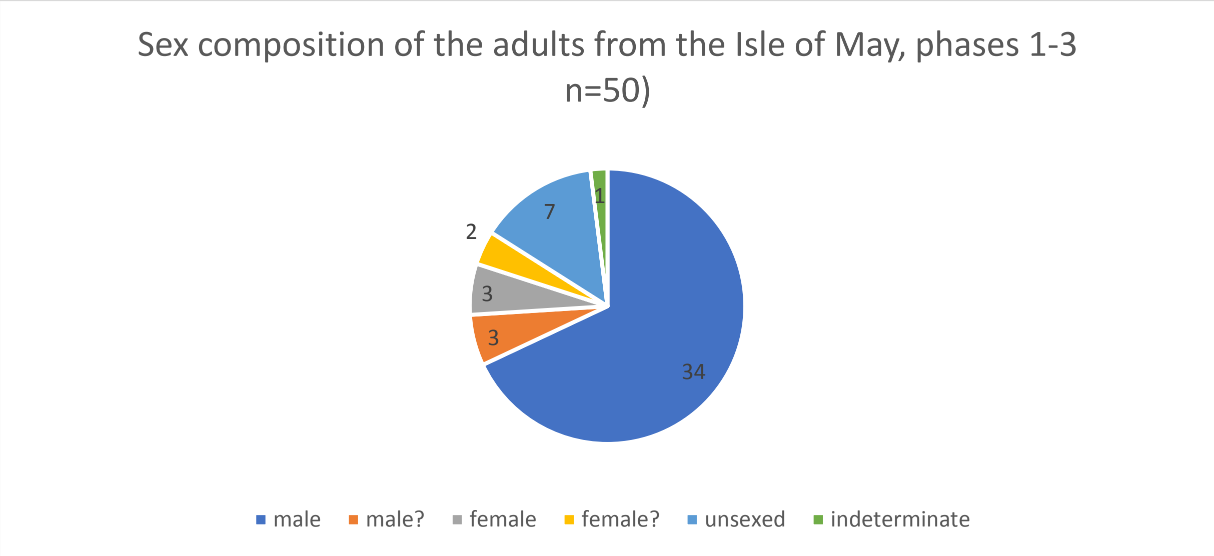
Only 12 adults were identified at Four Winds and comprised 4 males, 1 female and 7 unsexed adults so the apparent predominance of males is unlikely to be significant. Additionally, three graves were not excavated (burials 13, 21 and 27) while a further seven skeletons could not be located during the current analysis (skeleton 11, burials 12, 14, skeleton 13 from burial 16a, burial 15, skeletons 17a and 17b). It is likely that skeletons 11, 17a and 17b were destroyed during radiocarbon dating (see Dalland 1992, 202).

Figure 5.5: Sex composition of the adults at Four Winds (n=12)



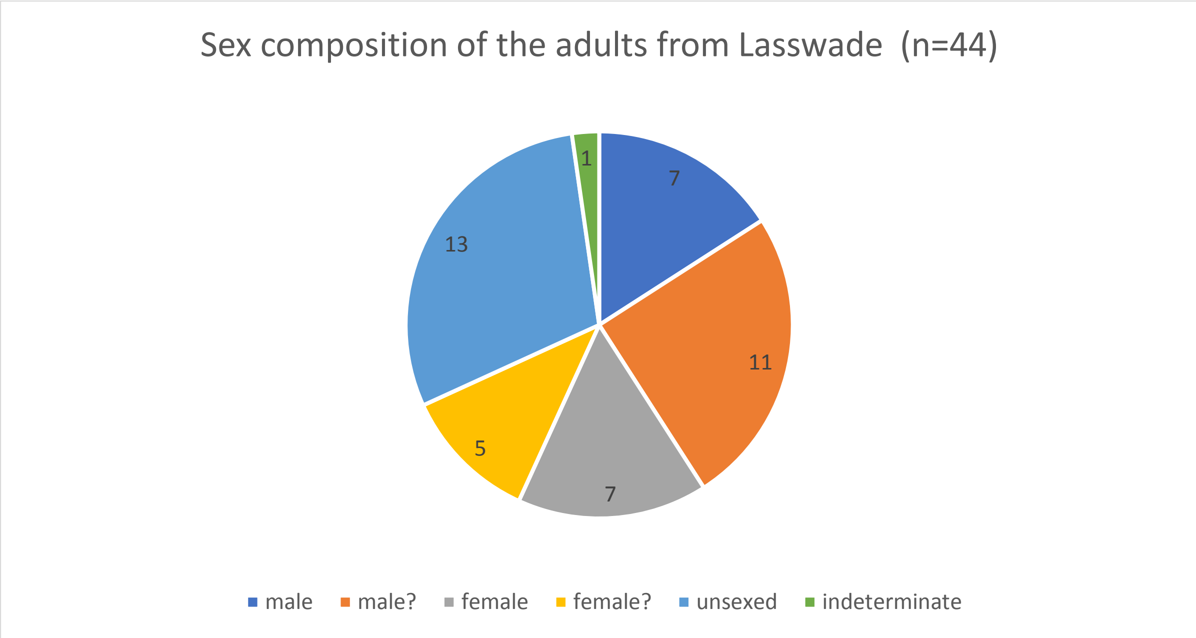
Burial activity at the Isle of May was divided into six phases (1-6) on the basis of stratigraphic relationships and radiocarbon dates. The current research incorporates all burials from phases 1-3 (n=55) although the burials from phases 4-6 (n=12) have been recorded in full for the purposes of comparison. Three skeletons (384, 831, 1021) from the early phases could not be located. A total of 50 adults from phases 1-3 were recorded; there were 5 non-adults. Sex composition of the adults is presented in Figure 5.5 below. Males and probable males accounted for the vast majority of the assemblage (37/55, 67.27%) with a small proportion of females and probable females (5/55, 9.09%). There were more unsexed adults (7/55, 12.73%) than females and a single adult of indeterminate sex (1/55, 1.82%). The predominance of males is unsurprising given the identification of the Isle of May as a monastic community.

Figure 5.6: Sex composition of the adults from the Isle of May (n=50)



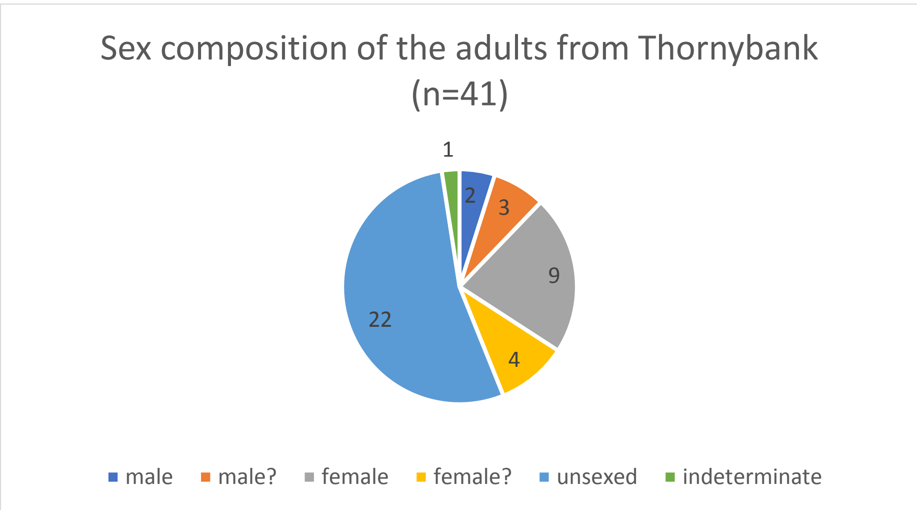
A total of 49 skeletons from Lasswade have been analysed. Males and probable males appear to be in the majority (18/49, 35.74%) although this may not be significant given the proportion of unsexed adults (13/49, 25.53%) and adults of indeterminate sex (1/49, 2.08%). Females and probable females comprised just under one quarter of the assemblage (12/49, 24.49%) (see Figure 5.7 below).

Figure 5.7: *Sex composition of the adults from Lasswade (n=44)*



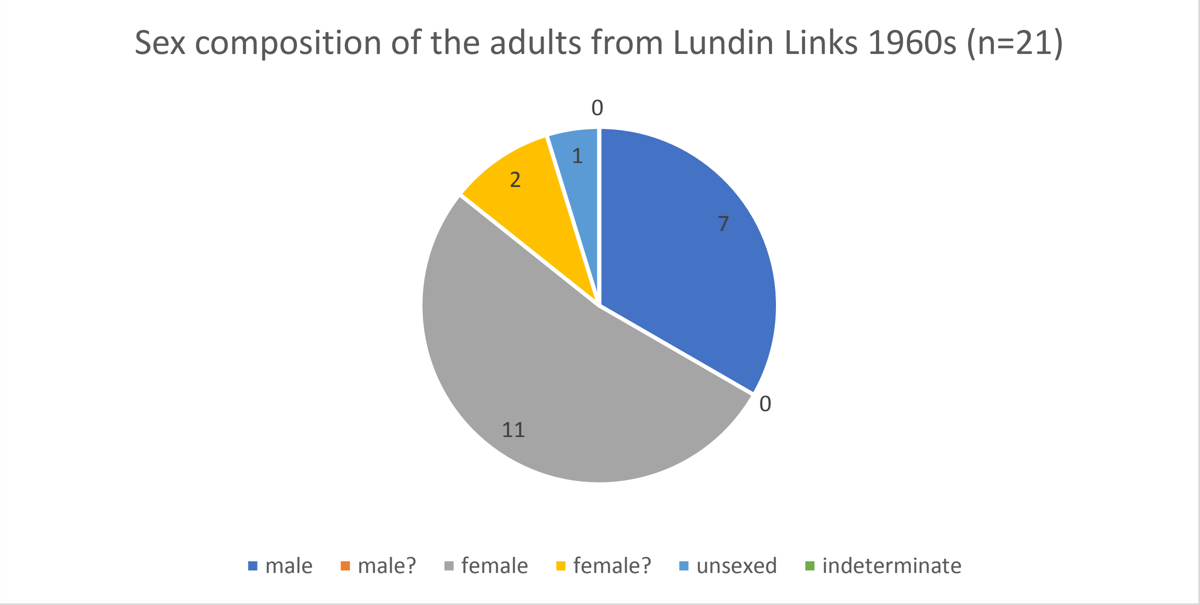
A total of 62 skeletons from Thornybank were analysed. The sex composition of the adults is illustrated in Figure 5.8 below. Poor survival at Thornybank precludes the formulation of any firm conclusions about the sex composition of the assemblage. More than one third of the assemblage were adults who could not be sexed (22/62, 35.48%) and one fifth of 'skeletons' could not be aged or sexed (13/62, 20.96%). There appeared to be more females/probable females (13/62, 20.96%) than males/probable males (5/62, 8.06%) and a single adult of indeterminate sex (1/62, 1.6%).

Figure 5.8: *Sex composition of the adults from Thornybank (n=41)*



A total of 11 skulls were recovered from Lundin Links during the 19th-century and comprised six males, four females/probable females, and one unsexed adult. The latter are thought likely to be part of the cemetery excavated in the 1960s although this is unproven. This assemblage had more females/probable females (13/21, 61.9%) than males (7/21, 33.3%) with only a single unsexed adult (1/21, 4.76%).

Figure 5.9: Sex composition of the adults from Lundin Links, 1960s excavation (n=21)



Research by Maldonado (2013, 9) suggested that field cemeteries tended to have a majority of females. The research presented here tends to support these broad trends although the evidence from Parkburn Quarry, Lasswade may be contradictory. Since its publication (Henshall 1956-7; Henshall 1966-7) this cemetery has featured heavily in archaeological discussions (eg. Maldonado 2013; Williams 2007) although until now osteological data has derived exclusively from Wells (1957) and Inkster (1966-67).

5.4.8 Assessment of age

Age categories employed in previous osteological analyses of assemblages from within the study group are variable and this would have hampered past research that relied on published osteological data (eg Maldonado 2013, 25, tab. 1).

5.3.8.1 Adult age estimation

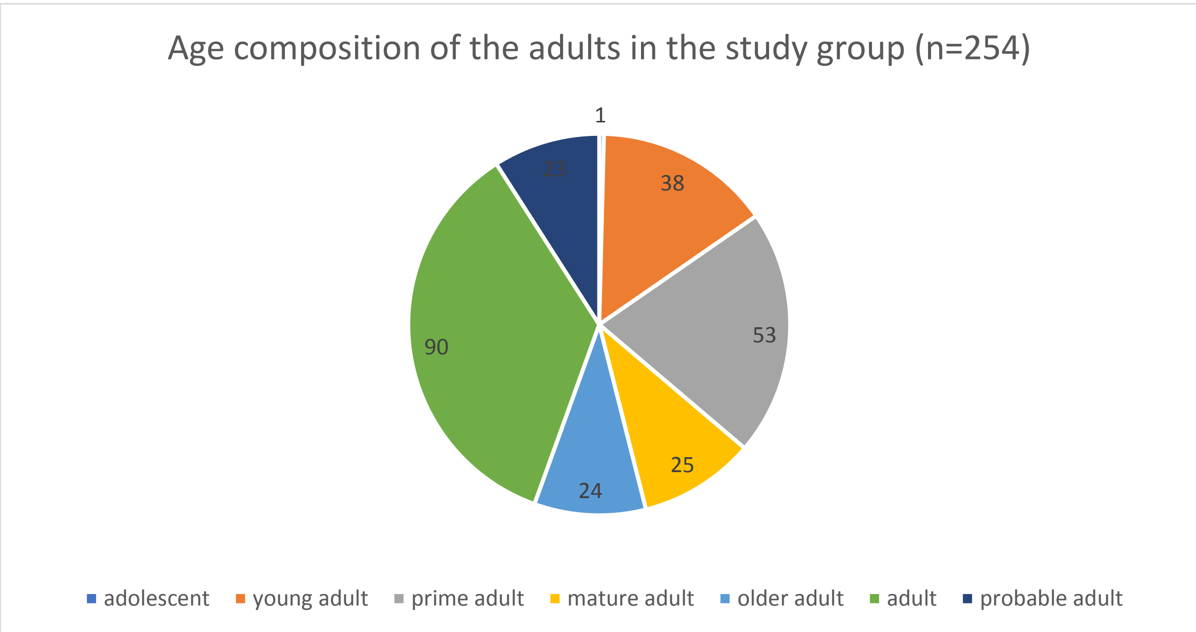
There were a total of 254 adult skeletons within the study group. The majority were placed in the broad adult/probable adult category (113/254, 44.49%), followed by prime adults (53/254, 20.87%), young adults (38/113, 14.96%), with almost equal proportions of mature adults (25/113, 9.84%) and older adults (24/113, 9.45%). A single adolescent male was included in the total (1/254, 0.39%) (see Table 5.14 and Figure 5.10 below).

Table 5.14: Adult age and sex distribution, all assemblages (n=254)

Age category	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
Adol.	1	0.39	0	0	0	0	0	0	0	0	0	0	1	0.39
YA	15	5.9	3	1.18	11	4.33	5	1.97	4	1.57	0	0	38	14.96
PA	30	11.81	6	2.36	13	5.12	2	0.79	1	0.39	1	0.39	53	20.87
MA	15	5.9	1	0.39	8	3.15	0	0	1	0.39	0	0	25	9.84
OA	17	5.69	0	0	5	1.97	0	0	0	0	2	0.79	24	9.45
A	14	5.5.1	0	0	11	4.33	13	5.12	51	20.1	1	0.39	90	35.43
A?	0	0	17	5.69	0	0	0	0	6	2.36	0	0	23	9.05
Total	92	35.22	27	10.63	48	18.89	20	7.87	63	24.8	4	1.57	254	100

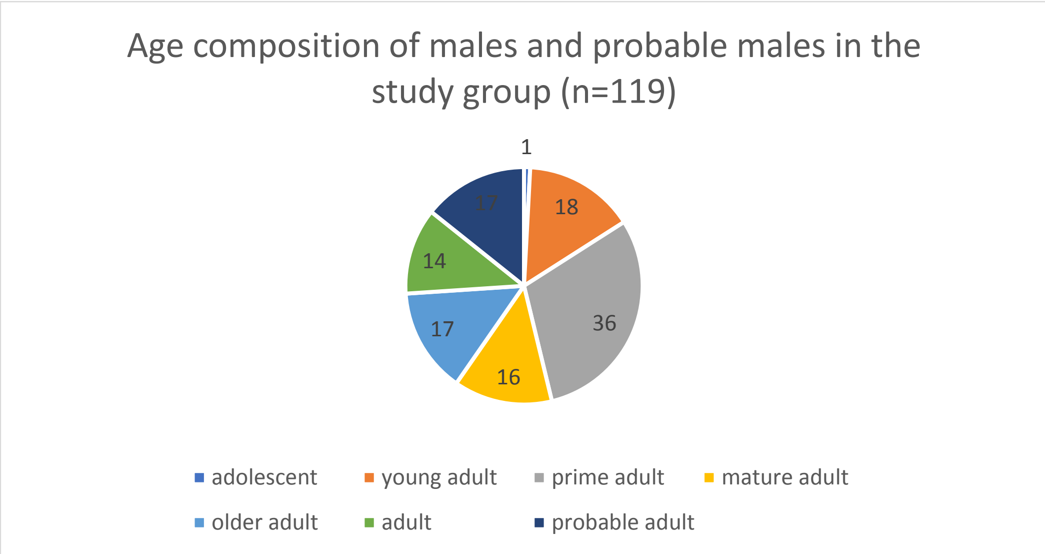
Key: Adol. = adolescent 13-17 years); YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (probable adult 18+ years).

Figure 5.10: Age composition of the adults in the study group (n=254)



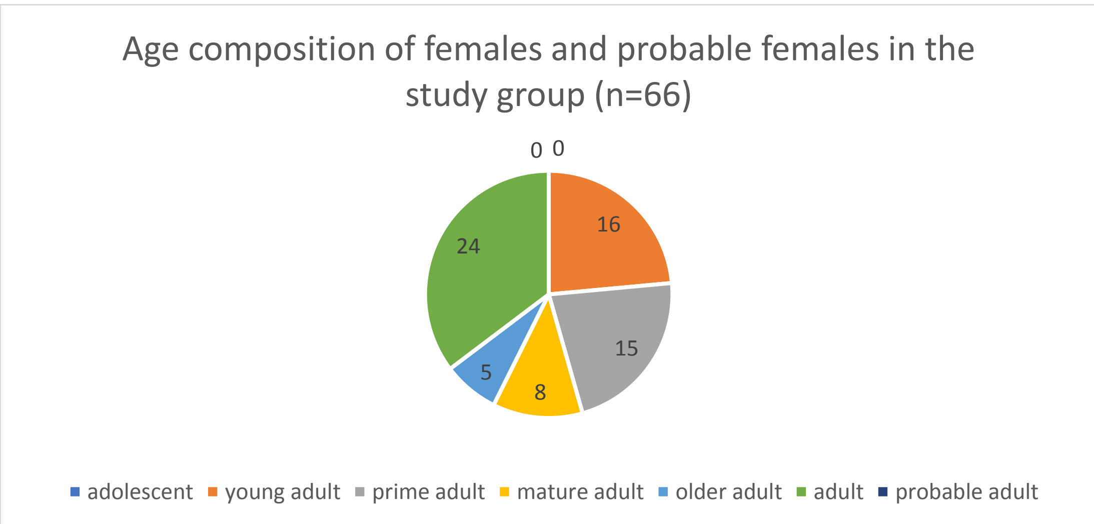
The bulk of the males or probable males fell into the prime adult category (36/119, 30.25%) while the distribution within other age categories was broadly similar: young adult (18/119, 15.13%); mature adult (16/119, 13.45%); older adult (17/119, 14.29%); adult (14/119, 11.76%); probable adult (17/119, 14.29%) (see Figure 5.11 below).

Figure 5.11: Age composition of males and probable males in the study group (n=119)



Most females or probable females within the study group were assigned to the adult category (24/66, 35.36%) followed by young adults (16/66, 24.24%), prime adults (15/66, 22.72%), mature adults (8/66, 12.12%) and older adults (5/66, 7.58%) (see Figure 5.12 below).

Figure 5.12: Age composition of females and probable females in the study group (n=66)



Given the poor survival at Thornybank it is unsurprising that the majority of skeletons were placed in the adult (20/41, 48.78%) or probable adult category (5/41, 12.2%).

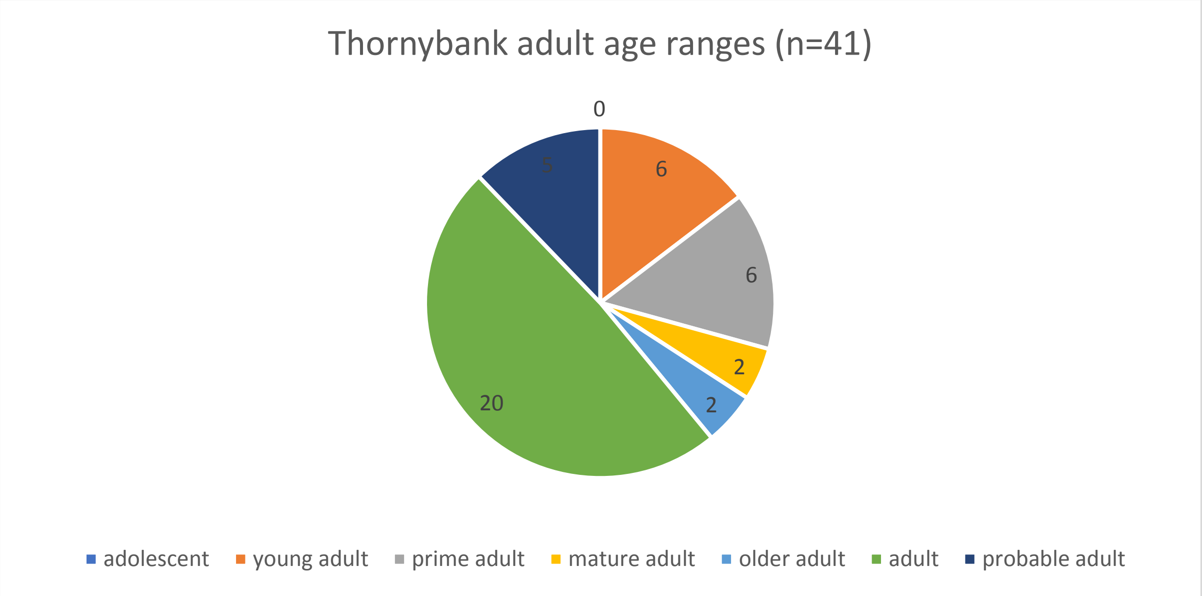
Table 5.15: Age and sex distribution of adults, Thornybank (n=41)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	0	0	4	5.45	1	1.61	1	1.61	0	0	6	9.68
PA	1	1.61	1	1.61	2	3.23	1	1.61	0	0	1	1.61	6	9.68
MA	0	0	0	0	2	3.23	0	0	0	0	0	0	2	3.23
OA	1	1.61	0	0	1	1.61	0	0	0	0	0	0	2	3.23
A	0	0	2	3.23	0	0	2	3.23	16	25.8	0	0	20	32.26
A?	0	0	0	0	0	0	0	0	5	8.06	0	0	5	8.06
Total	2	3.23	3	4.84	9	14.52	4	5.45	22	35.48	1	1.61	41	65.13

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA - mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Females and probable females were most common in the young adult category (6/41, 14.63%) followed by the prime adult category (3/41, 7.32%).

Figure 5.13: Adult age composition at Thornybank (n=41)



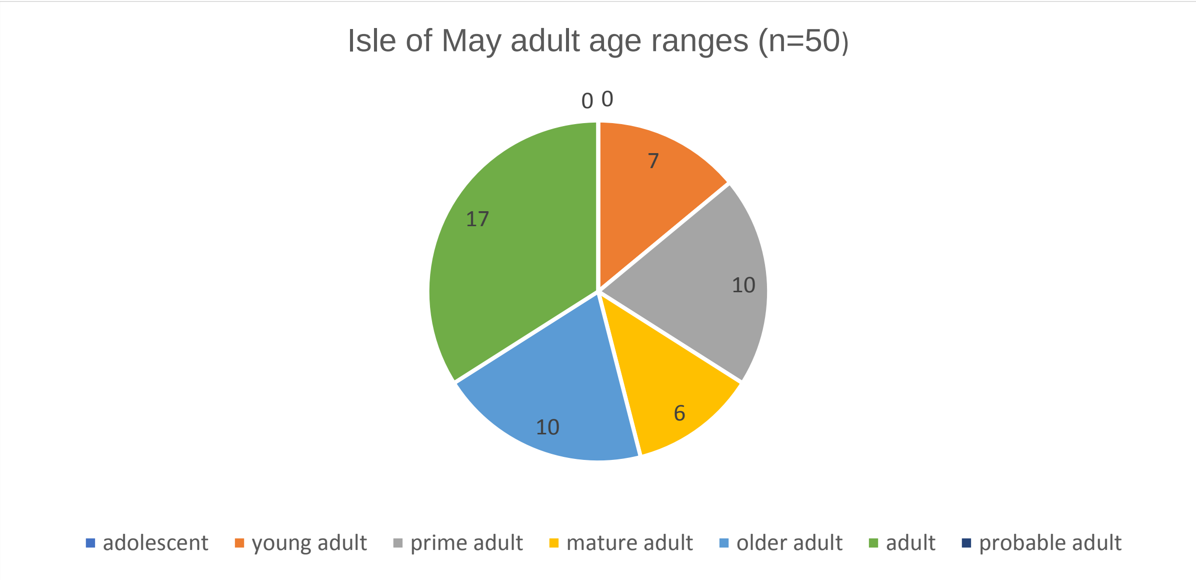
Most of the skeletons at the Isle of May have been assigned to the broad adult category (17/50, 33.33%). The most common age categories are prime adult (10/50, 20%) and older adult (10/50, 20%). Young adults (7/50, 14%) and mature adults (6/50, 12%) are represented equally.

Table 5.16: Adult age and sex distribution, Isle of May (n=50)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	6	10.9	0	0	1	1.8	0	0	0	0	0	0	7	12.7
PA	9	15.36	0	0	0	0	1	1.8	0	0	0	0	10	15.13
MA	5	9.09	0	0	1	1.8	0	0	0	0	0	0	6	10.9
OA	10	15.13	0	0	0	0	0	0	0	0	0	0	10	15.13
A	4	7.27	3	5.45	1	1.8	1	1.8	7	12.73	1	1.8	17	30.9
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	34	61.8	3	5.45	3	5.45	2	3.64	7	12.73	1	1.8	50	90.9

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Figure 5.14: Adult age composition at the Isle of May (n=50)



At Lasswade the majority of skeletons were assigned to the broad adult category (33/49, 67.35%). All other age categories were represented equally. There is an apparent predominance of males and probable males (18/49, 35.73%) over females and probable females (12/49, 24.49%) although the proportion of unsexed adults (12/49, 24.49%) and adults of indeterminate sex (2/49, 4.08%) suggests that this may not be significant.

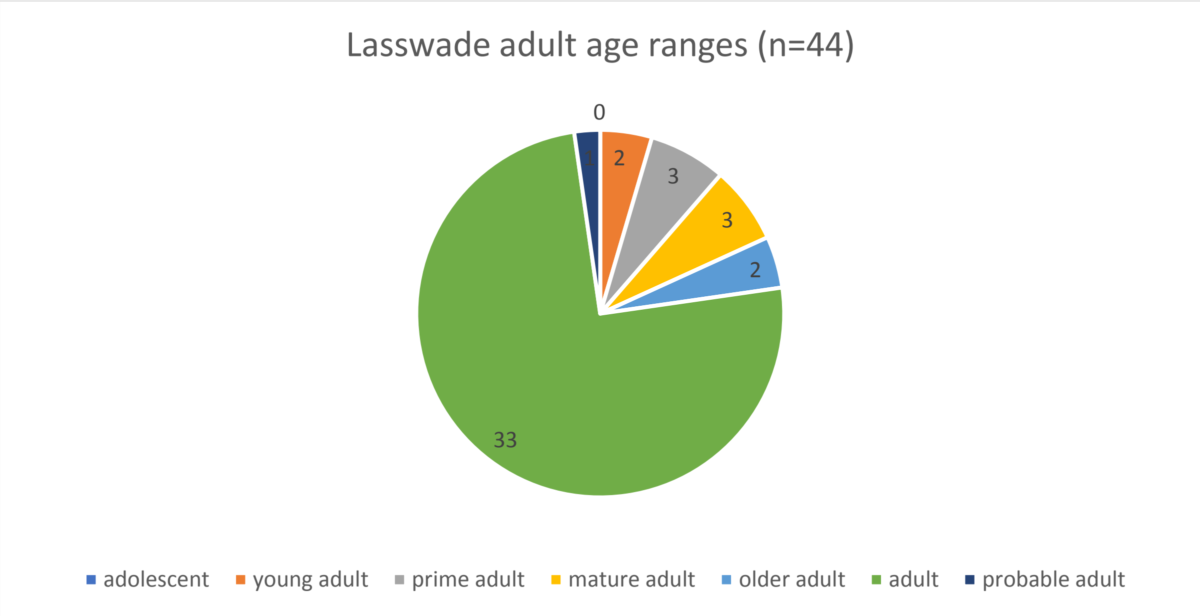
Table 5.17: Adult age and sex distribution, Lasswade (n= 44)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	1	2.04	1	2.04	0	0	0	0	0	0	2	4.08
PA	2	4.08	0	0	1	2.04	0	0	0	0	0	0	3	5.12

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
MA	3	5.12	0	0	0	0	0	0	0	0	0	0	3	5.12
OA	1	2.04	0	0	0	0	0	0	0	0	1	2.04	2	4.08
A	1	2.04	10	20.41	2	4.08	5	10.2	12	24.49	0	0	33	67.35
A?	0	0	0	0	0	0	0	0	0	0	1	2.04	1	2.04
Total	7	14.29	11	22.45	6	12.24	5	10.2	12	24.49	3	5.12	44	89.79

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Figure 5.15: Adult age composition at Lasswade (n=44)



For ease of reference the 19th-century human remains recovered at Lundin Links are tabulated separately (see Tables 5.18-5.19 below). A total of 11 skeletons were recovered during the 19th century. There was a slight predominance of males (6/11, 54.6%) over females and probable females (4/11, 35.36%). All age ranges were represented. A single adolescent was sexed as male.

Table 5.18: Adult age and sex distribution, Lundin Links, 19th-century discoveries, (n=11)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
Adol.	1	9.09	0	0	0	0	0	0	0	0	0	0	1	9.09
YA	0	0	0	0	0	0	2	18.18	0	0	0	0	2	18.18
PA	3	27.27	0	0	0	0	0	0	0	0	0	0	3	27.27
MA	0	0	0	0	1	9.09	0	0	0	0	0	0	1	9.09
OA	1	9.09	0	0	0	0	0	0	0	0	0	0	1	9.09

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
A	1	9.09	0	0	1	9.09	0	0	1	0	0	0	3	27.27
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	54.54	0	0	2	18.18	2	18.18	1	0	0	0	11	100

Key: Adol. = adolescent (13-17 years); YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Problems with mixing and loss of human remains excavated at Lundin Links in the 1960s have already been highlighted. Basing his information on published data (Smart and Campbell-Wilson 2000) Maldonado commented that all 22 assessed individuals from this excavation fell into the age range of 17-35 years (2013, 9). The results of the current analysis contradict this assertion. The assemblage includes an adolescent (13-17 years), three mature adult males and one mature adult female (35-45 years), and one older adult female (45+ years). Furthermore, one adult male, an adult female and an adult who was probably female could not be aged more closely than upwards of 18 years.

Figure 5.16: Adult age composition at Lundin Links 1960s excavation (n=21)

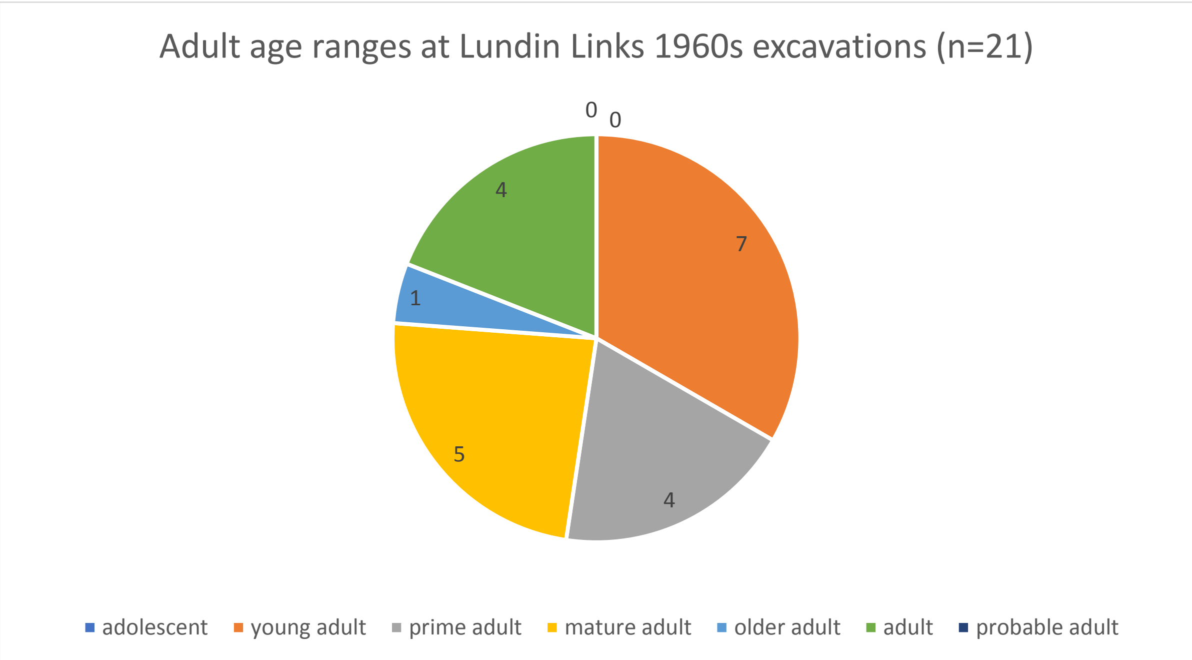


Table 5.19: Adult age and sex distribution, Lundin Links 1960s excavation (n=21)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	3	13.64	0	0	3	13.64	0	0	1	4.55	0	0	7	31.82

PA	0	0	0	0	4	18.18	0	0	0	0	0	0	4	18.18
MA	3	13.64	0	0	2	9.09	0	0	0	0	0	0	5	22.73
OA	0	0	0	0	1	4.55	0	0	0	0	0	0	1	4.55
A	1	4.55	0	0	1	4.55	2	9.09	0	0	0	0	4	18.18
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	31.82	0	0	11	50	2	9.09	1	4.55	0	0	21	95.45

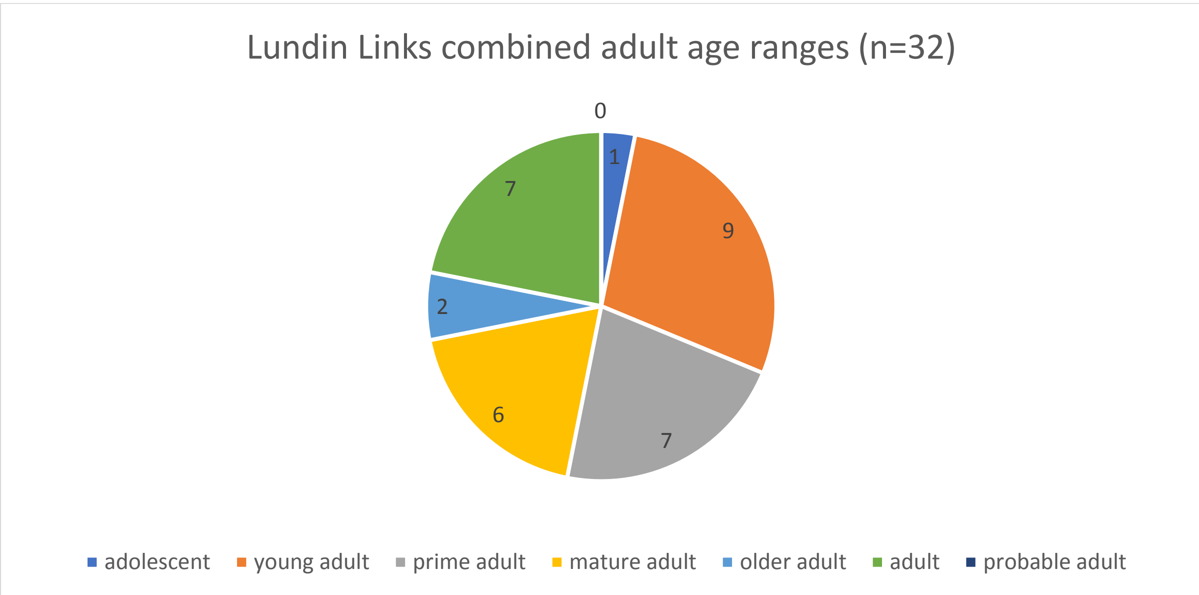
Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Table 5.20: Adult age and sex distribution, combined Lundin Links (n=32)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
Adol.	1	3.03	0	0	0	0	0	0	0	0	0	0	1	3.03
YA	3	9.09	0	0	3	9.09	2	5.06	1	3.03	0	0	9	27.27
PA	3	9.09	0	0	4	12.12	0	0	0	0	0	0	7	21.21
MA	3	9.09	0	0	3	9.09	0	0	0	0	0	0	6	18.18
OA	1	3.03	0	0	1	3.03	0	0	0	0	0	0	2	5.06
A	2	5.06	0	0	2	5.06	2	5.06	1	3.03	0	0	7	21.21
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	13	39.39	0	0	13	39.39	4	12.12	2	5.06	0	0	32	95.96

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Figure 5.17: Combined adult age ranges at Lundin Links (n=32)



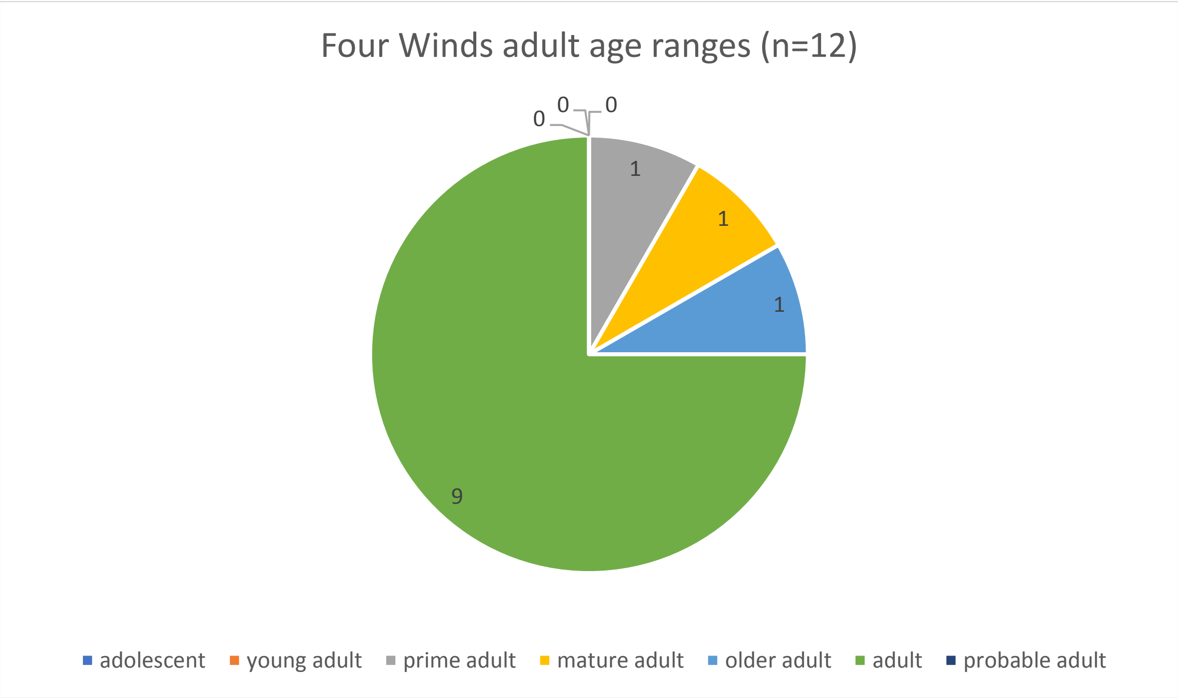
The majority of skeletons at Four Winds were placed in the broad adult category (9/12, 75%). There was an apparent predominance of males (4/12, 33.3%) over females (1/12, 8.3%) although given the number of unsexed adults (7/12, 58.3%) this may not be significant.

Table 5.21: Adult age and sex distribution, Four Winds (n=12)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA	1	4.76	0	0	0	0	0	0	0	0	0	0	1	4.76
MA	1	4.76	0	0	0	0	0	0	0	0	0	0	1	4.76
OA	0	0	0	0	1	4.76	0	0	0	0	0	0	1	4.76
A	2	9.52	0	0	0	0	0	0	7	33.33	0	0	9	43.86
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	19	0	0	1	4.76	0	0	7	33.33	0	0	12	57.14

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Figure 5.18: Adult age composition at Four Winds (n=12)



Survival of human remains at Catstane was extremely poor and very little demographic data could be recovered. No females were identified and the majority of adult skeletons were unsexed (6/8, 75%).

Table 5.22: Adult age and sex distribution, Catstane (n=8)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	1	7.69	0	0	0	0	2	15.38	0	0	3	23.08
PA	1	7.69	0	0	0	0	0	0	0	0	0	0	1	7.69
MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	4	30.77	0	0	4	30.77
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	7.69	1	7.69	0	0	0	0	6	45.15	0	0	8	61.54

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

A total of eight skulls were recovered from Seacliffe during the 19th century and are likely to be part of the larger cemetery at Auldhame (Crone and Hindmarch 2016). There was a predominance of males and probable males (5/8, 62.5%) over females (1/8, 12.5%). Young, prime and mature adults were almost equally represented.

Table 5.23: Adult age and sex distribution, Seacliffe (n=8)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	1	10	1	10	0	0	0	0	0	0	0	0	2	20
PA	3	30	0	0	0	0	0	0	0	0	0	0	3	30
MA	0	0	0	0	1	10	0	0	1	10	0	0	2	20
OA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	1	10	0	0	0	0	0	0	0	0	0	0	1	1
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5	50	1	10	1	10	0	0	1	10	0	0	8	80

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

A total of nine skulls were recovered from Seacliffe Mausoleum in the 19th century. There was a predominance of males and probable males (6/9, 65.6%) over probable females (1/9, 11.1%). Prime adults and adults were equally represented.

Table 5.24: Adult age and sex distribution, Seacliffe Mausoleum (n=9)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA	1	10	2	20	0	0	0	0	1	10	0	0	4	40
MA	1	10	0	0	0	0	0	0	0	0	0	0	1	10

OA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	2	20	0	0	0	0	1	10	1	10	0	0	4	40
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	40	2	20	0	0	1	10	2	20	0	0	9	90

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

The adult skeletons from Cramond appear to have been deposited in two separate phases. The neonatal skeletons, which are discussed below have not been radiocarbon dated and given the archaeological context of burial in a latrine associated with the Roman fort it is conceivable that they are earlier in date than the adult skeletons. There are slightly more females and probable females (5/9, 55.55%) than males or probable males (4/9, 44.44%). Most fall within the prime adult category (5/9, 55.55%) followed by older adults (2/9, 22.22%) with a single mature adult (1/9, 11.11%).

Table 5.25: Adult age and sex distribution, Cramond (n=9)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	0	0	0	0	1	11.11	0	0	0	0	1	11.11
PA	3	33.33	1	11.11	1	11.11	0	0	0	0	0	0	5	55.55
MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OA	0	0	0	0	2	22.22	0	0	0	0	0	0	2	22.22
A	0	0	0	0	1	11.11	0	0	0	0	0	0	1	11.11
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3	33.33	1	11.11	4	44.44	1	11.11	0	0	0	0	9	100

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

A small group of five adults was recovered from Gullane Golf Course. There were slightly more males (3/5, 60%) than females (2/5, 40%). All age ranges with the exception of young adults were represented.

Table 5.26: Adult age and sex distribution, Gullane Golf Course (n=5)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA	0	0	0	0	2	33.33	0	0	0	0	0	0	2	33.33
MA	1	15.66	0	0	0	0	0	0	0	0	0	0	1	15.66

OA	2	33.33	0	0	0	0	0	0	0	0	0	0	2	33.33
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3	50	0	0	2	33.33	0	0	0	0	0	0	5	83.33

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

5.3.8.2 Non-adult age estimation

There is a clear under-representation of non-adults in the study group (30/306, 9.8%) although the five disarticulated, partial neonatal skeletons from Cramond are a significant addition. The non-adult numbers are significantly expanded by the addition of the assemblage from Four Winds (n=6).

Figure 5.19: Non-adults within the study group (n=30)

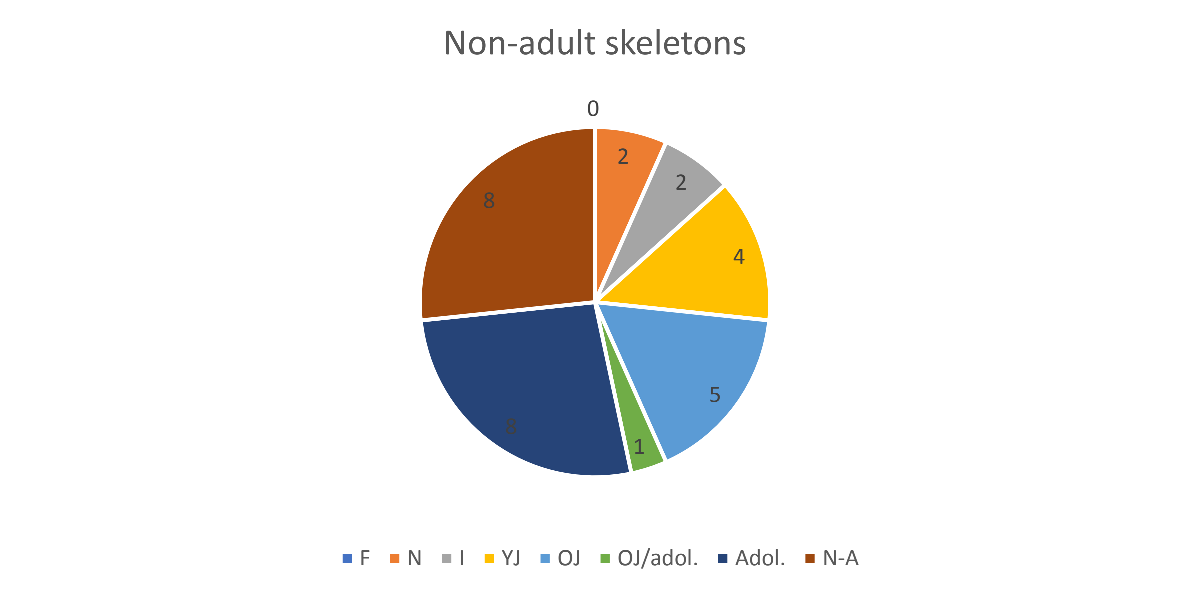


Table 5.27: Non-adults within the study group (n=30)

Age group	No of skeletons	% of non-adults	% of study group
Foetus	0	0	0
Neonate (Gullane Golf Course No. 4, Thornybank 35)	2	5.66	0.65
Infant (Seacliffe S56/11 C, Four Winds 4)	2	5.66	0.65
Younger juvenile (Four Winds 15, Lasswade 32, Thornybank 49 and 72)	4	13.33	1.3
Older juvenile (Logan Cottage, Four Winds 10 and 16, Isle of May 970 and 1030)	5	13.33	1.63
Older juvenile/adolescent (Thornybank 68)	1	5.66	0.33
Adolescent (East Fortune 1, Seacliffe S56/11 A, Lundin Links ET2, Lasswade 33 and 35, Isle of May 814, 997, 1026b)	8	25.66	2.6
Non-adult (Seacliffe Mausoleum skull e, Four Winds 6 and 19, Lasswade 27, Thornybank 6, 10, 81 and 86)	8	25.66	2.6
	30	100	9.8

5.3.9 Comparison with later assemblages

5.3.9.1 Captain's Cabin

A total of 65 skeletons from the cemetery at Captain's Cabin, Dunbar were recorded alongside 11 skeletons from phases 4 to 6 at the Isle of May for the purposes of demographic comparison. Radiocarbon dates for the cemetery at Captain's Cabin indicate a long period of use in the later medieval period (Maloney 2001, 285, tab. 1). The distribution of adults and non-adults is much more equal than in any of the cemeteries from the study group.

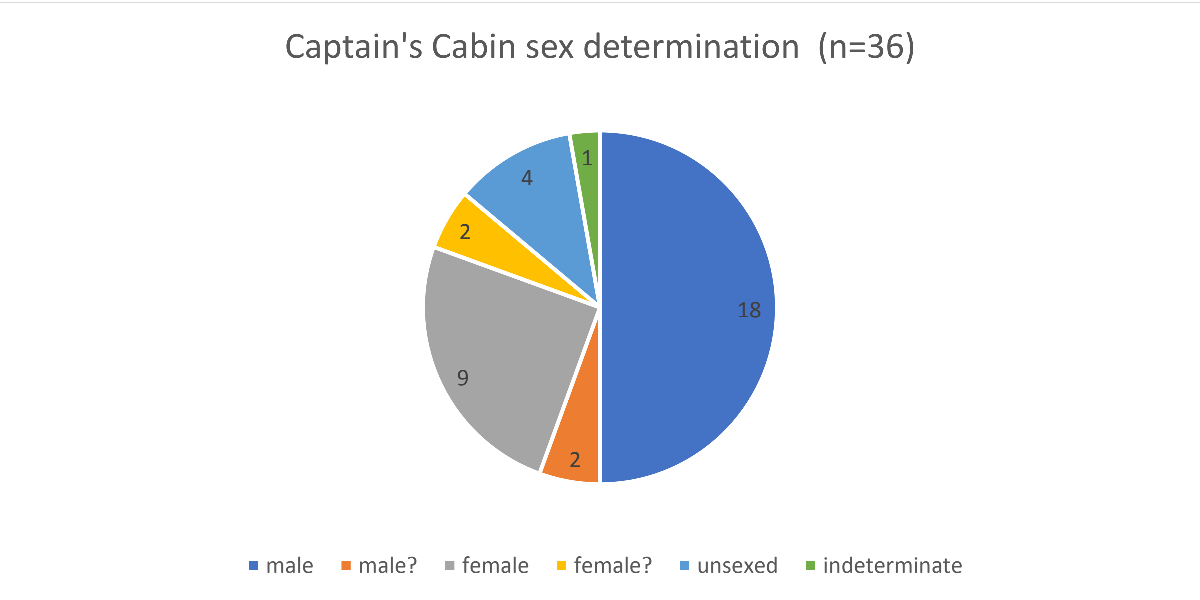
Table 5.28: Adult age and sex distribution, Captain's Cabin, (n=36)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
Adol.	0	0	0	0	1	1.54	0	0	0	0	0	0	1	1.54
YA	2	3.08	0	0	0	0	0	0	0	0	0	0	2	3.08
PA	3	4.62	1	1.54	0	0	1	1.54	0	0	1	1.54	6	9.23
MA	6	9.23	0	0	7	10.77	0	0	0	0	0	0	13	20
OA	1	1.54	0	0	1	1.54	0	0	0	0	0	0	2	3.08
A	6	9.23	1	1.54	0	0	1	1.54	4	5.15	0	0	12	18.46
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	18	27.69	2	3.08	9	13.85	2	3.08	4	5.15	1	1.54	36	55.38

Key: Adol. = adolescent (13-17 years); YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

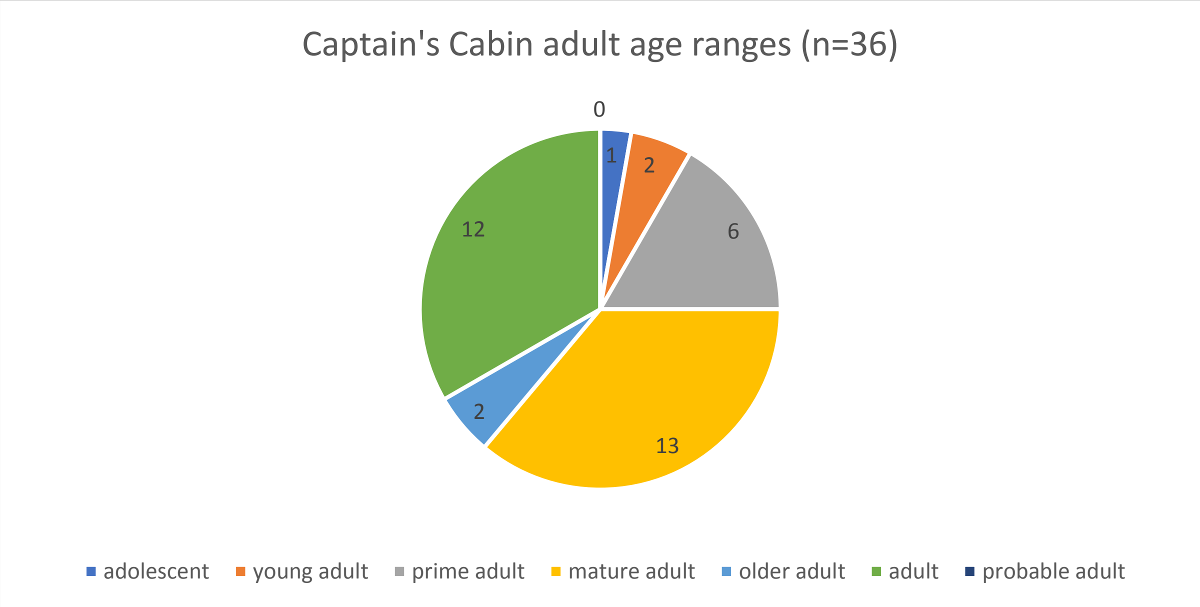
There are almost twice as many males and probable males (20/36, 55.55%) as females and probable females (11/36, 30.55%). Small numbers of unsexed adults (4/36, 11.11%) and adults of indeterminate sex (1/36, 2.77%) were also identified.

Figure 5.20: Sex composition at Captain's Cabin (n=36)



Most adults at Captain's Cabin were in the mature adult category (13/36, 35.1%) followed by the adult category (12/36, 33.33%).

Figure 5.21: Adult age composition at Captain's Cabin (n=36)

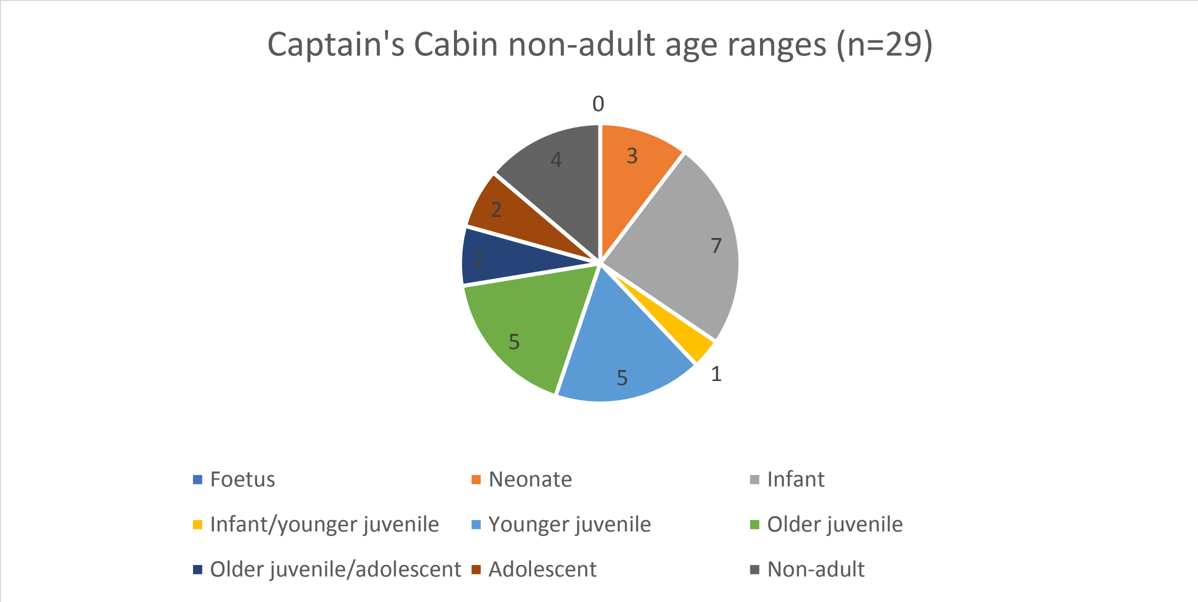


Non-adults accounted for almost half of the assemblage (29/65, 44.62%) (see Table 5.29 and Figure 5.22 below). Infants were the most commonly represented category (7/29, 24.13%) followed by younger (5/29, 17.24%) and older juveniles (5/29, 17.24%).

Table 5.29: Distribution of non-adults, Captain's Cabin (n=29)

Age group	No of skeletons	% of non-adults	% of assemblage
Foetus	0	0	0
Neonate	3	10.34	4.62
Infant	7	24.14	10.76
Infant/younger juvenile	1	3.45	1.54
Younger juvenile	5	17.24	7.69
Older juvenile	5	17.24	7.69
Older juvenile/adolescent	2	5.89	3.07
Adolescent	2	5.89	3.07
Non-adult	4	13.79	5.15
	29	100	44.61

Figure 5.22: Non-adult age composition at Captain's Cabin (n=29)



One of the adolescents from Captain's Cabin has been sexed as female and has been included in the adult total. A minimum of 51 individuals were represented by the disarticulated material. The high percentage of non-adults strongly suggests that this was an area which had been set aside mainly for the burial of children.

5.3.9.2 The Isle of May

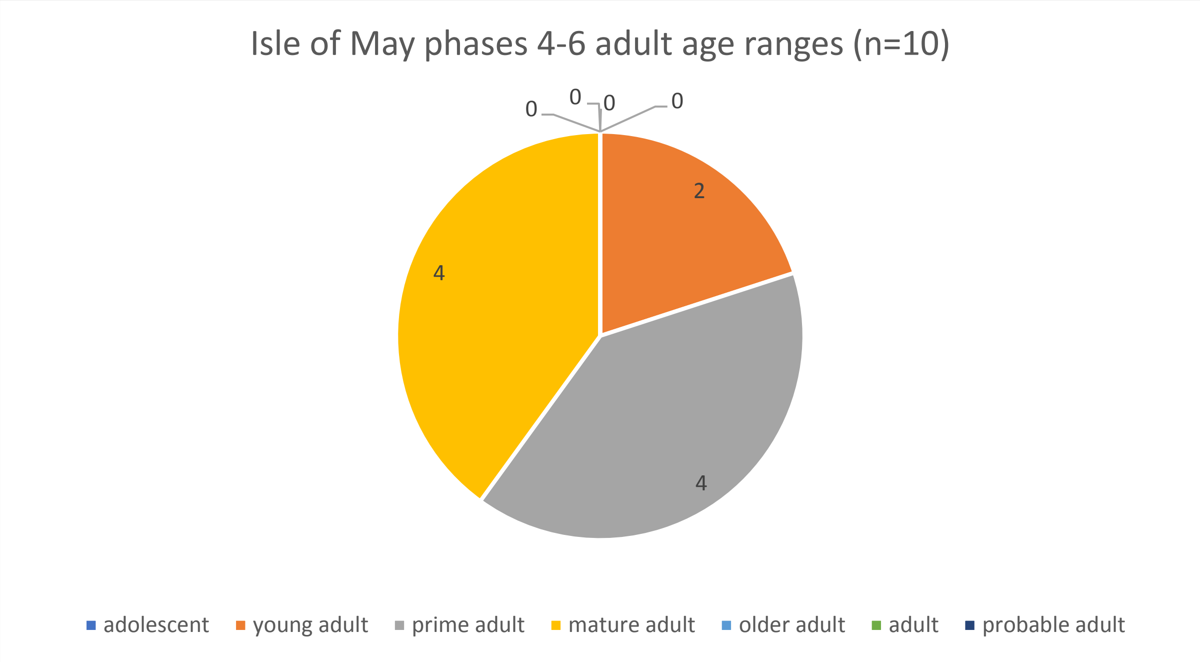
A total of 10 adult skeletons from phases 4-6 at the Isle of May were analysed. In common with phases 1-3 there were more males (8/10, 80%) than females or probable females (2/10, 20%). Prime and mature adults were equally represented (4/10, 40%) followed by young adults (2/10, 20%). A single older juvenile was also present.

Table 5.30: Adult age and sex distribution, Isle of May, phases 4-6 (n=10)

Age group	M	%	M?	%	F	%	F?	%	U	%	I	%	Total	%
YA	1	10	0	0	0	0	1	10	0	0	0	0	2	20
PA	3	30	0	0	1	10	0	0	0	0	0	0	4	40
MA	4	40	0	0	0	0	0	0	0	0	0	0	4	40
OA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8	80	0	0	1	10	1	10	0	0	0	0	10	100

Key: YA = young adult (18-25 years); PA = prime adult (25-35 years); MA = mature adult (35-45 years); OA = older adult (46+ years); A = adult (18+ years); A? (?18+ years).

Figure 5.23: Adult age composition at the Isle of May phases 4-6 (n=10)



5.4 METRIC ANALYSIS

5.4.1 Stature

Due to the degree of fragmentation and completeness it was only possible to estimate stature for a total of 41 males and 22 females. Few complete long bones survived. Reconstruction for measurements of long bone length was not attempted as in many cases the breaks were not recent and therefore the edges were eroded. The data is presented in Table 5.31 below.

Table 5.31: Stature (n=63)

	Number	% of total		Range	
Sex	(n)	(%)	Mean	Min.	Max.
Male	41	34.45	171.81	155.66	185.95
Female	22	31.82	157.99	143.99	174.27

5.4.2 Cranial indices

It was possible to calculate the cranial indices of 34 skulls within the study group. The results are summarised in Table 5.32 below. The majority were mesocranic (average or medium headed), followed by dolichocranic (narrow or long headed), brachycranic (broad or round headed) and hyperbrachycranic (very broad headed).

Table 5.32: Details of cranial indices (n=34)

Cranial index	No. of males	No of females	Indeterminate	Range	Mean
Dolichocranic	2	3	1	67.04-75.7	73.37
Mesocranic	13	10	0	75.14-79.89	77.12
Brachycranic	2	1	0	80.35-81.76	81.27
Hyper brachycranic	1	1		85.19-88.48	85.84

5.4.3 Meric and cnemic indices

Measurements taken from the femora and tibiae were used to calculate the meric index (degree of flattening of the femur shaft front to back) and the cnemic index (degree of medio-lateral flattening of the tibia shaft). Generally speaking, femur and tibia shafts have become rounded (meric and cnemic) over time, possibly due to an increasingly sedentary lifestyle (Brothwell 1981; Wells 1964, 32). However, the relationship between mechanical stress and flattening is far from clear and there could be other causes, such as mineral and vitamin deficiency (Waldron 2007). The degree of fragmentation and level of completeness meant that few measurements could be taken.

Table 5.33: Meric index – range and mean

Sex	Right			Left		
	Mean	Range		Mean	Range	
		Min.	Max.		Min.	Max.
Male	79.74 (n=39)	60.71	102.69	83.83 (n=40)	62.46	108.77
Female	83.97 (n=27)	69.06	84.81	83.39 (n=27)	68.83	95.67
Unsexed	81.16 (n=4)	65.9	96	85.73 (n=4)	75.59	95.87
Indeterminate	84.67 (n=1)	84.67	84.67	0	0	0

Table 5.34: Meric index – number of femora in each category

	Male		Female		Unsexed		Indeterminate		Total	

	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Platymeric	27	14	14	13	2	1	1	0	44	28
Eurymeric	11	12	13	13	2	1	0	0	26	26
Stenomeric	2	1	0	0	0	0	0	0	2	1
Total	40	27	27	26	4	2	1	0	72	55

Table 5.35: Cnemic index – range and mean

Sex	Right (n=48)			Left (n=57)		
	Mean	Range		Mean	Range	
		Min.	Max.		Min.	Max.
Male	71.03	57.22	93.98	70.34	57.94	69.72
Female	72.06	55.26	98.12	72.79	60.49	69.87
Unsexed	68.14	65.34	69.93	67.83	62.78	69.42

Table 5.36: Cnemic index – number of tibiae in each category

	Male		Female		Unsexed		Total	
	Right	Left	Right	Left	Right	Left	Right	Left
Hyperplatycnemic	0	0	0	0	0	0	0	0
Platycnemic	2	2	1	1	0	1	3	4
Mesocnemic	10	13	9	7	2	3	21	23
Eurycnemic	12	14	12	15	0	1	24	30
Total	24	29	22	23	2	5	48	57

5.5 NON-METRIC TRAITS

Non-metric traits occur in a minority of skeletons and may suggest hereditary affiliation (Saunders 1989). The heritability of some is open to question (Tyrell 2000) and other factors such as mechanical stress (Kennedy 1989) and environment (Trinkhaus 1978) have also been implicated. A total of 30 cranial and 30 post-cranial traits are routinely recorded (Berry and Berry 1967; Buikstra and Ubelaker 1990; Finnegan 1978). Wells discussed mandibular tori as part of his osteological analysis (1957) and the analysis of non-metric traits in general comprised a significant element of the work by Lorimer on Lundin Links (2000) with a focus on the possible identification of familial relationships. Some twenty years on, advances in aDNA analysis which include the ability to extract genetic material from the small ossicles of the ear (incus, malleus, stapes) and to isolate the whole genome mean the identification of familial relationships alongside other significant traits such as hair and eye colour is now a reality. Many of the skeletons in the study group have been sampled for aDNA analysis (see Appendix 5.3).

The frequencies of both cranial and post-cranial non-metric traits are summarised in this section although detailed discussion is limited. There is potential for further analysis of the data which is beyond the scope of this research.

5.5.1 Cranial non-metric traits

It was possible to observe the presence or absence of non-metric traits in 66 of the adult skeletons. Frequencies are presented in Tables 5.37-5.38. Due to the incomplete nature of many of the adult skeletons, the number of individuals for which each trait could be observed was often far fewer than the total number of adult skeletons present. Most skulls were highly fragmented, the facial region and the skull base being most affected. This impacted on the number of cranial traits that could be recorded.

Table 5.37: Midline cranial non-metric traits (adults)

Midline traits	Trait present	Part present	%
Ossicle at lambda	12	112	10.71
Ossicle at bregma	0	104	0
Metopic suture	11	119	9.24
Precondylar tubercle	1	80	1.25
Palatine torus	3	69	4.35

Lambdoid and coronal ossicles (or wormian bones) were the most common cranial traits with prevalence rates of 77.97% and 53.64% respectively. These are the small irregular bones which often occur along the cranial sutures. Bennett (1965) has suggested that the formation of ossicles in these sutures may be related to stresses placed on the growing cranium during foetal life and early infancy. Genetic as well as environmental factors have been proposed

(Bellary *et al.,* 2013, 922). In a clinical setting 50% of ossicles occur in the lambdoid suture followed by the coronal suture at 25% (Bellary *et al.,* 2013, 923; Jeanty *et al.,* 2000). There are disparities in the clinical literature regarding the degree to which the formation and frequency of wormian bones can be attributed to environmental or genetic influences (e.g. Sanchez-Lara *et al.,* 2007). Their presence has also been linked to deformation in the shape of the skull, either through a deliberate cultural practice or because of premature sutural closure (O'Loughlin 2004; Sanchez-Lara *et al.,* 2007) where increased tension placed on the opposite side to the fused suture forces the suture apart, encouraging the formation of ossicles within the suture to bridge the gap.

The current study identified five skeletons from Lasswade with one or more mandibular torus (0, 8b, 14, 30, 62) and a single female from Dunbar, Winterfield Mains IB210, exhibited small bilateral mandibular tori and it is unclear which skeleton Wells examined. In addition to those examples mentioned above, tori were identified among 20 skeletons: one from Cramond (sk. 6), two from Gullane Golf Course (skeletons 1 and 3), seven from the Isle of May (815, 848, 859, 887, 888, 959, 968), eight from Lundin Links (IB212D, skeletons 1, 3, 5, 12, 12b, 13 and 18), and two from Thornybank (skeletons 54 and 55).

Table 5.38: Paired cranial traits (adults)

	Right			Left		
Paired traits	Trait present	Part present	%	Trait present	Part present	%
Highest nuchal line	0	115	0	0	114	0
Lambdoid ossicle	92	118	77.97	93	126	73.81
Coronal ossicle	63	109	37.8	59	110	53.64
Ossicle at pterion	2	72	2.78	6	67	8.96
Parietal notch bone	6	95	5.32	10	95	10.53
Ossicle at asterion	15	102	14.71	11	101	10.89
Parietal foramen	25	119	21.9	25	116	21.55
Auditory torus	2	122	1.64	2	122	1.64

	Right			Left		
Foramen of Huschke	7	69	10.14	8	70	11.43
Mastoid foramen extrasutural	16	108	14.81	26	109	23.85
Sutural mastoid foramen	4	108	3.7	8	109	7.34
Posterior condylar canal open	2	65	3.08	9	63	14.29
Double condylar facet	5	75	5.67	4	74	5.41
Double anterior condylar canal	2	73	2.74	3	67	4.48
Incomplete foramen ovale	2	64	3.13	4	63	5.35
Open foramen spinosum	4	64	5.25	3	63	4.76
Accessory lesser palatine foramen	9	66	13.64	9	64	14.06
Maxillary torus	2	92	2.17	4	92	4.35
Mandibular torus	25	121	20.66	24	113	21.24
Zygomatic facial foramen absent	12	72	15.67	10	72	13.89
Bridging of supraorbital notch	12	72	15.67	10	72	13.89
Accessory infraorbital foramen	3	60	5	4	55	7.27
Accessory supra-orbital foramen	6	101	5.94	7	97	7.22
Anterior ethmoid foramen extrasutural	5	35	14.29	6	43	13.95
Posterior ethmoid foramen extrasutural	4	35	11.43	6	34	17.65

5.5.2 Post-cranial non-metric traits

Frequencies for post-cranial traits are presented in Tables 5.39-40. Due to the incomplete nature of many of the adult skeletons, the number of individuals for which each trait could be observed was often far fewer than the total number of adult skeletons present. The most common traits were double anterior calcaneal facets (34.43%) followed by the transverse foramen bipartite (27.08%) and double inferior talar facets (21.67%).

Table 5.39: Midline post-cranial traits (adults)

Midline traits	Trait present	Part present	%
Sternal foramen	1	22	4.55

Table 5.40: Paired post-cranial traits (adults)

	Right			Left		
Paired traits	Trait present	Part present	%	Trait present	Part present	%

	Right			Left		
Lateral atlas bridging	1	40	2.5	0	42	0
Double atlas facet	6	54	11.11	3	57	5.26
Posterior atlas bridging	4	40	10	6	44	13.64
Transverse foramen bipartite	13	48	27.08	12	46	25.09
Suprascapular foramen	1	40	2.5	0	37	0
Accessory acromial facet	1	35	2.86	0	29	0
Circumflex sulcus	2	51	3.92	1	50	2
Supracondyloid process	0	64	0	0	62	0
Septal aperture	2	65	3.08	2	56	3.57
Accessory sacral facet	1	52	1.92	0	50	0
Acetabular crease	1	69	1.45	0	67	0
Allen’s fossa	1	53	1.89	0	46	0
Poirier’s facet	4	51	7.84	1	44	2.27
Plaque	2	51	3.92	2	45	4.44
Hypotrochanteric fossa	2	64	3.13	3	59	5.08
Exostosis in trochanteric fossa	4	63	5.35	5	59	8.47
Third trochanter	4	64	5.25	4	59	5.78
Emarginate patella	1	42	2.38	1	51	1.96
Vastus notch	3	42	7.14	6	51	11.76
Vastus fossa	1	42	2.38	1	51	1.96
Medial tibia squatting facet	0	49	0	1	41	2.44
Lateral tibia squatting facet	8	49	15.33	9	44	20.45
Peroneal tubercle	5	48	10.42	5	48	10.42
Double anterior calcaneal facet	18	61	29.51	21	61	34.43
Absent anterior calcaneal facet	2	61	3.28	2	61	3.28
Double inferior talar facet	13	60	21.67	12	58	20.69
Medial talar facet	2	59	3.39	2	57	3.51
Os trigonum	1	60	1.67	1	58	1.72
Lateral talar facet	0	59	0	0	58	0

5.6 SKELETAL PATHOLOGY OTHER THAN TRAUMA

This section presents a summary with crude prevalence rates alongside the age and sex of affected individuals.

5.6.1 Joint disease

Extra-spinal joint disease is the most common skeletal pathology seen among the adults in the study group (88/254, 34.65%). Almost half of all cases are from the Isle of May (33/88, 37.5%) and most are men (28/33, 84.85%) which is unsurprising given the sex composition of this assemblage. A small number of affected individuals are from Lundin Links (12/88, 13.63%) where women are most commonly affected (8/12, 65.66%), followed by Thornybank (10/88, 11.36%) where again women are most commonly affected (7/10, 70%). The number of affected individuals at Lasswade is small (7/88, 7.95%) and in contrast men are most commonly affected (5/7, 71.43%). All age categories were represented across the study group.

Spinal joint disease is the second most common skeletal pathology seen among the adults in the study group (87/254, 34.25%). Just over half of all cases are from the Isle of May (34/87, 39.08%) and most are men (27/34, 79.41%), which is unsurprising given the sex composition of this assemblage. The number of affected individuals at Lasswade and Lundin Links are the same (11/87, 12.64%). At Lundin Links women are very slightly more affected than men (7/11, 63.64%) and even less so at Lasswade (6/11, 54.55%). Even fewer affected individuals are found at Thornybank (7/87, 8.05%) where women are very slightly more affected than men (4/7, 57.14%). All adult age ranges are represented. A single adolescent from the Isle of May exhibits evidence for spinal joint disease.

The number of adult individuals who exhibit evidence of extra-spinal osteoarthritis is small (20/254, 7.97%). Three-quarters of all cases are from the Isle of May (15/20, 75%) and again men are most commonly affected (13/15, 85.66%). One male and one female from Thornybank are affected with one each from Four Winds, Longniddry and Seacliffe.

There are four cases of spinal osteoarthritis: three from the Isle of May and one from Seacliffe.

5.6.2 Neoplasms

Isle of May skull 959, a prime adult male, has a button osteoma on the left parietal with a maximum diameter of 11 mm. An older adult female from Cramond, skull 6 has a button osteoma on the left frontal above the orbit. It measures 5.65 mm in diameter.

Lundin Links skull IB212B, an older adult male, has a near circular perforation on the anterior portion of the left palate which extends just beyond the midline (see Plate 5.1 below). It is smooth-walled with a maximum diameter of 15.77 mm and there is abnormal porosity associated. There is also a small perforation in the nasal floor. This neoplastic lesion may have led to the ante-mortem loss of the left maxillary 2nd incisor. This individual also has a healed nasal fracture.

Plate 5.1: Lundin Links, skull IB212B, benign neoplasm of the palate (©Angela Boyle)

An older adult male from the Isle of May (skeleton 859) exhibits evidence of a metastatic carcinoma. Irregular spongy bone is present on the medial surface of the ilium adjacent to the auricular surface. It measures 18.75 mm (A-P) x 21.74 mm (P-D). A similar deposit is present on the lateral surface close to the iliac crest. This condition has been identified as probable prostate cancer and will be reported on in a future publication.

5.6.3 Maxillary sinusitis

A total of six individuals with sinusitis have been identified within the study group (6/306, CPR 1.96%). They comprise a prime adult male (967) and an older juvenile (970) from the

Isle of May, a mature adult male from Lundin Links (LL3), an adult male from Lasswade (49), a mature adult female from Seacliffe (56/11) and a mature adult female from Thornybank.

5.6.4 Infection

A total of 10 individuals with active or healed periostitis have been identified within the study group (10/306, CPR 3.27%). The low prevalence rate can be linked to both poor surface preservation and the absence of post-cranial remains in 105 cases. The skeletons comprised seven from the Isle of May, one from North Berwick, Beach Road and two from Seacliffe. There were three males, three females, an adult of indeterminate sex, an adolescent and two older juveniles. In six cases isolated bones were affected; two were active lesions and four were healed.

Isle of May skeleton 997 is an unsexed adolescent who was recently diagnosed with either tuberculosis or congenital syphilis (Willows 2016). Certainly, a chronic infectious process is reflected by severe osteomyelitis which affects the femora, tibiae, fibulae and metatarsals. The cortical bone is much thinned and there is very little trabecular bone surviving. Active periostitis is also present on the left and right ilium, the right clavicle and the visceral surfaces of three left and three right ribs.

Isle of May skeleton 970, an older juvenile, exhibits active periostitis which affects the femora, fibulae, radii, ulnae and ribs. Further work, including biomolecular analyses, is planned for both of these skeletons.

Craig’s Quarry 56/9 IB265A is a young adult male. There is severe destruction of the vertebral bodies of TV6-9 which has led to kyphosis (see Plate 5.2 below). Woven bone is associated with all lesions.

Plate 5.2: Craig’s Quarry 56/9 IB265A, TV9, superior view (©Angela Boyle)

5.6.5 Circulatory

A total of five skeletons from the Isle of May exhibit evidence of osteochondritis dissecans (379, 385, 440, 832, 995). All skeletons are adult males. Affected bones comprised a right tibia, a left tibia, a left 1st metatarsal, two left and one right proximal foot phalanx.

5.6.6 Metabolic

Gullane Links skeleton 4, a neonate, has abnormal porosity which affects the ectocranial surface of the left and right temporals, left orbital rim, sphenoid, pars basilaris, and the left and right ilium.

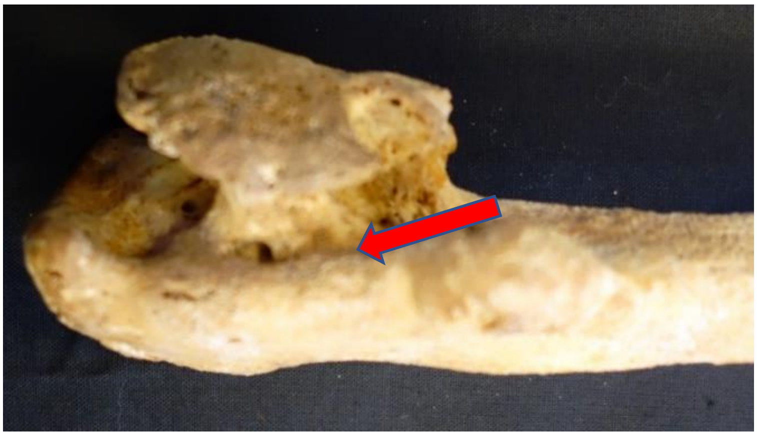
A total of 30 skeletons (30/306, CPR 9.8%) within the study group exhibit evidence of cribra orbitalia. Males and females were equally affected (12/30, 40%) followed by six non-adults (6/30, 20%) who were younger juvenile (1), older juvenile (3) and adolescent (2). The assemblage from Lundin Links contains the highest number of affected individuals (8/30, 25.67%) with equal numbers of males and females. Five skeletons are from the Isle of May (5/30, 15.67%) and comprise two males, one female and two non-adults.

5.6.7 Congenital and developmental conditions

Craig's Quarry IB265B, a young adult male, exhibits evidence of unilateral hip dysplasia. The left acetabulum is shallow and wide with an enlarged articulation. The left femur head has a flattened mushroom appearance while the left femur shaft is angled anteriorly. The left knee joint is normal.

Lundin Links skeleton 12, a prime adult female, exhibits evidence of a unilateral hip dysplasia (see Plate 5.3 below). The left femur has a wasted appearance with a very short neck and a flattened femoral head which has moderate porosity and osteophtyes. The left pelvis is no longer present although it is referred to in the original report (Stuart and Campbell-Wilson 2000).

Plate 5.3: Lundin Links, skeleton 12, left femur, posterior view (©Angela Boyle)



Isle of May skeleton 832, a young adult male, exhibits squaring of the bodies of vertebrae TV11-LV2, which is suggestive of Scheuermann's disease.

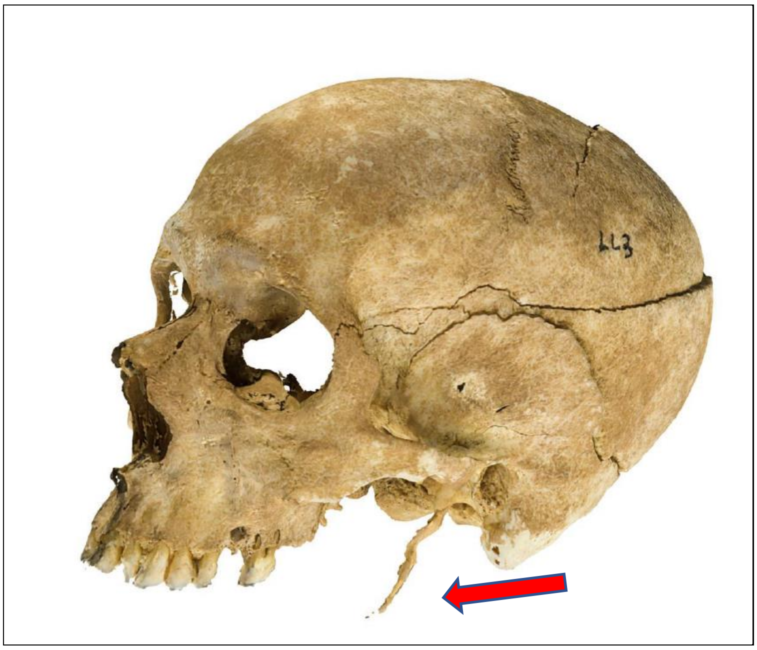
Isle of May skeleton 971, a young adult male has spina bifida occulta and lumbarisation of SV1. The neural arch of CV1 is unfused. Isle of May skeleton 980, a young adult male, exhibits unusual vertebral morphology. CV2-5 have bifid spinous processes. The spinous process of CV5 is short and twisted, presumably to accommodate the spinous process of CV6 which protrudes superiorly. The spinous processes of TV9 and 10 are fused together.

Isle of May skeleton 1023, a prime adult male, exhibits abnormal fusion of the sternum (see Plate 5.4 below).

Plate 5.4: Isle of May, skeleton 1023, abnormal fusion of sternum, anterior view (©Angela Boyle)

Lundin Links skull 3, a mature adult male, exhibits evidence of a rare condition known as Eagle Syndrome. The left and right styloid processes are abnormally long (see plate 5.5 below). The left measures 48.73 mm while the right, which is missing its tip, measures 39.52 mm. The condition leads to calcification of the ligaments of the styloid process. The standard syndrome is characterized by odynophagia (painful swallowing), dysphagia (difficulty swallowing), cervicalgia (neck pain), and craniofacial pain. The carotid syndrome entails faintness, feelings of intoxication, and even cerebro-vascular accidents. Death can occur due to stimulation of the vagus nerve which can cause sudden cardiac arrest. This man suffered fatal sharp force trauma.

Plate 5.5: Photogrammetric model of skull 3, Lundin Links, Fife. Lateral view. Note the elongated styloid process. © Polyphonic Murders



5.7 DENTAL PATHOLOGY OTHER THAN TRAMA

A total of 200 individuals within the study group have one or more tooth surviving (200/306, 65.36%). The vast majority were adults (181/200, 90.5%) with a small number of non-adults (19/200, 9.5%). The prevalence rates for dental pathologies appear in Tables 5.41-5.42 below while prevalence rates for non-adults can be found in Table 5.42.

Table 5.41: Prevalence rates for dental pathologies, adults only

AMTL	Calculus	Caries	DEH	Abscess
329/3707 (8.88%)	622/2813 (22.11%)	60/2782 (2.16%)	172/2781 (5.18%)	96/3195 (3.00%)

Table 5.42: Prevalence rates for dental pathologies, non-adults only

AMTL	Calculus	Caries	DEH	Abscess
0/308 (0%)	18/299 (5.02%)	1/287 (0.35%)	25/287 (8.71%)	0/249 (0%)

CHAPTER 6: RESULTS: THE OSTEOLOGICAL EVIDENCE FOR VIOLENCE AND TRAUMA

"It is remarkable how little evidence there is of violent deaths or even major bodily trauma in the Scottish burial record before the 9th century" (Maldonado 2013, 11).

6.1 INTRODUCTION

The primary aim of this research is to identify injuries that caused the death of an individual or were intended to inflict harm (Kimmerle and Barayaber 2008, 266) and where possible to explore the causative factors involved. The difficulty of finding intent in observed injuries is a general theme/interpretative issue (e.g. Dyer and Fibiger 2017, 1516; Schulting and Fibiger 2012, 126). While cranial fractures are often seen as more diagnostic of deliberate aggression than post-cranial trauma (Lovell 1997, 149; Schulting 2012, 224) certain cranial fractures are often discounted as they are believed to be caused by accidental trauma (Freeman *et al.,* 2014, 64; Lovell 1997, 150).

In order to elucidate the possible causative factors behind identified injuries it is important to combine a detailed analysis of traumatic lesions with other osteological parameters. In particular the age and sex distribution of affected individuals has been assessed in order to determine if there are recognisable patterns both within and between assemblages. It is also crucial where possible to identify post-mortem modification and taphonomic changes.

This chapter presents a detailed description of the skeletal evidence for violence and trauma within the study group.

6.2 CRANIAL TRAUMA

The evidence for cranial trauma is discussed under separate sections for ante-mortem and peri-mortem blunt-force and sharp-force trauma. These sections are followed by a section on dental trauma and forced occlusion. There are at least two convincing examples of dental trauma whose likely cause is forced occlusion provoked by severe fatal peri-mortem trauma (one blunt-force and one sharp-force) and a further three which have been classified as possible examples (two blunt-force and one sharp-force). The fifth section considers penetrating injuries and is followed by a section which discusses ante-mortem post-cranial trauma. The final section considers pseudo-trauma which is defined as post-mortem damage that could be mistaken for peri-mortem trauma.

All the examples of cranial trauma discussed in this thesis have not previously been recorded in the earlier published osteological analyses (Battley *et al.,* 2008; Lorimer 2000) with the exception of Isle of May skulls 959 and 1211 (the latter from a later phase and included for comparative purposes). The peri-mortem sharp-force trauma exhibited by Isle of May 959 was briefly described but its significance was not further explored.

A total of 27 skeletons exhibiting definite or possible cranial trauma derive from 10 sites across the study area (CPR 6.82%, 27/306) (see Table 6.1 below). The highest numbers derive from the mass burial at Cramond and the cemetery at Lundin Links. The four examples from Dunbar come from unrelated sites within the town whose precise context is unclear.

Table 6.1: Summary of sites in study group where cranial trauma is present

Site name	Ante-mortem blunt-force trauma	Ante-mortem sharp-force trauma	Peri-mortem blunt-force trauma	Peri-mortem sharp-force trauma	Total	%
Kirkliston/Catstane	0	0	0	1	1	3.7
Cramond	2	1	2	1	6	22.2
Dunbar	1	1	0	2	4	14.8
Isle of May	1	1	0	1	3	11.1
Lundin Links	4	0	0	2	6	22.2
Ringleyhall	0	0	0	1	1	3.7
Seacliffe	1	1	0	0	2	6.4
Seacliffe Mausoleum	0	0	1	0	1	3.7

Stonelaws	1	1	0	0	2	6.4
Thornybank	0	0	0	1	1	3.7
Total	10	5	3	9	27	100

A total of 232 skulls were present within the study group; this provides a true prevalence rate for all cranial trauma of 11.64% (27/232). The overwhelming number of affected individuals were male (85%, 23/27), followed by females (11.1%, 3/27), two from Cramond, one from Dunbar, with a single neonate (3.7%, 1/27) from Cramond. A Fisher exact test was carried out to determine if the predominance of males is significant. The value is 0.0134 which is significant at $p<0.05$. The most commonly affected cranial elements are the right parietal and the occipital (24.32%, 9/37) followed by the left parietal (5/37, 13.5%).

Table 6.2: All cranial trauma, affected elements

Cranial element	Cranial trauma	Total present	% TPR
r. frontal	3	150	2.00
l. frontal	2	148	1.35
l. orbit	1	95	1.05
r. parietal	9	167	5.39
l. parietal	5	166	3.01
r. occipital	5	173	2.89
l. occipital	4	171	2.34
r. nasal	2	65	3.08
l. nasal	2	63	3.17
r. maxilla	1	116	0.86
l. maxilla	1	111	0.90
r. mandible	2	147	1.36
Total	37	920	4.02

6.2.1 Ante-mortem blunt-force cranial trauma

A total of ten skulls exhibited evidence for ante-mortem blunt-force cranial trauma and are summarised in Table 6.3 below. With the exception of a mature adult female from Lundin Links (IB212D) and an older adult female (Cramond 6) all the skulls are male or probable male, and all adult age ranges are represented. The Fisher exact test statistic value is

0.4993. The result is not significant at $p<0.05$. The location of all injuries are illustrated in Figure 6.1.

Table 6.3: Summary of skulls exhibiting ante-mortem blunt force trauma

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Cramond 1	Prime adult (26-35 years)	Male	1	Right parietal
Cramond 6	Older adult (46+ years)	Female	2	Right frontal, body of right mandible
Dunbar IB226	Older adult (46+ years)	Male	1	Left parietal
Isle of May 1022	Young adult (18-25 years)	Male	1	Left maxilla, left maxillary 2nd molar
Lundin Links IB212B,	Older adult (46+ years)	Male	1	Left and right nasal
Lundin Links IB212C (12)	Prime adult (25-35 years)	Male	1	Occipital
Lundin Links IB212D	Mature adult (25-35 years)	Female	1	Right occipital
Lundin Links IB225	Prime adult (25-35 years)	Male	1	Right frontal
Seacliffe S56/11	Young adult (18-25 years)	Male?	1	Right maxilla
Stonelaws ET8	Mature adult (36-45 years)	Male	1	Left and right nasal

A total of 13 cranial elements exhibit evidence of ante-mortem blunt-force cranial trauma and are summarised in Table 6.4 below. Injuries to the right frontal bone, the right occipital and the nose were most common with the remainder being represented by single injuries.

Table 6.4: Ante-mortem blunt-force cranial trauma, affected elements

Cranial element	Ante-mortem BFT	Total present	% TPR
r. frontal	2	150	1.33
r. parietal	1	167	0.60
l. parietal	1	166	0.60
r. occipital	2	173	1.16
r. nasal	2	65	3.08
l. nasal	2	63	3.17
r. maxilla	1	116	0.86
l. maxilla	1	111	0.90
r. mandible	1	147	0.68
Total	13	1158	1.12

6.2.1.1 Depressed fractures

A prime adult male from Cramond (skull 1) has a possible broadly circular depressed fracture located on the posterior portion of the right parietal (see Plate 6.1 below). It measures 11.42 mm (A-P) by 5.81 mm (M-L) and is associated with abnormal porosity indicative of infection which may suggest that the injury occurred shortly before death. Evidence of ante-mortem sharp-force trauma is also present (see Section 6.2.2 below) as is pseudo-trauma in the form of root etching (see Section 6.6 below).

Plate 6.1: Cramond skull 1, right parietal, circular depressed fracture, lateral view (©Angela Boyle)

A prime adult male from Lundin Links (IB225) exhibits a depressed circular fracture to the right side of the frontal bone close to the coronal suture (see Plate 6.2 below). The injury is broadly circular measuring 25.74 mm (M-L) by 24.63 mm (A-P). Post-mortem damage to the right gonial angle of the mandible could be mistaken for peri-mortem sharp-force trauma (see Section 6.6 below). The application of consolidant precludes radiocarbon dating and aDNA analysis although there is potential for isotope analysis.

An older adult male (46+ years) skull, Dunbar IB226, has a healed ante-mortem blunt-force depressed fracture, which is linear (see Plate 6.3 below). The fracture was located on the posterior portion of the left parietal, close to the sagittal suture. It is aligned diagonally from lateral to medial in an anterior-posterior direction. It has a maximum length of 26.81 mm and a maximum width of 13.53 mm. The edges of the injury are smooth and largely remodelled; the cross-section is U-shaped; the medial edge of the injury is slightly raised; there is no evidence of infection.

Plate 6.2: Lundin Links, skeleton IB225, depressed circular fracture, superior view (©Angela Boyle)

Plate 6.3: Dunbar IB226, depressed linear fracture, left parietal, posterior view (©Angela Boyle)

The skull is asymmetrical with a bulge in the region of the occipital. Evidence of pseudo-trauma is also present. The skull was recovered from a 'stone coffin' (long cist) in 1896. No further information is available.

A prime adult male from Lundin Links (IB212C) exhibits a possible healed linear depressed fracture to the right occipital bone (see Plate 6.4 below). There is considerable post-mortem erosion and the fragments have been glued and pinned, which further obscures detail. The fracture has a maximum length of 22.9 mm and a maximum width of 12.38 mm.

Plate 6.4: Lundin Links, skeleton IB212C, possible depressed linear fracture, posterior view (©Angela Boyle)

Depressed fractures of the cranial vault occur from in-bending at the point of impact when the cranium is struck by an object moving at high velocity (Knüsel 2005, 56).

Four of the ante-mortem blunt-force injuries are depressed fractures, which are a consequence of direct blows that cause ‘caving-in’ of the bone’s cortex. The scale of the injury in the skull depends to an extent on the size of the impacted area and the velocity of the force (Gurdjian 1975). Depressed fractures may present with or without actual penetration of the skull (Heary *et al.,* 1993; Wedel and Galloway 2014, fig. 8.2). Commonly only the outer table will be involved with the inner table remaining intact. Slingstones could produce a range of depressed fractures depending on their size, weight and velocity, from small to medium-sized depressed fractures or more extensive penetrating cranial injuries

(Fibiger 2009, 105). Indeed, the easiest to use, most widely available and highly effective missile is a stone thrown by hand (ibid.; Wilson *et al.,* 2016). All four skeletons with depressed fractures are adult males, three are prime adults and one is an older adult. Two examples are among the 19th-century discoveries from Lundin Links, one is from Dunbar and one is from Cramond. Only Cramond skull 1 has been radiocarbon dated and subjected to DNA and isotope analysis (see below).

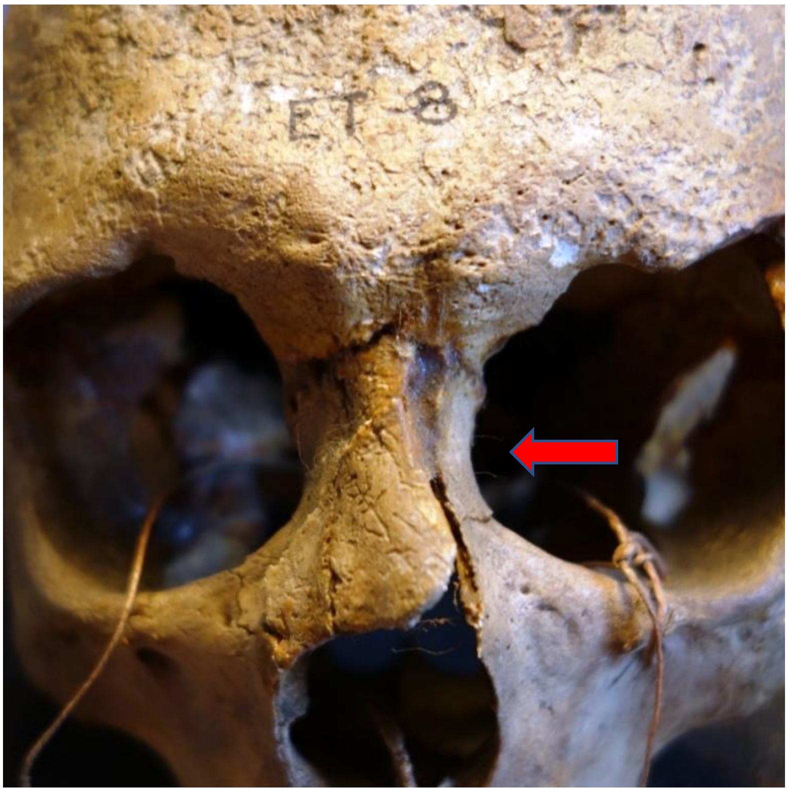
6.2.1.2 Facial fractures

An older adult male from Lundin Links (IB212B) has a healed nasal fracture (see Plate 6.5 below). The nasal bone is deviated towards the left with a clearly visible linear fracture. There is a spur of bone on the left side which extends into the left orbit. The left nasal bone and part of the left orbit are displaced very slightly in a posterior direction giving the face a slightly lopsided appearance.

Plate 6.5: Lundin Links, skeleton IB212B, healed nasal fracture, anterior view. (©Angela Boyle)

A mature adult male from Stonelaws (ET8) has a possible ante-mortem fracture of the nasal bone (see Plate 6.6 below). The bone is deviated towards the left and a possible fracture line is obscured by poor reconstruction.

Plate 6.6: Stonelaws, skull ET8, possible ante-mortem fracture of nasal bone, anterior view (©Angela Boyle)



Isle of May skeletons 386 and 1138, also from later phases of burial, each have a deviated nasal septum, probably indicative of a broken nose. The former is a young adult male and the latter is a young adult female.

Nasal fractures are the most common of all facial fractures (Erdmann *et al.,* 2008). Causes include punches, kicks and falls including those from a standing height (Wedel and Galloway 2014, 150). A survey of the incidence of nasal fractures recorded an early peak in males usually of between 20 and 40 years with a second peak among the elderly (Bremke *et al.,* 2009).

A young adult male (25-35 years) from the Isle of May (skeleton 1022), has a healed fracture of the left maxilla (see Plate 6.7 below). The fracture line runs diagonally for 4 mm from the alveolar edge at the point between the left maxillary 2nd and 3rd molars. The left maxillary 2nd molar is associated with an externally draining, smooth-walled abscess with a maximum diameter of 6.65 mm.

Plate 6.7: Isle of May, skeleton 1022, fractured left maxilla and externally draining abscess, lateral view (©Angela Boyle)

During the original analysis this skull was examined by a dentist who commented as follows: 'Large cystic area associated with left maxillary 2nd molar, has not penetrated antrum, root tips are not complete, presence of enamel fracture on disto-buccal cusp suggests tooth sustained a sharp vertical blow, rendering tooth non-vital, arresting further development and precipitating development of dental cyst. Trauma likely to have happened at age 13 or 14 years.'

A probable male young adult from Seacliffe (1954 S56/11) has a healed comminuted fracture of the right maxilla in the region of the frontal process (see Plate 6.8 below). A linear fracture line runs diagonally from the corner of the right orbit to the nasal aperture. The skull has also been subjected to post-mortem compression.

In a modern context accidents are a common cause of facial fractures, especially in adolescents and young adults (Marshall *et al.,* 2003; Perkins *et al.,* 2000; Reehal 2010) while falls become the more common cause of fracture in older adults (Lida *et al.,* 2003). Nonetheless, interpersonal and domestic violence are also implicated (Arosarena *et al.,* 2009; Bakardjiev and Pechalova 2007; Erdmann *et al.,* 2008). Fractures of the maxilla are also common because of the thinness of the bone and account for 10-20% of all facial fractures (Doerr and Mathog 2009) although they are complex and difficult to classify with any accuracy (Wedel and Galloway 2014, 151).

Plate 6.8: Seacliffe, skeleton S56/11, ante-mortem fracture of right maxilla, anterior view (©Angela Boyle)

Cramond 6, an older adult female, has a possible healed fracture of the body of the mandible on the right side. A radiograph would be required to confirm this diagnosis. There is marked contour change to this part of the bone (see Plate 6.9 below) and osteoarthritis of the right mandibular condyle evidenced by contour change, a lytic defect and mild porosity. The right mandibular fossa is unaffected. Post-mortem breakage of the right condyle has occurred. The left mandibular 1st and 2nd molars have chipped enamel.

Plate 6.9: Cramond 6, right side of mandible exhibiting contour change, right lateral view (©Angela Boyle)

The most commonly cited location for the mandible to fracture varies according to the study as do likely causes which include fist fights, falls, assaults, sports and motor accidents (Wedel and Galloway 2014, 153-5, fig. 8.7).

6.2.1.3 Haematoma

Cramond 6 has an ossified extradural haematoma located on the anterior portion of the right frontal. It is an irregular oval with a maximum diameter of 25.8 mm and measures at least 5 mm in thickness (see Plate 6.10 below). It is conceivable that this injury along with the possible fracture of the body of the right side of the mandible discussed above occurred during a single event.

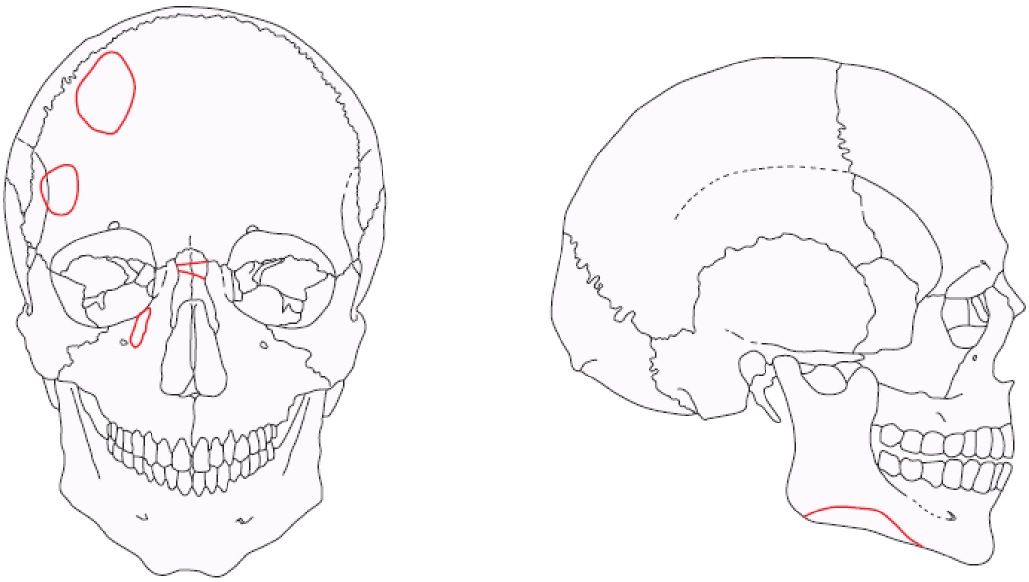
Plate 6.10: Cramond skull 6, ossified haematoma, right frontal, right lateral view (©Angela Boyle)

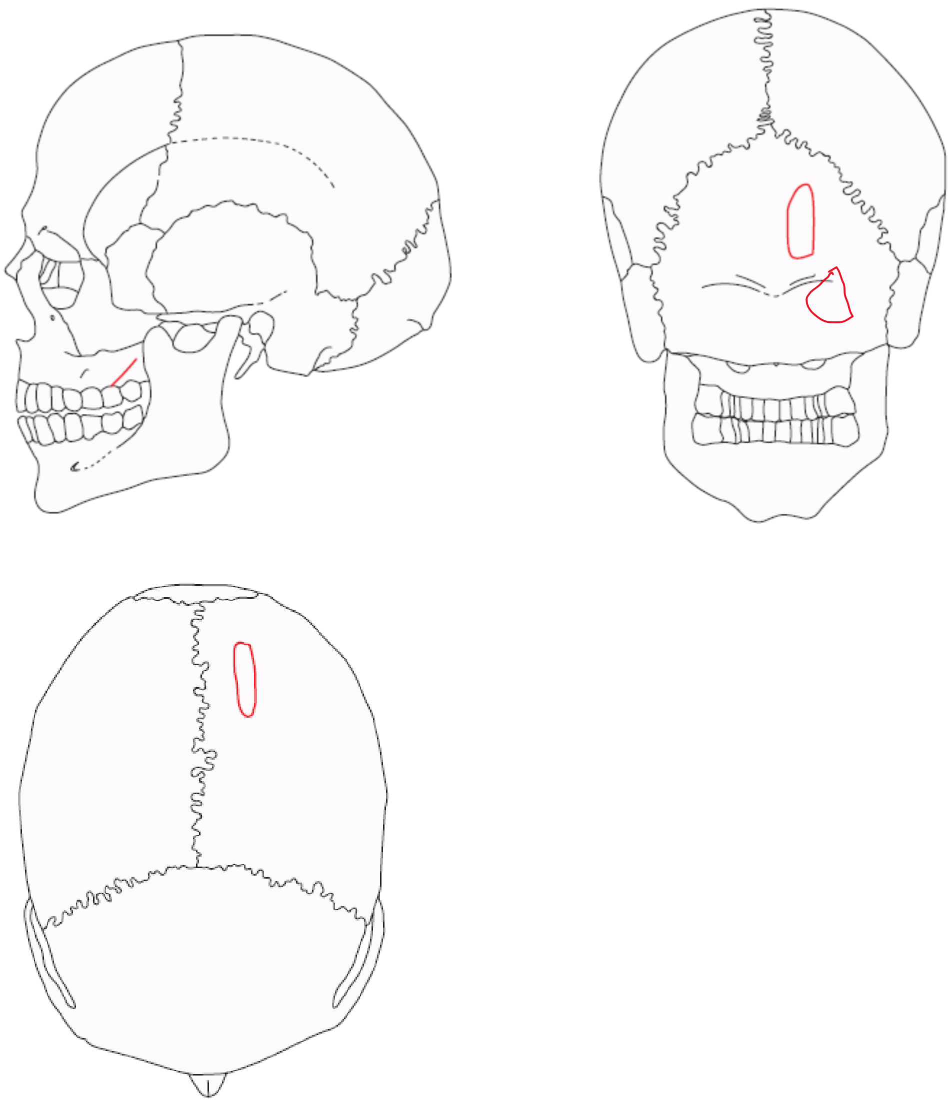
Lundin Links skull IB212D, a mature adult female, has a broadly circular plaque of bone on the right side of the occipital below the nuchal crest (see Plate 6.11 below). It has a maximum diameter of 12.23 mm. It may be an extradural haematoma, although a differential diagnosis of a button osteoma is a possibility.

Plate 6.11: Lundin Links, skull IB212D, possible extradural haematoma, posterior view (©Angela Boyle)

The distribution of ante-mortem blunt-force cranial trauma is illustrated in Figure 6.1 below.

Figure 6.1: Distribution of ante-mortem blunt-force cranial trauma, anterior, right lateral, left lateral, posterior and superior views (©Peter Lorimer, Pighill Graphics)





6.2.2 Ante-mortem sharp-force cranial trauma

A total of five skulls exhibit evidence of ante-mortem sharp-force cranial trauma and are summarised in Table 6.5 below. All are male with the exception of a prime adult female from Dunbar, Kirkhill Braes (IB262). The distribution of all these injuries are illustrated in Figure 6.2 below.

Table 6.5: Summary of skeletons exhibiting evidence of ante-mortem sharp-force cranial trauma

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Cramond 1	Prime adult (25-35 years)	Male	1	Right frontal
Dunbar Kirkhill Braes IB262	Prime adult (25-35 years)	Female	1	Right gonial angle
Isle of May 859	Older adult male (46+ years	Male	1	Left and right occipital
Seacliffe 1954 '1 fragmented skull'	Prime adult (25-35 years)	Male	1	Right parietal

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Stonelaws ET10	Prime adult (25-35 years)	Male?	1	Left frontal

All cranial elements are affected equally (see Table 6.6 below).

Table 6.6: Ante-mortem sharp-force cranial trauma, affected elements

Cranial element	Ante-mortem sharp-force trauma	Total present	% TPR
r. frontal	1	150	0.67
l. frontal	1	148	0.68
r. parietal	1	167	0.59
r. occipital	1	173	0.58
l. occipital	1	171	0.58
r. mandible	1	147	0.68
Total	6	1051	0.57

A prime adult male, Cramond 1, exhibits a linear cut which is located on the right frontal (see Plate 6.16 below) and is posterior to a post-mortem defect caused by root etching. The linear cut which has partly remodelled measures 15.71 mm in length (A-P) and 5.3 mm in width (M-L). There is an associated broadly circular area of healed porosity, which measures 34.28 mm (A-P) by 26.87 mm (M-L). This injury is well-healed and it is therefore not possible to determine the shape of the cross-section. The length of the cut is suggestive of a short rather than a long weapon. The location may suggest an attack from the front by a left-handed assailant. Green staining was present on the left and right parietals and the left mandibular ramus. This is perplexing as no artefacts were recovered.

A prime adult female from Dunbar Kirkhill Braes (skull IB262) exhibits possible healed sharp-force trauma which has removed a small part of the right gonial angle (see Plate 6.13 below). The surviving surface is enlarged though smooth and remodelled. The affected area has a maximum length of 24.77 mm and a maximum diameter of 6.93 mm. An ear ossicle has been submitted for aDNA analysis and results are awaited.

Plate 6.12: Cramond skull 1, right frontal, healed sharp-force cranial trauma associated with abnormal porosity, right lateral view (©Angela Boyle)

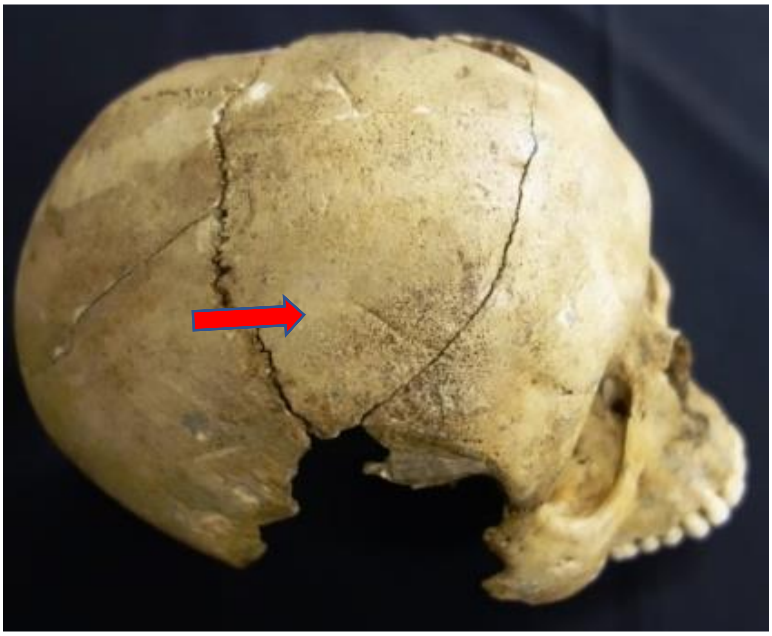


Plate 6.13: Dunbar Kirkhill Braes, skull IB262, right gonial angle (a) lateral view, (b) posterior view (©Angela Boyle)

A later medieval skeleton from Eyemouth exhibits a similar injury, which is less well-healed (see Plate 6.59 below). Further afield, there are numerous examples from Ridgeway Hill, Weymouth (e.g. Boyle 2014, 142, fig. 4.13). All are related to the process of decapitation from behind and are unhealed. In the case of Dunbar skull IB262 the injury could also have been inflicted from behind by a right-handed assailant or from the front by a left-handed assailant.

An older adult male from the Isle of May (skeleton 859) has a healed sharp-force injury to the occipital (see Plate 6.14 below). The injury runs diagonally upwards from lateral to medial, measuring 65.88 mm in length. There is clear evidence for remodelling along 25.2 mm of its length. The injury penetrated through the ectocranial surface, diplöe and endocranial surface. The injured fragments did not re-unite leaving a *c.* 5 mm gap. The length of the injury suggests that a long blade was used and the attack came from behind. XRF and SEM failed to identify any traces of iron left by the weapon on the cut edges (see Appendix 5.5 below).

Plate 6.14: Isle of May, skull 859, occipital, healed sharp-force trauma, posterior view (©Angela Boyle)

There is a compression fracture of the third lumbar vertebra which has caused collapse of the body on the left side although the bone is too damaged to measure variation in thickness. Significantly, there is also skeletal evidence of a possible metastatic carcinoma of the prostate, which is likely to be one of the earliest recorded examples in the UK (Simon Mays pers. comm.).

A prime adult male from Seacliffe (1954 '1 fragmented skull') exhibits a healed sharp-force injury located on the right parietal (see Plate 6.19 below). An elongated portion of bone has been removed from the ectocranial surface although the diplöe has not been penetrated. The defect measures 40.31 mm in length and 5.08 mm in width. The affected area is smooth and remodelled. There is clear bevelling on the medial side of the injury which is less marked on the lateral edge. There is no evidence of infection. The sex of the skeleton has been confirmed by aDNA analysis (Armit in preparation, GENLAB 304 – 16415). There are parallels with an injury sustained by Towton 10 where a wedge of bone has been removed (Knüsel 2005, 58, fig. 15). The uppermost margin is sharp while the margin below is more irregular. The blow could have come from the front or the back.

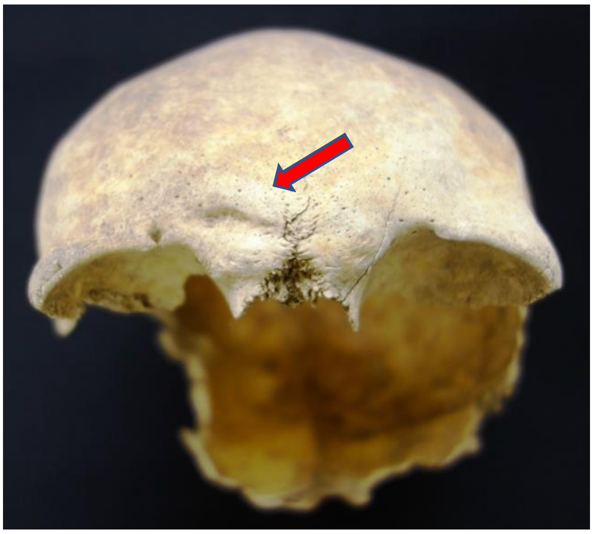
Plate 6.15: Seacliffe, 1954 '1 fragmented skull', right parietal, healed sharp-force trauma, right lateral view (©Angela Boyle)

A prime adult male from Stonelaws (skull ET10) exhibits a healed sharp-force injury to the left frontal (see Plate 6.16 below). It is a linear defect running in an antero-posterior direction with a maximum length of 16.44 mm and a maximum width of 3 mm. It penetrates the ectocranial surface only. The edges are smooth and remodelled.

Plate 6.16: Stonelaws, skull ET10, healed sharp-force trauma, left frontal, left lateral view (©Angela Boyle)

A single prime adult male skeleton (1211) from the later phases of burial at the Isle of May exhibits an ante-mortem sharp-force injury to the right of the glabella (see Plate 6.17 below). It measures 15.3 mm in length and 3.5 mm in width.

Plate 6.17: Isle of May, skull 1211, ante-mortem sharp-force trauma, anterior view (©Angela Boyle)

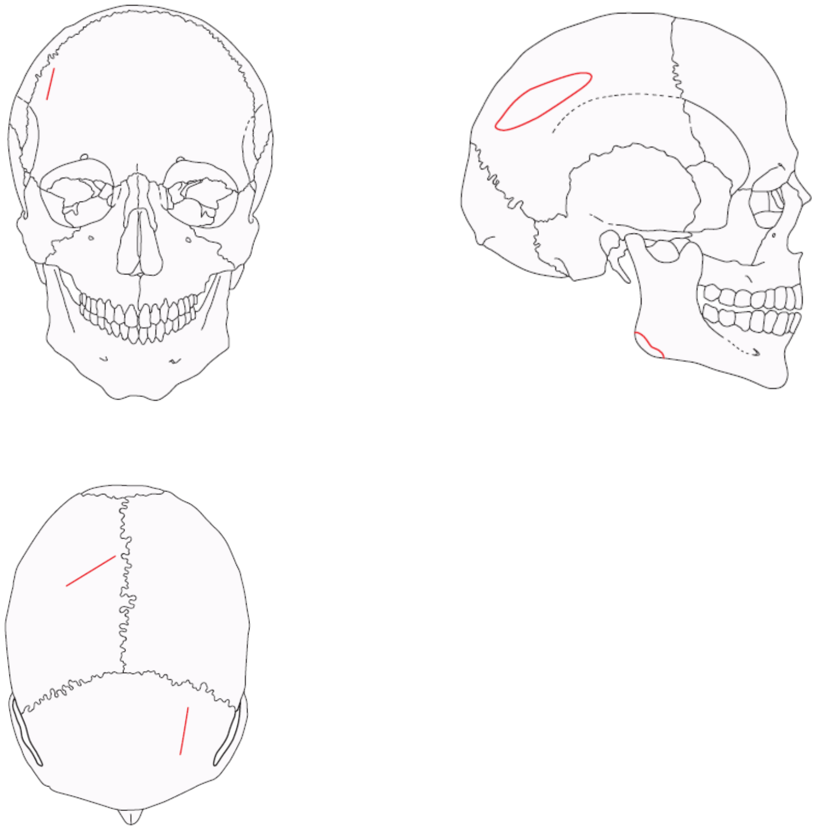


A less convincing injury to the right parietal of Isle of May skeleton 1211 is a possible circular depressed fracture (see Plate 6.18 below) associated with abnormal porosity.

Plate 6.18: Isle of May, skull 1211, right parietal, possible depressed fracture, superior view (©Angela Boyle)

The distribution of ante-mortem sharp-force cranial trauma is illustrated in Figure 6.2 below.

Figure 6.2: Distribution of ante-mortem sharp-force cranial trauma within the study group, anterior, right lateral and superior views (© Peter Lorimer, Pighill Graphics)



6.2.3 Peri-mortem blunt-force cranial trauma

A young adult female from Cramond (skeleton 5) and an adult male aged upwards of 18 years from Seacliffe Mausoleum (skull C) exhibited peri-mortem blunt-force cranial injuries (see Table 6.7 below). The example from Cramond is very convincing while that from Seacliffe is less so. A disarticulated fragment of neonatal parietal from Cramond has a probable peri-mortem blunt-force injury. The location of all three injuries is illustrated in Figure 6.3.

Table 6.7: Summary of skeletons exhibiting evidence of peri-mortem blunt-force cranial trauma

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Cramond 5	Young adult (18-25 years)	Female?	1	Right parietal
Cramond disarticulated	neonate	n/a	1	Right parietal
Seacliffe Mausoleum skull C	Adult (18+ years)	Male	1	Right parietal

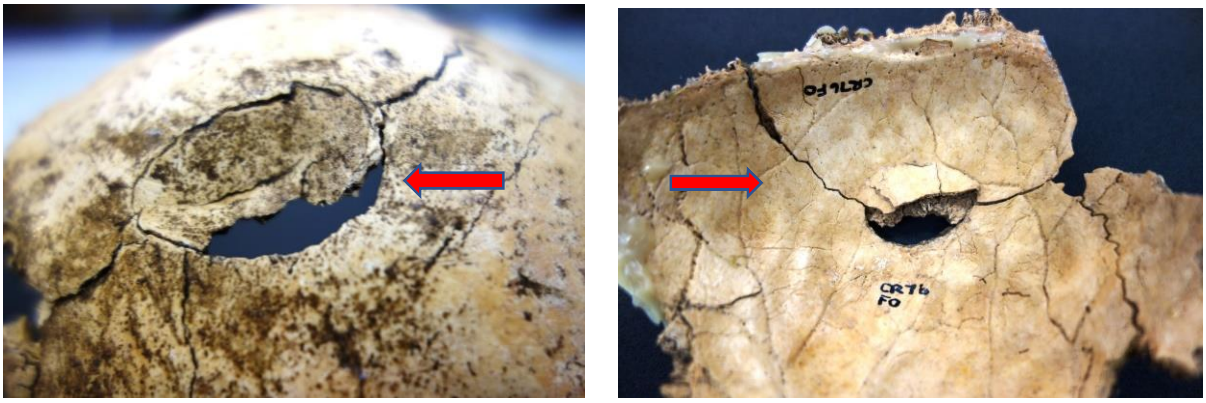
The right parietal was the only cranial element affected (3/3, 100%) (see Table 6.8 below).

Table 6.8: Peri-mortem blunt-force cranial trauma, affected elements.

Cranial element	Peri-mortem blunt-force trauma	Total present	% TPR
r. parietal	3	167	1.80
Total	3	3041	0.10

The right parietal of Cramond 5 has an oval, egg-shaped depression fracture which measures 33.9 x 22.17 mm (see Plate 6.19a and b below). The inner table of the skull has separated from the diplöe at the point of impact; there are four radiating fractures; the affected area of the skull is depressed but most of the affected bone remains in place. Penetration of the outer table, the diplöe and the inner table has occurred on the lateral side of the injury. There is no evidence of remodelling or infection. The piece of bone that conjoins within the perforation suggests that this fracture was also comminuted (made up of a series of broken fractures). A very similar injury affects the left parietal and temporal region of Towton 11 and there are three associated radiating fractures (Knüsel 2005, 54, fig. 8; Novak 2007, 97, fig. 6.6a). Blunt-force wounds at Towton tended to produce a great deal of damage on the endocranium where large portions of the vault were crushed internally.

Plate 6.19: Cramond skull 5, right parietal, peri-mortem blunt-force trauma, (a) ectocranial view, (b) endocranial view ((©Angela Boyle)



A marked bulge of the right parietal is located inferior to the injury on Cramond 5. The skull had been poorly reconstructed and came apart during analysis. Evidence of possible forced dental occlusion linked to the blunt force trauma is discussed below (see Section 6.6).

Strontium and oxygen isotopic data suggest that this woman was local to Cramond (Czére *et al.,* forthcoming). Results of DNA analysis are awaited.

An adult male skull aged upwards of 18 years from Seacliffe Mausoleum (skull C) has an irregular oval-shaped perforation located on the right parietal adjacent to the sagittal suture (see Plate 6.20 below). Ectocranial bevelling is present and a depressed hinge of bone is located on the medial edge of the perforation. No concentric or radiating fractures are present unlike Cramond 5 above. Post-mortem erosion and breakage partly obscures the detail. The perforation measures 42.55 mm in length (anterior-posterior) and 33.48 mm in width (medial-lateral).

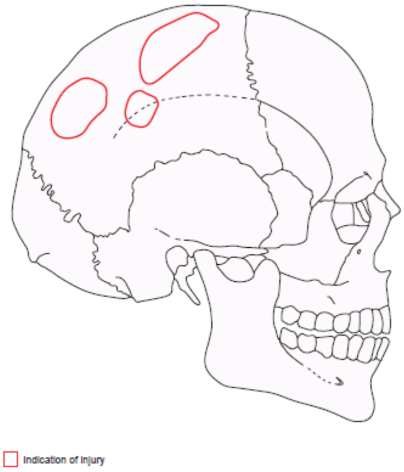
Plate 6.20: Seacliffe Mausoleum, skull c, right parietal, possible peri-mortem blunt-force trauma, superior view (©Angela Boyle)

A disarticulated fragment of neonatal right parietal from Cramond exhibits possible peri-mortem blunt-force trauma (see Plate 6.21 below). An irregular, broadly circular perforation is present in the region of the right parietal eminence. It was glued back into position at some point after excavation and the edges are no longer accessible for examination. The circular fragment has a maximum diameter of 15.37 mm. Three radiating fractures are present.

Disarticulated remains of a minimum of five neonates were identified during the analysis of the mass burial but unlike the adult material, have not yet been radiocarbon dated. It is possible that they predate the deposition of the adults in this context and are in fact Roman. Today, the presence of a cranial fracture in children under two years is considered highly indicative of child abuse (Hobbs 1984; Lewis 2013, 44).

Plate 6.21: Cramond, neonate, right parietal, possible peri-mortem blunt-force trauma, disarticulated (a) ectocranial surface (b) endocranial surface (©Angela Boyle)

Figure 6.3: Distribution of peri-mortem blunt-force cranial trauma within the study group, right lateral view (© Peter Lorimer, Pighill Graphics)



6.2.4 Peri-mortem sharp-force cranial trauma

A total of eight skeletons from the study group exhibited evidence of peri-mortem sharp-force cranial trauma and are summarised in Table 6.9 below. All were adult males, four of whom were in the prime adult category. The location of all the injuries is illustrated in Figure 6.4 below.

Table 6.9: Summary of skeletons exhibiting evidence of peri-mortem sharp-force cranial trauma

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Catstane (Kirkliston) ET34	Prime adult (25-35 years)	Male	1	Left parietal
Cramond 9	Prime adult (25-35 years)	Male	2	Right parietal
Dunbar NMS X 55.2	Adult (18+ years)	Male?	1	Right parietal
Dunbar ET36	Prime adult (25-35 years)	Male	1	Left parietal and left side of occipital
Isle of May 959	Prime adult (25-35 years)	Male	2	Left frontal and left parietal
Lundin Links ET1	Adult (18+ years)	Male	1	Left and right occipital condyles
Lundin Links 3	Mature adult (35-45 years)	Male	3	Left and right parietals and occipitals
Ringleyhall	Young adult (18-25 years)	Male	1	Right occipital
Thornybank 44	Prime adult (25-35 years)	Male	1	Right parietal

The most commonly affected cranial element was the right parietal (6/17, 35.29%) followed by the left parietal (4/17, 23.53%) (see Table 6.10 below). The Fisher exact test was used to determine whether or not the predominance of injuries on the right parietal is significant. The Fisher exact test statistic value is 0.0523. The result is not significant at p<.0.05.

Table 6.10: Peri-mortem sharp-force cranial trauma, affected elements

Cranial element	Peri-mortem SFT	Total present	% TPR
l. frontal	1	95	1.05
r. parietal	6	167	3.59
l. parietal	4	166	2.41
r. occipital	3	173	1.73
l. occipital	3	171	1.75
Total	17	920	1.85

The attribution of Kirkliston skull ET34 to the cemetery at Catstane was previously uncertain, however, the present analysis confirmed that it is Turner's skull D, now fragmented (Hutcheson 1868; Turner 1917, 226, tab. 8) which was removed from grave 49, a west-east oriented long cist in row H of the cemetery. The whereabouts of three other skulls A, B and C from similarly oriented long cist graves 12, 34 and 35 are unknown.

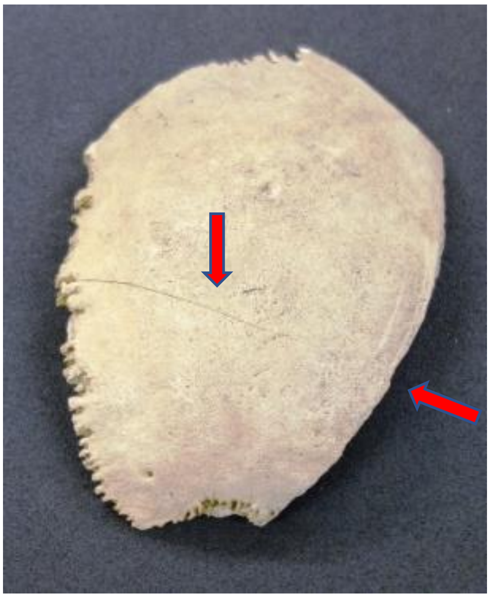
Kirkliston skull ET34 is a prime adult male (25-35 years according to dental attrition). The fragmented skull is unwashed. Consolidant and probable Plaster-of-Paris have been applied with fragments both glued and taped together. Probable peri-mortem sharp-force trauma has been identified on the left parietal (see Plate 6.22 below). The injury, which has penetrated through the skull to the endocranial surface, runs diagonally from the coronal suture on the left parietal in a posterior direction towards the squamous portion of the left temporal. It has a maximum length of 59.77 mm and patination is comparable to that of the surrounding bone apart from some recent post-mortem damage located at the lateral end of the injury. In contrast, other breaks to the skull have irregular edges and much lighter patination. XRF and SEM analysis to identify traces of iron in the cut surfaces was unsuccessful (see Appendix 5.5 below). This would have been a blow applied with great force from the front by a right-handed assailant.

Plate 6.22: Kirkliston ET34, (a) sharp-force trauma on left parietal, ectocranial surface; (b) plaster-of-Paris endocranial surface (©Angela Boyle)

All that remains of Cramond 9 is a mandible and a fragment of right parietal which cannot be associated with absolute certainty. The estimation of age and sex (prime adult, possible male) is based solely on features of the mandible, although the right parietal appears to be adult (18+ years). Two peri-mortem sharp-force injuries have been identified (see Plate 6.23 below). The first is a very fine incision on the right parietal, which extends from the sagittal suture in a medio-lateral direction for 49.23 mm, terminating 11.88 mm from the second injury, cut 2. Cut 2 has bisected the right parietal in an anterio-posterior direction; it is slightly curved with a maximum length of *c.* 90 mm. The length of the injury and the fact that it has penetrated all the way through the skull suggests a long-bladed weapon which was wielded with a great deal of force.

There is no direct relationship between the two injuries, however, the second was clearly the fatal blow. The presence of this apparently isolated skull fragment is difficult to explain. There are no conjoining fragments among the rest of the assemblage.

Plate 6.23: Cramond skull 9, right parietal, ectocranial view, two peri-mortem sharp-force injuries (©Angela Boyle)

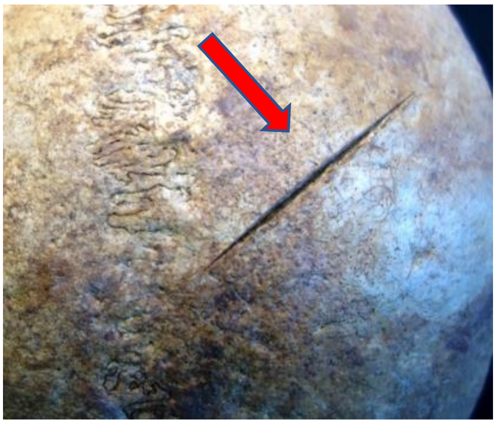


A small assemblage of disarticulated human bone, recovered during excavation in 2010 at Cramond, includes a small fragment of adult parietal which exhibits a single sharp force injury (see Plate 6.24 below). Patination suggests that this occurred in the peri-mortem period, either as a fatal injury or immediately after death. There is a marked bevel on the ectocranial surface. All the other edges are irregular. Nothing comparable was seen on any of the other cranial fragments.

Plate 6.24: Cramond 2010, sharp-force injury on a fragment of adult parietal. Context 018, small find no. 170 (©Angela Boyle)

A possible male adult aged upwards of 18 years from Dunbar (skull 55.2) has a sharp-force injury located on the right parietal (see Plate 6.25 below) running diagonally from the sagittal suture towards the anterior portion of the squamous temporal. It measures 40.41 mm in length and 2.3 mm in width. The injury has penetrated through to the endocranial surface where it has a maximum length of 12.65 mm. Patination is comparable with the surrounding bone. On the ectocranial surface the anterior-facing edge is smooth while the posterior is more ragged. There is no evidence of remodelling.

Plate 6.25: Dunbar skull 55.2, (a) ectocranial surface, right parietal; (b) endocranial surface, right parietal (©Angela Boyle)

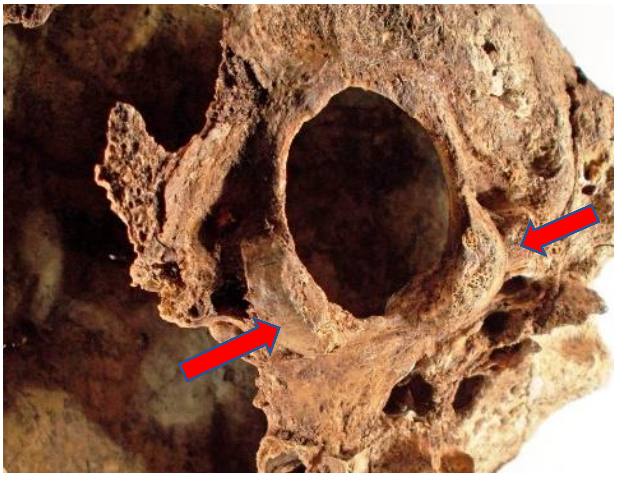


Two comparable injuries were part of the assemblage from the Viking mass grave at Ridgeway Hill in Dorset (Boyle 2014, 72-73, figs 3.28-3.29). A peri-mortem sharp-force injury was located on the left side of the frontal of adult male skull 3693 close to the coronal suture, and it would have extended into the missing portion of frontal bone. Two possible radiating fractures were associated and there was also a flake of bone which had partially detached. The cut measured 31 mm in length and 0.7 mm in depth. It did not penetrate to the endocranial surface and was angled diagonally from left to right. The posterior side of the cut was straight, while the other was more ragged. These features are consistent with a blow from the front by a right-handed assailant. Young adult male skull 3704 had a cut on the left parietal measuring 34.1 mm in length and 1.5 mm in width. The cut was aligned diagonally and had a smooth anterior margin and a more ragged posterior margin with two flaked areas. This is probably the result of a shallow glancing blow from the left which did not penetrate the endocranial surface. Two fine striations running parallel to this cut may relate to imperfections in the blade used.

The morphology of the Dunbar injury also has similarities to one produced by experimental work using a Bronze Age replica sword (Downing and Fibiger 2017, 550, tab. 3, fig. 6). The perpendicular experimental strike (number 5 in the publication) produced a narrow, V-shaped linear cut mark without feathering, flaking, fracture or breakage. It should, however, be noted that Bronze Age swords are mechanically, and therefore, functionally different from later examples (op. cit., 547).

An adult male skull from Lundin Links (ET1) exhibits clear evidence of decapitation (see Plate 6.26 below). There was also evidence of pseudo-trauma which is discussed below (see Section 6.6 below). Small slivers of bone have been removed from the posterior portions of the left and right occipital condyles. The cut surface on the right facet measures 10.34 x 6.33 mm while that on the left facet measures 12.73 x 5.55 mm. A very fine incision is present on the posterior portion of the left facet; it runs very slightly diagonally upwards from lateral to medial and has a maximum length of 3.41 mm. An apparent ‘cut’ through the right mastoid process is unlikely to be a peri-mortem injury as its edges are ragged and patination is lighter than the surrounding bone.

Plate 6.26: Lundin Links, skull ET1, decapitation, (a) peri-mortem sharp-force cuts through occipital facets, inferior; (b) detail of left facet showing fine incision, basilar view (©Angela Boyle)



A possible parallel for this injury was recently identified (Boyle in preparation). A multiple burial containing three skeletons, two men and an adolescent yielded radiocarbon dates of the 6th to 7th centuries was excavated at Portbury near Bristol. Preservation of this skeleton is poor and microscopic analysis has not been carried out yet. It would appear that the base of the left and right occipital condyles have been cut through leaving flattened surfaces. Post-mortem erosion makes it difficult to be certain without microscopic analysis. Two fragments of parietal also have possible cut edges which are obscured by post-mortem erosion and would also benefit from microscopic analysis.

A second example of fatal peri-mortem sharp-force trauma was identified among the skeletal assemblage excavated at Lundin Links in 1965-6 (skull LL3). This was not reported in the original, or indeed the second, osteological examination (Lorimer 2000; Smart and Campbell-Wilson 2000). The initial identification was made by Laura McMillan, a PhD researcher at the University of Edinburgh who was examining the dental health of this assemblage.

Lundin Links skeleton 3, originally survived as a largely complete skeleton although now only a skull and mandible can be associated with any certainty. The original manuscript report (published as Smart and Campbell-Wilson 2000) described him as a male aged 40-50 years, height 1.785 m, with big bones and good muscular markings. He has a prominent bifid chin produced by flanging of the mandible outwards on each side of the symphysis. It was also noted that he exhibited pronounced osteoarthritic changes in the thoracic and lumbar segments of the spine with ossification of the anterior longitudinal ligament, particularly in the region of LV3-LV5 where there was also evidence of protrusion of the interarticular disc. A unilateral fracture through the lamina of the third lumbar vertebra was also present. The present analysis has estimated that this is a mature adult male (35-45 years).

Macroscopic and microscopic examination of the cranial skeleton revealed multiple blows to the back of the head with a long sharp-bladed weapon such as a sword or an axe. A minimum of three sharp-force injuries have been inflicted to the back of the skull and have resulted in removal of a substantial area of the posterior vault (see Plate 6.27 below). This has complicated any attempt to sequence the injuries. The skull is now very fragile and no attempt was made to take measurements.

Plate 6.27: Lundin Links, skull 3, posterior view, arrows indicate sharp-force injuries (©Angela Boyle)

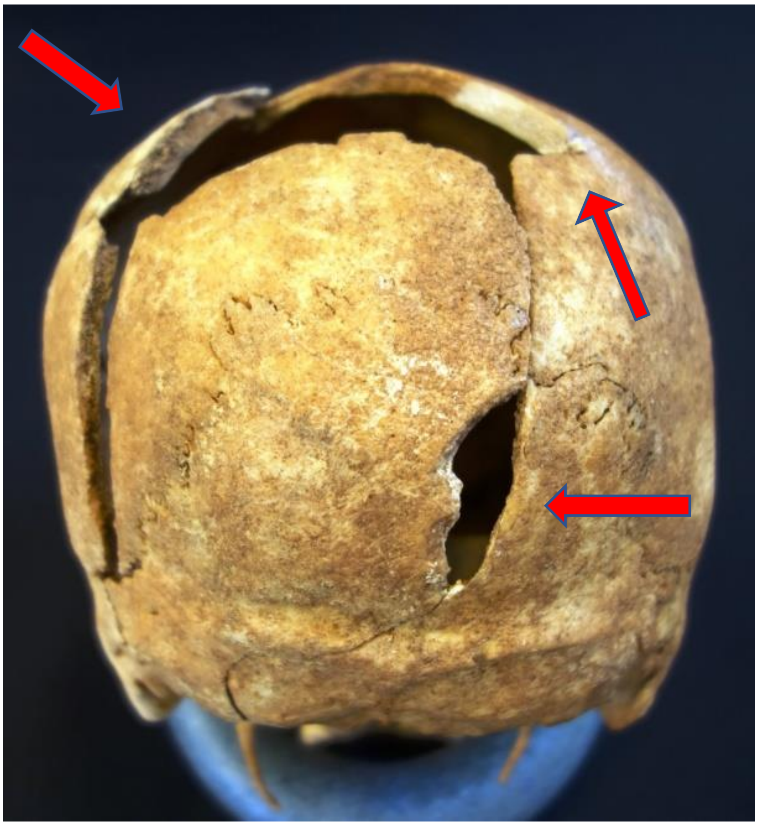
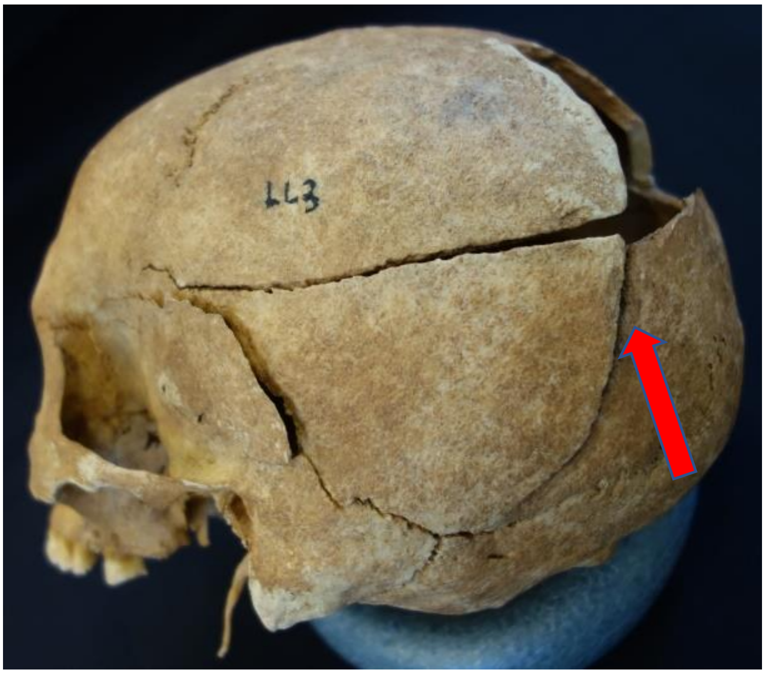


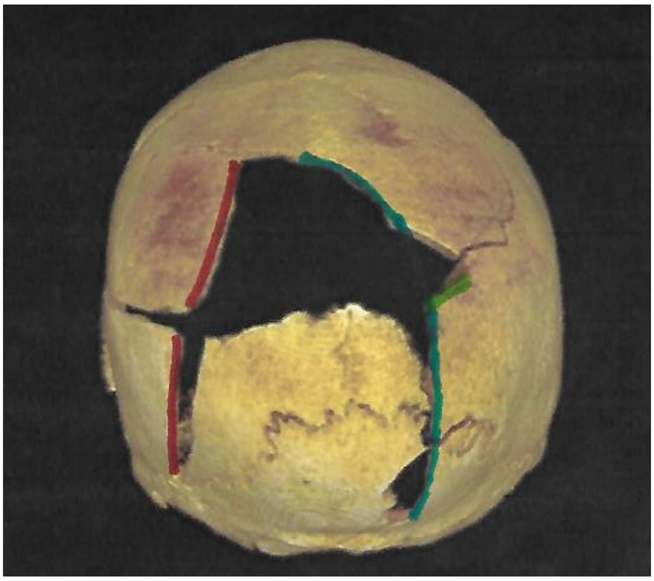
Plate 6.28: Lundin Links, skull 3, peri-mortem radiating linear fracture, left lateral view (©Angela Boyle)



Linear fractures are the most common type of cranial fracture associated with cranial injuries and may appear at some distance from the point of impact. They usually extend right through the vault and are often accompanied by intracranial bleeding (Knüsel 2005, 55, fig. 10). The adult cranium is isotropic, which means that it resists force transmission with its entire surface area as a single entity. Therefore although it is an extremely strong structure, when the cranium is fractured, the fracture lines tend to migrate across its entire surface (ibid.).

Injury 1 extends from the base of the left temporal diagonally through the posterior part of the left parietal and has a slight endocranial bevel (see Plate 6.29 below, annotated in red). A radiating fracture extends from the upper terminus of injury 1 across the left parietal. Injury 2 extends from the upper portion of the right occipital and extends through the right parietal towards the sagittal suture (annotated in blue). A fracture line extends from the terminus of injury 2 across the occipital bone. The third injury (annotated in green) is located on the right parietal and has an ectocranial bevel. A fracture line extends from the terminus of injury 3 across the right parietal. The numbering of the injuries does not indicate the sequence in which they were inflicted. The experimental work of Wenham (1989, 132) suggested that axe injuries are very much more likely to show terminal fractures than are sword injuries.

Plate 6.29: Lundin Links, skull 3, peri-mortem injuries are highlighted in red, blue and green, posterior view. © Polyphonic Murders. Annotations added by Angela Boyle



The positioning of the wounds on the rear of the skull suggests the attack came from behind the victim's head. One or more blows to the head could have been delivered whilst the victim was upright, laying face-down or a combination of the two. It is difficult to ascertain the sequence in which the blows were struck as although the wounds intersect, the radiating fracture lines do not. Any one of the cranial injuries would have been rapidly fatal as they would have caused damage to the brain with severe blood loss leading to unconsciousness and death very quickly. There is possible evidence of forced occlusion linked to the head injuries which is discussed below (see section 6.4 below).

A young adult male aged 18-25 years was excavated at Ringleyhall in 1972 (Ritchie *et al.,* 1975). Fragmentation was severe and it was not possible to reconstruct the skull. Nonetheless, probable peri-mortem sharp-force cranial trauma was identified (see Plate 6.30 a-c below). The injury was located on the right side of the occipital, running upwards diagonally from lateral to medial with a maximum length of 25.36 mm. Patination of the cut edge is comparable to the surrounding bone although the edges are a little ragged. There is no bevelling or evidence of remodelling or infection. The injury penetrated through to the endocranial surface. A radiocarbon date and results of aDNA analysis are awaited. The skull was unwashed and consolidant has been applied to the dentition.

A prime adult male skull from Kirkhill, Dunbar (ET36) exhibits possible peri-mortem sharp-force trauma running diagonally from the left parietal towards the base of the occipital for a maximum length of 72.92 mm (see Plate 6.31 a and b below). The patination of the cut edge is comparable to the surrounding bone. There is no bevelling and the edges are a little ragged. An incorrectly attached fragment is obscuring part of the cut edge and there is also post-mortem damage.

Plate 6.30: Ringleyhall, skeleton 1972, occipital fragment, possible peri-mortem sharp-force trauma, (a) endocranial surface, (b) ectocranial surface, (c) cut edge (©Angela Boyle)

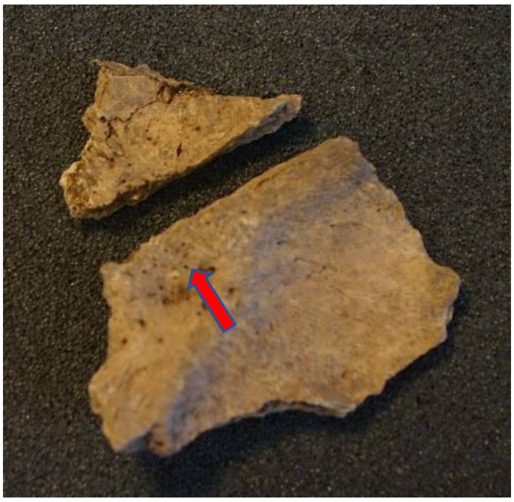


Plate 6.31: Kirkhill, Dunbar skull ET36, (a) possible peri-mortem sharp-force trauma, lateral view, (b) detail of peri-mortem sharp-force trauma, lateral view (©Angela Boyle)

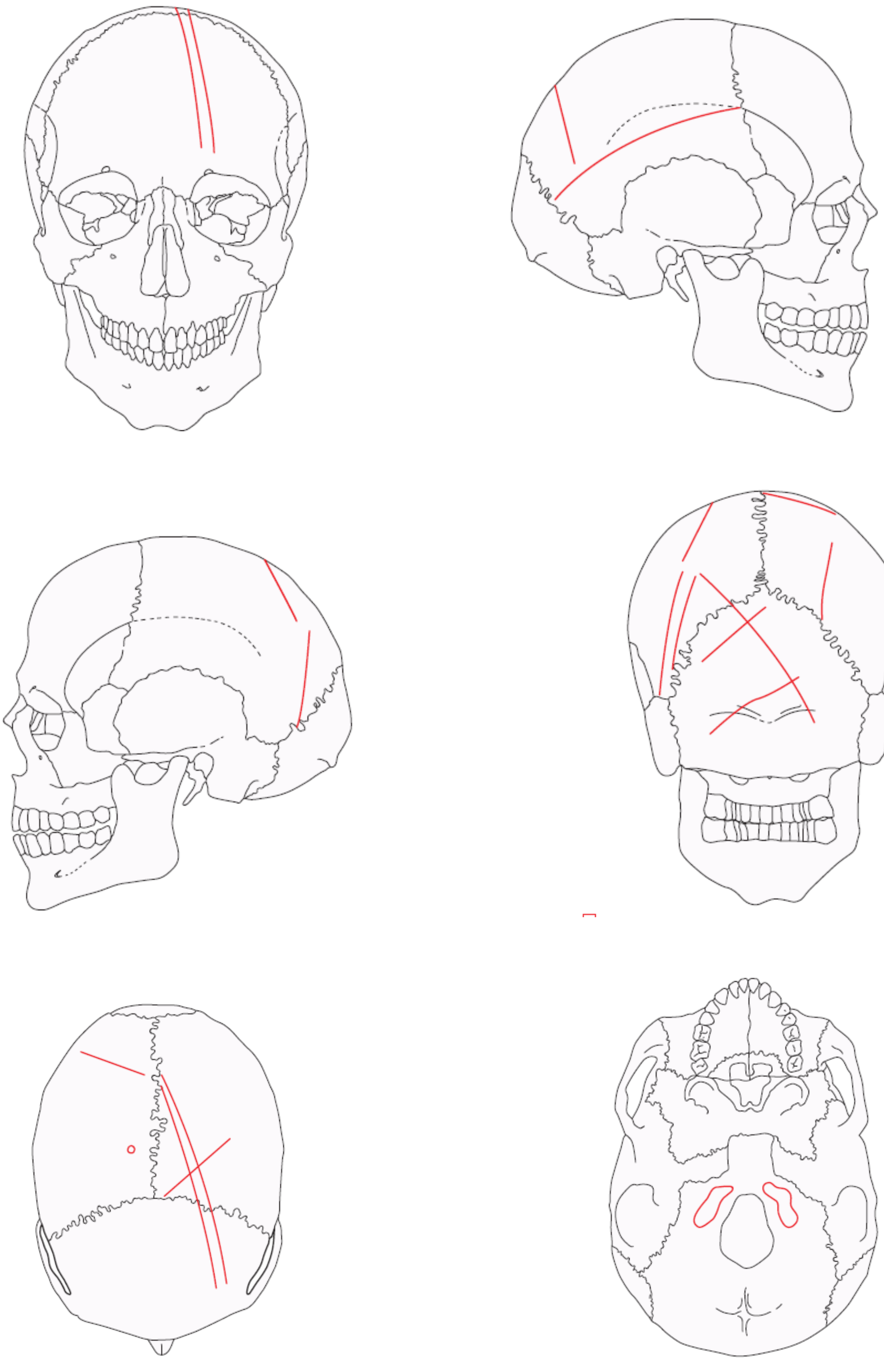
A highly fragmented skull (959) from the Isle of May exhbited a minimum of two fatal sharp force injuries (see Plates 6.32-6.33 below). It has been identified as a prime adult male (25-35 years). The injuries have bisected the left frontal and left parietal and terminate at the sagittal suture. The cuts run in a diagonal direction from anterior to posterior with a gap between them of *c.* 5 mm. Part of a detached fragment from between the two cuts survives. Striations are visible on the cut edges, both of which have a slight endocranial bevel. There is at least one sizeable radiating fracture on the right side of the vault. The fragmented condition of the skull made it impossible to attempt measurements.

Plate 6.32: Isle of May, skull 959, (a) peri-mortem sharp-force trauma, superior view, (b) detail (©Angela Boyle)

Plate 6.33: Isle of May, skull 959, radiating fracture line, superior view (©Angela Boyle)

Figure 6.4 below illustrates the distribution of all peri-mortem sharp-force trauma within the study group.

Figure 6.4: Distribution of peri-mortem sharp-force cranial trauma, anterior, right lateral, left lateral, posterior, superior, inferior views (©Peter Lorimer, Pighill Graphics)



Two probable fatal sharp-force injuries were identified (skeletons 59 and 73) during the original osteological analysis (Roberts 2001, 298) of the assemblage from Captain's Cabin. The affected elements of these skeletons could not be located during the current analysis.

6.3 DENTAL TRAUMA AND FORCED OCCLUSION

Dental trauma is not a feature which is routinely recorded in osteoarchaeological analyses. This is perhaps due to the fact that the dentition, particularly the less well protected anterior teeth, are vulnerable to post-mortem damage (Hillson 1996, 319). Furthermore, chips (dental infractions) and cracks are relatively common in archaeological populations (Mulner and Larsen 1991, 370). It is argued here that where dental trauma occurs in association with cranial trauma, it could conceivably be linked to forced occlusion caused by the force of a blow/blows to the head, although other causes such as falls and bumps cannot be completely ruled out. Two basic types of dental trauma have been distinguished in the present study: the first type is a small chip and/or crack in the dental enamel; the second type is the complete fracture of a crown and/or root. Five examples have been identified in the present study and are summarised in Table 6.11 below.

Table 6.11: Summary of individuals with dental trauma linked to cranial trauma

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Cramond 5	Young adult (18-25 years)	Female?	1	Mandibular left 1st molar
Cramond 6	Older adult (46+ years)	Female	2	Left mandibular 1st and 2nd molars
Isle of May 859	Older adult (46+ years)	Male	1	Mandibular left 2nd molar
Lundin Links IB225	Prime adult (25-35 years)	Male	?	Mandibular 2nd molars
Lundin Links 3	Mature adult (35-45 years)	Male	3+	Left maxillary 2nd incisor, left and right maxillary 2nd molars, left maxillary 2nd molar, tight mandibular 1st and 2nd molars, left mandibular canine, left mandibular 1st and 3rd molars

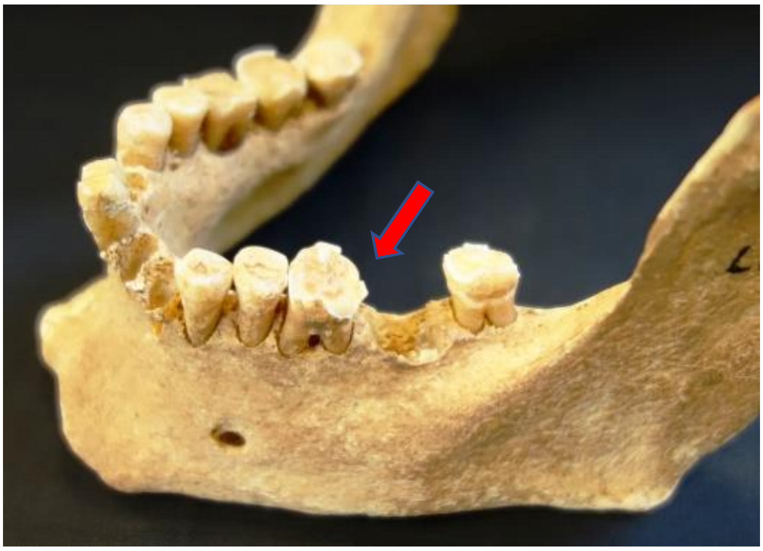
A probable young adult female (skull 5) from the mass burial at Cramond Roman Fort suffered a fatal blunt-force injury to the right side of her head (see section 6.3.3 above). It is likely that chipping of the left mandibular 1st molar on the buccal and occlusal surfaces depicted on Plate 6.34 below may well be linked to the fatal injury.

Plate 6.34: Cramond 5, buccal and occlusal chips on left mandibular 1st molar, (©Angela Boyle)

An older adult female aged 46+ years from Cramond (skull 6) exhibited chipping of two teeth which may have been caused by the blow to the right parietal which caused an ossified haematoma (see Section 6.3.1 above). Skeleton 859, an older adult male (46+ years), from the Isle of May has a chipped mandibular left 2nd molar which may be linked to the healed sharp-force trauma to the back of his head (see Section 6.3.2 above). A prime adult male from Lundin Links (skull IB225) exhibited chips to the distal edges of the mandibular 3rd molars and this may be linked to the depressed fracture on the right frontal bone.

Perhaps the most convincing example of forced occlusion is Lundin Links 3, a mature adult (35-45 years) male, with a minimum of three peri-mortem sharp-force injuries to the back of the head. The maxillary left 2nd incisor has a diagonal chip, which has removed approximately one third of the crown on the right side. The right maxillary 1st premolar has a mesial chip; the left maxillary 2nd premolar has a buccal/distal chip; the left maxillary 2nd molar has mesial/lingual and buccal/distal chips; the right mandibular 2nd molar has a buccal/distal chip; the right mandibular 1st molar has a buccal chip; the left mandibular canine has a mesial chip; the left mandibular 1st molar has mesial/distal/lingual chips; the left mandibular 3rd molar has mesial/lingual/distal chips (see Plate 6.35 below).

Plate 6.35: Lundin Links LL3, showing dental trauma to mandibular dentition, left lateral view (©Angela Boyle)



In the current study dental trauma was observed on 44 individuals (44/192, CPR 22.92%) who between them had 111 teeth affected (111/3059, TPR 3.63%). Data on the affected individuals appears in Table 6.12 below. Four of those affected were non-adults accounting for 5.41% of the total teeth affected (6/111).

Table 6.12: Summary of skeletons exhibiting dental trauma

Site name	Sk. No.	Age	Sex	No. of teeth affected	Total no. of teeth	TPR (%)
Broxmouth	4	young adult	M	10	27	36.04
Cramond	5	young adult	F?	1	24	4.17
Cramond	6	older adult	F	1	17	5.88
Dryburn Bridge	2	prime adult	M	4	20	20.00
Dunbar, Winterfield Mains	IB 210	prime adult	F	1	17	5.88
East Fortune	3	prime adult	M	2	18	11.11
Four Winds, Longniddry	sk 3 (burial 3)	mature adult	M	1	30	3.33
Gullane Golf Course	1	older adult	M	1	25	4.00
Isle of May	814	Adolescent	n/a	1	9	11.11
Isle of May	820	mature adult	M	1	5	20.00
Isle of May	859	older adult	M	1	18	5.56
Isle of May	888	prime adult	M	3	24	12.50
Isle of May	968	mature adult	M	1	12	6.33
Isle of May	985	prime adult	M	1	28	3.57

Site name	Sk. No.	Age	Sex	No. of teeth affected	Total no. of teeth	TPR (%)
Isle of May	1023	prime adult	M	1	11	9.09
Logan Cottage	Ex 1968	older juvenile or adolescent	n/a	1	23	4.35
Lundin Links	IB225	prime adult	M	2	30	6.67
Lundin LInks	LL12	prime adult	F	4	24	16.67
Lundin Links	LL13	mature adult	F	2	18	11.11
Lundin Links	LL21	young adult	M	11	27	40.74
Lundin Links	LL3	mature adult	M	9	22	40.91
Lundin Links	LL4	prime adult	F	1	30	3.33
Lundin Links	LL5	mature adult	M	8	15	53.33
Lundin Links	LL6	Adult	M	1	30	3.33
Parkburn Quarry, Lasswade	7	Adult	U	5	5	100.00
Parkburn Quarry, Lasswade	10	Adult	U	1	1	100.00
Parkburn Quarry, Lasswade	30	Adult	F	1	3	33.33
Parkburn Quarry, Lasswade	31	Adult	F	4	7	56.14
Polmood (Polmond)	no number	prime adult	M	2	5	40.00
Seacliff	EUAD 56/11	Adult	M	1	6	16.67
Seacliff	S56/11 A	Adolescent	n/a	3	17	16.65
Seacliff	S56/11 B	mature adult	U	2	3	66.67
Seacliff	skull and mandible'	prime adult	M	1	29	3.45
Seacliffe Mausoleum	mandible G	mature adult	M	1	14	6.14
Seacliffe Mausoleum	mandible J	prime adult	M?	1	4	25.00
Stonelaws	ET10	prime adult	M?	2	31	6.45
Thornybank	34	mature adult	F	1	17	5.88
Thornybank	43	prime adult	M?	5	25	20.00
Thornybank	44	prime adult	M	1	30	3.33
Thornybank	45	prime adult	F	2	32	6.25
Thornybank	46	young adult	F?	2	29	6.90
Thornybank	49	younger juvenile	n/a	1	17	5.88
Thornybank	55	older adult	M	1	27	3.70
Thornybank	60	prime adult	F	5	15	33.33
Total				111	821	13.52

The most commonly affected adult group was mature adult males (6/14, 42.85%) (see Table 6.13 below).

Table 6.13: Distribution of dental trauma by age and sex, as a percentage of adults with dentition

Age group	M		%	M?		%	F		%	F?		%	U		%	I		%	Total		%
YA	2	13	15.38	0	3	0	0	10	0	2	4	50	0	3	0	0	0	0	4	33	12.12
PA	9	25	36	3	6	50	5	13	36.46	0	1	0	0	2	0	0	1	0	17	48	35.42
MA	6	14	42.85	0	1	0	2	7	26.57	0	0	0	1	1	100	0	0	0	9	23	39.13

OA	3	14	21.43	0	0	0	1	4	25	0	0	0	0	0	0	0	2	0	4	20	20
A	2	5	40	0	9	0	2	9	22.22	0	5	0	2	18	11.11	0	1	0	6	47	12.77
A?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	22	71	30.99	3	19	15.79	10	43	23.26	2	10	20	3	24	12.5	0	4	0	40	171	23.39

Key: ya = young adult (18-25 years); pa = prime adult (25-35 years); mature adult (35-45 years); oa = older adult (46+ years); a = adult (18+ years); a? (?18+ years). *Two skeletons who could not be aged or sexed are excluded from this table.

Table 6.14: Distribution of dental trauma by age, as a percentage of non-adults with dentition

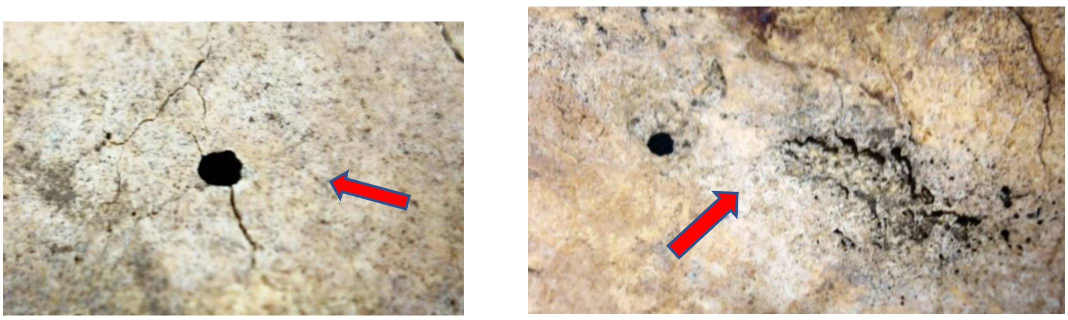
Age Category	No of skeletons affected	No. of skeletons with dentition	%
Infant	0	1	0
Younger juvenile	1	3	33.33
Older juvenile	1	5	20
Older juvenile/adolescent	0	1	0
Adolescent	2	6	33.33
Non-adult	0	3	0
Total	4	19	21.05

6.4 PENETRATING INJURIES

6.4.1 Peri-mortem penetrating injuries

A prime adult male (aged 25-35 years) from Thornybank (skeleton 44) exhibits evidence of a possible penetrating wound from a projectile or pointed weapon such as a crossbow (see Plate 6.36 below). A small circular perforation with a maximum diameter of 2.71 mm is located on the right parietal adjacent to the sagittal suture. The edges are irregular on the endocranial surface. There are two associated radiating fracture lines. A second irregular erosive lesion on the endocranial surface is located laterally and posteriorly from the first.

Plate 6.36: Thornybank skeleton 44, possible peri-mortem sharp-force trauma, right parietal, (a) ectocranial surface, (b) endocranial surface ((©Angela Boyle)



6.4.2 Ante-mortem penetrating injuries

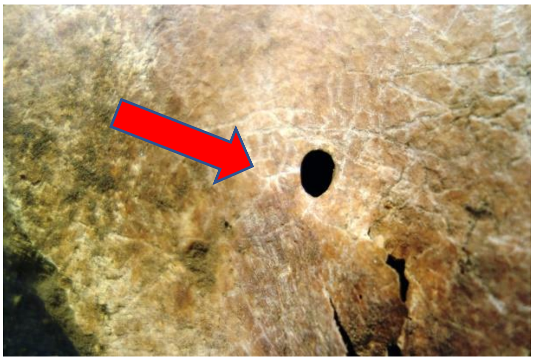
Two skeletons exhibit evidence of possible ante-mortem penetrating injuries and are summarised in Table 6.15 below.

Table 6.15: Summary of skeletons with possible ante-mortem penetrating injuries

Site/skeleton No.	Age	Sex	No. of injuries	Elements affected
Lasswade 14	Mature adult (35-45 years)	Male	1	Left ilium
Lasswade 53	Older adult male (46+ years)	Male	1	Rib shaft

A mature adult male from Lasswade (skeleton 14) has on oval perforation on the left ilium, lateral to the auricular surface (see Plate 6.37). The lesion penetrates all the way through the bone. On the lateral surface it is regular with smoothed edges and measures 5.56 mm in diameter. The edges are less regular on the medial surface.

Plate 6.37: Lasswade skeleton 14, possible penetrating injury, left ilium, (a) lateral view, (b) medial view ((©Angela Boyle)



An older adult male (46+ years) from Lasswade (skeleton 53) exhibits a smooth-walled oval lesion on the visceral surface of a rib fragment (see Plate 6.38 below). It has a maximum diameter of 2.01 mm.

Plate 6.38: Lasswade, skeleton 53, possible penetrating injury, rib, visceral surface (©Angela Boyle)

6.5 POST-CRANIAL ANTE-MORTEM TRAUMA

6.5.1 Introduction

The CPR for all post-cranial ante-mortem trauma including fractures, exostoses, spondylolysis and os acromiale is low (54/3373, 1.6%). Fractures and/or haematomas have been recorded by precise location (e.g. for long bones – proximal epiphysis, proximal shaft, central shaft, lateral shaft, lateral epiphysis; for vertebrae – body, right transverse process, left transverse process, spinous process).

A total of 39 skeletons from 12 sites within the study group exhibit one or more of exostoses, fractures and/or haematomas, spondylosis and os acromiale. Details of individual skeletons appears in Table 6.16 below.

Table 6.16: Summary of skeletons within the study group exhibiting evidence of post-cranial ante-mortem trauma

Skeleton No.	Age	Sex	Exostosis	Long bone fracture	Rib fracture	Scapula	Manubrium and sternum	Pelvis	Vertebral fracture	Hand	Foot	Spondylolysis	Os acromiale
Broxmouth 4	YA	M		left clavicle									
Craig's Quarry 56/9 IB265A	YA	M										LV5	
Dryburn Bridge 2	PA	M	2 x right fibula	right fibula									
Dryburn Bridge3	YA	F		right tibia									
Dunbar, 2 Clyde Villas	PA	M		left fibula	right 7th								bilateral
Gullane Golf Course 1	OA	M							TV12, LV1-2, LV4				
Gullane Golf Course 2	MA	M		right fibula									
Isle of May	A	U		right fibula									

Skeleton No.	Age	Sex	Exostosis	Long bone fracture	Rib fracture	Scapula	Manubrium and sternum	Pelvis	Vertebral fracture	Hand	Foot	Spondylolysis	Os acromiale
Isle of May	MA	M		left ulna									
Isle of May 830	A	M?	left tibia										
Isle of May 837	A	M							LV4				
Isle of May 846	OA	M			right 8th								
Isle of May 848	OA	M					yes						
Isle of May 859	OA	M							LV3				
Isle of May 868	OA	M			1 x midshaft	right body			TV12, LV1-3				
Isle of May 885	OA	M			1 x midshaft						Right 5th proximal phalanx		
Isle of May 888	PA	M								right 3rd metacarpal			
Isle of May 957	PA	M	left fibula										
Isle of May 967	PA	M			1 x midshaft				LV4				
Isle of May 981	OA	M								left 4th metacarpal			
Isle of May 987	OA	M			2 x midshaft			left ilium					
Isle of May 995	PA	M	left tibia						TV7				right only
Isle of May 1025	YA	M	right tibia	Left radius					TV4, TV6-9, TV12, LV5				left only
Isle of May 1026a	A	F?	left ulna										
Lundin Links 4	PA	F										LV5	left only
Lundin Links 5	MA	M	right femur										
Lundin Links 8	MA	F	right 8th rib										
Lundin Links 13	MA	F							TV4, TV5, LV4				
Marine Villa 1990/36	PA	F	right fibula										
Parkburn Quarry, Lasswade 8b	OA	F		right femur									
Parkburn Quarry, Lasswade 30	A	F							TV12				
Parkburn Quarry, Lasswade 62	PA	M?										CV1	
Polmood ex. 1958	PA	M		right fibula									
Seacliffe 56/11	YA	M		left tibia					TV6				
Seacliffe 56/11	MA	F	right fibula										
Thornybank 2	A	U		right humerus, left femur									
Thornybank 44	PA	M		left tibia									
Thornybank 60	PA	F	right tibia										

Most affected individuals are adult males and all age ranges are represented. There are no non-adults who exhibit evidence of ante-mortem trauma.

6.5.2 Ante-mortem fractures

Only those fractures which may have been caused by a direct blow are discussed in any detail. The true prevalence rates appear in Table 6.17 below. The majority of the fractures are evident in the assemblage from the Isle of May and include long bone fractures, rib fractures, a fractured ilium, a fractured sternum, a fractured scapula and 19 compression fractures of vertebral bodies.

Table 6.17: Skeletal elements with evidence of ante-mortem fractures (TPR – True prevalence rate)

Bone	Part of bone	Parts with trauma	Total present	% affected
l. clavicle	Lateral shaft	1	69	1.45
r. humerus	Central shaft	1	86	1.16
l. ulna	Central shaft	1	79	1.27
l. ulna	Lateral shaft	1	58	1.72
l. radius	Lateral shaft	1	80	1.25
r. femur	Proximal shaft	2	109	1.83
l. femur	Central shaft	1	113	0.88
r. tibia	Central shaft	2	106	1.89
l. tibia	Central shaft	2	100	2.00
r. fibula	Proximal shaft	4	66	6.06
r. fibula	Central shaft	2	83	2.41
l. fibula	Proximal shaft	1	60	1.67
l. fibula	Lateral shaft	1	71	1.41
r. scapula	blade	1	71	1.41
l. pelvis	ilium	1	94	1.06
Sternum		1	37	2.70
TV4	body	1	46	2.17
TV5	body	1	46	2.17
TV6	body	2	49	4.08
TV7	body	2	49	4.08
TV8	body	1	47	2.13
TV9	body	1	51	1.96
TV12	body	4	58	6.90
LV1	body	2	63	3.17
LV2	body	2	64	3.13
LV3	body	2	64	3.13
LV4	body	3	68	4.41
LV4	l. transverse process	1	69	1.45
LV5	body	1	67	1.49

Bone	Part of bone	Parts with trauma	Total present	% affected
r. rib		4	602	0.66
Rib shaft unsided		2	630	0.95
r. 3rd metacarpal	shaft	1	44	2.27
l. 4th metacarpal	shaft	1	45	2.22
r. 5th proximal foot phalanx	shaft	1	29	3.45
		54	3373	1.6

Four individuals from the Isle of May have rib fractures. Skeleton 846, an older adult male, has a well-healed fracture of the midshaft of a right, probable 8th, rib. Skeleton 885, an older adult male, has a healed midshaft fracture of a right rib and a possible healed oblique fracture of a proximal foot phalanx. Skeleton 967, a prime adult male, has a healed midshaft fracture of a rib fragment and a compression fracture of the body of the 4th lumbar vertebra. Its anterior body diameter is 23.56 mm compared with 26.12 mm for the 3rd lumbar vertebra and 26.11 mm for the 5th lumbar vertebra.

Skeleton 379, an unsexed adult, has a healed fracture of the proximal third of the right fibula. Callus and woven bone are present. Skeleton 848, an older adult male has a healed transverse fracture of the upper third of the body of the sternum. There is extensive new bone deposition and the sternum has fused to the manubrium (see Plate 6.39 below). Skeleton 848 exhibits no other evidence of trauma.

Plate 6.39: Isle of May skeleton 848, healed fracture of manubrium, posterior view (©Angela Boyle)

Sternal fractures may be produced most frequently by direct violence to the chest (Wedel and Galloway 2014, 192). Less frequent mechanisms are those that are indirect including flexion of the thoracic cavity or in association with spinal hyperflexion injuries (Jones *et al.,* 1989). Direct blows do tend to produce transverse fractures in this bone (Collins 2000).

Isle of May skeleton 815, a mature adult male, has a healed midshaft fracture of the left ulna. It appears to be a simple transverse fracture. Skeleton 868, an older adult male, has a healed fracture of the body of the right scapula. The fracture line is raised but smooth (see Plate 6.40 below).

Plate 6.40: Isle of May skeleton 868, ante-mortem fracture of the body of the right scapula, anterior view (©Angela Boyle)

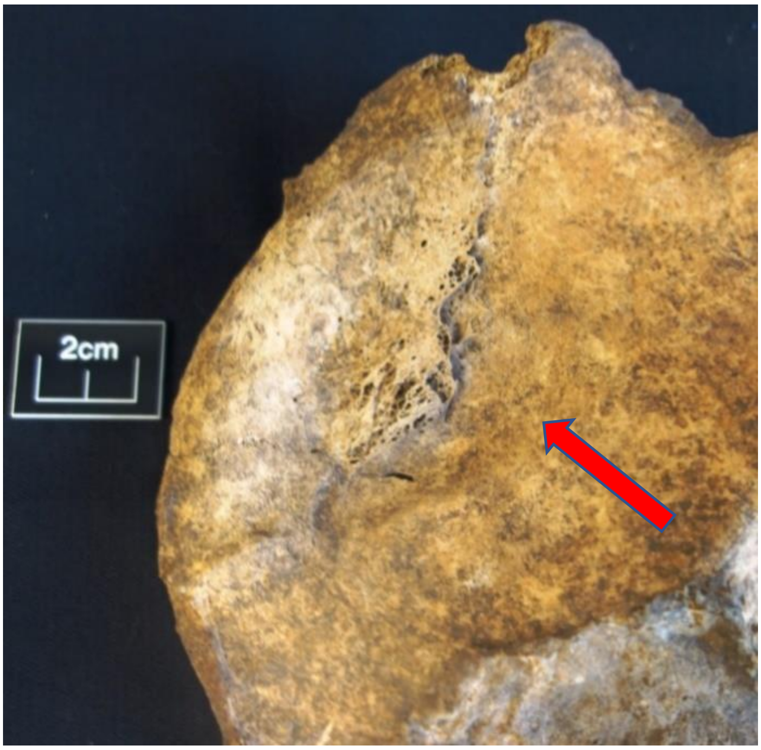
This skeleton also has compression fractures of the bodies of the 12th thoracic, and 1st to 3rd lumbar vertebrae leading to marked kyphosis. The body of the scapula is rarely injured due to protection by the overlying group of muscles (Rogers 1992) and is less prone to indirect trauma due to the 'floating' nature of its anatomical position (Wedel and Galloway

2014, 199). This form of injury can be caused by direct blunt-force trauma to the back, such as a heavy blow or a fall from a height (Walker 2012, 119).

Isle of May skeleton 981, an older adult male, has a healed fracture of the midshaft of the left 4th metacarpal. Slight callus is present and the shaft is angulated in a palmer direction.

Skeleton 987, an older adult male has a healed transverse fracture of the left ilium which runs from the anterior portion of the iliac crest to the auricular surface (see Plate 6.41 below). Irregular woven bone is present on the medial surface. An exostosis is present on the lateral-anterior side of the crest. It measures 13.27 mm (A-P) in width and 12.68 mm in length. The right sacro-iliac joint is ankylosed presumably in an attempt to stabilise the joint after the fracture. This type of isolated fracture of the iliac wing is known as Duverney's fracture and is caused by lateral compressive forces which do not disrupt the pelvic wing (Wedel and Galloway 2014, 252). This skeleton also has two healed midshaft fractures of unidentified right ribs. In both cases there is slight callus surviving.

Plate 6.41: Isle of May, skeleton 987, healed fracture of right ilium, medial view (©Angela Boyle)



Isle of May skeleton 1026a, a possible female adult, has a possible healed fracture of the left distal ulna with thickening of the shaft. The bone is angulated slightly in a posterior direction. Isle of May skeleton 837, an adult male, has a possible compression fracture of the body of LV4 which only affects the left side of the body. Isle of May skeleton 868, an older adult male, has compression fractures of TV12, and LV1-3 leading to marked kyphosis. Isle of May skeleton 967, a prime adult male, has a very mild compression fracture of the anterior body of LV4. Isle of May skeleton 995, a prime adult male, has a compression fracture of the anterior body of the 7th thoracic vertebra. It has a maximum diameter of 13.96 mm. The 9th thoracic vertebra has a maximum diameter of 16.39 mm. Isle of May skeleton 1025, a young adult male, has a healed fracture of the left distal radius. The shaft is angled in an anterior direction and there is considerable distortion of the distal articulation. This is known as a Colles fracture and is often caused by a fall onto an outstretched hand (Walker 2012, 127). This skeleton also has compression fractures of the anterior bodies of TV4, TV6-9, TV12 and LV5 leading to marked kyphosis.

Gullane Golf Course skeleton 1, an older adult male, has compression fractures of 12th thoracic and 1st to 2nd and 4th lumbar vertebrae leading to mild kyphosis. Lundin Links 13, a mature adult female, has a possible hairline fracture below the left superior facet of LV4 and the arch is deviated slightly towards the left. This skeleton also has a compression fracture of the anterior body of TV4. Parkburn Quarry, Lasswade skeleton 30, an adult female, has a compression fracture of the anterior body of TV12 with mild kyphosis.

Broxmouth skeleton 4, a young adult male, has a poorly healed fracture of the lateral third of the left clavicle. The angle of the bone is very deformed. The skeleton from Dunbar, 2 Clyde Villas, a prime adult male, has a healed fracture of the midshaft of the right 7th rib. The bone is well united although normal angulation has been altered in proximal and posterior directions. There is considerable callus surviving. This skeleton also has a healed transverse fracture of the left fibula located immediately above the malleolus. There is associated infection in the form of a large destructive lesion affecting all areas of the distal fibula. There is exposure of trabecular bone with active periostitis which is also present on all surface of the left distal tibia. The skeleton also exhibits destruction of the dorsal surface of the left calcaneus with woven new bone on the medial, lateral and planter surfaces. Less severe destruction of the proximal articulations of the left 1st to 5th metatarsals is also present.

Dryburn Bridge skeleton 2 has a possible healed fracture or haematoma at the midshaft of the right fibula indicated by slight swelling of the shaft. This skeleton has a small exostosis immediately below the right mandibular condyle on the lateral side. It measures 6.91 by 1.91 mm. Two exostoses are present on the right fibula, one on the medial surface below the proximal articulation, and a second at the midshaft. Skeleton 3 from Dryburn Bridge has a possible healed fracture or haematoma of the right tibia indicated by slight swelling at the midshaft on the medial surface.

Gullane Golf Course skeleton 2, a mature adult male, has a healed fracture of the right proximal fibula. Considerable callus is present. Lasswade skeleton 8b, an older adult of indeterminate sex, has a possible fracture of the neck of the right femur. The head and part of the neck do not survive, however, there is a proliferation of irregular new bone on the posterior surface. Polmood skeleton ex. 1958, a prime adult male, has a healed midshaft fracture of the right fibula. Considerable callus survives and there is a small area of woven new bone posterior to the interosseous crest.

Seacliffe 56/11, a young adult male, has a poorly healed oblique fracture at the midshaft of the left tibia. The distal half of the bone does not survive. This skeleton also has a compression fracture of the anterior body of TV6.

Thornybank 2, an unsexed adult, has a possible healed fracture or haematoma of the left femur indicated by slight swelling of the midshaft. There is also a healed fracture of midshaft of the right humerus below the deltoid tuberosity. The proximal half of the shaft is angled in a posterior direction. Thornybank 44, a prime adult male has a healed oblique fracture of the midshaft of the left tibia. There is poor alignment of the broken ends and the shaft is enlarged and misshapen. There would probably have been shortening of the bone although this cannot be determined due to the level of fragmentation.

6.5.3 Myositis ossificans traumatica

A number of skeletons within the study group exhibit one or more bony exostosis, probably ossified muscle which is the result of localised trauma. Tendons and muscle attachments may ossify, for example when a haematoma has been generated in the proximity of the injured periosteum (Aufderheide and Rodriguez-Martin 1998, 26).

Broxmouth skeleton 4 has two bony exostoses, which are located immediately posterior to the right mandibular fossa. The larger of the two measures 6.79 by 3.96 mm, while the smaller measures 3.96 by 0.33 mm. Isle of May skeleton 830, a probable male adult, exhibits a bony exostosis on the lateral surface of the left tibia at the distal end. It measured 35.5 mm (P-D) by 12.5 mm (A-P). Isle of May skeleton 957, a prime adult male, has a small exostosis on the lateral surface of left fibula at the proximal end. Isle of May skeleton 995, a prime adult male, has an exostosis on the lateral surface of the left tibia at the distal end. Isle of May skeleton 1025, a young adult male, has an exostosis on the lateral surface of the right tibia at the proximal end, immediately below the facet for the fibula. Lundin Links 5, a mature adult male, has a bony exostosis on the posterior surface of the right femur at the midshaft on the linea aspera. It has a maximum length of 46.16 mm. Marine Villa Archerfield skeleton 1990/36, a prime adult female, has an exostosis on the mesial surface of the right proximal fibula. The tip has broken off. Seacliffe 56/11, a mature adult female, has a small exostosis on the distal rim of the malleolus of the right fibula.

6.5.4 Spondylolysis

Young adult male, Craig’s Quarry 56/9 IB265A has partial spondylolysis of the 5th lumbar vertebra affecting the left side of the arch which is completely separate from the body. The right side of the arch is partially attached. Lundin Links 5, a mature adult male, has bilateral spondylolysis of the 5th lumbar vertebra at the pars articularis (see Plate 6.42 below). This condition is relatively common in archaeological populations. Clinical evidence reveals that spondylolysis is the result of a fatigue fracture where stress or repeated trauma, rather than a single event, leads to the break (Merbs 1983, 39).

Plate 6.42: Lundin Links 5, spondylolysis of the 5th lumbar vertebra, posterior view (©Angela Boyle)

Parkburn Quarry, skeleton 62, a probable prime adult male, exhibits spondylolysis of the 1st cervical vertebra.

6.5.5 Os acromiale

Four skeletons within the study group exhibit *os acromiale*. Dunbar, 2 Clyde Villas, Isle of May 995 and 1025, and Lundin Links 4. In three cases the condition is unilateral and in one case it is bilateral. Three of these individuals were male and one was female. *Os acromiale* is non-fusion of the acromion process to the spine of the scapula. This condition is caused by severe stress on the rotator cuff muscles, which hold the shoulder in place, during adolescent growth and development.

6.6 PSEUDO-TRAUMA

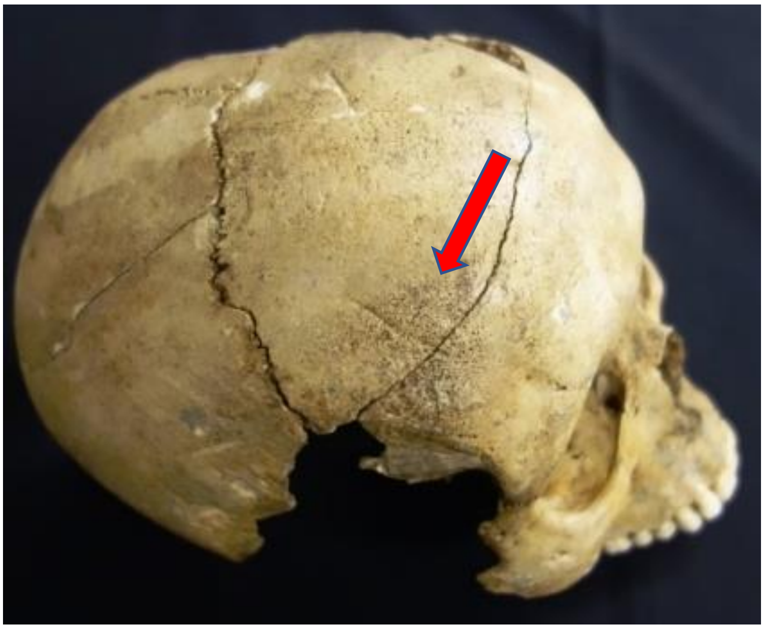
A total of 10 indviduals from seven sites exhibit evidence of pseudo-trauma and details can be found in Table 6.18 below. In all cases the skull was affected and it is important to illustrate these as they could be mistaken for cranial trauma.

Table 6.18: Details of individuals within the study group who exhibit evidence of pseudo-trauma

Site/skeleton No.	Age	Sex	No. of features	Elements affected
Cramond 1	Prime adult (25-35 years)	Male	1	Right frontal
Cramond 3	Prime adult (25-35 years)	Male	1	Left and right nasal
Dunbar IB226	Older adult (46+ years)	Male	1	Left zygomatic
Isle of May 444	Older adult (46+ years)	Male	1	Right frontal
Lundin Links IB212A	Prime adult (25-35 years)	Male	2	Complete skull, left zygomatic
Lundin Links ET1	Adult (18+ years)	Male	1	Right mastoid process
Lasswade 2	Young adult female (18-25 years)	Female	1	Left and right parietals
Lasswade 30	Adult (18+ years)	Female	1	Left parietal
Stonelaws	Mature adult (35-45 years)	male	1	Left orbit
Thornybank 37	Probable adult (18+ years)	Unsexed	1	Occipital

Cramond skull 1 has a defect originally identified as a linear cut. Further examination has determined that this almost certainly root etching (see Plate 6.43 below). It is located immediately above the right orbit just lateral to the supra-orbital notch with a maximum length of 14.11 mm (A-P) and a maximum width of 0.92 mm (M-L). A similar defect has been identified on Isle of May skull 444 (see below).

Plate 6.43: Cramond skull 1, root etching, right frontal, right lateral view (©Angela Boyle)



Cramond skull 3 exhibits slight deviation of the nasal septum which has been caused by post-mortem compression, which has also affected the skull vault.

Dunbar IB226 has a V-shaped incision on the left zygomatic arch (see Plate 6.44 below). There is a vertical break running away from the incision and the patination is much lighter than the surrounding bone. This may represent sampling although there is no record of this.

Plate 6.44: Dunbar skull IB226, left zygomatic, left lateral view (©Angela Boyle)

Isle of May skull 444 has root etching on the lateral side of the right frontal (see Plate 6.45 below).

Plate 6.45: Isle of May skull 444, right frontal, root etching, right lateral view (©Angela Boyle)

Lundin Links skull IB212A has an area of abnormal porosity on the latter half of the left zygomatic. A sample of bone appears to have been removed (see Plate 6.46).

Plate 6.46: Lundin Links IB212A, abnormal porosity on left zygomatic, sample of bone removed, left lateral view (©Angela Boyle)

Lundin Links adult male ET1 has a 'horizontal cut' which has removed the tip of the right mastoid process (see Plate 6.47 below). It has a ragged edge and the patination is unconvincing.

Plate 6.47: Lundin Links skull ET1, right mastoid, inferior view (©Angela Boyle)

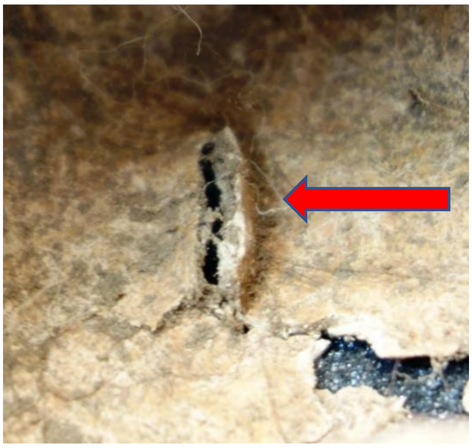
Parkburn Quarry, Lasswade, skull 2 has post-mortem damage to the skull which could be mistaken for peri-mortem sharp-force trauma (see Plate 6.48 below). The damage to the left posterior parietal is caused by post-mortem erosion. The perforation extending diagonally from this across the right parietal is also post-mortem. The edges are ragged and the patination is much lighter than the surrounding bone.

Plate 6.48: Parkburn Quarry, Lasswade skull 2, post-mortem damage, posterior view (©Angela Boyle)

Parkburn Quarry, Lasswade, skull 30 exhibits post-mortem damage to the left parietal which has penetrated all the way through the skull (see Plates 6.49-6.50). There is a lot of surface erosion and the skull is unwashed. Patination on the endocranial surface is lighter than the surrounding bone.

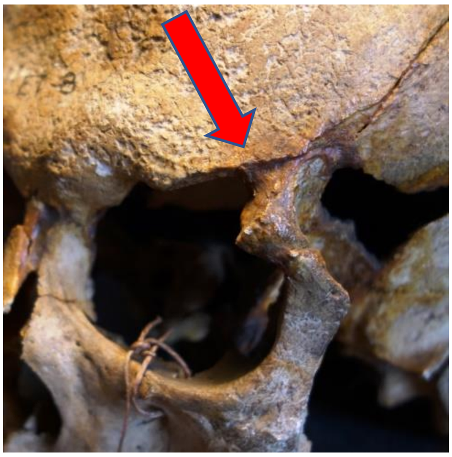
Plate 6.49: Parkburn Quarry, Lasswade, skull 30, ectocranial surface, left parietal, left lateral view (©Angela Boyle)

Plate 6.50: Parkburn Quarry, Lasswade, skull 30, left parietal, endocranial surface, left lateral view (©Angela Boyle)



A mature adult male (35-45 years) from Stonelaws (skeleton ET8) was initially believed to exhibit evidence of possible peri-mortem sharp-force trauma (see Plate 6.51 below). A triangular portion of left proximal orbital rim has been removed though the edges are obscured by dirt and glue. The maximum length of the medial edge is 22.12 mm; the maximum length of the lateral edge is 16.19 mm. There is slight bevelling of the lateral edge on the ectocranial surface. There are two broadly horizontal breaks/fracture lines on the lateral side of the left orbit which has also been glued. It is more likely that this portion was removed for sampling purposes but there is no record of this.

Plate 6.51: Stonelaws skull ET8, possible peri-mortem sharp force trauma, left frontal, lateral view (©Angela Boyle)



Thornybank skull 37 has a post-mortem perforation located on the left occipital (see Plate 6.52-6.53 below). The edges of the perforation are irregular and patination is lighter than the surrounding bone.

Plate 6.52: Thornybank, skull 37, post-mortem damage to occipital, ectocranial surface, posterior view (©Angela Boyle)

Plate 6.53: Thornybank, skull 37, post-mortem damage, endocranial surface, posterior view (©Angela Boyle)

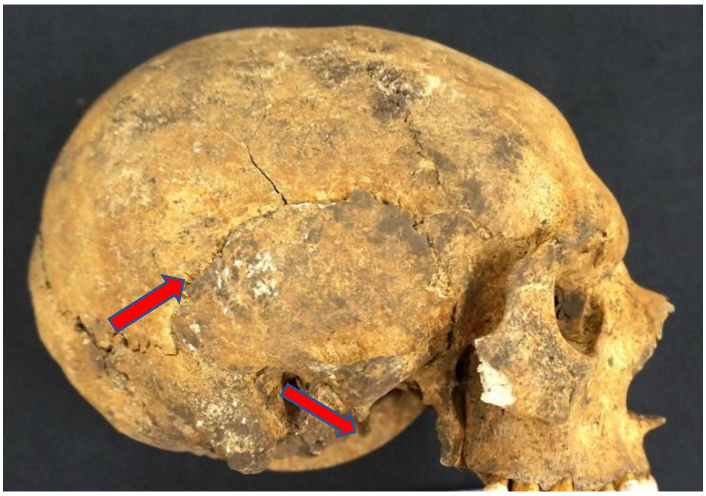
6.7 CRANIAL TRAUMA FROM OTHER SITES IN SCOTLAND

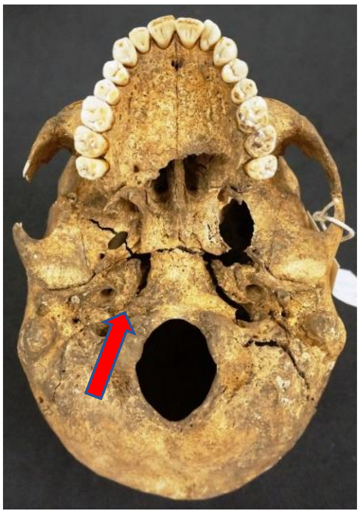
A young adult male skeleton was discovered in 2016 as part of the NOSAS Rosemarkie Caves Project in the Black Isle (Rosemarkie Caves Project 2016). The skeleton had been deposited in a dark alcove below a post-medieval cobbled floor and midden deposits. He was weighted down by stones with butchered animal bone scattered over his head.

Alignment was SE-NW and body position was unusual. The arms were level by the side of the torso while the lower limbs and feet were cross-legged with the knees splayed and raised upwards. No fewer than five peri-mortem injuries were identified by Professor Dame Sue Black (ibid.). They comprised a penetrating trauma to the right side of the mouth, a blow to the left side of the jaw, blunt-force trauma to the back and top of the skull vault. An implement was driven through the side of the skull from the left through to the right in front of the temple region. A radiocarbon date was obtained on the skeleton (SUERC-70721, GU42494, 1508+/-32 BP, cal AD 430-631, 2 sigma, 95.4% probability).

At Hallow Hills, Fife, three examples of cranial trauma (CPR 3/145, 2.1%) were identified (Young 1996, 430). These diagnoses have not been confirmed during the present analysis. Burial 66, a male in his 20s may have sustained a blow to the right side of his face which fractured the right zygomatic arch and the right temporal bone. The fracture line extends across the base of the skull (see Plate 6.54a and b). This skeleton has a radiocarbon date (GU-1864; 1390 +/- 65 BP).

Plate 6.54: Hallow Hills, skull 66, possible peri-mortem blunt-force trauma (a) right lateral view, (b) inferior view. © Laura Girdwood





A young female of 18-20 years, burial 151, exhibits a large extradural haematoma at the apex of the left temporal bone, while burial 171 is ‘probably a case of violence causing a fractured skull and death’ (ibid.).

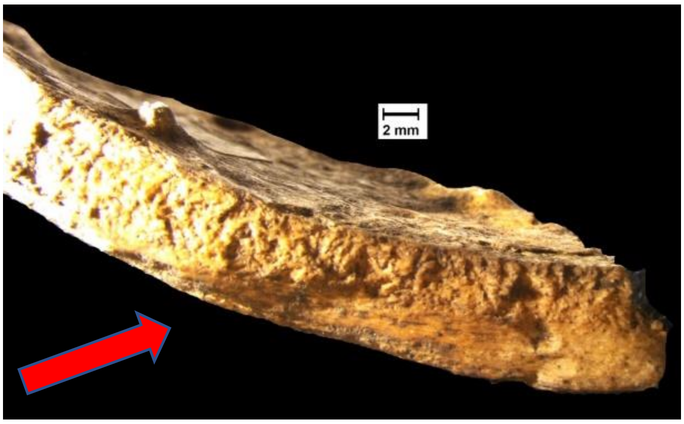
At the monastic site of Portmahomack, Easter Ross, a single example of fatal cranial trauma has been identified. Skeleton 152, a male aged 26-35 years, exhibits three sharp-force injuries to the right frontal, both parietals and the occipital (Carver *et al.,* 2016, 119, fig. 5.2.7). A radiating fracture extended from the latter cranial element towards the cranial base. The location of the injuries led to the suggestion that the first two blows came from behind. The position of the third injury on the crown of the head could mean that the victim was below the assailant at one point, i.e.. kneeling. The presence of the radiating fracture may indicate that a sword was used since larger weapons are more likely to produce terminal fractures (Wenham 1989). A second older male, skeleton 158, has two well-healed fractures of the right parietal. Both skeletons are thought to belong to period 3 (9th-11th centuries) and it has been conjectured that these men were attacked during a Viking raid (ibid., 260).

Auldhame is an Anglian monastic settlement and medieval parish church on the coast of North Berwick. An assemblage of 242 burials spanning 1000 years was excavated (Crone and Hindmarch 2016). Two skeletons from Auldhame exhibit fatal sharp-force cranial weapon trauma. Skeleton 216, an older adult male, has a linear cut to the left parietal measuring at least 800 mm in length, which has penetrated the skull (Melikian 2016, 100, fig. 78). The latter is part of phase 1, *c.* AD 650-1000. Skeleton 868, a young adult male has three linear cuts which have penetrated through the skull. They are located at the left zygomatic arch, left and right parietals, the frontal bone close to the bregma and the occipital. It was suggested that the assailant was right-handed (op. cit., fig. 79). The crude prevalence rate at Auldhame Is 0.8% for the total assemblage (2/242) and 1.2% for the adults (2/161). Skeleton 868 is a later medieval skeleton (phase 3, *c.* AD 1200-1400).

A skull fragment believed to come from the Pictish cemetery at Ackergill in Caithness was recovered in the early 20th century (Edwards and Bryce 1926). Two cut edges were identified and striations are clearly visible (see Plate 6.55 below).

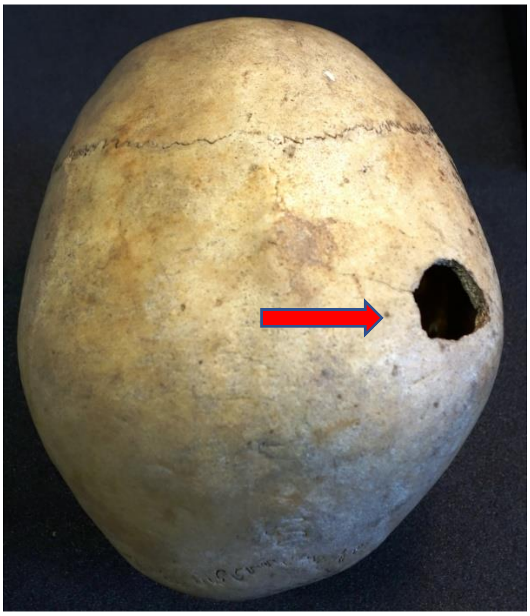
Radiocarbon dates were obtained on associated human remains as part of doctoral research into early medieval barrows and cairns in Scotland (Mitchell 2019). A fragment of maxilla and skull fragments, which were dated, entered the NMAS collections in 1909 as part of the Francis Tress Barry bequest. Many early medieval graves had been found at Ackergill (Edwards and Bryce 1926; Ritchie 2011) and a 5th to 6th century AD radiocarbon date obtained in 2018 for a skull (NMAS X.ET 32; see *DES* 19), found before 1892, was well in line with expectations for a Pictish period grave. However, the material discussed here produced Neolithic dates (Sheridan *et al.,* 2020). This strongly suggests that the damage was caused by workmen during its discovery.

Plate 6.55: Ackergill, right parietal, striations clearly visible (© Alison Sheridan)



Skull ET49 from Burghead Pictish fort in Moray is an older adult male curated at NMS Granton. It was discovered in a long cist by workmen in the late 19th century. A reference in the original publication to ‘a skull with a round hole in its upper part’ (MacDonald 1862, 357) encouraged the long-held belief that this was evidence of peri-mortem blunt-force trauma. Analysis by Rebecca Crozier and the author confirmed that this damage was post-mortem. The edges of the hole are ragged and irregular while patination of the edge is much lighter than the surrounding bone (see Plate 6.56a and b below). The skull was radiocarbon dated in 2018 to cal AD 645-764 (SUERC-81217, 1342 +/- 26 BP; *DES* 19). It had been presented to NMAS in 1861 by James MacDonald, having been found ‘some years before’, (MacDonald 1862, 358) when part of the north rampart on the lower terrace was removed, disturbing a cemetery.

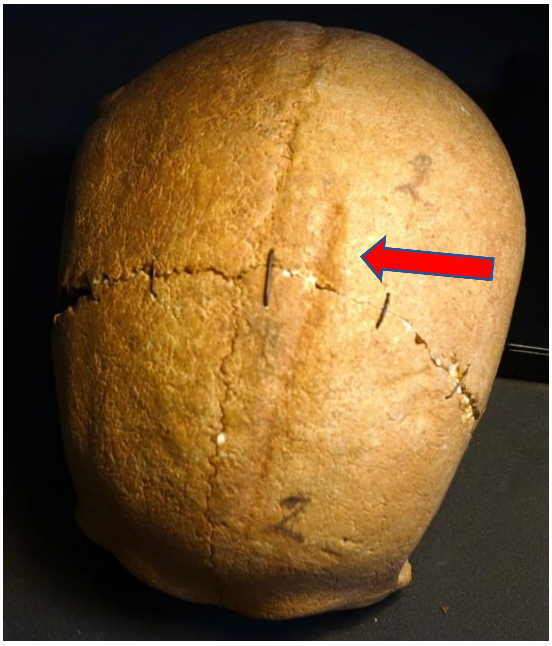
Plate 6.56: Burghead Fort, skull ET49, post-mortem damage to right parietal, (a) superior view, (b) detailed view (©Angela Boyle)



A single skull (x.ET80) curated at NMS Granton was recovered from Roxburgh Barns in 1939. It is described as part of the skeleton of a man buried with his hands behind his back. The entry in Canmore (58428) refers to several skeletons including skulls with sword or axe cuts found during road widening at Roxburgh Barns steading (NGR NT 7036 3315). It was suggested that this was either a medieval execution site or a burial place for those who had been executed (Hope 1940). No evidence of trauma or other pathology is present on male adult skull x.ET80.

A skull (no. 2) discovered in a sandbank at Eyemouth in 1896 is curated at NMS Granton. The presence of green-glaze pottery is suggestive of a medieval date. This prime adult male skull exhibits a minimum of three ante-mortem cranial injuries. A linear depression fracture affects the left frontal and parietal; it is aligned anterior-posterior and has a maximum length of 72.64 mm. it measured 10.11 mm in width and *c* 3 mm in depth (see Plate 6.57 below).

Plate 6.57: *Eyemouth skull 2, depressed linear fracture, superior view (©Angela Boyle)*



An ante-mortem sharp-force injury is located on the right parietal. The blow sliced through the ectocranial surface causing partial detachment of a portion of the vault but did not penetrate all the way through to the brain. In spite of extensive remodelling this portion is still protruding (see Plate 6.58 below).

Plate 6.58: *Eyemouth skull 2, ante-mortem sharp-force cranial trauma, right lateral view (©Angela Boyle)*

The base of the right gonial angle has been removed with a blow from a sharp-bladed weapon. Only limited remodelling has occurred. The surviving surface is flat and patination is comparable with the surrounding bone (see Plate 6.59 below).

Plate 6.59: Eyemouth mandible associated with skull 2, ante-mortem sharp-force trauma leading to removal of base of gonial angle, inferior view (©Angela Boyle)

6.7.1 A cautionary tale

A skull (IB250) attributed to one of the caves at Wemyss was examined as part of this analysis. The caves are well-known for their many Pictish carvings. The skull is that of an adult male aged upwards of 18 years and only the vault survives. The skull was found in 1952 by children playing and was reported to the police. The skull has been identified as an adult male upwards of 18 years at the time of death. Post-cranial bones, some of which may have been associated, comprised a pair of probable adult male humeri, a probable male right femur and an unsexed left tibia. Female bones comprised a pair of femora and a possible female left tibia. It is unclear whether any of the post-cranial bones belong to this individual.

A depression is located slightly off-centre and is an irregular oval shape measuring 46.72 x 20.21 mm. The impact of the injury was so severe that it left an irregular gap in the forehead just above the bridge of the nose (see Plate 6.60 below). The outer walls of both frontal sinuses have been fractured and crushed inwards on the left side. Significant irregular remodelling is present indicating that the individual survived the injury for a good many years.

Plate 6.60: Wemyss Cave, skull IB250, ante-mortem blunt-force cranial trauma, anterior view (©Angela Boyle)

The potential association of the skull with the Pictish carvings in the caves combined with the presence of significant ante-mortem blunt-force trauma provoked the decision to obtain a radiocarbon date on the skull. The resulting date was unexpected: 198 +/- 26 BP which calibrates to 1680-1950 AD (95.4% probability; SUERC-85220, GU50543; Sheridan *et al.,* 2020). A letter written by R B K Stevenson, former Keeper of the National Museum of Antiquities of Scotland (NMAS), stated that the findspot was not the 'main' Wemyss Cave but was one of the caves with carvings. The radiocarbon date reveals that his was a relatively recent death, within the last three centuries. The skull was CT-scanned and a 3-D print was made prior to confirmation of the radiocarbon date (see Appendix 5.6).

CHAPTER 7: DISCUSSION

"The bodies of the slain were one of the inevitable end-products of…warfare." (Wenham 1989, 123)

7.1 INTRODUCTION

This chapter discusses the osteological, archaeological and historical data that has been presented throughout this thesis. It will therefore focus on four case studies in order to demonstrate what the results can tell us about the severity, scale, and prevalence of interpersonal violence within the study area. This is followed by a discussion of the results within the broader context of early medieval Scotland. The chapter concludes with future directions for research and a summary of current limitations.

7.2 THE PHYSICAL EVIDENCE FOR VIOLENCE

A total of 306 skeletons were examined from 35 sites, mainly long cists, with the addition of the mass burial from Cramond Roman Fort and the Seacliffe Mausoleum. Adult males were in the majority (38.99%) with females at 22.2% and there was a clear under-representation of non-adults at 9.8%. (Figure 5.4, Table 5.11). The remainder were unsexed or no data were available due to extremely poor preservation. This research confirms Maldonado's assertion that 'infants and subadults are an almost invisible category in field cemeteries' (2013, 9) such as Lasswade and Thornybank within the study group.

A total of 27 skeletons exhibiting definite or possible cranial trauma derive from 10 sites across the study area (CPR 8.82%, 27/306; TPR 11.64%, 27/232) (see Table 6.1). Crude prevalence rate (CPR) is a percentage of the number of individuals who exhibit a condition out of the total number of individuals observed, while true prevalence rate (TPR) is a percentage of the number of skeletal elements exhibiting a condition out of the total number of skeletal elements observed. The highest numbers are from Cramond, Lundin Links, Dunbar and the Isle of May. These assemblages will comprise the case studies in this chapter. The overwhelming number of affected individuals are male (85%, 23/27), followed by females (11.1%, 3/27), with a single neonate (3.7%, 1/27).

Skeletal evidence has been identified for both healed (ante-mortem) and unhealed (peri-mortem) blunt-force and sharp-force cranial trauma and healed post-cranial blunt-force trauma (see Table 7.1 below for prevalence rates). No evidence of peri-mortem blunt-force and sharp-force post-cranial trauma or defensive wounds has been identified.

Table 7.1: Summary of prevalence rates for all ante-mortem and peri-mortem cranial and post-cranial trauma

Category	CPR	TPR	Males	Females	Non-adults
Ante-mortem blunt-force cranial trauma	3.27% (10/306)	4.3% (10/232)	8	2	0
Ante-mortem sharp-force cranial trauma	1.64% (5/306)	2.16% (5/232)	4	0	0
Peri-mortem blunt-force cranial trauma	0.98% (3/306)	1.29% (3/232)	1	1	1
Peri-mortem sharp-force cranial trauma	2.94% (9/306)	3.88% (9/232)	8	0	0
Ante-mortem blunt-force post-cranial trauma	1.31% (4/306)	1.72% (4/232)	4	0	0
Ante-mortem sharp-force post-cranial trauma	0.65% (2/306)	0.86% (2/232)	2	0	0

Key: (CPR) crude prevalence rate; (TPR) true prevalence rate.

7.2.1 Location of cranial injuries

It is generally agreed within modern forensic science and from ethnographic evidence (Wakely 1997, 27) that injuries to the left fronto-parietal region of the skull are caused by a fairly ‘formal’ style of fighting, face-to-face with a right-handed opponent (Wenham 1989). Of interest here is the fact that within the study group the majority of injuries are located on the right parietal (a total of 12, 3 healed, 9 unhealed) with 3 to the right frontal (2 healed, 1 unhealed). This is suggestive of attack either by a left-handed assailant from the front, or by a right-handed assailant from the back. The latter could suggest a surprise attack.

7.2.2 Severity of cranial injuries

Injury to the frontal bone has the potential to affect speech and cause changes in character, emotions and behaviour. Injury to the parietal bones has the potential to affect muscle contraction (leading to possible paralysis), sensory perception, memory and understanding. Isle of May skeleton 859 exhibits a healed sharp-force injury to the occipital which completely bisected the bone and this may have caused significant visual impairment.

7.2.3 Prevalence rates

Data on prevalence rates for regional studies on interpersonal violence is not easy to find and the level of detail is variable. The majority are for single cemeteries or for non-normative assemblages including battles and massacres such as Maiden Castle, Dorset (Morant and Goodman in Wheeler 1943, 352; Redfern and Chamberlain 2011, 68; Redfern 2020), Ridgeway Hill, Weymouth (Loe *et al.,* 2014), Towton (Fiorato *et al.,* 2007), St John's College, Oxford (Wallis 2014), Crow Creek, South Dakota (Zimmerman 1997; Willey 1982), Visby, Denmark (Inglemark 1939), St Andrew, Fishergate (Stroud and Kemp 1993), and are therefore not directly comparable with this research.

Generally speaking, in most cases a cemetery excavation may present one or two individuals with cut marks or healed depressions in the cranial vault (Boylston 2000, 357) and it is suggested that this extremely low frequency is in part due to bioarchaeologists' unfamiliarity with the identification of peri-mortem trauma (Roberts 1996). For this reason the application of modern forensic techniques should be an integral part of any skeletal trauma analysis.

The true prevalence rate for all cranial trauma (healed and unhealed) within the study group is 11.64% (27/232). This can be broken down into ante-mortem blunt-force trauma (4.3%), ante-mortem sharp force trauma (2.16%), peri-mortem blunt-force trauma (1.29%) and peri-mortem sharp-force trauma (3.88%). Prevalence rates are available for a small number of individual cemetery sites of the period in Scotland. At Auldhame two skeletons exhibited fatal sharp-force weapon trauma giving a prevalence rate for the assemblage of

0.8% (2/242) for the entire assemblage and 1.2% for the adults (2/161) (Melikian 2016,100-101). The prevalence rate at Hallowhill is 2.1% (CPR 3/145) (Proudfoot 1996), at Portmahomack the prevalence rate is 2.7% (2/74) (Carver *et al.,* 2016, 106) and at Captain's Cabin it is 3.1% (2/65). A cemetery from Ireland presents a similar picture. At Raystown, County Meath, two cases of sharp-force trauma were identified giving a prevalence rate of 2.15% (2/93) (Fibiger and Seaver 2016, 75-76). One of these men, a prime adult buried in a simple earth-cut grave was dated 430-600 AD. A total of 110 blade injuries were recorded on his ribs, shoulders, spine and pelvis, which is suggestive of a fierce, or even frenzied attack by more than one assailant. Data from Roberts and Cox for weapon injuries in the early medieval period suggests a crude prevalence rate of 2.6% for weapon injuries (CPR 36/1364; 32 men and 4 women), all of which are sites in England (2003, 169, tab. 4.2).

On the basis of the available data for the period the true prevalence rate for all interpersonal violence within the study group is unusually high. When the prevalence rate for individual assemblages is broken down an interesting picture emerges. Not unexpectedly, the highest prevalence rate is seen at Cramond (6/9, 66.7%), followed by Lundin Links 19th-century discoveries (5/9, 55.55%), Dunbar (4/7, 57.14% - though with the caveat that while all these skulls come from Dunbar they are not clearly related), and the Isle of May (3/55, 5.45%) This demonstrates a particular concentration in and around the Firth of Forth, in addition to isolated examples such as Ringleyhall and Thornybank.

Most of the skeletons within the study group were buried in field cemeteries such as Lasswade and Thornybank. Recent archaeological research on early medieval burial across Scotland (Maldonado 2013, 9-11, fig. 4), which identified a total of 855 skeletons concluded that such cemeteries were not intended for burial of all the dead in any given locale and that the numbers across much of the country were small. This could suggest that the high prevalence rate for violence identified as part of the current study is in fact an under-representation, notwithstanding the incalculable number of soft tissue injuries that cannot be identified.

7.2.4 The victims of violence

This research has identified skeletal evidence for cranial trauma on the skeletons of men, women and children although men are in the overwhelming majority (85%, 23/27, 23/232). Within the study group as a whole 11.64% (27/232) exhibit evidence of cranial trauma. Of that number 9.91% (23/232) are men compared to 1.29% for women (3/232). One woman has a haematoma while a second woman has a haematoma and a possible fractured mandible. It is possible in the latter case that both injuries occurred at the same time. The cause of these injuries could have been accidental due to falls or possibly due to deliberate blows. A single young adult female from Cramond suffered a massive blunt-force injury to the right side of her head which would have been rapidly fatal. The location of the injury on the right parietal strongly suggests that this was a surprise attack. This appears to be confirmed by the careless deposition of her body in a latrine along with a number of other (presumed) victims. Interpretation of the newborn infant, also from the latrine at Cramond, is slightly more problematic. This right parietal is one of a number of disarticulated bones which represent a minimum of five newborn infants. The injury is a single blunt-force blow to the head which would also have been rapidly fatal.

7.3 CONTEXTUALISING THE SKELETAL EVIDENCE FOR INTERPERSONAL VIOLENCE

7.3.1 Cramond

The assemblage from Cramond is of particular interest given the non-normative treatment afforded to the individuals. A total of nine adults and a minimum of five neonates had been deposited within a latrine which was part of the bathhouse attached to the Roman fort. A recent radiocarbon dating programme has demonstrated that the deposit of human remains is in fact of 6^{th} to 7^{th} centuries date, rather than medieval as previously thought. The application of Bayesian modelling suggests that the bodies were likely to have been deposited in the second half of the 6th century (see Appendix 5.2 below). Two phases of burial have been identified. Phase 1 is represented by burials 2, 4, 7 and 8 while phase 2 comprises burials 1, 3, 5, 6 and 9.

One of the neonates suffered a fatal blunt-force injury to the right parietal suggesting intent on the part of the attacker. It is conceivable that the other four children, whose partial remains were recovered from the Roman latrine met a similar fate. Infanticide is generally carried out at birth or soon after and has been practised on all continents and at every level of social complexity from hunter-gatherer to urbanised industrial societies (Mays 2000; Williamson 1978). While the numbers here are small, all are neonatal and it has been argued that such an age distribution showing a strong peak at about the age corresponding to a full-term baby is suggestive of infanticide (Mays 1993; Smith and Kahila 1992). The association of these five infants with the non-normative deposition of nine apparently murdered adults is potentially significant. Radiocarbon dating is required to determine if the neonates are contemporary with the adults or not.

Cramond skull 1, a prime adult male, has ante-mortem sharp-force and blunt-force cranial trauma. Cramond skull 5, a young adult probable female, has fatal blunt-force cranial trauma, which is associated with dental trauma in the form of forced occlusion. Cramond skull 6, an older adult female, has an ossified cranial haematoma and a possible healed fracture of the right mandible. Cramond 9, a possible male prime adult has a peri-mortem cranial injury; this is a substantial cut which has bisected the right parietal. There is no skeletal evidence of trauma among the phase 1 skeletons although any injuries sustained, even fatal ones, could have affected the soft tissue only. The manner of deposition of their bodies does strongly suggest that they died a violent death and were probably buried by their attackers.

Strontium and oxygen isotopic data suggest that both Cramond skull 1 and Cramond skull 8 may have spent their childhoods in a different region but their last few years were spent in close proximity to Cramond. Peebleshire, Lanarkshire and the region surrounding

Loch Lomond have been identified as possible places of origin for Cramond skull 1, while Cramond skull 8 was most likely born on one of the islands of the Inner Hebrides (Czére *et al.,* forthcoming). The osteological sexing of Cramond 1, 2 and 6 has been confirmed along with broadly local ancestry by DNA analysis. Skeletons 1, 2 and 6 were not close relatives, nor did they seem to belong to the same maternal lineages (see Appendix 5.3).

The nature of this deposit is of considerable interest and may raise more questions than it answers. In spite of the fact that Bayesian modelling suggests that all the bodies are likely to have been buried over a short period of time, most likely in the 6th century, two phases of non-normative burial have been definitively identified archaeologically. What possible sequence of events could account for this? Were two groups of locals unfortunate enough to be ambushed and killed by assailants on two separate occasions? If so this could point to a high level of violence in the area. Were the attackers Anglian incomers from the south or Picts from north of the Firth of Forth?

Two recent excavations have revealed new evidence for the chronology and function of the fort at Cramond in addition to Anglian/early medieval occupation of 7th to 10th centuries date including a previously unknown cemetery (Cook *et al.,* in preparation). Three radiocarbon dates were obtained from the disarticulated remains which lay above undisturbed W-E aligned graves. The latter provides new evidence for significant early medieval settlement at Cramond suggesting the site of the fort retained its significance after the Roman withdrawal, with evidence for both native and Anglian occupation. Only disarticulated human remains were removed as part of this work (see Appendix 5.1 below). A single fragment of adult parietal from this assemblage exhibits a cut edge most likely inflicted by a bladed weapon which bears some similarity to Cramond skull 9 and would have been fatal. Articulated burials from this phase of work have not thus far been excavated but could prove to be of significance.

The unidentified stronghold of Iudeu, which Bede called *urbs Giudi*, appears to have been a royal centre which was held by the 7th-century kings of Bernicia, and of sufficient importance to lend its name to the Firth of Forth in both British and Gaelic. Bede, however, provides only a brief description and it remains unlocated (Fraser 2008, 1). In the mind of Bede the Firth of Forth was a *sinus maris*, a bay of the sea, or else a *fretum maris*, a sea-strait, which 'penetrates far and wide into the lands of Britannia from the eastern sea', and also 'demarcates the lands of the English and the Picts' (Bede HE, i.12; iv.26). As Bede understood it *Iudeu* was an *urbs*, in other words, a stronghold fortified by natives rather than Romans (Bede HE., i.12; Campbell 1986, 99-102; Hunter-Blair 1947, 28) and therefore likely to have been in existence prior to the arrival of the Anglians.

The hypotheses relating to the possible location of Iudeu, variously Stirling, Inchkeith, Cramond, Inveresk, Carlingnose Battery and Blackness, were recently re-assessed by Fraser (2008, 21-25) who concluded, 'that no definitive identification is possible at present…However, the Black Ness and Cramond ought not to be ruled out lightly…If the debate is to be settled, it is likely to be so only at the end of the spade and the trowel.'

The skeletal evidence discussed in this thesis adds weight to the argument that Cramond is in fact *urbs Giudi.* A 6th-century date for the human remains would favour an attack on the locals by Picts, while a 7th-century date might point towards an attack by Picts on Bernicians.

7.3.2 Lundin Links

The human remains from Lundin Links incorporate discoveries made in the 19th century alongside an excavation in 1965. Unfortunately, contextual information for the early discoveries is sketchy at best. The remains from the later excavation comprise burials in scattered cists alongside cists which were sealed by a variety of cairns of different form and there can be no doubt that this is (at least in part) a barrow cemetery intended for the interment of an elite group. It has been suggested that clusters in particular monuments may be family groups (Greig *et al.,* 2000; Mitchell and Noble 2017, 4; Williams 2007) although all the burials in the so-called cairn complex are of females. Radiocarbon dates suggest that activity at Lundin Links spanned the 5th to 7th centuries (Maldonado 2013, 30; see Appendix 5.2).

Lundin Links skull ET1 is one of the 19th-century discoveries from the cemetery and can only be identified as an adult male aged upwards of 18 years since nothing else of the skeleton is present (possibly due to the retention policy of the time rather than actual preservation). This skull exhibits clear evidence of decapitation which was inflicted by a bladed weapon. Assuming that this man was alive when the head was removed, the blow must have come from behind and the neck would have been hyper-extended. Plate 7.1 below is an artist's reconstruction of possible events leading up to the death of this man which probably required a minimum of two if not three attackers/executioners.

Plate 7.1: Artist's reconstruction of the manner in which Lundin Links ET1 may have been restrained and decapitated (© Peter Lorimer, Pighill Graphics)

The absence of the dentition, mandible and post-cranial skeleton means that it is not possible to look for evidence of other blows possibly linked to decapitation or for defensive wounds which tend to occur on the bones of the chest, arms and hands. The morphology of the injuries suggests an attack from behind with a sword or an axe. Artefactual evidence for swords within the study area and indeed Scotland as a whole is limited but they are regularly depicted on carved stones. This could be an example of formal execution; certainly the use of a sword for the former is symbolically charged and may be suggestive of a high-profile and public event intended to demonstrate that a particular individual is indeed dead and that execution was carried out by decree of a higher authority (Knüsel 2005, 61). Execution cemeteries of the period are notably absent from southern Scotland but this example of decapitation may suggest that they await discovery. The mass burial at Ridgeway Hill in Dorset where 50 Vikings were decapitated by multiple blows from behind probably with a sword, is an extreme example of such a process.

It is unfortunate that no clear contextual information is available for the decapitated individual Lundin Links ET1, discussed above. Was he a prisoner of war? Or did this decapitation represent judicial execution of a local inhabitant? Depictions of decapitations appear on carved stones and are readily identifiable in the osteological record elsewhere which begs the question, why are there so few skeletal examples of decapitation in northern Britain.

The location of the injuries is unusual. Nothing comparable was seen at Ridgeway Hill, Weymouth, where mandibles and cervical vertebrae were most affected (Boyle 2014, 71, figs 3.26-3.27). Nor was anything comparable identified in a recent survey of decapitations in Britain, which included 387 individuals from 129 early medieval sites (Tucker 2015, 113). However, recent analysis of a multiple burial of 6th or 7th century date from Portbury near Bristol has identified a similar injury inflicted on an adult male (Boyle in preparation). Diagnosis in the latter case is complicated by taphonomic changes and further microscopic analysis is planned.

Closer to home a single cervical vertebrae (Dunbar 9) from a multiple burial of Iron Age date located at Dunbar shows well-defined damage which may well have resulted from a deep sword cut to the neck at the time of death (Brothwell and Powers 1966, 197, fig. 7). Evidence of decapitation has also been identified amongst Iron Age material at Sculptor's Cave, Covesea, in north-east Scotland (Armit *et al.,* 2011). Recent excavations at Musselburgh, East Lothian, revealed 12 skeletons radiocarbon dated to the late Iron Age and Roman period with a high incidence of evidence for decapitation in the form of cuts to cervical vertebrae (Moore *et al.,* 2020).

Lundin Links skull 3 exhibits a minimum of three sharp-force injuries to the back of the skull, which have resulted in removal of a substantial area of the posterior cranial vault. This has complicated any attempt to sequence the injuries. The injuries were inflicted with massive force either from above or behind by an assailant on horseback, when the victim was on his knees or lying on the ground. The significance of this man's association with the so-called 'dumb-bell' complex at Lundin Links is discussed below.

The dumb-bell complex consisted of two round cairns, each of which covered a single long cist. Lundin Links 3 was buried in cist E beneath the westernmost cairn while the easternmost cairn covered cist G (LL5). The two circular cairns were linked by an oblong cairn which also covered a cist (F) (LL15). This arrangement strongly suggests that there was a plan among the mourners for memorialising all three graves (Williams 2007, 155). The former has been radiocarbon dated (OxA-8895; 1560 +/- 40 BP, 420-600 cal AD, 95.4% probability). A radiocarbon date for Lundin Links 3 is highly desirable. In the case of Lundin Links 5, elevated strontium isotope values (although just within the range that can be found more broadly in the region), and the oxygen isotope values are higher than can be expected from an individual who spent his childhood locally. A west coast origin is a possibility (see Appendix 5.4).

The dumb-bell shape is among the most common of the Pictish symbols and is widely employed in commemorative contexts including Class I inscribed stones and later Class II sculpted slabs and cave walls (Allen and Anderson 1903). It is suggested that the dumb-bell at Lundin Links was a widely deployed and recognisable symbol rendered on a massive scale for the purpose of burial (Williams 2007, 155).

The conjoining and elaboration of certain barrows may suggest the importance of particular members of society, and imply that the creation of lineages of the dead (whether real or fictive) may have comprised an important element in the establishment and maintenance of cemeteries (Mitchell and Noble 2017, 28; Williams 2007). Conjoining of barrows may have situated the dead within particular relational networks of ancestry, and may have signalled evolving alliances and powerful emerging lineages (Williams 2007). While particular individuals in certain barrows may have been important in life what perhaps mattered more were the ways in which the living community manipulated the status of the dead and the architecture of the cemetery for their own needs (Barrett 1994, 51; Mitchell and Noble 2017, 30). Ó'Corráin (1998) discusses the use of unimportant or invented ancestors by lineages who acquired power centuries later (Mitchell and Noble 2017, 30, footnote 129). The extent of mobility demonstrated by ongoing isotope work at Lundin Links may be intimately connected to the probable high status of the individuals interred at the site and the 'dynastic' nature of cemetery use. It seems unlikely that Lundin Links 3 was a commoner, but rather a man who wielded power or was connected to those who did.

7.3.3 Dunbar

A total of four out of seven skulls from Dunbar exhibit evidence of cranial trauma. Radiocarbon dating of the skeletons is desirable given the context of Dunbar, first as a native British fortification, and then as a likely Anglian *urbs regis* or royal centre.

Excavations in the late 1980s on the headland opposite the later castle of Dunbar established definitively the true location of the Iron Age and later Northumbrian fortress which occupied a key strategic position at the mouth of the Firth of Forth in the Votadinian and Bernician patterns of settlement and lordship (Perry 2000, 16). The place-name means 'summit fort' and reveals Dunbar to have been the site of an earlier British fortification (Holdsworth 1993, 31). It was occupied as an enclosed promontory fort during the Roman period and controlled access to the natural harbour of Lamerhaven immediately to the east. Dunbar is thought to have functioned as a trading port for Traprain Law during the Roman Iron Age. Excavations have confirmed two phases of Anglian settlement at Dunbar: the first phase comprised earth-fast buildings, while the second phase buildings incorporated stone in their construction (Perry 2000, 319). Further excavation revealed a structure which had burnt down and was interpreted as a grain store (Maloney 2001, 287). It was argued that the location of the structure set back so far from the headland where the main evidence for occupation was recovered suggests a more extensive and complex settlement than had previously been proposed (ibid., 289). Previously, SUAT identified a defended settlement measuring approximately 0.5 ha (Perry 2000, 317). If the settlement extended as far back as the building identified under Captain's Cabin by Headland Archaeology it would have measured over 2 ha, which would be more fitting in size for a supposed *urbs regis* (Maloney 2001, 289) since Coldingham measured 3 ha and Bamburgh 2 ha (Alcock *et al.,* 1986, 274). It is highly probable that a settlement, be it 'proto-urban' rather than a town proper, existed in Dunbar from at least the 7th century if not earlier (Maloney 2001, 314).

The term Dynbaer meaning 'summit fort' was first recorded in the early 8th-century Life of Wilfred (Stephen, *Life of Wilfrid*, 147), which describes his imprisonment in the town during AD 680 after the rejection of a case he stated before a Northumbrian synod. Wilfrid was imprisoned by a reeve known as Tydlin. There is also a reference in the Life to the fact that the iron fetters failed to secure Wilfrid (Webb 1986, 145). Wilfrid's imprisonment at Dunbar indicates that the town was under Northumbrian control at this point, a status maintained until AD 843 when it was captured and burned by Kenneth MacAlpin (Maloney 2001, 283). The town would have been attractive to Anglian settlers as its natural haven made it a more convenient and accessible centre for commerce than its precursor Traprain Law (Alcock and Alcock 1990, 121). It is tempting to suggest that there was a higher incidence of interpersonal violence in the town due to increased population density or perhaps as a consequence of tension between Anglians and natives.

7.3.4 The Isle of May

Two examples of cranial trauma have been identified at the Isle of May and both are significant. An older adult male (skeleton 859) survived a substantial sharp-force blow with a bladed weapon to the back of the head. He appears to have died, however, of prostate cancer and was buried in a group 1 long cist of the 6th or 7th century. DNA analysis confirmed the osteological sex of the skeleton as male. The results of strontium and oxygen isotope analysis provide strong evidence that this man was not indigenous to the Isle of May (see

Appendix 5.4 for a full discussion). He may have come from the Northern or Western isles but he definitely did not come from the same place as Isle of May skeleton 959 who was also not local.

A prime adult male (disarticulated skull 959) suffered two massive sharp-force blows from a bladed weapon, probably a sword, either of which would have been fatal. He had been buried in a group 2 long cist containing several other burials. His disarticulation suggests that he was one of the earlier burials in the cist. How did this man come to be buried on the Isle of May? Was he killed on the island? Or was he killed on the mainland and transported to the monastery? A radiocarbon date and the results of DNA analysis are awaited, although osteological sex of the skull as male has been confirmed by preliminary results. The blows are likely to have been inflicted from above perhaps when the victim was on his knees or by an assailant on horseback (see Plate 7.2 below). They appear to bisect most of the skull from anterior to posterior and would have been rapidly fatal. Strontium and oxygen analysis was carried out by Dr Janet Montgomery at the University of Durham. The strontium and isotope ratios provide strong evidence that 959 was not indigenous to the Isle of May (see Appendix 5.4 for a full discussion).

Plate 7.2: The manner in which Isle of May 959 may have been attacked (© Peter Yeoman)

Comparable catastrophic injuries are present on the skull of skeleton 1, a mature adult male, from a mass grave at Heronbridge, Chester (Holst 2004, 8-9). This skeleton exhibits four healed depression injuries thought to have been caused some time before death possibly with a hammer, which suggests he was a battle veteran. The skeletal evidence suggests that this man had died in battle and was probably buried soon after death in a mass grave together with other battle victims. A minimum of four peri-mortem sharp-force injuries had been inflicted (see Plate 7.3 below). The first injury sliced across the right parietal, with the attacker probably standing to the right of the victim. The second blade injury was perpendicular to the first, thus creating a cross or X-shape on the right parietal probably deriving from the front and right side of the victim. The third blade injury ran across the left part of the frontal to the centre of the left parietal. This injury did not exhibit the sharp, smooth cut surface, characterising the other two cuts. It was suggested that the victim may have fallen by the time this blow was inflicted and the weapon may have been obstructed by something from entire penetration of the skull, thus just shattering the bone in a linear fashion. It is probable that the attacker stood on the left side of his victim. A fourth blade injury, which could not be sequenced, was located on the right parietal, just behind the ear.

Plate 7.3: Heronbridge, skeleton 1, peri-mortem sharp-force cranial trauma, superior view (© Chester Archaeological Society/Malin Holst, York Osteoarchaeology)

7.3.5 Lethal weapons

Patterns of violence and warfare vary according to social context but are also linked to the quality and precision of manufacture of the weapons, both of which are dependent on the material used and the level of available technology (Boylston 2000, 357). For example, the cut marks inflicted by a flint implement are clearly distinguishable from those inflicted by an edged weapon (e.g. Brothwell 1971). The weapons required for fighting on horseback are different from those required for fighting on foot and weapons can also be classified as effective at either long-, medium- or short-range (Gurdjian 1975).

Many weapons can produce more than one type of injury: for example, a sword or a knife can cut or thrust, and an axe can cut or chop, therefore, it is rarely possible to identify the weapon that caused a particular injury (Boylston 2000, 359). Furthermore, the damage caused by a weapon is dependent on the force of the blow or the velocity of the projectile (Berryman and Symes 1998).

The terminology of weapon-tools and tool-weapons applied by Harding (2007, 50-51) might also be applied to the early medieval period in Scotland. Tools and weapons were overlapping categories in the past as they are today, when hammers, screwdrivers, ice picks, machetes and agricultural tools are all implicated in interpersonal violence (Ferlinni 2013; Knüsel and Smith 2005, 8). Clearly the absence of dedicated weaponry has little bearing on the likely incidence of lethal violence (Armit 2011, 10) as has been well illustrated for the Neolithic period. The slingstone is perhaps the oldest of deadly weapons (Dohrenwend 2002; Issac 1987) whether recognised as such or not (Rosenberg 2009) but its apparent ubiquity in the archaeological record seems to stand in stark contrast to the apparent lack of cranial injuries that might be expected (Knüsel and Smith 2013, 8).

The artefactual evidence for recognisable weaponry is sparse in the south-east of Scotland and indeed in the country as a whole. Given the chronology of this research and the known Anglian take-over of the study area, it is legitimate to consider the evidence of

Anglo-Saxon weaponry which, while more restricted than the medieval period, commonly includes spears, and less commonly, swords, axes, seaxes or battle knives (Härke 1990). There is also an example of an arrowhead embedded in the vertebral column of an older male from Eccles in Kent (Manchester and Elmhirst 1980).

The lethal intent of identified skeletal injuries hinge on whether or not they are deemed to be weapon-related, and therefore a better indication of premeditated aggression (Knüsel and Smith 2013, 8). Wells (1982) observed that the sharply incised wound is least likely to be received accidentally and almost diagnostic of a combat injury. The injuries produced by bladed weapons have a much more straightforward association with armed aggression than weapons which produced blunt-force injuries that are more difficult to distinguish from accidental trauma. Bladed weapons, in particular swords, would have been limited in supply and their use would have required training (ibid., 9). Alcock (2003, 178) proposed an interesting alternative to the assumed use of the sword in relation to the interpretation of the head wounds identified at the cemetery in Eccles, Kent (Wenham 1989). All the injuries were attributed to swords on the basis of both observation and experimental work, however, by far the most common of Anglo-Saxon weapons were spears of various shapes and sizes, suggesting it was more than just a hunting weapon, which surely had some significance on the battlefield (ibid.). One type of Anglo-Saxon spearhead (Swanton 1973, type L) recovered from graves 34 and 55 at Norton, Cleveland (Sherlock and Welch 1992), has a long blade, which, if kept sharp, could have inflicted injuries comparable to those attributed to swords, assuming a slashing motion was employed (Alcock 2003, 178).

It is suggested here that the fatal blunt-force injuries inflicted on the woman and child from Cramond could have been inflicted by the butt of a spear. The location on the right parietals suggests either a blow from the front by a left-handed assailant or from the back by a right-handed one. The non-normative deposition of Cramond 5 combined with the blow to the head strongly suggests that she was the victim of a surprise attack with no opportunity to defend herself. No defensive wounds were identified among the human remains at

Cramond, which adds weight to the argument. The injuries on the skulls from the Isle of May and those exhibited by Lundin Links 3 and the Lundin Links decapitation are quite likely to have been inflicted by a sword. The location of the injuries on Isle of May 959 and Lundin Links 3 could indicate that either the assailant was on horseback or the victim was on his knees. The former suggests attackers of high-status, who had access to both a horse and probably a sword.

The depictions of weapons on carved stones have been discussed in some detail and include armour, swords, spears (the most common item), axes, clubs, knives or daggers, bow and arrow, shields and scabbards.

7.3.6 The nature and scale of violence

It has been argued that the violence in the early medieval west, which is well attested in the historical sources, was powered by social norms obliging men to rally round their kin in times of trouble, and for such kindred to resolve their differences through mutual hostilities (Fraser 2012, 65). To allow injured kin to go unavenged was considered a shameful failure of family duty and the right of 'normal freemen' (freemen with full legal status) to take revenge for injuries to their person, property or good name would not have been questioned (Charles-Edwards 1972).

In the absence of historical sources for Scotland, which pre-date the 8th century, anthropological analogy suggests that any military activity, whether small- or large-scale would have been understood at the time and also legitimised by the participants principally as the avenging of wrongs (Halsall 2003, 16). Stories which appear in 8th-century sources such as the *Life of Columba* (Anderson and Anderson 1991, bk ii, ch. 39) and the *Historia Ecclesiastica* (Sherley-Price and Farmer 1990, bk iv, ch. 20), describe the threat of violent reprisal which is regularly diffused by the payment of compensation. Therefore, it has been argued by some scholars that peace prevails through the power of retributive military activity as a deterrent rather than a reality (Fraser 2012, 68). Furthermore, the battles and sieges recorded in northern Britain may have been exceptional and therefore newsworthy, with a conscious avoidance of pitched confrontations (ibid.).

A siege (*obsidio*) of Bamburgh in AD 704, which is described in the Life of Wilfrid was apparently hastily resolved and there was no reference to direct combat (Colgrave 1927, ch. 60) though details of confrontation in the sources are lacking. There are also references to *combustio* (destruction through fire) at a number of locations including Bamburgh and this may have been seen as a less risky strategy than *obsidio* (Bede, HE, bk iii, ch. 6; Fraser 2012, 71) although it is plausible that it may simply have been a more readily available strategy.

Bede portrays invaders marauding across Northumbria while Adomnán talks of people fleeing for refuge to the churches with their women and children because of an attack by enemies (*Vita Sancti Columbae* bk I, ch. 46). The abundant references to *uastatores* and the off-hand treatment by contemporary authors implies that *uastatio* was a real and constant threat for the people of early medieval Scotland and that flight was the common response to news of enemy campaigning (Fraser 2012, 72). The fact that Adomnán perceived this threat as a real and dangerous one must have provoked him to produce his *Lex Innocentium* in 697.

Adomnán was the ninth abbot of the Hebridean island monastery of Iona although he is overshadowed by the memory of his predecessor Columba who founded the monastery in AD 563 (Márkus 2008, 1). Adomnán wrote a legal text concerning the protection of non-combatants in the 7th century. The Annals of Ulster, the Annals of Tigernach and the Chronica Scottorum all record that in AD 697 'Adomnán went to Ireland and gave the Law of the Innocents to the people' (CS 697.1; AT 697.3; AU 697.3; Márkus 2008). The main aim of the law was the protection of women – and to a lesser extent other 'innocents', children and clerics – from violence.

The existing text is composite and probably dates to the 10th century although the oldest material is that contained in §34-53 which seems to be the strictly legal text originating in the 7th century concerning offences and the penalties associated with them along with aspects of the enforcement of the Law (Márkus 2008, 4). The *Cáin Adomnán* from §34 is probably mostly original material and it forbids assaults on women, clergy and children and prescribes punishment for crimes against them (Márkus 2008, 6).

Fraser's recent re-appraisal of Adomnán suggests that while the promulgation of *Cáin Adomnán* qualifies him as a lawmaker, it does not necessarily qualify him as a peacemaker (2010, 95). Adomnán clearly expected to introduce his law into a society, 'in which ordinary people, whether male or female, child or adult, were in genuine peril of being killed, assaulted, degraded, and subjected to *dire mutilations and dismemberments'*. The clergy, clerical students and penitents were certainly not immune to such dangers, and neither were churches or sanctuaries safe from being violated, pillaged and burnt (*Cain Adomnán*, 34-6, 44, 46, 50; Fraser 2010, 95). Adomnán would have known that fighting was an obligation of free men in Gaelic society so had to content himself with attempting to protect the innocents, and as Márkus notes [*Cáin Adomnán*] was, 'not a pacifist text, and it did not seek [unrealistically] to stop war all together' (Márkus 2008, 6). The text, therefore, provides compelling evidence that during the period violence in all its forms was a real and constant presence. The *Cáin Adomnán* was promulgated in Ireland and contained only Irish and Pictish signatories. One of the guarantors was Bridei, king of the Picts which suggests that Pictland was sufficiently centralised under a single king for his guarantee of the law to suffice for the whole of Pictland (Márkus 2017, 103). The fact that these individuals were amenable to signing the document provides further convincing evidence of the ubiquity of violence in everyday life.

Nonetheless, there is increasing scepticism among some scholars about the value of references in the sources to pitched battles (Bede, HE, bk iii, ch. 24; see Keegan 1976, 35-45 for a classic discussion) and no detailed descriptions of major engagements exist (Fraser

2012, 75). Images of shield-bearing spearmen in file on the Dupplin Cross and the Pictish slab from Birsay may represent shield- walls, which are mentioned in poetry (e.g. Clancy 1998, 85), but the comparable image on the Aberlemno cross-slab is interpreted by some as a stylised deployment in an array of three ranks (Fraser 2002, 69-70). The use of archery is implied by images on the Sueno Stone along with finds of arrowheads at, for example, Dunadd, while other images may suggest the deployment of cavalry alongside infantry (Aitchison 2003, 62-4, 78-82; Alcock 2003, 149-150; Lane and Campbell 2000, 160-2). Fraser observes (2012, 77) that post-battle, it appears no great care was taken for the wounded and dead enemies but rather mutilation or decapitation may have occurred as is depicted on the Sueno Stone with scenes of combat next to systematic beheadings. It seems unlikely that such extreme forms of violent retribution would have been portrayed if they were not recognisable events. Lundin Links skull ET1 provides convincing skeletal evidence of the practice of decapitation.

There is a surprisingly low level of violence associated with sieges in the sources and pitched battles are comparatively rare, which may point to a more pragmatic approach in which 'the most effective way of ensuring's one survival in an age of [apparent] endemic warfare at all levels of society was to cultivate a healthy reluctance to allow the norms of customary vengeance to lead to unfettered fighting and bloodshed, when they were just as capable of leading to honourable, if uneasy peace' (Fraser 2012, 84).

There is little archaeological corroboration for 'armies' as such in Scotland, though some stones such as Glamis, Aberlemno and Birsay suggest that the household retainers of kings and lordly men; if that is what they were, commonly carried a long spear, a targe-type shield, perhaps a handful of javelins and wore a knee or ankle-length jacket-type tunic (Fraser 2012, 81). In some cases there was a thigh-length sword and a horse (Aitchison 2003, 44-70). There is evidence to suggest that, in Pictland at least, the spear was a weapon of status (see below).

Depictions of violent encounters appear on a number of carved stones and include battle scenes, possible fighting forces, interpersonal violence usually involving two men, decapitation and drowning. On balance it seems highly unlikely that these depictions are wholly unrealistic and that the use of violence in all its forms was a common occurrence. This is borne out by the high prevalence rate for cranial trauma within the study area.

7.3.7 Archaeological and historical context

It is useful to look backward to the Roman occupation of the study area in order to explore the implications of the intervallate zone for understanding the relationship between the native populations with Roman and later Anglian invaders. It has been argued that the creation of a frontier zone was a significant factor in the formation of Bernicia (Collins 2011). At the time of the Roman invasion of southern Scotland in AD 79, the area between the Tyne and the Forth was occupied by the Votadini (later the Gododdin) whose tribal centre was at Traprain Law. The absence of Roman sites in the coastal plain between Berwick and Inveresk implies that the area (and its occupants) posed little or no threat to the advancing Roman legions (Perry 2000, 5). Nonetheless, the Roman arrival must have had a considerable impact on the native populations, not just in military action but in opportunities for commerce and the Roman requirement for food supplies (Morris 1995, 54).

Recent work on the Roman period in Scotland has been influenced by more general trends in 'frontier studies' (e.g. Barrett *et al.,* 1989) and in 'romanisation studies' (e.g. Millet 1990) through challenging the traditionally held paradigm of a 'Roman interlude' and arguing that Rome was in fact a significant factor in the development of the region (Hunter 2007; Wooliscroft and Hoffman 2006). Hunter (2007) explores the significance of Roman material found on native sites; he charts periods of boom and bust, suggesting that this was a deliberate attempt by the Romans to manipulate local politics by favouring some groups over others in order to create tensions between them. These developments reflect an increasing interest in the native people of Roman Iron Age Scotland as active participants instead of passive extras, rather than an obsession with Roman remains *per se* (Fraser 2009, 113-117, 388). The leaders of native societies would have been agents in the process of romanisation seeking to maximise the opportunities created by Rome (Márkus 2017, 9).

The paradigm of the 'Roman interlude' necessitates a minimalist view of the Roman impact on northern Britain with native people emerging from the Roman Iron Age: ' [The *Gododdin* appear to be] untouched by even the thinnest veneer of Romanisation, and apart from their Christianity, they might just as well belong to the world of the ancient Celts as described by Herodotus or Poseidonius' (Smyth 1984, 18). It has been argued that the substantial social, cultural and ethnic change which took place in Outer Brigantia, Caledonia and in parts of Atlantic Scotland shaped the Early Historic Period and perhaps more controversially, that the appearance of native written sources *did not* mark much of a watershed in northern Britain (Fraser 2009, 116).

It is impossible to determine with certainty the nature of the relationships between Rome and the native groups in outer Brigantia. The idea that Votadinian leaders were allies of Rome as early as the Flavian period is an old one but has much to recommend it (e.g. Fraser 2009). The route of the Roman road which linked Erboracum (York) with the Forth skirted around the edge of Votadinian territory and could have served either to contain or protect. The re-use by the Votadini of the Bronze Age fortification at Traprain Law during this period is evidenced by considerable quantities of both native and Roman material, suggesting that the Votadini were on very good terms with Rome (e.g. Armit 1997, 103; Breeze 1982, 150-3; Breeze 1996, 114; Harding 2004, 189-191; Hunter 2007).

If the notion that trade with barbaricum was prohibited by Roman frontier policy is correct (Breeze 2006, 153) then Roman items, particularly silver may have been acquired during some form of formal diplomatic exchange as the Roman army had to do more than fight - they needed to keep the peace, negotiate for supplies and to tax the local inhabitants (Blackwell *et al.,* 2017, 12-13; Fraser 2009, 25).

The creation of the intervallate region during the Roman period is important because it created a new and very clear distinction between the people of outer Brigantia and those of the largely untamed north. There is compelling evidence that the Votadini of south-east Scotland had enjoyed relatively good relations with Rome and were likely to have been more Romanised than their immediate neighbours to the west and north. This may have made them more amenable to the influence of Bernicia and later Northumbria in the centuries to come.

Reliable historical sources are scarce for the early medieval period in Scotland and recent revisionist scholarship has radically altered perceptions of those that do exist by questioning the motivations behind their creation (e.g. Fraser 2009). The simplistic view of Britons and Anglo-Saxons in southern Scotland, with Picts to the north and Gaels to the west is no longer tenable. Increasingly, strontium and oxygen isotope analysis suggests that mobility was a real possibility across Scotland in the early medieval period (e.g. Lamb *et al.,* 2012; Müldner *et al.,* 2009; Czére *et al.,* forthcoming; see Appendix 5.4 below). Important cultural and social transformations took place during these centuries, apparently typified by struggles between conflicting political powers (Fraser 2009), and by the 6th century kingdoms of the Gododdin (successors to the Votadini) and Strathclyde at Dumbarton Rock began to emerge (Foster 1996; Wormald 2005). It is therefore feasible to suggest that clear evidence of such struggles will be apparent in the human skeletal remains of the period, should they be analysed.

One of the major transformations of the early medieval period was the instigation of a hereditary aristocracy and the emergence of individuals with sufficient power and authority to call themselves kings (Mitchell and Noble 2017, 28). With the consolidation of power in 7th-century Pictland, the local and regional genealogies that barrow cemeteries helped create may have no longer been sufficient to express the authority of elites who began to rule large territories (op. cit. 34). It is perhaps in this context that we see disinvestment in the architecture of the dead, and greater interest in other forms of elite monument that more clearly expressed the relationship of elites to their Christian faith. The most obvious example of this is Class II Pictish sculpture, likely 7th-9th centuries in date. These monuments are carved with depictions of elites, often mounted on horseback, shown in close juxtaposition with monumental Christian crosses and/or the image of David (Goldberg 2012, 155).

The absence of any explicit historical information for Anglian expansion into south-eastern Scotland has led to an over-reliance on poorly recorded events (often battles) especially in the reign of Ethelfrith, while the influence of Northumbria beyond the Firth of Forth has been coloured by the exile of his sons into the region (Blackwell 2018, 33). Hunter Blair saw the establishment of friendly relations during this exile as important in securing control of land between the Tweed and the Forth and suggested that south-east Scotland was absorbed rather than conquered given the few explicit records of war in the region (1954, 162). The tradition used by Bede, based on Gildas, states that Anglo-Saxon warriors settled in Britain as a direct response to the aggression of Pictish and Irish invaders, however, the possibility that there was considerable overlap between the aggression of Gaels and Picts in the 4th century with the establishment of *foederati* within Britannia should not be forgotten (Fraser 2009, 151).

There were two kingdoms in Northumbria: Bernicia which corresponded roughly with Northumberland and Durham; and Deira, which corresponded roughly with modern Yorkshire. Bernicia would have been keen to expand into south-east Scotland because of the existence of fertile farmland, which would ensure the acquisition of wealth and allow Northumbrian kings and princes to enhance their power and prestige while rewarding their followers. The origin legends for Bernicia are superficial, focussing as they do on the foundation of Bamburgh and Lindisfarne by the (potentially mythical) Ida in 547 (Hunter Blair 1947, 43).The lack of reference to any migration (Ortner and Wood 2007, 111) and the fact that *Berneich*, Latin *Bernicii* appears to be British in origin have led some to postulate that the first Bernicians may have been British in origin (e.g. Fraser 2009, 152).

Alcock (2003, 45) considered the possibility of a take-over of existing power structures which he contrasted with the level of conflict described by Bede. In the opinion of Bede (HE, I. 34, II.5) Northumbria was a colonial superpower that was expanding, annexing or subjugating the rest of northern Britain, however, these accounts are no longer accepted as completely unbiased but rather seen as attempts at redesigning the past, present and future (Blackwell 2018, 21; Fraser 2009, 5). The integration of osteological evidence is therefore crucial in any study of the region, and as unequivocal evidence of violence, it needs to be taken seriously.

Bede describes Ethelfrith as 'a very powerful and ambitious king…[who] ravaged the Britons more cruelly than any other king or ealdorman, exterminating or enslaving the inhabitants, making their lands either tributary to the English or ready for English settlement' (Sherley-Price 1970, 92). The district around Edinburgh was certainly in Bernician hands by AD 655 when Oswy occupied the elusive stronghold of Iudeu most likely located in or around West Lothian, at a site allowing for the Firth of Forth to be called the 'sea of Iudeu' (HE 2, §64-5). In, or soon after, AD 680, the monastery of Abercorn (foundation date unknown) became the see of Trumwine who, in spite of the fact that Abercorn lay in English territory, was described by Bede as bishop of the Pictish province (HE. IV, xii), which clearly implies Northumbrian influence beyond the Firth of Forth. Such influence within Pictland could not have been acquired entirely peaceably in spite of the exile of the sons of Ethelfrith to the kingdom (Blackwell 2018, 33).

The Northumbrian conquest of south-east Scotland was complete with the capture of Edinburgh in 638, *obsessio* Etin - according to a single phrase in the Annals of Ulster for that year (Anderson 1922, I, 164), which we now know were written at Iona (Bannerman 1968). The lack of detail means that it is not clear who was besieging whom and what the outcome was (Rolleson 2003, 89). The siege is now generally seen as one event in a series of largely unrecorded battles [and undiscovered battle-dead], whose end result was Northumbrian control of south-east Scotland (e.g. Higham 1986, 262). It has been further suggested that the siege of Edinburgh may have been a reflection of the siege of Iudeu where Oswy hid out rather than face Penda and his British allies (Fraser 2009, 185-6).

The highpoint of Northumbrian dominance came to a decisive end in AD 685 at the battle of Dunnichen when Egfrith was defeated and killed by the Picts under the leadership of Bridei. The Anglo-Saxon Chronicle records that 'King Egfrith was killed to the north of the sea…[i.e. The Firth of Forth, dividing Anglian from Scots territory] on 20 May, and a great raiding party with him.' It seems likely that the crushing of Northumbrian power came at the cost of many lives even though their remains are undiscovered. Bede further commented that after Egfrith's death some of the British kingdoms broke free and reclaimed their independence. Was south-east Scotland one of these areas? Egfrith's defeat at Dunnichen demonstrated the need for securing the frontier on a defensible line. Dunbar was too far to the east so it is conceivable that the plausible alternative was *urbs Guidi* to which Bede refers (HE. I, xii) in terms that suggest it seemed to him to be a place hardly less important than *urbs Alcluith*, the British stronghold at the western end of the frontier (Hunter-Blair 1954, 172). The last recorded incident in the frontier warfare against the Picts is Bertfrid's victory in AD 711. Bede records that ' the ealdorman Bertfrid fought against the Picts' (*HE,* v, 24). This could be seen as an attempt to again expand Northumbrian power northwards.

7.3.8 A warrior ethos?

Warrior values are closely linked with conventional notions of masculinity, in both non-state and subsistence cultures, and politically and economically elaborate societies where a distinct warrior caste of high status developed (McCarthy 1994). The cultivation of a reputation for strength, a striking visual persona and a willingness to respond disproportionately to any aggressive action would have been deterrents to potential aggressors (e.g. Armit 2011, 12 in relation to the warrior in the Bronze Age). The identification of four attributes/qualities identified as essential for a warrior is useful to consider (see Table 7.2 below).

Table 7.2: Warrior values drawn from a wide survey of cultural models (after McCarthy 1994, 106)

Attribute	Definition
Physical courage	The warrior likes to fight, is prepared to risk injury or death, and will engage with superior forces. If death is inevitable he faces it bravely and without flinching.
Endurance	The warrior can withstand extremes of climate, pain, hunger, thirst and fatigue; he will fight on after defeat and reverses; he is not demoralised either by prolonged hard fighting or by captivity.
Strength and skill	The warrior is physically robust, fit and proficient in the use of his weapons; he is a shrewd tactician and planner, not merely a berserk thug, although an element of frenzy in the heat of battle is to be expected.
Honour	The warrior is 'pre-eminently' a man of honour; he keeps his word, is loyal to his leader and to his comrades, and fights honourably without resorting to illegitimate underhand tricks or ruses; he defends and protects the wounded, the aged and women and children, even the helpless prisoners of the enemy; he is extremely sensitive to any slight or insult to his own honour or to that of his band or clan, and will respond decisively and forcefully, regardless of risk.

It is acknowledged that these attributes are aspirational and derelictions would have been commonplace and that negative experiences outweigh the positive in the context of battle. This begs the question of why young men would be impelled or attracted to the warrior role (McCarthy 1994, 107). Possible reasons include material reward, an exaggerated division of the world into kin and non-kin (Wilson 1978), perception of a threat such as massacre or deprivation of resources and perhaps more significantly, a high level of cultural approval and social status including access to valued privileges and prerequisites (e.g. Chagnon 1988; Daly and Wilson 1988; Herdt 1982; Saitoti 1986; Spencer 1965). Cross-cultural studies have suggested that high levels of homicide/assault are unintended consequences of the need to produce effective and unambivalent warriors (Armit 2011, 3; Ember and Ember 1994, 620).

At the end of Roman occupation southern Scotland became home to both natives and migrants with different areas controlled by a patchwork of tribal chiefs and warlords for whom warrior values were a central occupation. It is argued that sustained involvement by a group or society in lethal combat requires the evolution or adoption of some system of warrior values (ibid., 118). This is in marked contrast to what Keegan (1976, 18) describes as the procedural approach to [modern] warfare where the conduct of war is reduced to a set of rules and procedures, thereby making orderly and rational what is essentially chaotic and instinctive.

The concept of warrior values or a warrior ethos is commonly cited as a possible cause of male violence and known to persist and thrive in societies where 'warfare' is small-scale or infrequent, provided that it is advantageous (McCarthy 1994). Definitions of 'warfare' are problematic. We know very little about the manner in which fighting took place during the period. Was formalised fighting less commonplace than surprise attacks, ambushes, massacres or raids? Was the mere threat of violence a sufficiently potent deterrent? While there are numerous early medieval historical references to sieges and battles in northern Britain, there are few surviving details concerning these encounters, or the mentality and ethos of the combatants (Alcock 2003, 144-45; Fraser 2012; Hall *et al.,* 2020).

A controversial exception to this is the text of *Y Gododdin* (Koch 1997), which praised the warriors of a polity centred on the Forth to Tyne area and portrays around AD 600, a life revolving around feasting, plundering and heroic death (Haycock 2016). Traditionally, the poem is believed to describe the annihilation of the forces of Gododdin at *Catreath*, often identified as Catterick although this is only one possible reading. There is no single poem but rather two variant texts which are contained in a single manuscript. The stronghold of the Goddodin was referred to in the poem as *Din Etin* (*Din Eidyn*), which for many years has been identified as Castle Rock in Edinburgh (e.g. Jackson 1959). The identification of *Din Eidyn* with Castle Rock is accepted by many as being reasonably secure (e.g. Alcock 1983, 6-11) and is variously referred to as *Dineidin, Edin Vre, Caer Eidyn* and *Kynted Eidyn* which are respectively 'hill-fort', 'hill', 'fortified city', and 'royal seat' (Dunshea 2013, 90, endnote 55). This putative connection with Edinburgh is perhaps the main reason for the high level of scholarly interest in the poem, along with the romantic notion of the legend of *Catraeth*, often represented as a kind of Early Historic battle of Culloden (Woolf 2013, 5).

In essence the story is a simple one described thus: a small, highly mobile and mounted force of Britons rode deep into the enemy territory of the pagan kingdom of Deira only to be wiped out by the forces of the English (Lowe 1999, 13). The battle resulted in the death of virtually all the attackers. The poem describes specific incidents in the battle, the heroism of the war-band, the futility of the campaign, and elegies to individual warriors which praise their previous exploits as well as their deeds at *Catraeth* (Clancy 1998, 47).

It is conceivable that the heroes of the poem were celebrated as representatives of a lost era of British greatness rather than as historical individuals (Fulton 1994, 36). Indeed, the heroic ethos demonstrated in *Y Gododdin* supports a later date since 'heroic ages' have generally been retrospective in European literature: examples include Beowulf (Padel 2013, 141).

More concrete evidence for a 'warrior ethos' can be found in the iconography of the carved stones in Scotland. The depictions may have served dual symbolic and political functions, such as making a social statement about prestige or serving as a prophetic warning against attack (Knüsel 2005, 49). The recent discovery of a new carved stone at Tulloch near Perth, prompted a detailed reconsideration of a warrior ideology in northern and eastern Scotland linked to elite cemeteries and their association with a small group of important, and potentially early stones of similar type (Hall *et al.,* 2020). Since weapon burials are generally absent from Scotland and Ireland (e.g. O'Brien 2009, 136-138; Maldonado 2013) it is argued that the association of these carved stones with monumental barrow cemeteries allows for an alternative expression of a martial ideology (ibid.). Carved stones are almost entirely absent from south-east Scotland as are monumental structures with the notable exception of Thornybank (Rees 2002). It seems unlikely that this warrior ethos was absent from south-east Scotland so it may have been expressed in a different way. Excavations at Thornybank revealed the remains of over 100 burials, amongst which were the most southerly examples of square-ditched graves one of which may have had a wooden structure around or over it, and an unusual four-posted earth-cut grave (ibid.).

The Tulloch stone depicts a human figure who is carrying a spear with a kite-shaped blade and a doorknob-style butt, which compares well with examples from Rhynie (stone 3), Newton of Collessie, and Balblair. Rhynie 3 holds a spear with a doorknob-shaped butt and a rectangular shield. A 19th-century illustration suggests that he may have worn a helmet (Logan 1829, 56, pl. V) but this is no longer clear. A photogrammetric survey of the Collessie stone clarified some details of the carving: the shield has a central boss and the spear has a lozenge-shaped head and a doorknob-shaped butt very similar to Tulloch (Hall *et al.,* 2020, 6). The Balblair individual is carrying a club or staff rather than a spear. This may suggest a different social status for the figure or a different function for the stone. The axe-wielding figures on stones such as Rhynie (stone 7) again differ and may be depicting yet another status or role (Noble *et al.,* 2013, 1147).

Representing the human form on carved stone monuments appears to have developed through contact with the Roman world (e.g. Hunter 2007, 38-42). The association of the stones at Rhynie and Collessie with barrow cemeteries is suggestive of a date in the 5th or 6th century (Noble *et al.,* 2019). The distinctive type of doorknob-butted spear may equate with the description by Cassius Dio (*Roman History* 76.12.3) writing about the *Maeatae* and the Caledonii who lived north of the Roman frontier of ‘a short spear with a bronze apple on the end of the shaft’ (Mann and Penman 1996, 40). Evidence suggests that these spears were certainly in circulation in the 4th century with a period of use from the 3rd to the 5th or 6th centuries AD (Heald 2001, 690).

Alex Woolf has highlighted that elites in early medieval northern Britain were first and foremost leaders in war (2007, 26). Certainly images of armed figures are seen throughout the Pictish corpus with martial imagery spanning at least five centuries (Hall *et al.,* 2020). The decorative programmes of many of the carved stone monuments testify to the social and cultural achievements of the people of Scotland in this elusive period while the written sources provide the background noise (Fraser 2012, 64).

There is evidence that the spear was an elite weapon at least in Pictland. The cross of Constantine shows a powerful Pictish ruler mounted and carrying a spear with his retinue below him, also armed with spears (Hall *et al.,* in press) who is interpreted as King Constantín, c AD 788-820 (Forsyth 1995).

The group of stones to which Tulloch belongs may depict individuals who were warriors, or a martial ethos embodied and legitimised by invoking a mythical hero, ancestral figure or god (Hall *et al.,* 2020, 14). Further, the individuals may represent a war-orientated social organisation that was integral to resisting the Roman Empire and to creating the overtly hierarchical societies of the post-Roman period (ibid.).

7.4 SUMMARY

The aim of this research was to test the validity of the traditional view, based largely on the evidence from historical sources that the early medieval period in south-east Scotland was conflict-ridden. The efficacy of the models of Northumbrian expansion outlined in Chapter 1 has also been tested. Through osteological analysis of a substantial group of skeletons (n=306) derived from a variety of burial groups across south-east Scotland, this research has demonstrated that there is in fact definitive proof that levels of violence within and on the fringes of the study area were unusually high. Clear skeletal evidence for interpersonal violence has been identified with significant concentrations in and around the Firth of Forth at Lundin Links, Cramond and the Isle of May. A fourth concentration has been identified at Dunbar. The victims are predominantly men of fighting age.

During the Roman occupation of south-east Scotland the area was marked out as distinctive from the areas to the south and the north by the creation of the intervallate zone bounded by the Antonine wall which defined the boundary with Pictland and Hadrian's Wall, which defined the northernmost limit of the Romanised south. There is compelling archaeological evidence to suggest that the Votadini (later the Gododdin) who were the native occupants of the intervallate zone enjoyed a largely beneficial relationship with the Roman occupants who were more preoccupied with the Picts to the north of the Antonine Wall. Skeletal syntheses are, however, currently lacking for south-east Scotland in the Roman Iron Age and it is fair to say, that osteologically, this hypothesis remains unproven.

The literal veracity of the historical sources such as the *Historia Ecclesiastica* has been critically questioned in recent years and, while it is now generally accepted that they have more to tell us about the motivations of their authors writing in the 8th century than they do about the events that they are describing it would be foolish to discount them in their entirety. It seems likely that the literary, art historical and historical sources present a reasonably accurate picture of the relatively routine use of violence in everyday life. The results of this research which identified a high prevalence of violence in the form of skeletal trauma within the study area provide incontrovertible proof of this fact.

It is likely that violence took many forms and in addition to large-scale pitched battles would have included sieges, burning, plundering and marauding. Certainly, violence was sufficiently normalised to provoke Adomnán to write his *Lex Innocentium.*

The predominant burial tradition of the early medieval period in south-east Scotland was unaccompanied burial in long cists and therefore the rich evidence for weaponry which is a feature of the Anglo-Saxon south is completely lacking. Limited artefactual evidence has survived but perhaps more important are the depictions of combat and weapons on the carved stones of north-east Scotland which can be linked to a prevailing warrior ideology.

Despite the dearth of actual weaponry in the archaeological record the skeletal evidence clearly demonstrates the use of swords, axes and projectile points. In addition, fatal blunt-force trauma at Cramond may have been inflicted by the butt of a spear. The presence of men, women, and potentially children, dumped in a Roman latrine during the 6th or 7th century has been interpreted as evidence of at least one, if not two, attacks. Non-accidental cranial trauma at Lundin Links is evidenced by decapitation which may be an example of judicial execution, alongside an extremely violent attack on a man with serious health problems. Another young man buried at the Isle of May was also the victim of a violent attack, almost certainly with a sword. Isotope analysis demonstrates that he originated some distance from the island, as did an old warrior who survived a serious attack with a bladed weapon only to die of prostate cancer in old age.

This research is the first osteological synthesis of skeletal remains of the period, certainly in south-east Scotland, and possibly across the country. Skeletal evidence for trauma, which extends as far back as the Palaeolithic period, provides direct evidence of violence in the past and should be seen as the basic building block of any study of conflict. When combined with the other strands of evidence, it is clear that violence was a fact of life, and certainly, within the study area, both elites and commoners were implicated. Lundin Links 3 received impressive commemoration in death as illustrated by his interment in a cist beneath a complex cairn structure. Some effort was expended in the transportation of skeleton 959 to the monastery on the Isle of May for burial. Evidence for the likely use of swords has been identified, alongside the probable presence of attackers on horseback, both of which suggest elite involvement in conflict.

7.5 LIMITATIONS AND FUTURE DIRECTIONS

The present study has focussed on a tightly defined area of south-east Scotland and a relatively short time span of 400 years. During the four centuries in question, the study area experienced a number of significant events including the end of Roman Britain, the conversion to Christianity, the Anglian occupation and the commencement of Viking raids. It is the first regional synthesis of human remains of the period in south-east Scotland and has clearly demonstrated the value of re-examining existing assemblages of human remains using modern osteological methods. Virtually all the skeletal evidence for violence, which is reported on here, was previously unknown. The field of trauma studies is a fast-moving one and techniques are constantly evolving. Highly significant examples of skeletons from previously published assemblages with incontrovertible evidence for violence were either not reported on or not recognised at the time. A significant proportion of the human remains within this study group have never been osteologically examined until now. There are many important assemblages which were beyond the immediate scope of this research that are definitely worthy of (re-) examination.

It would be a logistical next step to extend both the spatial and chronological extent of the research sample to explore regional variations in other parts of Scotland. This would assist in determining if violence decreases or increases over time and across different regions. South-east Scotland is quite unusual in terms of its location inside the intervallate region between the Antonine and Hadrian’s Walls, which had a significant effect on the nature of the relationship between the native Votadini and the Roman occupiers, possibly also between the Votadini and the Picts to the north. Subsequently, the study area was occupied by the Anglians. As the predominant long cist tradition of burial appears to originate in the preceding Iron Age and probably straddles the period of the conversion to Christianity it would make sense to look backwards into the preceding Iron Age.

From the outset a biocultural approach was adopted in order to fully utilise all available strands of evidence. Radiocarbon dating, scientific and biomolecular analyses have formed a significant part of this research. A programme of radiocarbon dating which incorporates the victims of violence is recommended. The neonates from Cramond are of particular interest as it is currently unclear whether they are Roman or early medieval in date. Further radiocarbon dates for the assemblage from Lundin Links are also highly desirable and would complement the DNA and isotope analyses.

Strontium and oxygen isotope analysis of individuals from Lundin Links provided by Dr Kate Britton ahead of publication has revealed a diverse early medieval population, with some individuals likely to have spent their childhoods in the immediate area, and others likely to have moved to the region later in life. At least seven non-locals may have spent their childhoods in diverse areas of Scotland (including the Highlands and the west coast) and perhaps even further afield. Several females may have spent their childhoods in the west coast of Scotland.

The most recent (capstone) burials at the site, dating to the mid-6th/mid-7th century likely contain individuals who grew up locally, whereas the oldest dated burial appears to contain an individual who spent their childhood elsewhere. Throughout the use of the site immigration appears to have continued, with a number of individuals likely originating from other parts of Scotland or beyond. A programme of modern dating and Bayesian modelling of new dates to determine the succession of burials at the site is recommended to investigate and adequately characterise this trend further. These results could be correlated with isotope data, and perhaps future DNA work, to provide new insights into Pictish demography, lifetime movement and burial practice.

Isotope analyses of selected individuals from the Isle of May, Thornybank, Lasswade and Catstane are ongoing and results have not yet been incorporated into this research. The same is also the case for much of the DNA analyses.

A spatial analysis of the skeletal distribution of violence could be plotted against other strands of evidence such as fortified sites, chance finds of weaponry and carved stones to determine if the distributions are mutually exclusive or overlapping. This may assist in the identification of battle sites and or mass graves of the battle-dead.

CHAPTER 8: CONCLUSION

8.1 RESEARCH AIMS AND OBJECTIVES

In terms of the research aims introduced in Chapter 1, this study has

- Provided the first regional population-based study of the prevalence rates for both non-accidental and accidental cranial and post-cranial trauma in south-east Scotland during the early medieval period of 306 individuals.
- Documented a range of both healed and unhealed injuries in the sample and suggested the possible weapons used.
- Demonstrated that prevalence rates are higher than in published reports on assemblages beyond the study group.
- Provided a review of the existing evidence for non-accidental trauma within and beyond the study area.
- Provided a full written and photographic record of all skeletons within the study group.
- Identified spatial patterning relating to non-accidental trauma.
- Presented biomolecular data on origins, mobility and relatedness of some of the victims of non-accidental trauma.
- Discussed the social and cultural context of the observed injuries and highlighted significant factors operating in south-east Scotland including the creation of the intervallate zone and the Anglian occupation.
- Outlined future avenues of research which will contribute to a better understand of violent interaction in south-east Scotland and within the country as a whole. Future work would include the chronological and spatial expansion of the osteological

dataset alongside incorporation of new radiocarbon dates and biomolecular analyses.

8.2 RESEARCH HYPOTHESES

In terms of the research hypotheses introduced in Chapter 1 this study has shown that

- Interpersonal violence is a predominantly male phenomenon, and that fatal sharp-force trauma is an exclusively male phenomenon.
- The prevalence of women and children affected by interpersonal violence is low and the evidence for domestic abuse and child abuse is unproven.
- Evidence for elder abuse is currently lacking.
- The prevalence of healed injuries is slightly greater than the prevalence of unhealed injuries.
- Interpersonal violence is linked to fighting age of the predominantly male victims.
- Victims of interpersonal violence received both normative and non-normative treatment suggesting that they were a combination of elite and non-elite groups.
- Interpersonal violence is concentrated, though not exclusively, in specific locations such as frontiers.
- The prevalence rate of interpersonal violence is high when compared with other datasets.

8.3 FINAL CONCLUSIONS

This research presents the first regional synthesis of the skeletal evidence for violence in south-east Scotland. A significant number of new examples have been identified and there appear to be concentrations both in the town of Dunbar, and around the Firth of Forth. The skeletal evidence from Cramond adds considerable weight to the argument that it may be the location of the hitherto unidentified *urbs Guidi* referred to by Bede. The evidence strongly suggests that the use of violence was routine.

This research demonstrates the power of a biocultural approach and the particular importance of skeletal studies of trauma in a period when historical sources are biased in favour of the motivations of their authors. The integration of biomolecular data has provided important data on origins, mobility and genetic relationships which, when combined with the skeletal evidence for trauma, contributes greatly to our understanding of the period.

CHAPTER 9: BIBLIOGRAPHY

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