

New evidence for the origins and evolution of Dunbar: excavations at the Captain's Cabin, Castle Park, Dunbar, East Lothian

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ABSTRACT

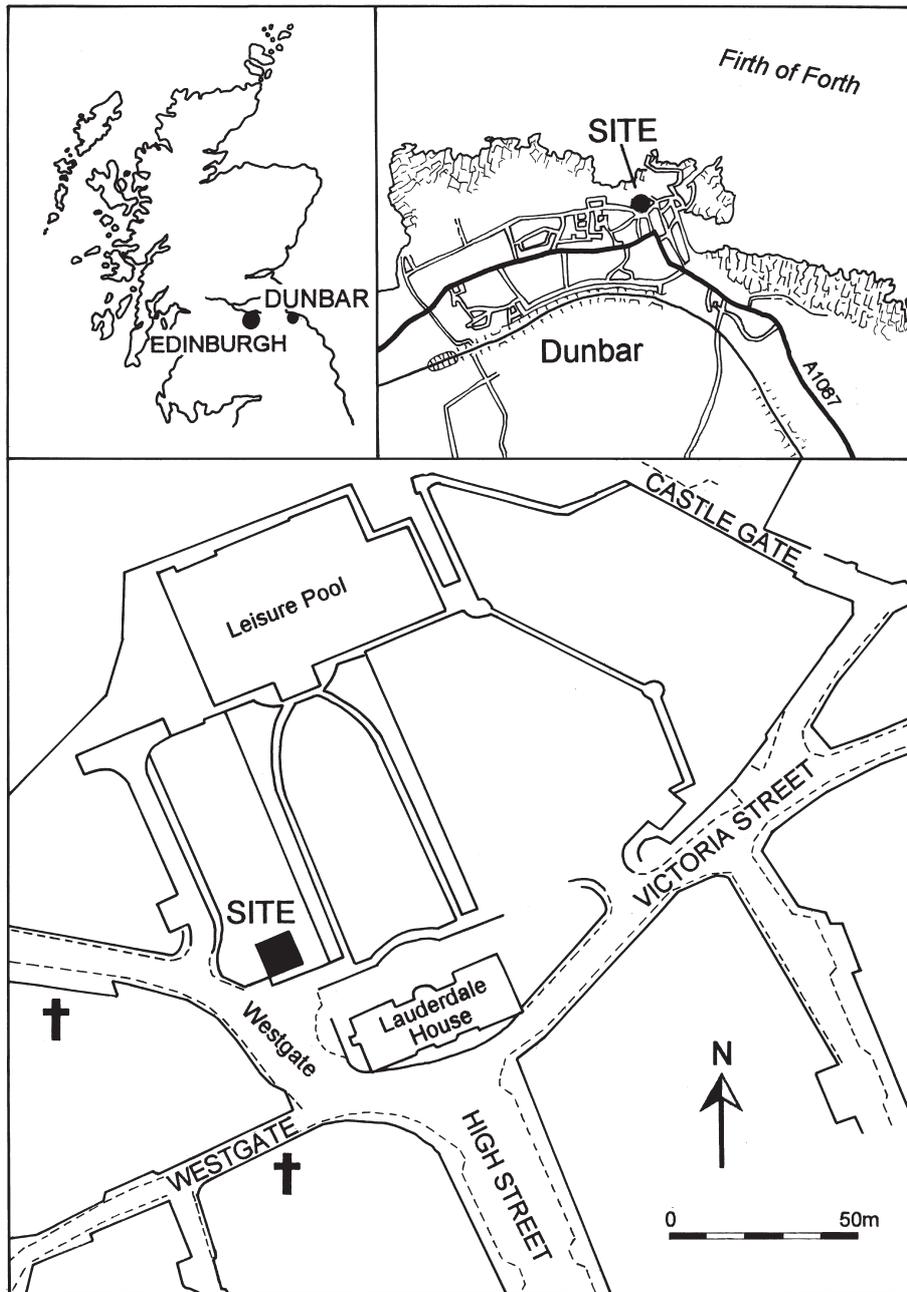
An archaeological excavation was undertaken by Headland Archaeology Ltd in 1998 in advance of the construction of a public toilet block on the site previously occupied by the Captain's Cabin, Castle Park, Dunbar. The investigation identified a sequence of deposits reflecting around 2000 years of human influence at the site. The earliest feature identified was a large ditch which may have formed part of the defences/enclosure system of the promontory fort previously identified at Castle Park. A rectangular building, probably contemporary with the Anglian occupation of the area, was built over the top of the ditch. Between the 9th and 11th centuries AD the site was used as a cemetery. A dump of midden above the cemetery and below the foundations of the military barracks contained a substantial quantity of elephant ivory off-cuts in deposits dating to the 18th or 19th centuries.

BACKGROUND

The historical background to Dunbar has been summarized by Turner Simpson and Stevenson (1981). The place name Dunbar is probably of Celtic derivation and can be translated as 'summit fort'. The town was first mentioned in the early eighth-century *Life of Wilfrid* which describes his imprisonment in the town in AD 680 after the rejection of a case he stated before a Northumbrian Synod. It would appear that the town was under Northumbrian control at this point, a status maintained until AD 843 when it was taken and burned by Kenneth MacAlpin. Dunbar appears to have remained an administrative centre until the 12th century. The earldom of Dunbar was created in 1072 when Malcolm III granted it to Cospatrick, the deprived Earl of Northumbria, in the hands of whose family it remained until 1435. Dunbar was a baronial burgh in the 13th century. David II granted a free burgh at Dunbar in 1370 and the burgh gained royal status in 1445.

Excavations undertaken at Castle Park by the Scottish Urban Archaeological Trust between 1988 and 1993 (Perry 2000) have added greatly to our understanding of the town's origins and early development. The results of these investigations highlight the town's strategic position at the mouth of the Forth. The headland was first fortified during the Iron Age when a

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ILLUS 1 Location map. (Based on the Ordnance Survey map © Crown copyright)

promontory fort was constructed. The same site was chosen for an Anglian *urbs regis* during the seventh and eighth centuries and was defended again in the medieval period as part of the precinct of the medieval castle of Dunbar. The French re-fortified the headland in the 16th century and the site was occupied by the British army during the Crimean war.

THE 1998 EXCAVATION

Although quite a small area was investigated in 1998 the discoveries provide valuable information for the origins and early development of Dunbar, if placed in the context of the extensive excavations undertaken by SUAT during the preceding decade. The excavation trench measured 9.5 m by 8.5 m and was within the footprint of the Captain's Cabin, a small gift shop which previously served as the lock house of the military barracks (illus 1). The excavation was commissioned by East Lothian Council in advance of the construction of a public toilet block. Archaeological features or deposits below the formation level of the proposed new building were left *in situ*, where they are preserved. Four main phases of activity were identified during the investigation.

TABLE 1

The results of radiocarbon analyses from the upper ditch fills (Phase 1) and from excavated skeletons (Phase 3).

Lab No	Reference	Delta 13C rel PDB	Radiocarbon	Calibrated age ranges	
			Age BP	1σ	2σ
Upper fill of ditch					
GU-8642	Charcoal from the upper ditch fill	-25.9%	2000 ± 60	cal BC 50–cal AD 70	cal BC 168–cal AD 128
Excavated Skeletons					
GU-8652	SK21	-21.1%	980 ± 50	cal AD 1003–1155	cal AD 981–1186
GU-8653	SK15	-18.2%	920 ± 50	cal AD 1028–1206	cal AD 1018–1222
GU-8654	SK22	-18.6%	970 ± 50	cal AD 1018–1157	cal AD 983–1207
GU-8655	SK26	-20.2%	7406 ± 50	cal AD 1259–1294	cal AD 1214–1382
GU-8656	SK44	-19.9%	8806 ± 50	cal AD 1043–1219	cal AD 1024–1264
GU-8657	SK45	-20.4%	9306 ± 50	cal AD 1024–1184	cal AD 1002–1219
GU-8658	SK59	-19.5%	9206 ± 60	cal AD 1024–1209	cal AD 999–1257
GU-8659	SK67	-18.9%	980 ± 50	cal AD 1003–1155	cal AD 981–1186

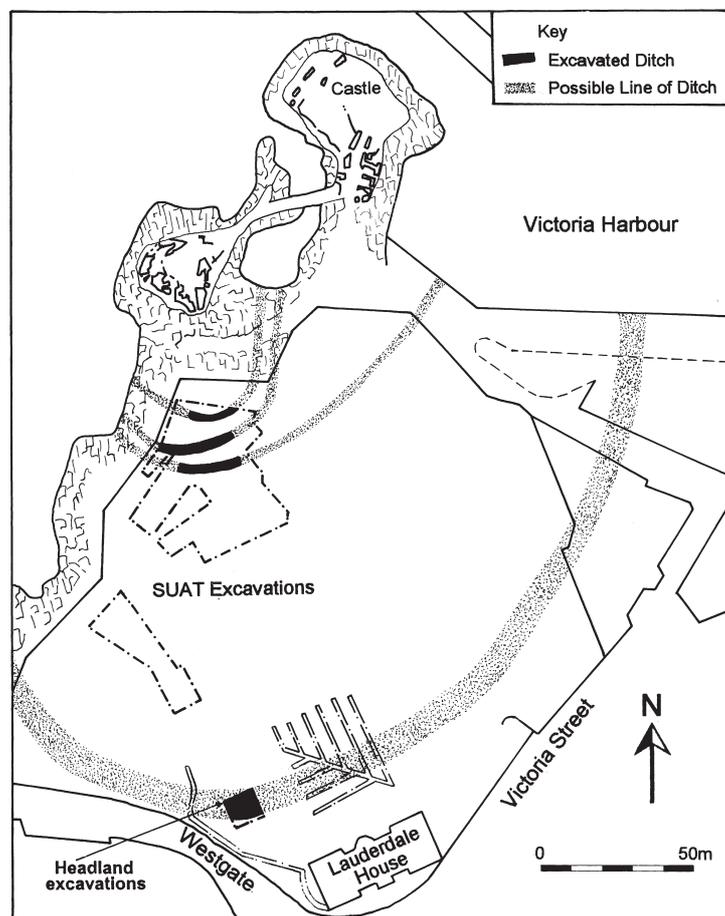
PHASE 1 IRON AGE

One edge of a ditch (the southern) was identified running across the trench from west to east (illus 2). As this was not at a level that would be affected by the construction of the toilet block it was not excavated. However a number of shallow slots were excavated into the feature to clarify its edge and allow it to be planned accurately. This demonstrated that the ditch had a steeply-cut edge and was likely to have been of considerable depth; its northern edge was not identified within the excavation trench, suggesting that the feature was more than 8 m wide. Radiocarbon analysis of charcoal from the upper fill of the feature provided a calibrated date of between 50 BC and AD 70 (Table 1).

The most likely interpretation of this feature is an outer ditch for the promontory fort identified during the SUAT excavations. The Dunbar fort appears to be 'complex', as defined by Cotton (1959), with multivallate defences not constructed as a single unit but added to and developed over a considerable period of time. SUAT identified three concentric ditches (illus 2). The form of the earliest fort on the promontory appears to have comprised a single (inner) ditch cutting off the promontory (Perry 2000, 312). This predates the Roman Iron Age and is likely to be contemporary with the ditch found beneath the Captain's Cabin. Radiocarbon dates from the

SUAT excavations, together with the presence of Samian ware, place the other two ditches in the Roman Iron Age (Perry 2000, 312).

The ditch identified under the Captain's Cabin would appear to form an external enclosure increasing the area previously understood to be defined by the fort by as much as 2 ha. The area within the main defensive system is unknown because of severe coastal erosion and the effects of later military alteration of the coast. However, this 'new' outer ditch does not sit comfortably as purely a promontory defence. It is not sited in an appropriate location and does not take advantage of the topography. Instead it may have served as some form of enclosure boundary, possibly marking the extent of the settlement in times of peace. An extant enclosure system outwith the main defences of a promontory fort can be seen at Doon Eask, Co Kerry, Ireland (Lamb 1980, 55).



ILLUS 2 Iron Age ditches

PHASE 2 ANGLIAN

The partial remains of a structure were identified (illus 3) above the uppermost fill of the Iron Age ditch and directly beneath the cemetery (Phase 3). Again, as this structure was below the proposed development level it could not be fully investigated within the constraints of the project brief.

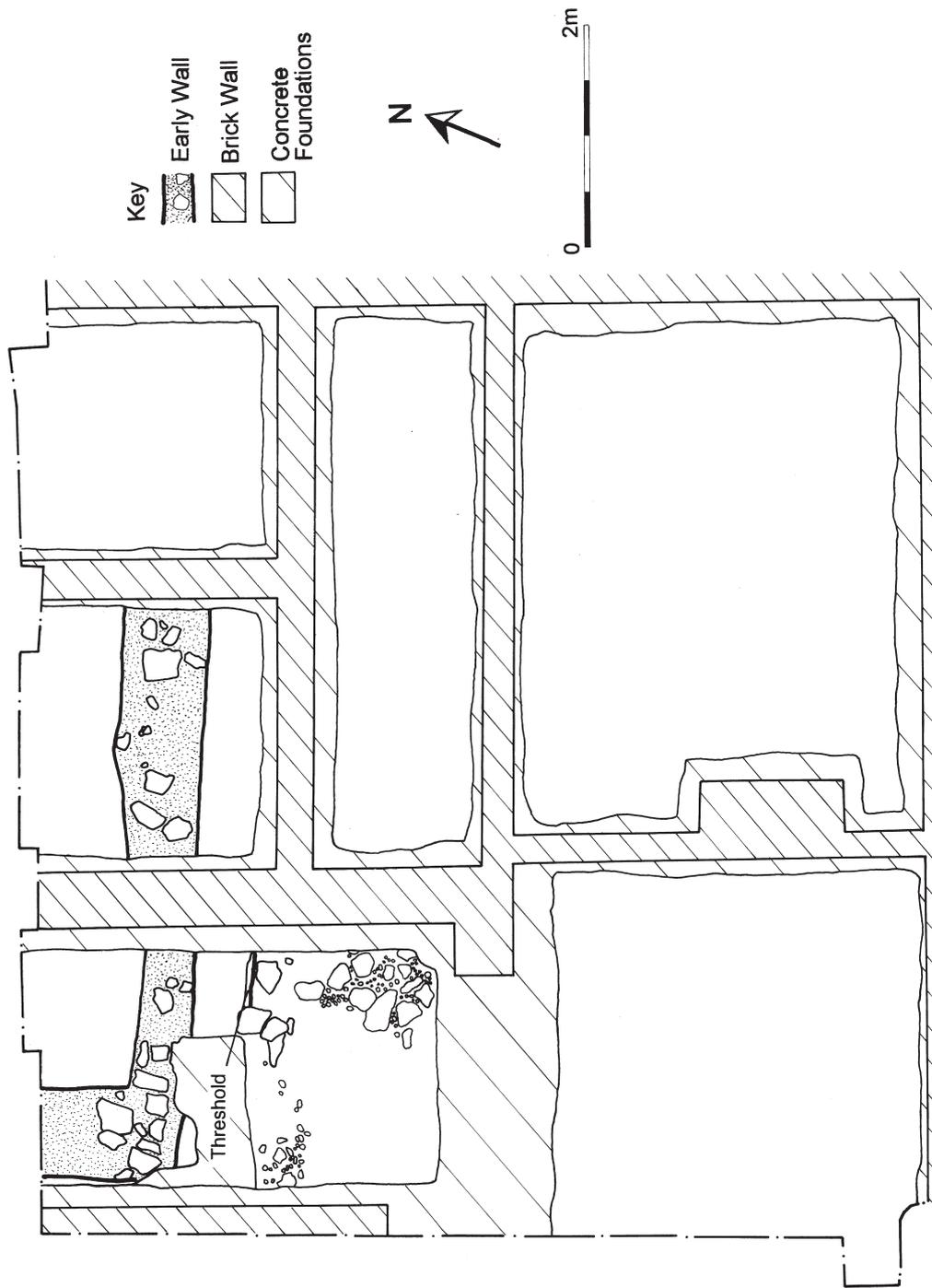
A line of boulders bonded with clay was identified crossing the trench from east to west and turning to the north to form a right-angle. Layers of burning were found both to the north and south of this wall, on either side of a possible threshold. The threshold was constructed of a rectangular sandstone slab set vertically on its long side with boulders supporting it on the west side and with a worn flagstone set in front of it. A worn paved surface was identified to the south of the threshold. Although the structure was only partly within the trench it appeared to have comprised a rectangular stone foundation, presumably the footings for a timber superstructure. The eastern extent of this structure was not visible at the level to which we could excavate, possibly because of deeper overburden in this area or later truncation by grave digging. Alternatively, it may have corresponded with the line of the foundations of the 19th-century barracks and been completely destroyed by them. If this is the case the structure would have measured 5 m from west to east.

The environmental evidence would suggest that the structure had been used to store grain and had burnt down (see Environmental Evidence, below). It would appear that the building was used for the storage of a cleaned crop, mainly of barley, and smaller quantities of oats and wheat. Clustering of the burnt seeds within the structure would suggest that different crops were stored in different areas. A single seed of flax was also recovered. A spread of sand containing charred grain was found outside the threshold and may be the result of raking out detritus from within the structure. A small quantity of iron-working debris was also found within the structure.

The stratigraphic position of the structure places it within the period of Anglian occupation in Dunbar. The building differs considerably from the structural evidence identified during the earlier excavations (Perry 2000, 35–78). Neither the *Grubenhäuser* nor timber halls excavated by SUAT had the characteristics of the excavated portions of this new building. This may be explained by the structures having different functions. It appears that two functional types were identified: a) *Grubenhäuser* which served a specific industrial function and b) timber halls which were associated with a reputed royal stone hall at the extreme north of the excavated areas (Perry 2000, 35–77). If the structure beneath the Captain's Cabin was a grain store, it would have differed from the buildings on the headland.

A rectangular building interpreted as a barn was associated with a corn drying kiln at an Anglian monastic site at Hoddum (Lowe, in prep). This was constructed of timber on a stone foundation and had also burnt down. The Hoddum example was located at the boundary of the settlement and it is likely that the Dunbar structure was also at the boundary.

The SUAT excavations identified two phases of Anglian settlement. The first phase comprised earthfast buildings while the second phase buildings incorporated stone in the construction (Perry 2000, 319). The use of stone in the construction of the building implies a later rather than an earlier date. The same sequence was identified at Hoddum (Lowe, in prep). Although no finds were recovered from the building, the overlying churned-up graveyard soil contained both a fragment of probable Anglian pottery and a piece of bone decorated with a motif similar to that on a composite comb, dated to the 9th or 10th centuries, recovered in the SUAT excavations (Cox 2000, 145–8). It is possible that this material derived from the Anglian building.



ILLUS 3 Anglian building

The location of the building is significant. The presence of a building set back so far from the structures identified on the headland suggests a more extensive and complex settlement than previously assumed. SUAT identified a defended settlement measuring approximately 0.5 ha (Perry 2000, 317). If the settlement extended as far as the building identified under the Captain's Cabin it would have measured over 2 ha, which would be more fitting for a supposed *urbs regis*: Coldingham measured 3 ha and Bamburgh 2 ha (Alcock *et al* 1986, 274).

PHASE 3 MEDIEVAL

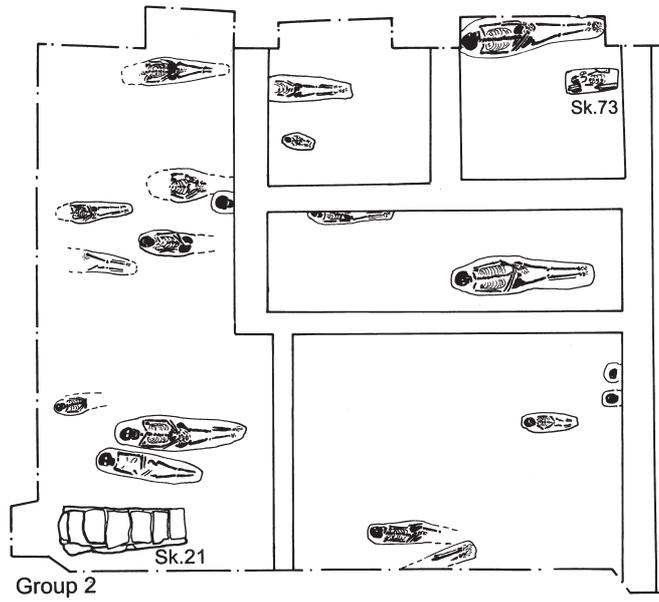
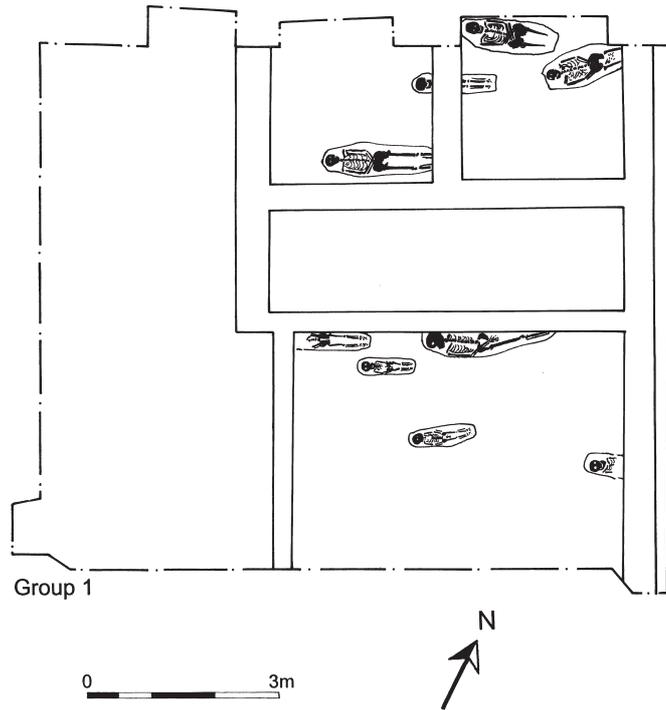
Between the 9th and 12th centuries the site lay within the confines of a cemetery (illus 4 & 5). Seventy-six articulated skeletons were recovered and analysed and the disarticulated remains of a further 51 individuals were also identified. The articulated skeletons were all extended, in a supine position, and aligned east/west with heads to the west. In all cases the hands were crossed over the pelvis. Phasing of the excavated skeletons was problematic. The cemetery had been intensively used and the soil in which the graves were set was heavily disturbed, making the identification of the grave cuts very difficult. Four groups of burials were identified, based on the depth of burial and inter-cutting of burials (illus 4 & 5). Further areas of the cemetery had previously been excavated by SUAT in 1993 (Perry 2000). Eight of the inhumations were subjected to radiocarbon analysis, the results of which are summarized in Table 1.

Graves

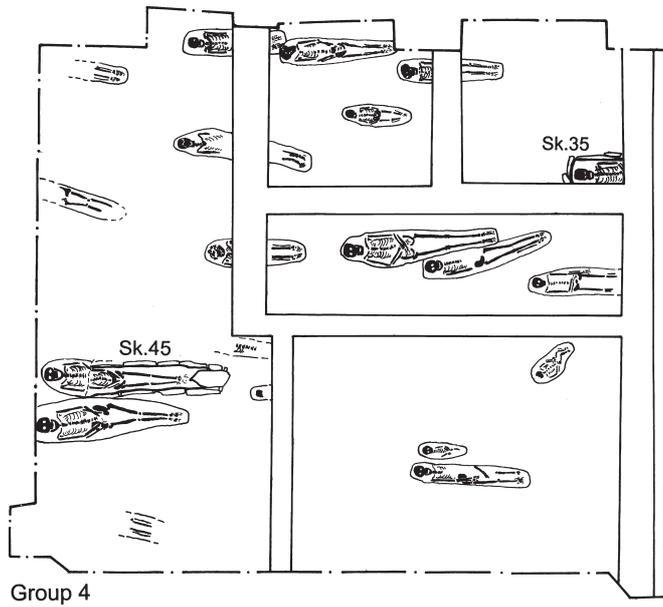
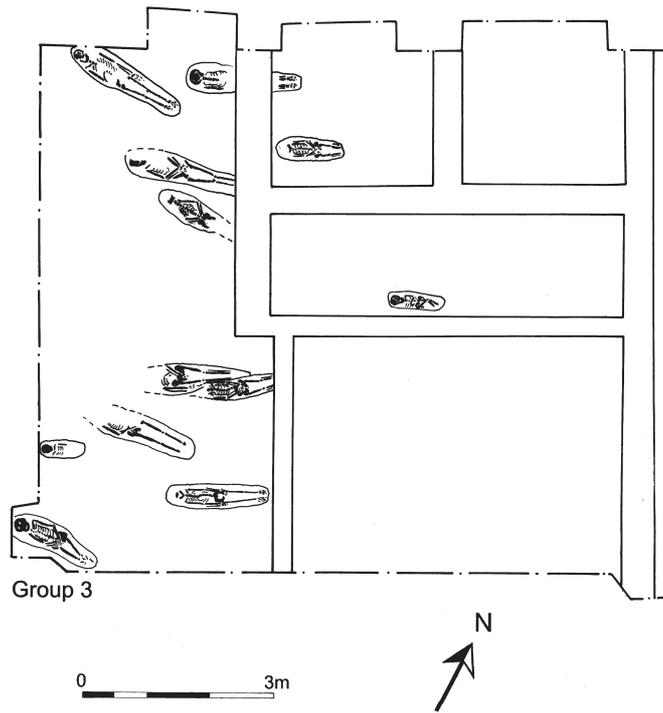
Unlike Hallow Hill (Proudfoot 1996, 441) no evidence was recovered for grave clusters, alignments or other forms of spatial organization within the small area of the cemetery investigated. The majority of inhumations were in simple earth-cut graves, probably bound in shrouds. Several of the shroud-burials had an arrangement of 'pillow stones' supporting the head. Four long cists were identified although only one of these was complete. This is very different from the sample excavated by SUAT where 26 cist-burials and 21 shroud-burials were excavated. However the sampling strategy employed during the earlier intervention was radically different, as the archaeologists were working within the confines of a narrow service trench which had been partially machined out before an archaeological presence was requested (Perry 2000, 283). In such a situation the identification of stone cists would have been much easier than simple shroud-burials.

In general no grave goods were present. However, a single object was retrieved from the chest of an adult in the form of a bone and copper alloy buckle (see Finds, below). A number of pins identified during the excavation may have served as shroud fasteners (illus 11).

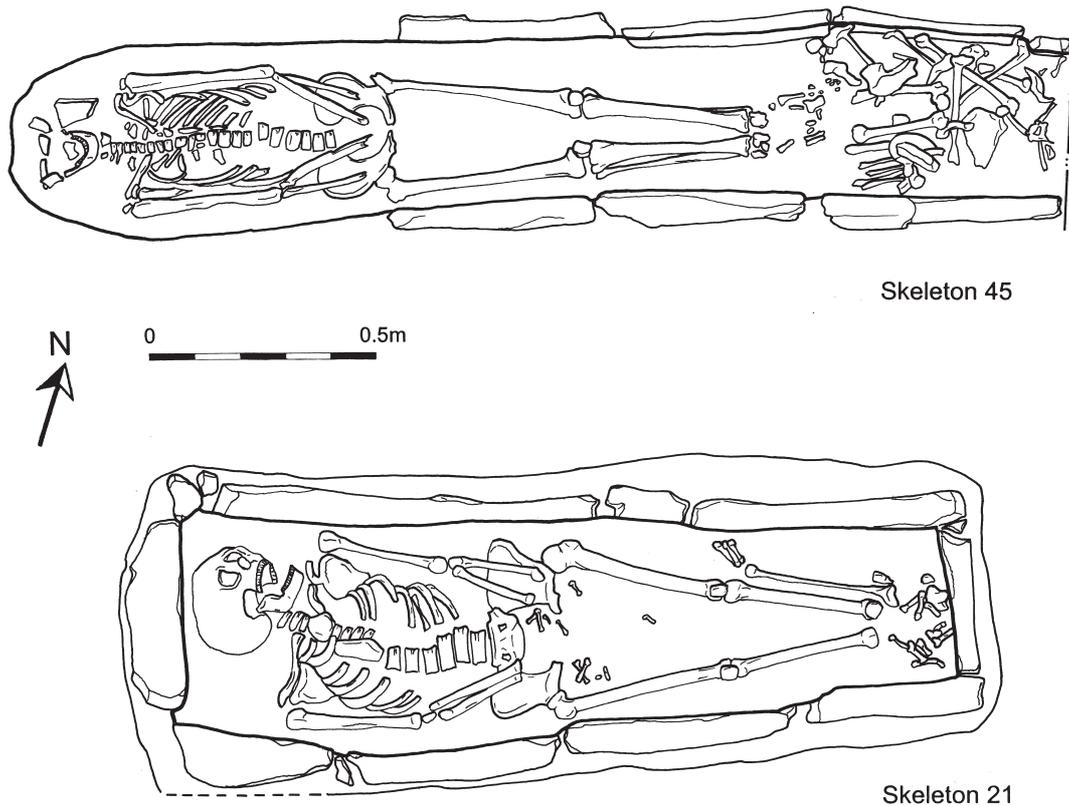
The best-preserved cist consisted of a rectangular stone-lined cut measuring 1.9 m by 0.6 m (illus 6, skeleton 21). The base, capping and sides were constructed of red sandstone flags, and a thin layer of clean white sand was laid over the base. The skeleton (SK21) in the cist was an adult male. A second similarly constructed cist is also worthy of note (illus 6, skeleton 45). It was constructed of white sandstone and again contained a bedding layer of clean white sand. This cist was re-used on three occasions. As each new burial was laid out the remains of the previous occupant were neatly stacked at the east end. The final burial was an adult male (SK45). The three other burials were a child (SK43), an adult female (SK44) and an adult of indeterminate sex (SK48). Of the two remaining cists, one was badly disturbed by the construction of the barrack block and contained a juvenile skeleton (SK73), and the other contained the skeleton of an infant (SK35).



ILLUS 4 Groups 1 and 2 of the medieval cemetery



ILLUS 5 Groups 3 and 4 of the medieval cemetery



ILLUS 6 Skeletons 45 and 21

Cists were represented during all periods of burial and their presence is likely to be part of the general single-inhumation tradition present throughout the use of the cemetery. This would appear to be typical of Scottish burial tradition during the later first millennium AD as identified at Kirkhill, St Andrews (Wordsworth & Clark 1997, 9). The significance of the cists is unclear but the greater effort invested in the grave construction may reflect the social standing of the interred individuals.

A children's cemetery

The high percentage of immature individuals (48%) is striking and suggests that the excavated burials lay within an area set aside for the burial of children (see Human Remains, below). This suggestion is supported by the failure of the earlier investigations, further to the east, to identify any children's graves (Perry 2000, 288), indicating perhaps that the investigation was outwith the area set aside for them. An account of the discovery of cist burials by workmen in 1801 beside Lauderdale House also makes specific mention of the inhumation of children (Miller 1830, 6). Segregation in cemeteries is not unprecedented. O'Sullivan (1994, 359) describes the exclusive use of St Ronan's church, Iona for the burial of woman and children. However in that case it is

believed that Irish traditions were very influential, while in Dunbar there is a greater likelihood of the influence of Anglo-Saxon burial tradition. The children's cemetery at Whithorn (Hill 1997, 45) may be a product of the same beliefs and traditions as at Dunbar. Between the eighth and ninth centuries an area to the east of the burial chapel at Whithorn was set aside for the burial of infants and young children. Both Whithorn and Dunbar cemeteries would appear to owe their origins to Northumbrian settlements of the seventh or eighth centuries.

The extent of the cemetery

The extent of the cemetery can be postulated by combining the results of the 1998 excavations with the previous identification of human burials in Castle Park (Perry 2000) and the 19th-century reference to human remains being uncovered during construction work associated with Lauderdale House (Miller 1830). We can suggest that the cemetery covered a roughly D-shaped area approximately 0.5 ha in extent (illus 7). The area encompassing the known extent of skeletons compares well with an area defined on Roy's Military Survey (1747–55). Roy shows streets on the line of modern Westgate, High Street and Victoria Street but he also depicts a further street running east/west to the north of Lauderdale House. This appears to define an irregular D-shaped island of development divided between four properties. The possibility that an early church site is located within this boundary or nearby cannot be discounted.

PHASE 4 MODERN

The final phase of activity on the site was represented by the foundations of the lock house associated with the military use of the area during the Crimean War. A dump of midden containing off-cuts of elephant ivory was found in a levelling deposit laid out in preparation for the construction of the building. This is believed to have been imported in the form of complete tusks during the 19th century for the manufacture of ivory objects such as combs, piano keys and chess pieces (see Ivory, below). This building was later converted into the Captain's Cabin, a well known gift shop.

HUMAN BONE

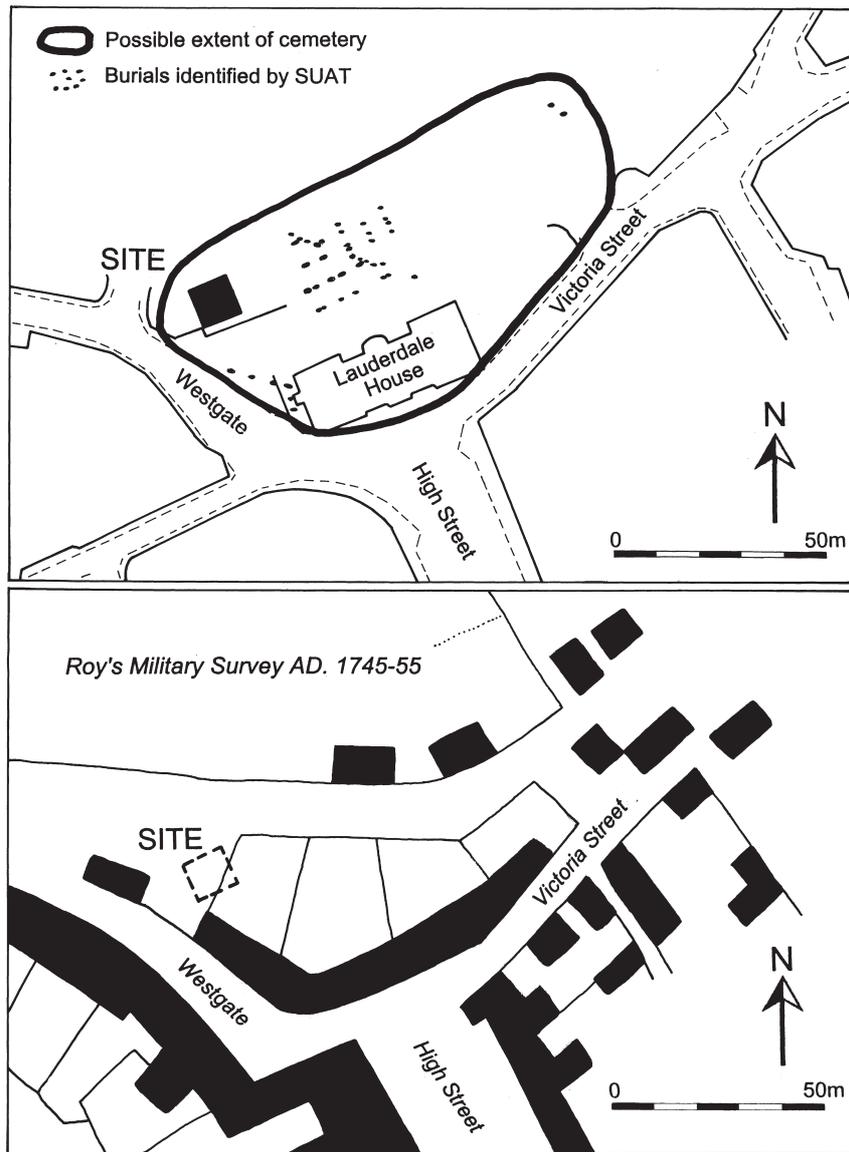
J Roberts

ARCHAEOLOGICAL BACKGROUND AND STATE OF PRESERVATION

This report presents the results of osteological analysis of the skeletal remains recovered from the excavations at the Captain's Cabin. When considering the results of analysis it is necessary to take into account the potential problem of sample bias. This particular group of skeletons constitute only a portion of the original cemetery population, which in itself is only a sample of the living population.

The age at death, sex, stature, and health status of each articulated skeleton was assessed in order to produce a demographic and epidemiological profile of the group. Findings from the disarticulated remains, from which it was generally not possible to extract such detailed information, are summarized at the end of the report. Detailed information on methodology and data relating to each individual skeleton can be found in the original archive report (lodged in the National Monuments Record of Scotland).

Seventy-six articulated skeletons from 72 contexts were analysed. An assessment of the state of preservation of each articulated skeleton was made, based on the percentage of the skeleton surviving, the amount of fragmentation present and the degree of surface erosion to the bones. The results showed that the



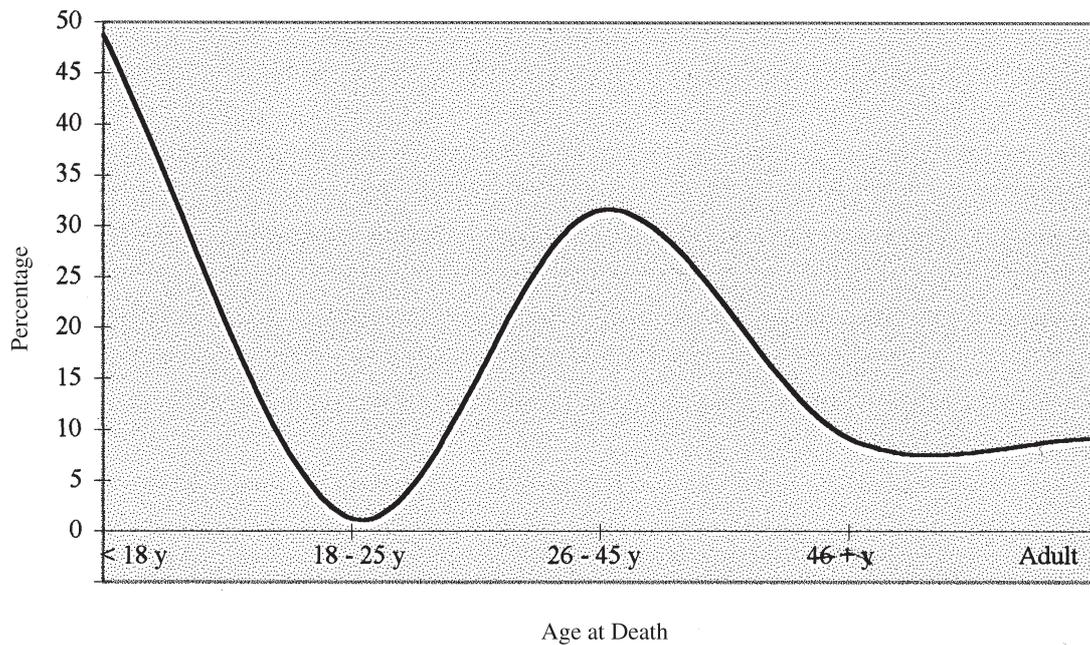
ILLUS 7 The extent of the cemetery compared to Roy's 1747-55 map of Dunbar

same percentage was either below 40% or 40-70% complete (36.8%), and 26.3% were more than 70% complete. The majority of skeletons (85.5%) were in a fair, fair to good, or good state of presentation.

DEMOGRAPHY

Age at death

Methods used for determining age at death were in accordance with those outlined by Buikstra & Ubelaker (1994) and Krogman & Iscan (1986). Individuals of all ages from birth to mature adult were represented in



ILLUS 8 Mortality profile of articulated skeletons

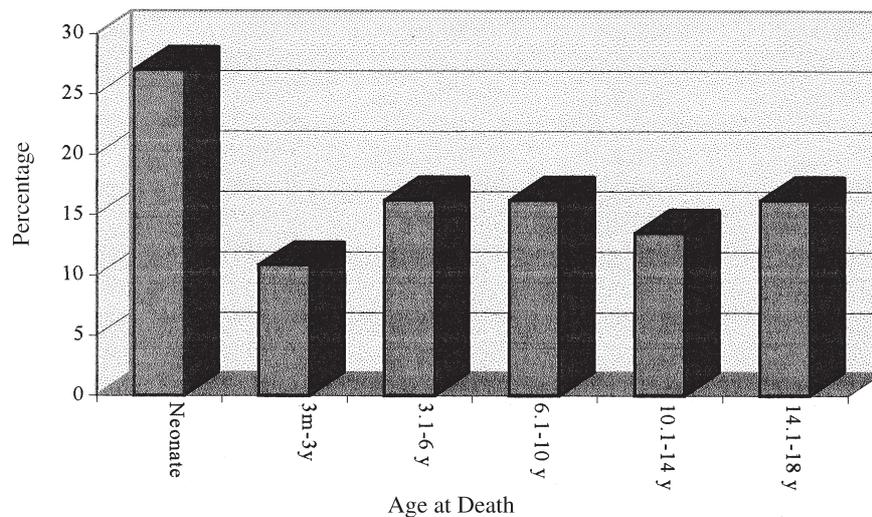
the Dunbar assemblage. Of the 76 articulated skeletons, 37 (48.7%) were immature, and 39 (51.3%) were adult. Table 2 shows the numbers of individuals within each age category and illus 8 shows these numbers as a percentage in the form of a mortality curve.

A high mortality rate in infancy and childhood, followed by a sharp decrease in the percentage of deaths in young adulthood, was common in pre-modern societies (Roberts & Manchester 1997). Even by medieval standards, however, the number of immature individuals in the sample from Dunbar was unusually high. This might be explained in several ways. First, there may simply have been better preservation of neonatal and infant remains at Dunbar than at other sites. Second, the area excavated might, by chance, have been an area of the cemetery either reserved for immature individuals, or one in which they were frequently buried. Finally, the high mortality rate might accurately reflect the actual situation, perhaps an epidemic of disease or famine that temporarily increased the death rate amongst this most vulnerable section of society. The age distribution of individuals within the immature category as a whole was relatively normal, with the highest number of deaths occurring in the neonatal period, although more of a decline might have been expected in the older child and juvenile categories.

Of the adult burials, only one (2.6%) was young, 24 (61.5%) were middle-adults, seven (17.9%) were mature, and a further seven could only be termed 'adult'. Although young adulthood is considered be one of the safest periods of life in terms of survival, the number of individuals within this age category still seems

TABLE 2
Number of individuals within each age category

<i>Age at Death</i>	<i>Number of Individuals</i>
<18 years	37
18–25 years (Young Adult)	1
26–45 years (Middle Adult)	24
>45 years (Mature Adult)	7
Adult (Adult of undetermined age)	7
Total	76



ILLUS 9 Percentage of immature individuals within each category

low in comparison to that seen at other sites (Bruce 1985; Cardy 1997; Roberts 1999): the reasons for this are unclear. Methodological error is an unlikely explanation as a relatively high degree of accuracy can be obtained when ageing young adults, particularly where, as in this instance, preservation is good, and epiphyseal fusion can be observed. The fact that the majority of adults appeared to have died before or around the onset of middle age might reflect a genuinely shorter lifespan during the medieval period, or, alternatively, problems associated with determining age in this category. Other medieval sites have consistently shown this age category to contain the greatest number of individuals (Roberts 1999). The comparatively *low* percentage of mature adults might be explained by the majority of the population having died before reaching middle age. Methodological error, however, can again not be ruled out.

Sex

Sex determination was based on the criteria defined by Buikstra & Ubelaker (1994), Krogman & Iscan (1986), and Bass (1995). It was possible to assign a definite or probable sex to 33 of the 39 adults, and five older juveniles (aged 16 to 18 years). Of these, 16 were male and 22 were female. There was a tendency towards marked sexual dimorphism within the group, ie the males were very masculine and the females were very feminine in terms of pelvic and cranial morphology. With regard to sex-specific mortality, the single young adult was male, and there was a greater number of females in the older juvenile, middle-adult and mature adult categories. There were equal numbers of male and female individuals in the 'adult' category.

STATURE AND BODY BUILD

Stature

It was possible to calculate the stature of 31 individuals, 13 male and 18 female (Trotter 1970). The average male stature was 1.70 m (5 ft 6in), with heights ranging from 1.60 m \pm 29 mm to 1.75 m \pm 33 mm (5ft 2.5in to 5ft 8in). The average female stature was 1.60 m (5ft 2.5in), with heights ranging from 1.55 m \pm 42 mm to 1.75 m (5ft 1in to 5ft 7.5in). These values are consistent with those observed at other sites of comparable date, with the female average being at the higher end of the range (see Archive Report). The mean female stature was increased by a single value, derived from the middle-adult female, skeleton 20 who was 1.75 m tall (5 ft 7.5in). Despite her unusual height, her bones were slender and gracile, and her pelvic and cranial

morphology were indisputably female. It is possible that she came from particularly tall genetic stock, and/or was of a sufficiently high status to achieve her full growth potential.

Lower limb shape

Measurements of the proximal shafts of the femora and tibiae were made in order that meric and cnemic indices could be calculated (Bass 1995). These indices measure the degree of flattening, front to back, and side to side, of the upper shafts of the femur and tibia, respectively. The extent of this flattening is thought to be related to physical activity (Brock & Ruff 1988).

It was possible to calculate 38 meric indices in total, relating to 22 individuals. With the exception of one middle-adult male, and one older juvenile female all individuals were found to have platymeric femora, ie flattened from front to back, rather than rounded. Indices ranged from 57.5 to 89, with 75.2 being the mean value. These findings are consistent with other medieval communities where the predominant femoral shape is platymeric. Mean male and female values were almost equal, and there was little difference between that of the right and left femur, in both sexes.

It was possible to calculate 32 cnemic indices in total, relating to 18 individuals. Tibial shape varied, with approximately equal numbers of individuals having platycnemic, mesocnemic, and eurycnemic tibiae (flattened, moderately rounded and rounded). Indices ranged from 59 to 79.8 with the mean cnemic index being 68.8. There appeared to be little relationship between tibial shape and age or sex, and the mean indices for right and left tibiae were the same.

Cranio-metric data

The individuals from Dunbar were a diverse group in terms of cranial morphology and facial characteristics. Unfortunately, due to fragmentation of many of the crania, it was possible to record some type of cranio-metric data on only 12 individuals (after Bass 1995). Based on this small sample, the following observations were made. Four individuals had low skulls and one was of medium height; two had broad and one had a medium-shaped head. One individual had a narrow face with a broad nasal aperture and one had a broad face with a narrow nasal aperture. A further individual had a narrow nasal aperture and narrow orbits. There was also some variation in mandibular dimensions, with some males having considerably wider and larger lower jaws than others. Amongst the distinctive facial characteristics observed were marked prognathism (overbite and large, protruding top teeth) in an older juvenile female, and large, hooked nasal bones and a prominent gap between the upper and lower central incisors, in a middle-adult male.

Health and disease

All of the articulated skeletons and disarticulated remains were examined for evidence of pathology and, where possible, lesions were classified according to cause. Texts used to assist in differential diagnosis included Aufderheide & Rodriguez-Martin (1998), Roberts & Manchester (1997), and Ortner & Putschar (1981). Examples of traumatic injury, infectious disease, degenerative joint disease, metabolic disorders, spinal joint disease, and dental disease, were identified.

Trauma

Four main types of traumatic injury were identified in the Dunbar skeletons: fractures, soft tissue injury (enthesopathies), cut marks, and osteochondritis dissecans, a trauma-related circulatory disorder.

Seven individuals, four males and three females, showed evidence of one or more fractured bones. This frequency rate of 9.2% compares well with findings from sites of a similar date, such as Logies Lane (10.7%), Whithorn (6.7%) and Glasgow Cathedral (11.6%). All of the fractures occurred in either the vertebrae, fibulae or ribs. Two of the three individuals suffering from vertebral fractures were female, and it

is possible that osteoporosis may have been an underlying cause. The fractured ribs, affecting three males and one female, may have been the result of a direct blow in the form of a punch, or sustained during a minor accident or fall. The fractured fibulae, affecting two males, might also have been caused by direct force, or by landing awkwardly in a fall. None of the fractures were complicated, and all were relatively well-aligned, although some were still in the process of healing, with large amounts of callous present.

Five individuals showed evidence of soft tissue injury. Examples included: an individual with enthesopathies at the insertion points for *flexor hallucis longus* on the left fibula, and the tibial collateral ligament on the left femur, which might have been sustained in the same event; a middle-adult male with a large enthesopathy on the lateral lip of the bicipital sulcus and bilateral enthesopathies at the insertion points for both costo-clavicular ligaments, which may have been related to sudden protraction or retraction of the shoulders; and a further three individuals with enthesopathies relating to the interosseous ligament on the tibia, the interosseous border of the radius, and the ventral surface of the pubis at the insertion point of one of the adductor muscles.

Several of the skeletons had pronounced muscle insertion points on certain bones that could not be described as enthesopathies, but were evidence of repeated use of a particular muscle. A mature adult male had rugged insertion points for *pectoralis major*, deltoid and teres major on the right humerus, muscles which relate to the shoulder girdle and upper arm, involved in such activities as lifting, pushing and pulling. The left humerus did not display the same characteristics, and in fact was probably used less due to the severe degenerative arthritis affecting the elbow. A middle-adult male also had bone production relating to pronounced musculature of both upper arms, and an adult male had rugged insertions for rectus femoris on the patella, and tendo achilles on both calcanei. The latter is likely to have been associated with repeatedly walking for long distances.

Nine individuals had cut marks of varying severity on their bones. Five of these cases were superficial injuries, affecting the tibia or fibula, most probably incurred by knocking the shins during normal daily activity. In three of these instances there was associated infection of the periosteum (periostitis), a common phenomenon in the shin bone where the overlying soft tissue is thin and open cuts provide a source of entry for infectious organisms. A more serious injury was seen in a middle-adult male who had a cut mark with a 'gouged-out' appearance on the mid shaft of his femur. Although there was slight remodelling of the bone around the edges of the lesion, it was also surrounded by thick periosteal new bone growth, indicating that infection had occurred fairly recently prior to death. Damage to the overlying quadriceps muscles would have been incurred in order for the bone to be cut in this region. This would undoubtedly have caused a great deal of pain and resulted in limited mobility. Two probable blade injuries that were likely to have caused death were observed; one was on the cranium of a 16–18 year old female, and the other was on the cranium of a juvenile aged 11–14 years. The injury on the 16–18 year old appeared to be consistent with a blow from a bladed instrument (such as an axe) wielded by an attacker standing opposite the victim. Although it did not pierce the inner table of the skull, it cut through the outer, exposing the sinuses at the lower end. There was no remodelling around the edges of the cut, indicating that this was an injury that had occurred around the time of death. On the cranium of the 11–14 year old, the right parietal bone had been cut through both the external and internal tables of the skull. Again, there was no remodelling around the edges of the lesion, indicating that it had happened around the time of death.

Osteochondritis dissecans is a condition whereby the impaction of one joint surface against another causes fracture of the articular cartilage and underlying bone (Forrester & Brown 1987). A small plug of bone then becomes detached, leaving a smooth, clearly circumscribed area on the joint surface. The condition can cause pain and discomfort, as well as a 'locking' sensation in the joint. It was seen in only one of the articulated skeletons from Dunbar, a middle-adult female, who had a well demarcated lesion on the lateral condyle of the right femur.

Infectious disease

Acute infectious diseases such as typhoid, diphtheria and cholera can cause death quickly, particularly in younger individuals, leaving no trace on the skeleton. Many infectious diseases therefore remain

undiagnosed by the palaeopathologist. Certain types of infection do, however, manifest themselves skeletally if their hosts survive for a sufficiently long time. Periostitis is frequently observed in archaeological populations and may be related to a specific condition such as tuberculosis or leprosy, or may occur as a result of non-specific infection or direct injury. Osteomyelitis is the term given to infection of the whole of the bone including the medullary canal, rather than just the periosteum and the cortex. It is more severe and even today it is difficult to treat.

Evidence of infectious disease was observed in 34 of the articulated individuals, 19 adult and 15 immature. Although this frequency of 44.7% appears rather high, the majority of changes identified were mild cases of periostitis affecting the lower limbs. Exceptions to this included one example of more severe, diffuse periostitis affecting the humerus as well as the lower limbs; four examples of endocranial infection; three examples of infection on the inner surfaces of the ribs; one case of osteomyelitis; and three examples of maxillary sinusitis. The changes observed on the inner surfaces of the ribs most likely represent chest infections, although it is not possible to be specific about the causative organism. In one individual the lesions were confined to the left upper to middle ribs, suggesting an upper lobe infection of the left lung, such as pneumonia. In all cases the reactive new bone was thick and woven, indicating that the infection was still active at the time of death.

Three of the individuals showing evidence of new bone growth on the surface of the endocranium were aged under 12 months. It is possible that the periosteal bone growth was a reaction to trauma and sub-dural haemorrhaging that had occurred during birth. The fourth individual, an older juvenile, had changes on the endocranial surface of the frontal that may have been associated with a lytic lesion on the outer surface of the orbit.

Three examples of maxillary sinusitis were identified, in a 4–5 year old child, a mature adult male, and a middle-adult male. This condition may be caused and exacerbated by a number of factors including dust, pollution, dental infections and allergies (Roberts & Manchester 1997). During life, the soft tissue in the maxillary sinuses would have been inflamed, causing pain, discomfort and congestion.

Only one example of osteomyelitis was observed, affecting the right 2nd metatarsal of a middle-adult female. The disease had virtually destroyed the distal end of the finger, where bone production, remodelling and cloaca formation had occurred. It is likely that the infection had occurred subsequent to traumatic injury, and also that it was probably a constant source of pain and discomfort to the individual concerned.

Dental disease

Eight hundred and ninety-two teeth from 48 sets of dentition were analysed. Twenty-six were from adults and 22 were from immature individuals. Of these, 79% showed evidence of one or more of the following oral pathologies: caries, periodontal disease, abscesses, ante-mortem tooth loss, dental enamel hypoplasia (DEH) and calculus. Caries is an infectious progressive disease that occurs when oral bacteria metabolize any fermentable carbohydrates present on a tooth. Research has shown there to be a greater prevalence in populations whose diet is primarily carbohydrate-based or where sugar consumption is high (Larsen 1984). Twenty-seven of the 892 teeth were affected by carious lesions, a prevalence rate of 3%. This is comparable with the value of 3.7% observed in the medieval skeletons from City Churches, Dundee (Roberts 1999). The percentages from both Dunbar and Dundee were low in comparison to the prevalence rates of caries from other medieval sites, such as Whithorn, which have consistently been observed at around 6% (Lunt, pers comm). At Dundee, however, there was an exceptionally high degree of attrition to the vast majority of the teeth. This was not the case at Dunbar, where, generally, the teeth were in good condition and dental attrition age tended to correlate with other age indicators. The Dunbar individuals may therefore have had either higher standards of oral hygiene than other medieval populations, or differences in their diet, such as a heavier reliance on meat and fish and a lower intake of foods containing sugar.

Calculus, the mineralized form of plaque, is an extremely common condition frequently observed on the teeth of archaeological skeletons. Twenty-four individuals from Dunbar suffered from calculus, predominantly adults. Of these 24 cases, 18 were slight, 15 were medium, and one was heavy (classification after Brothwell 1981). Periodontal disease is a term used to describe the inflammatory changes that can

occur in the soft tissues and bone around a tooth in response to plaque. It is a major, although not the sole, cause of ante-mortem tooth loss. Again, it is frequently observed in archaeological populations, where lack of oral hygiene is a primary cause. Twenty-one individuals suffered from periodontal disease that in nine cases was slight, eight cases moderate, and in four cases severe. Nineteen individuals had lost a total of 84 teeth ante-mortem. In nine instances the tooth loss was associated with periodontal disease of moderate or considerable severity, and in 14 cases with dental abscesses.

Thirty-four dental abscesses, affecting 16 individuals, were observed. The number of abscesses per individual ranged from one to six, the average being two. Abscesses varied in severity and were not always associated with carious lesions. A particularly severe example was observed in an adult male, where the infection had perforated the floor of the maxillary sinus, and a cyst was starting to form.

DEH is the name given to the defects, linear grooves and pits, which appear in the enamel of the teeth, representing a cessation in the growth and development of the tooth. These defects have been ascribed to physiological stress, caused by such things as febrile infections, malnutrition and metabolic disorders (Aufderheide & Rodriguez-Martin 1998). Twenty percent of the teeth observed showed evidence of DEH ($n=174$). The older juveniles had the greatest number of teeth affected per individual, and also suffered from what appeared to be the most severe manifestations of the condition. It is possible that these individuals had suffered repeated ill-health during childhood, before dying in their late teens.

In addition to oral pathology, several dental anomalies were observed. These included overcrowding of the anterior teeth, prognathism, rotated canines, and abnormally placed canines that were located further back in the palate, behind the lateral incisors.

Circulatory disorders

A possible case of Legg-Calve Perthes disease was observed in skeleton 72, a middle-adult male. Perthes disease is caused by a disruption of the blood supply to the femoral head during childhood, resulting in the death of the bone. It often resolves spontaneously, but the individual can be left with deformity and a predisposition towards degenerative joint disease. The right and left femoral heads of skeleton 72 were flattened, neither had a fovea and the femoral necks were shortened, although there was little secondary arthritis. The deformity was not severe and it is unlikely that the mobility of the affected individual would have been compromised.

Degenerative joint disease (DJD) and spinal joint disease (SJD)

Degenerative joint disease and spinal joint disease are often the most frequently identified pathological conditions in an archaeological population. The aetiology of the two conditions is essentially the same, the most common causes being age and repeated stress. It may be primary or secondary (developing after a traumatic injury), and the over-riding symptoms are pain and restricted mobility of the affected joint. In this instance, the severity of the condition was graded using a system adapted from Jurmain (1990) by King (1994).

Fifty-one percent ($n=20$) of the adult individuals from Dunbar showed signs of degenerative joint disease. The most frequently affected joints were the tubercular facets of the right and left ribs, the left wrist, the left sterno-clavicular and the right acromio-clavicular joints. Overall, in terms of severity, 16.5% of cases were slight, 60.7% were moderate, and 22.8% were severe. Examples of severe degenerative change included the left elbow and right knee of a mature adult male, the right and left hip of a middle-adult male, and the left hand of an adult male. An example of degenerative arthritis secondary to traumatic injury was seen in the foot phalanx of skeleton 36, a middle-adult male. Males and females were affected by the condition in equal numbers and, as might be expected, the frequency and severity of the disease increased with age.

Sixteen of the adult individuals from Dunbar were affected by spinal joint disease. In terms of individual vertebrae, 553 were observed, of which 382 showed signs of degenerative changes. The frequency with which each type of vertebra was affected displayed a pattern typical of that encountered in archaeological populations. The lumbar vertebrae were the most frequently affected (81%), followed by the

thoracic (67.1%), and then the cervical vertebrae (64.9%). Untypically, however, a higher percentage of cervical than lumbar vertebrae displayed severe changes (see Archive Report for details).

Metabolic disorders

Two types of metabolic disorder were identified: iron deficiency anaemia (characterized by *cribra orbitalia* and porotic *hyperostosis*), and osteoporosis. There are many causes of iron deficiency anaemia, amongst the most common being lack of absorbable iron in the diet and a high pathogen load within the body (Stuart Macadam 1992; Grauer 1993). Four individuals out of a possible 45 showed signs of *cribra orbitalia*. These were a mature adult female, a middle-adult female, a young juvenile, and an older child. A further two individuals, a mature adult female and a middle-adult female were found to suffer from porotic hyperostosis. The prevalence rate of *cribra orbitalia* was low at 8.8%, when compared with populations from other medieval sites, where rates ranged from 24.4% (City Churches, Dundee) to 41.6% (Kinnoul Street, Perth). It is possible that the individuals from Dunbar were either subjected to less physiological and environmental stress, or were more buffered against it.

Osteoporosis was observed in two individuals, a middle-adult and a mature adult female. The condition is characterized by a loss in bone volume, the causes of which include lack of calcium in the diet, lack of exercise and hormonal imbalance — making post-menopausal women particularly susceptible. The females concerned had sustained vertebral fractures as a result of loss in bone mass, a frequently occurring condition both in the past and today.

Miscellaneous

Conditions observed which fitted into none of the above categories included a small button osteoma (a benign growth) on the nasal bone of a middle-adult male, slight cranial deformity in a middle-adult female, and two examples of sacralization of the fifth lumbar vertebra, in an older juvenile female and middle-adult male.

Non-metric traits

In addition to pathological conditions, skeletal variants termed non-metric traits were recorded (Berry & Berry 1967; Finnegan 1978). These traits, which cannot be measured on a metric scale, are simply recorded as being present or absent. They are thought to be genetically or environmentally determined and are generally used to compare differences between population groups. The fact that many of the crania were fragmented meant that it was often not possible to record traits from points of articulation, or those relating to the basi-cranium and the infra cranium which had been destroyed.

The most commonly observed cranial trait was ossicles in the lambdoid suture, present in 56.5% (n = 11) cases where it was observable, closely followed by parietal foramen which was present in 50% of cases (n = 13). Other frequently occurring traits included bridging of the supra-orbital notch (43.8%, n = 7), accessory supra-orbital foramen (31.3%, n = 5), and ossicles in the coronal suture (23%, n = 3). Metopic suture occurred at a rate of only 5.8% (n = 17), a much lower frequency than at other Scottish medieval sites (see Archive Report). Retention of this suture is said to vary greatly between populations, being dependent on such factors as period, place and race.

The post-cranial remains were better preserved than the crania, which allowed for larger sample sizes, and therefore more representative data, to be obtained. The most frequently observed post-cranial trait was the lateral tibial squatting facet, seen in 83% (n = 20) of individuals. It has been suggested that a habitual squatting posture, such as that adopted by various populations in India, can cause this particular trait, but it has also been seen in fetuses of both Indian and European origin (Kennedy 1989). The lateral squatting facet was also the most frequently occurring post-cranial trait at City Churches Dundee, but at a lower rate of 45% (Roberts 1999). Acromial articular facet (60%, n = 15), bipartite transverse foramen (50%, n = 14)

and double anterior calcaneal facet (45.8%, $n=11$), were the next most commonly observed traits. In all cases the bipartite transverse foramen involved the 5th, 6th or 7th cervical vertebra, the most frequently affected being the 7th. Traits relating to the scapula, patella, and atlas were amongst the least frequently observed. In addition to the variants described above, two individuals were found to have cervical ribs.

THE DISARTICULATED REMAINS

A minimum of 51 individuals were identified amongst the disarticulated remains, which had been recovered from 30 different contexts. Preservation of the remains varied, with some individuals being represented by only a few fragments of bone, and others by elements which allowed age at death and/or sex to be determined with a reasonable amount of accuracy.

All ages were represented, from infants aged 0–6 months to mature adults. Thirty (58.8%) of the individuals were adult, and 21 (39.2%) were immature. Of the adults, 23 could be identified only as ‘adult’, four were identified as middle-adults, and three as mature. Amongst the immature remains nine were classified as infants (including those more specifically aged at 0–6 months, 6–18 months, 1–2 years and 2–3 years), three were children (aged 3–10 years), and nine were juveniles (aged 10–18 years). This reflected the pattern observed in the articulated remains, of the highest mortality rate occurring during infancy. The sex of only nine of the adults could be determined. Six of these were male or (?)male and three were female or (?)female.

It was possible to calculate the statures of six individuals (Table 3). Where two values are given, the sex of the individual was uncertain, therefore both the male and female heights were calculated. The average meric and cnemic indices were 78.3 ($n=3$) and 61.3 ($n=3$) respectively.

Pathological conditions identified included a fractured thoracic vertebra, dental disease, iron deficiency anaemia, osteochondritis dissecans, degenerative joint disease and spinal joint disease, superficial cut marks, and a large lytic lesion of unknown cause located in the orbit of an infant. Non-metric traits observed included bipartite foramen of the cervical vertebrae, bridging of the supra-orbital notch, exostosis in the trochlear fossa, and lateral tibial squatting facets.

TABLE 3

Stature (to nearest 0.1 m)

<i>Stature</i>	<i>Sex</i>
1.67 ± 0.03 m–1.63 ± 0.04 m	Unknown
1.50 ± 0.04 m	Female
1.57 ± 0.04 m	Female
1.58 ± 0.04 m	Female
1.65 ± 0.03–1.61 ± 0.04 m	Unknown
1.67 ± 0.04 m	Male

CONCLUSIONS

Individuals of both sexes and all ages, from neonate to mature adult, were represented in the Dunbar skeletal assemblage. There was a higher than normal proportion of immature individuals in the group, even by medieval standards, with a particularly high mortality rate in the neonatal and early infancy periods. The greatest number of adult deaths occurred in the middle-adult age range.

The average male height was 1.70 m (5ft 6in) and the average female height 1.60 m (5ft 2.5in), values consistent with those obtained from sites of a similar date. Generally speaking the population was of average build, and varied in terms of cranial morphology and facial characteristics. There was a tendency towards marked sexual dimorphism, ie osteologically, the males were very masculine and the females were very feminine.

There was little evidence of serious disease in the adult individuals. There was a high prevalence rate of superficial infection, in the form of periostitis, but the majority of cases were slight in severity. Standards of oral hygiene were generally good, and there was a low frequency of dental caries. The prevalence rate of iron deficiency anaemia, often termed a stress indicator, was low in comparison to other medieval sites. The above findings may suggest a lack of environmental stress, although there are many other factors to be taken into consideration, such as host resistance and genetic composition. There was some evidence of inter-personal violence, represented by the head injuries inflicted upon skeletons 59 and 73. Such types of injury are more commonly found in adult males and, given that the burials were not part of a massacre site, it is slightly unusual that the victims were a female in her late teens, and a child aged 11–14 years.

Despite the high infant mortality rate, there was little evidence of pathology on the immature remains. Acute infectious disease would have left no trace on the skeleton, and was likely to have been the primary cause of death, as indeed it still is today in this age group in developing countries. Overall, long bone length correlated with dental developmental age, and few stress indicators were observed. The exceptions to this were in the older juvenile age category, where several individuals showed severe manifestations of dental enamel hypoplasia.

Although the individuals from Dunbar represent what may only be a small proportion of a much larger cemetery, they are still an important resource in providing an insight into the everyday lives and deaths of people living in the region during the medieval period. The assemblage also serves as a useful source of comparison with populations from other sites of a similar date. It is hoped that the findings from this project can be integrated into a larger database containing information on medieval populations from all over Scotland. This would facilitate the study of regional differences in such areas as child mortality rates, sex specific mortality patterns, health status and disease prevalence rates.

THE FINDS

J Franklin

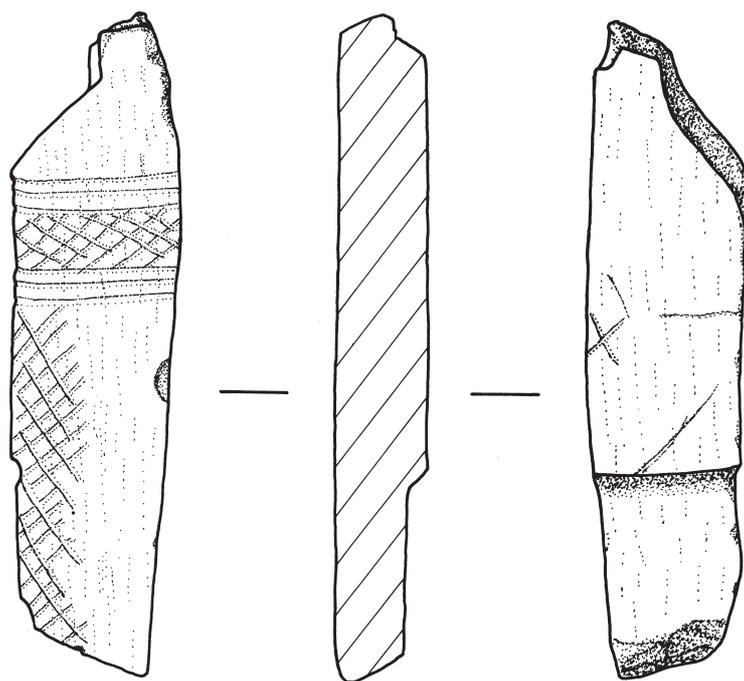
All the finds were from the cemetery, although only one, a bone buckle (2), was associated with a burial. Most of the pottery is intrusive, being later in date than the radiocarbon dates retrieved from the skeletal material. A few of the finds are also of a demonstrably later date. In addition, some of the finds may have been disturbed from Anglian deposits through which the cemetery was cut. Contexts cannot therefore be used in dating the assemblage, though a few of the finds are of the same period as the burials.

BONE OBJECTS

There was evidence of a modern bone-working industry in the shape of many surface finds of off-cut pieces of ivory. However, several of the bone finds are of a demonstrably much earlier date.

The decoration on one bone fragment (1: *illus* 10) is strikingly similar to that on a complete composite comb, also found in Dunbar (Holdsworth 1993). It has the same band of cross-hatching within vertical lines and was found very near to the present site. A piece of a similar comb was also found at North Berwick (Hall & Bowler 1998, 673). Both have been dated to the 9th or 10th centuries. Graham-Campbell & Batey (1998, 105) identify these combs as classic Scandinavian types made by specialized comb makers and use them as evidence for the development of a northern trade route in such luxury items. This piece adds further evidence towards Dunbar being part of that network.

The bone, however, is unlikely to be part of a comb. Combs were generally made of antler as it was much stronger (MacGregor 1985, 74). It also lacks a rivet hole in the centre, where the comb would have



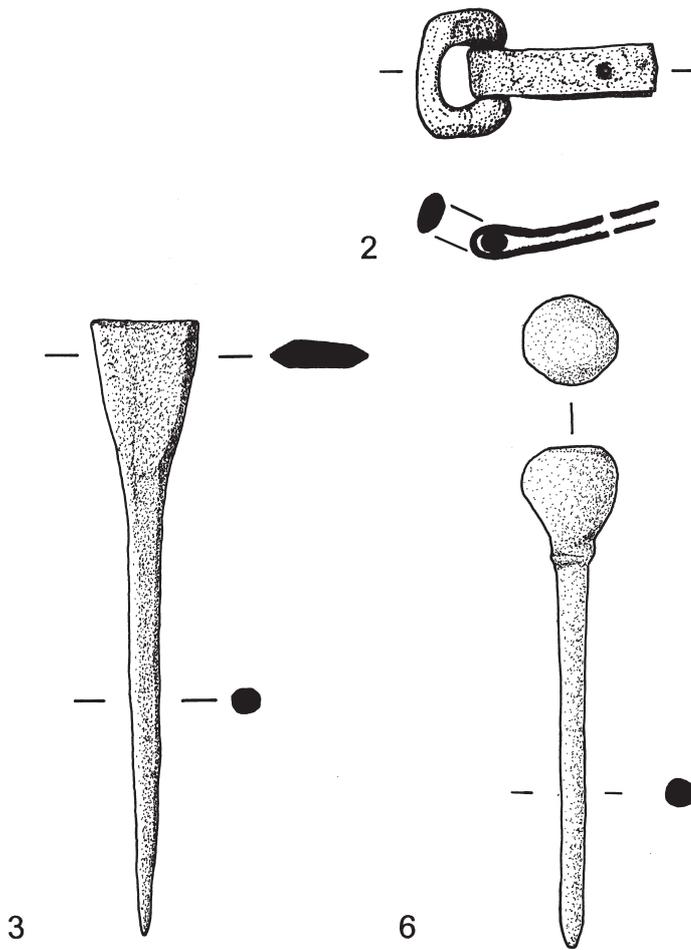
ILLUS 10 Decorated bone fragment (no 1 in catalogue)

been held together. It could be from a comb case. These were made of similar plates but only riveted at each end. Alternatively it may have been part of an implement handle.

A complete bone pin (3: illus 11) was found in a grave fill and could have been redeposited. It is similar in shape to the type of pig-fibula pin found all over Britain and Ireland throughout the Early Historic period. Although especially associated with Vikings they are also common in Saxon, Anglian and Celtic areas (MacGregor 1985, 121). They were probably used to fasten loose clothing and are sometimes found around the shoulder area of a buried body. They could also have been used as hair pins. Pig-fibula pins were simply made, not being much altered from the natural bone. This pin is finer, being made from a piece of a large animal long bone (D Henderson, pers comm) and is well-shaped and polished. It is not so elaborate, however, as to suggest it is necessarily the work of a specialist pin maker. Pins may have been made on site. Two fragments of worked bone (4 & 5) could be pin-making debris.

The buckle (2: illus 11) is the most enigmatic of the finds. It was found on the chest of an adult skeleton (SK16), though the burial was disturbed and it could be intrusive. Its identification as a buckle is uncertain as there was no sign that it ever had a pin. It does not serve any obvious decorative purpose and no parallels have been forthcoming from Early Historic or medieval sites.

- 1 Decorated bone fragment. Illus 10. Piece of long bone incised with parallel lines and cross-hatching. Both sides have been smoothed and polished, with a step cut into the back. Length 44 mm, width 11 mm. Small find 3. Context 016.
- 2 Bone. Illus 11. (?)Buckle with copper alloy plate. The small frame is an irregular rectangle in shape but has been well made with the bar thinning under the plate. The plate is made from a plain strip of sheet copper alloy, with a rivet hole towards the end. Traces of the strap may be preserved between the two plates, possibly of leather. Length 32 mm, width of frame 17 mm. Small find 2. Context 067.



ILLUS 11 Artefacts of bone (2 & 3, both scale 1:1) and copper alloy (6, scale 2:1)

- 3 Pin. Illus 11. Complete bone pin with a wide flat head. The shaft is rounded and ends in a fine point. It is polished, either by design or through use. Length 81 mm, width of head 14 mm, thickness of shaft 4 mm. Small find 6. Context 077.
- 4 Point. Sliver of bone fashioned to a point but otherwise unworked. Possibly a piece of an uncompleted pin. Length 34 mm, width 4 mm. Small find 7. Context 077. Not illustrated.
- 5 Piece of bone worked into a wedge-shaped point at one end. Possibly debris from pin manufacture or other bone working. Length 37 mm, width 11 mm. No small find number. Unstratified. Not illustrated.

COPPER ALLOY OBJECTS

The only identifiable finds of copper alloy were two pins. Wire pins became common in the late medieval period. Those with their head attached to the shaft by stamping them within a small spherical mould, as in pin 7, tend to be earlier than those with soldered heads. At Sandal Castle (Caple 1983, 274) stamped heads were found in deposits dating to the late 15th century or after. Wire pins were still being produced in this

way in the 19th century (Tylecote 1972). The good condition of this pin implies that, if anything, it came from the latter part of this range. Pin 6 (illus 11), however, with its thick shaft and large solid head has more in common with pins dating to the Early Historic period than the medieval period (Nicholson 1997; Laing 1973). It is small compared to most of these, but smaller pins were found at Whithorn in the eighth and ninth centuries and were tentatively linked with female dress (Nicholson 1997, 363).

- 6 Pin. Illus 11. Cast with a solid conical head with a small collar at the top of the shaft. Length 33 mm, width of head 6 mm, width of shaft 1.9 mm. Small find 1. Context 40.
- 7 Pin. Small wire pin with a stamped coiled wire head. The shaft is bent near the top and traces of tinning remain over the whole surface. Length 23 mm, width of head 1.8 mm, width of shaft 0.8 mm. Small find 12. Context 173. Not illustrated.
- 8 Sheet. Broken fragments of sheet copper alloy, some folded, one with a rivet hole, possibly part of a buckle plate or hinge. Small find 18. Context 292. Not illustrated.
- 9 Small unidentifiable fragments. Small find 17. Context 279. Not illustrated.

POTTERY

Only 23 small sherds were recovered, mostly of medieval date. The exception was one sherd of a coarse hand-made ware of Anglian date (Context 153). The fabric is buff-coloured, sooted on the exterior and contains varied coarse inclusions and voids as well as abundant fine particles of mica. Of the medieval pottery, 16 sherds were of White Gritty Ware, including one cooking pot rim, dating to between the 12th and 15th centuries. Two sherds were of later medieval reduced green-glazed ware. There were two sherds of imported wares, one Dutch Redware, one fine green-glazed sherd, possibly English. All these are common medieval finds along the east coast of Scotland. Two sherds (Context 055), including one cooking pot rim, were of possible early medieval imports. The fabric is gritty and reddish buff on the surface with a grey reduced interior and appears to be hand made though wheel finished at the rim.

THE CHARRED PLANT REMAINS

M Hastie & T G Holden

BACKGROUND AND METHODOLOGY

Environmental samples were taken primarily from the building phase, although a number of control samples were taken from grave fills and the abdominal regions of a number of skeletons.

The samples were processed in a Siraf-style flotation tank. The floating debris (the flot) was collected in a 250 µm sieve and, once dry, scanned using a binocular microscope. Residues were wet-sieved down to 1 mm and sorted by a trained technician. Identifications were made with reference to the modern comparative collection of Headland Archaeology Ltd and seed atlases (Berggren 1969, 1989). Botanical nomenclature generally follows that of the Flora Europaea (Tutin *et al* 1964–80). The results are summarized in Table 4.

RESULTS

All botanical material recovered had been preserved by charring with wood charcoal, cereal grains and weed seeds being present in a high proportion of the 22 samples processed.

Cereal remains

The most common component was cereal grain with barley, oat and wheat all being present. Grains of barley were most frequently encountered and the better-preserved of these were of the hulled variety. Straight (symmetrical) and twisted (asymmetrical) grains were identified where preservation allowed. A ratio of approximately 1:1 straight to twisted was recorded, potentially indicating that both the two-row form and six-row variety were present. Ten barley rachis fragments were also recovered but these were not in sufficiently good condition to improve upon the identifications gained from the grain morphology.

Grains of oat were present in many samples. It is, however, generally impossible to distinguish between, on the one hand, the cultivated oats *Avena strigosa* (small/bristle/black oat) and *Avena sativa* (common oat) and, on the other, the wild species *Avena fatua*, purely on the morphology of the grains. Separation of the varieties relies on the floret bases or chaff being present and none were recovered from this site. Nevertheless, the quantity of grains present probably indicate that it was being grown as a crop and *A fatua* can therefore be discounted.

Wheat grains were recovered although not in the same numbers as the barley and oat grains. As with the other cereals most were present in samples associated with the Anglian building. Overall morphology was typical of *Triticum aestivo-compactum* (bread/club wheat). Chaff fragments were very rare with only one sample containing a small number of rachis internodes (three in total). These were extremely small, probably deriving from the tip of the ear. On the basis of these it was not possible to distinguish between *T aestivum* and *T compactum*.

Weed seeds

The weed seed assemblages were very sparse. The most commonly encountered wild taxa were Gramineae (Grasses), *Polygonum* sp (Knot grass), *Rumex* sp (Docks), *Carex* sp (Sedges), *Raphanus raphanistrum* siliqua fragments (Wild Radish) and *Galium aprine* (Goosegrass/Cleavers). Most are weeds of cultivation and waste places. The most likely explanation for their presence on site is that they were brought into the settlement as the last remains of the seed element that had been harvested along with the cereals. The low concentrations of the remains make any detailed discussion of field ecology impossible.

Potential economic species

One seed of flax (*Linum usitatissimum* L) was found in a sample from an area of cobbles at the north-west end of the site. Flax is an extremely versatile species which can be used to produce an edible oil or fibres for the spinning of linen. It has been recovered from a number of Scottish archaeological sites dating back to the Neolithic (Fairweather & Ralston 1993) and its presence at the Captain's Cabin suggests that this important resource was also being utilized within the area. The single seed, however, offers little scope for analysis, other than to note its presence.

DISCUSSION

Since no suitable samples were obtained from the Iron Age deposits the samples can be split into three categories:

- 1 internal floor deposits from the Anglian structure;
- 2 external surfaces and pits also relating to the Anglian structure;
- 3 cist and grave fills from the medieval cemetery.

Overall preservation of cereal grains was generally poor with most samples containing relatively low numbers of cereal grains. Five samples, however, stand out with respect to concentration of plant material. Contexts 190, 302, 303 and 304 were part of an interior floor surface while context 278 was a deposit situated outside the Anglian building.

TABLE 4

Latin name	Plant part	Phase	7th–8th Century										10th–11th Century												
			Internal surfaces					External surfaces and features					Internal surfaces					External surfaces and features							
Context with no identifiable remains	nothing		190	302	303	304	305	136	275	278	279	280	281	282	283	292	293	199	227	153	153	153	153	177	301
<i>Polygonum aviculare</i> L.	nutlet	Context no	9	21	22	23	24	1	12	11	13	16	17	18	19	14	15	7	8	2	4	5	6	20	
<i>Polygonum persicaria</i> / <i>lapathifolium</i>	nutlet	Sample no	20	9	8	8	10	5	9	0	6	8	4	9	1	4	4	5	5	10	8	8	10	10	
<i>Polygonum cf. minus</i>	nutlet	Orig. volume (litres)	A	F	B	A	A	E	F	G	G	G	G	G	G	G	G	D	D	E	E	E	E	F	
<i>Polygonum</i> sp.	nutlet	Area	Floor	Floor	Floor	Floor	Cobbled Area	Pit	Pit	Sand Layer	Industrial Layer	Industrial Layer	Industrial Layer	Sand Layer	Sand Layer	Pit	Pit	Grave	Grave	Cist	Cist	Cist	Grave	Grave	
cf. <i>Polygonum</i> sp.	nutlet	Feature	Deposit	Deposit	Deposit	Deposit																			
<i>Rumex</i> sp.	nutlet	Common name																							
<i>Chenopodium album</i> L.	nutlet																								
<i>Chenopodiaceae</i> indet.	nutlet																								
<i>Stellaria media</i> (L.) Vill.	seed	fat hen	4	1	2	8	1																		
<i>Raphanus raphanistrum</i> L.	siliqua	goosefoot family	2	1	2	2																			
cf. <i>Trifolium</i> sp.	seed	chickweed																							
<i>Calluna vulgaris</i> (L.) Hull	bud	wild radish/charlock	3																						
<i>Galium aparine</i> L.	seed	clover																							
cf. <i>Galeopsis</i> sp.	nutlet	ling. heather																							
		cleavers																							
		hemp-nettle																							

Anglian structure — internal floor surfaces

Interior floor samples (from contexts 190, 302, 303 & 304) are dominated by barley with lesser quantities of oat and wheat. From the few excavated Early Historic period sites in Scotland the presence of barley and oats at Dunbar is typical (Boyd 1988). Wheat is, however, much less common and its presence probably reflects the favoured microclimate and high-quality agricultural land available in East Lothian. These four samples also contain the majority of the weed seeds recovered (approx 85%) and the only chaff fragments found from the site. The weed seeds are dominated by large and medium grass seeds, *Galium aprine* and *R raphanistrum siliqua* which are generally large-seeded and represent elements of the flora that are close in size and density to the grain. Nevertheless, the overall percentage of weed seeds only constitutes 5% of the total plant remains and the quantity of chaff is extremely low.

Processing of the harvested crop results in the creation of a number of products and by-products which can be identified by the relative percentages of chaff, straw and weed seeds present (Hillman 1981). Taking into account the lack of chaff and very low percentage of weed seeds it is evident that the samples represent the charred remains of a cleaned crop, the remaining weed seeds representing only a proportion of the original seed burden not removed by winnowing and sieving.

Corn-drying or storage? The quantities of charred grain were such that some sort of accident concerning processing or storage seems likely. The two most obvious sources of quantities of burnt grain are from the destruction of storage facilities by conflagration and through accidental burning during the drying of the crop. The excavation at the Captain's Cabin provides little evidence that could distinguish between the two events. In northern altitudes grain is primarily dried for four reasons:

- 1 to stop germination in the seeds during malting;
- 2 to dry grain that is needed for the next year's seed;
- 3 to prepare the grains for milling/grinding;
- 4 to parch the grains to aid removal of awns from hulled grains (Fenton, 1978).

Methods used ranged from large scale kiln-drying to smaller pot and basket drying (Crawford 1987). The recorded assemblage, being dominated by oat and barley, would be in keeping with cleaned cereals being dried prior to hummeling (removal of hulls and awns).

A one-off kilning accident would not, however, explain all of the data. When sample composition is considered it can be seen that those from contexts 190, 303 and 304 have a predominance of barley and oat while context 302 contains a much higher percentage of wheat. This clustering is reflected in the location of the samples, the first three being situated to the north-west of the building, the fourth located to the south-east. This observation would be more in keeping with the burning of stored grain during a conflagration in a house or specific storage facility. In this case the differences in composition of the remains potentially indicate the storage of different crops in different parts of the building.

Anglian structure — external deposits

Generally, samples taken from external pits and surfaces only contained very low concentrations of grain. One high concentration of charred material was, however, recovered from context 278 which related to a spread of sand outside the Anglian structure. The composition was identical to that recovered from the interior of the structure and it would seem likely that it derives from the same source, having been raked out of the building. The low concentrations of grain in many of

the other external features suggests the reworking of sediments containing material that originated from the main burning event inside the structure.

Cist and grave fills

These features contained low levels of cereal grain. The likely sources of the charred material are the grain-rich deposits from the Early Historic period sediments that had become incorporated into the later grave-fills.

THE IVORY

D Henderson

BACKGROUND AND METHODOLOGY

One hundred and sixty-one individual pieces of ivory (totalling 1127 g in weight) were recovered from two contexts (010 and 046). Context 046 was a pit-fill, and context 010 was a similar material spread in a layer over the surrounding area. The contexts were both considered to date to the 18th or 19th century. The sample was hand-picked from the deposits. The ivory represents both off-cuts derived from sawing whole tusks into usable pieces for manufacture, and discarded, part-finished items which had broken before the object was completed.

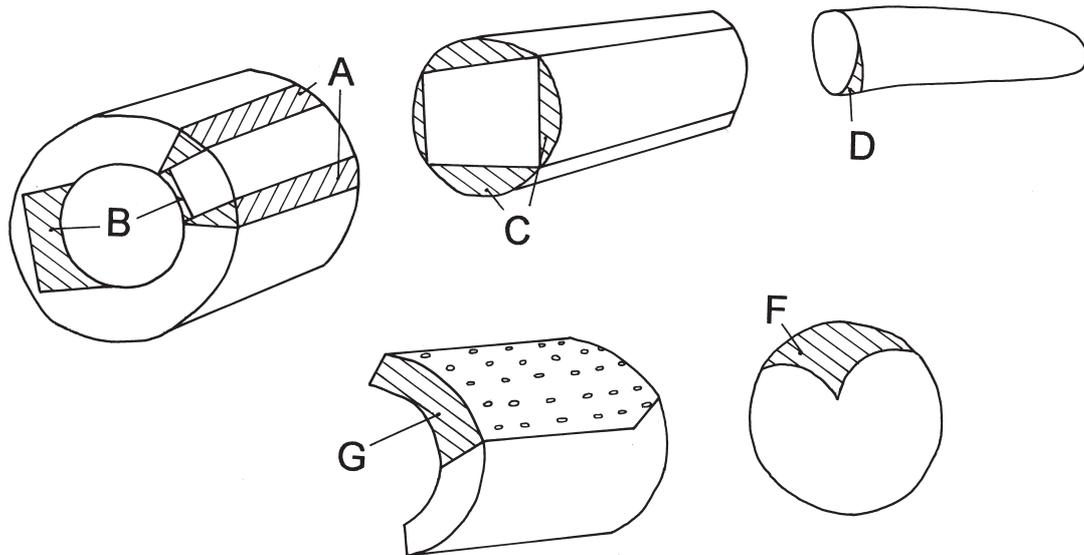
All the ivory which was identifiable was from elephant (MacGregor 1985, 14–20) although it is very difficult to distinguish between ivory from the African (*Loxodonta africana*) and Indian (*Elephas maximus*) elephants, or indeed from the mammoth (*Mammuthus primigenius*) (MacGregor 1985, 14–20).

The sample was analysed and divided into two broad categories of items. Pieces of tusk which retained either the outer surface or the inner surface of the pulp-cavity were classified as 'off-cuts' from the initial preparation of the raw material to form regular blocks of ivory suitable for processing into finished objects. Four different types of off-cut were identified (illus 12), designated A to D. Pieces of ivory which had undergone further processing, usually exhibiting saw-marks on all surfaces or with signs of having been turned on a lathe, were classified as part-finished. Six types of part-finished object were identified, designated E to J. A further category of substantially finished, but broken, objects (K) was also assigned. The weight of all the items in each category was recorded.

RESULTS

Raw material

The ivory used all displayed the distinctive characteristics of elephant tusk, where ascertainable. The tusks of elephants are elongated upper incisor teeth, nearly circular in section and tending towards a longitudinal spiral curve with increasing length. The tusks grow continuously in life, and the first third or so, nearest the jaw, contains the pulp-cavity. This is cone-shaped, so that the ivory (actually the dentine of the tooth) is thinnest near the root, and becomes solid towards the tip of the tusk. A layer of cementum anchors the tusk in the jaw. As all parts of the tusk, including cementum, are represented in the sample, it is clear that complete tusks were imported to the site. By analysing the curvature of the outer surface of the tusk found on waste pieces, the maximum diameters of the tusks were ascertained; the largest diameter was of the order of 0.14 m, the smallest 0.05 m, with most clustering around 0.08 to 0.10 m. All these measurements relate to the hollow part of the tusk, where it is widest, although it is not possible to ascertain how close to the jaw the piece originated, so these are not necessarily maximum figures. Most of the ivory was of a light cream or pale yellow colour, and the outer surface, where present, was usually smooth and uncracked. In some pieces, however, the material was of a darker, reddy-brown hue and the surface layer was fissured. It is not impossible that some mammoth ivory was utilized. In 1869 the zoologist W Boyd Dawkins noted that a



ILLUS 12 Diagrammatic representation of sectioning of elephant tusks: A, B, C, D, F & G are types of off-cuts recovered

mammoth tusk from Clifton Hall, in the Forth Valley, was found 'in such preservation that it was sold to an ivory turner for £2. Before it was rescued it had been sawn asunder . . . for the manufacture of chessmen' (quoted in MacGregor 1985, 40). It would also be possible that mammoth ivory from northern Russia could find its way to the east coast of Scotland through the herring trade with the Baltic ports.

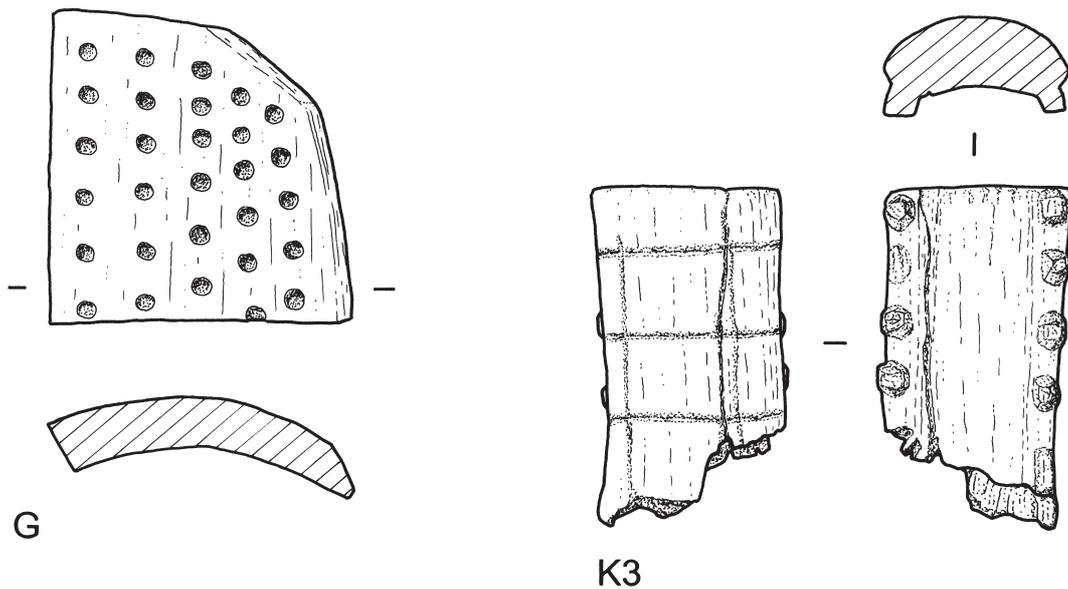
Off-cuts

Four types of off-cut, or waste pieces were identified.

- A Wedge-shaped pieces which derive from the hollow part of the tusk, and have two sawn edges with either the outer cortex alone or both the outer and inner surfaces of the tusk. These pieces are cut along the longitudinal axis of the tusk.
- B Pieces with five faces sawn, the other long face derived from the concave surface of the pulp-cavity. These pieces are trimmings from the internal surface of the blocks of ivory produced by off-cut type A.
- C Pieces from the solid part of the tusk, with a single longitudinally sawn face forming a chord to the circumference.
- D Sections cut transversely across the tusk. Appear as two types; those derived from the hollow part of the tusk are annular, with the width of the ivory ranging from 7 mm to 36 mm, and those derived from the solid part of the tusk. In both cases, the purpose seems to be to compensate for the longitudinal curve of the tusk and perhaps to remove blemishes and chips on the outer surface.

Worked pieces

- E Three rectangular strips, sawn on all six sides and split or cracked during manufacture.
- F Two sections of solid tusk from which sub-circular 'cylinders' have been sawn.
- G Three blanks for (?hair-)brushes. Rectangular sections cut from the hollow part of the tusk, with the outer cortex shaved off, the tusk was approximately 80 mm in diameter and the ivory over 7 mm thick. One side is bevelled and one corner chamfered, presumably two pieces would be fitted together in the finished article, which would be about 80 mm long and 90 mm wide. One of the pieces has five longitudinal rows of six drilled holes, 2.2 mm diameter and 4.4 mm deep, on the convex surface.



ILLUS 13 Worked ivory (1:1)

- H Four squared blocks, six plate-like pieces and an inaccurately cut octagonal plate of ivory.
- I Two sticks of ivory of rectangular section and one stick of triangular section.
- J Five pieces of waste from lathe-turned objects.
- K Three finished pieces:
 - 1 A curvilinear piece 7.1 mm thick and 26.8 mm long, shaped like a comma with a notch cut out of the bulbous end.
 - 2 A longitudinal slice of the outer surface of a tusk, 133 mm long and 4 mm thick with a 3.3 mm diameter hole drilled through 23 mm from one end. Similar to a net-mending needle.
 - 3 Broken inlay for an implement handle, 25 mm wide, 15 mm thick and 46 mm long. Illus 13. An arched section with a row of peg-like teeth down each side. The convex surface is crudely incised with a grid pattern (illus 13, K3).

CONCLUSION

The ivory waste-pieces represent an insight into the processing of tusks to produce pieces of ivory suitable for manufacture into objects. It seems certain that whole tusks were imported, although the sources must remain uncertain. Apart from the African and Indian sources provided by the British Empire in the 19th century, the possibility of mammoth ivory, both local and imported, cannot be discounted.

The raw material was initially cleaned of any adhering cementum at the end, then a ring of tusk about 50 mm long would be sawn off. This was then cut into blocks with a square section of 10 to 20 mm, and the intervening wedge shaped pieces would be discarded as waste type A. The concave base of the block would then be trimmed off, to form waste type B. The process would then be repeated with a section of tusk around 0.8 m long, forming slightly larger blocks of ivory; then a section around 0.12 to 0.14 m would be processed. It is uncertain what these blocks of ivory would be used for, as no finished pieces were recovered, but one possibility is that they could be made into cutlery handles.

Alternative uses of the hollow part of the tusk include the manufacture of hair-brushes and the production of plates of ivory, suitable for inlaying or for covering piano keys and the faces of dominoes. The solid part of the tusk would yield large blocks of ivory which could be used to produce a range of items, from inlay, musical instrument parts and ornaments to billiard balls. The waste from lathe-turning suggests that chessmen could have been produced on site.

DISCUSSION

The results of the excavation at the Captain's Cabin add to the already emerging story of a strategic headland defended through two millennia which served as a focus for a substantial community by the ninth century, if not earlier. The importance of the site is amplified by the rich archaeological resource preserved beneath Castle Park.

It is unlikely that the promontory fort extended much further inland than the ditch identified in the 1998 excavations. However the nature of promontory forts is as yet a poorly researched topic and the hinterland of such a settlement may have been much more complex than we have hitherto expected. The area of activity on the headland up to the construction of Lauderdale House appears to have been delineated by a boundary probably based on the bank erected on the inner edge of the Iron Age ditch. If the Anglian building is in fact a grain store it is likely that this was situated at the boundary of the settlement as at Hoddom (Lowe, in prep). The northern extent of the cemetery also appears to be defined by this boundary, which would appear to have been fossilized in the town street plan as recorded by Roy in c 1750 (illus 7). It is interesting that the 12th/13th-century settlement based on the High Street was located to the south of this boundary. This would suggest that the original focus of settlement at Castle Park either became unfashionable or was reserved for some other activity, possibly relating to the castle. The cemetery was also south of this boundary suggesting that it was outwith castle lands and related instead to the town rather than the castle.

The population identified in the cemetery is remarkable for the high percentage of children present, possibly indicating that the area investigated was set aside for the burial of children. The adult population appears to have been of average build and height with marked sexual dimorphism. In general the population appears to have been relatively healthy with very little evidence of stress or serious disease evident on the bone. An interesting aspect of the assemblage was the evidence for violent attacks on two of the children, probably with weapons.

The absence of structural evidence for settlement in Dunbar between the 8th and 12th centuries is striking and requires further investigation. It has been presumed that the present line of the High Street is a 12th- or possibly 13th-century creation. However the absence of evidence of occupation at Castle Park between the eighth-century and the construction of the castle may suggest that the population buried in the cemetery between the 9th and 12th centuries may have lived on the High Street. This would imply that the settlement had been established for several centuries before gaining burghal status; the question is, where was it? Current evidence supports the following interpretation. A Northumbrian settlement, fragments of which have been identified through excavation, developed at Castle Park in the seventh century. The confined area of Castle Park may have been insufficient to accommodate a growing population and by the 10th century a 'new' town was laid out on the line of the present High Street. Alternatively the area may have been cleared to make way for the castle or destroyed by conflagration — Kenneth MacAlpin sacked and burned Dunbar in 843. Whatever the reason, it is highly probable that a settlement, be it 'proto-urban' rather than a town proper, existed in Dunbar from at least the seventh century.

Parallels for such a settlement in Scotland are rare. However a recent paper by Hall and Bowler (1998) suggests a similar model of development for North Berwick.

The two examples (Dunbar and North Berwick) cited above call into question the reliability of dating the origins of a town from its charter. That urbanization came to Scotland solely as a result of David I's activities can now be seen to be highly improbable. Towns or 'proto' towns are likely to have existed for centuries before the first issue of a Royal Charter. The 12th century may instead have seen a substantial increase in trade and industry focused on towns, which increasingly became a source of revenue which needed to be controlled and taxed by the crown. The example of Dunbar highlights the need to delve deeper into the archaeology of Scotland's historic burghs to identify the true nature and origins of urbanization in Scotland.

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