TARBAT DISCOVERY PROGRAMME

PORTMAHOMACK

ROSS-SHIRE

RESEARCH EXCAVATION SECTOR 4 DATA STRUCTURE

OCTOBER 2012

TARBAT DISCOVERY PROGRAMME

TARBAT OLD CHURCH

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DATA STRUCTURE REPORT

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Project Summary

The Tarbat Discovery Programme was initiated in 1993 by Professor Martin Carver as a research project of the Department of Archaeology, University of York, following an invitation by the Tarbat Historic Trust (THT). A monastic site at Portmahomack was predicted from discoveries in the churchyard of elaborate Pictish sculpture (Class II and III), including a fragment bearing Pictland's only Latin inscription in insular majuscules, and a silver hoard of the late 10th century. Evaluation of the site was funded by a grant from Highland Council and subsequent major sponsorship came from the THT, the University of York, Ross and Cromarty Enterprise, the Highland Council, the Heritage Lottery Fund, European Regional Development Fund, the National Museums of Scotland and Historic Scotland. Four sectors were defined for investigation; Sector 4 was assigned to St Colman's Church and its surrounding churchyard (Carver 1995).

Evaluation of Sector 4 included topographic survey (Intervention 4), radar survey (Intervention 9), and memorial survey (Intervention 5). The subsequent long-term research excavation incorporated interventions in the nave, crypt and north aisle of Tarbat Old Church (Interventions 17/20, 13 and 19) in advance of its refurbishment as the Tarbat Discovery Centre, along with small-scale excavation in response to the museum development (Intervention 16 and 22 service trenches; Intervention 21 watching brief on repairs to churchyard wall) and fabric recording and analysis (Intervention 18 and 23).

This Data Structure Report concerns investigations in Sector 4 carried out between 1991 and 1998 by Justin Garner-Lahire, Annette Roe, Andrew Copp, Jill Harden, Fred Geddes, Martin Jones and Graham Robins. It draws on, and refers to, an earlier post-excavation analysis by Annette Roe towards Bulletin 3 (Carver 1997), and Field Report 3 and an interim synthesis and interpretation prepared by Martin Carver and published in summary form in *Portmahomack, Monastery of the Picts* (Carver 2008).

Acknowledgements

The Tarbat Discovery Programme would like to thank the Tarbat Historic Trust and the village of Portmahomack for their hospitality, and current sponsors Historic Scotland. We are grateful to Rod McCullagh, Deputy Head of Archaeological Programmes and Grants Advice, Historic Scotland, for his support, advice and guidance.

1.0 INTRODUCTION

This document reports on the archaeological excavation of Sector 4 of the Tarbat Discovery Programme, Portmahomack (Figure 1; NGR: NH 915 840). The fieldwork was undertaken during two principal sessions, evaluation and watching brief in 1996 and excavation and further watching brief in 1997 with ongoing building fabric analysis during the refurbishment of the St Colman's Church during its conversion to the Tarbat Discovery Centre. This document represents the Data Structure Report (DSR) for these investigations. It uses a first stage of post-excavation work undertaken by Annette Roe towards Bulletin 3 and subsequent preliminary analysis and preparation of the Sector 4 Field Report by Martin Carver towards interim publication (Carver 2008).

1.1 PROJECT HISTORY

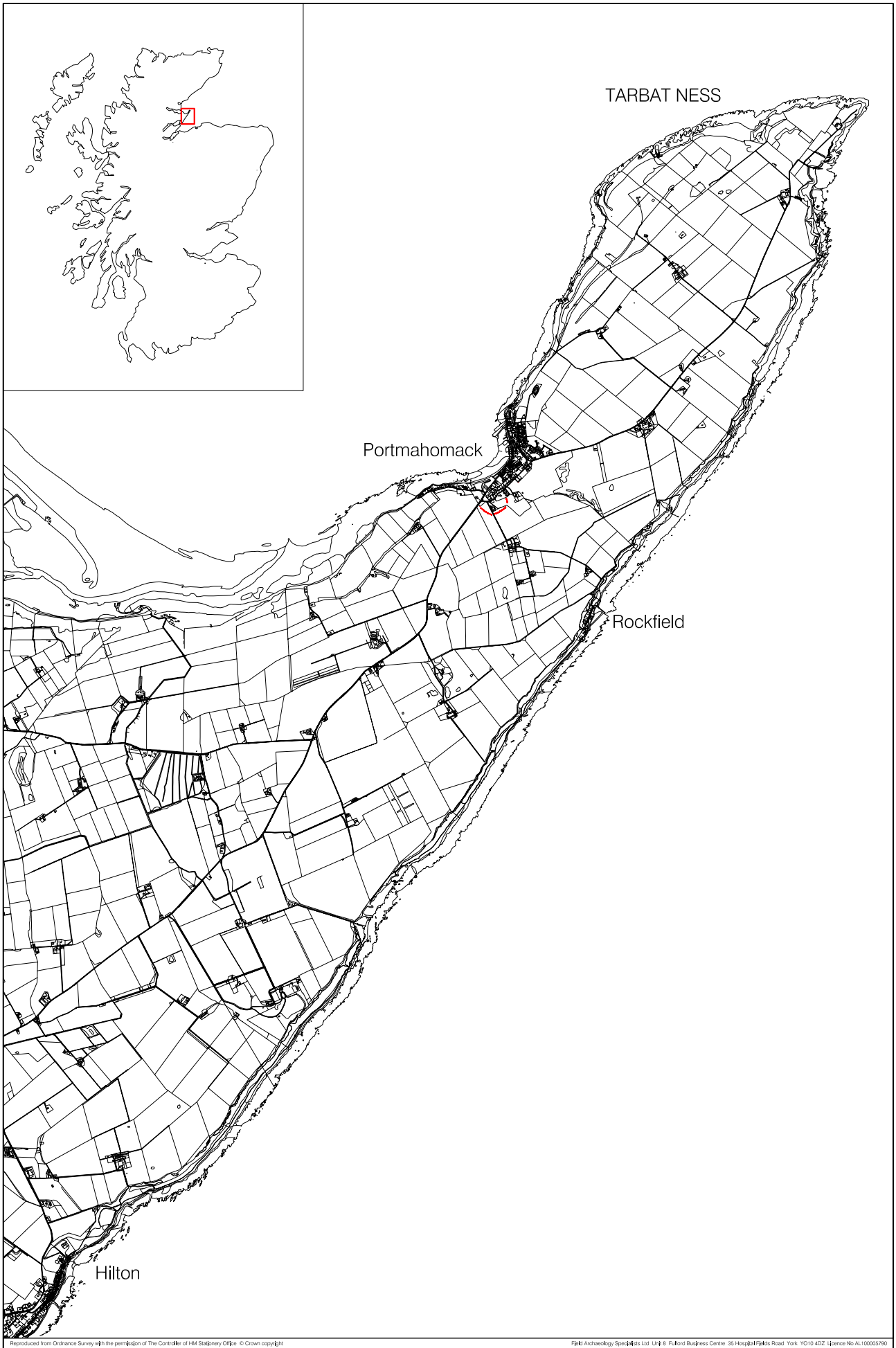
Sector 4 was assigned to St Colman's Church and its churchyard at the outset of the research excavation. Once the research programme was underway the conversion of St Colman's Church was enabled by a Heritage Lottery Fund grant to convert the church into a museum and visitor centre to present the history of the church and the surrounding settlement including local history. The detailed history of the project can be found in the Sector 4 field report (Section 3.1.0 Description of the investigation).

2.0 FIELDWORK PROCEDURE (Figure 2)

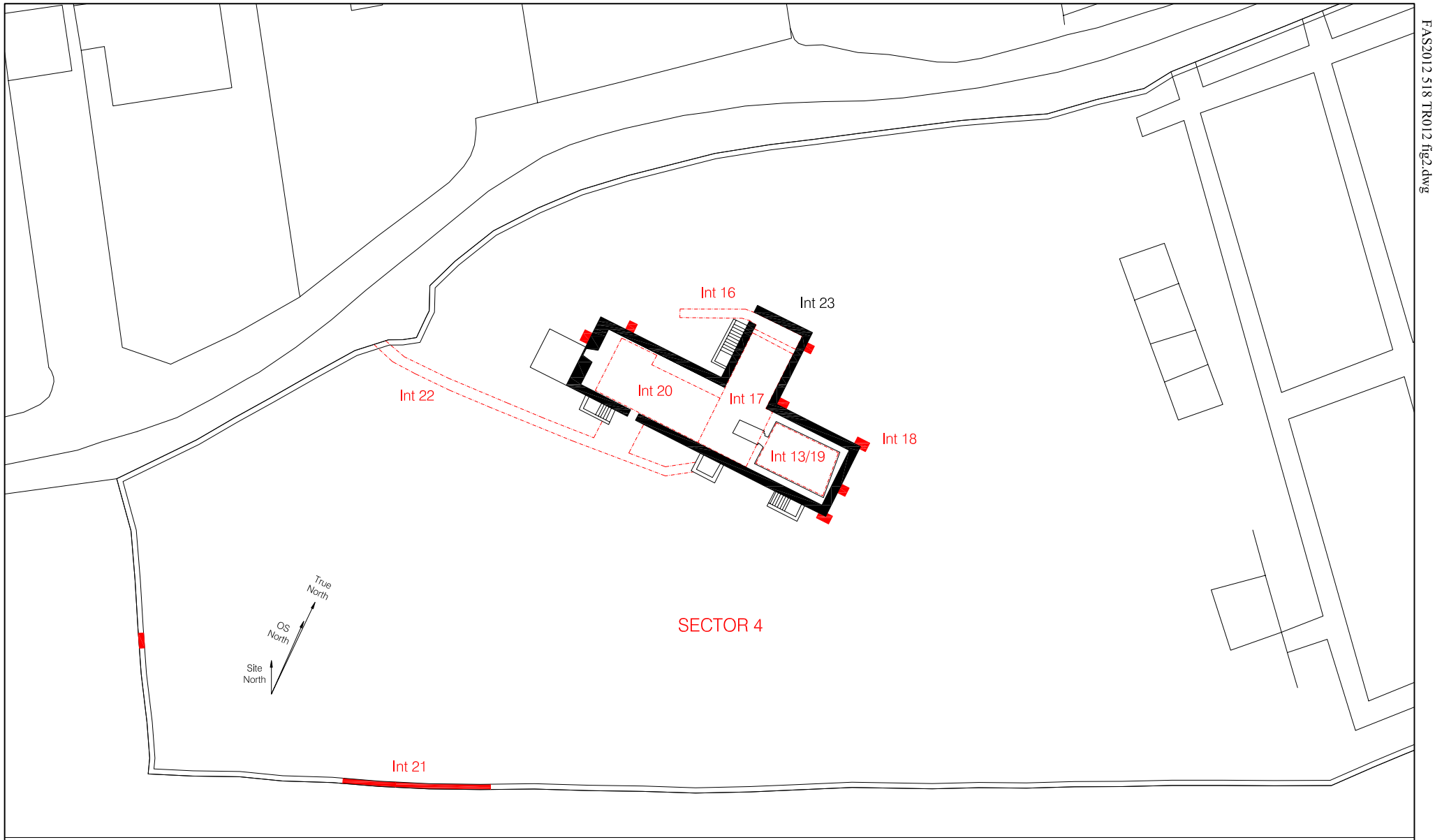
A deposit model for Sector 4 formed part of the Project Design and included an architectural and historical overview, and an appraisal of the potential of below-ground strata and the extant fabric (Carver 1995, 37-42). This guided subsequent interventions within Sector 4.

Table 1 Index of interventions for Sector 4

Int.No.	Location	Activity	Originator	Date
4	Zones B-F	Contour survey	Copp	1994
5	Sector 4; Zone A	Church map	Copp	1994
6	Sector 4, Zone B	Churchyard map	Copp	1994
9	Zones B-E	Radar survey	Sympkins	1994
13	Sector 4; Zone A	Crypt clearance	Harden	1992-1995
16	Sector 4; Zone B	Service trench excavation	Lahire	1996
17	Sector 4; Zone A	Evaluation trench	Roe	1996-1997
18	Sector 4; Zone B	Test pit excavation	Geddes	1997
19	Sector 4; Zone A	Crypt excavation	Roe	1997
20	Sector 4; Zone A	Excavation	Roe	1997
21	Sector 4; Zone B	Watching brief	Robins	1997
22	Sector 4; Zone B	Service trench excavation	Roe	1997
23	Sector 4; Zone B	Building recording	Jones	1997



Location map | Scale 1:50000 | Figure 1



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Location of Sector 4 showing interventions

Scale 1:500

Figure 2

Int.No.	Location	Activity	Originator	Date
28	Sector 4; Zone B	Gravestone recording	Carver	2002

2.1 EVALUATION

2.1.1 Intervention 4 - Churchyard topographic survey (Figure 3)

Intervention 4 was undertaken during late winter of 1994 by Justin Garner-Lahire and Andrew Copp assisted by Tony Austin and John Kenny. The survey was undertaken using a Total Station Theodolite (Wild TC1010). Data captured was used to generate the topographic map using Liscad and SEE digital terrain modelling, output at 0.2m vertical intervals.

2.1.2 Intervention 9 - Radar survey in churchyard

Intervention 9 was undertaken during the summer of 1994 by a team from Oceanfix International Ltd led by Peter Sympkins. The ground penetrating radar (GPR) was used to produce vertical slices across a series of profiles across the churchyard. The density of graves and reflections from memorials hampered the acquisition of useable results. A long east-west profile undertaken to the immediate south of the southern churchyard wall was broadly indicative of deep and complex strata.

2.1.3 Intervention 17 - Evaluation excavation

Intervention 17 was assigned to evaluation excavation within the nave of St Colman's initiated in 1996 by Justin Garner-Lahire assisted by Toby Simpson. During this phase of fieldwork Intervention 17 measured 4m x 5m and encountered a sequence of burials and walls. Intervention 17 was extended during the main phase of excavation to include the whole of the north aisle and the east end of the nave directed by Annette Roe.

2.2 OPEN AREA EXCAVATION

2.2.1 Intervention 17/20 - Excavation of nave and north aisle of St Colman's Church

Intervention 17 assigned to evaluation excavation in 1996 was extended to incorporate the north aisle and the east end of the nave, being the area originally intended for full excavation. This area was extended during the 1997 season to include the whole of the nave; the westward extension to Intervention 17 was assigned Intervention 20 for which separate feature and context indices were maintained. Fieldwork was directed by Annette Roe. Burial numbers were assigned to graves during post-excavation in order to provide a unique number index and will be used in the following text. Non-burial features and strata are prefixed with 17/ or 20/ as appropriate. A digest of intervention, feature and context numbers for burials is provided as Appendix A.

The edges of intervention were restricted for safety reasons. Intervention 17 was excavated from the south wall to the north wall, but Intervention 20 was excavated leaving a 1.0m baulk against the north, south and west wall strengthened during fieldwork using sand bags.

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Topographic survey of churchyard

Scale 1:750

Figure 3

The site grid used for recording purposes was local and aligned to magnetic north. The figures within this report, which are primarily studies of the church architecture and periods of burial, have been rotated to true north to facilitate discussions of alignment. Figures which incorporate studies of Sector 4 as a whole are presented on the site grid which differs from Ordnance Survey by 24°; a triple north arrow is provided in these illustrations.

2.2.2 Intervention 13 - Crypt clearance

The clearance of the crypt was undertaken under the supervision of Jill Harden between 1991 and 1994 with volunteers from the Tarbat Historic Trust. The work was allocated Intervention 13 retrospectively. The material assemblage from the intervention is in the care of the National Museums of Scotland and FAS. A copy of the list of finds and notes made during excavation is included in the archive held by FAS. Clearance of the crypt was undertaken down to undisturbed strata and involved the removal of accumulated rubbish being the result of dumping and animal habitation and disturbance. The soil was sieved for artefacts and a range of material was recovered. A small finds indexing system was maintained by Jill Harden; noteworthy finds were assigned numbers from a list maintained in parallel by FAS within the overall project archive.

2.2.3 Intervention 19 - Crypt excavation

Intervention 19 was assigned to the stratigraphic excavation of the remaining strata within the crypt and was undertaken during 1997 concomitant with excavation of the nave of the church by FAS directed by Annette Roe.

2.3 MITIGATION EXCAVATION

2.3.1 Intervention 16 and 22 - Service trench excavation

Intervention 16 was assigned to the archaeological excavation of a service trench from the north aisle leading out of the church undertaken in 1996, but was abandoned and replaced with Intervention 22 (see Figure 2). Intervention 22 was excavated successfully from the south door of the church through the churchyard to the west entrance onto Tarbatness Road and houses a sewer serving the converted church. The results of the intervention provide the only physical link between the archaeology within Sector 2 and 4.

2.4 BUILDING FABRIC ANALYSIS

2.4.1 Intervention 18 - Foundation test pit excavation

Intervention 18 was assigned to the excavation of five test pits located around the exterior of the church against the walls to inspect the nature of foundations (see Figure 2). In addition three pits were excavated at the position of the crypt lights in order to refurbish them and two pits were excavated against the eastern corners of the church to inspect the foundations. The pits provided valuable insight into the variable nature of the foundations and elevations of the church building sequence. The pits were excavated and then recorded by Annette Roe, Fred Geddes and Martin Jones.

2.4.2 Intervention 23 - Standing fabric analysis

The upstanding fabric of St Colman's as well as fabric exposed during excavation was recorded by Martin Jones and Fred Geddes. The recording was undertaken using an index of contexts and annotated architect drawings of the church supported by colour print and slide photography.

2.5 CHURCHYARD RECORDING

2.5.1 Intervention 6 - Churchyard survey (Figure 4)

Intervention 6 was assigned to survey of the Tarbat churchyard and its memorials. The survey was undertaken in 1994 by Justin Garner-Lahire and Andrew Copp using a Total Station Theodolite to locate boundaries and all visible monuments. The resulting survey formed the basis of Intervention 28.

2.5.2 Intervention 21 - Watching brief on churchyard wall

Intervention 21 was assigned to a watching brief which involved the creation of a new western gateway through the western churchyard wall and monitoring of repairs to an area of collapse within the southern length of churchyard wall. The structure is Grade A Listed. The watching brief was undertaken in March 1997 by Graham Robins, North Highland Archaeology, and was the subject of a separate report held in the project archive (Robbins 1997).

2.5.3 Intervention 28 - Memorial recording

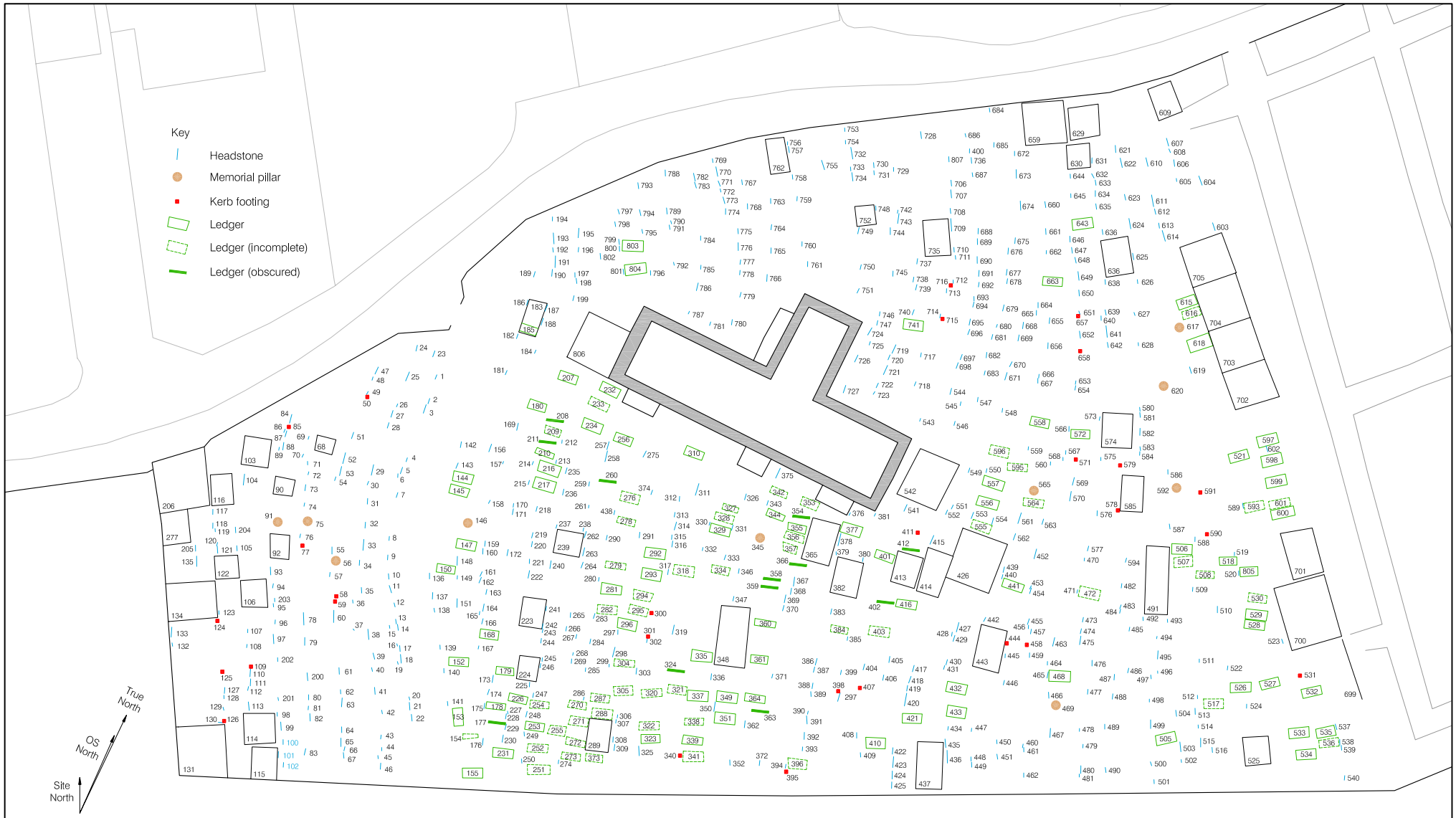
Intervention 28 was assigned to the recording of extant memorials located and numbered during survey of the churchyard (Intervention 6). Each of the Tarbat memorials was photographed and a recording pro-forma completed. The resulting archive is in the care of the Tarbat Historic Trust.

Recording was undertaken by members of the excavation team field school and latterly as part of a more extensive memorial recording project funded by the Fearn Peninsula Partnership including several surrounding churchyards including Old Nigg Church.

The memorials were also recorded for Dr Susan Buckham, Council for Scottish Archaeology (CSA), who was assessing stone preservation and conservation. These records were placed in the care of the CSA.

2.6 RECORDING PROCEDURE

The excavation and recording system employed during most interventions within Sector 4 is based on a set of principles known as *Field Research Procedure* (Carver 1999). The recording system structures excavation data in an hierarchical system: deposits defined during excavation, which are considered to have been formed by a single action, are defined as 'contexts' (standard stratigraphic units); sets of contexts are defined as higher order stratigraphic units defined as 'features'; groups of features can be defined as belonging to 'structures'. Thus,



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Memorial survey of churchyard

Scale 1:500

Figure 4

where appropriate, contexts are grouped during excavation as 'features', and similarly, features into groups called 'structures'; feature records are additional to, not alternative to, context records (*ibid* 158). Separate indices are maintained for contexts, features and structures and each have structured pro-forma recording sheets to be completed using a system of keywords. Interventions 16, 17, 18, 19, 20 and 22 were provided with separate indices for contexts starting at C1000 and for features starting at F1. Indices of drawings, photographs and finds were also separately maintained.

In addition to the hierarchical recording system, predetermined recovery levels can be employed ranging from Recovery Level A to E, representing increasing levels of investment and intensity of investigation. For the purposes of excavation, Recovery Level D was been predetermined and applied during fieldwork. This recovery level consists of trowel definition, finds recovery by 3-D from graves, floor surfaces, occupation or craft-working deposits or by context from non-burial feature fills and layers, as well as environmental sampling. Contexts required an outline plan using 3-D survey data with hachures where appropriate, full written description and hand-excavation accompanied by horizon photography, while features required an outline pre-excavation plan and photograph, full written description, half-section drawing as appropriate and photography and post-excavation plan and photography. All site drawings were drawn at 1:10 and survey was undertaken using a Total Station Theodolite; the local site grid was used for recording purposes.
The system for recording articulated burials relied on rectified photographic recording from which skeleton plans were subsequently digitised. Proformae for recording skeletons and coffins exist within the recording system and were employed during recording of burials in Intervention 16, 17 and 20.

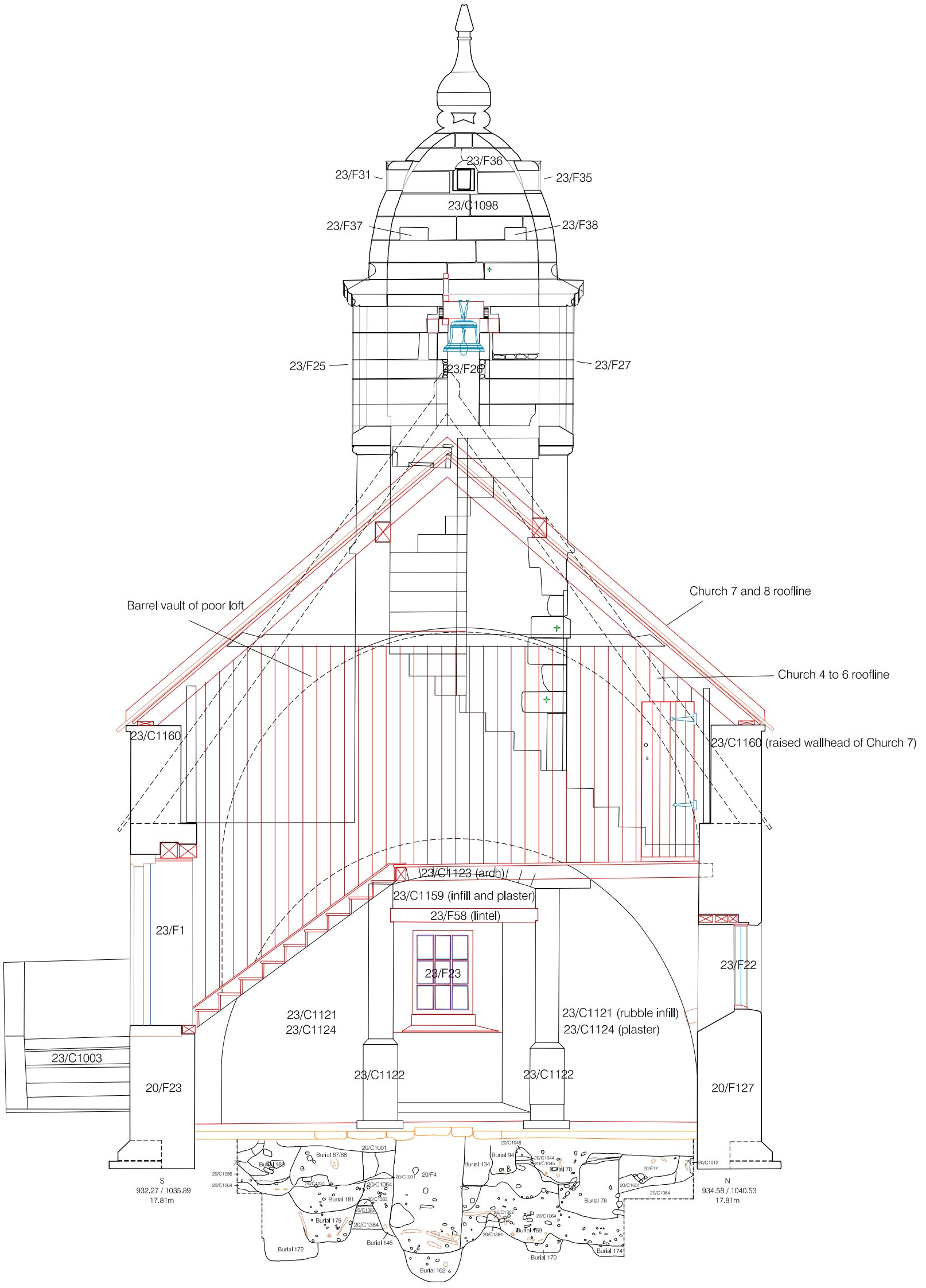
3.0 FIELDWORK RESULTS

3.1 PERIOD 1

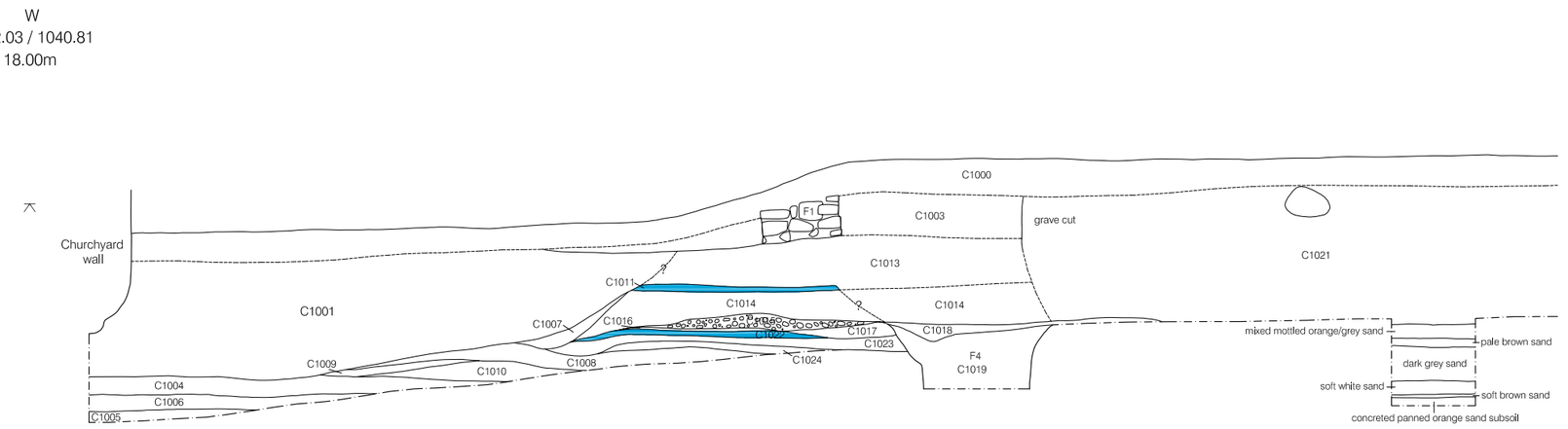
3.1.1 Natural subsoil and buried soil

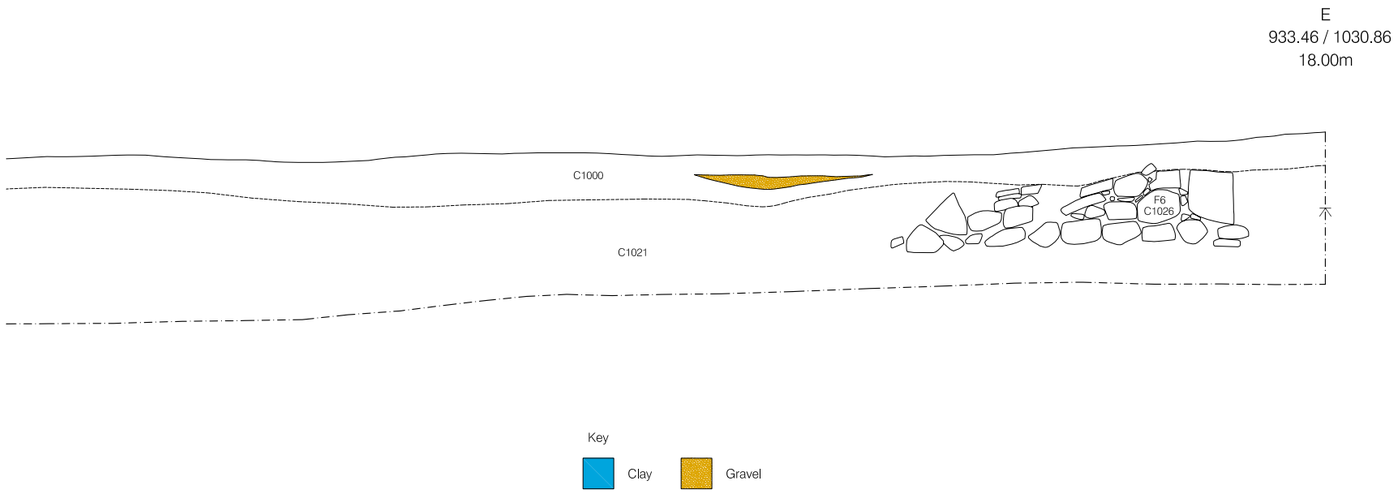
Virgin sand subsoil, assigned 16/C1011, 17/C1291=20/C1216, 19/C1012 and 22/C1005, was encountered at *c*.17.4mAOD, *c*.17mAOD, *c*.14.8mAOD and *c*.16.26mAOD respectively (Figure 5 and 6). Within Intervention 20, subsoil 20/C1216 could be seen to be overlain by accumulating buried soils in stratigraphic order 20/C1384 (weathered and mineralised subsoil head), 20/C1382 (buried soil and turfline), 20/C1383 (podsolised buried soil), which were preserved intermittently being limited in plan only where burials had not removed them completely and recorded best in the east-facing section of Intervention 20 (see Figure 5). The highest point of the uppermost layer 20/C1383 lay at *c*.17.4mAOD within Intervention 20, and as a group they are interpreted as original, developing buried soils predating any settlement or funerary activity at the site. Analogues of these layers were also identified within Intervention 22 as 22/C1004 and 22/C1006 which lay at *c*.16.6mAOD (see Figure 6). Counterparts to these layers have also been identified at the northern end of Sector 2.

A small quantity of residual prehistoric material was recovered from Sector 4, most notably an early Bronze Age carved stone ball (Plate 1). The ball has been identified as a 6-knob type with nose-shaped interspace (Marshall Type 4c). In addition a number of flints were recovered during clearance of the crypt. A total of six pieces were



Intervention 20 - east-facing section | Scale 1:50 | Figure 5





Intervention 22 - south-facing section

Scale 1:50

Figure 6

identified as a knife, four flakes and a piece of debitage.

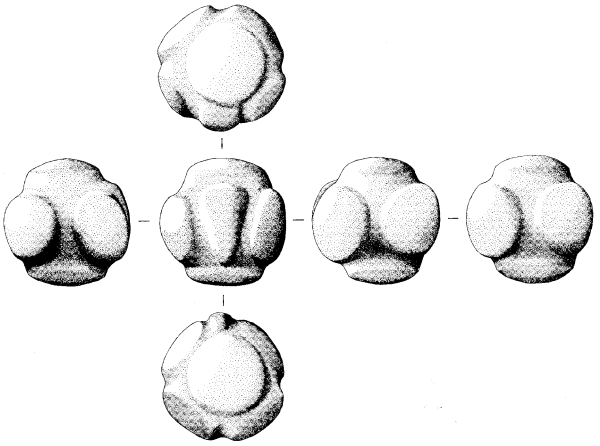


Plate 1 Early Bronze Age carved stone ball

Burials at Balnabruach

Three articulated burials were encountered during the replacement of mains water in Balnabruach and the remains of a total of six individuals were later identified osteologically among the bone assemblage, three of which were radiocarbon dated under the auspices of the Tarbat Discovery Programme. The dates were returned as 410-230BC, 240-420AD and 260-530AD and indicate prehistoric funerary activity of the mid- to late Iron Age (Appendix B). All radiocarbon dates expressed herein are expressed as calibrated, including for marine carbon reservoir effect where detected, and modelled following stratigraphic sequencing by Derek Hamilton and Gordon Cook, SUERC.

3.1.2 Period 1 Burials

Period 1 is defined by radiocarbon dating on a group of cist burials and the earliest phase of structural activity within Sector 2 north. Radiocarbon determinations from these features and structures and the date of subsequent activity have been used to define Period 1 date parameters as *c*.550 and *c*.700AD. Most Period 1 burials are identified as those which could be defined during excavation, or can now be supposed to have been, cut through 20/C1383 (Figure 7). A group of cist burials belong to Period 1 for which the rite was almost exclusively extended, supine inhumation with a single prone burial, within a long cist of Old Red Sandstone slabs furnishing all four sides of the grave, but not the base, and supporting a slab lid, which rarely survived intact, but did survive occasionally in a collapsed and fragmentary state (Figure 8). Three simple inhumations oriented west-east situated close to a distinct cluster of cist burials were also interred before *c*.700 and are thus grouped in Period 1. A total of 16 Period 1 burials have been identified; three further Period 1 burials, two cist burials and a simple inhumation, were encountered within Sector 2, Burial 186 to 188 inclusive, but are not discussed in detail here. Radiocarbon dated Period 1 cist burials suggest the rite originated as early as the 5th century, but did not occur after the late 7th century, corroborated by the Sector 2 long cist burials, Burial 186 and 187, which have been dated to AD420-610 and AD540-650 respectively. Radiocarbon dated simple inhumations, all mature males, appear to originate in the later 6th century and continue into Period 3.

A cluster of six burials including five long cists was present in the southwest corner of the area of intervention comprising in stratigraphic order Burial 172, 179 and 146, 131, 181 and 162 with possible outlier Burial 82/3 (Plate 2). These were the only Period 1 burials with stratigraphic or clear spatial relationships with one another, the other Period 1 burials were more dispersed by comparison (see Figure 5). The cluster

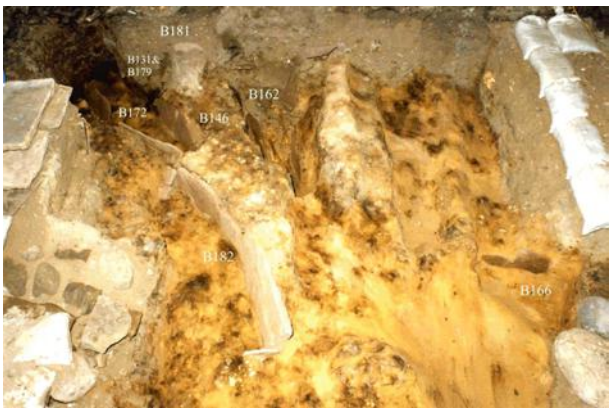
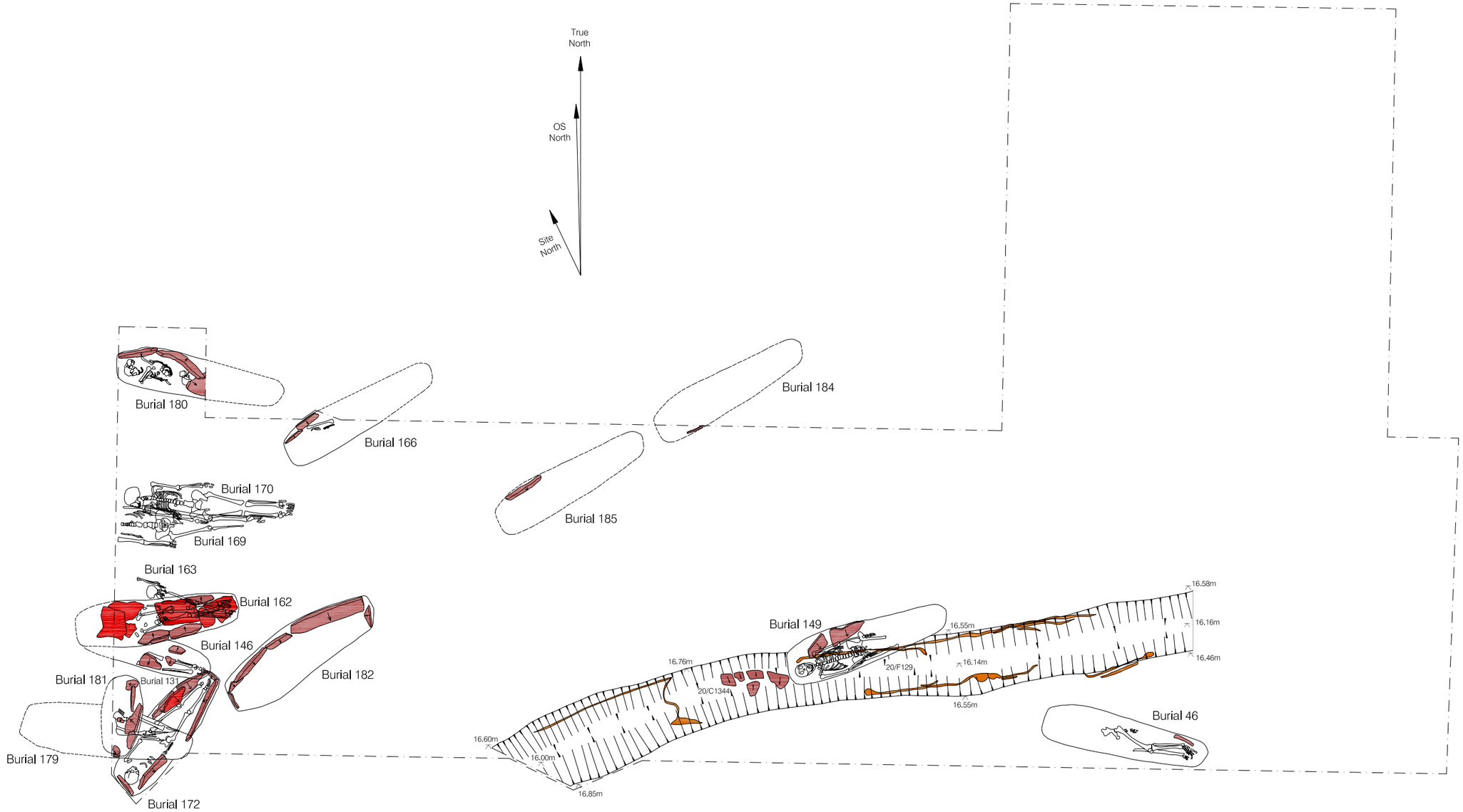
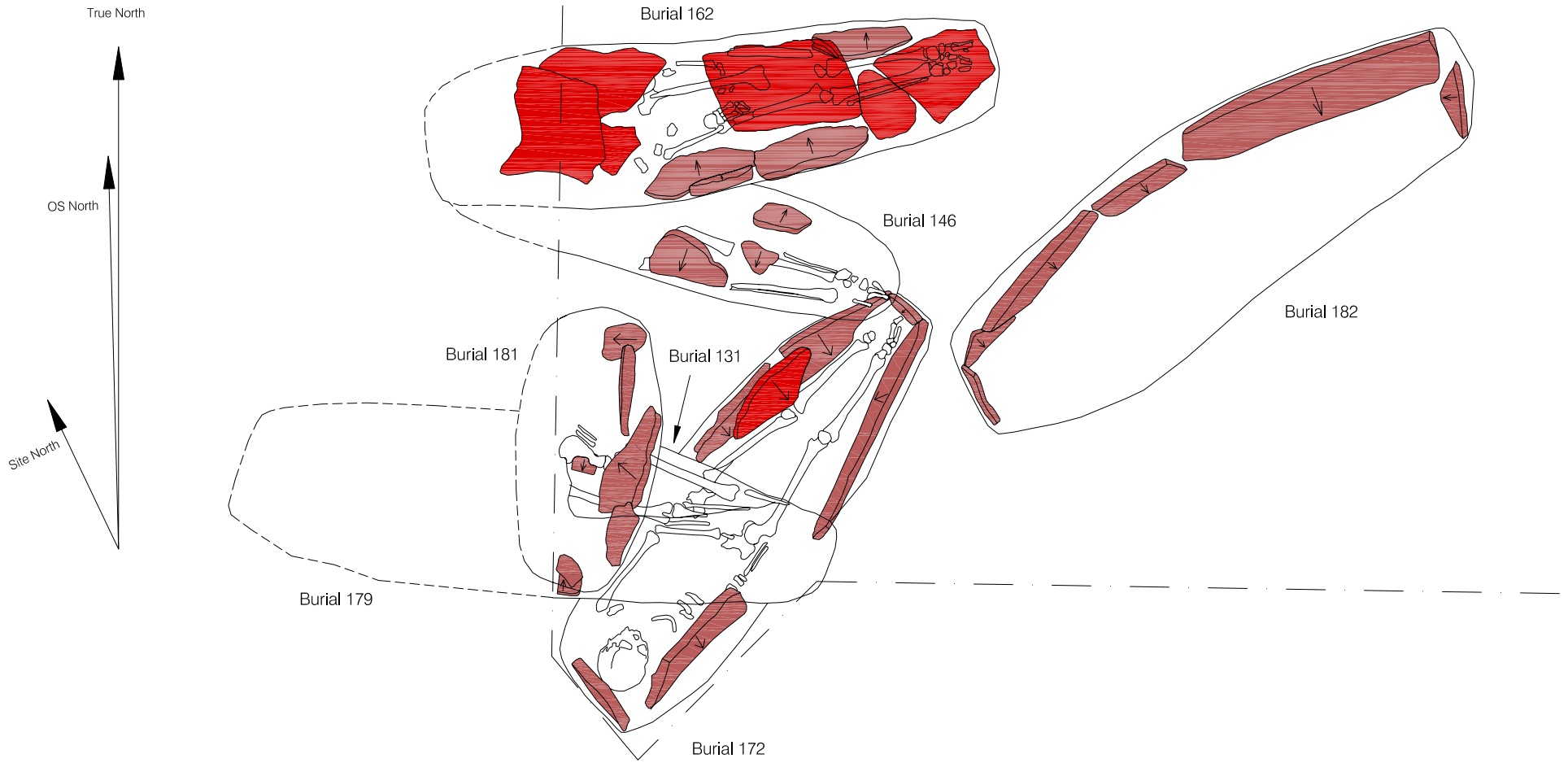


Plate 2 Period 1 cist group during excavation looking west



Period 1 burials and ditch 20/F129 | Scale 1:50 | Figure 7



Study of cist burials

Scale 1:20

Figure 8

may represent a family group and comprised three female burials, one possible female burial, one male burial, a further adult and a possible child Burial 181. It may be significant that the simple Period 1 and later Period 2 burials tended to avoid this cluster of Period 1 burials and given the height of the latest interment (Burial 181 at 17.6mAOD highest), the position of these accumulated graves may have created a legible feature within the succeeding Period 2 cemetery. Burial within Period 1 as a whole included three males and four females with six undetermined adults (see Appendix A, C and D); infants, children and juveniles were not apparently represented, although part-excavated Burial 181 could represent a small cist for a subadult.

Orientation varied from WSW-ENE to west-east with Burial 181 possibly oriented north-south. Where preserved, burial rite was extended, supine, with one burial slightly flexed and one prone, a single blade wound was also recorded on one Period 1 male. Burials assigned to this period of earliest burial are summarised in Table 2. Since the analysis of the skeletons from Tarbat was reported in 2000, ageing criteria have been revised and reappraisal of the age of Tarbat individuals is underway and age groups will be updated.

A single non-burial feature can also be assigned to this period, ditch 20/F129=17/F100, which was cut by cist burial, Burial 149.

Table 2 Period 1 burials

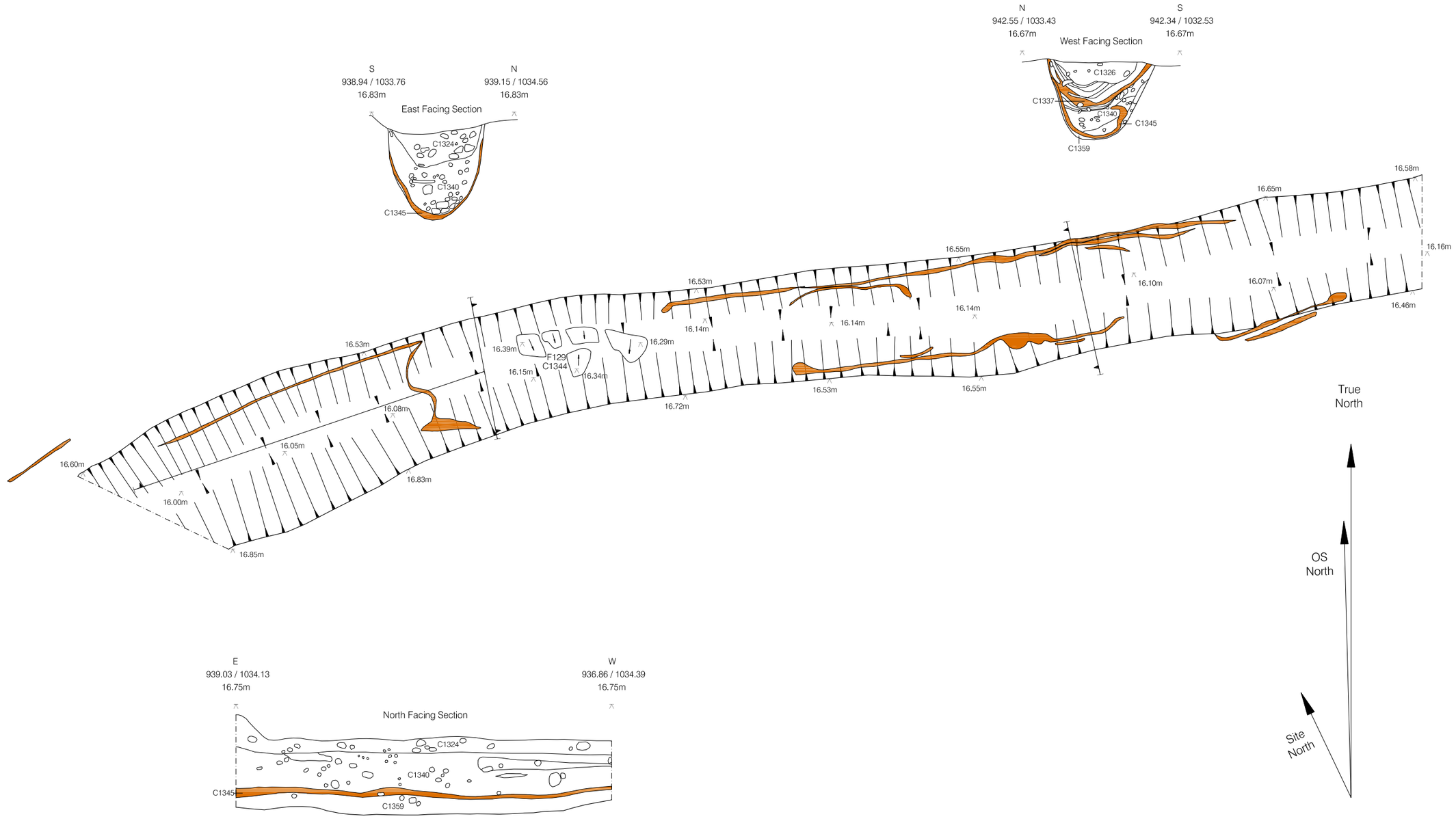
Burial	Description	C14 date	AOD height (m)
46	Burial of adult, probable male, extended/slightly flexed, supine, heavily cut away by later graves, oriented W-E, furnished with cist represented by side slab at lower right leg, lay at east end of area of intervention	-	Sacrum - 16.8 Tibia - 16.9
131	Burial of female, 46 years+, extended, supine, unfurnished, oriented broadly W-E, cut by cist Burial 179 and truncated by unknown agent, disappeared beyond western and southern limits of intervention	-	Grave cut 16.9- 17.2
146	Burial of female, 26-45 years, extended, supine, oriented WSW-ENE, represented by legs only, possibly furnished with cist represented by side slab at right lower leg and part lid fragment over left leg, post-dated cist Burial 172, later truncated to west by bell casting pit 20/F4	660-780	Tibia - 17.02
149	Burial of male with blade wound, 46 years+, extended, supine, oriented WSW-ENE, in long cist represented by side slabs down to upper leg, cut into Period 1 ditch 20/F129=17/F100, cut by Period 2 head box Burial 125	-	Skull - 16.9 Sacrum - 16.7
162	Burial of adult male, extended, supine, oriented WSW-ENE, in long cist represented by side slabs down to lower leg and partial lid over upper torso, disappeared beyond western limit of intervention, pre-dated cist Burial 146	AD430-575	Tibia - 16.6
163	Burial of male, 26-45 years, extended, supine, probably shrouded, oriented W-E, collapsed into underlying Period 1 cist Burial 162 when lid gave way	AD640-690	Sacrum - 16.8 Tibia - 16.7
166	Burial of adult, probable female represented by right arm and part right torso with sandstone cist side slab, oriented SW-NE, truncated by Period 2 Burial 155	-	Grave cut - 16.6-16.9m

Burial	Description	C14 date	AOD height (m)
169	Burial of male, 26-45 years, extended, supine, oriented W-E, post-dated Burial 170, in dense northwest zone, disappeared beyond western limit of intervention	AD610-680	Sacrum - 16.9 Tibia - 16.9
170	Burial of male, 26-45 years, extended, supine, oriented W-E, early, deep burial in dense northwestern zone	AD580-660	Skull - 16.9 Sacrum - 16.7 Tibia - 16.7
172	Burial of female, 46 years+, extended, supine, oriented SW-NE, in full long cist of side slabs with possible collapsed lid fragment, postdated by Burial 131 and cist Burial 146, later disturbed by Period 5 20/F4=F147 bell pit and partially redeposited therein	AD570-650	Skull - 16.9 Sacrum - 16.7 Tibia - 16.8
179	Burial of adult, extended, prone, furnished with cist represented by two side slabs down to knees, oriented W-E, cut Burial 131, later truncated by unknown agent and overlain by cist Burial 181, disappeared beyond western and southern limit of intervention, left *in situ*	-	Top cist sides - 17.21 Grave base - 16.91
180	Burial of adult, extended, supine, oriented W-E, in long cist of side slab and part lid, disturbed while semi-articulated possibly by cist collapsing, recorded during underpinning of church, remains *in situ*	-	Grave cut 17.0-17.4
181	Stone slabs packed with cobbles of possible small cist oriented N-S, ?child burial, disappeared beyond western limit of intervention, cut Burial 131 and truncated cist Burial 179	-	Grave cut 17.3-17.6
182/3	Cist of side and end slabs (assigned Burial 182), no skeleton preserved although body stain recorded within cist backfill (assigned Burial 183), oriented broadly SW-NE	-	Grave base 16.8-17.0
184	Cist of part side slab, heavily truncated by later graves, disappeared beyond northern limit of intervention, likely oriented SW-NE	-	Slab 16.8-17.0
185	Cist of part side slab surviving repeated truncation by later graves	-	Slab 16.8-17.2

Ditch 20/F129=17/F100

A single non-burial feature can be assigned to this period of activity. Ditch 20/F129=17/F100 was identified cut into buried soil 20/C1384 and spanned both Intervention 17 and 20 disappearing beyond eastern and southern limits of excavation, but where excavated was recorded using indices of Intervention 20, so is hereafter 20/F129 (see Figure 7).

An 8.0m length of the ditch was excavated where it proved to consist of a narrow, steep-sided, linear cut deep into sand subsoil, oriented broadly west-east, measuring 0.75m wide. The base of the ditch was recorded at between 16.0-16.15mAOD representing a surviving maximum depth of *c*.0.55m. The fill system of the feature was relatively convoluted beginning with initial slumping of sand edges 20/C1359 followed probably swiftly by the insertion of a wood and part sandstone slab lining 20/C1345 and 20/C1344 (Figure 9; Plate 3). When sampled and processed by flotation 20/C1345 was found to contain a quantity of burnt wheat and barley (Appendix E); a carbonised barley grain from 20/C1345 was radiocarbon dated to AD540-660. This deposition was followed by an episode of collapsing edges of sterile sand creating 20/C1340 followed by another deposit of dark organic material, 20/C1337 which also produced charred cereals identified as wheat, barley, oat and rye



Ditch 20/F129 plan and section porfolio

Scale 1:25

Figure 9

(see Appendix E). Subsequent fills 20/C1326 and 20/C1324 consisted of redeposited sand and gravel subsoil and appeared to derive from the excavation of graves nearby and indeed into the partially backfilled and presumably partially visible feature. Graves which cut into 20/F129 were Burial 40, Burial 127 and Burial 149.

Plate 3 Period 1 ditch 20/F129, west-facing section showing lining C1345 and collapsed lid C1377

The function of 20/F129 is not altogether clear. The heights of the ditch base vary by only 0.15m along an 8.0m excavated length including some variation therein, so identification as a drain is not supported overwhelmingly by the recorded levels. Possible wood lining 20/C1345 may have been coupled with a wooden lid (20/C1377), which suggests the feature may represent a water conduit tapped into a natural spring providing water with some energy, rather than a drain, especially given that the natural drainage of this part of the site is exceptionally good. Both layers 20/C1345 and 20/C1337 yielded notable quantities of a variety of carbonised cereals suggesting processing of cereals nearby over a period of time. Period 1 burials were located to both sides of the feature and eventually into it.

3.2 PERIOD 2

3.2.1 Period 2 burials

The identification of Period 2 burials is reliant on the site-wide period concordance, wherein Period 2 is modelled as the monastic period with onset *c*.700AD supported by the structural sequence within Sector 2 and closes *c*.800AD with evidence for a fire across Sector 2 north. Within Sector 4 the Period 2 cohort was easily identifiable during excavation primarily as those burials which were truncated by, or lay below the depth of, the foundations for Church 2: 20/F73 (west), 17/F85 (east), 17/F2 (north) and 20/F63 (south). Burials without the immediacy of these stratigraphic markers were assigned to Period 2 by burial rite marked in many cases by stones placed at the head and simple unfurnished burials stratified beneath and among them with the exception of Burials 163, 169 and 170 whose radiocarbon results place them within Period 1.

Several Period 2 (and some Period 3) burials were furnished with stone slabs set near the head. Some well-preserved examples consisted of two slabs to either side of the head with a covering slab enclosing the head, hereafter head box burials. Other settings consisted of two slabs to the sides of the head, but where disturbance could be invoked are recorded as probable head box burials. Nine Period 2 burials are confidently identified as furnished with a head box with a further four probable head boxes out of a total of 19 burials with head slabs. Other variants also appeared to be represented however, with one individual being furnished with larger slabs supporting the head and torso down to the elbows. Others were so poorly preserved that the original rite could not be read and are recorded simply as head slab burials with one exception who had a slab placed over the head and upper torso with no other slabs.

Stratigraphic relationships with features assigned to Period 1 included long cist Burials 149 and 162 cut by head box Burial 125, as well as ditch 20/F129 being cut by head box Burial 40, and simple Burials 43 and 127. Burials assigned to this phase of burial are summarised in Table 3. Radiocarbon dating suggests that head box burial began as early as the early 7th century and was still being used into the 11th or Period 3; simple inhumation began during Period 1, persisted throughout Period 2 and into Period 3 (see Appendix B).

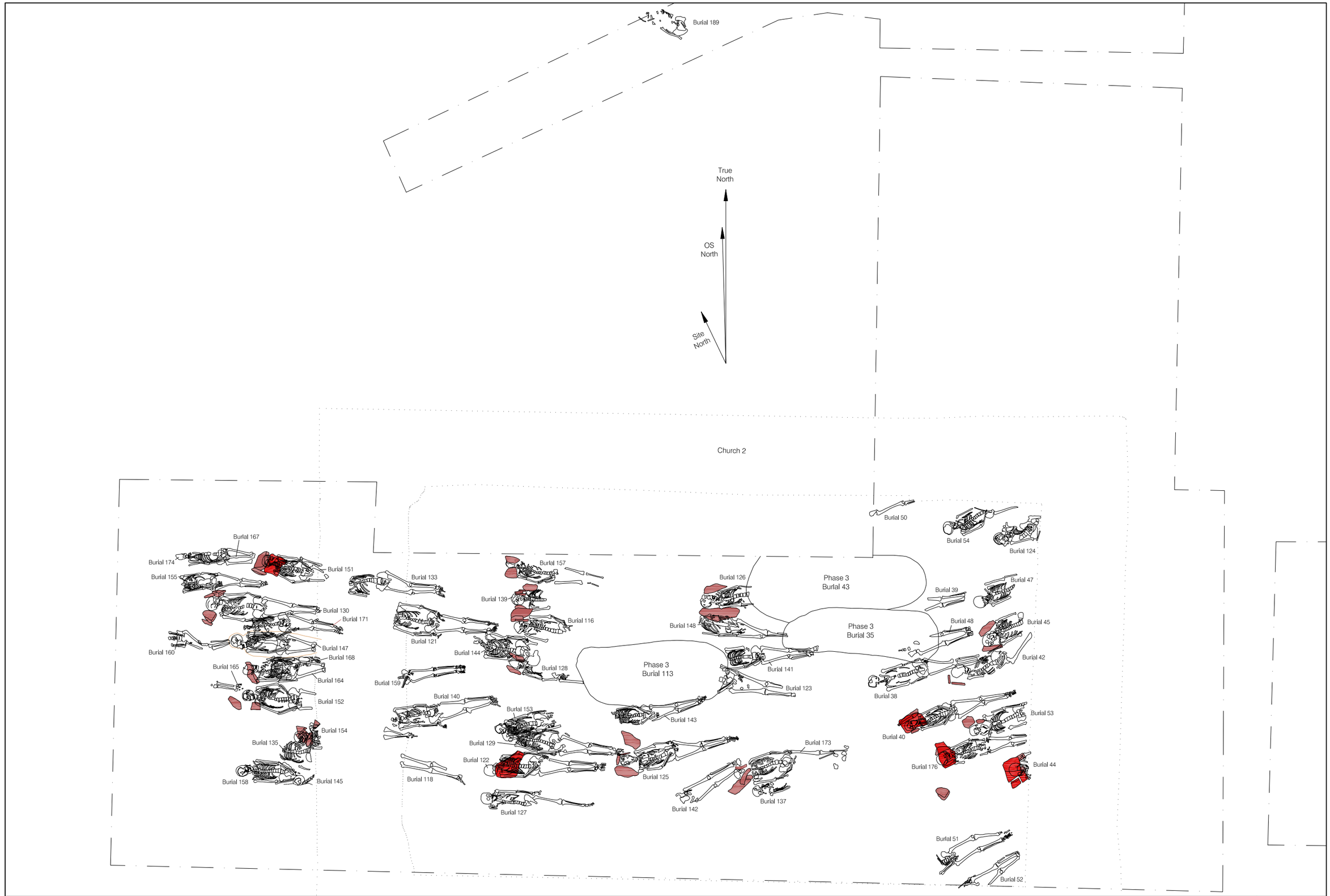
Period 2 burials were interred within an accumulating sand and gravel cemetery soil, primarily a redeposited glacial subsoil, assigned 20/C1064 with analogues 20/C1068, 20/C1215, 17/C1203, 17/C1231 and 17/C1291. This layer appears to have begun developing during Period 1 burial (see Figure 5). Patches of a buried soil were recorded as having been cut by the foundations for Church 2 and this has been modelled accordingly as a buried soil which developed over 20/C1064 following the disuse of the Period 2 cemetery implying a hiatus in burial corroborated broadly by radiocarbon determinations. This buried soil was assigned as 20/C1191, 20/C1217, 20/C1298, 17/C1051, 17/C1202, 17/C1240, 17/1244; 17/C1257 and 16/C1007. Recorded AOD data for this horizon were between 17.2m and 17.6mAOD. The recorded depth of Period 2 graves lay between 16.5mAOD and 17.3mAOD.

Period 2 cemetery plan and organisation

A total of 55 Period 2 burials have been identified and were distributed across the area of intervention including an inhumation within Intervention 16 (Figure 10). The intrusion of the foundations of Church 2 accounts for interruption of many Period 2 burials and further truncation and loss took place during the excavation of deep, late Period 4 burials within the nave of Church 4, which again accounts for gaps in the burial plan. Indeed, most truncation of Period 2 burials can be attributed to Period 4 activity, while by contrast during Period 2 and into Period 3 there is clear evidence for ordered burial marked at the surface. In favour of this, 13 small cross-slabs, possible grave markers, are represented within the corpus of sculpture from Sector 4. One marker in particular, TR25, is the only example potentially recovered from an original context (Plate 4). This slab, incised with a crude, simple cross was recovered from 16/C1008 identified as a likely buried ground surface for the Period 2 cemetery at between 17.3 and 17.5mAOD.

Plate 4 TR25 (scale 10cm)

Several other features of burial distribution argue for graves being marked within the Period 2 cemetery. Notwithstanding agents of disturbance, a notable concentration of burials is present in the northwest corner of Intervention 20 representing 12 Period 1 and 2 interments within an area of *c*.3.5m^2 initiated by the deep Period 1 simple inhumation Burial 170. It is possible that there was a feature within the cemetery which provided a focus for these burials, perhaps even Burial 170 itself. It may be significant that this cluster is situated to the immediate north of the Period 1 long cist burial cluster. The close and layered interments in the Period 2 group often left preceding burials undisturbed, but were sometimes so close that mere centimetres separated articulated bones, particularly at the elbows of adjacent burials. This apparent knowledge of the layout and organisation of burial plots persisted into Period 3, so much so in fact that two Period 3 inhumations, Burial 136 and Burial



Period 2 burials

Scale 1:50

Figure 10

156 appeared to represent a double interment, which could easily be an artefact of the trend for fastidiously careful burial (Plate 5). Elsewhere within the distribution of Period 2 burials, careful tight-knit rows are present.

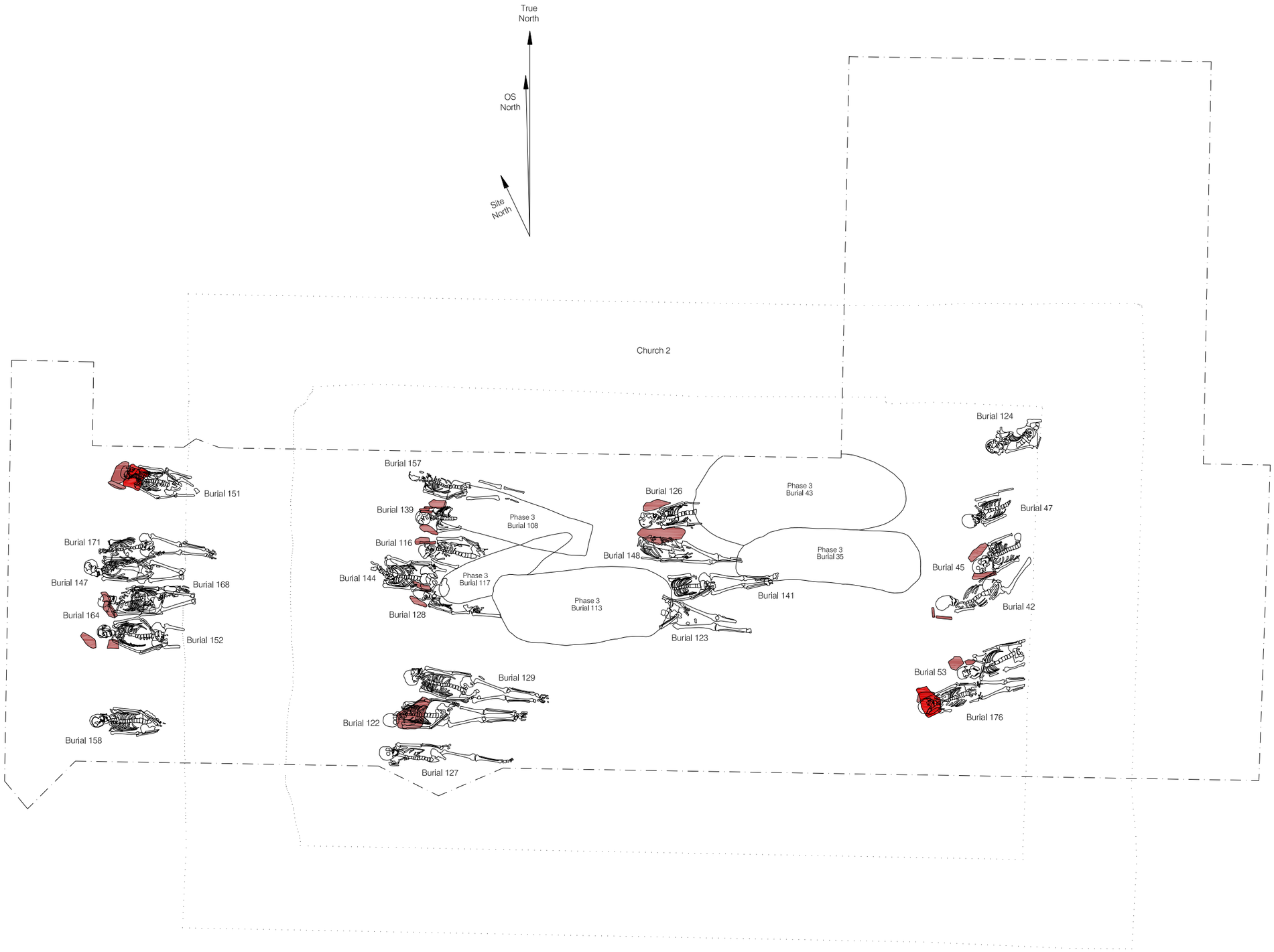
Plate 5 Period 3 double Burial 136 (right) and 156 (scale 1.0m)

The cemetery plan shows that individuals in these rows were not only interred very close together, but also that where truncation did take place it was often superficial, graves were sometimes truncated only slightly horizontally or laterally, or only toes were lost or the feet of later burial oversailed the skull of an earlier row (see Figure 10; Figure 11). This cemetery organisation is displayed best in the following burials, from south to north, Burial 127, 122, 129, 128, 116, 139 and 157, and Burial 158, 152, 164, 168, 147, 171, Period 3 Burial 156 and 136, with another possible row in Burial 123, 141, 148 and 126, although in some areas of the burial ground this practice appears to break down over time with later Period 2 burials deviating from the original order.

The proximity and apparent crowding of the Period 2 cemetery is also noteworthy suggesting the cemetery was contained by fixed boundaries. The northernmost burial, Burial 189, located within Intervention 16 on a notably skew alignment may lie outside the main burial area, since subsoil was exposed for the continuation of the trench and no further Period 2 burials were exposed. The free section provided through natural subsoil to a depth of 17.0mAOD provided by Period 4 Mackenzie grave did not expose or clearly truncate further Period 2 burials in this position. This suggests the crowded rows of burial did not extend much further north. Likewise, Intervention 22 encountered strata belonging to non-cemetery activity and where subsoil was exposed, no burials were identified suggesting the southern boundary of the Period 2 cemetery also lay nearby between the bounds of Intervention 17/20 and Intervention 22.

A total of 19 burials Period 2 have been identified with stones placed at the head and a few surviving examples which included a head-cover slab suggest that the head box rite had been the original furnishing employed in the cemetery (Figure 12; Plate 6). Head box burials were distributed throughout the excavated area and through the sequence of Period 2 burial. Overall, however, burial rite was dominated by simple, unfurnished, supine, extended inhumation accounting for 34 Period 2 interments (Figure 13), although many articulated skeletons had lost the head and upper torso to later truncation and could have originally been furnished with a head support (see Figure 9). These simple inhumations were stratified frequently among burials with head boxes. Some deviation from the simple and head box burial was noted: Burial 122 was provided with a single stone slab covering the region of the lower face and upper torso; Burial 147 appeared to have been buried within an anthropomorphic, organic matrix which was analysed and identified as highly humified

Plate 6 Period 2 Burial 40 with head box cut into Period 1 ditch 20/F129 (scale 1.0m)



Rows of burial within Period 2 cemetery

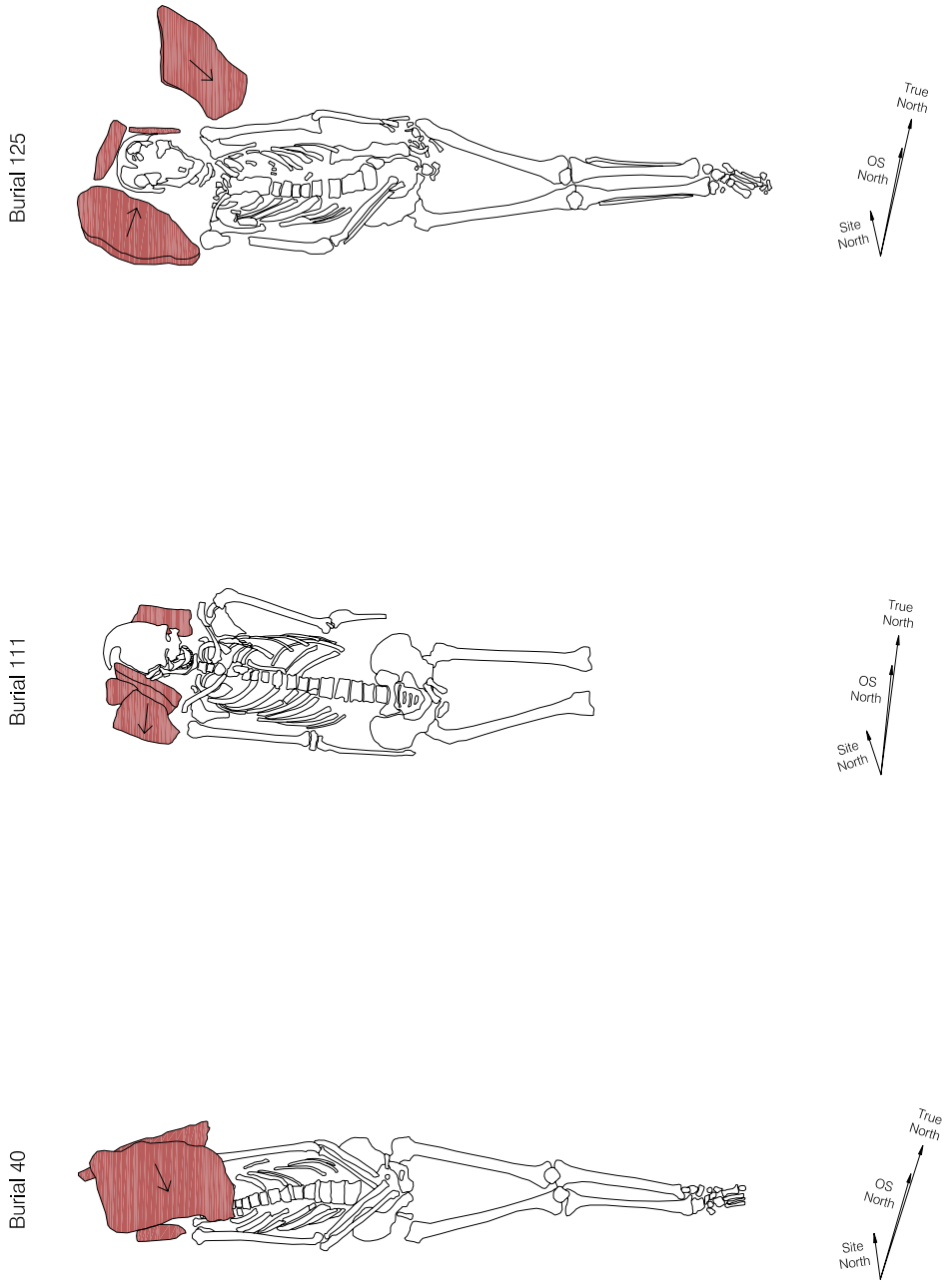
Scale 1:50

Figure 11

Study of head setting burials

Scale 1:20

Figure 12

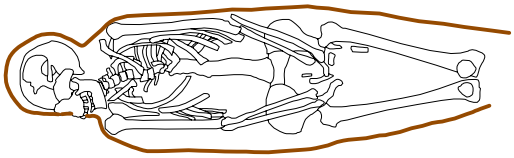


Study of simple and variant burial rites

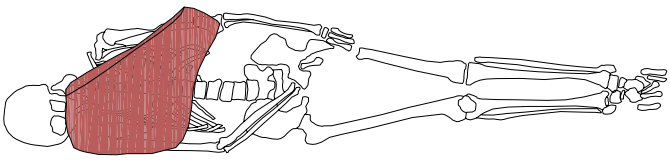
Scale 1:20

Figure 13

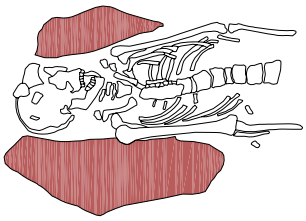
Burial 147



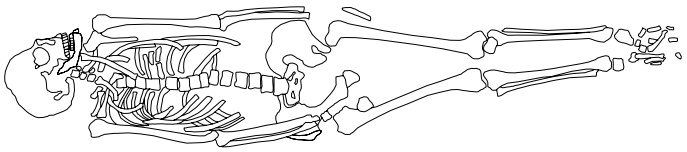
Burial 122



Burial 126



Burial 129



organic remains, possibly wood or wicker (Plate 7; see Figure 13; see Appendix E). Some Period 2 burials were noted during excavation as shrouded and examination of burial photographs and body position has allowed the identification of further examples. In total, 13 shrouded and eight probably shrouded burials have been identified within Period 2. The evidence for shrouded burial consisted of signs of bodily constraint in burial position, notably constrained upper body particularly shoulders and arms and lower limbs positioned unnaturally close together at the knees and feet. Both simple inhumations and head box burials included shrouded individuals.

Plate 7 Period 2 Burial 147 showing possible wood or wicker matrix (scale 1.0m)

Period 2 burials were characterised by greater uniformity of orientation being close to true west-east. This was noted against the more variable orientation of Period 1 burials and was indistinguishable from the later orthodoxy of medieval burial orientation. Within the Period 2 burials, organised burials in rows appeared to conform closely to a west-east orientation with later interments often deviating slightly. Period 2 burials at the eastern limit of intervention hinted at a group deviation in orientation closer to WSW-ENE than west-east. Again this may have been influenced by increasing proximity to a feature within the cemetery. The location of a 'Danish Cross' on the first edition OS was marked 14m to the east of these burials.

The demographics of this group breaks down into 47 males or probable males and three females (including two probable females) with three undetermined adults and a single Period 2 burial pending analysis. A single child of 10-14 years was interred in the cemetery. The age at death of the male burials consisted of 21 individuals aged over 46 years and 19 between 26 and 45 years, or a total of 40 individuals aged over 26 years. Four individuals younger than 26 years were included with three defined only as adult males. It may be significant that two of the females were interred side-by-side within the dense northwestern zone.

Strontium and oxygen stable isotope analysis of five Period 2 individuals suggested that they could have been of local origin with one individual possibly originating in the Cairngorms. Preliminary results from the first phase of isotopic analysis are held in the project archive; analysis of more Period 2 individuals is ongoing.

In addition to information relating to diet deriving from osteological analysis, ongoing dietary (carbon and nitrogen) isotopic analysis of individuals at Tarbat has demonstrated that Period 2 individuals relied primarily on terrestrial foodstuffs (Curtis 2010; forthcoming). Analysis of dental calculus of Period 2 burials, Burial 127 and 144, identified starch granules from wheat, oat and barley. This analysis targeted 15 individuals and was undertaken as part of a Masters dissertation by Becca Walters, University of York, a full copy of which is held in the project digital archive.

Table 3 Period 2 burials

Burial	Description	C14 date	AOD height (m)
38	Burial of male, 46 years+, extended, supine, probably shrouded, oriented W-E, overlay head slab Burial 42 and cut by head box Burial 45	-	Sacrum - 16.6 Tibia - 16.8
39	Burial of adult, probable male, extended supine, oriented W-E, represented by lower legs only, cut by Burial 47	-	Tibia - 16.8
40	Burial of male, 26-45 years, extended, supine, shrouded, oriented WSW-ENE, furnished with head box, cut into Period 1 ditch 20/F129	-	Skull - 16.6 Sacrum - 16.5 Tibia - 16.5
42	Burial of male 46 years+, extended, supine, furnished with head side slab, overlain by Burial 38, later truncated by Burial 45	-	Skull - 16.8 Sacrum - 16.9
44	Burial of probable male, 46 years+, extended, supine, skull and upper torso only, oriented W-E, furnished with head box, cut by Church 2 east wall foundation 17/F85	-	Skull - 16.8
45	Burial of male, 46 years+, extended, supine, oriented WSW-ENE, furnished with head box, overlay Burial 38	-	Skull - 16.8 Sacrum - 16.6
47	Burial of male 26-45 years, extended, supine, oriented WSW-ENE, cut by Church 2 east wall foundation 17/F85	-	Skull - 16.9
48	Burial of probable male, 26-45 years, extended, supine, oriented WSW-ENE, represented by lower legs, minus feet cut by head box Burial 45, later truncated by deep Period 4 Burial 35	-	Tibia - 16.9
50	Burial of adult, extended, supine, oriented W-E, represented by upper right leg only, disappeared beyond northern baulk, truncated by Period 3 Burial 1	-	Tibia 17.0
51	Burial of probable male, 26-45 years, extended, supine, oriented SW-NE represented by lower right arm, lower torso and legs, truncated to west by Church 2 south wall 20/F62	-	Sacrum - 16.7 Tibia - 16.7
52	Burial of male, 46 years+, extended, supine, shrouded, oriented SW-NE aligned with Burial 51, cut by Church 2 east wall 17/F85 and south wall 20/F63	-	Tibia - 16.7
53	Burial of male, 46 years+, extended, supine, furnished with (disturbed) head slab, oriented WSW-ENE, cut into Period 1 ditch 20/F129, cut by head box Burial 176	-	Skull - 16.8 Sacrum - 16.6
54	Burial of male, 17-25 years, oriented WSW-ENE, legs cut by 17/F72 foundation trench of north wall of Church 2	-	Skull - 16.83
116	Burial of male, 26-45 years, extended, supine, furnished with (disturbed) head box, oriented broadly west-east, cut by Burial 117, cut Burial 144	AD680-880	Skull - 17.1 Sacrum - 16.8
118	Burial of adult, probable male, represented by legs	-	Tibia - 17.2
121	Burial of male, 26-45 years, extended, supine, oriented west-east, preceded Period 2 Burial 144, head truncated later by Church 2 west wall 20/F73	-	Sacrum - 16.9 Tibia - 16.9
122	Burial of male, 46 years+, extended, supine, probably shrouded, furnished with slab covering lower face and torso, oriented W-E aligned with Burial 127 and 129	-	Skull - 17.1 Sacrum - 16.8 Tibia - 16.9

Burial	Description	C14 date	AOD height (m)
123	Burial of male, 46 years +, extended, supine, oriented broadly W-E, postdated Burial 141	-	Sacrum - 16.7 Tibia - 16.8
124	Burial of male, 17-25 years, extended, supine, oriented WSW-ENE, disturbed and repositioned while partially articulated, later cut by Church 2 east wall 17/F85	-	Skull - 16.8 Sacrum - 16.7
125	Burial of male, 46 years+, extended, supine, oriented WSW-ENE, furnished with probable head box and shrouded, postdated Period 1 cist Burial 149 and may have reused robbed stones from cist for head setting, also cut Period 2 Burial 129 but did not disturb it	-	Skull - 17.0 Sacrum - 16.9 Tibia - 16.9
126	Burial of probable male, 46 years+, extended, supine, oriented W-E, furnished with head support, postdated Burial 148 but did not disturb it	-	Skull - 16.8 Sacrum - 16.7
127	Burial of probable female, 46 years +, extended, supine, oriented W-E aligned with Burial 122 and 129, disappeared beyond southern baulk	-	Skull - 16.8 Sacrum - 16.6 Tibia - 16.7
128	Burial of probable male, 46 years+, extended, supine, oriented W-E, furnished with probable head box, postdated by Burial 144 but not disturbed by it, later truncated by Burial 117	AD640-770	Skull - 17.1 Sacrum - 16.8
129	Burial of probable male, 17-25 years, extended, supine, shrouded, oriented W-E, aligned with Burial 127 and 122, postdated but not disturbed by Burial 125 and 153	AD670-880	Skull - 16.9 Sacrum - 16.7 Tibia - 16.8
130	Burial of male 26-45 years, extended, supine, probably shrouded, oriented W-E, furnished with head box, buried in dense northwest zone, postdated Burial 171 but did not disturb it, postdated by double Burial 136/156 but not disturbed by them	AD660-780	Skull - 17.3 Sacrum - 17.20 Tibia 17.10
133	Burial of probable male, 46 years+, extended, supine, probably shrouded, oriented W-E, truncated by Church 2 west wall 20/F73	-	Sacrum - 16.9 Tibia - 16.8
135	Burial of adult, 26-45 years, sex undetermined, extended, supine, oriented W-E, postdated head box Burial 154, cut by Church 2 west wall 20/F73	-	Sacrum - 17.3
137	Burial of male, 26-45 years, extended, supine, oriented W-E, furnished with head slab, cut by head box Burial 173	-	Skull - 17.0
139	Burial of male, 46 years +, extended, supine, oriented W-E, furnished with probable head box, postdated by head support Burial 157	-	Skull - 17.0
140	Burial of male 17-25 years, extended, supine, probably shrouded, oriented broadly W-E, postdated head box Burial 154	-	Sacrum - 16.9 Tibia - 16.9
141	Burial of male, 26-45 years, extended, supine, shrouded, oriented W-E, post-dated by Burial 123, later truncated by Period 4 Burial 113	-	Sacrum - 16.6 Tibia - 16.7
142	Burial of male, 46 years+, extended, supine, oriented SW-NE, post-dated head box Burial 173	-	Sacrum - 16.9 Tibia - 17.0
143	Burial of male, 46 years+, extended, supine, shrouded, oriented W-E, post-dated by head box Burial 111	-	Sacrum - 16.8 Tibia - 16.8
144	Burial of male, 46 years+, extended, supine, oriented W-E, post-dated by Burial 116 but not disturbed by it, later truncated by Burial 117	AD680-890	Skull - 17.1 Sacrum - 17.0

Burial	Description	C14 date	AOD height (m)
145	Burial of probable male, 26-45 years, extended, supine, oriented W-E, disappeared beyond southern baulk, cut Burial 158 and cut by Church 2 west wall 20/F73	-	Skull 17.1
147	Burial of male, 26-45 years, extended, supine, oriented W-E, furnished with anthropomorphic cover, cut toes of Burial 160, lower legs cut away by Church 2 west wall 20/F73	AD720-960	Skull - 17.3 Sacrum - 17.10
148	Burial of male, 46 years+, extended, supine, probably shrouded, oriented W-E, cut by head box Burial 126, truncated later by Period 4 burial	-	Sacrum - 16.8 Tibia - 16.9
151	Burial of male, 46 years+,extended, supine, shrouded, oriented W-E, furnished with head box, post-dated Burial 155, 167 and 174 in dense northwestern zone, predated double Burial 136 and 156, later truncated by Church 2 west wall 20/F73	-	Skull - 17.1 Sacrum - 16.9
152	Burial of male, 26-45 years, extended, supine, oriented W-E, furnished with head slab, blade wound, aligned with and very close to head box Burial 164	AD780-1000	Skull - 17.2 Sacrum - 17.1
153	Burial of male, 26-45 years, extended, supine, shrouded, oriented slightly towards WSW-ENE, postdated Burial 129, cut by head box Burial 111	AD650-780	Skull - 17.1 Sacrum 16.9
154	Burial of male, 26-45 years, extended, supine, shrouded, oriented W-E, furnished with head box, post-dated Burial 140, later cut away through torso by Church 2 west wall 20/F73	-	Skull - 17.1
155	Burial of female, 46 years+, extended, supine, shrouded, oriented W-E, post-dated Burial 170, postdated by head box Burial 151 but not affected by it in dense northwestern zone, buried adjacent to female Period 2 Burial 174	-	Sacrum - 17.0 Tibia - 17.0
157	Burial of male, 26-45 years, extended, supine, oriented W-E, furnished with probable head box	-	Skull - 17.0 Sacrum - 16.8 Tibia - 16.8
158	Burial of male, 46 years+, extended, supine, shrouded, oriented W-E, blade wound, aligned with row of Period 2 burials, cut by Burial 145	AD680-900	Skull - 17.1 Sacrum - 16.9
159	Burial of child, 10-14.5 years, extended, supine, oriented W-E, aligned with Burial 140 and 121, cut by Church 2 west wall 20/F73	-	Sacrum - 16.9 Tibia - 16.9
160	Burial of probable male, 46 years+, slightly flexed, supine, probably shrouded, oriented W-E, predated Burial 169 and beneath Burial 147 in dense northwestern zone, disappeared beyond western limit of intervention	AD680-880	Sacrum - 17.1 Tibia - 17.1
164	Burial of male, 26-45 years, extended, supine, shrouded, oriented W-E, furnished with head box, aligned with head box Burial 152, cut away by Church 2 west wall 20/F73	-	Skull 17.2 Sacrum - 17.0
165	Burial of adult, sex undetermined, supine, extended, oriented W-E represented only by lower legs, post-dated Burial 163, post-dated by head box Burial 152	AD650-780	Tibia - 16.9
167	Burial of probable male, adult, extended, supine, oriented W-E, represented by part right side, early burial in dense northwestern zone post-dated by Burial 174	-	Sacrum - 16.8

Burial	Description	C14 date	AOD height (m)
168	Burial of probable male, 26-45 years, extended, supine, oriented W-E, predated head box Burial 164	-	Sacrum - 16.9
171	Burial of male, 26-45 years, extended, supine, oriented W-E, post-dated Burial 169 and post-dated by head box Burial 130	AD660-850	Sacrum - 16.9 Tibia -16.9
173	Burial of male, 46 years+, extended, supine, furnished with head box, oriented W-E, cut Burial 137, post-dated by Burial 142	-	Skull - 17.0 Sacrum - 16.7
174	Burial of probable female, adult, extended, supine, shrouded, oriented W-E, post-dated Burial 167, post-dated by head box Burial 151, buried adjacent to female Period 2 Burial 155	-	Skull - 17.1 Sacrum - 17.0
176	Burial of probable male, 26-45 years, extended, supine, probably shrouded, furnished with head box, oriented WSW-ENE aligned with Burial 53, 42, 45, 47 and 124, cut by Church 2 east wall 17/F85	-	Skull - 16.9 Sacrum - 16.7
189	Burial, extended, supine, oriented NW-SE, encountered within Intervention 16 cut into subsoil covered with buried soil, analysis of skeleton pending	-	Skull - 17.55 Sacrum - 17.35

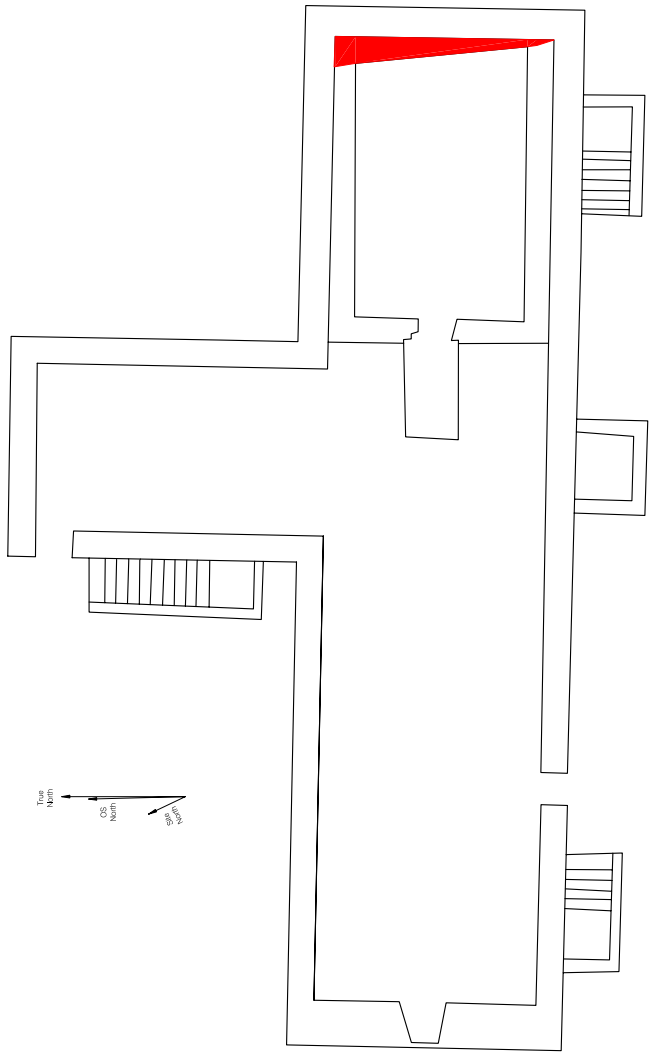
3.2.2 Church 1

No structural remains can be linked stratigraphically to the Period 2 burials and there is no direct evidence for an early church. However, the presence of a putative Church 1 could be implied based on the alignment of the east wall of the crypt 19/F3, which differs from the west, north and south walls of the crypt and the walls of Church 2 and succeeding churches (Figure 14). It is possible that 19/F3 represents a remnant of structure earlier than Church 2. Other fragments of sculpture are of a scale sufficient to suggest large architectural pieces which may have been situated within a church building, such as stone panels TR 13, 17, 28/35, possible shrine post TR27, and possible sarcophagus lid TR22.

A full discussion including possible models for Church 1 can be found in the Field Report (see Section 3.3.4 The Form of Church 1).

3.3 PERIOD 3

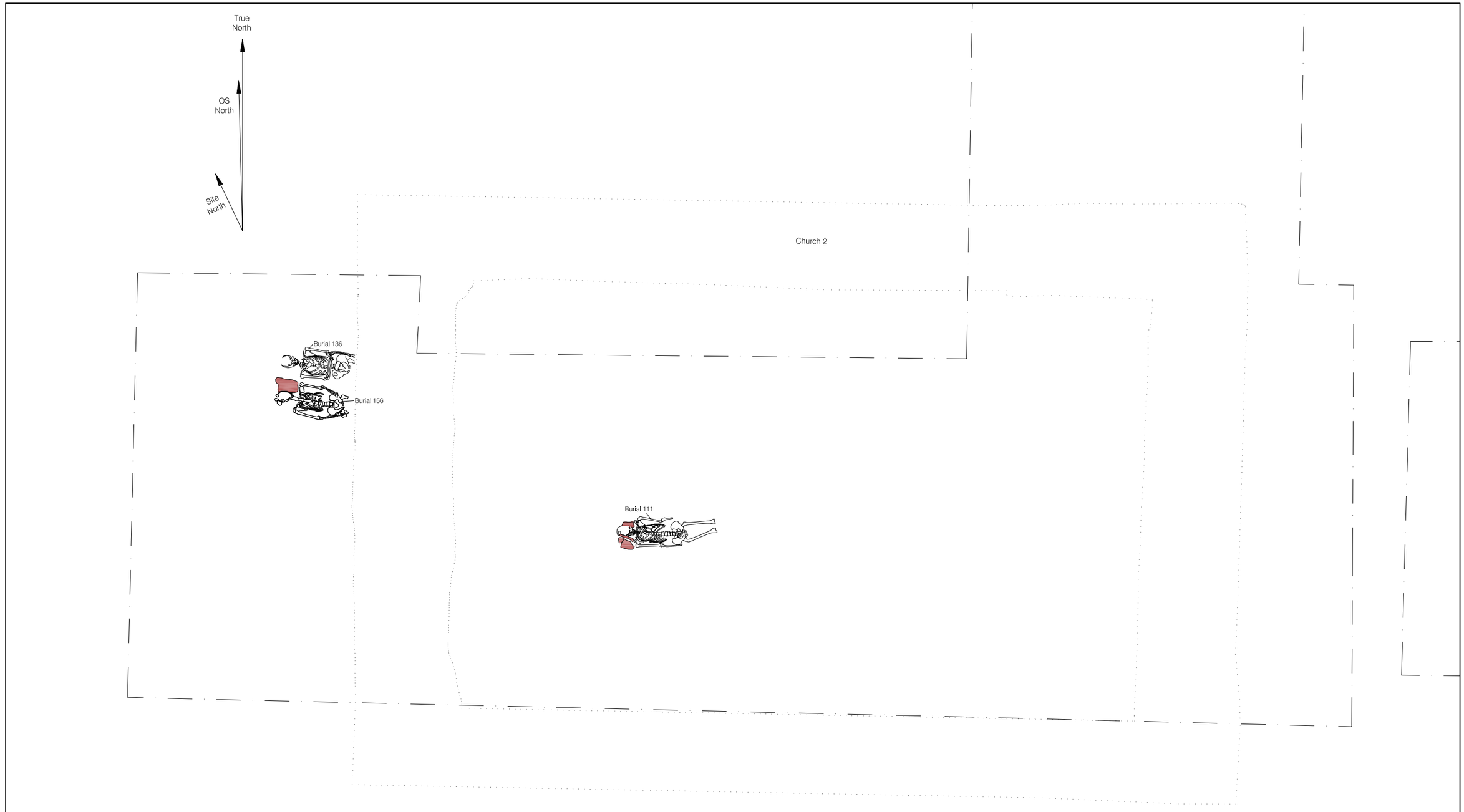
Like Period 2 the parameters of Period 3 are modelled based on activity within Sector 1 and 2 with onset marked by evidence for a site-wide fire across Sector 2 north *c*.800AD and glimpsed briefly within Sector 4 in Intervention 22 where a layer of intense burning like that observed within Sector 2 was observed (22/C1022; see Figure 6). This event is modelled to have taken place in the early 9th century and burials within Sector 4 which wholly post-date this but otherwise conform to Period 2 rite and demographic are assigned to Period 3 (Figure 15). The radiocarbon date range of some Period 2 burials suggest some late interments might belong with this cohort. Within Sector 2 evidence for activity post-1100AD is absent which is broadly supported by the determinations of the definite Period 3 burials. Head box burial was also in use during Period 3 and although the group is only represented by three individuals they were all male aged over 26 years.



East wall of crypt 19/F3 showing skew alignment

Scale 1:200

Figure 14



Period 3 burials

Scale 1:50

Figure 15

Table 4 Summary of Period 3 burials

Burial	Description	C14 date	AOD height (m)
111	Burial of male, 26-45 years, extended, supine, furnished with head box, oriented W-E, cuts Period 2 Burial 143 and Burial 153	AD1020-1210	Skull - 17.2 Sacrum - 16.9
136	Burial of male, 46 years+ in possible double burial with Burial 156, extended, supine, oriented W-E, in dense northwest zone, postdated but did not disturb head box Burials 130 and 151, cut by Church 2 west wall 20/F73	AD970-1040	Skull - 17.0
156	Burial of male, 26-45 years, extended, supine, oriented W-E, furnished with head box, possible double burial with Burial 136 although recorded heights are 0.20m higher	AD970-1040	Sacrum - 17.2

3.4 PERIOD 4

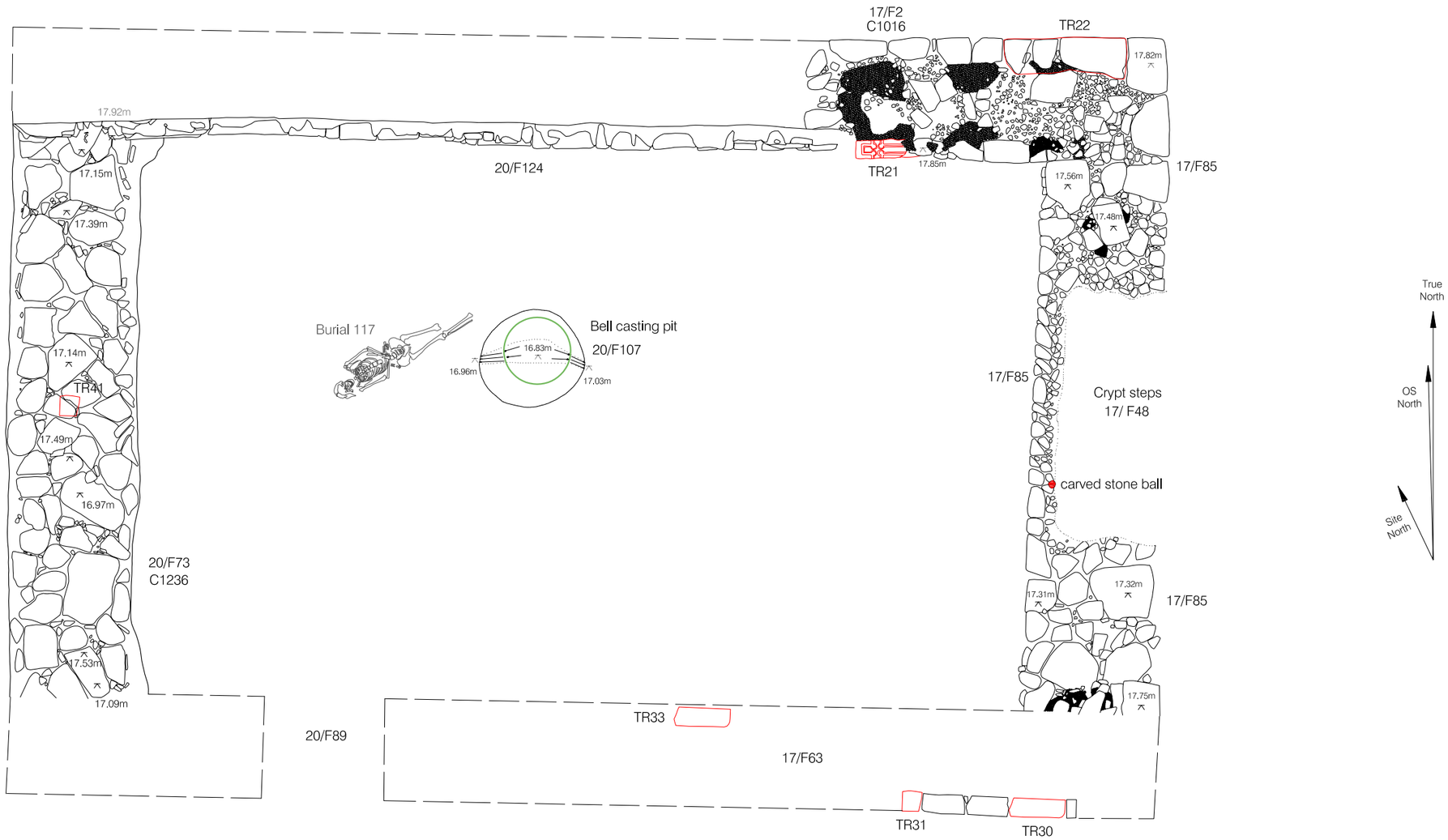
Period 4 follows evidence for a hiatus supported by resumption of activity within Sector 1 and 2 and marks a sea change in activity within Sector 4 and has been assigned to the first medieval parish church established at the site. The evidence for Church 2 suggests a simple single-cell church with a south door, furnished with a belfry, and whose internal walls were plastered and lime-washed. Radiocarbon targets for this period of activity are few, since the church does not appear to have received burial with a single possible exception: Burial 117, radiocarbon dated to AD1150-1270 (cal 95%), although the burial could predate the construction of Church 2. Unidentified charcoal from a bell-casting pit of Church 2/3 20/F107 returned a date of AD1040-1260, but may not be a reliable sample. The form of Church 2 is parallelled in other Scottish churches no earlier than the 12th century.

3.4.1 Church 2

Church 2 represents the construction of a simple, single-cell stone building (Figure 16). The wall foundations for Church 2 were recorded as cutting through a layer of rubble 20/C1297, which overlay remnants of a buried soil thought to have developed over the Period 2/3 cemetery, 20/C1191, 20/C1217, 20/C1298, 17/C1051, 17/C1202, 17/C1240, 17/1244 and 17/C1257.

The principal components of Church 2 were assigned as follows: east wall foundation 17/F85 (17.4mAOD); north wall foundation 17/F72 and part elevation 17/F2=20/F124 (top of surviving fabric in elevation, 18.2mAOD); south wall foundation and part elevation 17/F63= 20/F89 (top of surviving fabric in elevation, 18.2mAOD); west wall foundation 20/F73 (17.5m AOD)(see Figure 15). Further elements of the south walls of Church 2 were encountered during Intervention 18 where excavation revealed it within the south vestry during its conversion to a toilet. Together, these walls defined a building measuring *c*.11.5m east-west x 8.0m north-south externally with an internal footprint of 9.0m east-west x 5.5m north-south.

The construction technique for the walls of Church 2 consisted of deep foundation trenches measuring up to 0.5m, filled with unbonded, closely interlocking beach cobbles and waterworn sandstone blocks overlain by a course of mortar-bonded, thin rectangular slabs which received the first course of elevation formed of large,



Plan of Church 2

Scale 1:50

Figure 16

carefully squared blocks of yellow sandstone (Plate 8). Where the external elevation of 17/F63 was exposed within the south vestry the upper course of foundation could be seen to step out from the elevation (Plate 9). Inspection of the sandstone blocks of the elevation of Church 2 suggested the stone had been sourced in the Portmahomack to Tarbatness area (Appendix F).

Plate 8 Church 2 south wall foundation and elevation 17/F62 and F63 (scale 1.0m)

Something of the internal arrangement and appearance of Church 2 can be surmised from the few features assigned to the building. The doorway for Church 2 was located 1.3m from the internal west end of the south wall and was visible as blocked lower door jambs over an *in situ* threshold stone (20/F89 C1212 and C1253) visible in, and integral with, the north elevation of south wall 17/F63=20/F89; the threshold lay at *c*.18.0mAOD (Figure 17; Plate 10). The yellow sandstone blocks forming the elevations of Church 2 both inside and out were remarkably carefully shaped and very tightly jointed demonstrating highly accomplished masonry. Geological inspection of the threshold stone identified it as an extremely fine grained sandstone, which may have been sourced differently from the stone used in the elevations and may originate from the south side of the Tarbat peninsula (see Appendix F).

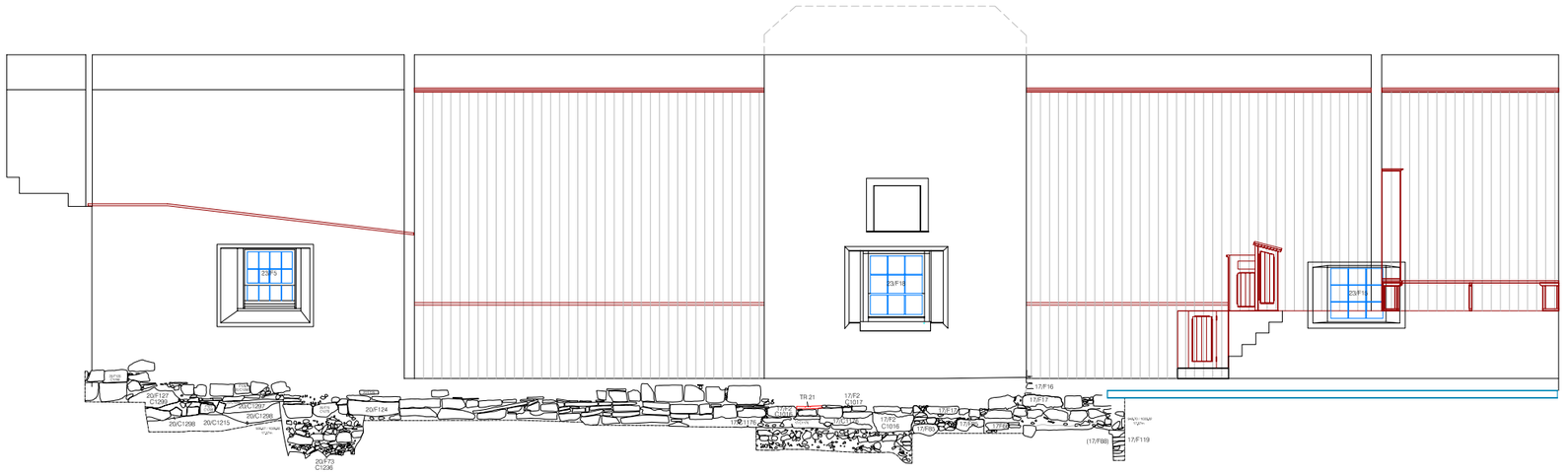
Plate 9 Church 2 south wall 17/F63 external elevation and foundation

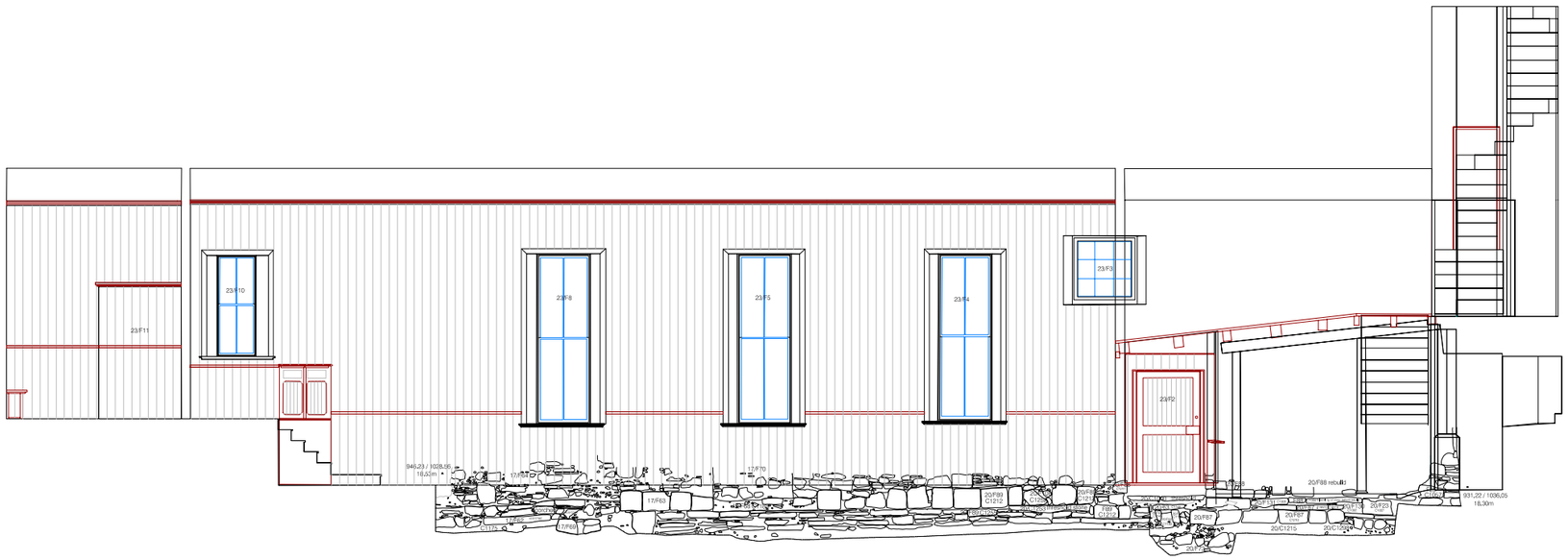
It is noteworthy however that internally the remains of the slab foundations of Church 2 are recorded as being partially covered with a smoothed, white plaster (17/F2 C1176) down to *c*.17.5mAOD (see Figure 17; see Plate 9). Indeed, stonework forming the slab foundation elevations had at some stage been tooled roughly on the diagonal, possibly to aid the adhesion of wall plaster. The internal upper course of the foundation of 17/F2 also become scorched by heat at *c*.17.7mAOD again suggesting that it was exposed at least to that level at the time of the fire. The change in height from the threshold at 18mAOD to the level of exposed foundations at *c*.17.6mAOD suggests the original floor level of Church 2 was sunken.

Plate 10 Church 2 threshold 20/F89 and its blocking 20/F108 set in south wall 17/F63=20/F88 (scale 1.0m)

Sculpture in fabric of Church 2

A total of six pieces of reused sculpture have been identified within the make-up of Church 2 being five cross-slab grave markers or fragments thereof and a larger architectural piece (see Figure 16; Table 5). Without exception these fragments were recovered from the slab course of Church 2 foundations. An early Bronze Age





North and south internal elevations of St Colman's church

Scale 1:100

Figure 18

carved stone ball was also recovered from 17/F85.

Table 5 Summary of sculpture reused in fabric of Church 2

Identifier	Description
TR21	Small cross-slab grave marker
TR22	Sarcophagus lid
TR30	Small visible fragment of cross-slab grave marker with hollow-armed cross built into south wall 17/F63
TR31	Small visible fragment of cross-slab grave marker with hollow-armed cross built into south wall 17/F63
TR33	Small cross-slab grave marker with pelleted cross with flared terminals
TR 41	Small fragment of cross-slab grave marker showing part of hollow-arm of cross recovered from 20/F73 C1175

Bell-casting pit 20/F107

A bell-casting pit 20/F107 was identified among the few features internal to Church 2 and truncated two Period 2 burials, Burial 141 and 148. Associated pit features 20/F78, 20/F85, 20/F91 and 20/F92 contained fills comprising ash, charcoal and bronze droplets. 20/F107 was itself defined in a much truncated state having been cut away by Period 4 burials Burial 81, 90 and 150 (Plate 11). The remnants of the feature suggested a pit measuring *c*.1.0m in diameter and the base of the feature in relation to the postulated internal floor level of Church 2 (*c*.17.5mAOD) suggested a reconstructed depth of *c*.0.7m for the feature, while the internal diameter of the base of the pit suggests a diameter of *c*.0.6m for the cast bell. The feature itself was filled with 20/C1220, which produced several bell cope mould fragments and flotation of the fill recovered small droplets of bell metal. Charcoal recovered from the pit fill by flotation was submitted for radiocarbon dating and returned as AD1040-1260.

Plate 11 Bell-casting pit 20/F107 (scale 0.25m)

3.4.2 Burial in Church 2

Burial 117 may have been buried within Church 2 but this is by no means clear. Burial 117 was interred on a NW-SE orientation and markedly deviant from preceding Period 2/3 and proceeding Period 4 burial. The burial cut Period 2 head box Burial 116 and also punctured through two further Period 2 burials Burial 128 and 114. The burial itself has apparently been laid out with some care with the arms crossed neatly over the lower torso (see Figure 16; Plate 12). The burial has been radiocarbon dated to AD1150-1270 and lay at *c*.16.9mAOD being *c*.0.6m below the

Plate 12 Burial 117 (scale 1.0m)

postulated floor level of Church 2. Burial 117 was subsequently cut by Period 4 Burials 141 and 148 which truncated the lower legs of the burial.

Burial 117 was identified as a male aged 17-25 years, and had three cut marks on his skeleton, one on the back of the skull and two on the back of the femurs. There was no evidence of healing suggesting that the wounds were fatal; the position and nature of the cuts suggested a violent attack from behind, with a sharp weapon such as a sword (see Appendix C).

3.4.3 Church 3

Church 3 was identified by, and limited to, structural activity at the east end of Church 2; the activity does not signal the end of Church 2, but represents alterations to it. The remains of two parallel walls oriented west-east measuring a maximum of 1.35m in length, cut by the west crypt wall of Church 4 were identified abutting the exterior elevation of Church 2 west wall 17/F85. Again, these structural changes and associated features allow something of the form and interior of Church 2/3 to be reconstructed.

The two walls were assigned 17/F66 (north wall) and 17/F69 (south wall), and were exposed as rubble foundations lying at *c*.17.4m and *c*.17.5mAOD respectively upon removal of a thin layer of sand signalling preparation for the construction of Church 4 (17/C1157)(Figure 18). Several conjoining fragments of aquamanile were recovered from 17/C1157 and can be dated to the 13th- to 14th-century providing a broad *terminus ante quem* for the demolition of the walls. Both walls abutted Church 2 east wall 17/F85 and were truncated to the east soon after by the construction of the west crypt wall assigned 17/F88 (north of crypt entrance)=17/F97 (south of crypt entrance)(Plate 13). Walls 17/F66 and F69 are interpreted as the remains of a small chancel added to the east end of Church 2. The width of the chancel was preserved being 3.9m internally and *c*.5.5m externally, although the external face of the walls did not fall within the limit of intervention. Nor was the length of the chancel preserved, although it can be conjectured based on anticipated proportions from similar churches.

Plate 13 Church 2 wall 17/F85 abutted by Church 3 wall 17/F66 (scale 0.5m)

The construction of the chancel would have necessitated the partial demolition of Church 2 east wall 17/F85 up to the limit of the inner face of both 17/F66 and 17/F69. It is likely that a chancel arch was inserted in order to support the roof of Church 2. An architectural fragment of Old Red Sandstone was recovered during a watching brief on the replacement of water mains beneath Tarbatness Road undertaken in 2007 by Cait McCullagh, Highland Archaeology Services. The stone was recovered from a layer of rubble positioned adjacent to St Colman's Church. The fragment is in Romanesque style and is likely to have originated in Church 2/3. The fragment has been identified as a cushion capital acting as a respond for the springing of a chancel arch.

17/F2
C1016

TR22

17.82m

17.94m

17.85m

TR21

20/F124

17.15m

17.39m

17/F93

17.56m

17/F85

17/F66

17.48m

17.37m

Crypt wall 17/F88

17.14m

TR41

20/F73
C1236

17/F85

Crypt steps
17/ F48

17.49m

14.97m

17.32m

17.31m

17/F85

Crypt wall 17/F97

17.53m

17.53m

17/F92

TR33

17.75m

17/F69

17.09m

20/F89

17/F63

TR31

TR30

True
North

OS
North

Site
North

Plan of Church 2/3

Scale 1:50

Figure 17

Two post-holes were identified adjacent to the east end of Church 2 which were stratigraphically early features, 17/F92 and 17/F93 defined at *c*.16.9m, but were probably cut from higher up, since they measured only *c*.0.15m deep upon excavation. They must predate two possible mortar floor remnants assigned to Church 4 17/F46 and F47). The position of the postholes, parallel and offset from the east wall by *c*.0.9m, suggests function as a possible internal division within the church. Their position close to the east end and adjacent to the chancel suggest they may represent the position of a screen or rail at that point (see Figure 18).

The fragmentary aquamanile recovered from the preparatory levelling for Church 4 may have been used within Church 2/3 (Plate 14) and medieval window glass in the same layer suggests that Church 2/3 was lit by glazed windows.

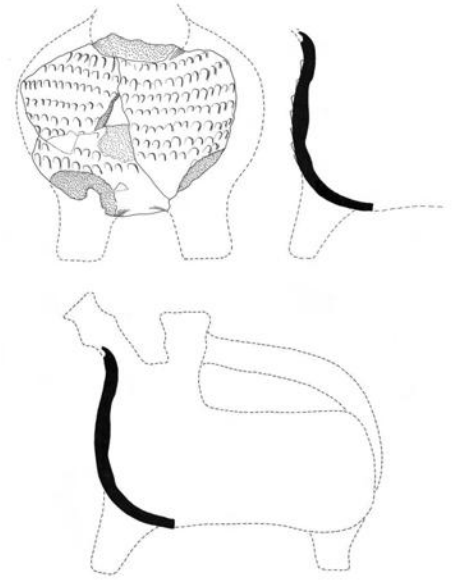


Plate 14 Zoomorphic aquamanile from Church 2/3

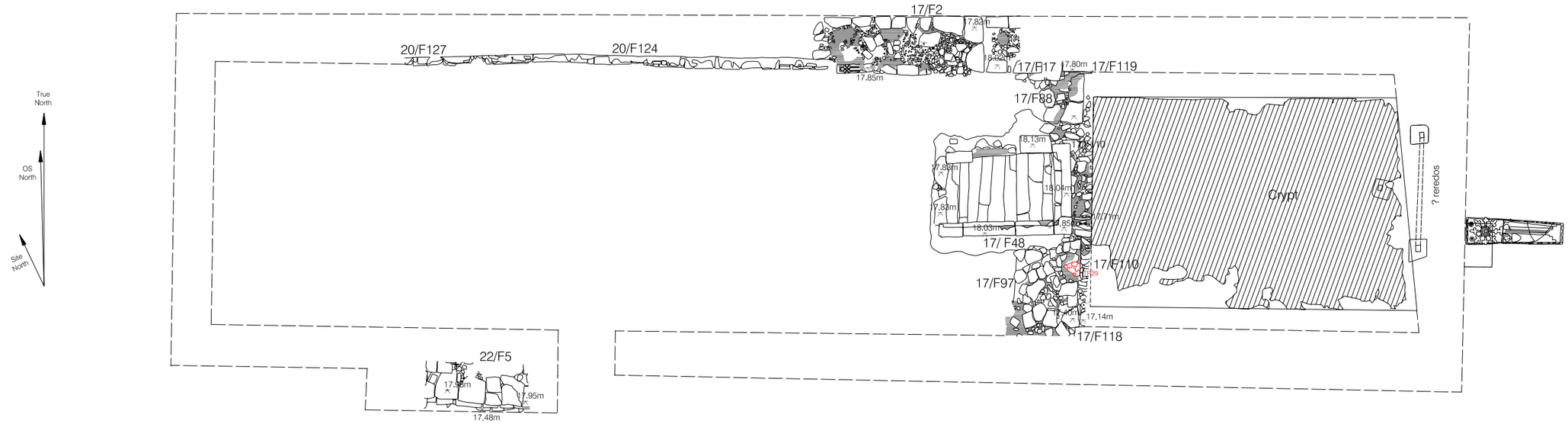
3.4.4 Church 4

Period 4 is marked by significant adaptation of Church 2/3 representing a new church probably of the mid- to late 13th century assigned Church 4. Evidence for adaptations to Church 4, such as the insertion of a vault in the crypt was also recorded. Evidence for scorching of internal stonework of the reused walls of Church 2/3 and the newly built walls of Church 4 including the lateral walls of the crypt might provide a context for such works. By contrast with Church 2/3, Church 4 received a total of 86 burials representing members of the medieval congregation. The remains assigned to Period 4 represent by far the most complex stratigraphy within Sector 4 incorporating a complex building sequence and associated layers deriving from construction, possible floor levels and dense inhumations. Once again, accumulatively, something of the layout and interior of Church 4 can be surmised from the evidence.

Church 4 was defined as an elongated rectangular structure oriented west-east, for which the west and east ends of Church 2/3 including the chancel were demolished and the southern and northern walls extended 5.7m to the west and 10.3m to the east from the nave of Church 2 defining a new church 27.5m long x 7.7m wide externally (Figure 19). The west and east walls of Church 2/3, 20/F73, and 17/F85 were demolished to their rubble foundations, the upper slab course of which was robbed out in both cases to *c*.17.5mAOD. It seems that during this operation the lowering of the internal floor level of Church 2/3 took place. At a certain moment in time, while the new internal floor level of Church 4 lay at *c*.17.5mAOD the walls of Church 2/3 in their extended Church 4 guise all become scorched by heat in places down to this level. The lateral walls of the crypt were also marked by scorching, although the crypt vault appears to have reused burnt stones. Before Church 4 received burials in the nave, a layer of imported sand was laid down covering early mortar floors and raising the floor level back up to *c*.17.9mAOD (17/C1008). A small area of this sand was identified in plan at the very east end of the nave where burials had not encroached where it consisted of a clean, pale, pure sand (17/C1008).

South wall

The extensions to the south wall were assigned 17/F62 (east) and 20/F23 (west); the threshold and door of



Plan of Church 4 | Scale 1:100 | Figure 19

Church 2/3 was retained. A small length of stone wall was also encountered immediately outside the south door of the church during excavation of Intervention 22 assigned 22/F5. This footing stepped out from the alignment of most of the south wall and its purpose is not understood. The stones forming this feature bonded through and were visible in the north-facing elevation of the south wall (see Figure 17). A small portion of the continuation of the south wall to the east was encountered where it also formed the south wall of the crypt where it was assigned 17/F119=23/C1109.

North wall

The extensions to the north wall were assigned 17/F17 (east) and 20/F127 (west). Two test pits against the exterior of the north wall were excavated and identified a stone chamfer stringcourse in both positions. Like the south wall, a small continuation of the north wall to the east was visible within Intervention 17 where it also formed the north crypt wall below and was assigned 17/F118=23/C1108.

West wall

During excavation, the interior elevation of the west wall of Church 4 was obscured by 18th-century rubble infilling of a large supporting arch for the Church 5 belfry tower. The rubble was removed during refurbishment revealing the internal elevation which is partially recorded photographically. The eaves height of Church 4 was preserved in the internal elevation. A small portion of its external west elevation was exposed within a test pit located against the wall to the immediate north of the Macleod enclosure and the exterior elevation was exposed following the removal of harling in 1997.

East wall

The east wall lay beyond the area of intervention, although external excavation around the east crypt lights during their refurbishment exposed small areas of the east crypt elevation and a further test pit excavated to investigate settlement cracks on the southeast corner of the vestry revealed the external corner of Church 4 and its crypt. Externally the wall was seen to have been formed in dressed stonework to 16.8mAOD suggesting the ground surface dropped away to deliberately expose the crypt exterior. In support of this, an elaborate mid-14th-century grave cover was encountered during the excavation of a pit to refurbish the southernmost of the eastern crypt lights (Appendix G). The grave slab was positioned flush with the external east wall of the chancel, thus in a sought after position, oriented west-east and is considered likely to be *in situ* when uncovered (see Figure 19). The top of the slab was recorded at 17.1-17.2m AOD and is likely to represent the 14th-century external ground level at the east end of Church 4.

During refurbishment works at the east end interior at ground-floor level two squared stone blocks with square niches were identified one of which appeared *in situ* against the east wall. These are interpreted as stone supports for a reredos at the east end of the chancel and were covered by the level of the flagstone floor of Church 5 (see Figure 19).

Church 4 plinth

The chamfered plinth which was a diagnostic characteristic of the exterior of Church 4 was recorded externally consistently at *c*.17.8-*c*.18.0m AOD and was identified in the following locations: within Intervention 17 as part of 17/F17 where it abutted the north-facing external elevation of Church 2 wall 17/F2 and slightly further to the

east externally within Test pit E (Intervention 18) where it was in turn abutted by the east wall of the north aisle (see Figure 19; Plate 15). It was also observed within a test pit at the west end of the church to the north of the Macleod enclosure (Test pit B) and against the north wall (Test pit A).

Plate 15 Chamfered plinth of Church 4 (scale 0.5m)

Church 4 crypt

Church 4 incorporated a crypt beneath the extended chancel both occupying approximately one-third of the length of the building (Figure 20). The structural elements were allocated as west wall 17/F88=23/C1110 (north) and 17/F97=23/C1110 (south). These walls were visible in plan within the area of Intervention 17 and were abutted by a vault allocated 17/F110=19/F18=23/1111;1112 and C1113). The interior space was cleared by Jill Harden with members of the Tarbat Historic Trust and then stratified strata excavated as Intervention 19. The structural features belonging to the crypt were allocated as follows: doorway 17/F112=19/F1=23/C45 (with iron pintel 23/C1114) and door 23/F45, east wall 19/F3=23/C1107 with aumbry (19/F40=23/C1132) and lights 19/F21=23/F41 (north) and 19/F22=23/F42 (south)(Plate 16), west wall 19/F4, and lights within vault 19/F18, 19/F19=23/F43=23/F46 (north light) and 19/F20=23/F44=23/F47 (south light). The steps down into the crypt were cut into the demolished east wall of Church 2 and occupied most of the footprint of the demolished Church 2/3 chancel. The original opening to the stairs (23=F51) was remodelled for Church 5 (23/F51) to receive a trapdoor; no traces of its medieval finish survived the operation, although given its position is likely to have been furnished with some form of stone coping and rails. Evidence for plastering throughout the interior was encountered as 23/C1130 and 23/C1131 covering areas of burning 23/C1116 and 23/C1133.

Plate 16 East wall of crypt 19/F3 showing aumbry and lights

Two Period 4 burials oversailed the crypt vault - Burial 34 and Burial 19/31; the lower legs of both adult inhumations were observed as present during excavation but left *in situ* since they lay beyond the eastern limit of Intervention 17 extending beyond 17/F88 over 17/F110.

The earliest layer encountered during excavation overlay sand subsoil and abutted the walls of the crypt can be assigned to Church 4 and consisted of a green clay layer 19/C1013 which may have been preparatory to a stone floor indicated by the presence of a slab of Old Red Sandstone (19/F14) set into the surface of 19/C1013 (see Figure 19) or may have been the floor surface itself as it may have been patched or resurfaced with clay 19/C1028 and 19/C1031 and separated therefrom by black occupation film 19/C1029. The surface of floor 19/C1013 had many interesting traits: it had been marked by scoring (19/F6), perhaps with numerals, was burnt in small discontinuous patches on its surface (19/C1027) and also received eroding mortar/plaster onto its

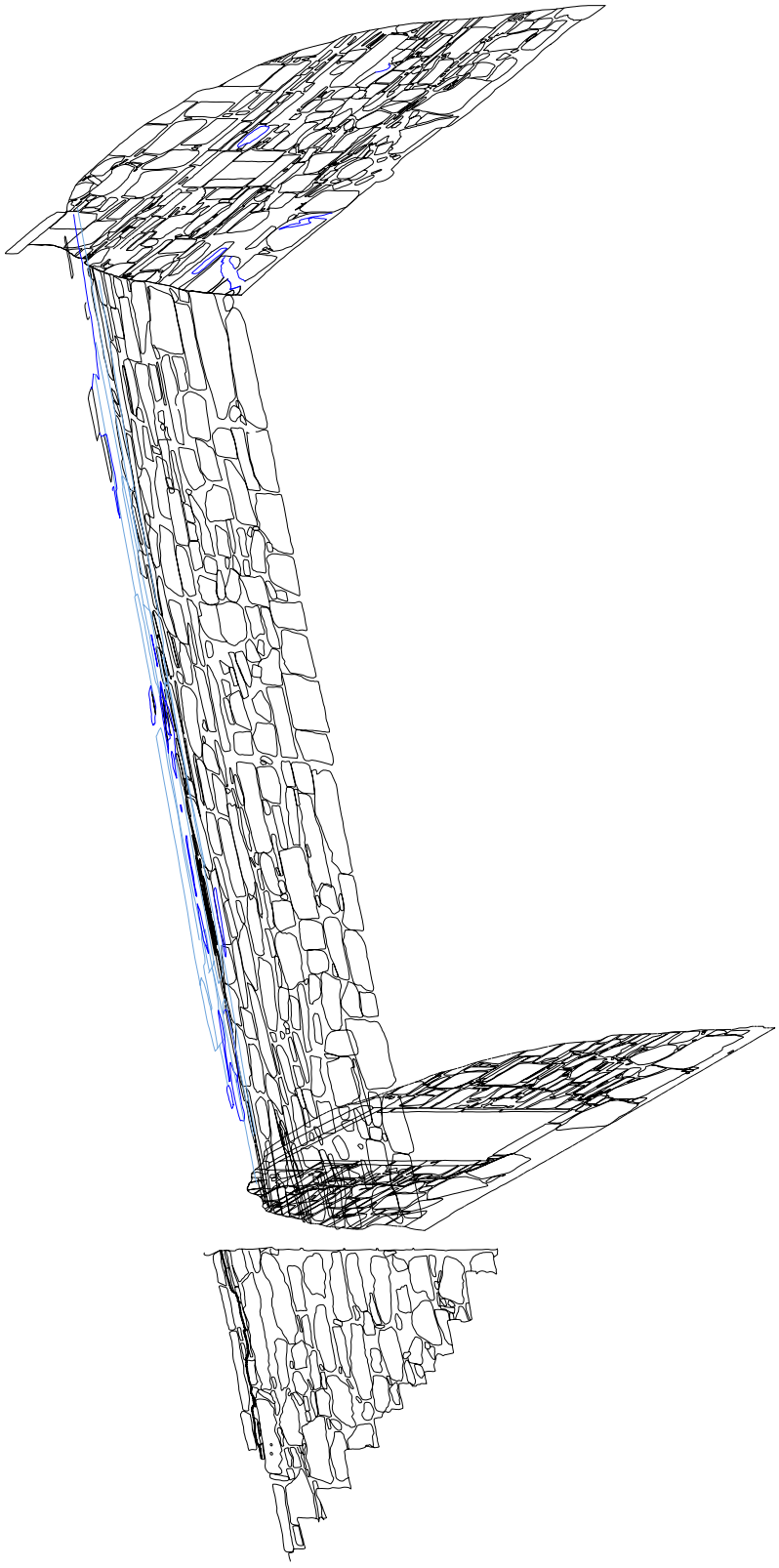


Figure 20

Scale 1:50

Axonometric view of crypt from south

surface (19/C1024 and 19/C1025). A number of possible postholes and linear depressions in the surface of 19/C1013 may represent internal features and impressions left by others and also areas of wear. In the southwest corner a small 'basin' was recorded as a rectangular mortar patch reflected by plaster on the adjacent walls (19/F5). The eroding plaster and remnants thereof still adhering to the walls during excavation demonstrate the interior of the crypt was probably plastered at some point.

Sculpture from and reused in the Fabric of Church 4

Three fragments of sculpture of early medieval date originating in Period 2 were reused within the fabric of Church 4. A small fragment of grave-marker cross-slab was reused in the west wall of the crypt TR 29, while two further fragments formed part of the vault of the crypt, TR20 and TR26 (north light lintel)(Table 6).

Plate 17 Late 14th- to 15th-century grave slab

Two medieval grave slab covers were identified during refurbishment of the church. A late 14th- to 15th-century memorial was found bonded with two plain flagstones in the northwest corner of the church beneath the 18th-century blocking of the belfry arch of Church 5. The slab depicts a great sword or Claymore and bears a later addition in the form of the initials 'AMRM' (Plate 17). The presence of a medieval cross-slab grave-cover within the church, albeit reset, is noteworthy and may have originated in a floor of Church 4. A further cross-slab grave-cover was located during the excavation of the southernmost east light of the crypt. The slab depicts a floreate cross on stepped base, great sword and two shields and dates to the mid-14th-century (see Appendix G)(Plate 18). The slab abuts the east external wall of the crypt implying it had been built by *c*.1350.

Table 6 Summary of sculpture belonging to and reused in fabric of Church 4

Identifier	Description
TR20	Fragment of large cross-slab with panels of spiral and dragon with monks and animal scene on reverse
TR26	Cross shaft of small grave marker reused as lintel, edge moulding visible
TR29	Fragment of small cross-slab grave marker reused in west wall 17/F97 bearing stepped cross
-	Complete late 14th- to 15th-century grave slab depicting great sword and later initials
-	Complete 14th-century grave slab with floreate cross, great sword, shields and edge scalloping

Strata and possible floors within Church 4

Before Church 4 received burials in its nave a group of strata was laid down and appears to relate to the construction or adaptation of the building, perhaps following the fire, and the earliest surviving floor level in the church. The group identified consisted of a levelling sand 17/C1157, cut by amorphous scoops (17/F52; 17/F60), burning on the surface of levelling layer 17/C1157 (17/F61), a hearth containing a small molten lead mass (17/F59 Find no 226), spreads of mortar 17/C1175=17/C1192, including 17/C1150 which yielded a piece of lead soldering rod (Find no 154), overlain by a more substantial but very mixed layer 17/C1147. 17/C1147

produced the majority of artefacts recovered during the excavation including five sherds of 13th to 15th-century ceramic (Appendix H), including a fragment of chafing dish (Plate 19) and 38 fragments of 13th-15th century window glass including a fragment of painted stickwork border (Appendix I).

Plate 18 Mid-14th-century grave slab

Overlying the group of likely construction layers was a plaster slab (17/F47) laid over the remains of a possible wooden floor (17/C1140) which overlay a preparatory bed of lime mortar (17/F46). Plaster slab 17/F47 lay at *c*.17.6mAOD and the newly exposed slab foundation of Church 2/3 walls 17/F2 and 17/F63 appear to have been tooled back and covered with white plaster down to the same level; given the threshold for Church 4 reusing that of Church 2 lay at *c*.18.0m, a small step down into this phase of church would have been inevitable.

At a certain point, plaster slab 17/F47 was buried by a thick layer of clean imported sand 17/C1008 into which all Period 4 burials were cut (see Figure 19). Once laid the upper surface of C1008 lay at *c*.17.9mAOD meaning that internal floors levels once again drew level with the Church 2-4 threshold. By far the majority of Period 4 burials lay well above 17.0mAOD with a small notable group of prominent and relatively late burials such as Burial 43 and 113 which lay at *c*.16.5mAOD. Other Period 4 burials were interred at comparatively shallow depth given the internal floor level of the church, up to 17.7-8mAOD, a phenomenon encountered at other church excavations believed to have been made possible by some form of embalming.

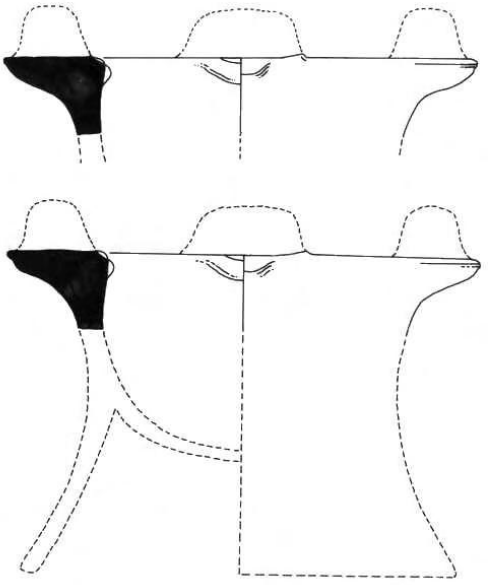
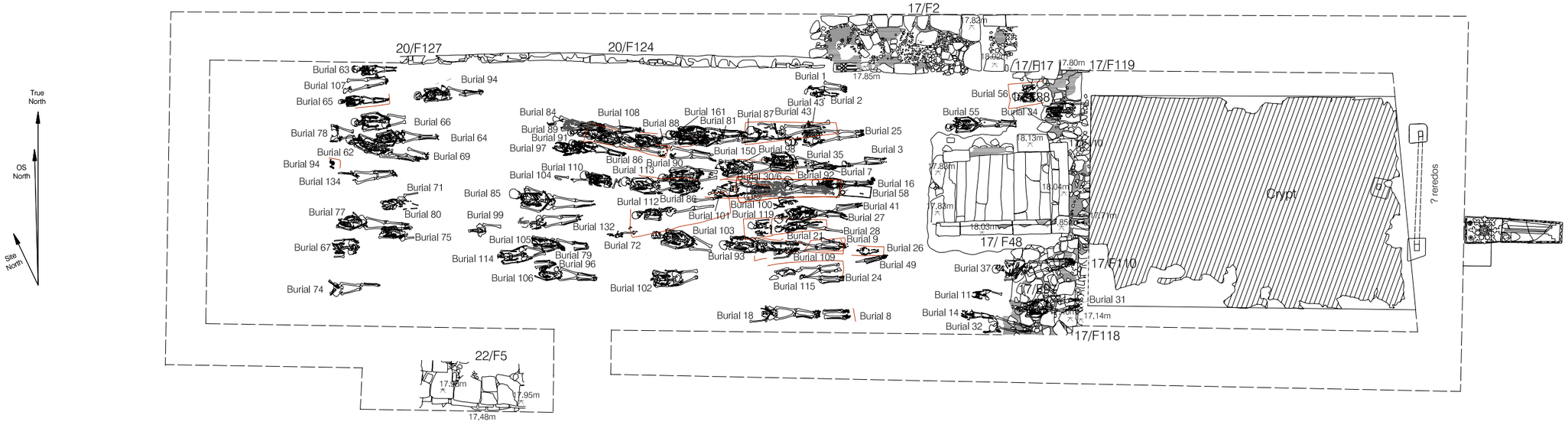


Plate 19 Chafing dish sherd recovered from layer 17/C1147

3.4.5 Period 4 burials

A total of 86 burials have been assigned as burials placed in the nave and lower end of the transept of Church 4 over the crypt vault (Figure 21). The burials were oriented west-east, with a few exceptions, following the orientation established by the Period 2 cemetery and Church 2/3. Burials were sometimes coffined (19), sometimes shrouded (7) and more rarely both (3). The depth of burial appeared to shift through time with some of the original Period 4 burials in the nave being comparatively shallow compared to a notable group of later graves in the nave.

Dating material was more forthcoming from Period 4 burials and several grave backfills contained 13th- to 15th-century ceramic (see Appendix H), fragments of medieval glass (see Appendix I) and coins (Appendix J). Burial 34 contained a sherd from a glass hanging lamp of 13th- to 16th-century date. Radiocarbon dating of seven Period 4 burials suggests that burial began in the late 13th century and continued into the early 17th century.



Period 4 burials

Scale 1:100

Figure 21

The demographics of this group breaks down into 64 adults (39 males or probable males, 22 females or probable females and 3 undetermined adults), 17 children, four infants and one juvenile. The age at death of the adults was weighted towards individuals over 46 years, of which there were 30, with 16 individuals aged between 26 and 45 and 8 adults younger than 25. This demographic is notably higher than comparable Scottish sites (see Appendix C, Section 3.3).

Table 7 Period 4 burials (NB orientation of burial W-E unless otherwise noted)

Burial	Description	C14 date	AOD height (m)
1	Burial of adult, probable male, late interment sealed by 17/F6 flagstone floor of Church 5, overlay Burial 2, close to east end	-	Tibia - 17.5
2	Burial of infant, 0.6-2.5 years, overlain by Burial 1, close to east end	-	Skull - 17.2 Sacrum - 17.1 Tibia - 17.1
3	Burial of child, 10.6-14.5 years, overlain by child and infant Burial 7 and infant Burial 6, close to east end	-	Tibia - 17.6
7	Burial of young child, 2.6-6.5 years, incorporated remains of later infant burial, overlay Burial 3	-	Tibia - 17.6
8	Burial of probable male, 17-25 years, coffined, truncated to knees by Burial 18, close to east end	-	Tibia - 17.5
9	Burial of adult, probable male, coffined, overlay coffined child Burial 55, overlain by coffined Burial 93, close to east end	-	Tibia - 17.3
10	Burial of child, 6.6-10.5 years, overlain by coffined Burial 8, cut polished plaster slab 17/F47	-	Tibia - 17.7
11	Burial of young child, 2.6-6.5 years	-	Sacrum - 17.6
14	Burial of young child, 2.6-6.5 years, post-dated Burial 32 which contained late 15th-century coin	-	Sacrum - 17.7 Tibia - 17.7
16	Burial of child, 6.6-10.5 years	-	Skull - 17.5 Sacrum - 17.4 Tibia -17.5
18	Burial of male, 46 years+, post-dated coffined Burial 8	-	Sacrum - 17.4 Tibia - 17.5
19/31	Burial of male, 46 years+, grave fill contained 13th- to 15th-century pottery	-	Skull - 17.5 Sacrum - 17.3
20	Burial of probable female, 46 years+, overlay coffined, clothed Burial 43 and overlain by Burial 5, close to east end	-	Sacrum - 17.2
21	Burial of young child, 2.5-6.5 years, coffined overlay coffined child Burial 119, overlain by Burial 28	-	Skull - 17.1 Sacrum - 17.3 Tibia - 17.0
24	Burial of juvenile, 14.6-17 years, grave fill contained three coins of late 15th- to early 16th-century date	-	Tibia - 17.5
25	Burial of male, 46 years+, overlay clothed, coffined Burial 43, overlain by Burial 35, close to east end	-	Sacrum - 17.4 Tibia - 17.5

Burial	Description	C14 date	AOD height (m)
26	Burial of infant, 0-0.5 years, coffined, overlay shrouded Burial 49, overlain by coffined Burial 9	-	Skull - 17.2 Sacrum - 17.2 Tibia -17.2
27	Burial of child, 10.6-14.5 years, contained 13th- to 15th-century pottery, overlay Burial 42, overlain by coffined Burial 30/36 and coffined child Burial 21, close to east end	-	Sacrum - 17.2 Tibia - 17.3
28	Burial of female, 46 years+, overlay coffined child Burial 21, late interment sealed by 17/F6 flagstone floor of Church 5	-	Sacrum - 17.3 Tibia - 17.5
30	Burial of male, 46 years+, in oak coffin, with four accompanying skulls, skull removed on interment of Burial 36 over, contained 13th- to 15th-century pottery, deep late grave, burial joined by coffined infant Burial 58 at feet, close to east end centred in nave	-	Sacrum - 16.8 Tibia - 17.0
32	Burial of male, 46 years+, contained late 15th-century coin, overlain by child Burial 14	-	Sacrum - 17.6 Tibia - 17.7
34	Burial of male, 46 years+, overlain by child Burial 59, overlay crypt vault 17/F110, fragment of 13th- to 16th-century glass hanging lamp contained in grave fill	-	Sacrum - 17.3
35	Burial of male, 17-25 years, overlay Burial 25 and 178, overlain by child Burial 3	-	Skull - 17.1 Sacrum - 16.9 Tibia - 17.0
36	Burial of male, 46 years+, interred over Burial 30 in oak coffin replacing position of head between four skulls, burial joined by coffined infant Burial 58 at feet, close to east end centred in nave	-	Skull - 17.1 Sacrum - 16.9 Tibia - 17.0
37	Burial of probable male, 26-45 years, predated Burial 32	-	Skull - 17.6 Sacrum - 17.5 Tibia - 17.6
41	Burial of male, 17-25 years, early burial in nave, overlain by Burial 27 which contained 13th- to 15th-century pottery	-	Skull - 16.9 Sacrum - 16.8 Tibia - 16.8
43	Burial of male, 46 years+, coffined (oak with ash lid), clothed with leg hose and shod with low leather boots, dated to the late 14th to early 15th century, close to east end, overlain by Burial 20 and 25	-	Skull - 16.8 Sacrum - 16.7 Tibia - 16.6
49	Burial of probable female, 46 years+, possibly shrouded, early burial in nave overlain by coffined infant Burial 26	-	Tibia - 17.0
55	Burial of adult, sex undetermined, 17-25 years, cut the cut for the crypt steps 17/F48	-	Skull - 17.6 Sacrum - 17.5 Tibia - 17.6
56	Burial of male, 46 years+, coffined, late burial over child Burial 60 sealed by 17/F6 flagstone floor of Church 5	-	Skull - 17.8
58	Burial of infant, 0.6-2.5 years, coffined, interred at feet of Burial 30/36	-	Sacrum - 17.0 Tibia - 17.0
62	Burial of female, 46 years+, shrouded, late burial in the nave sealed by 17/F6 flagstone floor of Church 5, overlay Burial 64	-	Skull - 17.8 Tibia - 17.7

Burial	Description	C14 date	AOD height (m)
63	Burial of young child, 2.6-6.5 years, late burial in nave	-	Skull - 17.8 Tibia - 17.7
64	Burial of male, 46 years+, overlay shrouded Burial 69 and overlain by shrouded Burial 62	-	Tibia - 17.6
65	Burial of child, 6.6-10.5 years, coffined	-	Skull - 17.6 Sacrum - 17.4 Tibia - 17.5
66	Burial of male, 26-45 years, overlay shrouded Burial 78 and overlain by infant Burial 73	-	Skull - 17.7 Sacrum - 17.6
67/68	Burial of female, 26-45 years, including pre-term foetus in womb, Burial 68, disappeared beyond western limit of intervention	-	Sacrum - 17.5
69	Burial of female, 46 years+, shrouded, overlay shrouded Burial 78, overlain by Burial 64	-	Sacrum - 17.6 Tibia - 17.6
71	Burial of young child, 2.5-6.5 years, overlay Burial 80, sealed by 17/F6 flagstone floor of Church 5	-	Sacrum - 17.55
72	Burial of adult, sex undetermined, postdated coffined Burial 112	-	Grave 17.4-5
74	Burial of male, 46 years+, sealed by 17/F6 flagstone floor of Church 5	-	Sacrum - 17.5 Tibia - 17.6
75	Burial of adult, probable male, cut by Burial 77	-	Sacrum - 17.6
77	Burial of male, 26-45 years, cut Burial 75, cut by Church 5 bell casting pit 20/F4	-	Sacrum - 17.7 Tibia - 17.7
78	Burial of female, 26-45 years, shrouded, overlain by shrouded Burial 69 and Burial 66	-	Sacrum - 17.6
79/114	Burial of probable female, 17-25 years, overlay Burial 105, cut by 20/F63, flue/vent for Church 8	-	Sacrum - 17.43 Tibia - 17.5
80	Burial of male, 46 years+, early burial in nave, overlain by infant Burial 70 and child Burial 71	-	-
81/87	Burial of child, 6.6-14.5 years	-	Sacrum - 17.4 Tibia - 17.5
82	Burial of female, 46 years+, later interment in nave, overlay coffined child Burial 86	-	Skull - 17.53
83	Burial of probable female, 26-45 years, cut by clothed, coffined Burial 43	-	Sacrum - 17.3
84	Burial of male 46 years+, late interment in nave sealed by 17/F6 flagstone floor of Church 5, overlay coffined child Burial 86	-	Sacrum - 17.5 Tibia - 17.5
85	Burial of probable male, 17-25 years, late interment in nave sealed by 17/F6 flagstone floor of Church 5, overlay Burial 120/132 and Burial 104	-	Sacrum - 17.2 Tibia - 17.2
86	Burial of child, 6.6-10.5 years, coffined, postdated coffined Burial 108 and overlain by Burial 82 and 91	-	Skull - 17.4 Sacrum - 17.2
88	Burial of female, 26-45 years, coffined and shrouded, post-dated coffined Burial 161 and sealed by 17/F6 flagstone floor of Church 5	-	Skull - 17.4 Sacrum - 17.3 Tibia - 17.3

Burial	Description	C14 date	AOD height (m)
89	Burial of infant, 0.6-2.5 years, possibly coffined, overlain by Burial 84, post-dated Burial 91	-	Sacrum - 17.3 Tibia - 17.4
90	Burial of male, 46 years+, shrouded, post-dated radiocarbon dated coffined Burial 113, post-dated by coffined Burial 98	AD1460-1660	Sacrum - 17.4 Tibia - 17.4
91	Burial of female, 26-45 years, shrouded, postdated coffined child Burial 86, postdated by coffined child Burial 89	-	Skull - 17.4 Sacrum - 17.2 Tibia - 17.2
92	Burial of female, 26-45 years, coffined, early burial in nave, overlain by Burial 178	-	Sacrum - 17.4
93	Burial of male, 26-45 years, pine coffin, late burial in nave, grave fill contained 13th- to 15th-century pottery	-	Sacrum - 17.2 Tibia - 17.2
94	Burial of adult, probable male, coffined	-	Grave 17.6-8
95	Burial of female, 46 years+	-	Skull - 17.5 Sacrum - 17.4 Tibia - 17.5
96	Burial of adult, probable male, post-dated Burial 106	-	Tibia - 17.5
97	Burial of probable female, 46 years+, shrouded	AD1440-1640	Sacrum - 17.4
98	Burial of male, 26-45 years, coffined, post-dated radiocarbon dated Burial 90	AD1420-1620	Sacrum - 17.4 Tibia - 17.4
99	Burial of female, 46 years+	-	Sacrum - 17.5
100	Burial of female, 26-45 years	-	Grave - 17.3-4
101	Burial of female, 46 years+, coffined and shrouded, grave fill contained 13th- to 15th-century	AD1410-1480	Sacrum - 17.4 Tibia - 17.4
102	Burial of female, 26-45 years	-	Sacrum - 17.3 Tibia - 17.3
103	Burial of male, 26-45 years, post-dated by coffined Burial 93	-	Sacrum - 17.4
104	Burial of adult, probable male, postdated by Burial 85	-	Tibia - 17.5
105	Burial of female, 46 years+, postdated by Burial 79/114	-	Sacrum - 17.4 Tibia - 17.5
106	Burial of female, 46 years+, postdated by Burial 96	-	Sacrum - 17.7 Tibia - 17.6
107	Burial of male, 17-25 years	-	Tibia - 17.8
108	Burial of male, 26-45 years, coffined, postdated Burial 50, post-dated by coffined child Burial 86	-	Skull - 17.1 Sacrum - 16.9 Tibia - 17.0
109	Burial of male, 46 years+, coffined, post-dated by coffined child Burial 119	-	Skull - 17.0 Sacrum - 16.8 Tibia - 16.9
110	Burial of child, 10.6-14.5 years, shrouded, post-dated by coffined Burial 113	AD1280-1400	Skull - 17.1 Sacrum - 16.9

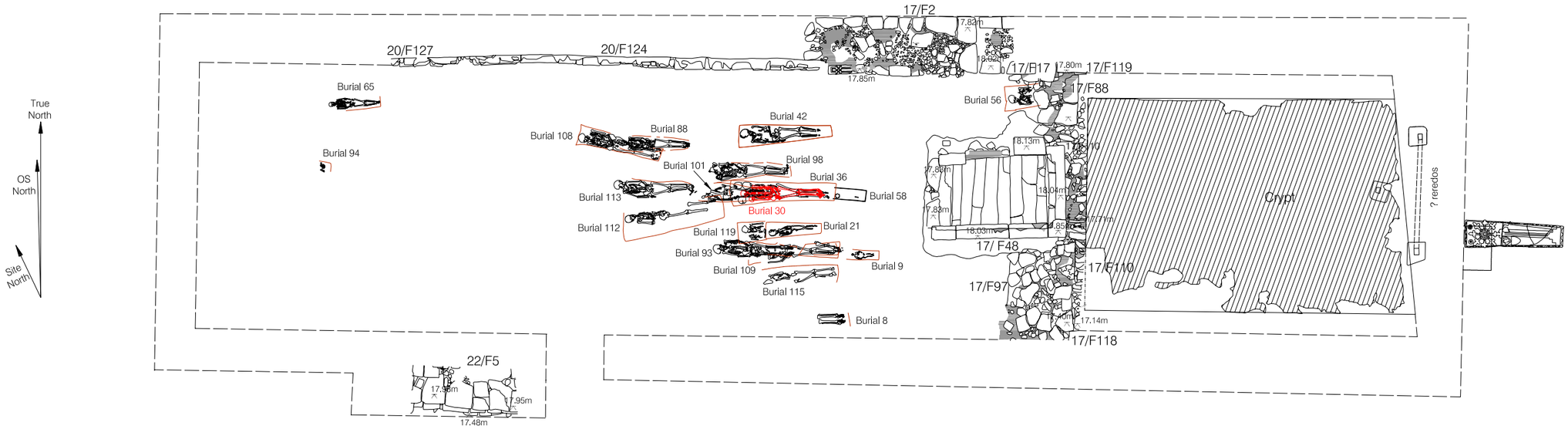
Burial	Description	C14 date	AOD height (m)
112	Burial of male, 46 years+, coffined, early burial in nave, post-dated by coffined, shrouded Burial 101 and Burial 72	AD1280-1420	Skull - 17.2 Sacrum - 17.1 Tibia - 17.1
113	Burial of male, 46 years+, coffined and shrouded, very deep grave, post-dated Burial 101 and 110, post-dated by radiocarbon dated Burial 90	AD1290-1430	Skull - 16.6 Sacrum - 16.3 Tibia - 16.4
115	Burial of adult, probable female, coffined, post-dated by Burial 24 which contained late 15th- to early 16th-century coins	-	Sacrum - 16.8 Tibia - 16.8
119	Burial of child, 10.6-14.5 years, coffined, post-dated coffined Burial 109, post-dated by coffined Burial 93	-	Grave - 16.9-17.2
120/132	Burial of male, 46 years+, post-dated by Burial 85, later truncated by flue/vent 20/F63 for Church 8	-	Skull - 17.4 Sacrum - 17.5 Tibia - 17.5
134	Burial of probable male, 17-25 years, cut by Church 5 bell-casting pit 20/F4	-	Tibia - 17.6
150	Burial of adult male, early burial in nave, post-dated by coffined Burial 108	-	Tibia - 17.0
161	Burial of male, 26-45 years, coffined, post-dated child Burial 175, post-dated by coffined Burial 88	-	Skull - 17.2 Sacrum - 17.0 Tibia - 17.0
175	Burial of child, 6.6-10.5 years, early burial in nave, post-dated by coffined Burial 161	-	Skull - 17.5 Sacrum - 17.4
178	Burial of adult, sex undetermined, post-dated by Burial 35 and 101, post-dated coffined Burial 92	-	Sacrum - 17.5
190	Burial of child, 2.6-4.5 years, cut by Church 5 bell-casting pit	-	Grave - 17.7-9

Coffined burials

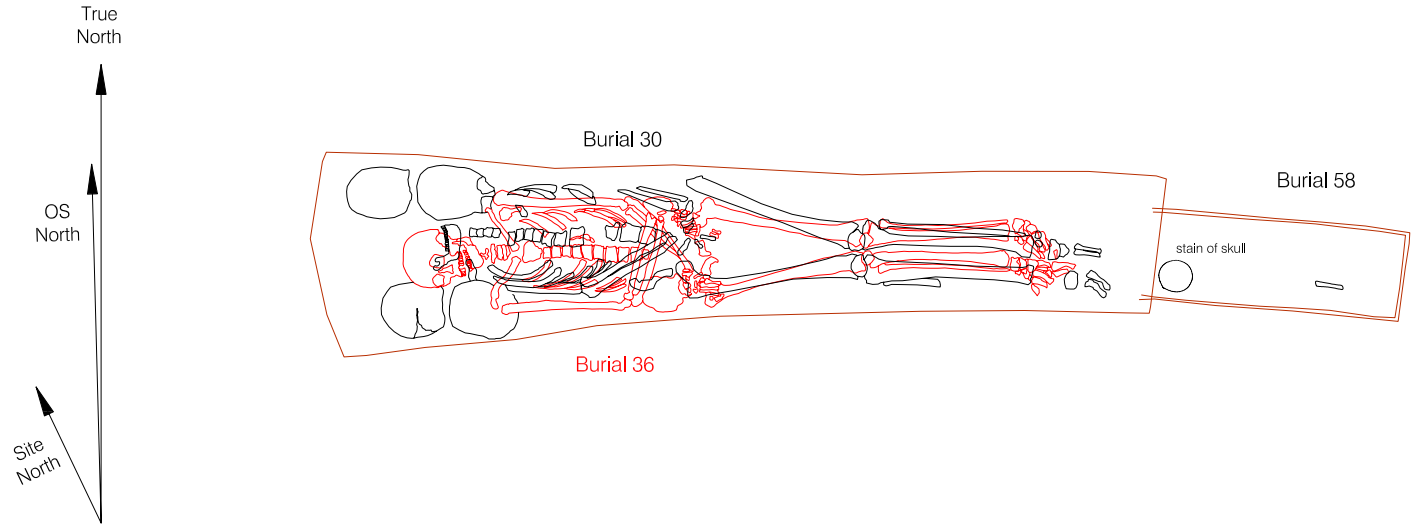
A total of 19 coffins were identified during excavation and their distribution shows clustering close to the east end with 12 at the crypt entrance (Figure 22). Individuals interred in coffins were identified as 11 males or probable male burials, four females or probable females and four were children or infants. Of the coffined males, four were aged 46 years+, three were 26-45 and one was 17-25; interment within a coffin was weighted towards mature men. Analysis of coffin wood samples were identifiable to species in six instances with oak, pine and ash among the assemblage (Appendix K).

Burial 30/36 group (Figure 23)

Burial 30/36 clearly represents the coffined burial of two important males joined by a coffined infant buried at their feet (Burial 58, the only coffined infant (0-0.5 months), perhaps a young male heir)(Plate 20). As a group these coffined burials occupy the centre of the nave as close a possible to the crypt entrance. The skull and mandible of Burial 30 and the mandible of Burial 36 suggested both men were aged 46 to 59 years and recorded stature shows Burial 36 to be the tallest in the medieval population at 180cms and Burial 30 not far behind at 175cms. The sequence of their burial consisted of the first male C1214 being interred in an oak coffin accompanied by four skulls C1217 all looking east surrounding his head, followed by a second interment C1209



Coffined burials | Scale 1:100 | Figure 22



Burial 30/36 group

Scale 1:20

Figure 23

which involved the removal of the first man's skull to allow the positioning of the second man's head in that position (presumably once the first burial was skeletalised and so perhaps a generation apart); the skull of the first man may have been reburied with his successor. A skull was then laid on top of Burial 30 and has also been aged to 46 to 59 years suggesting it may represent the displaced skull of Burial 36. The skull has been recorded as displaying evidence for blade trauma to the face suggesting the man died violently. The collection of accompanying skulls and skull/head swapping on the second interment is remarkably divergent from the medieval orthodox rite.

Plate 20 Period 4 Burial 36

The skeletons within this grave and those among a broader coffined group remain unmolested by all subsequent burials. Their grave *cuts* are affected by later overlying burial, but crucially not the bodily remains or coffins. The reopening of Burial 36 to receive Burial 30 suggests that some graves were marked, perhaps by slabs, supported by the presence of a repositioned late 14th- to 15th-century grave slab reused within the floor of Church 5.

Burial 43, an adjacent coffined burial of a mature male, aged 46 years+, of large stature (172cms), is notable in its juxtaposition and alignment with Burial 30/36 and its completeness suggesting its position was also marked. Burial 109, another male aged 46 years or more, also of relatively high stature, represents another coffined burial on the same alignment. Nearby, another two coffined children were added to this group and their position may indicate familial association. A further unmolested, carefully shrouded, burial of a young man (175cms) lay between Burial 30/36 and Burial 43 and although uncoffined appears to belong in this group of burials at the east end of the nave.

Burial 43

Burial 43 included leather shoes or low boots and woollen leg hose (Plate 21); these are Christian grave goods and are a rare example of a clothed and shod burial from medieval Scotland. The skeleton was identified as that of a male aged 46 years or older. A report on the textile identified the textile as leg hose in an undyed, heavy felted wool tabby of early 15th-century date (Appendix L). The hose were worn indicating they had been used in life prior to inclusion as grave goods. The footwear was identified as a pair of low boots also of an early 15th-century style (Appendix M). The man was interred within an oak coffin lidded with ash.

Plate 21 Low boots and leg hose from Burial 43

3.4.6 Period 4/5 infant burials

A total of 21 articulated infant burials (0-2.5 years) were recorded within the nave and 24 were represented in the 'charnel' layer beneath

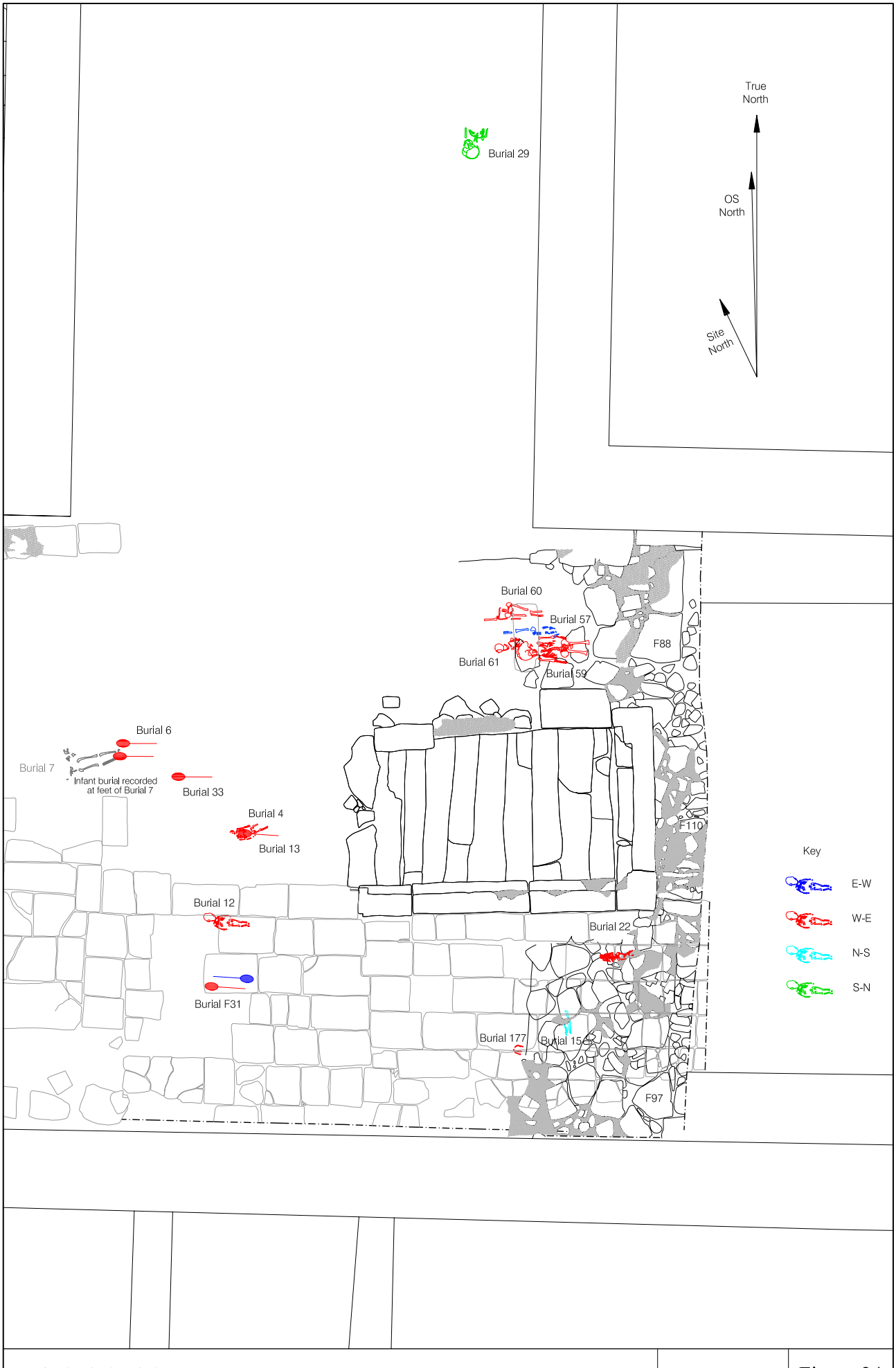
the flagstone floor of Church 5. A further 15 infants were identified in the assemblage of disarticulated bone amounting to a noteworthy total of 60 infant burials within the church. Of the articulated infant burials, four clearly belonged to Period 4 being stratified with Period 4 adult burials (Burial 2, 26, 58 and 89; see Table 6), while the remaining 17 were identified as the latest, or probably the latest, interments in the sequence. The high presence of infants represented in the 'charnel' also suggests late interment. The group of late articulated infant burials have been assigned as Period 4/5 to acknowledge them as a group, some of whom may have been interred during the later part of Period 4 and some could belong to Period 5, Burial 29 interred in the north aisle certainly belongs to Period 5 (Table 7).

The distribution of this group of late infant interments suggests burial near the crypt was favoured (Figure 24). Burial 4, 12, 13 and F31(double burial) formed a row, while Burial 33, 6 and the remains of an infant recorded at the feet of Burial 7 suggest further ordering (Plate 22). The rite appeared to have been, uncoffined while two were shrouded. Orientation of burial varies notably compared to adult burials with the infants in F31 buried west-east and east-west, Burial 57 was also oriented east-west, Burial 15 and 29 were oriented south-north and north-south respectively, the latter apparently tucked between two walls. Burial 59 was that of a young child placed beneath and above flagstones, a noteworthy divergent burial rite and is grouped here accordingly.

Plate 22 Period 4/5 Burial 12

Table 8 Summary of Period 4/5 burials

Burial	Description	AOD height (m)
4	Burial of infant, 0 - 0.5 months	Skull - 17.6 Sacrum - 17.5 Tibia - 17.6
6	Burial of infant, 0.6 - 2.5 years, suffered from rickets	Skull - 17.5
(7)	Infant bones excavated at feet of Burial 7	Grave - 17.6
12	Burial of infant, 0.6 - 2.5 years	Skull - 17.6 Sacrum - 17.5 Tibia - 17.5
13	Burial of infant, 0.6 - 2.5 years	Skull - 17.6 Sacrum - 17.6 Tibia - 17.6
15	Burial of infant, 0.6 - 2.5 years	Grave - 17.6
22	Burial of infant, 0 - 0.5 months, evidence of infection	Skull - 17.4 Sacrum - 17.4 Tibia - 17.4
29	Burial of infant, 0.6 - 2.5 years	Skull - 17.8



Period 4/5 burials | Scale 1:50 | Figure 24

Burial	Description	AOD height (m)
33	Burial of infant, 0 - 0.5 months	Sacrum - 17.0 Tibia - 17.0
57	Burial of infant, 0.6 - 2.5 years	Skull - 17.5 Sacrum - 17.6
59	Burial of young child, 2.6-6.5 years, buried with flagstones above and beneath	Skull - 17.8 Sacrum - 17.7 Tibia - 17.7
60	Burial of infant, 0.6 - 2.5 years	Sacrum - 17.5 Tibia - 17.5
61	Burial of infant, 0.6 - 2.5 years	Skull - 17.5 Sacrum - 17.5
70	Burial of infant, 0.6 - 2.5 years, shrouded	-
73	Burial of infant, 0.6 - 2.5 years, shrouded	Sacrum - 17.5 Tibia - 17.6
177	Burial of infant, 0 - 0.5 months	Sacrum - 17.6
F31	Burial of two infants, oriented, W-E and E-W, with feet placed on shoulders	Grave - 17.5-6

3.5 PERIOD 5

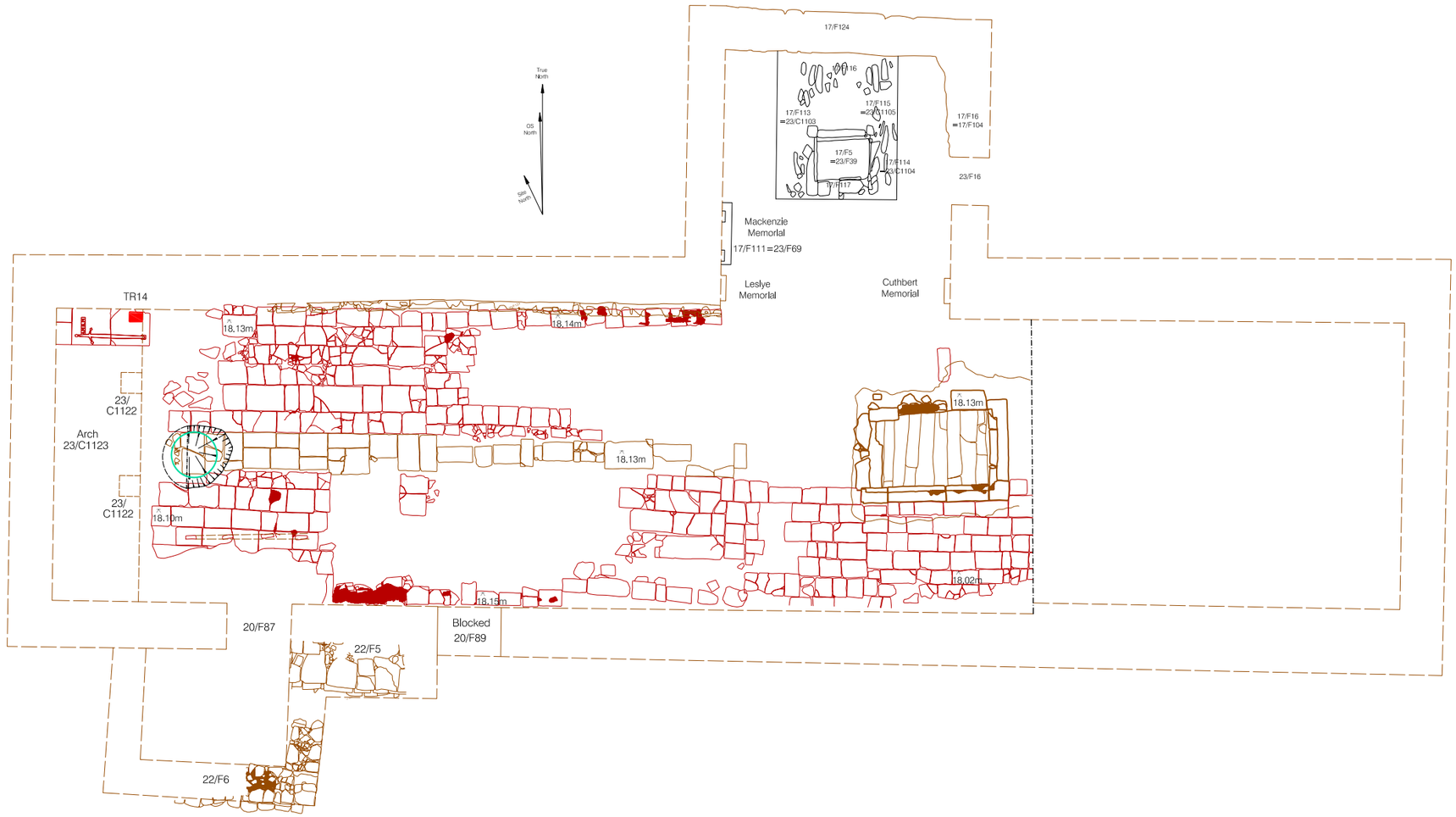
Period 5 is assigned broadly to the post-Reformation period and associated changes to the fabric of Church 4 to create Church 5 as well as changes in burial practice (Figure 25). As acknowledged in the identification of the Period 4/5 infant burials, some burial may have continued within the nave for a time, although this practice was broadly brought to an end within Church 5. The construction of a north aisle took place to commemorate notable local individuals and later to facilitate burial of the laird and family; the burial annexe also received three further burials.

3.5.1 Church 5

The transition from Church 4 to 5 was structurally quite light with few physical adaptations to the fabric of Church 4; features belonging to Church 5 largely constitute additions to the body of Church 4. While changes wrought to the internal appearance of Church 4 would have been significant, they are hard to identify archaeologically. Nevertheless the reredos, stained glass windows, altars and aumbry are likely to have been stripped out, perhaps reluctantly so. The laying down of a flagstone floor within Church 5 (17/F1 and F6; 20/C1000) signalled the beginning of the end of burial in the nave with the possible exception of the special treatment of infants. From this period on below-ground archaeological features within the nave are rare.

A coin recovered from the sand preparation of the flagstone floor 17/C1061 dated 1623 is supported by two memorials incorporated within the east and west walls of the north aisle with the same date.

The entrance into Church 4 was blocked (20/F89 C1212 and C1253)(see Figure 17) and a new doorway cut into south wall manifest as a surviving threshold (20/F87). Features associated with this new entrance suggest it was provided with a porch represented by 22/F6 (Plate 23) and a series of four niches cut into the flagstone floor



Plan of Church 5

Scale 1:100

Figure 25

suggest an internal screened lobby entrance.

Plate 23 Church 5 porch footings, 22/F6

Church 5 belfry and bell

A belfry tower was constructed implied by the construction of a relieving arch 23/C1123 strengthened by two stone drum columns 23/C1122 and by the reuse of ship's timbers in the fabric. Relieving arch 23/C1123 was cut into the westernmost end of the lateral walls of Church 4 (20/23 and 20/F127) *c*.0.4m above internal ground level and therefore did not impact on the internal floor space. A fragment of early medieval sculpture was incorporated into the north side of the arch and remains *in situ* (Table 8). Immediately adjacent to and centred on the drum columns a bell-casting pit was located and excavated (20/F4=F147)(see Figure 5 and 25). The feature consisted of a steep-sided sub-circular pit measuring 1.2m in diameter and 1.3m deep. The pit could be seen to belong late in the sequence sealed by the flagstone floor and cutting and truncating Period 4 Burials 77, 134 and 190 penetrating as deep as Period 1 Burials 146 and 162. Two fragments of clay bell mould were recovered from the backfill (Find no 20/265).

Table 9 Summary of sculpture belonging to and reused in fabric of Church 5

Identifier	Description
TR14	Fragment with fine interlace incorporated in 23/C1123
-	Complete late 14th- to 15th-century grave slab depicting great sword with addition of initials 'AMRM' set into floor 17/F1
-	Leslye memorial plaque in west wall of north aisle dated 1623
-	Cuthbert memorial plaque in east wall of north aisle dated 1623
-	Mackenzie memorial in east wall of north aisle dated 1642
-	17th-century grave slab with Mackenzie arms, skull and cross-bones, sexton's bell and hour glass, surviving text reads 'and his spous'

Church 5 floor

The flagstone floor within Church 5 involved the deposition of a thin bed of preparatory sand (17/C1002, 17C1061, 17/C1065, 20/C1001, 20/C1007) beneath closely jointed thick sandstone flags (17/F6; 20/C1000, hereafter 17/F6) laid over the whole body of the nave, recorded stone-by-stone where encountered within excavated areas and noted as existing at the west end immediately prior to refurbishment (Plate 24). The access hatch into the north aisle burial vault was also recorded as constructed to receive the flagstones suggesting they extended into this area. The crypt

Plate 24 Church 5 17/F1 flagstone floor

appears to have been disused as a space with a hatched entrance (17/F19=23/F39; 23/C1115) fitted into 17/F6 demonstrating its closure. The reworking of the crypt doorway may also have taken place for Church 5; the doorway is certainly reworked, although there is no independent dating as to when this took place.

The flagstone floor laid down in Church 5 was long-lived and never entirely superceded within the church until its conversion to a museum, although largely replaced by a timber floor in the nave after the Disruption. Inconsistencies in its make-up betray the patching of the former position of the pulpit of Church 5 opposite the north aisle.

Evidence for the stripping out of Church 4 is slight, but nevertheless detectable as material trapped within the preparatory sand of floor 17/F6. A piece of lead window came from a figural scene (Find no 17/13) and nine fragments of plain, late medieval glass, along with a piece bearing 15th-century Gothic lettering were recovered from 17/C1061. This assemblage suggests the late medieval glazing schemes, which may have included personal dedications or memorials, were stripped out. The flagstone floor of Church 5 also sealed the two stone bases for the reredos identified at the east end. In addition, 108 fragments of plain window glass of 16th- to 17th-century date were recovered during clearance of the crypt and suggest that reglazing in simple, large, rectangular leaded quarries was undertaken for Church 5. The reuse of the late 14th- to 15th-century grave-cover in the northwest corner of Church 5 is the notable exception to an apparent dispensation with internal ornament in the nave and the initials 'AMRM' are likely to have been added to the reused slab at this time, perhaps commemorating members of the Mackenzie family.

A post-Union twopence of James VI of 1623 (Find no 17/11) was also recovered from sand 17/C1061 providing a *terminus post quem* for the insertion of the floor and the construction of the north aisle.

North aisle

The construction of the north aisle involved the addition of a small annexe measuring 4.5m x *c*.4.0m to the north side of the church close to the former nave/chancel junction (see Figure 25). A 4.5m length of Church 2 north wall 17/F2 and Church 4 north wall 17/F17 were demolished to foundation level while the walls of the north aisle were identified as 17/F124 (north), 17/F80=17/F107 (west wall and foundation) and 17/F73 (construction cut for west wall foundation) and 17/F16=17/F104 (east wall) and its construction trench (17/F11). 17/F124 was misaligned to the orientation of the medieval church while a possible remnant of its west wall was also slightly skew. Externally, the walls of the north aisle did not continue the chamfered plinth and appear quite plain (see Plate 15). A doorway in the east wall of the north aisle was identified and could be seen during recording of the fabric to have been remodelled as a window for Church 7 (23/F16). Two wall plaques both dated 1623 were also inserted into the cut-through of the north wall of Church 4 providing further *termini post quos* of 1623 for the construction of the aisle (see Table 8). It is possible that these memorials were concomitant with the building of the aisle and represent endowments by the Leslye/Cuthbert family towards the construction of the annexe.

A burial vault was constructed within the north aisle comprising a construction cut 17/F74 into which four walls were built, 17/F113=23/C1103 (west wall), 17/F114=23/C1104 (east wall), 17/F116 (north wall) and 17/F117 (south wall) with 17/F115-23/C1105 (vault) and entrance hatch (17/F5=23/F39). The burial vault contained

coffined burials, which remain *in situ*. Historical documents record the acquisition of rights to the aisle by Mackenzie of Tarbat in 1634.

Further burial activity within the north aisle was represented by a grave 17/F7 and associated wall monument, the Mackenzie monument 17/F111 providing a date of 1642 for the plaque and associated grave.

3.5.2 Period 5 burials

Period 5 burials are those which can be confidently identified as belonging to the post-Reformation period. Along with the transitional Period 4/5 infant burials, infant Burial 29 located within the north aisle belongs with this phase. This aberrant burial close to the laird's vault suggests the possibility of familial association, perhaps an illegitimate child not treated to formal burial (Figure 26). Unquantified burials were identified within the north aisle burial vault and also belong to Period 5. Two successive adult inhumations were excavated within the north aisle beneath the Mackenzie monument 17/F111, Burial 17 then Burial 23. Burial 17 was that of a mature man in an elaborate coffin assumed to be William Mackenzie, while the successive Burial 23 in a matching coffin containing a mature woman is assumed to be his widow.

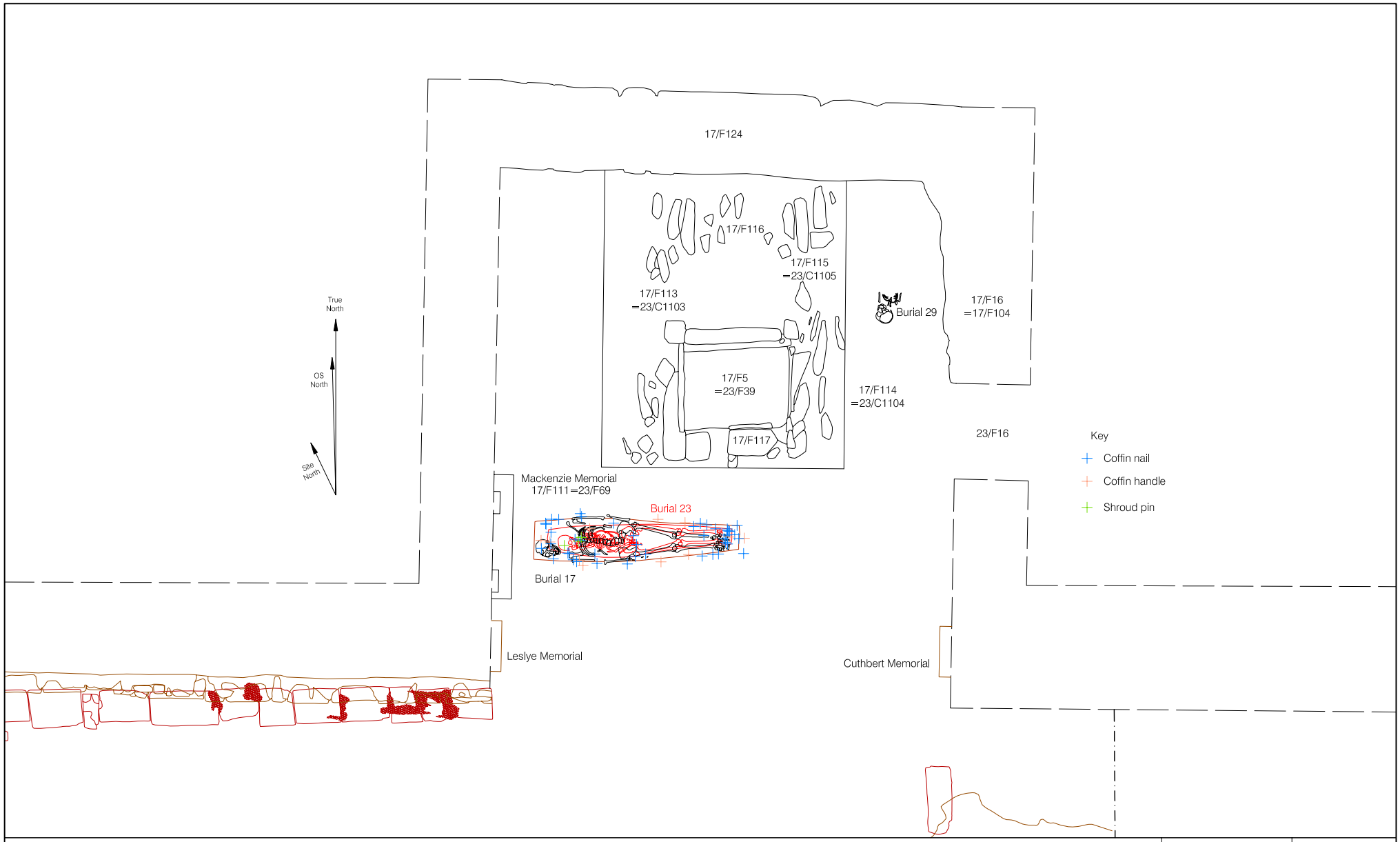
Table 10 Summary of Period 5 burials

Burial	Description	AOD
17	Burial of male, 26-45 years, in pine coffin fitted with six wrought-iron handles with lozenge-shaped mounts, held together with decorative strap hinges, identified as William Mackenzie, minister	Skull - Sacrum - Tibia -
23	Burial of female, 46 years+, interred over Burial 17 in coffin fitted with six wrought-iron handles with lozenge-shaped mounts, held together with decorative strap hinges, likely spouse of Wm Mackenzie	Skull - Sacrum - Tibia -

The majority of burials would have been interred outwith the church succeeding Period 4 burials postulated to have clustered around the exterior of Church 4 represented by the grave-cover at the east end. Memorials dating from the 17th century have been recorded within the extant churchyard and boundary features encountered during the excavation of Intervention 22 (22/F1) may originate in this period with the Period 5 cemetery marked with a bank and ditch. The reused, fragmentary Mackenzie memorial within Church 8 derives from this period of cemetery and originated either in Church 5 or in the Period 5 cemetery (Figure 27). Given the nature of the surviving inscription it is possible that the grave cover may have originated in the floor of the north aisle.

3.6 PERIOD 6

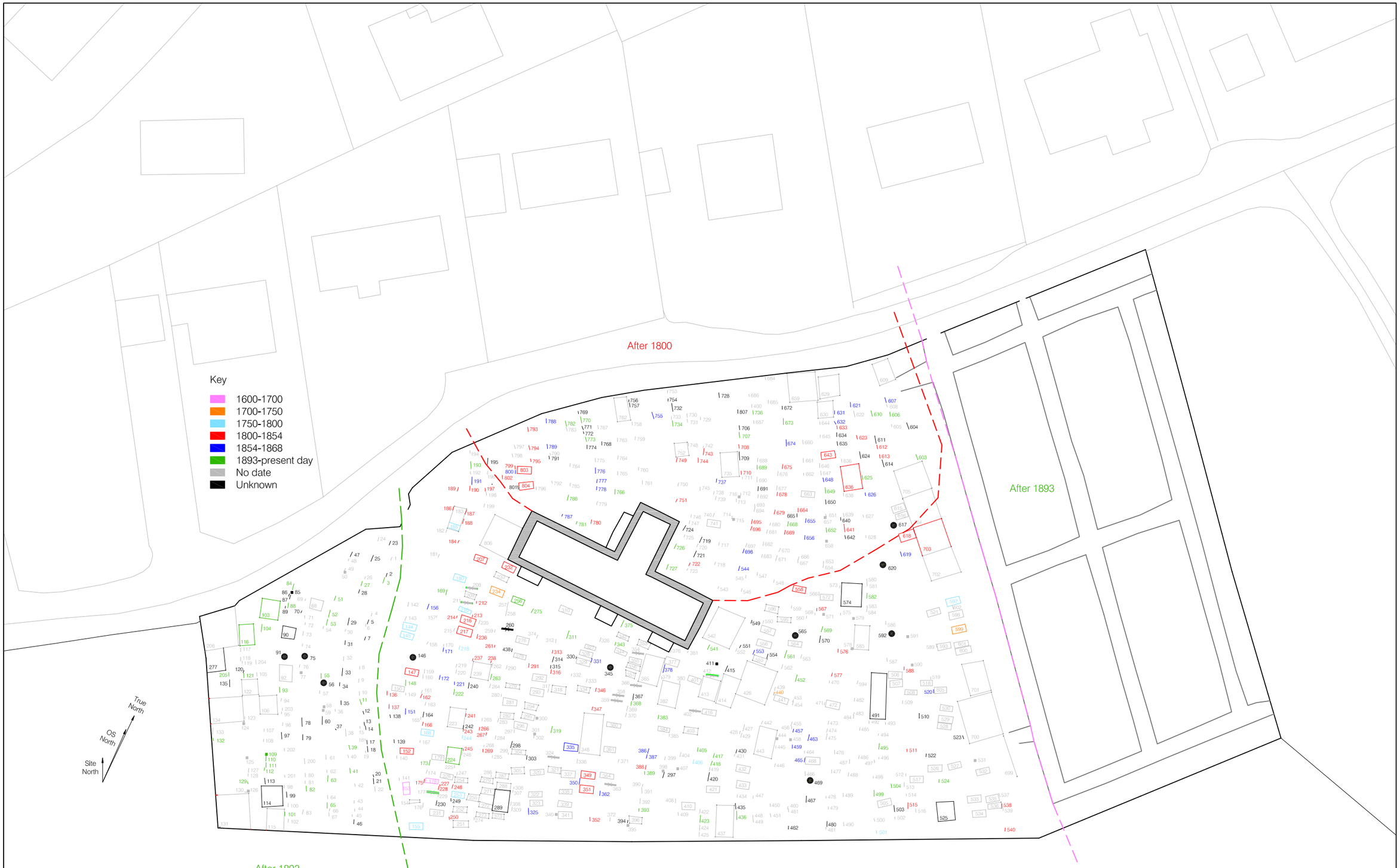
Period 6 is assigned to the 'rebuilding' of the church in 1756 in its current form assigned Church 6 and incorporating ongoing internal adaptations to the T-shaped church to house a rapidly growing congregation becoming Church 7. The adaptation of Church 5 into Church 6 saw some of the most significant changes to the fabric of the medieval parish church which had survived largely intact up to this point. Nevertheless, quite significant portions of the medieval church fabric must have been retained within the rebuild of the mid-18th century.



Period 5 burials in north aisle

Scale 1:50

Figure 26



Plan of dated memorials in churchyard showing cemetery development

Scale 1:500

Figure 27

3.6.1 Church 6

The footprint of Church 6 was exactly that of Church 4 as adapted for Church 5 with the exception of the northward extension of the north aisle (Figure 28). The west gable end of Church 4 (23/C1120) was retained within Church 5 where it also supported its belfry arch; this structural arrangement was retained wholesale for Church 6. The preserved west gable height of Church 4 was recorded during the watching brief and was the same as Church 6. Evidence for the rebuilding of the south lateral wall from near foundation level is provided in the drawn internal elevations which show that Church 2 south wall and Church 4 extensions were demolished to the first course and rebuilt. This may have been a response to the number and rhythm of doorways and windows required in the new Church 6 south wall (17/F64=20/F88=23/C1050). The north wall required far less intervention and may have survived largely intact (17/F65=20/F126=23/C1148), although externally the two ground floor windows appeared integral with the surrounding fabric. The *in situ* Leslye and Cuthbert memorials in the north aisle demonstrate this portion of the north wall of Church 5 being that of Church 4 reused also survived rebuilding intact. Notes for the east end made during external harling replacement suggest that some of the east gable was retained. The retention of the framework of the walls of Church 4 was likely an economic decision and is the reason that the footprint of Church 6 followed its medieval predecessor so closely. The flagstone floor of Church 5 was also retained in Church 6 and it is assumed that it would have been carried through into the extended ground floor of the north aisle.

Church 6 south wall

A total of three doorways served the south side of the ground floor of Church 6 and were seen to be integral to the fabric of the wall 23/C1050, 17/F68=23/F2 (square head), 23/F5 (later converted to a window) and 23/F9 (arched head) with 23/F2 persisting in use to the present day. The door for Church 5 was dismantled to threshold level and the remnants of the threshold blocked (20/F88)(see Figure 17).

Punctuating the space between the doors of Church 6 were two windows assigned 23/F4 and 23/F8. Access to a first-floor west gallery was facilitated by an external stair (23/C1003) leading to a door 23/F1 (square head). A stone 'flue' consisting of bonded sandstone sides and a slab cover was constructed beneath the threshold for south door 23/F2 beneath the flagstone floor 20/F63. The feature reached from the south side of the threshold cutting into 22/F5 and continued into the body of the church measuring a total 3.0m in length; the purpose of the feature is not clear (20/F63). The insertion of 20/F63 disturbed a number of Period 3 burials, Burial 99, Burial 120/132 and Burial 79/114.

Church 6 north wall

Some of the fabric of the north wall may have reused that of Church 4; the rebuild was allocated 23/C1148 overall. The elevation was punctuated by a remodelled two-storey north aisle and two windows to either side were assigned 23/F15 and 23/F22.

Church 6 west wall

The west wall of Church 6 retained that of Church 4 west wall assigned 23/C1120.

Plan of Church 6

Scale 1:100

Figure 28

Church 6 east wall

The east wall of Church 6 retained that of Church 4. A window was inserted into the elevation at ground floor level 23/F13 for Church 6.

Church 6 north aisle

The north aisle of Church 5 was substantially remodelled for Church 6 with evidence for the partial reuse of the west (visible as a joint in the fabric externally) and east walls (17/F80=F107; 17/F16=17/F104) and the demolition of the north wall 17/F124. The remodelled Church 6 north aisle consisted of a northwards extension to the annexe measuring *c*.6.6m x 4.4m and the creation of an upper storey; the fabric of these walls was bonded with red clay and assigned 23/C1161. The east door for the Church 5 north aisle was converted to a window (23/F16) while a new integral window lit the annexe from the north 23/F18. A small flue for a stove to heat the ground floor was identified and assigned 17/F3; the ceramic drains used for the flue were consistent with a mid-18th-century date onwards. A new ground-floor entrance was provided close to the north end of the west wall noted as integral to the fabric of the new west wall (23/F19). It is not clear how the first floor loft was accessed for Church 6 as no evidence for an internal or external stone or timber stair was identified, although a blocked door at first-floor level (17/F121), converted to a window probably for Church 7, is the most likely candidate for an entry point. The first floor was provided with a fireplace (Plate 25). A timber balcony was inserted at the front of the loft into the nave evidence for which was assigned 23/F66.

Plate 25 First-floor fireplace within laird's loft

Church 6 west gallery

The west gallery of Church 6 was inserted over the relieving arch and columns of the belfry and was accessed *via* external stone stair 23/C1003 becoming timber in construction internally and cutting across the belfry arch and its blocking. Externally, this stair overlay the remains of the porch of Church 5 22/F6. Internally, evidence for a flat gallery was identified in the fabric and evidence for a barrel-vaulted ceiling was also preserved as a scar. A timber balcony was provided at the front of the gallery looking into the nave assigned 23/F65. Documentary evidence suggests that this gallery was set aside as a poor loft until *c*.1780. Access into the belfry was *via* a stair from the west gallery.

The space beneath the west gallery was lit by an inserted window cut into the west wall of the church 23/F53=23/F23, the insertion being facilitated by a timber lintel cut into the columns 23/C1122 assigned 23/F58 with blocking over, which was also plastered 23/C1150. This window might explain why the blocking of the belfry arch was only undertaken to either side of the belfry columns and the space between left open.

Church 6 Belfry

The extant distinctive birdcage belfry is attributed to Church 6 its components were assigned 23/F25 to F28 and 23/F30 to F38. The existing belfry arch of Church 5 was strengthened to bear the new load by the insertion of rubble blocking beneath to either side of the Church 5 stone pillars which was also plastered over (23/C1121

and 23/C1124)(Plate 26). The rubble blocking also partially obscured the reused late 14th to 15th-century grave marker set into the flagstone floor initiated in Church 5. A small fragment of early medieval sculpture was incorporated within 23/C1121 assigned TR32. Geoffrey Stell dates the belfry to the late 17th to 18th century suggesting that it may actually predate 1756 (Carver 1995, 39).

Plate 26 North column 23/C1120 with blocking 23/C1121 and plaster over 23/C1124

Church 6 crypt

There is evidence for reuse of the crypt in this period for the storage of peat fuel. A discontinuous layer of peat layer was identified overlying the floor of Church 4 crypt identified as 19/F3 C1016. 19/C1016 was found to contain aquatic fruit and seeds and was thus identified as fen peat (see Appendix E). The peat cannot have formed *in situ* and it is postulated that the material was imported and related to the use of the crypt or fuel storage of for the fireplace and stove within the church, namely those in the laird's loft and lower north aisle.

Table 11 Summary of sculpture reused in fabric of Church 6

Identifier	Description
TR32	Fragment of slab with border and spiral scheme on face and key pattern on side recovered from 23/C1121

Church 6 churchyard

Several memorials dating to 1750-1800 have been recorded within Intervention 28 and cluster against the western churchyard boundary of Church 6 (see Figure 27). This boundary was encountered below-ground within Intervention 22, assigned 22/F1 (see Figure 6).

3.6.2 Church 7

Church 7 is assigned to ongoing adaptation to the interior and access arrangements for Church 6 up to the Disruption (Figure 29). This period saw a steep rise in the population of Portmahomack and consequently the number of parishioners. This resulted in crowding inside the church prompting attempts at alleviating pressure on space. Documentary evidence of 1780 suggests that ground-floor space within the laird's aisle was given over to parishioners, the 'poor loft' of Church 6 was adapted as a more high status space for use by the heritors and their families and an eastern gallery was created; the galleries of the laird's loft and the east and west were high status areas incorporating separate entrances and elevated positions for the laird, the church heritors and their families. A total of seven access points can be related to the accumulative adaptations to Church 6 as Church 7. The adaptation of creating galleries went hand-in-hand with the raising of the church wall plate and gables by *c*.1m including the north aisle, and remodelling of the church roof. The addition of a south vestry and separate access for the minister postdated the raised wall head, although this is likely to have been sequential rather than a distinctly different development and simultaneous adaptation of a door into a window suggests the development belonged to the larger scheme of adaptation. Likewise new windows serving the west and east

Plan of Church 7

Scale 1:100

Figure 29

galleries are highly likely to have been integral with the raising of the wall head. Perhaps the very latest addition to Church 7 was the erection of a memorial to William Forbes, Minister of Tarbat in 1841, set adjacent to the pulpit he preached in for over 40 years overseeing a difficult period in the history of the church 'dealing with daring sinners and presumptuous hypocrites' (23/F63, 23/C1155, 23/C1156)(Table 11). A full transcription of the memorial is held in the project archive and the memorial remains *in situ*.

Table 12 Summary of sculpture belonging to and reused in Church 7

Identifier	Description
TR34	Fragment of cross slab with hollow-armed cross and border moulding on reverse
-	Wall memorial plaque to Wm Forbes, Minister of Tarbat 1797 to 1838 erected 1841

Church 7 north aisle

Changes to the north aisle during Church 7 remodelled access arrangements and the laird's loft including raising the wall head, gable and roof assigned 23/C1167. An external stair was built against the west wall of the Church 6 north aisle, assigned 23/C1082, which led to a newly inserted door, 23/F21 providing direct access into the laird's loft. A fragment of early medieval cross slab was recovered from the fabric of the north stair during its removal in 1998 (see Table 11). The previous access into the loft was converted to a window (17/F121; blocking thereof 23/C1168). The ground floor was divided into two spaces by the insertion of a timber partition. This space, opening directly into the nave, would likely have housed parishioners, perhaps still gaining entry *via* the east door 17/F16 or direct from the nave, while the space behind the partition, accessed *via* the west door 23/F19 may have been reserved as private space for the laird.

Church 7 west gallery

Remodelling of the west gallery included the creation of a sloping gallery 23/F64 providing improved views into the nave and the minister for the heritors and their families who now occupied the former poor loft. The raising of the wall plate for the body of Church 6 assigned 23/C1160 may have been prompted by the remodelling of the west gallery and its conversion from a space occupied by poor parishioners to a space occupied by the church heritors (see Figure 5). A small light was provided for the new loft, facilitated by and probably concomitant with the raising of the wall plate, assigned 23/F3. The new church roof provided more headroom and the barrel-vaulted ceiling was removed. Access to the belfry was retained and gained from this gallery.

Church 7 east gallery

An east gallery appears to have been inserted into Church 6. An external stair was built 23/C1044 providing access to a door opening, notably straight-sided not chamfered like the doors of Church 6. This door, assigned 23/F11, provided entry to the east gallery which was set at the height of the laird's loft and the west heritors' gallery. The elevated position and separate entrance suggests the east gallery, like its counterparts, was reserved for parishioners of some standing. The gallery was lit by a new large window 23/F14 inserted into the east gable again facilitated by the raised wall head; the area beneath the gallery would have continued to have been lit by Church 6 23/F13 and 23/F15.

Church 7 south vestry

Plate 27 Blocking of Church 6 central door 17/F68=23/F5 to create Church 7 window

Along with more segregated means of entry into the church elsewhere a south vestry was built sequentially after the raising of the wall head, but very probably as a coherent part of the development. The vestry, assigned 23/C1031, consisted of a small annexe measuring 1.7m x 1.4m internally and was accessed *via* a door in the east wall, 23/F7. The interior space was lit by a single window in the south wall 23/F6 and contained a small vestment cupboard in the northwest corner. Access into the pulpit was *via* a door with timber lintel cut into the south wall of Church 6 23/C1050 assigned 23/F61. A small flight of stairs led into the pulpit which was fitted with a canopy (evidence for which was assigned 23/F62) and was the focal point for all galleries and the body of the nave. Evidence for the location of the pulpit was preserved within the floor of Church 5 which persisted in use until the end of Church 7. This development initiated the blocking of the central door of Church 6 (17/F68=23/F5) assigned 17/F70=23/F60 C1153 and C1154 and its conversion to a window (Plate 27). The three windows of the south wall were heightened facilitated by the new wall head.

Church 7 churchyard

This period of population boom, greater social stratification and the consequent internal pressure on church space is manifest architecturally and archaeologically by the changes to the church interior. This period also saw an increase in memorials in the churchyard some of which were markedly elaborate and ostentatious while others are notably humble.

Macleod Enclosure

The construction of the Macleod enclosure at the west end of the church belongs to part of this growth of investment in elaborate memorials. The north wall of the enclosure obscured part of the north external jamb of Church 6 window 23/F23 and a test pit adjacent showed the walls incorporated a chamfered plinth now buried. The enclosure measured *c*.4.5m x *c*.4.0m, its walls were assigned 23/C1101 and it was accessed *via* a flat-headed entrance 23/F29 set originally with a gate evidence for which was assigned 23/F52 and 23/C1102. The enclosure was constructed to house burial of members of the Macleod family of Geanies. Some time after 1807 a memorial to two sons of Donald Macleod of Geanies, who died in 1805 and 1807 respectively, was erected within the enclosure cut into the west gable end of the church (23/F24 and 23/C1096). Exactly when this memorial was erected cannot be determined confidently since a subsequent memorial to Donald Macleod (23/C1117 and its cut 23/F54) who died in 1834 was not erected until 40 years after his death. This later memorial to Macleod, initiated by his last-born child Catherine in 1874, implies that the remains of Macleod, his wife Margaret Crauford and their second son lie in the enclosure; their 11 other children were not permitted that honour. Donald and Margaret were married for 19 years, during which time Margaret gave birth to 12 children before her death in 1781. A transcription of these memorials was made and is kept in the project archive; a small marble removed from the enclosure during restoration in 1999 is displayed in St Colman's Gallery in the Tarbat Discovery Centre.

3.7 PERIOD 7

Period 7 is marked by Church 8 which represents a much altered church in response to the dramatic loss of parishioners following the Disruption of 1843 (Figure 30).

3.7.1 Church 8

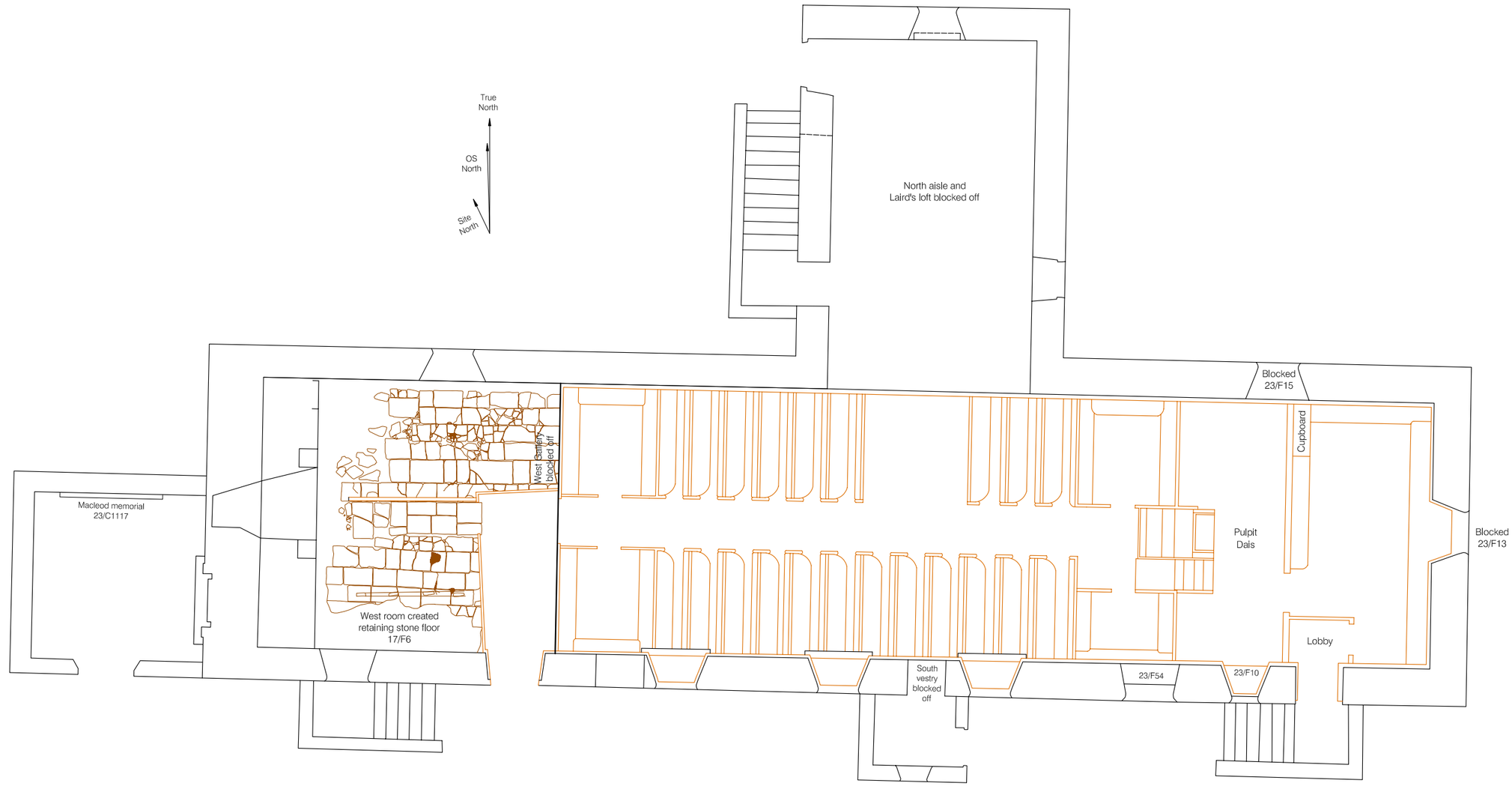
The principal changes undertaken to create Church 8 were the reorientation of worship to a west-east axis and the contraction of space required for a much reduced congregation. The western gallery and both floors of the north aisle were blocked off, while the eastern gallery was dismantled to allow the construction of a new vestry. A timber floor was inserted over most of the flagstone floor 17/F6 initiated in Church 5, although perhaps not immediately since a stone 'aisle' 17/F1 was identified as a strip of raised flags respecting the west-east orientation of worship reinstated with Church 8. The timber floor was assigned 17/C1000 and some of the flags of 17/F1 were stacked to form joist supports (assigned 17/C1058).

Access into Church 8 was thus reduced to a single south door reusing that of Church 6 17/F68=23/F2. The easternmost south door of Church 6 23/F9 was blocked (23/F54, C1135) incorporating the remains of a 17th-century grave cover slab to a Mackenzie (see Appendix G) and a post-medieval slab incised with a capital 'A' and further lettering both of which remain *in situ* (Table 12).

Church 8 vestry
The axis of worship returned to east-west with a raised east end incorporating a timber gallery with precentor's box and vestry behind. This arrangement rendered the previous pulpit and south vestry obsolete; the pulpit canopy was removed and the door from the south vestry 23/F60 blocked off. The creation of the new vestry required the blocking of east and north windows 23/F13 and 23/F15, while window 23/F10 was inserted adjacent to the south door 23/F11 to light the new pulpit which also retained the use of the former east gallery window 23/F14. The vestry was partitioned from the nave by timber panelled stud walls.

Church 8 west room
As part of the general contraction of space within Church 8, a west room was formed to the left of the door by timber stud walls. Within this space the flagstone floor continued in use up until the conversion of the church. The room was lit with the pre-existing windows of Church 6 and 7 (23/F22 and 23/F23).

Church 8 crypt
The layers cleared as Intervention 13 are generally those derived from an extended period of disuse and neglect of the crypt following its use as a fuel store in Church 6/7, since Church 8 no longer incorporated private fireplaces. The bone component within the fuel peat layers was not consistent with the importation of fen peat and evidence for the use of the crypt by a variety of animals was recovered. From the clearance deposit, a minimum of 18 hares were identified along with a leveret, rabbits, dog, cat and kitten, many species of bird as well as amphibian and fish bone. At least some of the remains might be attributable to importation by carnivorous animals such as owls and otters who may have been responsible for the presence of rabbit, amphibian and fish. The assemblage suggests that the space had become wholly abandoned by this stage and



Plan of Church 8

Scale 1:100

Figure 30

that the space was unglazed allowing ingress for these animals. Further features were identified as likely burrows, such as 19/F10, 19/F16 and 19/F17.

Other material recovered seemed to imply some use for the disposal of soil perhaps from grave digging, or that which may have tumbled into the below-ground space. A fragmentary 19th-century memorial stone was identified along with disarticulated human bone, fragments of leather shoes, and ironwork, perhaps coffin fittings. Most notably, six fragments of early medieval sculpture were recovered including three conjoining fragments of slab with incised interlace (TR17), a further small remnant of spiral decoration (TR18) and two fragmentary grave-marker cross-slabs were identified, one with a hollow-armed cross on both sides (13/Find no 89), the other preserving a pecked cross arm with a double-looped terminal (13/Find no 84)(see Table 12). An assemblage of 15 coins from the late medieval period onwards was also recovered and awaits identification and cataloguing. A further nine copper-alloy shroud pins were identified along with a late medieval thimble, lace chapes and other dress accessories along with a possible bone stylus.

Table 13 Summary of sculpture recovered from Church 8

Identifier	Description
TR17	Three conjoining fragments with incised spiral and interlace recovered from dumping in crypt
TR18	Small fragment with spiral and part border recovered from dumping in crypt
13/84=17/469	Small fragment of cross-slab with pecked cross arm with looped terminal recovered from dumping in crypt
13/89	Small fragment of cross-slab, double sided with hollow-armed cross similar to TR21 recovered from dumping in crypt
-	Fragment bearing incised capital 'A' and illegible further lettering used within blocking of 23/F9
-	Reused 17th-century Mackenzie grave cover in blocking of door 23/F9=23/F54 used within blocking of 23/F9

4.0 DISCUSSION

The account presented here represents the accumulative analyses of the archaeology of Sector 4 undertaken by members of the project team since 1997. Further discussion awaits input from specialist studies which can be summarised as follows:

- Stable isotope dietary study of Tarbat individuals
- Stable isotope analysis for provenance of Tarbat individuals
- Cataloguing of metalwork assemblage
- Cataloguing of sculpture assemblage
- Identification of assemblage of coins from Intervention 13
- Full reporting on the assemblages of disarticulated bone toward demographic reconstruction
- Re-ageing of articulated burials to current criteria
- Reporting of Burial 189 and 190

- Reappraisal of Burial 30/36 and associated disarticulated skull assemblage

Once the reports on these analyses have been received the results can be incorporated into the final research report. The reports will enable the final and most complete dating of the sequence and demographic reconstruction, analysis and discussion.

References

Carver, M.O.H. 1995. (ed) *Bulletin of the Tarbat Discovery Programme Bulletin Number 1*, (York)

Carver, M.O.H. 1997. (ed) *Bulletin of the Tarbat Discovery Programme Bulletin Number 3*, (York)

Carver, M.O.H. 1999. 'Field Archaeology', in G. Barker (ed) Companion Encyclopaedia of Archaeology (Routledge, London and New York):128-181

Carver, M.O.H. 2008. *Portmahomack, Monastery of the Picts* (Edinburgh)

Historic Scotland 1996 *Archaeology Procedure Paper 2, Project Design, Implementation and Archiving* (Edinburgh)

APPENDIX A INDEX OF BURIALS

Burial	Int	Feature	Context	Period	Condition	Completeness	Age	Sex	Burial mode
1	17	20	1079	4	good	<40%	adult	probable male	
2	17	56	1163	4	good	>70%	0.6-2.5	-	
3	17	24	1084	4	fair	40-70%	10.6-14.5	-	
4	17	39	1122	4	good	40-70%	0-0.5	-	shrouded
5	17	25	1085	4	fair	>70%	46+	female	
6	17	22	1081	4	fair	40-70%	0.6-2.5	-	
7	17	21	1077	4	good	<40%	2.6-6.5	-	
8	17	34	1117	4	good	<40%	17-25	probable male	coffined
9	17	45	1139	4	good	<40%	adult	probable male	coffined
10	17	40	1124	4	good	<40%	6.6-10.5	-	
11	17	36	1098	4	poor	<40%	2.6-6.5	-	
12	17	35	1119	4	good	>70%	0-0.5	-	
13	17	39	1138	4	fair	>70%	0.6-2.5	-	
14	17	27	1101	4	poor	<40%	2.6-6.5	-	
15	17	41	1128	4	good	<40%	0.6-2.5	-	
16	17	28	1103	4	poor	>70%	6.6-10.5	-	shrouded
17	17	7	1127	5	poor	>70%	26-45	male	coffined
18	17	33	1114	4	good	40-70%	46+	male	shrouded
19/31	17	54/42	1158/1130	4	fair	>70%	46+	male	
20	17	49	1145	4	poor	<40%	46+	probable female	
21	17	75	1196	4	poor	40-70%	2.6-6.5	-	coffined
22	17	50	1148	4	fair	<40%	0-0.5	-	
23	17	7	1108	5	good	>70%	46+	female	shrouded and coffined
24	17	43	1133	4	good	<40%	14.6-17	-	
25	17	26	1099	4	fair	>70%	46+	male	shrouded
26	17	55	1162	4	poor	40-70%	0-0.5	-	coffined
27	17	38	1120	4	good	>70%	10.6-14.5	-	shrouded
28	17	44	1135	4	fair	<40%	46+	female	
29	17	77	1213	5	fair	<40%	0.6-2.5	-	
30	17	76	1209	4	good	>70%	46+	male	coffined; four extra skulls; head replaces that of B36
32	17	30	1106	4	poor	<40%	46+	male	
33	17	79	1224	4	fair	>70%	0-0.5	-	
34	17	51	1152	4	poor	40-70%	46+	male	
35	17	82	1225	4	good	>70%	17-25	male	shrouded
36	17	76	1214	4	poor	>70%	46+	male	coffined, four extra skulls; head replaced by B30
37	17	32	1102	4	fair	>70%	26-45	probable male	
38	17	99	1272	2	fair	>70%	46+	male	probably shrouded
39	17	96	1265	2	poor	<40%	adult	probable male	
40	17	120	1304	2	fair	>70%	26-45	male	head box
41	17	84	1233	4	poor	>70%	17-25	male	shrouded
42	17	108	1288	2	fair	<40%	46+	male	head slab
43	17	83	1288	4	fair	40-70%	46+	male	coffined, clothed and shod

Burial	Int	Feature	Context	Period	Condition	Completeness	Age	Sex	Burial mode
44	17	94	1261	2	fair	<40%	46+	probable male	head box
45	17	107	1285	2	fair	<40%	46+	male	head box
46	17	91	1254	1	fair	<40%	adult	probable male	long cist
47	17	98	1271	2	good	<40%	26-45	male	
48	17	89	1250	2	fair	<40%	26-45	probable male	
49	17	90	1252	4	poor	<40%	adult	probable female	possibly shrouded
50	17	101	1274	2	fair	<40%	adult	undetermined	
51	17	102	1276	2	fair	40-70%	26-45	probable male	
52	17	109	1292	2	good	40-70%	46+	male	shrouded
53	17	106	1282	2	poor	40-70%	46+	male	head slab
54	17	103	1278	2	poor	40-70%	17-25	male	
55	17	8	1048	4	fair	>70%	17-25	undetermined	shrouded
56	17	8	1015	4	good	40-70%	46+	male	coffined
57	17	8	1031	4/5	good	<40%	0.6-2.5	-	
58	17	79	1224	4	poor	<40%	0-0.5	-	coffined
59	17	8	1025	4/5	good	>70%	2.6-6.5	-	flagstone burial
60	17	14	1045	4/5	good	40-70%	0.6-2.5	-	
61	17	8	1042	4/5	good	<40%	0.6-2.5	-	
62	20	5	1016	4	good	40-70%	46+	female	shrouded
63	20	2	1011	4	fair	>70%	2.6-6.5	-	shrouded
64	20	8	1020	4	good	>70%	46+	male	shrouded
65	20	16	1036	4	good	>70%	6.6-10.5	-	coffined
66	20	9	1021	4	good	40-70%	26-45	male	
67	20	7	1019	4	good	40-70%	26-45	female	
68	20	7	1019	4	good	>70%	pre-term	-	
69	20	10	1022	4	good	40-70%	46+	female	shrouded
70	20	15	1035	4/5	good	40-70%	0.6-2.5	-	shrouded
71	20	18	1038	4	fair	40-70%	2.6-6.5	-	
72	20	46	1099	4	poor	<40%	adult	undetermined	
73	20	11	1027	4/5	fair	40-70%	0.6-2.5	-	shrouded
74	20	25	1063	4	good	<40%	46+	male	
75	20	13	1030	4	poor	<40%	adult	probable male	shrouded
77	20	6	1017	4	good	40-70%	26-45	male	shrouded
78	20	19	1041	4	good	<40%	26-45	female	shrouded
79/114	20	51/82	1122/1200	4	good	>70%	17-25	probable female	
80	20	20	1039	4	poor	<40%	46+	male	
81/87	20	43/52	1100/1125	4	good	>70%	10.6-14.5	-	
82	20	38	1101	4	poor	<40%	46+	female	
83	20	42	1093	4	fair	40-70%	26-45	probable female	
84	20	39	1102	4	fair	<40%	46+	male	
85	20	36	1110	4	fair	>70%	17-25	probable male	
86	20	60	1144	4	fair	>70%	6.6-10.5	-	coffined
88	20	50	1117	4	fair	>70%	26-45	female	coffined and shrouded
89	20	59	1142	4	fair	40-70%	0.6-2.5	-	possibly coffined
90	20	45	1106	4	fair	>70%	46+	male	shrouded
91	20	62	1147	4	good	>70%	26-45	female	shrouded

Burial	Int	Feature	Context	Period	Condition	Completeness	Age	Sex	Burial mode
92	20	66	1159	4	fair	<40%	26-45	female	coffined
93	20	28	1115	4	good	>70%	26-45	male	coffined
94	20	21	1048	4	good	<40%	adult	probable male	coffined
95	20	71	1169	4	fair	>70%	46+	female	
96	20	57	1135	4	good	<40%	adult	probable male	
97	20	48	1107	4	poor	<40%	46+	probable female	shrouded
98	20	49	1113	4	good	>70%	26-45	male	coffined
99	20	76	1183	4	good	<40%	46+	female	
100	20	64	1155	4	good	<40%	26-45	female	
101	20	47	1105	4	fair	>70%	46+	female	coffined and shrouded
102	20	31	1123	4	good	40-70%	26-45	female	
103	20	32	1119	4	good	>70%	26-45	male	
104	20	37	1120	4	good	<40%	adult	probable male	
105	20	56	1131	4	poor	40-70%	46+	female	
106	20	54	1138	4	good	40-70%	46+	female	
107	20	1	1010	4	good	<40%	17-25	male	
108	20	75	1180	4	good	>70%	26-45	male	coffined
109	20	77	1189	4	fair	>70%	46+	male	coffined
110	20	79	1193	4	good	40-70%	10.6-14.5	-	shrouded
111	20	86	1209	3	poor	>70%	26-45	male	head support
112	20	69	1174	4	good	40-70%	46+	male	coffined
113	20	84	1206	4	good	>70%	46+	male	coffined and shrouded
115	20	83	1202	4	poor	<40%	adult	probable female	coffined
116	20	96	1228	2	poor	<40%	26-45	male	probable head box
117	20	93	1222	Church 2/3	poor	40-70%	17-25	male	
118	20	102	1242	2	fair	<40%	adult	probable male	
119	20	81	1198	4	fair	<40%	10.6-14.5	-	coffined
120/132	20	58	1140/1195	4	good	>70%	46+	probable male	
121	20	110	1259	2	fair	>70%	26-45	male	
122	20	112	1263	2	poor	>70%	46+	male	head and torso cover, probably shrouded
123	20	100	1237	2	poor	<40%	46+	male	
124	20	109	1256	2	fair	<40%	17-25	male	
125	20	113	1265	2	poor	>70%	46+	male	probable head box, possibly shrouded
126	20	97	1229	2	fair	40-70%	46+	probable male	head support
127	20	128	1300	2	poor	40-70%	26-45	probable female	
128	20	103	1244	2	poor	<40%	46+	probable male	probable head box
129	20	118	1277	2	fair	>70%	17-25	probable male	shrouded
130	20	133	1309	2	fair	>70%	26-45	male	head box
131	20	135	1312	1	fair	<40%	46+	female	
133	20	122	1288	2	fair	40-70%	46+	probable male	probably shrouded
134	20	14	1034	4	fair	<40%	17-25	probable male	
135	20	120	1280	2	fair	<40%	26-45	undetermined	
136	20	121	1286	3	fair	40-70%	46+	male	
137	20	119	1278	2	poor	<40%	26-45	male	head slab

Burial	Int	Feature	Context	Period	Condition	Completeness	Age	Sex	Burial mode
139	20	106	1251	2	fair	<40%	46+	male	probable head box
140	20	123	1289	2	fair	>70%	17-25	male	probably shrouded
141	20	101	1240	2	fair	>70%	26-45	male	shrouded
142	20	111	1260	2	poor	40-70%	46+	male	
143	20	90	1214	2	poor	>70%	46+	male	shrouded
144	20	98	1232	2	good	40-70%	46+	male	
145	20	139	1329	2	good	<40%	26-45	probable male	
146	20	137	1318	1	fair	<40%	26-45	female	long cist
147	20	125	1294	2	good	40-70%	26-45	male	wood/wicker matrix
148	20	99	1235	2	fair	<40%	46+	male	probably shrouded
149	20	117	1275	1	poor	40-70%	46+	male	long cist
150	20	94	1224	4	good	<40%	adult	male	
151	20	140	1322	2	fair	40-70%	46+	male	head box, shrouded
152	20	132	1307	2	fair	40-70%	26-45	male	head slab
153	20	14	1268	2	fair	40-70%	26-45	male	shrouded
154	20	141	1331	2	good	40-70%	26-45	male	head box, shrouded
155	20	146	1338	2	poor	>70%	46+	female	shrouded
156	20	121	1284	3	poor	40-70%	26-45	male	head slab
157	20	104	1247	2	good	40-70%	26-45	male	probable head box
158	20	138	1328	2	fair	40-70%	46+	male	shrouded
159	20	115	1270	2	good	40-70%	10.6-14.5	-	
160	20	148	1346	2	poor	<40%	46+	probable male	probably shrouded
161	20	74	1177	4	good	>70%	26-45	male	possibly coffined
162	20	159	1373	1	poor	40-70%	adult	male	long cist
163	20	160	1374	1	poor	40-70%	26-45	male	probably shrouded
164	20	151	1353	2	fair	>70%	26-45	male	head box, shrouded
165	20	158	1371	2	poor	<40%	adult	undetermined	
166	20	161	1381	1	poor	<40%	adult	probable female	long cist
167	20	156	1365	2	poor	<40%	adult	probable male	
168	20	153	1357	2	poor	<40%	26-45	probable male	
169	20	155	1362	1	fair	>70%	26-45	male	
170	20	157	1368	1	poor	>70%	26-45	male	
171	20	154	1360	2	good	>70%	26-145	male	
172	20	152	1364	1	poor	40-70%	46+	female	long cist
173	20	116	1271	2	good	<40%	46+	male	head box
174	20	144	1334	2	poor	<40%	adult	probable female	shrouded
175	20	40	1090	4	good	40-70%	6.6-10.5	-	
176	17	95	1263	2	fair	>70%	26-45	probable male	head box, probably shrouded
177	17	37	1086	4/5	good	40-70%	0-0.5	-	
178	20	65	1157	4	-	-	-	-	
179	20	136	1314	1	unexcavated	-	-	-	
180	20	164	1342	1	unexcavated	-	-	-	long cist
181	20	27	1074	1	unexcavated	-	-	-	long cist
182/183	20	142/149	1343/1348	1	body stain	-	-	-	long cist
184	20	162	1378	1	unexcavated	-	-	-	
185	20	163	1379	1	no skeleton	-	-	-	long cist

Burial	Int	Feature	Context	Period	Condition	Completeness	Age	Sex	Burial mode
186	14	515	2987	1	fair	>70%	46+	male	long cist
187	14	516	3346	1	fair	>70%	26-45	male	long cist
188	14	517	3367	1	poor	<40%	adult	undetermined	long cist
189	16	1	1009	2	poor	<40%	pending	pending	
190	20	3	1006	4	poor	<40%	2.6-6.5	-	

APPENDIX B SUMMARY OF RADIOCARBON DETERMINATIONS

Burial/ FNo	Period	Age BP	C14 cal 95% (88%)	Lab No
17/107	Ch. 2/3	865±39	AD1040-1260	OxA-10536
20/129	1	1465±35	AD540-650	SUERC-13263 (GU-15001)
Bal A	-	2290±35	BC410-230	SUERC-13257 (GU-14998)
Bal B	-	1705±30	AD240-420	SUERC-13261 (GU-14999)
Bal C	-	1655±35	AD260-530	SUERC-13262 (GU-15000)
90	4	439±30	AD1460-1660	OxA-13521
97	4	475±27	AD1440-1640	OxA13762
98	4	520±30	AD1420-1620	SUERC-33400 (GU-23364)
101	4	450±30	AD1440-1630	SUERC-33401 (GU-23365)
110	4	644±27	AD1290-1410	OxA-13490
111	3	945±30	AD1020-1210	SUERC-33402 (GU-23366)
112	3	710±30	AD1280-1420	SUERC-33403 (GU-23367)
113	3	659±27	AD1290-1430	OxA13491
116	2	1268±28	AD680-880	OxA-13489
117	Ch. 2/3	830±35	AD1150-1270	GU-9298
128	2	1364±28	AD640-770	OxA-13487
129	2	1255±30	AD670-880	SUERC-33404 (GU-23368)
130	2	1280±30	AD660-780	SUERC-33405 (GU-23369)
136	3	1020±30	AD970-1040 (AD960-1050)	SUERC-33406 (GU-23370)
144	2	1304±28	AD680-890	OxA-13488
147	2	1213±31	AD720-960	OxA-13485
152	2	1120±35	AD780-1000	GU-9297
153	2	1315±30	AD650-780	SUERC-33410 (GU-23371)
156	3	1020±30	AD970-1040 (AD960-1050)	SUERC-33411 (GU-23372)
158	2	1215±35	AD680-900	GU-9296
160	2	1283±27	AD680-880	OxA-13486
162	1	1536±26 1565±35	AD430-575 (mean)	OxA-13483 SUERC-13255
163	1	1359±26	AD640-690	OxA-13484
165	2	1309±26	AD650-780	OxA13509
169	1	1375±30	AD610-680	SUERC-33412 (GU-23373)
170	1	1420±30	AD580-660	SUERC-33413 (GU-23374)
171	2	1325±30	AD660-850	SUERC-33414 (GU-23375)

Burial/ FNo	Period	Age BP	C14 cal 95% (88%)	Lab No
172	1	1498±34 1395±30	AD570-650 (mean)	OxA-9699 SUERC-37079
186	1	1525±35	AD420-610	SUERC-13256 (GU-14997)
187	1	1470±30	AD540-650	SUERC-33416 (GU-23377)

APPENDIX C HUMAN BONE REPORT

Sarah King

1.0 INTRODUCTION

This report presents the results of human osteological and palaeopatholgical analyses of 177 skeletons and 6,309 disarticulated fragments/bones excavated in Tarbat Old Church, Portmahomack in Scotland by Field Archaeology Specialists Ltd. (FAS), University of York. Most of the data collected were entered into an SPSS database (version 9.0), and are available for future comparative analyses. Scottish assemblages that were compared with Tarbat are presented in Appendix I.

All articulated skeletons represent separate burial events, with the exception of a mother buried with a foetus *in situ* (SK 67 and SK 68). The burials span five phases: Phase 1 represents cist burials thought to be contemporary with the 8th-century monastery, Phase 2 represents 'pillow burials' from the 8th to 11th centuries, Phases 3 and 4 represent a medieval period from the 12th to 16th century and Phase 5 represents the period after the Reformation of 1560. The majority of inhumations were from the medieval period (56%) followed by phase 2 (38%). Very few skeletons belonged to phases 1 or 5 (Table 1.1).

Table 1.1 Tarbat burials by phase

Phase	**N**	**%**
1 (cist burials - 8th C)	4	2.3
2 ('pillow' burials - 8th - 11th C)	67	37.9
3 & 4 (medieval burials - 12th - 16th C)	99	55.9
5 (post-medieval burials - post-1560)	7	4.0
Total	**177**	**100**

2.0 PRESERVATION

The general state of preservation in a skeletal assemblage can be assessed by examining the completeness of each skeleton and the condition of the bones. Of 177 burials recovered for analysis, the majority (40%) were incomplete (< 40% of the skeleton was represented), although 29% were > 70% complete (Table 2.1). The relatively high percentage of incomplete burials in the Tarbat sample was a result of a high degree of disturbance by subsequent burials over the course of several centuries. A few inhumations were also truncated by the various construction phases of the church, and some were partially beyond the limits of the archaeological excavations.

Thirty-seven percent of the skeletons were in good condition, 35% were in fair condition (some erosion, flaking or fragmentation), and 28% were in poor condition (soft, friable, eroded and/or extensively fragmented) (Table 2.1). In contrast to the findings for completeness, the condition of the bones varied by phase. In Phase 2, the majority of skeletons were in poor to fair condition, whereas in Phases 3 and 4 (the medieval period), most of the skeletons were in fair to good condition (Table 2.3). All of the skeletons from the earliest phase were in poor condition, and five of seven skeletons from Phase 5 were in good condition. Thus, it is apparent that the later burials were generally in better condition than the earlier burials. In some cases, burial conditions were excellent such that hair and other organic material (e.g. a leather shoe) were preserved in association with the skeletons.

In the Tarbat sample, there were no significant differences between the adults and subadults (< 17 years of age) in terms of completeness or bone condition (^{2} = 1.39 and ^{2} = 5.40, df = 2, p = ns, respectively). Similar to the adults, a number of

the subadult burials were truncated by later inhumations. These findings suggest that the sample of subadults is not likely to be underrepresented as a result of preservation factors.

Table 2.1 Preservation of the Tarbat skeletons

	Completeness			
Condition	**> 70%**	**40-70%**	**< 40%**	**Total**
good	18	24	24	66 (37.3%)
fair	24	17	21	62 (35.0%)
poor	10	14	25	49 (27.7%)
Total	**52 (29.4%)**	**55 (31.1%)**	**70 (39.5%)**	**177 (100.0)**

Table 2.2 Completeness of skeletons by phase

	Phase 1		**Phase 2**		**Phases 3 and 4**		**Phase 5**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
> 70%			17	25.4	31	31.3	4	57.1
40-70%	3	75.0	21	31.3	30	30.3	1	14.3
< 40%	1	25.0	29	43.3	38	38.4	2	28.6
Total	**4**	**100.0**	**67**	**100.0**	**99**	**100.0**	**7**	**100.0**

Table 2.3 Bone condition by phase

	Phase 1		**Phase 2**		**Phases 3 and 4**		**Phase 5**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
good			12	17.9	49	49.5	5	71.4
fair			30	44.8	31	31.3	1	14.3
poor	4	100.0	25	37.3	19	19.2	1	14.3
Total	**4**	**100.00**	**67**	**100.0**	**99**	**100.0**	**7**	**100.0**

3.0 AGE ESTIMATION

3.1 ADULTS

Where possible, age-at-death was estimated for each skeleton based on methods recommended by Buikstra and Ubelaker (1994). For adults, this included examining the pubic symphyses (Todd 1921a, 1921b; Suchey and Katz 1986; Brooks and Suchey 1990), auricular surface of the os coxae (Lovejoy *et al.* 1985; Meindl and Lovejoy 1989) and cranial suture closure (Meindl and Lovejoy 1985). In addition, dental attrition was recorded (Brothwell 1981), and sternal rib end morphology (Iscan *et al.* 1984; 1985) was examined when other techniques could not be applied. However, the majority of skeletons (69%) could be aged using the pelvis (alone or with other techniques), and only two skeletons were aged using either dental attrition or sternal end morphology alone. When none of the methods could be applied, skeletons were classified as 'adult' based on size and development (i.e. fused epiphyses).

All of the methods produce age range estimates, and based on an overall assessment, each skeleton was assigned to a standardized age range (Calvin Wells Lab, University of Bradford) to facilitate comparison:

17-25 years - young adult
26-45 years - middle adult
46+ years - old adult

Of 138 adult burials, 14 (10%) were estimated to be young adults, 44 (32%) were middle adults, 57 (41%) were old adults and 23 (17%) were assigned as 'adult'. There was no significant difference in the distribution of age-groups between Phase 2 and the medieval phases (3 and 4) (^{2} = 4.4, df = 2, p = 0.11).

Table 3.1 Adult age distribution by phase

	Phase 1		**Phase 2**		**Phases 3 & 4**		**Phase 5**		**Total**	
Age	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
adult	2	50.0	11	16.7	10	15.6			**23**	**16.7**
17-25			5	7.6	8	12.5	1	25.0	**14**	**10.1**
26-45			27	40.9	16	25.0	1	25.0	**44**	**31.9**
46+	2	50.0	23	34.8	30	46.9	2	50.0	**57**	**41.3**
Total	**4**	**100**	**66**	**100**	**64**	**100**	**4**	**100**	**138**	**100**

3.2 SUBADULTS (< 17 YEARS OF AGE)

The skeleton and teeth undergo several changes in childhood as it is a period of rapid growth (Johnston and Zimmer 1989). As a result, it is often possible to assign smaller age ranges to subadult skeletons than to adult skeletons. As recommended by Buikstra and Ubelaker (1994), age of subadults was estimated by examining dental formation (Morrees *et al*. 1963a, 1963b) and eruption (Ubelaker 1989) as well as bone fusion of primary ossification centres and union of epiphyses (see Buikstra and Ubelaker 1994). In addition, a selected number of bone measurements were recorded following Buikstra and Ubelaker (1994). Measurements were taken on both sides (where possible) to the nearest 0.1 mm.

Dental development is the preferred method for estimating chronological age as the deciduous dentition may be largely buffered against environmental influences (Konigsberg and Holman, 1999). When dentition are absent, age may be estimated by comparing long bone length to references. In the Tarbat sample, 49% of the subadults did not have dentition. For these individuals, age was determined by comparing diaphyseal lengths to the references from Ubelaker (1989).

In total, 39 children were recovered from Old Tarbat Church (22% of the total sample). Of the subadults, several age groups were almost equally represented, with the exception of the pre-term group (represented by one foetus - 8 1/2 lunar months (Fazekas and Kosa, 1978) - found within the pelvis of an adult female), and one individual in the 14.6 to 17 year age group. However, there was a relatively high percentage of children in the 0.6-2.5 year age group (Table 3.2). As it is unlikely that there was preferential burial of this age group, this finding suggests that there was a relatively high prevalence of deaths after 6 months of age. Breast feeding provides an important source of nutrition and immunological protection to an infant, however, breast milk alone may not be nutritionally sufficient after 4 to 6 months of age (Whitehead and Paul, 1981). Supplementary food is associated with an increased risk of infection. Thus, this age group may be expected to be vulnerable to undernutrition-infection interactions, and high mortality.

Table 3.2 Age distribution of the subadults by phase

Age Group (years)	Phase 1		Phase 2		Phases 3 & 4		Phase 5		Total	
	N	%	N	%	N	%	N	%	N	%
pre-term					1	2.9			**1**	**2.6**
newborn -0.5					7	20.0			**7**	**17.9**
0.6-2.5					9	25.7	2	66.7	**11**	**28.2**
2.6-6.5					6	17.1	1	33.3	**7**	**17.9**
6.6-10.5					6	17.1			**6**	**15.4**
10.6-14.5			1	100	5	14.2			**6**	**15.4**
14.6-17					1	2.9			**1**	**2.6**
Total	**0**	**-**	**1**	**100**	**35**	**100**	**3**	**100**	**39**	**100**

Almost all the subadults (90%) were from the medieval phases (3 and 4). Only one individual (aged between 10.6 and 14.5 years of age) was recovered from Phase 2, and three subadults were recovered from phase 5 (two 0.6 to 2.5 years of age and one child from 2.6 to 6.5 years of age). As most of the church was excavated, the negligible representation of small children in the 8th to the 11th centuries suggests that there was a change in burial practices *within the church* after that period.

3.3 AGE-AT-DEATH AT TARBAT AND OTHER SCOTTISH SITES

While there may be problems examining age-at-death in a sample, a comparison of assemblages can help to identify broad patterns. There are very few Scottish sites available for comparison with the 8th to 11th century phase at Tarbat (Phase 2). In this phase, most of the individuals who were buried in the church were adults (only one young juvenile was represented). This differs from the Isle of May, where 10% of the individuals were subadults, and Hallow Hill, where most of individuals were subadults and young adults (Table 3.3).

There were several sites in Scotland that could be compared to the medieval phase at Tarbat (Table 3.4). Tarbat appears anomalous in having a high percentage of older adults (30%). Most of the other sites, with the exception of Glasgow Cathedral, had very few old adults. Generally, subadults and middle adults had the highest percentage of deaths (although the Isle of May site had a high percentage of young adult deaths). It is noted that in other medieval sites, such as Wharram Percy in England, high percentages (40%) of individuals died in old age (50+) (see Mays 1998).

The medieval assemblage at Tarbat has an age distribution that is roughly U-shaped - that is, there was a much higher risk of dying among the very young and very old. Although the sample is time averaged, this curve is characteristic of most population groups (Chamberlain 1994). Overall, these broad comparisons suggest that the individuals buried within the church at Tarbat during the medieval period are representative of a 'normal' age distribution, and were living to older ages in comparison to other population groups, with the exception of Glasgow Cathedral. Burial within churches is likely relatively high-status compared to burial out-side of the church, and it is possible that more privileged individuals lived to older ages. However, this hypothesis cannot be tested without analysing burials from outside of Tarbat church.

Table 3.3 Age-at-death in Scottish sites c.8th - 11th century

Site	Date	N	Subadults (%)	Young Adults (%)	Middle Adults (%)	Old Adults (%)
Tarbat	**8th - 11th C**	**67**	**1.5**	**7.5**	**40.2**	**34.3**
Isle of May	5th - 12th C	42	9.5	16.6	33.3	26.2
Hallow Hill	6th - 9th C	82	29.3	34.1	30.5	6.1

Table 3.4 Age-at-death in medieval Scottish sites

Site	Date	N	Subadults (%)	Young Adult (%)	Middle Adults (%)	Old Adults (%)
Tarbat	**12th - 15th C**	**99**	**35.4**	**8.1**	**16.1**	**30.3**
Glasgow Cathedral	12th - 15th C	56	19.6	1.8	25.0	25.0
Isle of May	12th - 17th C	14	7.1	35.7	35.7	7.1
Dundee	12th - 15th C	35	28.4	6.0	40.3	9.0
Dunbar	medieval	76	48.6	1.3	31.5	9.2
Whithorn	13th - 15th C	1605	31.9	12.5	39.7	7.1
Aberdeen (C)	13th - 16th C	193	32.1	15.5	29.0	8.2
Linlithgow	c.13th - 17th C	201	66.2	16.9	6.5	3.5

4.0 SEX DETERMINATION

The sex of each adult skeleton was determined by examining sexually dimorphic features on the pelvis and skull (as recommended by Buikstra and Ubelaker 1994). In addition, measurements (i.e. articular surfaces and clavicle length) were taken on several bones to help assess dimorphism (after Bass, 1987). In those cases where an individual demonstrated both male and female traits, sex was determined by the predominating number of traits. However, (if present) the pelvis was considered to be the most reliable indicator of sex (Buikstra and Ubelaker 1994). While there are some methods for determining sex in subadults (see Mays 1998 for an overview), these techniques are not generally accepted (Saunders 1992).

Due to incompleteness, several skeletons were assigned as either ''probable female' or 'probable male'. However, for analyses, these skeletons were included in the female and male categories. Overall, the Tarbat assemblage consisted of 24% females (including 11 'probable females') and 71% males (including 26 'probable males'). Sex could not be determined for seven skeletons (5%). It was noted that there was obvious sexual dimorphism in the Tarbat sample.

Table 4.1 demonstrates that there were differences in sex distribution between Phase 2 and the medieval phases (3 and 4) such that there were more men in the earlier phase. This relationship is highly significant ($^2 = 13.5$, $p < 0.001$). In Phase 2, the ratio of females to males was 1:9.2, and in the medieval phases (3 and 4), it was 1:1.6.

Table 4.1 Sex determination of the Tarbat skeletons by phase

Sex	Phase 1		Phase 2		Phases 3 & 4		Phase 5		Total	
	N	%	N	%	N	%	N	%	N	%
undetermined	0		5	7.6	1	1.6	1	25.0	**7**	**5.1**
female	2	50.0	6	9.1	24	37.5	1	25.0	**33**	**23.9**
male	2	50.0	55	83.3	39	60.9	2	50.0	98	71.0
Total	4	100	66	100	64	100	4	100	138	100

Table 4.2 presents the Tarbat individuals by sex, age category and phase. To determine if there were differences in the relative proportions of females and males between each age category, chi-square analysis was conducted by phase, however, no significant differences were observed (Phase 2: $^2 = 0.46$, df = 2, $p = 0.80$, Phases 3 and 4: $^2 = 1.5$, df = 2, $p = 0.46$). There was no association between sex and age-at-death.

Table 4.2 Distribution of females and males by age category and phase

	adult		17-25		26-45		46+	
Phase 1	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
undetermined								
female	1	50.0					1	50.0
male	1	50.0					1	50.0
Phase 2								
undetermined	4	36.4			1	3.7		
female	2	18.2			2	7.4	2	8.7
male	5	45.5	5	100.0	24	88.9	21	91.3
Phases 3 & 4								
undetermined	1	10.0						
female	3	30.0	2	25.0	8	50.0	11	36.7
male	6	60.0	6	75.0	8	50.0	19	63.3
Phase 5								
undetermined			1	100.0				
female							1	50.0
male					1	100.0	1	50.0
Total Sample								
undetermined	5	21.7	1	7.1	1	2.3		
female	6	26.1	2	14.3	10	22.7	15	26.3
male	12	52.2	11	78.6	33	75.0	42	73.7
Total	**23**	**100**	**14**	**100**	**44**	**100**	**57**	**100**

4.1 SEX DISTRIBUTION AT TARBAT AND OTHER SCOTTISH SITES

When compared with other broadly contemporary sites, the sex distribution of Phase 2 was most similar to the Isle of May, and unlike Hallow Hill (Table 4.4). The sex distribution of the medieval period from Tarbat was very similar to Glasgow Cathedral. At both of these sites, males were more often buried within the church than females. It is not possible to suggest whether this reflects differences in mortality rates between the sexes or whether males were more likely to receive preferential burial within the church. However, several other medieval assemblages also had more males than females, and only Dunbar and Linlithgow had more females than males (Table 4.5).

Table 4.4 Sex distribution in Scottish sites c. 8^{th} - 11^{th} C

Site	**Date**	**Females (N)**	**Males (N)**	**Ratio**
Tarbat	**8th - 11th C**	**6**	**55**	**1:9.2**
Isle of May	5th - 12th C	4	32	1:8
Hallow Hill	6th - 9th C	20	17	1.2:1

Table 4.5 Sex distribution in medieval Scottish sites

Site	Date	Females (N)	Males (N)	Ratio
Tarbat	**12th - 15th C**	**24**	**39**	**1:1.6**
Glasgow Cathedral	12th - 15th C	16	27	1:1.7
Isle of May	12th - 17th C	3	8	1:2.7
Dundee	12th - 15th C	15	16	1:1
Dunbar	medieval	22	16	1.4:1
Whithorn	13th - 15th C	356	314	1.1:1
Aberdeen (C)	13th - 16th C	46	60	1:1.3
Linlithgow	c.13th - 17th C	31	18	1.7:1

5.0 STATURE

Stature (height) was estimated by taking long bone measurements and applying regression equations suitable for white adult males and females (Trotter,1970). The formulae produces a standard error dependant on the bone measured, and it is likely that this error is greater when applied to different populations and individuals over 30 years of age (Ubelaker 1989). Moreover, stature estimates may differ depending on which bones are used to calculate height (see Waldron 1998). In the Tarbat assemblage, the femur and tibia were most often used to determine height.

Overall, stature could be estimated for 28 females and 86 males (83% of the total sample). When analysed by phase, there was no pattern of increasing height through time. In contrast, the mean stature for females in the medieval period (Phases 3 and 4: 153.8 cm, standard deviation = 4.6) was significantly shorter than in phase 2 (159.7 cm, SD = 3.5) (Table 5.1) (t-test = 2.67, df = 23, $p < 0.05$). In contrast, there was no significant difference between the males from Phase 2 and the medieval period ($t = 1.68$, df = 81, $p = 0.10$). There were however, significant differences in height between the males and females in both phase 2 ($t = 5.34$, df = 5, $p < 0.01$) and the medieval period ($t = 9.73$, df = 53, $p < 0.001$) - as would be expected, males are consistently taller than the females (Tables 5.1 and 5.2).

Table 5.1 Female stature by phase (cm)

Phase	N	Mean	SD	Minimum	Maximum
1	2	156.8	4.3	153.7	159.8
2	5	159.7	3.5	156.4	165.1
3 & 4	20	153.8	4.6	145.9	159.8
5	1	165.2	-	165.2	165.2
Total	**28**	**155.4**	**5.1**	**145.9**	**165.2**

Table 5.2 Male stature by phase (cm)

Phase	N	Mean	SD	Minimum	Maximum
1	1	167.7	-	167.7	167.7
2	48	170.1	4.2	160.7	177.3
3 & 4	35	168.3	5.7	156.4	180.3
5	2	168.4	0.8	167.9	169.0
Total	**86**	**169.3**	**4.9**	**156.4**	**180.3**

5.1 STATURE AT TARBAT AND OTHER SCOTTISH SITES

The height data from Tarbat demonstrate some interesting patterns. Firstly, the females from Phase 2 were taller than those from the medieval period (see Tables 5.3 and 5.4). Both groups of women were slightly below the modern average British height of 163cm (Knight, 1984).

In contemporary populations, undernutrition and infection are well-known causes of stunting during childhood. Although these individuals may grow for longer periods of time, they usually achieve less total growth and are shorter as adults (Bogin, 1988). It is possible that the medieval women buried at Tarbat experienced some environmental stress during their growing years. This suggestion may be supported by the observation that the medieval women from Tarbat were also shorter than their Scottish contemporaries. However, when considered in terms of feet and inches, the height of the Tarbat women was not widely different than the average modern British woman (Phase 2: 5'3", medieval period: 5'1", modern: 5' 4"). Thus, while it is possible that the medieval female experienced some environmental stress, it was not likely to have been severe.

The height of the males did not significantly differ between the phases, but was greater than the females. Generally, the stature of women averages between 88 and 95 per cent of the stature of males (see Bogin, 1988) - a finding also observed in the Tarbat assemblage.

Both the females and males from Phase 2 demonstrated remarkably similar statures to other sites in Scotland from roughly the same time period (Table 5.3). It is noted, however, that the sample sizes were small, especially for the women.

The medieval males were, on average, shorter than other medieval males from Scotland, although by only 1 to 6cm (Table 5.4). The average male stature from Phase 2 (5'7") and the medieval period (5'6") revealed that the males, particularly from the medieval period, were probably not as healthy and well nourished during childhood as the average modern British man, who has an average height of 5'10" (177cm) (Knight, 1984). However, as with the women, the differences in height were not large.

Table 5.3 Statures from Scottish sites c. 8th - 11th C (cm)

Site	Date	N	Females	N	Males
Tarbat	**8th - 11th C**	**5**	**159.7**	**48**	**170.1**
Isle of May	5th - 12th C	2	159.1	29	170.4
Hallow Hill*	6th - 9th C	17	160.2	11	169.7

* the researcher used the method of Dupertuis and Hadden (1951)

Table 5.4 Statures from medieval Scottish sites (cm)

Site	Date	N	Females	N	Males
Tarbat	**12th - 15th C**	**20**	**153.8**	**35**	**168.3**
Glasgow Cathedral	12th - 15th C	14	156.5	22	174.1
Isle of May	12th - 17th C	3	161.2	8	173.7
Dundee	12th - 15th C	27	157.8	30	170.8
Dunbar	Medieval	18	159.8	13	170.4
Whithorn	13th - 15th C	140	155	128	169
Aberdeen (A)	c.13th - 17th C		160		168
Aberdeen (B)	13th -16th C	28	158	47	170

Site	Date	N	Females	N	Males
Linlithgow	c.13th - 17th C		156		170

6.0 LOWER LIMB SHAPE

It has been observed that the proximal part of the tibia and femoral shafts sometimes show differences in shape between populations. The degree of antero-posterior flattening of the femur was calculated using the meric index, and the degree of medio-lateral flattening of the tibial shaft was calculated using the cnemic index (Brothwell 1981; Bass 1987). Indices were calculated using bones from the left side of the skeleton, unless they were missing.

In total, measurements were taken on 96 femora (from 21 females, 72 males and 3 undetermined) and 75 tibiae (from 17 females, 57 males and 1 undetermined). The majority of the Tarbat individuals had femora that were platymeric (i.e. an index below 84.9) (see Tables 6.1 and 6.2). That is, the individuals had flattening of the femoral shaft as opposed to rounded femoral shafts. The average meric index, and the percentages of individuals with platymeria and eurymeria was similar between Phase 2 and the medieval period (Phases 3 and 4). In both phases, the majority of individuals were platymeric (90% in Phase 2 and 88% in the medieval period).

Table 6.1 Meric index by phase

Phase	N	Mean	SD	Minimum	Maximum
1	2	73.4	5.2	69.7	77.1
2	40	76.8	7.1	58.8	95.0
3 & 4	50	75.2	8.0	60.2	94.3
5	4	80.2	3.5	75.3	82.9
Total	**96**	**76.0**	**7.5**	**58.8**	**95.0**

Table 6.2 Meric index by percentage and phase

Phase	N	% Platymeric	% Eurymeric
1	2	100.0	
2	40	90.0	10.0
3 & 4	50	88.0	12.0
5	4	100.0	
Total	**96**	**89.6**	**10.4**

Platymeric - index below 84.9
Eurymeric - index of 85 to 99.9

The Tarbat tibiae were largely eurycnemic (broad with an index above 70.0), followed closely by mesocnemic tibiae (moderate degree of flattening - index between 63 and 69.9) (Tables 6.3 and 6.4). Individuals with playtcnemia have tibiae that are flattened medio-laterally. There was no significant difference between the proportions of tibiae in each class between Phase 2 and the medieval period (Phases 3 and 4) (^{2} = 2.66, df = 2, p = n.s). In Phase 2, 43% of the individuals were eurycnemic, and 34% were mesocnemic. Similarly, 45% of the medieval tibiae were eurycnemic and 31% were mesocnemic.

Table 6.3 Cnemic index by phase

Phase	N	Mean	SD	Minimum	Maximum
1	1	71.3	-		
2	28	69.5	5.9	60.2	85.2
3 & 4	42	69.4	7.6	56.3	87.4
5	4	63.3	16.6	38.8	73.9
Total	**75**	**69.1**	**7.6**	**38.8**	**87.4**

Table 6.4 Cnemic index by percentage and phase

Phase	N	% Platycnemic	% Mesocnemic	% Eurycnemic
1	1			100.0
2	28	10.7	34.2	42.9
3 & 4	42	23.8	31.0	45.2
5	4	25.0	25.0	50.0
Total	**75**	**18.9**	**35.1**	**46.0**

Platycnemic - index below 62.9

Mesocnemic - index of 63 to 69.9

Eurycnemic - index above 70.0

6.1 LOWER LIMB SHAPE AT TARBAT AND OTHER SCOTTISH SITES

The meric indices were very similar between the Isle of May (5th to 11th C phase) and Phase 2 at Tarbat (Table 6.5)(no other sites could be compared). In addition, all of the medieval sites in Scotland, including Tarbat, demonstrate a high percentage of individuals with platymeria (i.e. anterior-posterior flattening of the femoral shaft)(Table 6.6). This finding suggests that the biomechanical stresses applied to the proximal femora were similar for all these Scottish groups.

The cnemic indices were also very similar between individuals buried at the Isle of May (5th to 12th C) and individuals buried at Tarbat (Phase 2)(Table 6.7). Platycnemic indices tend to be lower in more mechanically stressed populations than in less mechanically stressed populations (Larsen 1997). Thus, given that most of the individuals at Tarbat had high indices, it is unlikely that that they were a mechanically stressed population group - a finding that is consistent with all Scottish assemblages (Table 6.8).

Table 6.5 Meric indices from Scottish sites c.8th - 11th C

Site	Date	N	% Platymeric	% Eurymeric
Tarbat	**8th - 11th C**	**40**	**90.0**	**10.0**
Isle of May	5th - 12th C	21	85.7	14.3

Table 6.6 Meric indices from medieval Scottish sites

Site	Date	N	% Platymeric	% Eurymeric
Tarbat	**12th -15th C**	**40**	**88.0**	**12.0**
Isle of May	12th - 17th C	6	66.6	33.3

Site	Date	N	% Platymeric	% Eurymeric
Dundee	12th - 15th C	36	94.4	5.6
Dunbar	medieval	29	100.0	-
Whithorn	13th - 15th C	343	90.0	10.0
Aberdeen (C)	13th -16th C	100	86.0	46.0
Linlithgow	c.13th - 17th C	98	69.0	31

Table 6.7 Cnemic indices from Scottish sites c. 8th - 11th C

Site	Date	N	% Platycnemic	% Mesocnemic	% Eurycnemic
Tarbat	**8th - 11th C**	**28**	**10.7**	**34.2**	**42.9**
Isle of May	5th - 12th C	19	10.5	42.1	47.4

Table 6.8 Cnemic indices from medieval Scottish sites

Site	Date	N	% Platycnemic	% Mesocnemic	% Eurycnemic
Tarbat	**12th -15th C**	**42**	**23.8**	**31.0**	**45.2**
Isle of May	12th -17th C	9	11.1	55.6	33.3
Dundee	12th - 15th C	35	5.7	28.6	65.7
Dunbar	medieval	18	27.8 (38.8)	33.3 (44.4)	27.8
Whithorn	13th -15th C	411	15.0	45.0	40.0
Aberdeen (C)	13th -16th C	157	7.0	34.0	39.0
Linlithgow	c.13th-17thC	98	6.0	33.0	61.0

7.0 CRANIAL INDICES

A selected number of cranial measurements were taken on the adult skulls following Buikstra and Ubekaler (1994). These measures were summarised using indices which express the ratio of width to length of a feature (Bass 1987) and are used to describe the physical characteristics of the sample. Heritability studies have demonstrated that genes largely influence cranial shape, and as a result, it has been assumed that it may be possible to demonstrate that groups with similar craniofacial morphology are more closely related than groups that differ in skull size and shape (Buikstra and Ubelaker 1994).

There were 30 males and 6 females with crania that could be measured, at least partly (Tables 7.1 and 7.2). Generally, the males from all phases had similar cranial shape. T-tests revealed no differences in craniofacial morphology between the males from Phase 2 and the medieval period (sample sizes were too small to compare the females). On average, these men had medium shaped crania (as opposed to long or broad headed), low skull height, narrow faces and nasal apertures, medium sized eye orbits and broad palates (Appendix II presents data for all males and females). Two women from the medieval period had broader faces and nasal apertures, and narrower orbits than the men, however, there were no statistically significant differences between the males and females (for the medieval period or for the total sample).

Table 7.1 Female cranial indices by phase (mm)

	Phase 1			Phase 2			Phases 3 & 4			Phase 5		
Index	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
cranial	1	73.2	-	1	77.5	-	3	79.0	5.0	1	79.7	-

	Phase 1			Phase 2			Phases 3 & 4			Phase 5		
Index	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
mean height	1	80.6	-	1	83.0	-	2	79.9	0.9	1	77.4	-
fronto-parietal	1	67.9	-	1	68.1	-	2	67.8	4.7	1	68.1	-
upper facial							2	49.1	6.6	1	58.5	-
nasal							2	53.0	10.3	1	46.2	-
orbital	1	83.4	-				2	94.7	5.0	1	85.2	
maxilloalveolar							2	125.7	14.4			

Table 7.2 Male cranial indices by phase (mm)

	Phase 1			Phase 2			Phases 3 and 4			Phase 5		
Index	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
cranial	1	75.3	-	15	75.6	4.3	13	78.7	4.3	1	77.1	-
mean height	1	80.0	-	11	79.5	4.2	11	77.0	9.5	1	76.5	-
fronto-parietal	1	67.1	-	12	68.8	4.2	10	66.4	10.1	1	68.8	-
upper facial				1	74.6	-	4	57.6	13.5			
nasal				6	44.9	4.8	13	46.4	3.4	1	51.7	-
orbital				5	85.4	3.1	11	87.2	6.2	1	81.4	-
maxilloalveolar				3	123.1	9.5	7	120.6	6.4	1	122.1	-

The cranial index is calculated as maximum cranial breath x 100 / maximum cranial length (Bass, 1987). As presented in the tables above, the average skull shape in the Tarbat assemblage was average or medium shaped (mesocrany). When examined by percentages in each class, however, it appeared that a large percentage of individuals also had narrow or long heads (dolichocrany), except in the medieval period where a third of the individuals also had broad or round heads (brachycrany) (Table 7.3). Chi-square analysis revealed no significant difference in the proportions of individuals in each class between phase 2 and the medieval period (Phases 3 and 4) (^{2} = 2.1, df =2, p = ns).

Table 7.3 The cranial index by percentage and phase

Phase	**N**	**% Dolichocrany**	**% Mesocrany**	**% Brachycrany**
1	2	50	50.0	
2	16	43.8	43.8	12.5
3 & 4	16	25.0	43.8	31.3
5	2		100.0	
Total	**36**	**33.3**	**47.2**	**19.5**

Dolichocrany - below 74.99 (narrow or long headed)
Mesocrany - 75.00 to 79.99 (average or medium)
Brachycrany - above 80.00 (broad or round headed)

7.2 TARBAT CRANIAL INDEX AND OTHER SCOTTISH SITES

A number of skeletal reports did not calculate the cranial index, or the sample sizes were too small to be included in this comparison. The only sites comparable with Tarbat were medieval. In most of these sites, the majority of skulls were either medium or broad in size (except at Whithorn). It is apparent from this overview that the Tarbat assemblage is broadly

similar to other Scottish medieval groups.

Table 7.4 Cranial indices from medieval Scottish sites

Site	Date	N	% Dolichocrany	% Mesocrany	% Brachycrany
Tarbat	**12th -15th C**	**16**	**25.0**	**43.8**	**31.3**
Glasgow	12th -15th C	17	5.8	35.3	58.8
Whithorn	13th -15th C	18	39.0	61.0	
Aberdeen (C)	13th -16th C	52	9.6	40.4	50.0
Linlithgow	c.13th-17thC	22	9.1	59.1	31.9

8.0 NON-METRIC TRAITS

A selected number of cranial and post-cranial non-metric traits were recorded (following Berry and Berry 1967 and Finnegan 1978 in Buikstra and Ubelaker 1994). These are skeletal variants on the skeleton which are recorded as present or absent and may be used for broad comparisons between archaeological assemblages.

In the Tarbat sample, certain cranial non-metric traits were frequently observed in both Phase 2 and the medieval period - including supraobital notches, zygomatico-facial foramen, and mastoid foramen (data for the total sample is presented in Appendix III). Approximately half of the individuals from Phase 2 and the medieval period also had supraorbital foramen, parietal foramen and condylar canals (Table 8.1).

The most frequently observed traits in Phase 2 and the medieval period were lateral tibial squatting facets and double anterior calcaneal facets (Table 8.2). It is likely that the cranial non-metric traits observed at Tarbat were a result of genetic factors, although it is noted that nutrition could be correlated with some foramina and ossicles on the skull (see Mays 1998). Squatting facets in the ankle region, however, are more likely to be activity related, as the name suggests (Mays 1998).

Chi-square tests were conducted to determine if there were differences in the prevalence of non-metric traits between Phase 2 and the medieval phases (3 and 4). Only two significant relationships were observed: individuals with mandibular tori, and third trochanters were more likely to be from Phase 2 than from the medieval period ($^2 = 6.65$, $p < 0.05$, $^2 = 8.8$, $p < 0.005$ respectively). A third trochanter is a prominent bony process at the superior end of the gluteal (hypertrochanteric) crest and mandibular tori are bony ridges on the lingual surface of the mandible. Although the causes of these traits are not known, they may suggest minor biological differences between the phases.

Table 8.1 Prevalence of cranial non-metric traits

	Phase 1		Phase 2		Phases 3 & 4		Phase 5	
Trait	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**
Metopic suture	2	0	26	2 (8)	23	3 (13)	4	2 (50)
Supraorbital notches	2	2 (100)	**23**	**18 (78)**	**21**	**17 (81)**	4	3 (75)
Supraorbital foramen	2	0	**24**	**12 (50)**	**21**	**11 (52)**	4	1 (25)
Multiple infraorbital foramen	1	0	13	3 (23)	17	1 (6)	2	1 (50)
Zygomatico-facial foramen	1	1 (100)	**18**	**16 (89)**	**18**	**15 (83)**	3	2 (67)
Parietal foramen	2	1 (50)	**22**	**12 (55)**	**19**	**11 (58)**	4	2 (50)
Epipteric bone present	2	0	20	1 (5)	19	5 (26)	2	0

	Phase 1		Phase 2		Phases 3 & 4		Phase 5	
Trait	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**
Fronto-temporal articulation	2	0	20	0	19	1 (5)	2	0
Ossicles in coronal	2	1 (50)	23	0	19	1 (5)	3	0
Ossicle at bregma	2	0	23	0	19	0	3	0
Sagittal ossicles present	2	0	25	1 (2)	19	0	4	0
Apical bone present	2	0	26	4 (15)	20	3 (15)	4	0
Ossicles in lambdoid	2	1 (50)	27	17 (63)	19	7 (37)	4	3 (75)
Asterionic bone present	2	1 (50)	25	6 (24)	20	2 (10)	3	0
Ossicle in occipito-mastoid	2	0	25	0	20	0	3	1 (33)
Ossicle at parietal notch	2	0	25	2 (8)	21	5 (24)	3	1 (33)
Inca bone present	2	0	27	0	21	0	4	0
Condylar canal present	2	1 (50)	**22**	**11 (50)**	**14**	**7 (50)**	2	2 (67)
Divided hypoglossal canal	2	1 (50)	22	5 (23)	16	4 (25)	3	0
Foramen ovale incomplete	2	0	17	0	15	1 (7)	3	0
Foramen spinosum incomplete	2	2 (100)	17	6 (35)	14	4 (4)	3	0
Double condylar facet	2	0	21	4 (19)	14	1 (7)	3	0
Auditory exostosis	2	0	28	0	22	0	3	0
Mastoid foramen	2	1 (50)	**27**	**20 (74)**	**21**	**17 (81)**	4	1 (25)
Mandibular torus	2	1 (50)	30	10 (33)	23	1 (4)	4	1 (25)
Mylohyoid bridge	1	0	28	2 (7)	21	1 (5)	3	0

N = number of individuals observed

P = number of individuals exhibiting trait on either or both sides

Table 8.2 Prevalence of post-cranial non-metric traits

	Phase 1		Phase 2		Phases 3 and 4		Phase 5	
Trait	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**
Atlas bridging	1	1 (100)	24	6 (25)	11	3 (27)	2	0
Accessory transverse foramen	1	0	27	14 (52)	19	6 (32)	3	0
Suprascapular foramen	0		18	1 (6)	19	2 (11)	4	0
Circumflex sulcus	1	1 (100)	34	11 (32)	32	5 (16)	4	0
Acromial articular facet	1	0	21	1 (5)	27	2 (7)	4	0
Sternal foramen	0		58	1 (2)	28	0	2	0
Septal aperture	2	0	39	2 (5)	39	4 (10)	4	0
Supracondyloid process	3	0	39	0	38	1 (3)	3	0
Allen's fossa	2	0	34	1 (3)	50	2 (4)	3	1 (33)
Poirer's facet	2	0	31	2 (7)	49	11 (22)	3	0
Vastus notch	2	0	25	5 (20)	35	6 (17)	3	0
Third trochanter	2	0	43	7 (16)	50	0	3	1 (33)
Medial tibial squatting facet	2	0	27	4 (15)	40	1 (3)	3	0
Lateral tibial squatting facet	2	2 (100)	**28**	**20 (71)**	**41**	**24 (59)**	3	2 (67)
Double inf-ant talar facet	2	1 (50)	28	14 (50)	35	11 (31)	2	1 (50)

	Phase 1		Phase 2		Phases 3 and 4		Phase 5	
Trait	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**	**N**	**P (%)**
Double anterior calcaneal facet	2	1 (50)	**30**	**16 (53)**	**35**	**16 (46)**	2	1 (50)

N = number of individuals observed

P = number of individuals exhibiting trait on either or both sides

8.1 NON-METRIC TRAITS AT TARBAT AND OTHER SCOTTISH SITES

It is difficult to compare non-metric traits between sites as the type of traits recorded often differ. Moreover, there may be problems of intra-observer error. Taking these problems into consideration, different distributions of non-metric traits were observed in the Tarbat, Isle of May and Glasgow Cathedral samples. However, some cranial non-metric traits were present at all three sites with a frequency greater than 20%: the presence of supraorbital, parietal and mastoid foramina, ossicles in the lambdoid suture, and the presence of a condylar canal.

The only post-cranial non-metric trait observed at all three sites (during the medieval period) with a frequency greater than 20% was a double anterior calcaneal facet. For Phase 2 at Tarbat and the early phase at the Isle of May (5th to 12th C), the double anterior calcaneal *and* talar facets were frequently observed (greater than 35%) as well as a circumflex sulcus on the scapula (25% at Isle of May, and 32% at Tarbat).

It is difficult to interpret these observations at present, but they may be useful for future comparative studies of non-metric traits in Scotland.

9.0 HEALTH AND DISEASE

Pathological lesions on the skeleton provide an important source of information on health and disease in the past. By analysing frequencies and types of pathologies, including those that reflect diet and/or nutrition, population density, and activity patterns, health and disease can be inferred. In addition, examining groups of skeletons can provide important information on biological variation, cultural behaviour and environmental conditions.

While there are a number of diseases that can affect bone (e.g. syphilis, leprosy, rickets, neoplasms (cancers) and osteoarthritis), many do not. Thus, a palaeopathological reconstruction cannot represent the whole picture of health and disease in the past. For diseases that affect bone, an individual may not survive long enough for bony changes to occur. Incomplete skeletal remains may hinder a diagnosis, or may result in the underestimation of disease prevalence in a sample (see Roberts and Manchester, 1995). As many skeletons were incomplete in the Tarbat assemblage, the prevalence of pathological conditions is probably underestimated.

Nevertheless, some interesting patterns emerge from the palaeopathological analysis of the Tarbat assemblage. Dental disease, joint diseases, fractures, infection, anaemia, osteoporosis and cancer were some of the conditions present. Detailed analysis of these conditions are presented in the following sections. Diachronic comparisons were restricted to Phase 2 and the medieval period (Phases 3 and 4).

10.0 DENTAL DISEASE

The teeth and corresponding alveolar bone were examined for ante-mortem tooth loss, calculus, dental enamel hypoplasia, caries, abscess and periodontal disease (following Brothwell 1981 and Buikstra and Ubelaker 1994). While many of the dentition were only partially present, teeth from 73 individuals including three subadults (SK 4, 110 and 119) had at least

one type of dental disease. Three individuals suffered from all of the above conditions (SK17, 66 and 113). Table 10.1 presents the number of individuals from each phase with dentition and dental disease. In total, 1,249 teeth were present from these 73 individuals, and of those teeth, only 17% were not affected by dental disease. The number of observable teeth (by tooth type) for the entire sample, for Phase 2 and for the medieval period (Phases 3 and 4) are presented in Appendix IV.

Table 10.1 Number of individuals with dentition by phase

Phase 1	2
Phase 2	36
Phases 3 and 4	31
Phase 5	4
Total	**73**

10.1 CALCULUS

Calculus is mineralized plaque on the surfaces of the teeth. During life, this plaque is formed by a build up of bacteria embedded within a matrix - the matrix being manufactured by the bacteria themselves and proteins in the saliva (Hillson, 1986). There are a number of complex factors that affect the rate and extent of dental calculus formation, although diet is involved (see Lieverse, 1999). It is commonly observed on the lower incisors (towards the tongue) and on the upper molars (towards the cheek) where the main salivary glands are situated.

In the Tarbat sample, calculus was the most frequently observed dental condition, such that 95% of individuals with teeth had calculus (100% of individuals from Phase 1, 92% from Phase 2, 97% from Phases 3 and 4, and 100% from Phase 5). It was present on 76% of the teeth, and ranged in degree from flecks to considerable build-up.

Table 10.2 presents the prevalence of teeth with calculus by phase. There was a significant difference between Phase 2 and the medieval period (Phases 3 and 4) - teeth were more likely to have calculus from Phase 2 ($^2 = 11.1$, $p < 0.001$). There was no significant difference between the sexes for the medieval period (49 out of 65 female teeth had calculus (75%) and 335 out of 458 male teeth (73%) had calculus) ($^2 = 0.07$, p = ns). There were only 11 female teeth in phase 2, 8 of which had calculus. In contrast, 433 out of 546 male teeth had calculus in Phase 2.

Table 10.2 Percentage of teeth with calculus by phase

	N	**n**	**%**
Phase 1	16	9	56.3
Phase 2	557	441	79.2
Phases 3 and 4	581	410	70.6
Phase 5	95	93	97.9
Total	**1,249**	**953**	**76.3**

N = number of observable teeth
n = number of teeth with calculus

Tables 10.3 and 10.4 present the prevalence of calculus by tooth and phase (the total sample is presented in Appendix V). Generally, the lower teeth had more calculus than the upper teeth. The high percentages of teeth with calculus in all areas suggests that there was a lack of attention to remove plaque during life.

Table 10.3 Prevalence of calculus by tooth (Phase 2)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	10	12	8	11	14	12	6	5	7	6	10	14	12	12	10	9
%	**67**	**80**	**67**	**69**	**78**	**67**	**60**	**56**	**54**	**43**	**67**	**74**	**75**	**86**	**77**	**69**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	19	22	21	18	18	19	19	14	11	17	18	21	17	16	19	14
%	**95**	**85**	**88**	**86**	**86**	**79**	**86**	**93**	**92**	**94**	**82**	**88**	**84**	**80**	**86**	**82**

n = number of teeth with calculus

Table 10.4 Prevalence of calculus by tooth (Phases 3 and 4)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	1	8	7	12	15	18	17	15	13	13	17	14	11	12	9	5
%	**11**	**53**	**50**	**52**	**65**	**82**	**85**	**84**	**93**	**65**	**81**	**70**	**55**	**71**	**60**	**56**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	10	14	15	13	15	14	19	15	14	18	20	17	17	9	7	6
%	**83**	**70**	**79**	**62**	**71**	**70**	**95**	**79**	**78**	**90**	**77**	**74**	**77**	**56**	**44**	**75**

n = number of teeth with calculus

10.2 DENTAL CARIES

Bacteria in dental plaque ferment carbohydrate (especially sucrose) from the diet producing an acidic (low pH) waste product. These conditions cause demineralization of the dental tissues, resulting in caries. The lesions may occur anywhere on the tooth were plaque is formed, especially in protected traps or crevices. Caries in the early stages appear as white opaque spots. A cavity observed macroscopically represents a late stage in the disease process (Hillson 1986).

These cavities, or carious lesions were present in 43% of the individuals with dentition (from all phases) (Table 10.5). More individuals were affected by caries in the medieval period (55%) than in Phase 2 (28%).

Table 10.5 Percentage of individuals with caries by phase

	N	**n**	**%**
Phase 1	2	0	
Phase 2	36	10	27.8
Phases 3 and 4	31	17	54.8
Phase 5	4	4	100.0
Total	**73**	**31**	**42.5**

N = number of individuals with dentition

n = number of individuals with caries

Out of a total of 1,249 teeth, 5% had caries. Table 10.6 presents the percentage of teeth with caries by age category and phase. In phase 2, 4% of the teeth were affected by caries. In contrast, a significantly higher number of teeth had caries in the medieval period (phases 3 and 4) ($^2 = 4.13$, $p < 0.05$). Caries was observed to be age-related in both phase 2 and medieval period, such that younger adults had less teeth affected the middle or older adults.

Medieval females were more likely to have carious lesions than the males ($^2 = 7.53$, $p = < 0.01$). Out of 65 observable female teeth, 9 (14%) had caries. In contrast, only 26 out of 458 male teeth (6%) had caries. None of the female teeth from phase 2 had caries (N = 11), whereas 23 out of 546 male teeth (4%) had caries from Phase 2.

Table 10.6 Prevalence of caries by age category and phase

	17-25 years		**26-45 years**		**46+ years**		**Total***	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
Phase 1					14	0	**16**	**0**
Phase 2	88	0	272	14 (5)	197	9 (5)	**557**	**23 (4)**
Phases 3 & 4	78	1 (1)	197	12 (6)	209	18 (9)	**581**	**40 (7)**
Phase 5	25	1 (4)	29	1 (3)	41	3 (7)	**95**	**5 (5)**
Total	**191**	**2 (1)**	**498**	**27 (5)**	**461**	**30 (7)**	**1,249**	**68 (5)**

* includes 'adult' category

N = number of observable teeth

n = number of teeth with caries

Generally, the molars were the most frequently affected teeth (64% of the teeth with caries were molars). This finding is consistent with observations of caries in both archaeological and modern dentition (Lunt, 1974; Hillson, 1986). The following tables present the number of caries by tooth for Phase 2 and the medieval period (Phases 3 and 4)(caries by tooth for the total sample is presented in Appendix VI).

Table 10.7 Prevalence of caries by tooth (Phase 2)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	1	1	1	1	0	0	0	1	1	0	0	0	1	3	1	2
%	**7**	**7**	**8**	**6**	**-**	**-**	**-**	**11**	**8**	**-**	**-**	**-**	**6**	**21**	**8**	**15**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	3	2	0	0	0	0	0	0	0	0	1	0	1	2	1
%	**-**	**12**	**8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4**	**-**	**5**	**9**	**6**

n = number of teeth with caries

Table 10.8 Prevalence of caries by tooth (Phases 3 and 4)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	2	1	3	3	3	0	0	0	0	0	1	0	1	1	0	1

%	**22**	**7**	**21**	**13**	**13**	**-**	**-**	**-**	**-**	**-**	**5**	**-**	**5**	**6**	**-**	**11**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	3	3	3	3	0	1	1	1	1	2	2	0	0	3	0	1
%	**25**	**15**	**16**	**14**	**-**	**5**	**5**	**5**	**6**	**10**	**8**	**-**	**-**	**19**	**-**	**13**

n = number of teeth with caries

10.3 DENTAL ENAMEL HYPOPLASIA

Dental defects consisting of horizontal lines, grooves or pits on the enamel surface are indicative of dental enamel hypoplasia (DEH) (Hillson 1986). They are caused by temporary halts in enamel matrix production while teeth are developing, but remain on teeth throughout life (Goodman 1991). Thus, they represent a permanent record of a childhood environmental stresses, including nutritional deficiencies and illness (Hillson 1986; Roberts and Manchester 1995). The number of teeth with DEH in the Tarbat assemblage may be underestimated, as DEH could not be observed when teeth were heavily covered with calculus.

Overall, 34% of the individuals buried in the church had DEH. Table 10.9 shows that a higher percentage of individuals were affected by DEH in the medieval period (52%) than in Phase 2 (19%).

Table 10.9 Percentage of individuals with DEH by phase

	N	**n**	**%**
Phase 1	2	1	50
Phase 2	36	7	19.4
Phases 3 and 4	31	16	51.6
Phase 5	4	1	25
Total	**73**	**25**	**34.2**

N = number of individuals with dentition
n = number of individuals with DEH

Nine percent of the teeth from Tarbat had grooves or lines on the teeth. Table 10.10 demonstrates that a relatively high percentage of teeth from the medieval period had DEH. As with caries, there was a highly significant relationship, such that teeth with DEH were more likely to be from the medieval period (Phases 3 and 4) than from Phase 2 ($^2 = 37.2$, $p < 0.001$). There was also a significant difference between the sexes in the medieval period. Female teeth were more likely to have DEH (15 out of 65 - 23%) than male teeth (58 out of 458 - 13%) ($^2 = 5.29$, $p < 0.05$). No female teeth had DEH from phase 2 (N = 11), although 22 out of 546 male teeth had DEH (4%) from this phase.

Table 10.10 Prevalence of DEH by phase

	N	**n**	**%**
Phase 1	16	1	6.3
Phase 2	557	22	3.9
Phases 3 and 4	581	84	14.5
Phase 5	95	1	1.0
Total	**1,249**	**108**	**8.6**

N = number of observable teeth
n = number of teeth with DEH

Tables 10.11and 10.12 present the prevalence of DEH for each tooth type (for the total sample, see Appendix VII). From these tables, it is apparent that the most frequently affected teeth were the maxillary and mandibular incisors and canines. Particularly, the lower canines were often affected. The crown of canines develop until four years of age (Moorrees *et al.* 1963b), suggesting that a number of individuals experienced stress at some time during early childhood.

Table 10.11 Prevalence of DEH by tooth (Phase 2)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	1	0	1	1	0	0	1	1	1	1	0	0	0	0
%	**-**	**-**	**8**	**-**	**6**	**6**	**-**	**-**	**8**	**7**	**7**	**5**	**-**	**-**	**-**	**-**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	0	0	2	2	2	1	2	1	2	1	2	0	0	0
%	**-**	**-**	**-**	**-**	**10**	**8**	**9**	**7**	**17**	**6**	**9**	**4**	**11**	**-**	**-**	**-**

n = number of teeth with DEH

Table 10.12 Prevalence of DEH by tooth (Phases 3 and 4)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	2	0	0	2	6	5	3	4	5	7	1	0	0	2	0
%	**-**	**13**	**-**	**-**	**9**	**27**	**25**	**17**	**29**	**25**	**33**	**5**	**-**	**-**	**13**	**-**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	0	1	4	11	4	4	4	3	12	4	0	0	0	0
%	**-**	**-**	**-**	**5**	**19**	**55**	**20**	**21**	**22**	**15**	**46**	**17**	**-**	**-**	**-**	**-**

n = number of teeth with DEH

10.4 DENTAL ABSCESS

The soft tissues inside the pulp chamber of a tooth can be exposed to infection from mouth bacteria when a carious cavity, severe dental wear, periodontal infection or a traumatic fracture to the crown occurs. Inflammation and pus may develop which eventually kill the pulp. The infection may then continue down to the root canal and into the bone. As pus accumulates, pressure increases and causes a hole (sinus) to develop on the surface of the bone in order to allow pus to escape (Hillson 1986; Roberts and Manchester 1995). In skeletons, these lesions are often observed as round perforations in the bone at the apex (or base) of the tooth root.

Of those individuals with dentition, 29% had at least one abscess (Table 10.13). More individuals had abscesses from Phase 2 (31%) than from the medieval period (23%).

Table 10.13 Percentage of individuals with abscesses by phase

	N	**n**	**%**
Phase 1	2	1	50.0
Phase 2	36	11	30.6
Phases 3 and 4	31	7	22.6
Phase 5	4	2	50.0
Total	**73**	**21**	**28.8**

N = number of individuals with dentition

n = number of individuals with at least one abscess

Out of a total of 1,596 tooth positions from the entire sample, 3% had abscesses. In Phase 2, 4% of observable tooth positions had abscesses, whereas in the medieval period only 2% had abscesses (Table 10.14). This observation was found to be significant ($^2 = 7.32$, $p < 0.01$). When examined by age category, teeth from older individuals were more likely to have abscesses than teeth from middle adults from Phase 2 (no teeth from young adults had abscesses) ($^2 = 4.66$, $p < 0.05$), but not in the medieval period (see table below).

When examined by sex, no significant differences were observed. In the medieval period, only 1 abscess out of 111 (1%) observable tooth positions was observed on the female dentition, and 10 out of 520 tooth positions (2%) had abscesses on the male dentition. No females from Phase 2 had abscesses (N = 22), while 33 out of 751 (4%) male tooth positions had abscesses from this phase.

Table 10.14 Prevalence of abscess by age category and phase

	17-25 years		**26-45 years**		**46+ years**		**Total***	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
Phase 1					22	1 (5)	**24**	**1 (4)**
Phase 2	88	0	378	12 (3)	307	21 (7)	**773**	**33 (4)**
Phases 3 & 4	78	1 (1)	198	4 (2)	313	5 (2)	**689**	**13 (2)**
Phase 5	26	0	30	1 (3)	55	2 (4)	**110**	**3 (3)**
Total	**192**	**1 (1)**	**606**	**17 (3)**	**697**	**29 (4)**	**1,596**	**50 (3)**

* includes 'adult' category

N = number of observable tooth positions

n = number of tooth positions with an abscess

Tables 10.15 and 10.16 present the prevalence of dental abscess by tooth and phase (the total sample is presented in Appendix IX). When examined by tooth type, abscesses were frequently observed at the roots of molar teeth, particularly M1.

Table 10.15 Prevalence of dental abscess by tooth position (Phase 2)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	1	2	2	1	1	1	0	0	1	2	2	0	0	4	2	0
%	**4**	**8**	**7**	**4**	**4**	**5**	**-**	**-**	**5**	**9**	**9**	**-**	**-**	**15**	**8**	**-**

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	3	3	1	0	1	0	0	0	1	0	0	0	4	1	0
%	**-**	**9**	**10**	**4**	**-**	**4**	**-**	**-**	**-**	**4**	**-**	**-**	**-**	**14**	**3**	**-**

n = number of teeth dental abscesses

Table 10.16 Prevalence of dental abscess by tooth position (Phases 3 and 4, n = 13)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1
%	**-**	**-**	**5**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**5**	**5**	**-**	**8**

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	0	0	1	1	0	1	1	0	0	0	1	2	1	0
%	**-**	**-**	**-**	**-**	**4**	**5**	**-**	**4**	**5**	**-**	**-**		**4**	**9**	**5**	**-**

n = number of teeth with dental abscesses

10.5 ANTEMORTEM TOOTH LOSS

Ante-mortem tooth loss (AMTL) is a result of periodontal disease (see below) and caries (Brothwell 1981). In the Tarbat sample, approximately half of the individuals with dentition had some AMTL. In Phase 2, 50% had AMTL, and 39% of the dentition from the medieval phase had AMTL (Table 10.17).

Table 10.17 Percentage of individuals with AMTL by phase

	N	**n**	**%**
Phase 1	2	2	100.0
Phase 2	36	18	50.0
Phases 3 and 4	31	12	38.7
Phase 5	4	3	75.0
Total	**73**	**35**	**47.9**

N = number of individuals with dentition
n = number of individuals with ante-mortem tooth loss

In total, 22% of the teeth were lost ante-mortem. There appeared to be a trend of decreasing ante-mortem tooth loss with time (Table 10.18). Chi-square analyses revealed that this relationship was significant between Phase 2 and the medieval period ($^2 = 25.1$, $p < 0.001$). However, there was a highly significant difference between the males and females from the medieval period. Women were more likely to have AMTL than the men ($^2 = 56.2$, $p < 0.001$). Out of 111 female tooth positions, 46 (41%) had AMTL, whereas 62 out of 520 (12%) male tooth positions demonstrated AMTL. In Phase 2, half of the 22 female tooth positions had AMTL, and 205 out of 751 (27%) had AMTL.

In addition to these findings, there was a pattern of increasing AMTL from the middle to older age groups for both Phase 2 ($^2 = 4.55$, $p < 0.05$), and the medieval period ($^2 = 80.1$, $p < 0.001$). This result was not surprising, as dental disease is

more likely to occur the longer a person lives (Roberts and Manchester 1995).

Table 10.18 Prevalence of AMTL by age group and phase

	17-25 years		**26-45 years**		**46+ years**		**Total***	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
Phase 1					22	0	**24**	**8 (33)**
Phase 2	88	0	378	106 (28)	307	110 (36)	**773**	**216 (28)**
Phases 3 & 4	78	0	198	1 (1)	313	104 (33)	**689**	**108 (16)**
Phase 5	26	0	30	1 (3)	55	14 (25)	**110**	**15 (14)**
Total	**192**	**0**	**606**	**108 (18)**	**697**	**228 (33)**	**1,596**	**347 (22)**

* includes 'adult' category

N = number of observable tooth positions

n = number of tooth positions with an abscess

When examined by tooth type, AMTL occured most frequently in the molar region. Tables 10.19 and 10.20 demonstrate the prevalence of AMTL by tooth for Phase 2 and the medieval period (the total sample is presented in Appendix X).

Table 10.19 Prevalence of AMTL by tooth position (Phase 2)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	9	9	16	9	7	3	8	8	7	8	7	5	6	13	12	10
%	**38**	**38**	**57**	**36**	**28**	**14**	**44**	**47**	**35**	**36**	**32**	**21**	**27**	**48**	**48**	**43**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	7	6	7	6	5	1	2	2	3	5	4	2	6	8	7	8
%	**26**	**19**	**23**	**22**	**19**	**4**	**8**	**12**	**20**	**22**	**15**	**8**	**24**	**29**	**24**	**32**

n = number of teeth lost ante-mortem

Table 10.20 Prevalence of AMTL by tooth position (phases 3 and 4)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	3	4	7	2	1	1	1	3	2	2	2	3	2	5	4	3
%	**25**	**21**	**33**	**8**	**4**	**4**	**5**	**14**	**13**	**9**	**9**	**13**	**9**	**23**	**21**	**25**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	6	6	7	4	2	1	2	4	2	2	1	2	5	7	6	6
%	**33**	**23**	**27**	**16**	**9**	**5**	**9**	**17**	**10**	**9**	**4**	**8**	**19**	**30**	**27**	**43**

n = number of teeth lost ante-mortem

10.6 ALVEOLAR RESORPTION/PERIODONTAL DISEASE

When calculus accumulates between the tooth (and jaw) and soft tissues, periodontal pockets may form. These are associated with alveolar bone loss, and ultimately, may lead to loosening and loss of the teeth (Hillson, 1986). Predisposing factors of periodontal disease include poor oral hygiene, a soft, carbohydrate rich and/or sugar rich diet, although other factors may also be involved (e.g. crowding, malocclusion) (Hillson, 1986). There is however, some concern for identifying periodontal disease in skeletal material. As well as problems of standardized recording, it has been suggested that severe attrition may result in continued eruption of teeth, giving the appearance of periodontal disease (Roberts and Manchester 1995).

In the Tarbat sample, a very high percentage of individuals (87%) had alveolar resorption, and overall, 72% of observable jaw quadrants had alveolar resorption. As ante-mortem tooth loss was more frequently observed in Phase 2, it was expected that the severity of this disease would also be greater in this phase. However, only a slightly higher percentage of jaw quadrants had considerable alveolar resorption in Phase 2 than in the medieval period (phases 3 and 4) (Table 10.21).

Table 10.21 Prevalence of alveolar resorption by severity and phase

		Slight	**Medium**	**Considerable**	**Total**
	N	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Phase 1	8	1 (13)	0	4 (50)	**5 (63)**
Phase 2	136	23 (17)	19 (14)	59 (43)	**101 (74)**
Phases 3 and 4	102	14 (14)	17 (17)	38 (37)	**69 (68)**
Phase 5	16	4 (25)	4 (25)	6 (38)	**14 (88)**
Total	**262**	**42 (16)**	**40 (15)**	**107 (41)**	**189 (72)**

N = number of half maxillas and mandibles
n = number of half maxillas and mandibles with alveolar resorption
(degree of resorption is based on the descriptions of Brothwell, 1981)

When the number of medieval female and male quadrants with periodontal disease were examined, no significant difference was observed (^{2} = 0.2, p = ns). Out of 28 female quadrants, 14 (50%) had medium or considerable alveolar resorption, and out of 74 male quadrants, 41 (55%) had medium or considerable alveolar resorption. In Phase 2, 2 of 4 female quadrants were affected, and 76 of 132 (58%) male quadrants were affected (by medium or considerable alveolar resorption).

10.7 DENTAL WEAR

Dental wear (attrition) occurs when the teeth are ground together during mastication. Although it is not a dental disease *per se*, it may aid the development of caries and abscesses if the pulp chamber becomes exposed (Lukacs, 1989). A major factor affecting the degree of wear is diet type. For example, using a stone mortar introduces tiny particles of stone into the grain and the food produced from it (Roberts and Manchester 1995).

In the Tarbat assemblage, 18 male skeletons with dentition had very heavy wear on the teeth. Of these individuals, the majority were from Phase 2 (68%). Most of these individuals were middle or older adults (with the exception of one subadult - SK 2) which would be expected given that dental wear increases with age. In most of these cases the teeth were worn down to the roots, and in some instances, the roots were also affected. It was also noted that the wear was often uneven (i.e. occlusal surface was not flat). As heavy dental wear was more frequently observed in adults from Phase 2 (particularly in the older age group), it is possible that the medieval diet may have been softer and easier to chew (Table 10.22). A list

of the skeletons with heavy dental wear is presented in Appendix XI.

Table 10.22 Percentage of individuals with heavy dental wear by age group and phase

	26-45 years		**46+ years**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
Phase 1	0	0	2	1 (50)	**2**	**1 (50)**
Phase 2	17	3 (18)	14	9 (64)	**31**	**12 (39)**
Phases 3 and 4	9	2 (22)	14	2 (14)	**23**	**4 (17)**
Phase 5	1	0	2	1 (50)	**3**	**1 (33)**
Total	**27**	**5 (19)**	**32**	**13 (41)**	**59**	**18 (31)**

N = number of individuals with dentition
n = number of individuals with heavy dental wear

10.8 UNERUPTED THIRD MOLARS

Eleven of the adult individuals from the Tarbat assemblage did not have one or more erupted third molars (see Appendix XII). At Hallow Hill, a number of 3rd molars were also absent (Lunt, 1996). The significance of this observation cannot be determined until more sites are available for comparison.

10.9 DENTAL DISEASE AT TARBAT AND OTHER SCOTTISH SITES

Overall, there were differences in the prevalences of dental disease between Phase 2 and the medieval period (Phases 3 and 4). In Phase 2, calculus, dental abscesses, ante-mortem tooth loss and dental wear were more frequent, whereas in the medieval period, caries and dental enamel hypoplasia were more frequent. These differences may represent differences in diet and oral hygiene (see above and below). It is likely that the heavy dental wear observed on individuals from phase 2 resulted in exposure of the pulp cavities, causing dental abscesses. It is also possible that caries prevalence could be underestimated given the high percentage of ante-mortem tooth loss in Phase 2.

In the medieval period, the teeth from women had caries, dental enamel hypoplasia and ante-mortem tooth loss more frequently than the males. These findings suggest that there may have been differences in diet and oral hygiene between some of the medieval women and men buried in the church. Two out of seven medieval women had dental enamel hypoplasia, suggesting that both these women suffered from environmental stress during childhood.

A number of specialists have reported on the prevalence of caries in permanent teeth, allowing for comparisons of this dental disease to be made with the Tarbat material. It was noted however, that Hallow Hill was the only site that could be compared to Tarbat Phase 2. Both these sites had a low prevalence rate of caries relative to medieval teeth (with the exception of Dundee and Dunbar) (Tables 10.23 and 10.24). It has been reported that caries prevalence was low in Dark Age (4.3%) and Viking Scotland (2.9%) (Lunt, 1974). Although it is possible that a more recent overview of Dark Age Scottish teeth may reveal different rates, a relatively recent overview of Viking teeth from the North Atlantic demonstrated almost no, or a very low prevalence of, carious lesions (Scott *et al.*, 1992).

The percentage of medieval teeth with caries from Tarbat roughly corresponds with most other Scottish sites. Based on information compiled by Lunt (1993), 6.2% of Scottish teeth from this period had caries. Generally, there appears to be an increase in the prevalence of caries through time in British populations (Roberts and Manchester, 1995). It was not until the 12th century that cane sugar was imported into Britain, although it was generally unavailable to the majority of the

population. During the Anglo-Saxon or early medieval period (5th to 10th centuries), honey was probably the main sweetening agent, and bread was the main source of carbohydrate (Hardwick, 1960; Roberts and Manchester, 1995).

Table 10.23 Caries prevalence in Scottish sites c. 8th - 11th century

Site	Date	N	% Caries
Tarbat	**8th - 11th C**	**557**	**4.1**
Hallow Hill	6th -9th C	1162	3.3

N = number of teeth present

Table 10.24 Caries prevalence in medieval Scottish sites

Site	Date	N	% Caries
Tarbat	**12th -15th C**	**581**	**6.9**
Glasgow Cathedral	12th -15th C	585	5.6
Dundee	12th - 15th C	767	3.7
Dunbar	medieval	892	3.0
Whithorn	13th - 15th C	11,200	6.7
Aberdeen (A)	c.13th - 17th C	*	5.0
Aberdeen (B)	13th -16th C	741	6.7
Linlithgow	c.13th - 17th C	1,869	7.4
Kirkhill	medieval	2,864	6.8

* data not presented in report

N = number of teeth present

Other dental diseases could not be compared to the Tarbat assemblage with the exception of Glasgow Cathedral (12th to 15th century phase). The percentages of dental abscesses was almost identical (1.8% for Tarbat and 1.9% for Glasgow Cathedral). In contrast, the medieval dentition at Tarbat had almost twice as much ante-mortem tooth loss as the Glasgow Cathedral individuals (15.7% vs 8.7%). In addition, 14.5% of the teeth had dental enamel hypoplasia at Tarbat, whereas only 5.3% of the teeth from Glasgow Cathedral had dental enamel hypoplasia.

11.0 JOINT DISEASE

Any changes to the joint surfaces which involved lipping (osteophytes), pitting (subchondral porosity), eburnation (polishing of bone surface) and changes to the joint shape were described following the recommendations of Buikstra and Ubelaker (1994). However, for the purposes of analysis, osteoarthritis was only diagnosed if there was presence of eburnation, or when at least two of the following conditions were present: marginal osteophyte and/or new bone on the joint surface, pitting on the joint surface, or alteration in the bony contour of the joint (Rogers and Waldron, 1995). Based on the recommendations of Rogers and Waldron (1995), the severity of osteoarthritis was not considered in the analysis (with the exception of bony fusion in spinal joint disease).

11.1 OSTEOARTHRITIS

Osteoarthritis (OA) is a common disease in antiquity and in modern populations. It affects synovial joints and is characterised by a loss of articular cartilage and subchondral bone changes. Current understanding of OA is that it is a normal remodelling or repair process in response to joint failure as a result of alterations in joint mechanics. These may

occur partly through injury and activity, although other factors such as age, and the systemic and genetic predisposition of an individual are also important. The mechanical element may determine which joints are involved in people predisposed to OA (Rogers and Waldron 1995).

Out of 130 adult skeletons with joints to observe (excluding the spinal column), 41% had at least one joint affected by OA (as defined above). It is noted, however, that the incompleteness of many of the Tarbat skeletons may have resulted in an underestimate of this percentage. In modern populations, the prevalence of OA increases with age (Rogers and Waldron 1995). Despite the incomplete nature of the sample, this finding was also observed in the Tarbat assemblage (^{2} = 7.85, df = 2, p < 0.05) (Table 11.1).

Table 11.1 Percentage of individuals with OA by age category and phase

	Adult		**17-25 years**		**26-45 years**		**46+ years**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
Phase 1	2	0					2	2 (100)	**4**	**2 (50)**
Phase 2	8	1 (13)	5	0	26	10 (38)	22	11 (50)	**61**	**22 (36)**
Phases 3 & 4	7	4 (57)	8	2 (25)	16	6 (38)	30	16 (53)	**61**	**28 (46)**
Phase 5			1	0	1	0	2	1 (50)	**4**	**1 (25)**
Total	**17**	**5 (29)**	**14**	**2 (14)**	**43**	**16 (37)**	**56**	**30 (54)**	**130**	**53 (41)**

N = number of individuals

n = number of individuals with OA

The prevalence of OA was examined by joint. In order to facilitate this analysis, the number of observable joints was recorded. Overall, 1,120 joints were examined and 10% were found to have OA. Table 11.1 presents the number of affected joints by age category and phase. No significant difference was observed in the number of joints affected in Phase 2 compared to the medieval period (^{2} = 1.47, p = ns). As might be expected, there was a clear increase in the percentage of affected joints with age in phase 2, whereas in the medieval period, a slightly higher percentage of joints were affected in middle adults (18%) compared to old adults (15%). In the medieval period, male and female joints were equally affected by OA (12% for both - females: 19 out of 159 joints, and males: 43 out of 368 joints). No female joints had OA in Phase 2 (N = 31), although 10% of male joints were affected (48 out of 476 joints) from this phase.

Table 11.1 Prevalence of joints with OA by age category and phase

	Adult		**17-25 years**		**26-45 years**		**46+ years**		**Total**	
Phase	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
1	9	0					21	3 (14)	**30**	**3 (10)**
2	36	1 (3)	57	0	241	19 (8)	178	28 (16)	**512**	**48 (9)**
3 & 4	40	10 (25)	63	2 (3)	173	13 (18)	251	37 (15)	**527**	**62 (12)**
5	0		11	0	14	0	26	2 (8)	**51**	**2 (4)**
Total	**85**	**11 (13)**	**131**	**2 (2)**	**428**	**32 (8)**	**476**	**70 (15)**	**1,120**	**115 (10)**

N = number of joints

n = number of joints with OA

Tables 11.3 to 11.6 present the prevalence of joint disease by age category for each phase. From these tables, it is apparent that the most frequently affected joints in Phase 2 were the right toes (27%), right and left hips (22 and 18%), and the right

fingers (16%). In the medieval period (Phases 3 and 4), the right toes were also frequently affected (20%) as well as the right wrist (20%), followed by the left toes (19%), right fingers (17%), right shoulder and left hip (16% for both). Data for the total sample is presented in Appendix XIII. Twenty-two individuals also had OA on the ribs, but this was not included in the analyses as the prevalence could not be calculated.

Today, commonly observed sites of OA include the hands, acromioclavicular joint, first metatarsophalangeal joint (foot), hip and knee (Rogers and Waldron 1995). Certainly, the results from the Tarbat assemblage correspond well with these observations. The lack of unusual patterns of OA suggests that prevalence and distribution of OA is what might be expected in a population group of mainly middle and older adults.

There were no significant differences in joint involvement between Phase 2 and the medieval period (Phases 3 and 4), with the exception of the right knee (^{2} = 4.6, $p < 0.05$) - no right knee joints were affected by OA in Phase 2. There were also no significant differences in joint involvement by age in Phase 2, or in the medieval period (statistics not shown). In addition, no significant differences were found in male and female joint involvement, with one exception. Females in the medieval period were more likely to have joint disease in the left toe than males (^{2} = 7.14, $p < 0.05$) from this period.

Table 11.3 Prevalence of OA by joint and age category (Phase 1)

	Adult		**17-25**		**26-45**		**46+**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
R shoulder							2	0	**2**	**0**
L shoulder	1	0					2	0	**3**	**0**
R elbow							2	0	**2**	**0**
L elbow	1	0					2	1 (50)	**3**	**1 (33)**
R wrist							1	0	**1**	**0**
L wrist							1	0	**1**	**0**
R fingers							1	1 (100)	**1**	**1 (100)**
L fingers							1	0	**1**	**0**
R hip	1	0					2	0	**3**	**0**
L hip	1	0					2	0	**3**	**0**
R knee	1	0					1	0	**2**	**0**
L knee	1	0					1	1 (100)	**2**	**1 (50)**
R ankle	1	0					1	0	**2**	**0**
L ankle	1	0					1	0	**2**	**0**
R toes										
L toes	1	0					1	0	**2**	**0**
Total	**9**	**0**					**21**	**3 (14)**	**30**	**3 (10)**

N = number of joints observed
n = number of joints with OA

Table 11.4 Prevalence of OA by joint and age category (Phase 2)

	Adult		**17-25**		**26-45**		**46+**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
R shoulder			5	0	16	1 (6)	10	2 (20)	**31**	**3 (10)**

	Adult		17-25		26-45		46+		Total	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
L shoulder			5	0	17	2 (12)	11	1 (9)	**33**	**3 (9)**
R elbow	1	0	5	0	19	0	16	1 (6)	**41**	**1 (2)**
L elbow			3	0	19	0	17	1 (6)	**39**	**1 (3)**
R wrist			4	0	16	2 (13)	12	2 (17)	**32**	**4 (13)**
L wrist	1	0	4	0	16	0	12	3 (25)	**33**	**3 (9)**
R fingers	**1**	**1 (100)**	**3**	**0**	**11**	**3 (27)**	**10**	**0**	**25**	**4 (16)**
L fingers	1	0	3	0	14	0	11	1 (9)	**29**	**1 (3)**
R hip	**3**	**0**	**5**	**0**	**18**	**3 (17)**	**15**	**6 (40)**	**41**	**9 (22)**
L hip	**4**	**0**	**4**	**0**	**22**	**4 (18)**	**19**	**5 (26)**	**49**	**9 (18)**
R knee	6	0	4	0	16	0	9	0	**35**	**0**
L knee	5	0	3	0	18	0	13	1 (8)	**39**	**1 (3)**
R ankle	5	0	3	0	11	0	7	2 (29)	**26**	**2(8)**
L ankle	4	0	2	0	14	0	8	1 (13)	**28**	**1 (4)**
R toes	**2**	**0**	**2**	**0**	**7**	**2 (29)**	**4**	**2 (50)**	**15**	**4 (27)**
L toes	3	0	2	0	7	2 (29)	4	0	**16**	**2 (13)**
Total	**36**	**1 (3)**	**57**	**0**	**241**	**19 (8)**	**178**	**28 (16)**	**512**	**48 (9)**

N = number of joints observed

n = number of joints with OA

Table 11.5 Prevalence of OA by joint and age category (Phase 3 and 4)

	Adult		17-25		26-45		46+		Total	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
R shoulder			**3**	**0**	**12**	**0**	**16**	**5 (31)**	**31**	**5 (16)**
L shoulder	1	0	3	0	12	0	6	1 (17)	**22**	**1 (5)**
R elbow	1	1 (100)	3	0	13	1 (8)	19	2 (11)	**36**	**4 (11)**
L elbow			4	0	12	0	15	2 (13)	**31**	**2 (7)**
R wrist	**3**	**2 (67)**	**3**	**0**	**11**	**1 (9)**	**18**	**4 (22)**	**35**	**7 (20)**
L wrist	1	0	4	0	12	1 (8)	12	2 (17)	**29**	**3 (10)**
R fingers	**2**	**1 (50)**	**2**	**1 (50)**	**11**	**0**	**14**	**3 (21)**	**29**	**5 (17)**
L fingers	1	1 (100)	2	0	10	0	8	1 (13)	**21**	**2 (10)**
R hip	**3**	**0**	**4**	**0**	**14**	**4 (29)**	**24**	**3 (13)**	**45**	**7 (16)**
L hip	3	0	4	0	15	2 (13)	21	2 (10)	**43**	**4 (9)**
R knee	5	2 (40)	6	0	14	1 (7)	24	3 (13)	**49**	**6 (12)**
L knee	5	2 (40)	6	0	13	2 (15)	21	2 (10)	**45**	**6 (13)**
R ankle	4	0	6	0	7	0	18	1 (6)	**35**	**1 (3)**
L ankle	5	0	6	0	7	1 (14)	17	0	**35**	**1 (3)**
R toes	**3**	**1 (33)**	**4**	**0**	**5**	**0**	**8**	**3 (38)**	**20**	**4 (20)**
L toes	**3**	**0**	**3**	**1 (33)**	**5**	**0**	**10**	**3 (30)**	**21**	**4 (19)**
Total	**40**	**10 (25)**	**63**	**2 (3)**	**173**	**13 (8)**	**251**	**37 (15)**	**527**	**62 (12)**

N = number of joints observed

n = number of joints with OA

Table 11.6 Prevalence of OA by joint and age category (Phase 5)

	Adult		**17-25**		**26-45**		**46+**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
R shoulder					1	0	2	0	**3**	**0**
L shoulder			1	0	1	0	2	0	**4**	**0**
R elbow			1	0	1	0	2	0	**4**	**0**
L elbow			1	0	1	0	2	0	**4**	**0**
R wrist			1	0	1	0	2	0	**4**	**0**
L wrist			1	0	1	0	2	1 (50)	**4**	**1 (20)**
R fingers							1	0	**1**	**0**
L fingers							1	1 (100)	**1**	**1 (100)**
R hip			1	0	1	0	2	0	**4**	**0**
L hip			1	0	1	0	2	0	**4**	**0**
R knee			1	0	1	0	2	0	**4**	**0**
L knee			1	0	1	0	2	0	**4**	**0**
R ankle			1	0	1	0	1	0	**3**	**0**
L ankle			1	0	1	0	1	0	**3**	**0**
R toes					1	0	1	0	**2**	**0**
L toes					1	0	1	0	**2**	**0**
Total	**0**		**11**	**0**	**14**	**0**	**26**	**2 (8)**	**51**	**2 (4)**

N = number of joints observed

n = number of joints with OA

11.2 SPINAL JOINT DISEASE

Spinal joint disease (SJD) is characterised by OA of the vertebral body, posterior apophyseal joints and transverse joints, but may also be identified by Schmorl's nodes or degenerative disc disease Schmorl's nodes are depressions in the vertebral body as a result of herniation of the disc contents, possibly from trauma (Roberts and Manchester 1995). Degenerative disc disease (DDD) consists of course pitting, sometimes associated with new bone growth, on the superior and inferior surfaces of the vertebral bodies and is presumed to reflect degeneration of the intervertebral disc (Rogers and Waldron 1995).

Ninety-eight individuals had vertebrae to analyse (Table 11.7). Of these individuals, 79% had spinal joint disease and 5% had osteophytes, revealing that 84% of the individuals had some vertebral changes. As might be expected, the highest percentages of individuals with SJD were middle and older adults.

Table 11.7 Percentage of individuals with SJD by age category and phase

	Adult		**17-25 years**		**26-45 years**		**46+ years**		**Total**	
Phase	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
1							2	2 (100)	**2**	**2 (100)**
2	2	1 (50)	5	2 (40)	24	22 (97)	20	19 (95)	**51**	**44 (86)**
3 & 4	1	0	4	1 (25)	15	10 (67)	22	19 (86)	**42**	**30 (71)**
5			1	0			2	1 (50)	**3**	**1 (33)**
Total	**3**	**1 (33)**	**10**	**3 (30)**	**39**	**32 (82)**	**46**	**41 (89)**	**98**	**77 (79)**

N = number of individuals
n = number of individuals with SJD

There were 1,453 vertebrae present, of which 47% were affected by SJD (Table 11.8). In Phase 2, 52% of the vertebrae were affected by SJD, whereas less vertebrae (39%) were affected in the medieval period (^{2} = 25.7, $p < 0.001$). In both Phase 2, and the medieval period, there were clear increases in the percentage of affected vertebrae with increasing age. It was noted however, that a larger percentage of young adults had SJD in Phase 2 than in the medieval period (30% vs. 3%). It is hypothesised from this observation that the young adults from the earlier phase experienced more activity or injury related stresses to the back.

In Phase 2, there was a significant difference between the males and females, such that males were more likely to have SJD (^{2} = 17.25, $p < 0.001$) (9 of 42 female vertebrae were affected, and 379 out of 714 male vertebrae were affected). In the medieval period, 39% of female vertebrae were affected (74 out of 189) and similarly, 40% (167 out of 410) male vertebrae were affected by SJD.

Table 11.8 Prevalence of SJD by age category and phase

	Adult		**17-25 years**		**26-45 years**		**46+ years**		**Total**	
Phase	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
1							25	20 (80)	**25**	**20 (80)**
2	29	7 (24)	91	27 (30)	356	192 (54)	304	183 (60)	**780**	**409 (52)**
3 & 4	12	0	88	3 (3)	223	61 (27)	296	177 (60)	**619**	**241 (39)**
5			7	0	2	0	20	6 (30)	**29**	**6 (21)**
Total	**41**	**7 (17)**	**186**	**30 (16)**	**581**	**253 (44)**	**645**	**386 (60)**	**1,453**	**676 (47)**

N = number of vertebrae
n = number of vertebrae with SJD

Every vertebra was found to be affected by SJD - the least affected being C1 (Table 11.9). Overall, the most frequently affected vertebrae were C5/C6 and T8 to T12. As a result of spinal curvature, certain vertebrae are more commonly affected by SJD than others, including C5 and C6, T7 and T8, and L3 and L4 (Manchester 1983). The findings from the Tarbat assemblage were consistent with this, with the exception of the lower lumbar vertebrae, which were relatively less affected by SJD than other areas of the spine.

There were very few differences in the prevalence of affected vertebrae between Phase 2 and the medieval period (Phases 3 and 4) with the exception of T10, L1 and L2 - a significantly higher percentage of these vertebrae were affected in Phase 2 than in the medieval period (^{2} = 5.19, ^{2} = 6.25, ^{2} = 5.38, all $p < 0.05$). A number of vertebrae were also observed to increase in prevalence with age. In Phase 2, this involved C6, and in the medieval period, this involved C4 to C7, T1, T11 and T12 (statistics not shown). Finally, there were no differences between the females and males, except for T3. In the medieval period, this vertebra was most likely to be affected in females (^{2} = 6.66, $p < 0.05$).

Table 11.9 Prevalence of SJD by vertebrae and phase

	Phase 1		**Phase 2**		**Phases 3 & 4**		**Phase 5**		**Total**	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
C1	2	1 (50)	27	6 (22)	13	1 (8)	2	0	**44**	**8 (18)**
C2	1	1 (100)	29	11 (38)	15	4 (27)	2	0	**47**	**16 (34)**

	Phase 1		Phase 2		Phases 3 & 4		Phase 5		Total	
	N	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**	**N**	**n (%)**
C3	1	1 (100)	28	16 (57)	14	6 (42)	2	0	**45**	**23 (51)**
C4	1	1 (100)	30	16 (53)	17	9 (53)	2	1 (50)	**50**	**27 (54)**
C5	1	1 (100)	31	18 (58)	17	8 (47)	2	1 (50)	**51**	**28 (55)**
C6	1	1 (100)	31	20 (65)	19	10 (53)	2	1 (50)	**53**	**32 (60)**
C7	1	1 (100)	34	16 (47)	19	6 (32)	1	1 (100)	**55**	**24 (44)**
T1	1	1 (100)	33	12 (36)	21	5 (24)	0		**55**	**18 (33)**
T2	1	1 (100)	35	8 (23)	22	4 (18)	0		**58**	**13 (22)**
T3	1	1 (100)	37	12 (32)	23	9 (39)	1	0	**62**	**22 (36)**
T4	1	1 (100)	36	16 (44)	26	9 (35)	1	0	**64**	**26 (41)**
T5	1	1 (100)	34	19 (56)	26	12 (46)	1	0	**62**	**32 (52)**
T6	1	1 (100)	36	20 (56)	27	12 (44)	1	0	**65**	**33 (51)**
T7	0		34	22 (65)	29	12 (41)	1	0	**64**	**34 (53)**
T8	1	1 (100)	35	22 (63)	31	16 (52)	1	0	**68**	**39 (57)**
T9	1	1 (100)	33	21 (64)	31	16 (52)	1	0	**66**	**38 (58)**
T10	1	1 (100)	**32**	**23 (72)**	**32**	**14 (44)**	1	0	**66**	**38 (58)**
T11	1	1 (100)	32	23 (72)	32	17 (53)	1	0	**66**	**41 (62)**
T12	1	1 (100)	31	21 (68)	30	14 (47)	0		**62**	**36 (58)**
L1	1	0	**32**	**21 (66)**	**32**	**11 (34)**	0		**65**	**32 (49)**
L2	1	0	**33**	**21 (64)**	**34**	**12 (35)**	1	0	**69**	**33 (48)**
L3	1	0	33	16 (48)	35	16 (46)	2	0	**71**	**32 (45)**
L4	1	1 (100)	34	15 (44)	37	10 (27)	2	1 (50)	**74**	**27 (37)**
L5	2	2 (100)	30	13 (43)	37	8 (22)	2	1 (50)	**71**	**24 (34)**
Total	**25**	**21 (84)**	**780**	**408 (52)**	**619**	**241 (39)**	**29**	**6 (21)**	**1,453**	**676 (47)**

N = number of vertebrae

n = number of vertebrae with SJD (OA and/or SN and/or DDD)

A relatively high percentage of individuals had Schmorl's nodes in the Tarbat sample (41%). Five individuals (5%) had degenerative disc disease (DDD) in addition to DJD. Table 11.10 demonstrates the prevalence of osteoarthritis (OA), Schmorl's nodes (SN), degenerative disc disease (DDD) and osteophytes (O) for each vertebra *for the total sample*. It is evident from this table that OA and osteophytes affected all vertebrae, while Schmorl's nodes were most prevalent between T7 and L2. Similarly, DDD was observed on the lower thoracic and lumbar vertebrae.

Table 11.10 Prevalence of spinal joint disease (total sample)

		OA	**SN**	**DDD**	**O**
	N	**n (%)**	**n (%)**	**n (%)**	**n (%)**
C1	44	8 (18)	0	0	4 (9)
C2	47	16 (35)	0	0	5 (11)
C3	45	23 (51)	0	0	1 (2)
C4	50	27 (54)	0	0	1 (2)
C5	51	28 (55)	0	0	2 (4)
C6	53	32 (60)	0	0	2 (4)

		OA	SN	DDD	O
	N	**n (%)**	**n (%)**	**n (%)**	**n (%)**
C7	55	24 (44)	0	0	2 (4)
T1	55	18 (33)	0	0	3 (5)
T2	58	13 (22)	0	0	7 (12)
T3	62	22 (35)	1 (2)	0	9 (15)
T4	64	24 (38)	5 (8)	0	12 (19)
T5	62	24 (39)	13 (21)	0	12 (19)
T6	65	22 (34)	19 (29)	1 (2)	15 (23)
T7	64	18 (28)	25 (39)	1 (2)	19 (30)
T8	68	20 (29)	29 (43)	0	21 (31)
T9	66	18 (27)	28 (42)	1 (2)	22 (33)
T10	66	21 (32)	28 (42)	2 (3)	19 (29)
T11	66	22 (33)	31 (47)	2 (3)	17 (26)
T12	62	12 (19)	26 (42)	3 (5)	19 (31)
L1	65	10 (15)	24 (37)	3 (5)	20 (31)
L2	69	11 (16)	25 (36)	2 (3)	27 (39)
L3	71	18 (25)	17 (24)	3 (4)	20 (28)
L4	74	19 (26)	10 (14)	1 (1)	24 (32)
L5	71	20 (28)	7 (10)	1 (1)	20 (28)
Total	**1,453**	**470 (32)**	**288 (20)**	**20 (2)**	**303 (21)**

11.3 VERTEBRAL FUSION

There were two individuals who had several fused vertebrae, but the fusion did not demonstrate the classical characteristics of either ankylosing spondylitis (an inflammatory disease of unknown etiology) or diffuse idiopathic hyperostosis (see below). An old adult ?male from phase 2 (SK 128) had a fused sacro-iliac joint on the right side (the left side was missing), as well as fusion between T3 and T4 and the 4th ribs (with no joint space left between the vertebrae) and fusion between C5 to C7 (T5 to L1 were missing). The osteophytes on the cervical vertebral bodies were square and 'bamboo' like in appearance, with fusion also occurring between the lamina and transverse processes. In addition, the atlas was fused to the occipital in such a way that this individual's head would have been slightly raised and tilted to the right side.

An old adult male from phase 4 (SK 90) demonstrated fusion of the bodies (square), apophyseal joints and laminae between T4 and T5 (all vertebrae were present). In addition, T4 was slightly collapsed on the right side resulting in scoliosis. Ossification of ligaments was also present on a number of lumbar vertebrae, but only L4 and L5 were fused. In this case, the fusion was large and bulbous in appearance. It was also noted that this individual had an area of ossification on the base of the skull (lateral to the left occipital condyle), resulting in limited mobility to raise the head, and causing the head to be permanently faced slightly to the left side. No sacral-iliac fusion was present.

11.4 DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS

Diffuse idiopathic skeletal hyperostosis (DISH) has an unknown etiology, but has been associated with diabetes and obesity. It is slightly more common in males than females, and the age of onset is usually over 50 years. The disease is characterised by gradual and complete fusion of the spine with a 'candlewax' appearance of the osteophytes, particularly on the right side of the vertebrae, while the spaces between vertebral bodies and apophyseal joints are maintained. Ossified cartilage may

also be present in other areas of the skeleton as people affected with DISH are often 'bone formers'. Symptoms of this disease include pain, aching and stiffness (Roberts and Manchester 1995; Rogers and Waldron 1995).

In the Tarbat assemblage, there was only one old adult male (from Phase 4) who demonstrated changes characteristic of DISH (SK 64). This individual had 'candle wax' spinal osteophytosis on the right side of vertebral bodies of T12 to L4 (although not all were fused), without affecting the apophyseal joints. In addition, there was ligamentous fusion of both sacro-iliac joints without affecting the joint spaces. This individual also had enthesopathies (ossification) on the distal ends of the tibiae and fibulae.

11.5 DEFECTS OF THE ARTICULAR SURFACE

At least two skeletons had round lytic lesions of unknown etiology on the joint surfaces. Both SK 167 (adult ?male from phase 2) and SK 129 (young adult ?male from Phase 2) had a large lytic lesion with rounded edges on the proximal articular surface of the 1st proximal phalanx of the foot.

11.6 JOINT DISEASE AT TARBAT AND OTHER SCOTTISH SITES

Some interesting patterns emerged when joint disease was examined in the Tarbat assemblage. While there was no difference in the prevalence of joints affected by osteoarthritis (OA) between Phase 2 and the medieval period, there was a difference in the prevalence of spinal joint disease (SJD). More vertebrae were affected by SJD in Phase 2, and more younger individuals had SJD than in the medieval period. These findings suggest that the individuals from Phase 2 were likely experiencing different stresses on the back, particularly, the lower back - perhaps as a result of some physical activity.

Joint diseases are very difficult to compare between sites because of the different methodologies used to diagnose OA and SJD, and because of the differing age distributions. The prevalence rate of OA may be artificially increased or decreased depending on the proportion of older individuals (Waldron 1994). Table 11.11 and 11.12 present the prevalence rates from various Scottish sites. While they cannot be used for direct comparison, they demonstrate that both OA and SJD were frequently observed in Scottish assemblages.

Table 11.11 Prevalence of joint disease in Scottish sites *c*.8th - 11th century

Site	**Date**	**N**	**% OA**	**N**	**% SJD**
Tarbat	**8th - 11th C**	**512**	**9.4**	**780**	**52.4**
Isle of May	5th - 12th C	492	21.5	476	62.8

N = number of joints/vertebrae

Table 11.12 Prevalence of joint disease in medieval Scottish sites

Site	**Date**	**N**	**% OA**	**N**	**% SJD**
Tarbat	**12th -15th C**	**527**	**11.7**	**619**	**38.9**
Glasgow Cathedral	12th -19th C	*	*	548	47.3
Isle of May	12th - 17th C	168	10.1	178	43.3
Dundee	12th - 15th C	219	7.3	270	30.7
Dunbar	Medieval	*	*	553	69.1

* data not presented in report

N = number of joints/vertebrae

12.0 TRAUMA

In skeletal remains, trauma may be observed as fractures, weapon wounds, dental trauma, dislocations, scalping and surgery (trephination and amputation) (Merbs, 1989). In the Tarbat sample, 21% of the adults demonstrated traumatic injuries to the bones (no subadults had evidence of trauma on their bones), most of which were healed fractures. Overall, a higher percentage of individuals had traumatic injury in Phase 2 (32%) compared to the medieval period (12%). In the medieval period, 13% of the women and 11% of the men had fractures (Table 12.1).

Table 12.1 Percentage of individuals with traumatic injury by phase

	Females		**Males**		**Total***	
	N	**n (%)**	**N**	**N (%)**	**N**	**N (%)**
Phase 1	1	0	2	0	3	0
Phase 2	5	0	55	20 (36)	62	20 (32)
Phases 3 and 4	23	3 (13)	38	4 (11)	61	7 (12)
Phase 5	1	0	2	0	4	0
Total	**30**	**3 (10)**	**97**	**24 (25)**	**130**	**27 (21)**

* includes undetermined sex category

N = number of individuals

n = number of individuals with traumatic injuries

12.1 FRACTURES

The fibula was fractured more than any other bone at Tarbat, with 10% being affected from Phase 2, and 4% being affected from the medieval period (Table 12.2). Several individuals also had fractures to the ribs, hands or feet (see below), but the prevalences could not be calculated. A description of all the fractures are presented in Table 12.3.

Table 12.2 Prevalence of fractures by bone element

	Phase 2			**Phases 3 & 4**		
	N	**n**	**%**	**N**	**n**	**%**
Clavicle	67	3	4.5	53	0	-
Radius	48	1	2.1	61	0	-
Tibia	51	1	2.0	77	0	-
Fibula	39	4	10.3	70	3	4.3

N = number of complete bone elements

n = number of bone elements with fractures

Table 12.3 Fractures observed on the Tarbat individuals

Skeleton	Phase	Age	Sex	Bone	Side	Description
145	2	middle adult	M	clavicle	L	Non-united fracture approximately mid-shaft, with healed irregular new bone formation on both sides which articulated with one another. The ends of the bones are displaced such that the medial portion of the clavicle overlaid the lateral portion (anteriorly).
176	2	middle adult	M	clavicle	L	Non-united fracture approximately 25-30 mm from the acromial end. One side is flared, and the other is rounded, forming a pseudo-joint.
				ribs		Five healed middle ribs.
170	2	middle adult	M	clavicle	L	Well-healed fracture near the conoid tubercle - slightly displaced, so that the lateral end is slightly inferior to the rest of the shaft.
39	2	adult	M	fibula	R	Proximal end - well healed (with callus formation), complete, oblique fracture.
122	2	old adult	M	fibula	R	Proximal end - well healed (with callus formation), complete, oblique fracture.
141	2	middle adult	M	fibula	R	Proximal end - well healed (with callus formation), complete, oblique fracture.
113	3 & 4	old adult	M	fibula	L	Proximal end - well healed (with callus formation), complete, oblique fracture.
				1st metacarpal & hamate	R	Well-healed complete fractures. A proximal and middle phalanx from the left hand is fused at the joint with little new bone formation. - trauma?
				ribs	L	Well-healed fracture to four middle ribs. Weapon wound to the cranium also (see below).
64	3 & 4	old adult	M	fibula	L	Incomplete fracture on distal end (appears like a crack in the articular surface) with evidence of healing.
105	3 & 4	old adult	F	fibula	R	Well-healed incomplete fracture on distal end.
125	2	old adult	M	tibia fibula	L	Both are well-healed, complete, oblique fractures on the distal ends, but the tibia also has gaps and cloacae present along the fracture line. The ends of the fracture overlap by approximately 35 mm and as a result, the L tibia is shorter than the right. In addition, the proximal end of the fibula shaft is angled slightly medially and the fracture ends overlap by approximately 22 mm. This individual also has OA of the left hip (secondary?), and probably walked with a limp.
123	2	old adult	M	5th proximal phalanx	R	Well-healed, complete, straight fracture across the shaft.
74	3 & 4	old adult	M	3rd metacarpal	L	Fracture of the styloid process.
142	2	old adult	?M	5th metacarpal	R	Fusion at an angle with the proximal phalanx - trauma?
				5th metatarsal		Non-united fracture at the base (tuberosity).
51	2	middle adult	M	5th metatarsal		Non-united fracture at the base (tuberosity).
62	3 & 4	old adult	M	5th metatarsal		Non-united fracture at the base (tuberosity).

Skeleton	Phase	Age	Sex	Bone	Side	Description
5	3 & 4	old adult	F	rib		Healed fracture of a middle rib.
151	2	old adult	M	rib		Healed fracture of a middle rib.
42	2	adult	M	rib		Healed fracture with new bone formation which has developed into a facet for articulation with a middle rib.
158	2	old adult	M	ribs		Mid-shaft fractures on four middle ribs. One rib also has a lytic lesion (oval with rounded edges - approximately 4.4 x 2.8 mm in size) approximately 20 mm away from fracture, possibly indicative of infection. This individual also had evidence of trauma to the skull (see below).
164	2	middle adult	M	rib		Rib fracture as well as a trauma or infection to the pelvis (see below).

12.1.1 Compression Fractures of the Vertebrae

Trauma to the vertebrae can result from compression fractures caused by a vertical force induced by a hyperflexion injury, or secondary to osteoporosis (Roberts and Manchester 1995). One example of the latter may be observed on SK 95, an old adult female from the medieval period. The bones of this individual were light and it is likely that one of her thoracic vertebral bodies collapsed as a result of osteoporosis.

Three middle adult males from Phase 2 also had collapsed vertebrae. SK 153 had T6 to T8 flattened on the left side of the body, and T9 flattened on the right side of the body, resulting in scoliosis. In contrast, the anterior surface of the first lumbar vertebrae of SK 121 was wedge shaped, resulting in kyphosis. SK 176 also had kyphosis as a result of three wedge-shaped vertebrae (T12, L1 and L3). In this case, the vertebrae appear to have collapsed as a result of large lesions on the inferior surfaces of the body (with the exception of L3). It is possible that these individuals sustained these fractures as a result of a vertical force injury.

12.2 SPONDYLOLYSIS

Spondylolysis is a condition were a lumbar vertebra separates into two parts (between the upper and lower joint surfaces on the neural arch), possibly as a result of congenital weakness. It has also been suggested that recurrent stresses and strains as a result of bending and lifting in an upright posture create a gradual series of small fractures in this area of weakness (Roberts and Manchester, 1995).

This condition was observed in the skeletal remains of three middle adult males - all from Phase 2. As well as suffering from collapsed vertebrae, SK 121 had spondylolysis of L5. Skeleton 141 also had spondylolysis of the 5th lumbar vertebra, while uncommonly, SK 171 had spondylylosis of both L3 and L4.

12.3 WEAPON WOUNDS

Four of the skeletons had wounds inflicted with weapons - three of which were from Phase 2. The first case was a young adult male (SK 117) from phase 2 who had three sharp edged cut marks on the skeleton. One was present on the left parietal (near the occipital), and extended 53 mm in length. It was slightly angled, so that it sheared the outer table of the skull, and only partially extended into the internal table. The second cut was on the proximal end of the posterior surface of the left femur, and was 33 mm in length. Another was found on the proximal end of the right femur (posterior-lateral surface). This cut was approximately 4 mm deep, but only the cortex was affected. There was no evidence of healing suggesting that the

individual died at the time the cuts were made. The placement of the cuts - and the type of cuts suggested a violent attack from behind, with a sharp weapon such as a sword.

A middle adult male (SK 152) from Phase 2 had three sharp cut marks to the skull. One was approximately 72 mm in length and extended across both parietals with radiating fractures extending from both ends (one curved into the right side of the frontal bone and the other curved along the left parietal). The cut was angled such that one side was sharp and the other was broken post-mortem, but it did not extend into the endocranial surface (although there was a fracture line along the wound). The second wound bisected the lamboid suture on the left side. It was 41 mm in length, and was slightly angled and did not penetrate the inner table. The last fracture was on the right side of the occipital, however, much of the area was broken post-mortem and the extent of the wound was difficult to assess. A radiating fracture extended from this cut towards the cranial base. There was no evidence of healing suggesting this individual did not survive after the wounds were inflicted. As two of the cuts were on the back of the head, it is likely that the assailant attacked from behind. Given that one of the fractures was on the crown of the head, the individual may have been below the assailant at one point (e.g. kneeling). As injuries with larger weapons are more likely to produce terminal fractures (Wenham 1987), it is possible that a weapon such as a large sword may have been used to produce these fractures.

An old adult male from Phase 2 (SK 158) had two well healed fractures on the left parietal. They were smooth parallel depressions extending from the coronal suture approximately 46 and 30 mm posteriorly, and 12 and 10 mm wide, but did not extend into the internal table. Given the linear nature of the injuries, it is possible that a large blade was used to inflict these injuries, probably in a 'face-to-face' position.

Only one individual from the medieval period had evidence of violent trauma (SK 113). This old adult male had a healed wound to the right parietal bone (near the occipital), possibly as a result of a sharp blade. The wound was oval - approximately 45mm by 35 mm - with definite edges associated with a flat surface, suggesting that the bone was sheared. Within the oval, the bone surface was very slightly irregular, but did not affect the inner table of the skull. The interpretation of a healed bade injury may be supported by the number and type of other fractures present on the skeleton. Together, these injuries suggest that this individual likely experienced violent conflict earlier in his life.

12.4 OSTEOCHONDRITIS DISSECANS

Osteochondritis dissecans can be identified by well-defined, porous, and often circular defects in the subchondral bone of a joint surface (see Roberts and Manchester 1995). It occurs as a result of fragmentation and probable disruption of the articular cartilage after trauma (Rogers and Waldron 1995).

There was one possible case of osteochondritis dissecans in the Tarbat sample (not included in the prevalence figures above). A middle adult male from phase 2 (SK 171) had a depression on the superior portion of the articular surface of both acetabulae (approximately 10 mm in size, but triangular in shape). In addition, the femoral heads had plaques of new bone formation (associated with porosities) near the fovea capitis.

12. TRAUMA AT TARBAT AND OTHER SCOTTISH SITES

While the number of fractures was small, some types of fractures were consistently observed on the Phase 2 males, such as fractured left clavicles, right proximal fibulae, ribs, compression fractures of the vertebrae and spondylolysis. Most fractures are caused by sudden and excessive force from direct violence (e.g. blow) or indirect violence (e.g. bending or twisting of the bone) (Apley and Solomon, 1988). Rib fractures may occur as a result of a fall or from crushing, or from a direct blow (Roberts and Manchester, 1995). While it was not possible to determine what type of violence was inflicted (except for the cranial injuries), the pattern of fractures may be *suggestive* of shared activity patterns resulting in ?accidental trauma. The

weapon wounds were obvious indicators of interpersonal violence.

While there is some difficulty with comparing the percentage of individuals with fractures between sites, it is apparent that there were higher percentages of fractures in the earlier Scottish assemblages compared to the medieval ones (Tables 12.4 and 12.5). A broad overview of all these sites reveals that fractures to the clavicles, vertebrae (compression), ribs, hands, fibulae, 5th metatarsals and cut marks were common to all periods, with males being more affected than females.

Table 12.4 Percentage of individuals with fractures in Scottish sites *c*.8th - 11th century

Site	**Date**	**N**	**% Fractures**
Tarbat	**8th - 11th C**	**62***	**32.3**
Isle of May	5th - 12th C	42	23.8
Hallow Hill	6th - 9th C	37*	24.3

N = number of individuals

* adults only

Table 12.5 Percentage of individuals with in fractures in medieval Scottish sites

Site	**Date**	**N**	**% Fractures**
Tarbat	**12th -15th C**	**61***	**11.5**
Glasgow Cathedral	12th -19th C	62*	14.5
Isle of May	12th - 17th C	14	14.3
Dundee	12th - 15th C	35	8.6
Dunbar	Medieval	76	9.2
Whithorn	13th - 17th C	926*	7.0
Aberdeen (C)	13th - 16th C	108*	15.7

N = number of individuals

* adults only

13.0 INFECTION

Infection was evident on a few of the Tarbat skeletons in the form of periostitis. Periostitis can be identified as fine pitting, longitudinal striation and plaque-like new bone formation on the original cortex surface of the bone as a result of surface inflammation during life (Roberts and Manchester, 1995). In the Tarbat cases, the infections were non-specific - that is, not a result of a specific disease. As well as being a result of infection, periostitis could also result from trauma to the soft tissues (Ortner and Putschar 1985).

Of 130 adult skeletons, 12 (9.2%) had infectious lesions (two children also had infective lesions - see below). Five of these individuals were from phase 2 (8.1%) and seven were from the medieval period (11.5 %). While most of these lesions occurred on the long bones, one individual had spicules of new bone and thickening in the sinuses (SK 176 - a middle adult male from phase 2). This condition is referred to as maxillary sinusitis - a condition caused by the spread of dental infection through the sinus, or as a result of air pollution (such as smoke) or allergies irritating the sinus (Lewis *et al.*, 1995). It is likely that its occurrence was underestimated in the Tarbat sample, as sinuses could only be observed when skulls were fragmented. Another individual had fine, porous, grey new bone formation surrounding a dental abscess (SK 35 - a young adult male from the medieval period). Finally, a middle adult male from the medieval period (SK 93) had fine, porous, grey new bone formation on the left side of the mandible (internal and external surfaces) extending from the coronoid process

to the gonial angle on the external surface. This individual also had ?neoplastic disease which affected the jaw (see below).

Table 13.1 summarises the infectious lesions observed on the long bones. From this table, it is apparent that the tibia was the most frequently affected bone (with a prevalence rate of 7.8% for both phase 2 and the medieval period), followed by the femur (phase 2: 4.8%, medieval: 0%) and the fibula (phase 2: 2.5%, medieval: 1.4%). No other types of long bones had infective lesions.

Table 13.1 Individuals with infection

Skeleton	Phase	Age	Sex	Bone	Side	Description
143	2	old adult	M	tibia	R	Focal area (oval shape, approx. 42 by 14 mm) of well-healed, smooth lamellar bone on the proximal, posterior surface of the shaft.
154	2	middle adult	M	tibia	R	Smooth (well-healed lamellar) new bone formation on the anterior surface at the mid-shaft, extending approx. 80 mm.
148	2	old adult	M	femur	L	Focal area of raised (by approx. 2 mm), well-healed, smooth lamellar bone on the proximal half of shaft. Anterior/lateral surface is thickened in an area extending approx. 41 by 11 mm.
150	2	adult	M	femur	R & L	Striated (rough) new bone formation on distal ends (anterior surface) extending approx. 54 by 10 mm (both femora).
				tibia	R & L	Well-healed lamellar bone that is slightly porous and striated (but thickened) (anterior and medial surfaces of distal ends of tibiae are affected - and lateral surface at midshaft).
				fibula	L	Striated, but thickened area of new bone at the distal end of the fibula (approx. midshaft).
92	3 & 4	middle adult	F	fibula	R	Well-healed lamellar bone and fine porous, striated grey bone on the distal half of the shaft (medial and posterior surface).
104	3 & 4	adult	?M	tibia	L	Focal area (oval shape, approx. 40 by 19m) of striated, well-healed lamellar bone at the mid-shaft (medial surface).
107	3 & 4	young adult	M	tibia	R & L	Well-healed lamellar bone (more striated on right side) on proximal, medial surfaces (extends approx. 90 mm +).
108	3 & 4	middle adult	M	tibia	L	Small plaque of well-healed bone (approx. 8 by 16 mm) on the medial side, just above the mid-shaft.
134	3 & 4	young adult	?M	tibia	R & L	Striated, raised, plaque-like and sclerotic bone on the medial and lateral surfaces of the tibiae (almost entire lengths of shafts are affected).
				fibula	R & L	All surfaces affected - bone is more sclerotic on distal end, and striated, plaque-like bone at the proximal end (left fibula). Right fibula is fragmented, but not as extensively affected.

13.1 INFECTION AT TARBAT AND OTHER SCOTTISH SITES

Comparing the percentages of individuals with infection between assemblages was also difficult, as some authors reported percentages for all infectious diseases, whereas others reported percentages for non-specific and specific infections separately. Tables 13.2 and 13.3 present comparable information. In all these assemblages, with the exception of Glasgow Cathedral (which included one case of leprosy), the reported infections were entirely non-specific.

Overall, the percentages of individuals with infectious lesions were low at Tarbat compared to all other assemblages (for both phase 2 and the medieval period), with the exception of Glasgow Cathedral. Generally, the lower limbs are most often affected by infectious lesions in all sites presented below.

Table 13.2 Percentage of individuals with infections in Scottish sites c. 8th - 11th century

Site	**Date**	**N**	**% Infections**
Tarbat	**8th - 11th C**	**62**	**8.1**
Isle of May	5th - 12thC	42	35.7

N = number of individuals

Table 12.5 Percentage of individuals with infections in medieval Scottish sites

Site	**Date**	**N**	**% Infections**
Tarbat	**12th -15th C**	**97**	**9.3**
Glasgow Cathedral	12th -19th C	77	5.2
Isle of May	12th - 17th C	14	28.6
Dundee	12th - 15th C	35	45.7
Dunbar	Medieval	76	44.8

N = number of individuals

14.0 METABOLIC DISEASE

Metabolic diseases may be loosely considered as conditions resulting from deficiencies or excesses in diet, or in hormones (Roberts and Manchester, 1995). Three type of conditions were observed in the Tarbat assemblage: anaemia, rickets and osteoporosis (rickets is discussed below in the palaeopathology of subadults - section 19.1).

14.1 ANAEMIA

Anaemia occurs when there is a deficiency in the haemoglobin content in red blood cells, or in the number of circulating red blood cells per unit volume of blood. Iron is needed for the development of haemoglobin, but when depleted in the body, the bone marrow is stimulated to increase red cell production. In skeletal material, this process can be macroscopically observed as porous lesions in the external surfaces of the cranial vault (porotic hyperostosis) and orbital roofs (cribra orbitalia), which are a result of hyperplasia of the underlying marrow (see references in Lovell, 1997). It is believed that these lesions are a result of chronic anaemia during childhood (Stuart-Macadam 1985). Causes of anaemia include an iron-deficient diet, excessive blood loss through injury, chronic disease and parasitic infection of the gut (Roberts and Manchester 1995).

Cribra orbitalia was scored using the categories of Buikstra and Ubelaker (1994). Only three adults had cribra orbitalia (1 subadult also had cribra orbitalia - see below), all of which were classified as 'barely discernable'. These individuals were an old adult male from phase 1 (SK 149), an old adult ?male from Phase 2 (SK 139) and a middle adult male from Phase 2 (SK 176). The individuals from Phase 2 represented 14% of the sample. No cases of porotic hyperostosis were observed on the articulated skeletons.

14.2 OSTEOPOROSIS

Osteoporosis is characterised by a reduction in total bone volume, and is correlated with age, although a number of other factors such as diet, sex and exercise are also important (Roberts and Manchester 1995). The diagnosis of osteoporosis in skeletal material can be problematic, however, it is possible that at least two individuals had osteoporosis, both old adult females (SK 155 from Phase 2 and SK 95 from the medieval period). In both cases, the bones were very light, and in one case, a vertebrae had collapsed (SK 95). Scanning electron microscopy of sections of bones may be useful in assessing osteoporosis, and could confirm these diagnoses (Roberts and Manchester, 1995).

14.3 METABOLIC DISEASE AT TARBAT AND OTHER SCOTTISH SITES

There was very little evidence of metabolic disease on the articulated burials. However, only 47 adults and 5 subadults had frontal bones that could be observed for cribra orbitalia, and osteoporosis may have been underestimated due to the lack of macroscopic diagnostic techniques.

In Phase 2, 2 out of 22 individuals (9%) with eye orbits had cribra orbitalia and in the medieval period, 1 out of 26 adults and subadults (4%) had this condition. At the Isle of May, 27% of the individuals from the early phase, and 30% from the 12th to 17th century phase, had cribra orbitalia. At Glasgow Cathedral (12th to 15th century), 4% had cribra orbitalia and 16% had it at Aberdeen (13th to16th century). At Whithorn (13th to 15th century), 30% of the individuals had cribra orbitalia, and osteoporosis was observed in 38 skeletons. At Dunbar (medieval), 9% of the individuals had cribra orbitalia, and osteoporosis was observed in two individuals. Finally, 24% of the individuals had cribra orbitalia at Dundee (12th to 15th century) and one skeleton from this site had osteoporosis.

The results from the disarticulated remains suggests that cribra orbitalia may have relatively low at Tarbat compared to other Scottish sites, with the exception of Glasgow Cathedral. However, a high percentage of orbits with cribra orbitalia from the disarticulated material, suggests that the prevalence may be underestimated. The presence of osteoporosis suggests that this condition was observed in Scottish groups in the past, although the prevalence rate is not known.

15.0 NEOPLASTIC DISEASE

Neoplastic disease refers to uncontrolled growth of tissue cells which may be either benign or malignant. Malignant neoplasms are characterised by the spread of primary growth into local organs, and into distant organs of the body (metastases) (Roberts and Manchester 1995). Given that malignant neoplasms are uncommon in palaeopathology (Ortner and Putchar 1985), two possible cases of malignant neoplasms at Tarbat is of some significance.

An old adult male from Phase 2 (SK 38) had signs of neoplastic disease on the right pelvis, left pubis and right femoral head. The right pelvis was largely fragmented (the bone was fragile as a result of pathological changes), however, all fragments had new bone formation. Some fragments appeared thickened in size as a result of increased trabecular bone. On other fragments, the cortical bone appeared porous and slightly scalloped in some areas, while in other areas, it was sclerotic or thickened with disorganised new bone formation (woven or spiculed). Similarly, the trabecular bone was thickened in some areas, and destroyed in others. Two lytic lesions with sharp edges (9 x 6 mm and 12 x 10 mm) that exposed underlying trabeculae were present on the left pubis. In addition, the right femoral head demonstrated abnormal bone loss in a focal area near the fovea capitis. This area was slightly scalloped in appearance with irregular, but remodeled edges. This skeleton was greater than 80% complete, and no other lesions were found. An x-ray revealed no additional lesions on the pelvis, although further x-rays need to be conducted.

The pelvis observed at Tarbat was very similar to one described by Waldron (1997). His case is an old adult male from 19th-century London who demonstrated widespread periosteal new bone formation through the skeleton, including the vertebrae. He attributed these changes to prostatic carcinoma. Another similar case, with osteoblastic lesions on the pelvis

was presented by Ortner and Putschar (1985). The authors also attributed these changes to metastatic carcinoma of the prostate. The case of Tarbat may also represent a skeletal metastases of a primary tumour - *perhaps* secondary to cancer of the prostate.

The second possible case of neoplastic disease was observed in a middle adult male from the medieval period (SK 93). He had a number of lytic lesions on the skeleton, particularly on the cranium and mandible. There was abnormal bone loss (affecting the external table and diploe) on the frontal bone in the region of the glabella and the left supra-orbital margin, extending approximately 66 by 32 mm. The bone loss appeared like a series of scalloped lesions, although it was rough with some slight spicules. The right side of the mandible was also affected with large (approximately 4 mm deep) overlapping circular lytic lesions. Unlike the cranium, the bone within these lesions was smooth, and the edges were sharp. Alveolar resorption was present around the tooth roots, with subsequent loss of all teeth on the right side of the mandible.

In addition to these changes, several lytic lesions were present on the skeleton, including the left scapula (posterior to the glenoid fossa), left pelvis, rib shafts (four) and the body of L3. Although they varied in size from 8 by 10 mm to 15 by 12mm, all had sharp edges and affected both the cortical and trabecular bone. It appeared that the trabecular bone was affected first, thinning the cortical bone until a hole was produced. Some of the lesions had very fine, porous new bone formation surrounding them, suggesting an inflammatory response. Four lesions were present on the left pelvis: two on the ilium (one which extended from the anterior to the posterior surface), one on the ischium which extended into the acetabulum, and one on the inferior surface of the pubis. The right pelvis did not appear to be affected (by macroscopic examination).

A similar case to the one observed at Tarbat was reported by Greig (1931) of a old adult male with basal cell carcinoma of the frontal sinus. In this case, there was destruction of the frontal bone with no new bone formation and sharp edges (although no lesions were described elsewhere on the skeleton). The presence of lesions on the Tarbat skeleton other than on the cranium was suggestive of metastases (osteolytic metastatic carcinoma), perhaps secondary to the tumour on the face.

No other neoplasms of these types were observed in any other Scottish assemblages. In contrast, common neoplasms were button osteomas (benign small, smooth, round dense bone) observed at the Isle of May (Roberts and Battley 1998), Glasgow Cathedral (King 1994), Dundee (Roberts 1999) and Aberdeen (A) (Cross and Bruce 1989). Two cases of osteochondroma have also been tentatively diagnosed from Aberdeen and Linlithgow (Cross and Bruce 1989).

16.0 OTHER

Other miscellaneous pathological conditions were observed at Tarbat, including spina bifida occulta (a congenital condition), and a possible case of kidney stones.

16.1 SPINA BIFIDA OCCULTA

Spina bifida occulta is a genetic and congenital defect of the spine (it is not the severe form - spina bifida cystica). It is an asymptomatic condition involving incomplete fusion of the sacrum. This condition was observed in one old adult male (SK 42) from Phase 2. This normal variant has also been observed at Isle of May (5th to 12th century phase)(Roberts and Battley 1998), Glasgow Cathedral (King 1994), Whithorn (Cardy 1997), and Aberdeen (Cardy forthcoming).

16.3 POSSIBLE KIDNEY STONES

Three calcified masses were recovered with the right hand (which was placed on the pelvis at burial) of an old adult ?female from the medieval period (SK 97). They measured approximately 15.5 mm by 13.mm, 16.3 by 11.5 and one was broken.

The surface of the masses had an appearance of tiny flecks of bone fused together. In some areas the surface was smooth.

17.0 UNDIAGNOSED LESIONS

There are often lesions in a skeletal assemblage that cannot be diagnosed either because they are not characteristic of the 'normal' expression of a disease, they are not well-documented in the palaeopathological literature, or the skeleton is incomplete. Two skeletons at Tarbat had lesions on the pelvis which were uncharacteristic of commonly observed pathological conditions.

A middle adult male from Phase 2 (SK 164) had a large lytic lesion (approximately 36 by 28 mm) on the right pelvis in an area superior to the acetabulum, on the posterior surface. The lesion appeared scalloped with very little new bone formation (although there were some spicules and lipping around the acetabulum), and the edges were sharp and irregular. It is possible that this lesion may be a result of infection, although an alternative diagnoses could be neoplastic disease.

A young adult male from Phase 3 (SK 41) had a first sacral vertebrae that was angled upwards on the anterior portion of the body. Ossified ligaments were also present on the right side of the body. L5 was also slightly wedge shaped with some new bone formation (rough and irregular) on the anterior surface of the body. There was also a small facet on the spinous process of L5 with a corresponding facet on the inferior surface of L4 spinous process. The anterior surface of the bodies of L3 and L4 also had small bony nodules. These changes to the bone resulted in a angle between the sacrum and lumbar vertebrae which likely produced a significant kyphosis of the spine.

18.0 ANOMALIES OF THE SKELETON

The most common skeletal anomaly was six sacral segments, instead of the ususal five. This anomaly was observed on four skeletons: SK124, SK 140, SK 157 and SK141. Skeleton 141 also had only four lumbar vertebrae. It is noted that all of these individuals were from Phase 2. The only other skeletal anomaly was a left rib with two sternal ends (SK 103). A similar type of rib has also been identified at the Isle of May (5th to 12th century)(Roberts and Battley 1998).

19.0 PALAEOPATHOLOGY OF THE SUBADULTS

Only five children had pathological conditions on the skeleton - all from the medieval period. Two children had infective lesions, one which was less than 6 months of age (SK 22). Two rib fragments from the infant skeleton had small areas of raised, porous, new bone formation on the internal surfaces. The second child was older (in the 10.6 to 14.5 year age group - SK 110) and had fine, porous new bone formation on the distal end (anterior surface) of the right femur, extending approximately 23 by 13 mm. The left radius was also thicker in size than the right radius.

Cribra orbitalia was observed in one subadult aged from 6.6 to 10.5 years (SK 86), but was only barely discernable (Buikstra and Ubelaker, 1994). Finally, the femora were slightly bowed anteriorly in a child aged from 2.6 to 6.5 years (SK 63). In addition, the femora and tibiae were slightly bowed anteriorly in a child aged from 0.6 to 2.5 years of age (SK 6). These changes were characteristic of rickets - a condition caused by vitamin D deficiency which results in 'softening' of the bones. When a child begins to walk, the weight-bearing boned become bowed (Roberts and Manchester, 1995). Sources of vitamin D come from fish oil, animal fat and sunlight. The presence of rickets suggests that these children may have been swaddled or kept indoors during the first year of life and ate foods which lacked vitamin D.

There was no evidence of rickets at Aberdeen (Cross and Bruce 1989; Cardy forthcoming), Linlithgow (Cross and Bruce 1989) or Whithorn (Cardy 1997) although there was a possible case of rickets at the Isle of May (Roberts and Battley 1998). Thus, the cases of rickets at Tarbat may be anomalous.

20.0 THE DISARTICULATED REMAINS

The following sections present a brief analysis of 3,827 fragments and 2,482 bones collected from the soil between the articulated burials. As there was no phasing for these bones, the results were presented together. In addition to these disarticulated remains, Prof. Don Brothwell examined a 'charnel' deposit beneath the flagstone floor of the nave which represented a single context. Prof. Brothwell's detailed recording forms are available from FAS at the University of York. Where possible, some of the results of his analyses will be incorporated into the present overview. For the disarticulated remains examined below, detailed cranial measurements, non-metric traits, and dental disease were recorded for future reference. All other information, including that presented below, is available on a SPSS database (version 9.0).

20.1 MINIMUM NUMBER OF INDIVIDUALS

Tables 20.1 and 20.2 present an overview of the disarticulated fragments and bones by element and age (subadult vs. adult). Based on the number of complete left femora, the minimum number of subadults was 22, and based on the number of complete left tibiae, the adult MNI was 31, giving a total MNI of 53. For the 'charnel' deposit, an "MNI of a little over a 100" was estimated using the mandibles and sacra (Roe and Brothwell 1997). In this deposit, there were 51 left subadult femora and 69 left adult tibiae - giving an overall MNI of 173.

Table 20.1 Incomplete fragments (N = 3,827)

	Subadult	**Adult**
Skull	663	296
Maxilla	9	18
Mandible	14	29
Teeth	41	149
Vertebrae	339	149
Sacrum	26	25
Pelvis	48	118
Sternum	15	11
Ribs	298	612
Clavicle	14	16
Scapula	23	85
Humerus	12	71
Radius	18	48
Ulna	13	48
Carpals		1
Metacarpals	5	21
Phalanges (hand)		7
Femur	29	62
Patella		1
Tibia	32	70
Fibula	21	99
Tarsals	1	25
Metatarsals	1	40
Phalanges (foot)	1	8

	Subadult	**Adult**
Epiphyses	88	
Unidentified	15	92
Total	**1,726**	**2,101**

Table 20.2 Complete bones (N = 2,482)

	Subadult			**Adult**		
	U	**R**	**L**	**U**	**R**	**L**
Skull	2			24		
Maxilla	2	10	8	11	1	
Mandible	8	7	4	12	1	
Vertebrae	73			255		
Sacrum				13		
Pelvis		5	4		11	9
Ilium		15	8			
Ischium		8	9			
Pubis		7	7			
Sternum	1			3		
Ribs	2	86	84		54	55
Clavicle		10	11		12	10
Scapula		8	12		10	9
Humerus		18	21		13	14
Radius		8	10		17	10
Ulna		12	10		8	17
Carpals	2			136		
Metacarpals	52			169		
Phalanges (hand)	72			246		
Femur		19	22		21	21
Patella					18	9
Tibia		22	18		17	31
Fibula	18				6	13
Tarsals	13	9	5	119	42	44
Metatarsals	63			212		
Phalanges (foot)	5			35		
Total	313	228	233	1,235	231	242

20.2 AGE ESTIMATION

When the pelvis was present, adult age was determined based on the pubic symphysis and auricular surface (see section 3.1.1). However, age could only be determined on eleven right pelves: one young adult, six middle adults and four old adults. The significance of these findings were limited, other than to suggest that all adult age groups were represented in the disarticulated remains. Similarly, in the 'charnel' deposit, three young adults, twenty-four middle adults and ten old adults were identified.

For twenty-two subadults, age could be determined by comparing the left femoral lengths to the references of Ubelaker (1989). These comparisons revealed that two were foetal, seven were probably less than 6 months of age, six were between 0.6 and 2.5 years, two were between 2.6 and 6.5 years, two were between 6.6 and 10.5 years, and three were probably between 10.6 and 18.5 years (the reference data were not adequate for the teenage years to divide into smaller age groups). While there are some problems with this ageing technique, these finding suggest that subadults of all ages were represented in the disarticulated material, particularly children below 2.5 years of age. In the analyses of the 'charnel' deposit, Brothwell found that the majority of subadults (94%) were less than 6.5 years of age (based on dental eruption/development of teeth from the left or whole mandible).

20.3 SEX DETERMINATION

Based on an examination of the right pelves, five females and six males were identified. Again, these findings suggest that both sexes were represented in the disarticulated material. Similarly, Brothwell identified both females and males in the 'charnel' deposit.

20.4 STATURE

Stature was estimated from seven female and four male left femora using the equations of Trotter (1970). These females ranged in stature from 149.7 cm to 160.8 cm (with an average of 154.9 cm) and the males ranged in stature from 168.5 cm to 171.6 cm (with an average of 170.7 cm). Although the sample sizes were small, these estimates were found to fall within the ranges observed for the total sample of articulated burials (section 5.1). The average height of the males from the 'charnel' deposit was 167.7 cm.

20.5 LOWER LIMB SHAPE

Eighteen left femora could be measured to determine the meric index and all were found to be platymeric (i.e. an index below 8.9 suggesting flattened femoral shafts). This corresponded well with the femora from the articulated burials where the majority were also found to be platymeric.

Twenty-six left tibiae could be measured and 19% were found to be platycnemic, 42% were mesocnemic and 39% were eurycnemic. These percentages were broadly similar to those observed from the articulated burials, although more tibiae were eurycnemic than mesocnemic in the articulated burials (see section 6.1).

20.6 CRANIAL INDEX

The cranial index was calculated for 24 disarticulated skulls (see section 7.1). They ranged from 73.6 to 83.5 mm, with an average of 78.2 mm (SD = 2.48). When examined as percentages in each class, 8% were found to be dolichocranic (narrow or long heads), 58% were mesocranic (average or medium shaped) and 33% were brachycranic (broad or round headed). In the 'charnel' deposit, the mean cranial index was 77.8 mm (SD = 3.1) with a range from 71.7 to 86.6 mm (N = 45). The majority of these skulls were also mesocranic (56%), while 24% were brachycranic and 20% were dolichocranic. Overall, there is considerable evidence to suggest that the majority of individuals recovered from Old Tarbat church had average or medium shaped heads.

20.7 NON-METRIC TRAITS

Cranial and post-cranial non-metric traits were recorded when possible on the disarticulated remains. A selected list of traits is presented in Table 20.3. For the post-cranial traits, only bones from the left side of the skeleton were included in the table.

Similar to the articulated remains (total sample), supraorbital notches, parietal foramen and ossicles in the lambdoid were commonly observed on the disarticulated bones. A higher percentage of crania had epipteric bones in the disarticulated material than in the articulated material (32% vs. 14% for the total sample). The percentages of post-cranial traits differed between the articulated and disarticulated material, although both demonstrated that the lateral tibial squatting facet was the most frequently observed trait, followed by the double anterior calcaneal facet.

In the 'charnel' deposit, ten out of seventy-six (13%) of the crania demonstrated metopism. This figure is similar to that observed on the disarticulated (11%) and the articulated material (13% for the total sample). Other cranial non-metric traits were recorded by Prof. D. Brothwell, but were not included in this analysis.

Table 20.3 Cranial and post-cranial traits observed on the disarticulated remains

Trait	**N**	**P (%)**
Metopic suture	35	4 (11)
Supraorbital notches	31	23 (74)
Supraorbital foramen	30	13 (43)
Parietal foramen	31	17 (55)
Epipteric bone present	25	8 (32)
Ossicles in lambdoid	32	18 (56)
Septal aperture	17*	0
Allen's fossa	21*	4 (19)
Poirer's facet	21*	4 (19)
Vastus notch	12*	1 (8)
Medial tibial squatting facet	29*	3 (10)
Lateral tibial squatting facet	29*	21 (72)
Double inf-ant talar facet	17*	9 (53)
Double anterior calcaneal facet	18*	10 (56)

N = number of bones observed (* left side)

P = number exhibiting trait

20.8 HEALTH AND DISEASE

Dental disease, osteoarthritis, spinal joint disease, a fracture, weapon wounds, osteochondritis dissecans, non-specific infection, cribra orbitalia and rickets were observed on the disarticulated remains. These conditions were also observed on the articulated skeletons, and on the skeletons from the 'charnel' deposit. Overall, these diseases were ubiquitous at Tarbat.

20.8.1 Dental Disease

The teeth and alveolar bone from 24 maxillae and 18 mandibles were examined, and all except one individual (represented by a mandible) had at least one type of dental disease. As might be expected, calculus was the most frequently observed disease, although caries, dental enamel hypoplasia, dental abscess, ante-mortem tooth loss and alveolar resorption (periodontal disease) were also observed. A detailed record of these dental diseases exists for future analyses.

20.8.2 Joint Disease

There were 138 fragments/bones with joint changes (including osteophytes). Table 20.4 presents the percentage of complete bones with OA (as defined in section 11.1) out the total number of observable bones. The right clavicle and scapula were frequently affected by OA.

Table 20.4 Disarticulated bones (complete) with OA

	N	**n (%)**
Carpals	136	3 (4)
Metacarpals	169	3 (2)
Phalanges (hand)	246	1 (0.4)
Metatarsals	212	3 (1)
R clavicle	12	3 (25)
L clavicle	10	1 (10)
R scapula	10	2 (20)
R radius	17	2 (12)
R pelvis	11	1 (9)
R femur	21	1 (5)

20.8.3 Spinal Joint Disease

There were 127 vertebral fragments/bones with osteophytes, Schmorl's nodes, and/or osteoarthritis. Of the complete vertebrae, 45 had spinal joint disease (10 had Schmorl's nodes and 35 had OA). Overall, 18% of those vertebrae were affected by SJD. This percentage is less than that observed for the articulated burials (47%).

20.8.4 Trauma

Only one fracture was observed on the disarticulated bones - a phalanx from the hand of an adult. However, there were three vertebral compression fractures, one case of spondylolysis (adult), two cases of osteochondritis dissecans (one on the distal end of an adult humerus fragment, and one on an adult talus), two enthesopathies (one on the right femur of an adult male and one on a right adult fibula) and four weapon wound cases.

The first weapon wound case was on a maxilla of a middle adult of unknown sex (17/1229). A sharp edged weapon had sliced the whole maxilla roughly horizontally. The second case was present on a middle adult male (17/1132). The sharp edged blade wound extended approximately 84 mm in a sagittal plane from the left frontal to the left parietal. The blade appeared to have acted like a wedge and displaced a large, square piece of bone (the edges were rough on all three other sides of the wound). Another adult male had a sharp horizontal blade wound on the inferior surface of the right zygomatic (17/1211). There was also a shearing wound on the left frontal bone, just above the zygomatic. It appears that the maxilla would have been separated from the rest of the face. It is noted however, that the maxilla described above did not belong to this skeleton.

Finally, a large cranial fragment had a round perforation (approximately 9mm in diameter) on the left parietal near the coronal and sagittal sutures which extended into the internal table (20/1204). The wound was slightly beveled so that the internal surface was slightly larger than the external surface. A radiating fracture extended from this lesion. There were also two cuts on this skull - one on the right parietal (approximately 26mm) which was very shallow and did not penetrate the internal table, and one (approximately 23 mm) on the right side of the frontal. In all of the above cases, no healing was observed.

20.8.5 INFECTION

There were 41 cases of non-specific infection observed on the disarticulated fragments/bones. Nine cases of new bone formation were observed on the endocranial surface of subadult skull fragments. Conditions that could cause inflammation or haemorrhage of the meningeal vessels include meningitis, epidural haematomas, birth trauma, scurvy and tuberculosis (Kreutz *et al*., 1995; Schultz, 1993). While the cause of these lesions on the Tarbat material is not known, they are indicators of serious childhood illness.

Grey, porous, raised new bone formation was also present on a subadult tibia fragment, right tibia and fibula. Table 20.5 presents the fragments/bones with infectious lesions on the adult material. Similar to the articulated material, most of the infectious lesions were observed on the lower limbs. In addition to these lesions, there were three cases of maxillary sinusitis (one subadult (6.6 to 10.5 years of age) and two adults).

Table 20.5 Infectious lesions on the adult disarticulated fragments/bones (n = 26)

	Grey/ Porous	**Lamellar**	**Woven and Lamellar**
Metatarsals (fragments)	1		
Metatarsals (complete)	2		
Radius (fragments)			1
L ulna (complete)	1		
R femur (complete)	2	1	1
Tibia (fragments	3		
R tibia (complete)	1	1	
L tibia (complete)	2		
Fibula (fragments)	3	6	1

20.8.6 METABOLIC DISEASE

Cribra orbitalia (porosites and/or coalescing porosities) was observed on 19 skull fragments/crania. Eleven skull fragments were from children and two were from adults. Six complete skulls had cribra orbitalia (1 young adult female, 2 adult females, 2 adult males and 1 middle adult male), two of which also had healed porotic hyperostosis. Table 20.6 presents the number of right and left orbits examined, and the percentage with cribra orbitalia. These figures were relatively high compared to the articulated remains (see section 14.3).

Table 20.6 Cribra orbitalia

	Right Orbit		**Left Orbit**	
	N	**n (%)**	**N**	**n (%)**
Subadults	13	7 (54)	15	6 (40)
Adults	22	8 (36)	20	6 (30)
Total	**35**	**15 (43)**	**35**	**12 (34)**

N = number of orbits observed

n = number of orbits with cribra orbitalia

There were four possible cases of rickets observed in the disarticulated material. One right radius, one left radius and two

right femora were bowed. All were subadults - 3 which were probably between 0.6 and 2.5 years of age, and one which was 2.6 to 6.5 years of age. No cases of osteoporosis were identified in the disarticulated material.

20.8.7 POSSIBLE NEOPLASTIC DISEASE

There was one possible case of neoplastic disease on an adult proximal humerus fragment (also demonstrating osteoporosis). The articular surface appeared as a slightly expanded thin shell of bone with no underlying trabeculae. There was also a bony projection of bone just below the 'articular' surface on the lateral side (due to trauma?). This new bone formation may an osteoclastoma (giant cell tumor). This is a border-line benign neoplasm that is commonly observed in the proximal and distal ends of long bones (Ortner and Putschar 1985; Aufderheide and Rodríguez-Martín 1998). Two other cases of neoplastic disease have also been identified in the 'charnel' deposit by Prof. Brothwell.

20.8.8 OTHER

There was only one case of spina bifida occulta observed on an adult sacrum. One adult axis also demonstrated non-fusion of the lamina.

20.8.9 ANOMALIES OF THE SKELETON

One adult ?male had six sacral segments instead of five. No other skeletal anomalies were observed.

21.0 SUMMARY AND DISCUSSION

Most of the skeletons from Tarbat were from an 8th to 11th century phase (Phase 2) (N = 67) or a 12th to 16th century medieval period (Phases 3 and 4) (N = 99). In Phase 2, the individuals were mostly males who lived until middle or old age, whereas the medieval period was represented by individuals of all ages. In this later period, there was a more equal representation of females to males, with a ratio of 1:1.6, whereas in Phase 2 the ratio of females to males was 1:9.2. Overall, these differences suggest that there was a change in burial practice within the church through time.

The majority of phase 2 Tarbat individuals died at older ages compared to the Isle of May (6th to 9th century phase) and Hallow Hill (6th to 9th century). However, similar to Tarbat, very few females were buried at the Isle of May during the monastic phase. The majority of individuals from the medieval period at Tarbat also lived to relatively older ages in comparison to other medieval Scottish assemblages, with the exception of Glasgow Cathedral (12th to 15th century phase). At that site, most individuals died as middle or old adults. There was also an almost identical ratio of females to males at Tarbat (Phases 3 and 4) and Glasgow Cathedral.

The stature of the females and males from Phase 2 (5'3" and 5'7" respectively) was comparable to the Isle of May and Hallow Hill. The stature of the medieval individuals from Tarbat was slightly less than their Scottish contemporaries. In addition, the medieval females were, on average, less tall than the females from Phase 2. Overall, however, the average medieval female height of 5'1" and the average male height of 5'6" were not largely different than the average modern Scot (females: 5'4" and males: 5'10", Knight, 1984).

In terms of physical features, the Tarbat Phase 2 individuals had a similar lower limb shape to the individuals buried at Isle of May (5th to 12th century phase) - that is, the majority of individuals had anterior-posterior flattening of the femoral shaft, and broad tibiae. The lower limb shape of the Phase 2 individuals was also similar to those from the medieval period at Tarbat. Medieval Scottish assemblages generally demonstrate a pattern on anterior-posterior flattening of the femora, whereas tibiae were either broad or moderately flattened - depending on the site.

There were no differences in cranial morphological features through time at Tarbat (when examined as averages). Overall, the males and females had medium shaped crania, low skull height, narrow faces and nasal apertures, medium sized eye orbits and broad palates. However, when examined as proportions, an equal number of individuals from Phase 2 had narrow heads or medium shaped heads. In the medieval period, most individuals had medium shaped heads, although a third also had broad heads. Most of the individuals from other Scottish medieval assemblages had medium or broad shaped heads. Overall, the physical features of the Tarbat individuals were not unlike to those observed on individuals from other Scottish sites.

The Tarbat individuals suffered from a number of diseases - the most frequently observed being dental disease. Calculus, abscesses, ante-mortem tooth loss and dental wear were more frequently observed in Phase 2 than in the medieval period. However, medieval teeth were more likely to have caries and dental enamel hypoplasia. In addition, female teeth from the medieval period were more likely to have caries, dental enamel hypoplasia, calculus and ante-mortem tooth loss than the male teeth. Overall, the prevalence of caries in Phase 2 and in the medieval period was similar to other contemporary Scottish sites. In the medieval phase at Tarbat, however, there was more ante-mortem tooth loss and dental enamel hypoplasia than in the Glasgow Cathedral dentitions.

These findings suggested that there were differences in diet and oral hygiene between the two phases, between the females and males from the medieval period, and between the Tarbat and Glasgow Cathedral individuals. In Phase 2, the diet may have been more coarse than during the medieval period at Tarbat. Indeed, a small particle of stone was embedded in the pulp cavity of one of the well worn teeth from Phase 2. The heavy wear may have also resulted in exposure of the pulp cavities, causing dental abscesses. The presence of heavy calculus may be associated with diet type and/or the lack of oral hygiene to remove plaque build-up.

Similarly, the high frequency of dental disease in medieval females may be indicative of a difference in diet (and oral hygiene) between the sexes. It is possible that women may have been eating more high carbohydrate foods (or more sugary foods) than the males. It has been suggested that the consumption of animal protein may be associated with better dental health (Larsen, 1997).

The high prevalence of dental enamel hypoplasia at Tarbat in comparison to Glasgow Cathedral suggests that environmental stress during childhood may have been experienced more often (or more severely) by the Tarbat individuals, particularly by the females.

Osteoarthritis was also frequently observed in both phases (and sexes) at Tarbat - the pattern of joint involvement reflected what might be expected in groups of mainly middle and older adults, rather than reflecting any unusual stresses of the joints. There were however, differences in the pattern of spinal joint disease, with more vertebrae being affected in phase 2 (52%) than in the medieval period (39%). Particularly, T10, L1 and L2 were more affected by spinal joint disease in Phase 2. These observations, along with three cases of spondylolysis (a condition which may occur as a result of bending and lifting in an upright posture) and three cases of compression fractures of the vertebrae (possibly as a result of a vertical force injury) suggested that the Phase 2 individuals may have participated in activities resulting in lower back stress more frequently than the medieval individuals. There is also evidence to suggest that this stress began at younger ages in Phase 2 than in the medieval period.

There were also differences in the number of individuals with traumatic injuries between the phases, with more Phase 2 individuals suffering from fractures (32%) than the medieval individuals (12%). In addition, similar types of fractures were consistently observed on the Phase 2 skeletons, including three fractures of the left clavicle and three of the right proximal fibula. It is possible that these individuals experienced similar accidents. There was also evidence of interpersonal conflict at Tarbat - sharp edged weapon wounds were present on three skeletons from Phase 2, and one from the medieval period

(as well as four cases in the disarticulated remains). Weapon wounds have been observed in other Scottish sites spanning all time periods. Overall, a higher percentage of fractures were observed in earlier Scottish assemblages compared to the medieval assemblages.

In contrast to other Scottish assemblages (with the exception of Glasgow Cathedral), the Tarbat individuals did not have very many infectious lesions on their bones (phase 2 = 8.1% and the medieval period = 9.3%). In all assemblages, including Tarbat, the majority of the lesions were on the lower limbs.

Analysis of the articulated burials suggested that metabolic disease was low at Tarbat, with very few individuals showing signs of cribra orbitalia (9% in phase 2 and 3.8% in the medieval period). A similarly low percentage was also observed at Glasgow Cathedral (4.2%), whereas in other assemblages, higher percentages of individuals were affected. It is noted however, when the disarticulated remains were analysed, several orbits were affected by cribra orbitalia, suggesting that the prevalence of anaemia may have been underestimated in the articulated sample from Tarbat.

Unlike other Scottish assemblages, there were several cases of rickets observed in the Tarbat articulated and disarticulated remains. These children may have been swaddled or kept indoors (out of the sun) and/or ate foods which lacked vitamin D.

Tarbat also differed from other Scottish assemblages by having five possible cases of neoplastic disease (two from articulated burials, one from the disarticulated material and two from the 'charnel' deposit). One case was a possible metastatic carcinoma, perhaps secondary to prostate cancer. Another was a possible primary tumour to the face (basal cell carcinoma?) with secondary changes (metasteses) to the scapula, pelvis, ribs and a lumbar vertebra. The changes on the disarticulated bone remains undiagnosed, although osteoclastoma may be a possibility.

21.1 CONCLUSIONS

The demographic pattern in Tarbat Phase 2 was most similar to the Isle of May, suggesting that this phase may represent a monastic community. In contrast, the medieval period at Tarbat was more representative of a family community - consisting of children, women and men. The age and sex profile of the medieval phase was most similar to that observed at Glasgow Cathedral. As the burials were recovered within the parish church at Tarbat and Glasgow Cathedral, they might be expected to be of a higher status than those buried outside of the church. As both of these sites have relatively higher percentages of older individuals in their medieval phases, it is conceivable that Scottish people of relatively high status sometimes lived to older ages, or that old adults were often given more prestigious burials.

Although the Tarbat individuals died at relatively older ages in comparison to most other Scottish groups, there was evidence that the medieval men, and particularly the women, suffered from some environmental stress. They were slightly shorter in stature than their contemporaries, and the high prevalence of dental enamel hypoplasia suggests that they likely suffered from nutrition-infection interactions during childhood. The number of medieval children with rickets (and perhaps also anaemia) at Tarbat is suggestive of nutritional deficiencies, although anaemia may also result from other conditions including chronic disease or parasitic infection (Roberts and Manchester 1995). There was also evidence of non-specific infection on the crania of several subadult skull fragments from the disarticulated remains. Thus, while the adults who survived childhood lived to relatively old ages, childhood morbidity and mortality were prevalent at medieval Tarbat. Those individuals who did survive to adulthood suffered from age related diseases including osteoarthritis, spinal joint disease and osteoporosis.

The low percentage of individuals with infectious lesions at Tarbat, and the lack of specific diseases such as tuberculosis and leprosy may suggest that the population was not dense enough for these diseases to become prevalent (see Larsen 1997).

The presence of infectious lesions on the skeleton is indicative of long-term responses to pathogens. Thus, while acute diseases may have been present, there is evidence to suggest that some individuals survived long enough to elicit a skeletal response, and therefore, may have had relatively healthy immune systems (Ortner 1991).

Overall, the body build and head shape of the Tarbat individuals (from Phase 2 and the medieval period) was similar to their Scottish contemporaries. As discussed above, there was paleopathological evidence to suggest that the individuals from Phase 2 differed from the medieval period in terms of diet and perhaps, activity patterns. Moreover, there is evidence to suggest that although the medieval individuals suffered from childhood illnesses, they may have been healthier in older ages than other contemporary Scottish population groups, with the exception of Glasgow Cathedral.

References

Apley, A.G. and L. Solomon. 1988. *Concise System of Orthopaedics and Fractures*. Oxford: Butterworth-Heinemann Ltd

Aufderheide A.C. and C. Rodríguez-Martín. 1998. *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge: Cambridge University Press

Barrow, G.W.S. 1991. *Kingship and Unity: Scotland 1000-1306*. Edinburgh: Edinburgh University Press

Bass, W.M. 1987. Human Osteology: A Laboratory and Field Manual. 3rd ed. Columbia: Missouri Archaeological Society, Inc.

Berry A.C. and R.J. Berry. 1967. Epigenetic variation in the human cranium. *Journal of Anatomy* 101:361-37

Bogin, B. 1988. *Patterns of Human Growth*. Cambridge: Cambridge University Press

Brooks, S.T. and J.M. Suchey . 1990. Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution* 5:227-238

Brothwell, D.R. 1981. *Digging Up Bones*. Oxford: Oxford University Press

Buikstra, J.E. and D.H. Ubelaker. 1994. *Standards for Data Collection from Human Skeletal Remains*. Fayetteville: Arkansas Archaeological Survey Research Series No.44

Cardy, A. 1997. The human bones. In P. Hill: *Whithorn and St. Ninian: The Excavation of a Monastic Town, 1984-91*. Stroud: Sutton Publishing Ltd. pp. 519-562

Cardy, A. (forthcoming). The human remains. In A.S. Cameron and J.A. Stones: *Aberdeen Carmelite Friary Revisited*. Internet Archaeology

Chamberlain, A. 1994. *Human Remains*. London: British Museum Press

Cross, J.F. and M.F. Bruce. 1989. The skeletal remains. In J.A. Stones (ed.): *Three Scottish Carmelite Friaries: Aberdeen, Linlithgow and Perth*. Edinburgh: Society of Antiquaries of Scotland Monograph Series Number 6. pp.119-141

Dias, G. and Tayles, N. 1997. 'Abscess cavity' - a misnomer. *International Journal of Osteoarchaeology* 7:548-554

Dupertuis, C.W. and J.A. Hadden (1951) On the reconstruction of stature from long bones. *American Journal of Physical Anthropology* 9:15-53

Fazekas, I.G. and F. Kosa. 1978. *Forensic Fetal Osteology*. Budapest: Akedémiai Kaidó

Finnegan, M. 1978. Non-metric variation of the infracranial skeleton. *Journal of Anatomy* 125:23-37

Goodman, A.H. 1991. Stress, adaptation, and enamel developmental defects. In D.J. Ortner and A.C. Aufderheide (eds.): *Human Palaeopathology: Current Syntheses and Future Options*. Washington: Smithsonian Institution Press. pp. 280-287

Greig, D.M. 1931. *Clinical Observations on the Surgical Pathology of Bone*. Edinburgh: Oliver and Boyd

Hardwick, J.L 1960. The incidence and distribution of caries throughout the ages in relation to the Englishman's diet. *British Dental Journal* 108:9-17

Hillson, S. 1986. *Teeth*. Cambridge: Cambridge University Press

Iscan, M.Y, Loth, S.R. and R.K. Wright. 1984. Age estimation from the rib by phase analysis: white males. *Journal of Forensic Sciences* 29: 1094-1104

Iscan, M.Y, Loth, S.R. and R.K. Wright (1984) Age estimation from the rib by phase analysis: white females. *Journal of*

Forensic Sciences 30: 853-863

Johnston, F.E. and L.O Zimmer. 1989. Assessment of growth and age in the immature skeleton. In M.Y. Iscan and K.A.R. Kennedy (eds.): *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss. pp.11-22

Kerr, N.W., Bruce, M.F. and J.F. Cross. 1990. Caries experience in Medieval Scots. *American Journal of Physical Anthropology* 83: 69-76.

King, S.E. 1994. The human skeletal remains from Glasgow Cathedral Excavations 1992-93. Unpublished GUARD report.

King, S.E. 1995. Human remains from the Isle of May. Unpublished GUARD report

Knight, I. 1984. *The Heights and Weights of Adults in Britain*. London: HMSO

Konigsberg, L. and D. Holman. 1999. Estimation of age at death from dental emergence and implications for studies of prehistoric somatic growth. In R.D. Hoppa and C.M. Fitzgerald (eds.): *Human Growth in the Past: Studies from Bones and Teeth*. Cambridge: Cambridge University Press. pp. 264-289

Kreutz, K., Teichmann, G. and M. Schultz. 1995. Palaeoepidemiology of inflammatory processes of the skull: a comparative study of two early medieval infant populations. *Journal of Paleopathology* 7(2): 108

Larsen, C.S. 1997. *Bioarchaeology: Interpreting Behaviour from the Human Skeleton*. Cambridge: Cambridge University Press.

Lewis, M.E., Roberts, C.A. and K. Manchester. 1995. Comparative study of the prevalence of maxillary sinusitis in later medieval urban and rural populations in northern England. *American Journal of Physical Anthropology* 98:497-506

Lieverse, A.R. 1999. Diet and the aetiology of dental calculus. *International Journal of Osteoarchaeology* 9: 219-232

Lovejoy, C.O., Meindl, R.S., Pryzbeck, T.R. and R.P. Mensforth. 1985. Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of age at death. *American Journal of Physical Anthropology* 68:15-28

Lovell, N.C. 1997. Anaemia in the Ancient Indus Valley. *International Journal of Osteoarchaeology* 7:115-123

Lukacs. J.R. 1989. Dental paleopathology: methods for reconstructing dietary patterns. In M.Y. Iscan and K.A.R. Kennedy (eds.): *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss, Inc. pp.261-286

Lunt, D.A. 1974. The prevalence of dental caries in the permanent dentition of Scottish prehistoric and Mediaeval populations. *Archives of Oral Biology* 19:431-437

Lunt, D.A. 1993. Caries prevalence, permanent teeth: Scottish population groups. Unpublished report

Lunt, D.A. 1996. Mediaeval dentitions from St. Andrews. In: E. Cruwys and R.A. Foley (eds.) *Teeth and Anthropology*. Oxford: Bar International Series 291

Lunt, D. 1996. The dentitions. In E. Proudfoot: Excavations at the long cist cemetery on the Hallow Hill, St. Andrews, Fife, 1975-7. *Proceedings of the Society of Antiquaries of Scotland* 126:424-429

Lunt, D.A and M.E. Watt. 1997. The human dentitions. In P. Hill: *Whithorn and St. Ninian: The Excavation of a Monastic Town, 1984-91*. Stroud: Sutton Publishing Ltd. pp. 562-592

Manchester, K. 1983. *The Archaeology of Disease* (1st ed). Bradford: University of Bradford

Mays, S. 1998. *The Archaeology of Human Bones*. London: Routledge

Meindl, R.S. and C.O. Lovejoy. 1985. Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology* 68:57-66

Meindl, R.S. and C.O. Lovejoy. 1989. Age changes in the pelvis: implications for paleodemography. In M.Y. Iscan (ed): *Age Markers in the Human Skeleton*. Springfield: Charles C. Thomas. pp. 137-168

Merbs, C.F. 1989. Trauma. In M.Y. Iscan and K.A.R. (eds.): *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss, Inc. pp.161-189

Moorrees, C.F., Fanning, E.A and E.E. Hunt. 1963a. Formation and resorption of three deciduous teeth in children. *American Journal of Physical Anthropology* 21:205-213

Moorrees, C.F., Fanning, E.A and E.E. Hunt. 1963b. Age formation by stages for ten permanent teeth. *Journal of Dental Research* 42:1490-1502

Ortner, D.J. and W.G.J. Putschar. 1985. *Identification of Pathological Conditions in Human Skeletal Remains*. Washington: Smithsonian Institution Press

Ortner, D.J. 1991. Theoretical and methodological issues in paleopathology. In D.J. Ortner and A.C. Aufderheide (eds.): *Human paleopathology: Current Syntheses and Future Options*. Washington: Smithsonian Institution Press. pp. 5-11

Roberts, J.A. and N. Battley (1998) Skeletal Remains from the Isle of May Excavations 1995-1997. Unpublished GUARD report

Roberts, J. 1999. Skeletal Remains from City Churches, Dundee. Unpublished GUARD report

Roberts, J. 1999. Skeletal Remains from Dunbar. Unpublished GUARD report

Roberts, C. and K. Manchester. 1995. *The Archaeology of Disease*. 2nd ed. Stroud: Sutton Publishing Ltd

Roe, A. and D. Brothwell. 1997. The People of Tarbat. *Tarbat Discovery Programme Bulletin No.3*, University of York

Rogers, J. and T. Waldron. 1995. *A Field Guide to Joint Disease in Archaeology*. Chichester: John Wiley & Sons Ltd.

Saunders, S. 1992. Subadult skeletons and growth related studies. In S.R. Saunders and M.A. Katzenberg (eds): *Skeletal Biology of Past Peoples: Research Methods*. New York: Wiley Liss. pp. 1-20

Schultz, M. 1993. *Vestiges of Non-specific Inflamation in Prehistoric and Historic Skulls: A Contribution to Palaeopathology*. Aesch: Anthropolggische Beitrage

Scott, G.R., Halffman, C.M. and P.O. Pendersen. 1992. Dental conditions of Medieval Norsemen in the North Atlantic. *Acta Archaeologica* 62: 183-207

Stuart-Macadam, P. 1985. Porotic hyperostosis: representative of a childhood condition. *American Journal of Physical Anthropology* 66:391-398

Suchey, J and D. Katz. 1986. Skeletal age standards derived from an extensive multiracial sample of modern Americans. Abstract. *American Journal of Physical Anthropology* 69:269

Todd, T.W. 1921a. Age changes in the pubic bone. I: The male white pubis. *American Journal of Physical Anthropology* 3:285-334

Todd, T.W. 1921b. Age changes in the pubic bone. III: The pubis of the white female IV: The pubis of the female White-Negro hybrid. *American Journal of Physical Anthropology* 4:1-70

Trotter, M. 1970. Estimation of stature from intact limb bones. In T.D. Stewart (ed.): *Personal Identification in Mass Disasters* Washington: Smithosian Institution Press. pp.71-83

Ubelaker, D.H. 1989. *Human Skeletal Remains*. 2nd ed. Washington: Taraxacum Press

Waldron, T. 1994. *Counting the Dead: The Epidemiology of Skeletal Populations*. Chichester: John Wiley & Sons Ltd

Waldron, T. 1997. A nineteenth-century case of carcinoma of the prostate, with a note on the early history of the disease *International Journal of Osteoarchaeology* 7:241-247

Waldron, T. 1998. A note on the estimation of height from long-bone measurements. *International Journal of Osteoarchaeology* 8:75-77

Wenham, S.J 1987. Anatomical and microscopic interpretations of ancient weapon injuries. BSc. thesis, University of Leicester.

Whitehead, R.G. and A.A. Paul. 1981. Nutritional needs of healthy infants. in P. Stanfield, M. Brueton, M. Chan, M. Parkin, and T. Waterston (eds): *Diseases of Children in the Tropics and Subtropics*. 4th ed. London: Edward Arnold

Young, A. 1996. The skeletal material. In E. Proudfoot: Excavations at the long cist cemetery on the Hallow Hill, St. Andrews, Fife, 1975-7. *Proceedings of the Society of Antiquaries of Scotland* 126:429-431

Appendix 1 Sites Used for Comparison

Isle of May (5th to 12th and 12th to 17th C phases):

Roberts, J.A. and N. Battley (1998) Skeletal Remains from the Isle of May Excavations 1995-1997. Unpublished GUARD report (incorporating data from King, S.E. (1995) Human remains from the Isle of May. Unpublished GUARD report).

Hallow Hill, St. Andrews (6th to 9th C):

Young. A. (1996) The skeletal material. In E. Proudfoot: Excavations at the long cist cemetery on the Hallow Hill, St. Andrews, Fife, 1975-7. *Proceedings of the Society of Antiquaries of Scotland* 126:429-431.

Lunt, D. (1996) The dentitions. In E. Proudfoot: Excavations at the long cist cemetery on the Hallow Hill, St. Andrews, Fife, 1975-7. *Proceedings of the Society of Antiquaries of Scotland* 126:424-429.

Glasgow Cathedral (12th to 15th C):

King, S.E. (1994) The human skeletal remains from Glasgow Cathedral Excavations 1992-93. Unpublished GUARD report.

Dundee (12th to 15th C):

Roberts, J. (1999) Skeletal Remains from City Churches, Dundee. Unpublished GUARD report.

Dunbar (medieval):

Roberts, J. (1999) Skeletal Remains from Dunbar. Unpublished GUARD report.

Whithorn (13th to 15th C):

Cardy, A. (1997) The human bones. In P. Hill: *Whithorn and St. Ninian: The Excavation of a Monastic Town, 1984-91*. Stroud: Sutton Publishing Ltd. pp. 519-562.

Lunt, D.A and M.E. Watt (1997) The human dentitions. In P. Hill: *Whithorn and St. Ninian: The Excavation of a Monastic Town, 1984-91*. Stroud: Sutton Publishing Ltd. pp. 562-592.

Aberdeen A* (c.13th to 17th C):

Cross, J.F. and M.F. Bruce (1989) The skeletal remains. In J.A. Stones (ed.): *Three Scottish Carmelite Friaries: Aberdeen, Linlithgow and Perth*. Edinburgh: Society of Antiquaries of Scotland Monograph Series Number 6. pp.119-141.

Aberdeen B* and C* (13th to 16th C):

Cardy, A. (forthcoming) The human remains. In A.S. Cameron and J.A. Stones: *Aberdeen Carmelite Friary Revisited*. Internet Archaeology.

*Initial analysis of Aberdeen was conducted by Cross and Bruce, refered to as 'A'. Additional skeletons from this site were later analysed by Cardy (B) and her report included some data for the combined sample (C). Data from the combined sample was used in the present report whenever possible.

Linlithgow (c. 13th to 17th C):

Cross, J.F. and M.F. Bruce (1989) The skeletal remains. In J.A. Stones (ed.): *Three Scottish Carmelite Friaries: Aberdeen, Linlithgow and Perth*. Edinburgh: Society of Antiquaries of Scotland Monograph Series Number 6.

pp.119-141.

Kerr, N.W., Bruce, M.F. and J.F. Cross (1990) Caries experience in Medieval Scots. *American Journal of Physical Anthropology* 83: 69-76.

Kirkhill (medieval):

Lunt, D.A. (1996) Mediaeval dentitions from St. Andrews. In: E. Cruwys and R.A. Foley (eds.) *Teeth and Anthropology*. Oxford: Bar International Series 291.

Appendix 2 Cranial Indices of the Females and Males

Cranial indices of the Tarbat females (all phases)

	N	Mean	SD	Minimum	Maximum
cranial index	6	77.9	4.0	73.2	84.4
mean height index	5	80.1	2.1	77.4	83.0
fronto-parietal index	5	67.9	2.3	64.5	71.1
upper facial index	3	52.2	7.2	44.4	58.5
nasal index	3	50.7	8.2	45.7	60.2
orbital index	4	89.5	6.7	83.4	98.2
maxilloalveolar index	3	124.5	10.3	115.5	135.8

Cranial indices of the Tarbat males (all phases)

	N	Mean	SD	Minimum	Maximum
cranial index	30	76.9	4.3	65.7	88.3
mean height index	24	78.2	7.0	49.2	88.9
fronto-parietal index	24	67.7	7.0	38.4	79.3
upper facial index	5	61.0	14.0	45.8	77.6
nasal index	20	46.2	3.9	40.3	52.8
orbital index	17	86.3	5.4	76.9	100.0
maxilloalveolar index	11	112.5	6.6	112.5	130.7

Appendix 3 Non-Metric Traits (Total Sample)

Prevalence of cranial non-metric traits (total sample)

Trait	N	P	%
Metopic suture	55	7	12.7
Supraorbital notches	50	40	80.0
Supraorbital foramen	51	24	47.1
Multiple infraorbital foramen	33	5	15.2
Zygomatico-facial foramen	40	34	85.0
Parietal foramen	47	26	55.3
Epipteric bone present	43	6	14.0
Fronto-temporal articulation	43	1	2.3
Ossicles in coronal	47	2	4.3
Ossicle at bregma	47	0	-
Sagittal ossicles present	50	1	2.0
Apical bone present	52	7	13.5
Ossicles in lambdoid	52	28	53.8
Asterionic bone present	50	9	18.0
Ossicle in occipito-mastoid	50	1	2.0
Ossicle at parietal notch	51	8	15.7
Inca bone present	54	0	-
Condylar canal present	41	21	51.2
Divided hypoglossal canal	43	10	23.3
Foramen ovale incomplete	37	1	2.7
Foramen spinosum incomplete	36	12	33.3
Double condylar facet	40	5	12.5
Auditory exostosis	55	0	-
Mastoid foramen	54	39	72.2
Two mental foramen	58	1	1.7
Mandibular torus	59	13	22.0
Mylohyoid bridge	53	3	5.7

N = number of individuals observed

P = number of individuals exhibiting trait on either or both sides

Prevalence of post-cranial non-metric traits (total sample)

Trait	N	P	%
Atlas bridging	38	10	26.3
Accessory transverse foramen	50	20	40.0
Suprascapular foramen	41	3	7.3
Circumflex sulcus	71	17	23.9
Acromial articular facet	53	3	5.7
Sternal foramen	38	0	-
Septal aperture	84	6	4.3
Supracondyloid process	83	1	1.2
Allen's fossa	89	4	4.5
Poirer's facet	85	13	15.3
Vastus notch	65	11	16.9
Third trochanter	98	8	8.2
Medial tibial squatting facet	72	5	6.9
Lateral tibial squatting facet	74	48	64.9
Double inferior-anterior talar facet	67	27	40.3
Double anterior calcaneal facet	69	34	49.3

N = number of individuals observed

P = number of individuals exhibiting trait on either or both sides

Appendix 4 Number of Observable Teeth

Number of observable teeth (total sample, N = 1,249)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	26	34	30	42	44	43	31	29	30	37	38	42	41	35	32	25

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	36	51	46	46	47	49	46	37	34	41	53	51	44	39	41	29

Number of observable teeth (phase 2, N = 557)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	15	15	12	16	18	18	10	9	13	14	15	19	16	14	13	13

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	20	26	24	21	21	24	22	15	12	18	22	24	19	20	22	17

Number of observable teeth (phases 3 and 4, N = 581)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	9	15	14	23	23	22	20	18	14	20	21	20	20	17	15	9

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	12	20	19	21	21	20	20	19	18	20	26	23	22	16	16	8

Appendix 5 Prevalence of Calculus by Tooth (Total Sample, n = 953)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	13	22	18	25	31	32	24	22	23	22	29	31	27	27	23	17
%	**50**	**65**	**60**	**60**	**71**	**74**	**77**	**76**	**77**	**59**	**76**	**74**	**66**	**77**	**72**	**68**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	33	41	39	35	38	38	42	32	29	38	43	42	37	28	29	23
%	**92**	**80**	**85**	**76**	**81**	**78**	**91**	**85**	**85**	**93**	**81**	**82**	**84**	**72**	**71**	**79**

n = number of teeth with calculus

Appendix 6 Prevalence of Caries by Tooth (Total Sample, n = 68)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	3	2	4	4	3	0	0	1	1	0	1	0	2	6	2	3
%	**12**	**6**	**13**	**10**	**7**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**5**	**17**	**7**	**12**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	3	6	6	3	0	1	1	1	1	2	2	1	0	4	3	2
%	**8**	**12**	**13**	**7**	**-**	**2**	**2**	**3**	**3**	**5**	**4**	**2**	**-**	**10**	**7**	**7**

n = number of teeth with caries

Appendix 7 Prevalence of DEH by Tooth (Total Sample, n = 108)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	2	1	0	3	7	5	4	5	6	8	2	0	0	2	0
%	**-**	**6**	**3**	**-**	**7**	**16**	**16**	**14**	**17**	**16**	**21**	**5**	**-**	**-**	**6**	**-**
	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	0	0	1	6	13	6	5	6	4	15	5	2	0	0	0
%	**-**	**-**	**-**	**2**	**13**	**27**	**13**	**14**	**18**	**10**	**28**	**10**	**5**	**-**	**-**	**-**

n = number of teeth with DEH

Appendix 8 Number of Observable Tooth Positions

Number of observable tooth positions (total sample, N = 1,596)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	39	48	54	55	53	47	41	41	41	48	48	51	50	54	49	39

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	49	63	61	57	54	51	50	44	39	48	58	55	56	55	55	43

Number of observable tooth positions (phase 2, N = 773)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	24	24	28	25	25	21	18	17	20	22	22	24	22	27	25	23

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	27	32	31	27	26	25	24	17	15	23	26	26	25	28	29	25

Number of observable tooth positions (phases 3 and 4, N = 689)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	12	19	21	25	24	23	21	21	16	22	23	23	22	22	19	12

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
N	18	26	26	25	23	21	22	23	20	22	27	25	27	23	22	14

Appendix 9 **Prevalence of Dental Abscess by Tooth Position**
(Total Sample, n = 50)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	1	3	3	2	1	1	0	0	1	2	2	0	1	7	2	1
%	**3**	**6**	**6**	**4**	**2**	**1**	**-**	**-**	**2**	**4**	**4**	**-**	**2**	**13**	**4**	**3**

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	0	3	3	1	1	2	0	1	1	1	0	0	1	6	2	1
%	**-**	**5**	**5**	**2**	**2**	**4**	**-**	**2**	**3**	**2**	**-**	**-**	**2**	**11**	**4**	**2**

n = number of teeth with dental abscesses

Appendix 10 **Prevalence of AMTL by Tooth Position**
(Total Sample, n = 347)

	Right maxilla								Left maxilla							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	13	14	24	13	9	4	10	12	11	11	10	9	9	19	17	14
%	**33**	**29**	**44**	**24**	**17**	**9**	**24**	**29**	**27**	**23**	**21**	**18**	**18**	**35**	**35**	**36**

	Right mandible								Left mandible							
	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
n	13	12	15	11	7	2	4	7	5	7	5	4	12	16	14	14
%	**27**	**19**	**25**	**19**	**13**	**4**	**8**	**16**	**13**	**15**	**9**	**7**	**21**	**29**	**25**	**33**

n = number of teeth lost ante-mortem

Appendix 11 **Skeletons with Heavy Dental Wear**

SK number	Phase	Age
149	1	46+
2	2	subadult
44	2	46+
45	2	46+
53	2	46+
126	2	46+
130	2	26-45
139	2	46+
144	2	46+
151	2	46+
153	2	26-45
157	2	26-45
158	2	46+
173	2	46+
31	3 & 4	46+
36	3 & 4	46+
66	3 & 4	26-45
161	3 & 4	26-45
56	5	46+

Appendix 12 **Skeletons with at Least One Unerupted 3rd Molar**

SK number	Phase
172	1

40	2
47	2
145	2
157	2
35	3 & 4
43	3 & 4
88	3 & 4
91	3 & 4
100	3 & 4
56	5

Appendix 13 Prevalence of OA by Joint Type (Total Sample)

	N	**n**	**%**
R shoulder	67	8	11.9
L shoulder	62	4	6.5
R elbow	83	5	6.0
L elbow	77	4	5.2
R wrist	72	11	15.3
L wrist	67	7	10.4
R fingers	56	10	17.9
L fingers	52	4	7.7
R hip	93	16	17.2
L hip	99	13	13.1
R knee	90	6	6.7
L knee	90	8	8.9
R ankle	66	3	4.5
L ankle	68	2	2.9
R toes	37	8	21.6
L toes	41	6	14.6
Total	**1,120**	**115**	**10.3**

N = number of joints

n = number of joints with OA

APPENDIX D STRATIGRAPHIC DIAGRAM

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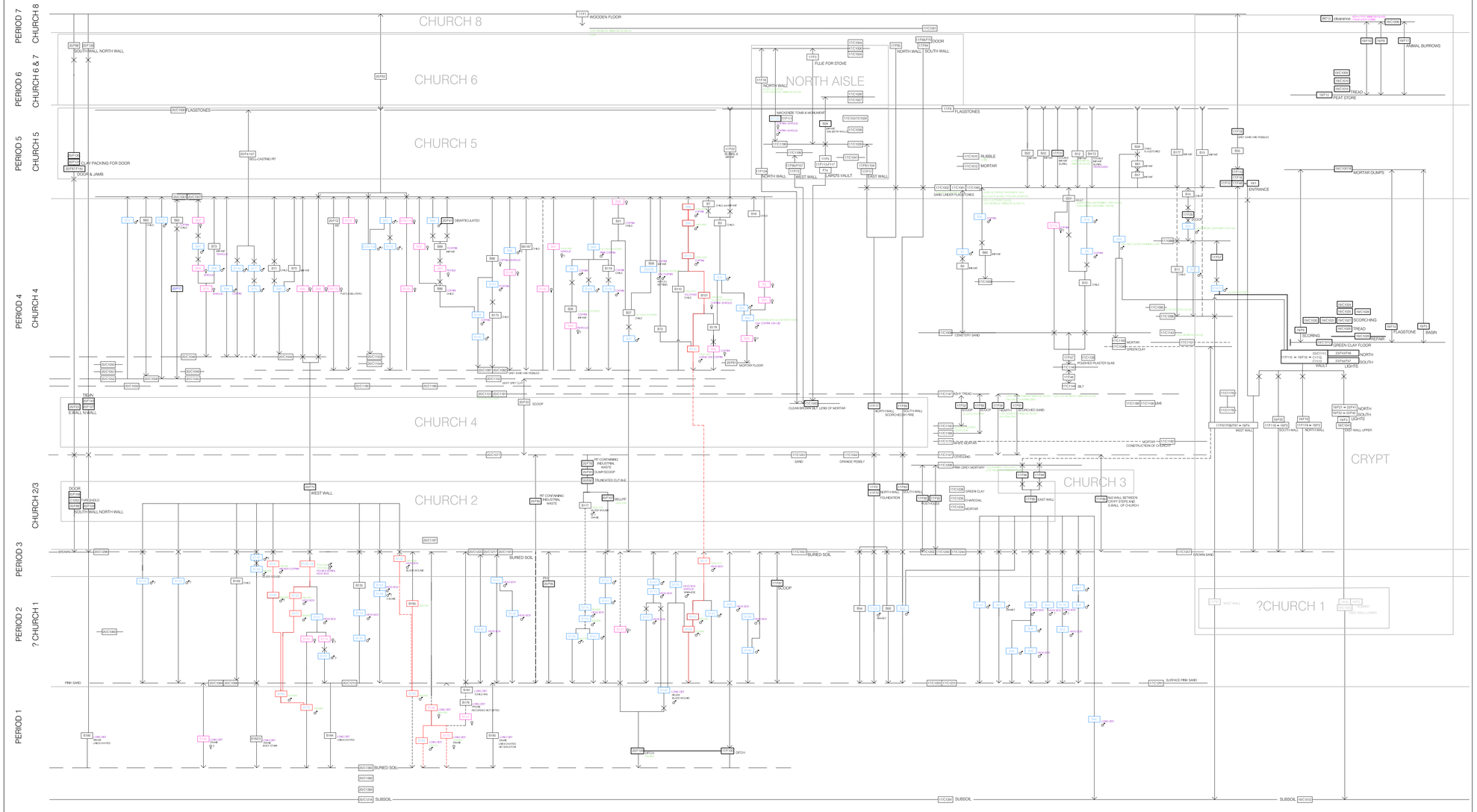
Tarbat Discovery Programme

SECTOR 4 DSR

Sector 4 Stratigraphic Diagram



SCALE	DRAWING NO.	REVISION
no scale	2	FINAL

SITE CODE	NOTES
TR	xxx
CREATED BY	
CAS	
DATE	
26/11/2012	
AUTHORISED BY	
CAS	

APPENDIX E ENVIRONMENTAL ANALYSIS

Dr Tim Holden, Headland Archaeology Ltd

1.0 BACKGROUND

A number of unprocessed samples were received from recent excavations at Tarbat Church, Easter Ross undertaken by Field Archaeology Specialists Ltd. The excavation revealed a sequence of 10 phases between the 7th and the 19th centuries, charting periods of construction, modification, abandonment and refurbishment. These samples derive from three distinct areas within the church:

A) Floor of the crypt
Two organic sediments deposited on top of silty clay floor of AD c.1620 (C1015 and C1016). These were covered by mortar dumps and spreads from the re-pointing of the crypt vault and other later sediments. FAS requested identification of the materials that constitute two spreads on the floor of the crypt:

B) Feature 125: Grave
A dark stain around a skeleton, possibly the remains of a shroud or coffin (?10th to 11th century). FAS requested further information on the nature and possible origin of the stain.

C) Feature 129: Ditch
The fills of a ditch predating the earliest stone church (7th to 9th century). FAS were interested to obtain further information regarding the function and other information available regarding this ditch.

2.0 METHOD

All the samples were examined under a binocular microscope and any identifications made with reference to the modern comparative collection of Headland Archaeology Ltd.

3.0 RESULTS AND DISCUSSION

A) Floor of the crypt

The samples from the two organic-rich contexts from the floor of the crypt are very different in character (Table 1).

> 1016 is dominated by dark, well-humified amorphous peat. Within this are the well-preserved remains of insects and acarid mites together with plant roots and stem tissue. The stem tissue is dominated by monocotyledon rhizome fragments (ie grass, sedge, rush) with occasional woody fragments of heather. A number of fruits and seeds were also recovered. These were primarily aquatic species, notably the crowfoots (*Ranunuculus* subgen. Batrachium) and pondweed (*Potamogeton* sp.). Small quantities of fish and small mammal bone were also present.
>
> 1015 consists primarily of small, broken shell fragments, fish and small mammal bone with amounts of desiccated plant remains of which most is wood. A seed element is also present in Sample 103 and although one aquatic seed was encountered (water plantain - *Alisma sp.*) the majority were typical components of a segetal/ruderal flora (ie of agriculture or waste places).

The presence of aquatic fruits and seeds in sample 1016 indicates that it cannot have formed *in situ*. Although most of the material was well-humified there was also a substantial element that was well-preserved. It is therefore unlikely that the

humification (ie the degradation of plant remains) took place within the crypt. If this had occurred then a more uniform sediment would have been expected unless there had been an actively growing vegetation on its surface. This would seem unlikely in the darkness of the crypt. The evidence suggests that this material consists of fen-type peat comprising both the humified substratum and parts of the vegetation growing on its surface. The animal bone in the sample is inconsistent with the fen peat and unlikely to be from the same source. A proportion of the bone could have derived from the overlying strata such as 1015 which is bone-rich. Other potential sources include carrion feeding birds such as crows and gulls of other carnivorous animals such as owls or otters.

Exactly why a deposit of peat was spread across the floor of the crypt on top of what appears to have been a deliberately laid floor surface is unclear. It would seem an unsuitable flooring material in that it would tend to absorb moisture. One other possible explanation is that it represents the remains of peat stored in the crypt possibly for use as fuel.

The shell, bone and desiccated plants from 1015 represent a very different sediment. Small fragments of mortar are present and small-diameter gravel is common. The most likely source of this material is from the mortar used to point the crypt roof, possibly accumulating over a number of years by weathering, or a combination of different raw materials used in its manufacture. The fish bone may have been inadvertently collected with coarse shall sand from the beach for use in mortar preparation while the small mammal bone was more probably deposited by scavengers of carnivores living in the crypt. The desiccated wood and other plant material can be explained as the remains of furnishings within the crypt or other detritus that had blown into the crypt through the lights.

Table 1 Contents of sample 1015 and 1016

Context	Sample	Category	Qty	Comments
1015	flot res	Marine shell	+++	Highly fragmented
		Mortar fragments	+	Small aggregates
		Small mammal bone	+	
		Fish bone	+	
1015	103	Insects	+	Body parts
		Vegetative plant parts	+++	Only aquatic taxa is *Alisma sp*. The rest are of disturbed places eg *Stellaria media* and *Chenopodium album*
1015	114	Fish bone	+++	Large - medium sized fish
		Mammal bone	+	inc. rodent teeth
1015	116	Fish bone	+++	Small fish bone, head bones, vertebrae and spines
		Mammal bone	+	
1015	117	Leather	+	One large piece
		Vegetative plant	++	Stem/rhizome fragments
		Wood fragments	+++	Inc. bark, some possibly with fungal infections
1015	120	Wood fragments	+++	
		Fish bone	+	
1016	flot res.			Identical in composition to 121
1016	105			Identical in composition to 121
1016	121	Amorphous peat	+++	
		Invertebrate eggs	+	
		Insects/mites	+	Whole mites, insect parts inc. beetle elytra
		Vegetative plant remains	++	Roots and small diameter monocotyledon stem fragments and twigs (including heather)
		Seeds/fruits	+	Aquatic species inc. *Ranunculus* subgen. *Batrachium*, *Potamogeton* sp.

Context	Sample	Category	Qty	Comments
1016	123	Wood fragments	+++	Inc. birch bark
		Fish bone	++	Small
		Coal	+	One fragment c. 1cm sq.
1016	125	Fish bone	+	Small
		Small mammal bone	++	Inc. rodent tooth
1016	126	Beetle elytra	++	Several separated elytra (wing cases)

Key: + = rare, ++ = occasional, +++ = common

B) Feature 125 grave

Samples 217-219 are all composed of highly humified organic debris (Table 2) but some differences were noted in the texture of the different samples. 217 consisted of a fine powder. Information regarding the orientation of the samples was not available as part of this assessment but this would be consistent with fine debris that had fallen from the sides of the grave and accumulated in the lower parts of the cut. 218 and 219 are more compacted with faint traces of laminations at some points. 218 was consistent with very degraded wood/wicker.

Sample 393 consisted of well-preserved insect puparia which had been separated from the surrounding sediment. These may offer some indication of conditions in the grave but given the poor conditions of all other organic remains these are more likely to represent more recent contaminations.

Table 2 Composition of the samples from F125

Context	Sample	Category
1293	217	Very fine brown powder with no traces of identifiable structure
1293	218	Highly degraded organic matter. Faint traces of degraded plant fibres are probably wood
1293	219	Degraded amorphous organic matter
1293	393	A number of insect puparia

C) Feature 129: Ditch

These samples were dominated by charred plant remains. Wood charcoal was present in most cases with varying quantities or amorphous organic material with small mineral inclusions. It is thought likely that much of this amorphous material is burnt peat, probably the remains of fuel. Cereal remains in the form of both chaff and grain were present in contexts 1337 and 1345. The dominant cereals were bread wheat (*Triticum aestivo-compactum*) and hulled barley (*Hordeum vulgare*) but lesser amounts of oat (*Avena* sp.) and rye (*Secale cereale*) were encountered. These are unlikely to have been charred *in situ* and do not therefore inform us about the function of the ditch. The quantity of grain and the presence of chaff, which is unusual in Scottish archaeological assemblages, could however offer come interpretation of on-site activities. Such assemblages would tend to imply bulk processing of cereals nearby which charring having occurred either during the corn drying phase of processing or during a conflagration of a storage context. The presence of wheat is of major significance because finds of this date are rare in Scotland. It has been recovered from the Anglian monastic site of Hoddom, Dumfries and Galloway where, it has been suggested, it was an imported grain.

Table 3 Composition of samples from F129

Context	Sample	Cereal grain	Seed	Chaff	Charcoal Qty	Charcoal AMS	Amorphous material	Comments
1325	390				+	*		Indet. Rhizome fragment
1337	346				+++	*		
1337	347	+++			++	*		Barley and wheat
1337	360	+++	+	++	++	*		Mostly wheat and rye
1337	381					*	+	
1337	382	+			+++	*	++	Wheat, barley and cf. Oat
1345	348	++		+	+	*	++	Wheat barley grain and wheat rachis fragments
1345	362	+				*		Wheat and barley

Key: + = rare, ++ = occasional, +++ = common, * = sufficient for an AMS date

Summary and recommendations
Samples from three different archaeological features were received for assessment.

A) Floor of the crypt -
Samples from two contexts were assessed:

1016 was interpreted as a spread of fen peat with additional animal bone that had probably been brought to the site by carrion feeders.
1015 was interpreted as an accumulation of raw materials used for mortar production and weathering from the roof with additional wind-blown elements and bone brought to site by carrion feeders

Future analysis could be undertaken on, for example, the fish bone and invertebrate remains. However, because these elements are not thought to be directly associated with human activity it is not likely that this would add much information of relevance to the interpretation of the samples.

Recommendation: No further action is recommended.

B) Feature 125: Grave

These samples were found to consist largely of degraded organic material. No identifiable microscopic traces were recovered from two of the samples, but a third (218) revealed traces of what is thought to be wood. Whether this was present as timber or wattles is impossible to say. It is possible however, that thin section analysis of the larger pieces might enable identification of structures not detected so far because of the crumbly nature of the sediment.

Chemical analysis of the remains could be attempted but since most vegetable fibres are primarily constructed of cellulose this is unlikely to be able to distinguish between, for example, textiles such as linen and wood. Wool and other animal fibres are unlikely to be chemically indistinguishable from the degrading organic material from the body itself. The only possible benefit of such analyses would be it there was a suspicion that the exotic materials such as oils or waxes had been used in the preparation of the body.

Recommendation: If it is important to find out more regarding these layers, thin section analysis of some of them could be

considered.

C) Feature 129: Ditch

The samples from this feature contain quarries of charred material with cereal present from 1337 and 1345. Of significance here is the presence of wheat, a cereal which is rarely encountered in Early Historic Scotland and cereal chaff which is also rarely encountered. It is possible that they represent imports into the area. The presence of these economic species would warrant some further work in order to provide a definitive statement regarding their identification and presence in Easter Ross of the 7th to 9th centuries. A more thorough characterisation of the samples might also enable interpretation of the processes that produced them, thereby providing a further insight into on-site activities in the pre-building phases of the site. This would benefit significantly from the analysis of similar material from other parts of the same settlement.

Recommendation: a) Detailed identification and production of a catalogue of the different weed and cereal elements recovered and their interpretation with respect to species present and the processes responsible for their deposition.

B) Analysis of the charred plant remains from other parts of the pre-building phases of the site with a view to understanding broader issues relating to the interpretation of individual features and the economy of the site.

APPENDIX F GEOLOGICAL REPORT

Nigel. A. Ruckley (ed. C.Spall 2011)

1.0 GEOLOGICAL OBJECTIVES

In April 1 998 I was asked to examine the carved stones from the Tarbat peninsula and provenance the source of the stone. Following a brief visit to the site in late August 1998 I was also asked to provenance some of the sandstones from the Tarbat Old Church.

The project was broken down into the following phases.

(a) Examination of carved stones held in the collection of the National Museum of Scotland at their workshop in Granton, Edinburgh (NMS);
(b) The collection of a representative sandstone collection from quarries and exposures in the Tarbat peninsula and, if required, further afield;
(c) The comparison of carved stone with collected rock samples collected, preferably by the use of petrological thin sections;
(d) Literature search for former quarry sites and geological notes pertaining to the project;
(e) Brief examination of the sandstones used in Tarbat Old Church;
(f) The establishment of a database of magnetic susceptibility readings from geological samples and carved stones;
(g) The establishment of a database of published geological data on carved stones.

2.0 METHODOLOGY

A brief examination was made of some of the stonework from the Tarbat Old Church to see if it was possible to provenance the stone from various construction phases.

3.0 PRELIMINARY RESULTS

3.1 BRIEF GEOLOGICAL OVERVIEW OF THE TARBAT PENINSULA

Portmahomack lies almost at the centre of an arc of sandstones that extend from the south shores of the Moray Firth, across the Black Isle and northwards in a thin coastal strip of sandstone towards Helmsdale where a mass of granite (*c*.420 Ma) emplaced during the late phase of the Caledonides separates the strip from the extensive Old Red Sandstones of Caithness. The ages of these sandstones vary from Devonian (Old Red Sandstone) (410 360 Ma) centred on the Black Isle and Tarbat peninsula to Triassic (250 - 200 Ma) between Burghhead and Lossiemouth, and Jurassic (200 140 Ma) around Golspie.

The Tarbat peninsula apart from the hill of North Sutor, is composed of Devonian sandstones belonging to the Old Red Sandstone Supergroup. The coastal strip from Tam eastwards towards Portmahomack and Tarbat Ness is comprised of Upper Old Red Sandstones of the Balnagown Group (UORS), whilst sandstones exposed along the coast from a little south of Shandwick and extending northwards along the southern coast of the peninsula to Wilkhaven are comprised of Middle Old Red Sandstones of the Strath Rory Group (MORS). The base of the UORS is conjectural, but is thought to run on a line from Nigg Bay to Hill of Fearn and then north east to Pitkerrie, Meikle Tarrel and on the coast at Wilkhaven.

Middle and Upper Jurassic sediments of clayey siltstone, sandy siltstone interbedded with calcareous siltstone, and coarse, poorly fossiliferous bituminous siltstone are exposed on the foreshore south of Balintore.

Drift deposits of either boulder clay, or, nearer the coast, of raised beach deposits, limit rock outcrop to the coastal section. The Moinian psammitic granulite of the North Sutor comprises the largest inland exposure of rock.

Quarries are generally limited to coastal areas or, where the drift deposits are shallow as in the Lower Pitkerrie area. Today there are no working quarries, but around a dozen quarries are known to have been in existence since the 18th century.

3.1 TARBAT OLD CHURCH

The former church that will form the Tarbat Discovery Centre contained a variety of sandstones from known and unknown sources. Most of stone does not appears to be not from the immediate vicinity of the building. The thin layer of plaster dust made identification difficult. Evidence of fire burnt stones was apparent in the crypt. The resultant damage to the stones would invalidate any magnetic susceptibility readings.

3.1.1 South exterior wall

The basal stones forming the first visible horizon of the wall on the south side of the church (17/F63/1180)(Church 2), to the right of the entrance, appear to be sandstone of UORS age. Some blocks are fine to medium grained, while other ones are of a coarser texture up to coarse grain size. Clasts of mudstone or voids, where the softer mudstone has weathered out, can be up to l0mm long by 2mm thick. Weathering of the stones has reduced even more the original low mafic content and the mica content. The colour varies from 2.5YR 6/2 'pale red' to 2.5YR 5/2 'weak red'. They were probably extracted from outcrops in the Portmahomack to Tarbat Ness area.

The main fabric of the lower south external wall (17/F64/1181)(Church 6) is comprised from a 10YR 6/6 'brownish yellow' well sorted medium sandstone. It is of massive appearance and well cemented, containing no mudstone or lithic clasts. The general appearance would suggest that the stone came from the MORS beds of the peninsula.

The 10YR 5/4 'weak red' coloured fine to medium grained laminated sandstones used for the upper courses of the wall (when the wallhead was raised in the 18th century)(Church 6) immediately below the roof line are again not found locally. Mica was evident on the bedding planes. Mudstone clasts varied from peas size up to 80mm by 35mm. Some clasts have green coloured reduction spots. The stone was not from the former quarry at Shandwick or from the Tarbat peninsula. Of ORS appearance possibly from the Black Isle/Cromarty Firth area.

Threshold Stone

The threshold stone (20/F108/1253)(Church 2), now split, is formed from an extremely fine grained sandstone. Clearly it is not from the immediate vicinity but has affinities to MORS from the south side of the peninsula on the shore near Balintore.

1.3.2 Crypt

The east wall of the crypt (19/F3/1002)(Church 4) contained many fire damaged sandstone blocks. No glacial erratics were noted. The stones in general had more in common with MORS sandstones than the local UORS from Portmahomack beach.

The west end off of the crypt (19/F4/1003)(Church 4) again showed evidence of major rebuilding and fire damage. No igneous or metamorphic erratics were noted and the sandstones in general indicated a non local source. Again, they appear to be from the MORS of the peninsula.

1.3.3 West end

The pillars at the west end of the church are imported (Church 5). The grain is very fine and compact with a high quartz content. No lithic or mudstone clasts were noted and the 5Y 5/3 ‘olive’ colour was noted to change to a 5YR 5/3 ‘reddish brown’ on a weathered surface. The stone does not resemble any from the Tarbat peninsula.

The very fine to fine current bedded sandstones forming the west belfry arch at the northwest corner of the church (Church 5) are 5Y 6/3 ‘pale olive’ in colour. Mudstone clasts of 5Y 4/1 'dark grey' to 5GY 4/1 ‘dark greenish grey’ colour can be seen and the bedding is picked out by grey 1mm thick laminae. Some fe blebs are present with fe staining on the surface. The stone is not from the immediate area of the church and sandstone with fe blebs has not been recorded in the peninsula.

The sandstone of the extant belfry provided a contrast to the stone found in the rest of the church (Church 6). The honeycomb nature of some blocks indicated its variable weathering qualities and other blocks were prone to algal staining. The colour on clean faces varied from 2.5Y 7/2 ‘light grey’ to 2.5Y 7/4 ‘pale yellow’. The well sorted very fine to fine grained sandstone exhibited numerous sedimentary structures including current and planar bedding. The stone does resemble a sample from the former quarry at Cadboll obtained last November by Mr. B. Grove. Again, this indicated that sandstones from the MORS were preferred for a high status building.

4.0 DISCUSSION

From this preliminary work it is evident that the wide variety of sandstones used in the carved stones have been imported into the Tarbat site from a variety of locations around the Moray and possibly the Dornoch Firths. Transport by boat or raft must seriously be considered as a feasible mode of transport.

The fabric of the existing Tarbat Old Church mirrored the earlier use of imported sandstone used in the carved stones. Certainly much of the later stone fabric of the church was not from Portmahomack and came from either the southern shore of the Tarbat peninsula or from the Black Isle/Cromarty Firth region.

APPENDIX G GRAVE SLAB REPORT

Dr Lawrence Butler

Four slabs are described and discussed. Two are clearly late medieval, the third is seventeenth century and the fourth is of uncertain date, but probably medieval.

1.0 CROSS-SLAB GRAVE-COVER FROM EAST END OF TARBAT OLD CHURCH

Description

Tapering cross-slab grave-cover (of coarse sandstone?) with chamfered edges and a low relief design.

The main feature is a cross-head with 8 fleur-de-lys terminals springing from two interlaced or overlapping diamonds. In the centre of the cross head is a circular ring whilst at the upper corners of the slab are two further circles, one (left) with a hollowed centre, the other with six petal-shaped depressions. The cross head is supported on a broad shaft with two incised lines running its full length. These incised lines do not continue into the large fleur-de-lys at the upper junction with the cross head nor into the uneven three-step base.

Flanking the shaft are two shields (left) and a sword (right). The upper shield has a beast, probably intended to be a lion rampant. The motif or charge on the lower shield is too indistinct to hazard a suggestion. The sword has a broad tapering blade with a rounded point (perhaps indicating a scabbard), a guard of slightly down-turned quillons, a hilt of concave sides and an unusual pommel of two uneven lobes in the form of a Y. On the blade just below the quillons is a sunk concave diamond, which also might indicate decoration on a scabbard, though no sword belt is shown. The outer (right-hand) quillon overlaps the chamfered edge of the slab, as do two of the fleur-de-lys terminals of the head. The chamfer has chevron ornament formed either of lanceolate leaves or (at base and lower right of slab) of simple incisions.

Discussion

The design of the cross head can be readily paralleled in northern England. There has been far less recording of this monument type in Scotland, but Northumbrian patterns extend into the Lothians and Fife. The interlaced diamond design occurs in 4 churches in Cumbria: Barton (Ryder 2005, 135, slab 1), Warcop (op. cit., 46, slab 1), Isel (op. cit., 127, slab 1) and Dearham (op. cit., 172-4, slabs 4, 8 and 9). In Northumberland the same design occurs in 3 examples: Bywell St. Andrew and Stamfordham in the central Tyne valley, and at Knaresdale in the south Tyne (Ryder 2000, 56 and 85 fig. 7, slab 3; 71 and 101, fig. 23, slab 2; 76 and 108, fig. 30, slab 1; Ryder 2003, 113, fig. 6). In county Durham the diamonds are more clearly interlaced and the motif is set within a circle though the fleur-de-lys heads remain outside the circle: e.g. Aycliffe slab 3 (Ryder 1985, 12-13 and fig. 1 (p. 16), design 13). Sometimes the entire design may be placed within a sunk circle. A few slabs show a central ring (Brancepeth slab 3) or a plain disc (Medomsley slab 5), whilst the majority enclose a central rosette (14 examples). On 4 other slabs the central zone is damaged. This same design of head also occurs just south of the river Tees within north Yorkshire.

The roundels in the upper corners occur sporadically in the northern counties of England north of the Trent-Mersey line, sometimes as a sun and a crescent moon, sometimes as stars and sometimes as rosettes of 6 or 8 petals. The steps at the base are also a common feature in northern England though many slabs with the interlaced diamond design at the head have a base of a plain semi-circular mound or a cusped ogee arch.

In the fourteenth and fifteenth centuries the sword guard with the down-turned straight quillons is as common as the sword with a straight guard. However the pommel is more usually leaf-shaped either plain or five-lobed (Ryder 1985, p. 19 and Fig. 2). The notched Y-shaped pommel occurs in only two examples: Dearham, Cumbria (Ryder 2005, 172, slab 2) and Hamsterley, Co. Durham (Ryder 1985, 92, slab 1).

There are slabs with incised and with low relief designs showing shields in the three northern counties of England. In Cumbria there are 15 slabs clearly showing heraldic arms and a further 7 slabs with plain shields which might have been painted. In Northumberland there are 14 slabs with heraldic charges and 6 with plain shields. In co. Durham there are 4 shields with heraldic charges and plain shields on 6 slabs.

The running leaf pattern on the edge chamfer occurs in Cumbria at Appleby St. Lawrence, Morland and Crosscanonby (Ryder 2005, 25-6: slab 2 , 38: slab 2, 170: slab 2), but not in Durham and Northumberland.

The most useful survey of memorial sculpture in northern Scotland has been that by Steer and Bannerman (1977). In the West Highlands, as on Iona, Oronsay and Kintyre, it is easy to find parallels on grave-slabs for the type of sword but not for the design of pommel (*ibid.*, 167-170, fig. 19). Sometimes the sword is shown within its scabbard. The sword is placed to the right-hand side of the cross shaft (as here at Tarbat), whilst the left-hand side has panels of floral design. It is interesting that these floral panels have been linked to Northumberland (by Lamont 1968, 34-5, discussing Islay) as being inspired by a slab at Hexham in the central Tyne valley. The cross heads in the West Highlands do not closely parallel the design at Tarbat. Where there are well-defined bases (Class I slabs on Iona and Islay: Steer and Bannerman 1977, 17-18, plates 1-2), they have a floral design within a semi-circle.

There are no roundels or rosettes, and heraldry only occurs on late 14th century low-relief military effigies. These show a warrior in a quilted surcoat carrying a shield on his left arm, holding a lance in his right hand and wearing a sword, usually with drooping quillons and an elaborate pommel, prominently displayed in a waist belt (*ibid.*, 22-26, plate 8).

The English examples of this cross design and sword type suggest a date in the early fourteenth century, but for this example in Easter Ross so far north from Northumbria it is probable that the central decades 1340-1370 may be more likely.

2.0 CROSS-SLAB GRAVE-COVER FROM INTERNAL WEST END OF TARBAT OLD CHURCH

Description

Cross-slab grave-cover, broken into two equal pieces. Similar red sandstone to above.

There are two designs on this slab, an incised sword and four initials, the latter are likely to be a later inscription. The sword is similar to that on slab 1, but originally it was the only design on the slab. The sword has a tapering blade ending in a rectangular scabbard chape. The quillons are straight and down-turned with each arm ending in a diamond shaped terminal. The hilt has a slight taper in its width and ends in a plain round pommel. The sword design is common in the late fourteenth and fifteenth centuries (Steer and Bannerman 1977, 167-170).

The four initials A M R M are in relief within a sunk rectangular panel to the right of the sword's hilt. The style of the lettering suggests a seventeenth-century addition, perhaps to two members of the Munro family.

Discussion

Although there are a number of examples in northern England where the sword is the only carving on the slab, these usually have the sword in the centre of the slab so that the four arms of the sword can substitute for the cross of the Crucified Christ. At Tarbat the sword is close to the left-hand margin of the stone in its present condition, but the left-hand margin appears to have been deliberately cut whilst the right-hand margin is more worn and tapering.

3.0 SLAB REUSED WITHIN BLOCKED DOORWAY OF TARBAT OLD CHURCH

Description

Probably a grave cover but with irregular edges. The stone appears to be metamorphic and not sandstone.

The only design which can be discerned is an incised triangular shape with another line(s) near the apex to create a diamond shape. Three possibilities may be suggested. The first is that this is a shield with the heraldic charge of a chevron. The second is this is intended to show an object suspended by a cord, such as a hunting horn. The third is that this is a letter A. For the last two suggestions the broken edge is at the bottom of the slab, but for the first suggestion the broken edge is at the top. There are faint suggestions of a rectangular object near the opposite margin: this could be a book with a fastening clasp, usually interpreted as the Gospels indicating the symbol of a priest. There are no diagnostic features, but a late medieval date is likely.

4.0 FRAGMENTS OF GRAVE-COVER SLAB REUSED IN BLOCK ED DOORWAY

A slab either broken in three pieces or, more likely, shown on three separate photographs. It is a coarse red sandstone.

This slab has three main elements. Around two sides are the incised letters of a border inscription within a frame. Although individual capital letters can be identified, the full text cannot be recovered; the inscription appears to be in English not Latin. The second element is a sunk roundel at the head of the slab in which is an ornate shield. This has an upper margin of half-round crenellation, straight sides and a bottom margin of two concave bases meeting at a point. The heraldic charge is of a stag and tree (?for Mackenzie). Below the roundel is a sunk rectangular panel which has in low relief a skull and cross-bones at the centre (as originally designed), a sexton's bell, an hourglass and either a miniature spade or an arrow at the top of the panel. For this design a seventeenth-century date is most likely.

References

Lamont, W. D., 1968. *Ancient and Medieval Sculptured Stones of Islay*

Ryder, Peter F. 1985. The Medieval Cross Slab Grave Cover in County Durham, *Architectural and Archaeological Society of Durham and Northumberland, Research Report No. 1* (Durham)

Ryder, P. 2000. Medieval Cross Slab Grave Covers in Northumberland, 1: South-West Northumberland', *Archaeologia Aeliana*, 5th Series, Vol. XXVIII, 51-110

Ryder, P. 2003. Medieval Cross Slab Grave Covers in Northumberland, 3: North Northumberland', *Archaeologia Aeliana*, 5th Series, Volume XXXII, 91-136

Ryder, P. 2005. The Medieval Cross Slab Grave Covers in Cumbria, Cumberland and Westmorland *Antiquarian and Archaeological Society*, Extra Series: Vol. XXXII (Kendal)

Steer, K.A. and Bannerman, J. W. M., 1977. Late Medieval Monumental Sculpture in the West Highlands (Royal Commission on the Ancient and Historical Monuments of Scotland, Edinburgh)

APPENDIX H CERAMIC REPORT

Derek W. Hall, SUAT Ltd

1.0 INTRODUCTION

This excavation produced a small assemblage of pottery (40 sherds) ranging in date from the early medieval period to the 19th century. All the material has been examined by eye and where possible assigned a recognised fabric name.

2.0 ASSEMBLAGE

2.1 GRASS-MARKED WARE

This fabric is commonly recovered from excavations in the Northern Isles and is normally of early medieval date (MacAskill 1978, 405). Handmade pottery very similar to this, known as craggan ware, was being made as late as the 19th century in the Hebrides and West Highlands but normally in identifiably modern forms such as cups and tea pots (Quail 1979, 39). There is a single sherd from the backfill of a grave (C1006, F3) which is from a hand made cooking vessel.

2.2 EAST COAST REDWARE

Fifteen years of archaeological excavations in the Scottish east coast burghs have identified this fabric type as forming a tradition of native pottery production apparently dating from the 13th to the 15th century (Hall 1996:126). The assemblage from Tarbat Old Church is dominated by this fabric (31 sherds). The fabric from Tarbat is much grittier than other examples of this fabric and is a much redder colour, however it does exhibit the purple wash under the glaze which is such a typical identifier for this fabric type (Hall 1996:126). The vast percentage of the sherds are from glazed jugs and it of interest that the glaze is of a much higher quality than normal and is very lustrous. Apart from jugs there are two sherds from cooking pots (C1178) and one rimsherd that may be from a chafing dish (C1147, Cat 4).

2.3 YORKSHIRE WARE

Vessels in these distinctively glazed fabrics are the most common imports in the east coast burghs in the 13th and 14th centuries (McCarthy and Brooks 1988:227-52). There are six sherds in this assemblage, one from a glazed water jug and the other 5 from the front half of a zoomorphic aquamanile (Cat 7) (McCarthy and Brooks 1988:228, fig 651).

2.4 CHINA

There is one rimsherd from a china teacup that has the remains of a stamped ‘heart’ decoration around its rim (Cat 8). This dates to the 18th or 19th century.

2.5 TILE

There are two pieces of green glazed floor tile from Intervention 22, C1013.

3.0 DISCUSSION

Recent work on Scottish ceramics has concentrated on trying to locate the sources of the East Coast redwares. A combination of thin section and ICPMS (Inductively Coupled Mass Spectroscopy) analysis has proved to be very successful

in suggesting where the kiln sites for these wares may be (Chenery, S and Phillips, E, forthcoming). What is most striking about this small assemblage from Tarbat is that it contains yet another variant of the East Coast Redwares which must be a local product, it is much grittier than the usual sandy matrix of this fabric. Although the clay source for this fabric is not known it would seem very likely that the alluvial deposits along both the Dornoch and Moray Firths may be the most likely location.

It is of great interest that the excavations at Portmahomack are producing what appears to be a local redware that belongs with the fabric type that has been found in Inverness (McAskill 1982:355-368) and more recently in Dornoch (Hall 1998). The absence of gritty wares from Tarbat is quite striking and may suggest that they were not readily available this far north. There is research currently taking place into this fabric type which suggests that it does not appear on the mainland any further north than Inverness (Will *et al* forthcoming).

All the pottery from the old church except the china would seem to date no later than the 15th century, the contexts containing Yorkshire ware are liable to date to the 13th or 14th centuries. The presence of at least two high status vessel types, a chafing dish and an aquamanile is also worthy of note.

4.0 RECOMMENDATIONS

It is recommended that some samples of the East Coast redware from the excavations at Tarbat are submitted to the British Geological Survey for inclusion in their continuing analysis of the sourcing of Scottish East Coast Redwares.

References

Chenery, .S and Phillips, E. forthcoming. 'ICPMS and thin section analysis of Scottish medieval redware pottery'

Hall, D. W. 1996. 'Blind Date - Scottish medieval pottery industries' *Tayside and Fife Archaeological Journal* Vol 2:126-128

Hall, D.W. 1998. 'The Scottish Medieval Pottery Industry-A Pilot Study' *Tayside and Fife Archaeological Journal* Vol 4:170-178

Hall, D.W. 1998. 'The pottery' in Colman, R 'A watching brief at Meadows business park, Dornoch' report for Highland Archaeology Service

MacAskill, N.L.1978. 'The Pottery' in MacGavin, N 'Excavations in Kirkwall, 1978' *Proc Soc Antiq Scot,* 112(1982):405-413

MacAskill, N.L. 1982. 'The pottery' in Wordsworth, J 'Excavations of the settlement at 13-21 Castle Street, Inverness' *Proc Soc Antiq Scot*,112:355-68

McCarthy, M. and Brooks, C.M. 1988. *Medieval pottery in Britain AD 900-1600*

Quail, G. 1979. 'Craggan ware' *Scot Pottery Soc Archive News*,4(1979):39-46

Will. R., Haggarty, G., Hall, D. W. and Vince, A. 1979.'Sourcing Scottish East Coast White Gritty ware' A pilot study for Historic Scotland

Illustration catalogue

East Coast Redware:

1. Rimsherd and rod handle junction from jug glazed lustrous brown on a purple wash (17/1150/189)

2. Rod handle fragment from jug glazed lustrous green on a purple wash (17/1112/461)

3. Unglazed basesherd from jug (22/1001/8)

4. Rimsherd from chafing dish ? with traces of internal lustrous brown glaze and slight external smoke blackening (17/1147/164)

5. Rimsherd from open vessel form ? internal glazed lustrous green brown on a purple wash (20/1075/106)

Yorkshire ware:

6. Fragment of small strap handle glazed lustrous green (17/1004/7)

7. Front end of zoomorphic aquamanile glazed lustrous green and decorated with scales. Junctions for spout and two legs are visible (17/1208/318)

China:

8. Rimsherd from teacup ? decorated with stamped pattern around rim (20/1064/281)

Pottery catalogue

Fabric Codes: Grass = grass-marked pottery; ECR = East Coast Redware; Yorks = Yorkshire ware.

Int.No	Context	Find No	Grass	ECR	Yorks	China	Tile
17	1004	7	0	0	1	0	0
17	1061	424414	0	3	0	0	0
17	1065	43	0	1	0	0	0
17	1112	24445946	0	3	0	0	0
17	1131	146	0	1	0	0	0
17	1147	164229245246275	0	5	0	0	0
17	1150	189228230	0	4	0	0	0
17	1154	190	0	1	0	0	0
17	1162	186	0	1	0	0	0
17	1189	460	0	1	0	0	0
17	1208	318462	0	0	6	0	0
17	1212	288299	0	2	0	0	0
20	1001	107	0	1	0	0	0
20	1006	343	1	0	0	0	0
20	1064	281	0	0	0	1	0
20	1075	106	0	1	0	0	0
20	1109	279	0	1	0	0	0
20	1178	341	0	2	0	0	0
20	1181	344	0	1	0	0	0

Int.No	Context	Find No	Grass	ECR	Yorks	China	Tile
22	1001	28	0	2	0	0	0
22	1013	1011	0	0	0	0	2
22	1014	1	0	1	0	0	0
TOTAL			**1**	**31**	**7**	**1**	**2**

APPENDIX I GLASS REPORT

Dr Hugh Willmott, University of Sheffield

1.0 INTRODUCTION

One-hundred and eight-four fragments of glass were recovered from excavations in the church during the Tarbat Discovery Programme. While the majority of the assemblage consists of window glass, a small quantity of vessel glass was found in the nave. The window glass comes from two distinct areas, the nave and the crypt, and is therefore discussed by area within this report.

2.0 VESSEL GLASS

2.1 THE NAVE

2.1.1 Vessel glass

Three vessels were recovered from contexts in the nave. The only medieval fragment is a small portion of rounded rim made in a potash-rich glass from a hanging lamp. Lamps are relatively common medieval vessels, particularly in ecclesiastical contexts, and are frequently found in the excavations of churches and monastic houses. First occurring in significant numbers in the early 13th century, they are a form that does not survive beyond the 16th century. The other two vessel present are post-medieval in date. The first is the rim and neck from a green glass thick-walled bottle. Although superficially resembling a wine bottle, the colour of the glass and the shape of the neck suggest that this might in fact be an early 18th-century mineral bottle. Mineral waters were popular drinks amongst those who could afford them and were imported from across Europe, the spa at Bad Pyrmont, Lower Saxony being the producer most favoured in the United Kingdom. The final vessel fragment is a late 19th-century mould-pressed jar rim.

2.2 Window Glass

Seventy-seven fragments of window glass were recovered from the nave area. The vast majority is undecorated and in the absence of edges relatively undiagnostic, although from the colour of the glass and its subsequent weathering most can be said to be medieval in date. Of these, only two fragments have any surviving evidence for surface painting and staining. This is not necessarily surprising, decorative window glass was a very expensive and specialist commodity. Furthermore, the medieval iron oxide paint and silver-based stains employed often do not survive in acidic archaeological conditions, and many of the fragments that now appear plain may once have been decorated. The earliest of the two painted fragments is probably 13th-century in date. Although extremely fragmented and without any edges, it is clearly pained with a scroll design that is found on ‘stickwork’ borders used around the edges of larger window compositions. The other painted fragment is also from a border. This is painted with the lower portions of several Gothic black letters that once formed an inscription, and are set against a stain wash. This style of decorative glass became popular in the 15th century and remained in use until the Reformation. Unfortunately the fragment is too small to reconstruct any of the letters or interpret what the inscription might have been.

Although plain, several other fragments retain two or more edges that demonstrate that they also formed portions of rectangular borders used to frame the edges of larger glazing schemes, and these vary in width from 25-51mm. The remaining fragments are largely undiagnostic, retaining either one or no edges. However, these are likely to have originally formed part of other rectangular borders, or more likely central diamond-shaped quarries, the most common shape of the period. Five fragments of window glass were also found in the nave that are clearly later, being 17th or even 18th-century in date. One of these is the central ‘bulls eye’ from a crown of window glass. These are usually associated with poorer

buildings that could not afford the thinner, clearer portions of glass made by this method, and its presence in the church might well indicate a change in its fortunes by this date.

2.2 THE CRYPT

2.2.1 Window glass

Excavations in the crypt produced a total of 104 fragments of window glass. In striking contrast to the nave, all this glass is early post-medieval and probably dates to the 16th or 17th century. Although most of the fragments are very small and relatively undiagnostic, it is possible to reconstruct other elements of the glazing pattern. Most interestingly two quarries can be sufficiently reconstructed to show that they were originally large and rectangular in shape, rather than the more typical diamond design. This was a glazing type that only started to appear in the later 16th century, when the increasing supply and quality of window glass enabled larger quarries to be used. Also present in the assemblage are two complete triangular corner pieces that would have fitted into this standardised geometric design. What is interesting is the lack of any medieval glass from this area, perhaps suggesting that it remained unglazed until the late 16th or 17th century.

Catalogue

Vessel Glass

The Nave

17/C1000

Find 6

1 fragment of rim from a press-moulded jar. Colourless glass.

Rim diameter 80mm. Late 19th century.

17/C1153

Find 168 F51

1 fragment of rounded vertical rim from a hanging lamp. Potash-rich glass. Diameter uncertain. 13th-15th century.

17/C1011

Find 45

1 fragment of rim and neck from a possible mineral water bottle. Green high lime low alkali glass. Rim diameter 28mm. Early18th century.

Window Glass

The Nave

17/C1002

Find 5

2 miscellaneous fragments. 17th-18th century?

17/C1003

Find 33

1 miscellaneous fragment. 17th-18th century?

17/C1004

Find 8

3 miscellaneous plain fragments, 1 edge. Late medieval.

17/C1061

Find 14

1 miscellaneous fragment. 17th-18th century?

Find 15

1 fragment of painted border 50 wide. Decorated with the lower portion of Gothic black lettering and a line edging. Find 16

3 joining fragments from a rectangular border 51mm wide. Late medieval.

Find 17

5 fragments from a rectangular border of uncertain width. Late medieval.

17/C1065

Find 2

1 miscellaneous fragment of thick 'bull's eye'. 17th-18th century?

17/C1095

Find 39

1 curved and rounded crown glass edge. Late medieval.

17/C1147

Find 161

1 fragment of painted stickwork border, with no edges remaining. 13th-15th century; 1 fragment of rectangular border 25mm wide. Late medieval; 7 fragments of rectangular border of uncertain width. Late medieval; 33 small miscellaneous plain fragments, some edges but unreconstructable. Late medieval.

Find 258

1 fragment of rectangular border 33mm wide. Late medieval.

17/C1099

Find 3

2 miscellaneous plain fragments, 1 edge. Late medieval.

17/C1011

Find 69 F 7

12 tiny miscellaneous plain fragment. Late medieval.

17/C1110

Find 79 F35

1 straight and rounded cylinder glass edge. Late medieval.

17/C1166

Find 202 F59

1 miscellaneous plain fragment. Late medieval.

17/C1208

Find 463

1 straight and rounded cylinder glass edge. Late medieval.

The Crypt

80 miscellaneous quarry fragments, some portions of edges. 16th-17th century

4 fragments from a rectangular quarry. Maximum surviving dimensions 52x43mm. 16th-17th century.

11 fragments from a rectangular quarry. Maximum surviving dimensions 75x66mm. 16th-17th century.

1 complete small triangular quarry. 33x33x47mm. 16th-17th century

1 complete small triangular quarry. 28x35x45mm. 16th-17th century

Find 9

1 miscellaneous quarry fragment, no edges. 16th-17th century

Find 11

1 quarry edge. 16th-17th century

Find 12

1 complete square quarry. 38x38mm. 16th-17th century

Find 13

1 corner from a rectangular or square quarry. 16th-17th century

Find 14

1 miscellaneous quarry fragment, no edges. 16th-17th century

Find 15

2 miscellaneous quarry fragments, no edges. 16th-17th century

APPENDIX J COINS

Nick Holmes, National Museums of Scotland

1.0 COINS

The earliest coin in this group, by some margin, is the English penny of Henry III (cat. no. 6). Minted during the period 1248-50, this coin would have ceased to be legal tender in England at the commencement of Edward I's new coinage in 1279, and although this does not mean that it could not have continued to circulate in Scotland for some years after this date, the moderate amount of visible wear does not suggest prolonged handling.

Four of the Scottish coins are base metal issues of James III and IV, minted between 1467 and *c*. 1510. It seems likely that the penny issues of James III, represented by nos. 1 and 2, were demonetised after the introduction of the second issue of James IV in around 1500. The latter issue, represented by nos. 3 and 4, is characterised by the presence of crowns and lis in the angles of the reverse cross, and this feature was no doubt intended to make these coins easily distinguishable from those they were intended to replace. These latest issues of James IV were minted in considerable numbers, and appear to have formed the bulk of the lowest-denomination coinage in circulation until the appearance of the lions of Mary in the 1550s.

The latest coin (no. 6) is a post-Union twopence of James VI from the 1623 issue. These coins were fairly plentiful, but appear to have been replaced in circulation fairly quickly by the turner issues of Charles I, particularly after the introduction of the smaller and lighter 'Stirling' issue in 1632.

LIST OF COINS

Scotland
TR97 INT17 C1091 find 41
James III billon penny, class Ciii (*c*. 1475-84)
13.0 x 14.0 mm; 0.35 g
edge ragged, slight surface corrosion; moderate wear

TR97 INT17 F43/1132 find 95
1. ? James III billon penny (*c*. 1467-88?)
14.0 x 13.0 mm; 0.47 g (0.31 after cleaning)
much corrosion and surface accretion
TR97 INT17 F43/1132 find 93
2. James IV billon penny, second issue, type III (*c*. 1500-10)
16.0 x 17.0 mm; 0.77g; die axis 6.5
obv.: + I0coBVSDeIGR0:R[ ]
rev.: + VIL / L0:e / DInB / VRGT
slight surface corrosion; fairly worn
TR97 INT17 F43/1132 find 94
3. James IV billon penny, second issue, type IV(d?) (*c*. 1500-10)
14.0 x 15.0 mm; 0.40 g; die axis 1.5
obv.: + I0coBVS[ ]
rev.: + V[IL] / L0De / eDIn / BVRG
broken in two; some surface corrosion and accretion; fairly worn

TR97 INT17 C1061 find 11
James VI copper twopence, second post-Union issue (1623)
19.0 x 18.5 mm; 1.83 g
surfaces corroded; degree of wear uncertain

England
TR96 INT13 find 5
Henry III silver penny, long cross 3b, by Walter at Lincoln (1248-50)
18.5 x 18.0 mm; 1.47 g; die axis 5.0
obv. * henRIcVSReX · III'
rev.: WaL / TeR / ONL / INc; aL, eR and ON ligatured
moderate wear

APPENDIX K COFFIN WOOD IDENTIFICATION

Steve Allen, York Archaeological Trust

1.0 OBJECTIVES

This report is the summary of the species identifications of a number of fragments of wood.

2.0 PROCEDURES

The objects were delivered to the Wet Wood Laboratory. Each was double bagged in self seal plastic bags, with the inner bag containing jiffy foam to support the contents, and all self seal bags were contained in the same Stewart box. Each object was in turn removed from its packaging, sampled and returned to its packaging. The samples were studied under various magnifications to identify the wood species.

3.0 CONDITION

The wood was generally in a poor state of preservation, The material was dry and degraded and in consequence, some identifications were not possible.

4.0 LISTING

The material is listed in burial number order. All species identifications follow Schweingurber, F.W. (1982) Microscopic Wood Anatomy (Zurich).

Burial No.	Feature No.	Context No.	Find No.	Species identification
9	45	1134	192	Not identifiable
17	7	1100	71	*Pinus sylvestris L.*
21	75	1195	263	Not identifiable
26	55	1161	180	Not identifiable
26	55	1161	181	Not identifiable
30/36	76	1215	289	*Quercus sp.*
43	83	1228	375	?*Fraxinus excelsior L.*
43	83	1230	490	*Quercus sp.*
93	28	1114	152	*Pinus sp.*
101	47	1104	153	Not identifiable
112	69	1174	136	*Quercus sp.*
112	69	1174	136	*Quercus sp.*

APPENDIX L TEXTILE REPORT

Penelope Walton Rogers

1.0 INTRODUCTION

Fragments of a yellowish-fawn textile were found in association with the leather shoes in burial 1228/F83. The largest fragments were in the ankle region (373, 374), but a small area was also noted peeping out of the decayed toe area of the left shoe [*the shoe with the buckle*].

The textile is a heavily felted wool tabby (i.e. plain weave). The yarn is Z-spun in one direction and S-spun in the other and there are 10/Z x 8/S threads per square cm. Microscopy of the fibres (xl00 and x400 magnification) shows that they are non-pigmented wool. The fibres are split and abraded and have rounded ends, indicating extensive wear. No dye was detected and, judging from the present colour, it seems likely that the textile was originally white. Some loose, coarse animal fibres were also found in association with the textile from the ankle area (373). These were short, lightly pigmented fibres, with intact roots and tips, and may represent light brown hair from the man's legs.

This textile is a typical medium-weight clothing fabric of the late 14th to 16th centuries. In the 12th to 14th centuries most clothing fabrics were made in twill, but during the course of the 14th century there was a shift to tabby weaves, first of all in English urban textile centres (Walton 1991, Crowfoot *et al* 1992 p434) and then in places with less well developed textile industries, such as Scotland and Norway (Walton Rogers forthcoming).

The position of the textile suggests that it represents cloth socks or 'foot-hose'. Hose with feet were a common feature of men's dress in medieval north-west Europe. Several pairs have been found on bodies in the late Norse cemetery at Herjolfsnes, Greenland (Nørlund 1924), and there is another pair on the 14th-century man from Bocksten bog, Sweden (Nockert 1997, 104-107). There are also discarded single examples from late 14th century London (Crowfoot et al 1992, 185-9) and another of uncertain date from Papa Stour, Shetland (Walton Rogers forthcoming). The London ones are made from wool tabbies with Z x S spinning and are therefore technically the most like the Tarbat textile.

Cloth hose was largely superseded by knitted stockings during the course of the 16th century, although there are some later examples in existence (Bennett in Walton Rogers forthcoming). The shoes in the Tarbat burial are of a style which was worn in London in the early 15th century and a similar date would be appropriate for the hose. The obvious wear on the textile indicates that they were probably the hose which the man wore in life.

References

Crowfoot E, Pritchard F, Staniland K, 1992, 'Textiles and Clothing c.1150-c.1450' in *Medieval Finds from Excavations in London 4*, (London)

Nockert M., 1997, *Bockstensmannen och hans drakt*

Nørlund P, 1924, 'Buried Norsemen at Herjolfsnes' *Meddelelser om Grønland*, 67, 1-270

Walton P, 1991, 'Textiles' in J Blair and N Ramsay English *Medieval Industries*, p319-354, (London)

Walton Rogers P, forthcoming, 'Textile, yarn and fibre from The Biggings, Papa Stour, Shetland' in B Crawford, forthcoming, *The Biggings, Papa Stour, Shetland*

APPENDIX M MEDIEVAL LEATHER SHOES

Clare Thomas

1.0 INTRODUCTION

A pair of shoes was found during excavation of a skeleton interred within the nave of Tarbat Old Church. The shoes were preserved beneath the wooden slats of the collapsed coffin lid, in a dry and oxygen -free environment.

The skeleton was that of a mature male of at least 46 years. Textile hose were identified during conservation (see separate report by Penelope Walton Rogers).

2.0 CONDITION OF SHOES

The shoes are in a fragmentary state and friable condition but with large areas of leather remaining intact. A copper-alloy buckle was found during excavation along with two linked straps.

When found the right shoe was under the left. They were separated during conservation and are now sotred in custom=built protective packaging with supportive mesh allowing views from both above and below. Unfortunately, the mesh obscures details. They cannot be handled, and thus it is impossible to examine the interior. During burials, as the skeleton's feet rotted, the shoes were squashed flat, leaving mostly grain surfaces visible. The surviving flesh surfaces are degraded; only a few traces of stitching are visible.

3.0 DESCRIPTION

3.1 CONSTRUCTION

The shoes are of turnshoe construction, with an upper attached to a single sole with an edge-flesh seam. There is no evidence for rands, which would have strengthened the seam and made it more waterproof.

3.2 STYLE

Insufficient remains to indicate sole style.

The uppers appear to be of one-piece design, with a butted edge-flesh seam linking quarters and vamp wing on the inside of the foot. These were high shoes or low boots, fastened by two straps and a buckle. The straps are no longer attached, but evidence from elsewhere suggests that they emerged from slits near the vamp throat.

3.3 LEFT SHOE

Substantial portions of the upper of this shoe survive and consist of vamp and quarters, as well as the two straps and a buckle. No sole fragments have been identified.

The vamp is now folded asymmetrically. A short stretch of lasting margin with grain to flesh stitching channel, stitch length 5.5 - 6mm, is exposed on the inner vamp wing. This stitch length indicates that the shoe is of turnshoe construction. The front portion of the vamp is extremely degraded, with no further lasting margin visible. However, most of the vamp survives; it appears to have had an oval toe. There is a short tear running forwards from the vamp wing; this is not a seam.

The quarters are folded and very fragmentary, and probably distorted. A small triangular portion at the front quarters is now folded backwards, exposing the flesh side. This tiny portion of flesh surface is delaminated and degraded but has very faint suggestion of hemstitch. The fold itself os accidental and of no significance. The top edge of the quarters has possibly been oversown. The back edge of the quarters is represented by a fold. The quarters end on the inside for a vamp/quarters seam on the outside of the foot, indicating that this upper is of one-piece design.

Two straps, linked by a copper alloy buckle, now lie on top of the quarters.

One strap is approximately triangular. It has a grain to flesh stitching channel halfway along the strap, and secured by folding the strap through a slit in itself. The other half of this strap is folded underneath the wider portion.

The second strap is a long tapering strip, and passes through the buckle. The buckle pin lies under the second strap. No pinholes are discernable.

The copper alloy buckle is round, with a diameter of 18mm, and a thickness of 2mm. The pin, which is partially hidden by the second strap is at least 13mm long and 2mm wide.

No slits through which these straps might have been anchored on the flesh side or interior of the shoe have been identified. Parallels from elsewhere (see below) suggest that these would have been in the vamp throat/vamp wing area, which is now too degraded for any slit to be recogniseable.

3.4 RIGHT SHOE

Parts of both sole and upper of this shoe survive.

3.5 SOLE

The grain side of seat, waist and rear of forepart of sole are visible from underneath. No stitching channels can be seen. There is no sign of a rand. There is a tear across the waist.

The upper fragments comprise most of the quarters and part of a vamp wing. The lasting margin survives folded under vamp wing and quarters but only two unrelated stitch holes are visible. Quarters and vamp wing are joined by a butted edge-flesh seam, stitch length 3.5mm.

There is also a short stretch of stitching channel, grain to flesh, but with the grain folded to form an edge, stitch length 3mm. This is on a fragment with grain surface, at present on the quarters; it could imply an insert. It is also possible that the fragment, which is not clearly connected to anything else, is in the wrong place.

The rest of the vamp does not survive.

4.0 DISCUSSION

The only published parallels for shoes with straps and buckles are from England. The best examples, and closest to the Tarbat shoes, are from London. These are low boots with one-piece wrap-around uppers with a straight opening down the centre of the vamp, and with two straps, one with a buckle. The straps emerge on either side of the foot from slits near the vamp throat. Some straps had been secured to the flesh side with stitching; other straps had spade-like terminals to prevent them being pulled through the slits. These boots are of early 15th -century date (Grew and de Neergaard 1988, 37, Fig. 59;

41, Figs 63-65, Fig. 105).

Grew and de Neergaard also illustrate another type of boot with straps and buckles but this had a much higher leg than is possible with the Tarbat examples (Grew and de Neergaard 1988, 37, Fig. 59; 42, Figs 67-68). The other shoes with straps and buckles discussed by Grew and de Neergaard are not relevant to Tarbat.

Similar boots were found in Coventry but unfortunately these are all from unstratified deposits (Thomas 1980, 12-13, Type 1a, fig. 4, 78/51/52 and 78/51/57; fig. 7, 58/158/7; fig. 18, 78/59/29).

Other parallels are know from Reading (early 14th century - 1539) and Poole (early 15th century)(Mould 1997, 111, Fig. 63, no.17; Mould 1994, 71-73, fig. 53, no. 14, fig 54, no. 20a).

According to Grew and de Neergard, most London shoe buckles of the early 15th century were made of lead alloy but with iron pins. Three of the lead/tin alloy buckles illustrated by Grew and de Neergaard resemble that from tarbat in shape (Grew and de Neergaard 1988, 75-76, Fig. 110, 1, b, c, I). Mould also illustrates a circular metal buckle from Reading, but does not defined the metal (Mould 1997a, Fig. 63, no.17 - early 14th century to 1539).

Shoes from burials are rare. The best examples are from Sandwell Priory, where six pairs of shoes and a pair of leather leg-coverings were found in graves that dated from the 13th to 16th centuries. The shoes were all turnshoes, and included four different sole and upper styles. The shoes were neither badly worn nor new. One pair had two straps but there was no indication of a buckle; also the design of the shoes was quite different to those from Tarbat. The leg coverings reached to about mid-thigh, and had laced slit above knee level. They were of 15th to early 16th-century date (Thomas 1991, 102-111).

A pair of knee-high boots was found in a pilgrim's grave in Worcester Cathedral; these possibly date to the last quarter of the 15th century (Thomas 1991, 110-111; J. Spriggs pers.comm.). Similarly a pair of shoes or boots was excavated at Hulton Abbey (Thomas 1991, 111).

A sole and upper, both of approximately 12th- to 14th-century date, along with other fragments of leather, were found in a grave at Jedburgh Abbey. However, these were not directly associated with any of the skeleton parts recovered from this grave (Thomas 1995, 114; Grove 1995, 122, 125).

This is probably the only surviving example of shoes and cloth hose. More common but still rare, are shoes with linings. An unstratified ankle-boot from the Perth High Street excavations, 1975-77, had a felt lining, while a calf-high boot from the same site, of 12th-century date, had stitching for a lining (Thomas forthcoming)

References

Bogdan, N.Q. and Thomas, M.C. forthcoming *The Perth High Street Excavation, the Leather Fascicule VI*

Grew, F. and de Neergaard, M. 1998. Shoes and pattens, *Medieval finds from London* (London)

Grove, R. 1995. The Human Burials in Lewis and Ewart, 117-130

Hawkes, J.W. and Fasham, P.J. 1997. Excavations on Reading Waterfront Sites 1979-1988 *Wessex Archaeological Reports 5, 108-141*

Hodder, M.A. 1991. Excavations at Sandwell Priory and Hall 1982-88 *South Staffordshire Archaeological and Historical Society Transactions 31*

Lewis, J. and Ewart, G. 1995. Jedburgh Abbey: the archaeology and architecture of a border abbey, *Society of Scotland Monograph Series 10*

Mould, Q. 1994. The Leather, in Watkins, 68-74

Mould Q. 1997. Leather in Hawkes and Fasham

Thomas, M.C. forthcoming. in Bogdan and Thomas

Thomas, M.C. 1991. The Leather Shoes and Leggings in Hodder, 102-111

Thomas, M.C. 1995. Leather in Lewis and Ewart, 114

Thomas, S. 1980. Medieval Footwear from Coventry

Watkins, D.R. 1994. The foundry excavation on Poole Waterfront 1986-7, *Dorset Natural History and Archaeological Society Monograph Series 14*

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