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Portmahomack on Tarbat Ness: Changing Ideologies in North-East Scotland, Sixth to Sixteenth Century AD

by Martin Carver, Justin Garner-Lahire and Cecily Spall

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Digest 6 CATALOGUE OF DIAGNOSTIC ARTEFACTS

6.1 Catalogue of cited objects (by period)

This is an index of the objects illustrated or referred to in the text. Full descriptions will be found in Digest 6.2–6.18 and in the OLA at 7.1.

Period 0 Prehistoric to *c* AD 500
(Chapter 4)

Two Mesolithic–Neolithic blades (24/4230 C1805; 6081 C2004).

Three scrapers of the late Neolithic to Bronze Age (24/1001 C1000; 6002 F419 C2170; 6176 C1881).

Awl (24/7868).

Tool fragment (24/7871; C3398).

Neolithic leaf-shaped arrowhead (14/1937; C1002) [Illus D6.1.1].

Neolithic leaf-shaped arrowhead (14/4376; C2793) [Illus D6.1.1].

Neolithic leaf-shaped arrowhead (14/2655; C1663) [Illus D6.1.1].

Neolithic leaf-shaped arrowhead (25/1651; F179 C1377) [Illus D6.1.1].

Late Neolithic–Bronze Age barbed and tanged arrowhead (14/3410; C2968) [Illus D6.1.1].

Carved stone ball 70mm diam, grooves typically 5mm D (17/366; F86 C1237) [Illus 4.3].

Trough querns

Trough quern fragment, retaining lower end of grinding trough and profile across quern edges, grinding surface smoothed, gabbro, 550mm L × 350mm W × 230mm Th (24/3875; F97 C1285) [Illus D6.1.2].

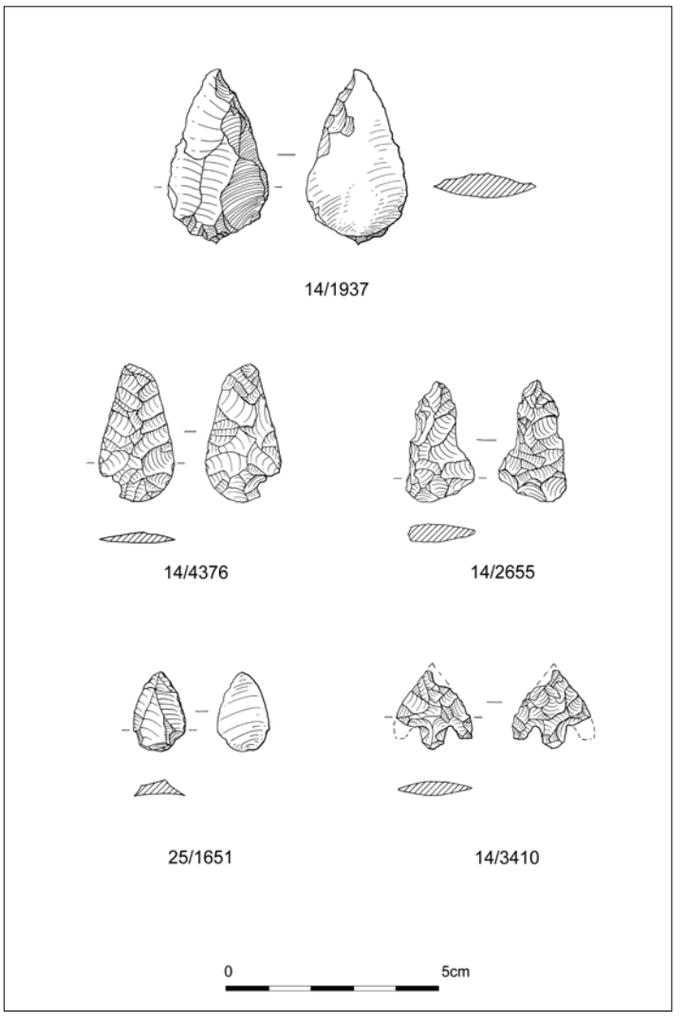

Illustration D6.1.1

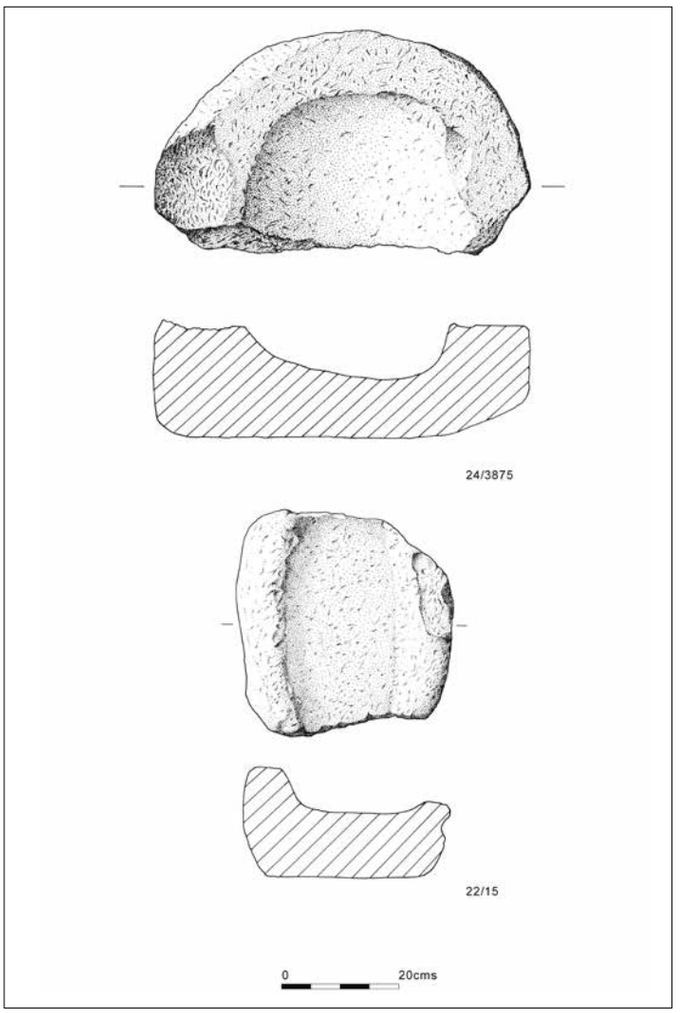

Illustration D6.1.2

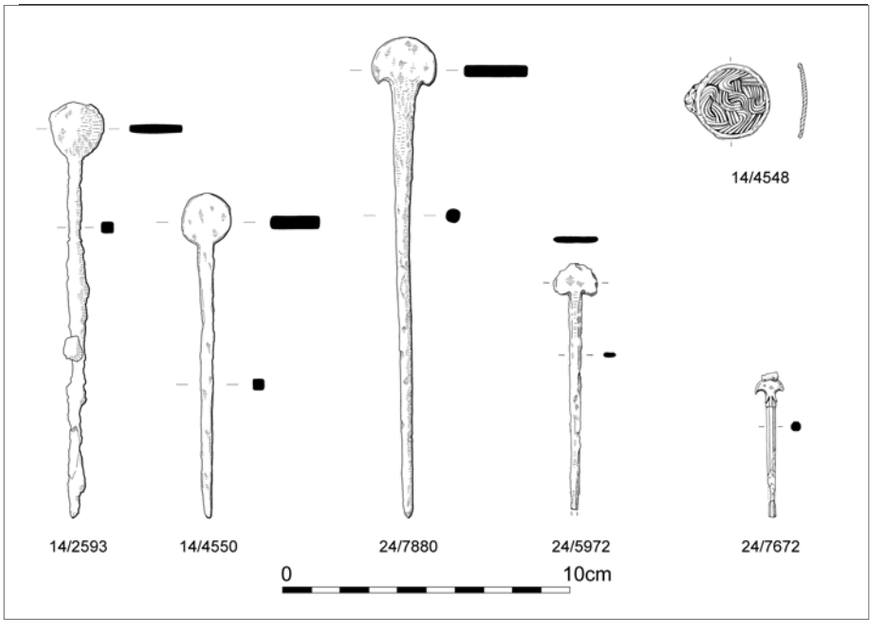

Illustration D6.1.3

Trough quern of grinding trough with end and edges missing, pink granite, 360mm L × 330mm W × 210mm Th (22/15) [Illus D6.1.2].

Trough quern edge fragment retaining part profile, grinding surface smoothed, possibly metamorphic gneiss, 260mm L × 190mm W × 150mm Th (14/4310; C2961).

Trough quern fragment of edge and part grinding surface, smoothed, syenite, 230mm L × 160mm W × 190mm Th (24/4593; C1326).

Trough quern fragment of edge and part grinding surface, mica schist 400mm L × 340mm W × 170mm Th (24/8048; F577 C3580).

Saddle quern fragment, roughly worked flat base and sides, working trough smoothed from use, extensive modern plough damage, quartz arenite, 310mm L × 150mm W × 90mm Th (29/42).

Period 1 Early Pictish

Sixth/seventh century (Chapter 4)

Dress pins [Illus D6.1.3 see also Illus 4.22]

Iron dress pin, complete with flat, disc-shaped head, 143mm × 19mm W (head), 5mm Th (shank) (14/2593; C1607).

Iron dress pin, complete with flat, disc-shaped head, 112mm × 13mm W (head), 3mm Th (shank) (14/4550; C3455).

Iron dress pin, complete with flat, elliptical head, 167mm × 22mm W (head), 8mm Th max (shank) (24/7880; C3351).

Iron dress pin, complete with flat, elliptical head, 86mm × 13mm W (head), 3mm Th (shank) (24/5972; C2109).

Copper alloy dress pin, near-complete, shank tip missing, elliptical head with faceted border and flared collar, shank octagonal in profile, 50mm × 10mm W (head) × 3mm Th max (shank) (24/7672; C3029) [Illus D6.1.3]

Harness mount

Harness mount: mercury-gilded, leaded bronze with Style II insular ornament, slightly concave with raised rim, 25mm diam. × 1mm Th, sixth/seventh-century (14/4548; C3428) [Illus D6.1.3; see also Illus 4.23].

Period 2 Monastic

Eighth century (Chapter 5.6, 5.7)

Plough pebbles from east boundary wall. Probably residual from Period 1 [fifty-three examples, see OLA 7.1.3.4;] [Illus 4.24].

Silver porcupine sceat series E. 11mm Diam; weight 0.55g. The coin dates to *c* AD 715–35. Redeposited in Period 3 from layers making up the Period 2 road (S13) (24/2283; F18 C1150; displaced to pit F185. EMC 1999.0147; see Blackburn in Digest 6.2) [Illus D6.1.4].

Leather pieces; cattlehide, five fragments, probably from a shoe (24/7810; from stone culvert F341 C3545 in S7; see report by Clare Thomas in Digest 6.16).

Object associated with stone carving

Iron sculptor's chisel with double-bevelled cutting edge and slightly burred head, 151mm L (24/4921; C2968) [Illus D6.1.5; see also Illus 5.3.56].

Objects associated with vellum working (Sector 2) [Illus 5.6.13, 14 and 15]

Handled hook

Iron hook with mineral-preserved wooden handle with clenched end, 200mm L, 75mm L (handle) × 11mm Th (hook) (14/2012 and 2016; F72 C1400) [Illus D6.1.7; see also Illus 5.6.5].

Blades [Illus D6.1.6]

Iron half-moon knife (*lunellarium*), vertical tang onto curved blade 74mm L × 68mm W (24/4575; C1875) [Illus D6.1.6].

Illustration D6.1.4

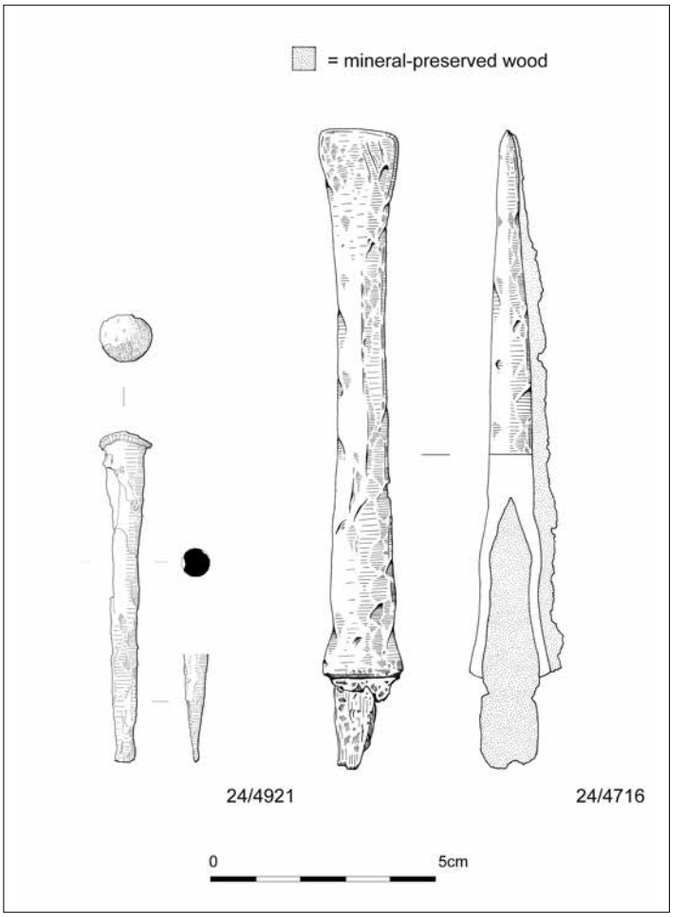

Illustration D6.1.5

Iron whittle tang blade, 60mm L (blade) 24mm L (tang) (24/6596; F180 C2144).

Iron whittle tang blade, 69mm L (blade) 9mm L (tang) (24/7670; C3083).

Iron whittle tang blade, 62mm L (blade) 4mm L (tang incomplete) (24/7673; F528 C3175).

Iron whittle tang blade, 72mm L (blade) 49mm L (tang) (24/7681; C3140).

Pumice rubbers

Pumice rubber, complete sub-triangular with sub-rectangular profile, perforation at top, areas of wear and visible white residue, 69mm L × 53mm W × 44mm Th (24/4019; C1827) [Illus D6.1.6].

Pumice rubber, complete, sub-rectangular with sub-rectangular profile, right-angled perforation at top, areas of smoothing from use, 105mm L × 39mm W × 40mm Th (24/4752; C2123) [Illus D6.1.6].

Pumice rubber, complete sub-rectangular with triangular profile, perforation at top, some areas of wear, 90mm L × 35mm W × 27mm Th (24/4793; F373 C1869) [Illus D6.1.6].

Pumice rubber, sub-rectangular, one corner missing, worn, 66mm L × 61mm W × 44mm Th (14/3958; C1998).

Pumice rubber, near-complete, sub-rectangular, one corner missing, slightly faceted, areas of wear, 63mm L × 31mm W× 28mm Th (24/6784; C2950).

Pumice rubber, complete, sub-oval, sub-rectangular profile, perforation at top, worn, 78mm L × 35mm W × 25mm Th (24/7307; C3229).

Pumice rubber, drop-shaped, worn, visible white residue, 108mm L × 74mm W × 40mm Th (24/7308; C3083).

Pumice rubber, small fragment of top with part perforation, 26mm L × 17mm W × 14mm Th (24/7704; C3135).

Rubber with perforation, fine-grained limestone. Two conjoining fragments 78mm L × 37mm W × 30mm; 44mm × 49mm × 29mm (24/6656; C2649).

Rubber fragment with double perforation, in soft powdery limestone, 71mm L × 66mm W × 24mm Th (24/8468; F526 C3535).

Pucks, slickers and whetstones [ninety-eight examples, see OLA 7.1.3.2, Inventory of stone objects]

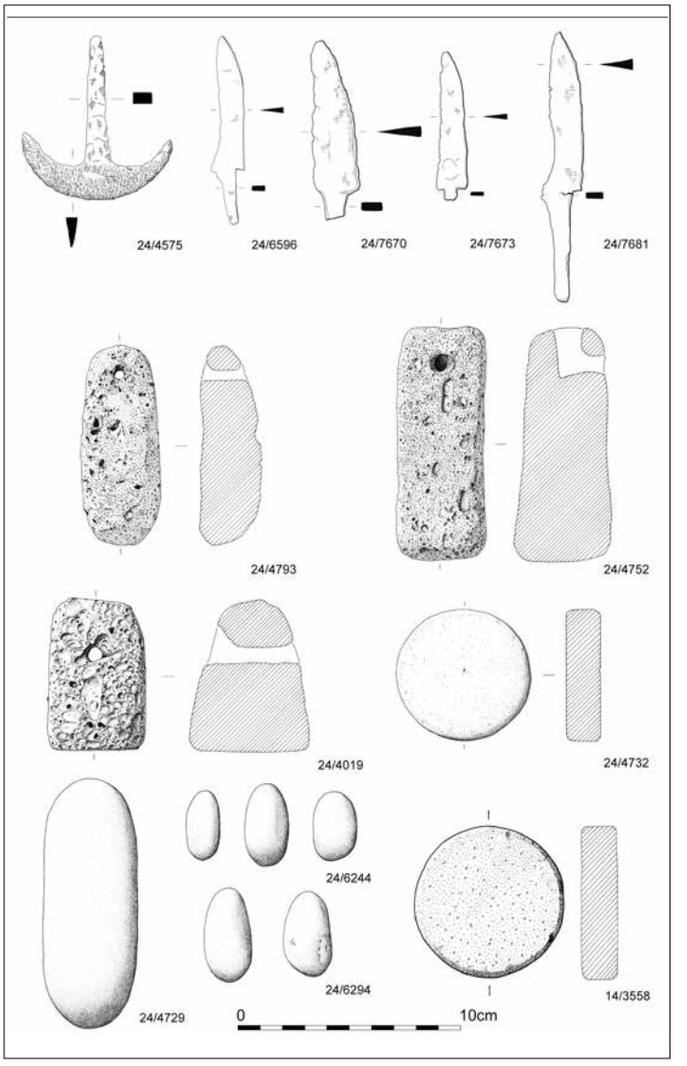

Illustration D6.1.6

Slicker, sub-rectangular in form and profile, haematite stained micaceous metaquartzite 112mm L × 42mm W × 30mm Th (24/4729; C2109) [Illus D6.1.6].

Whetstone, discoid, with smoothed edge and faces, medium to fine-grained, dark red ferruginous sandstone, 90mm reconstructed Diam × 6 to 12mm Th (8/211; F9 C1021).

Whetstone, discoid, micaceous schist 66mm Diam × 15mm Th (14/3558; C2438) [Illus D6.1.6].

Whetstone, discoid, medium to fine-grained, red ferruginous sandstone, 67mm Diam × 11.5mm Th (24/4577; C1326).

Whetstone, discoid, metaquartzite, 60mm Diam × 15mm Th (24/4732; C2109) [Illus D6.1.6].

Whetstone, irregular sub-rectangular form and profile in buff feruginous micaceous sandstone, bears naive interlace doodle, 83mm L × 20mm W × 13mm Th (24/4854; C2353) [Illus D6.1.7].

Whetstone, trapezoidal profile, marked by grooves from sharpening; 153mm × 33mm to 30mm × 24mm Th (24/4706; C2109) [Illus D6.1.7].

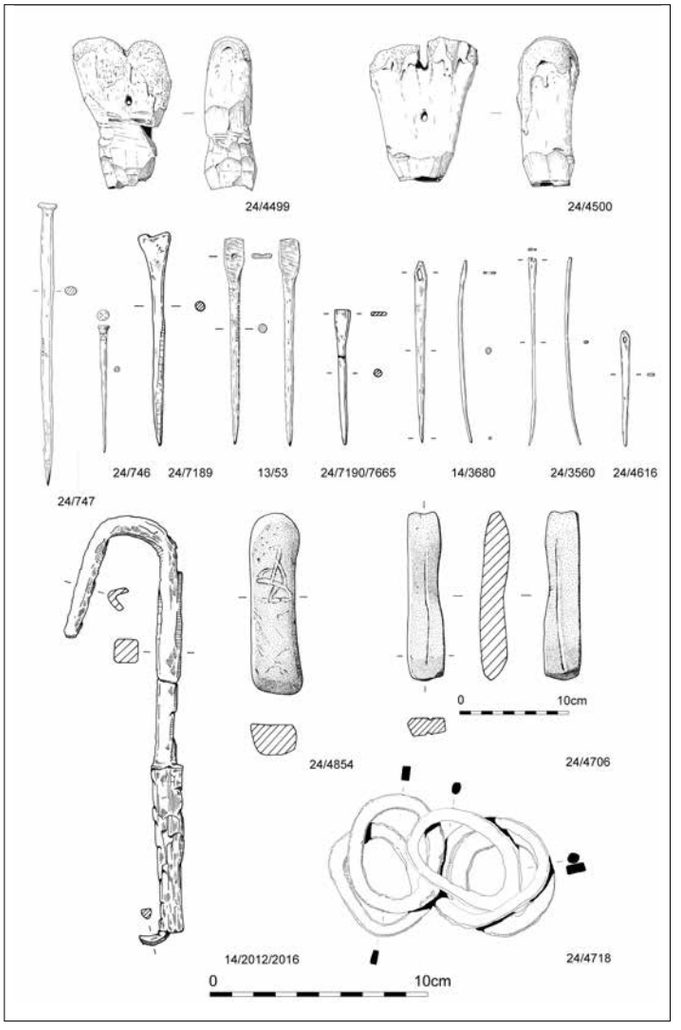

Illustration D6.1.7

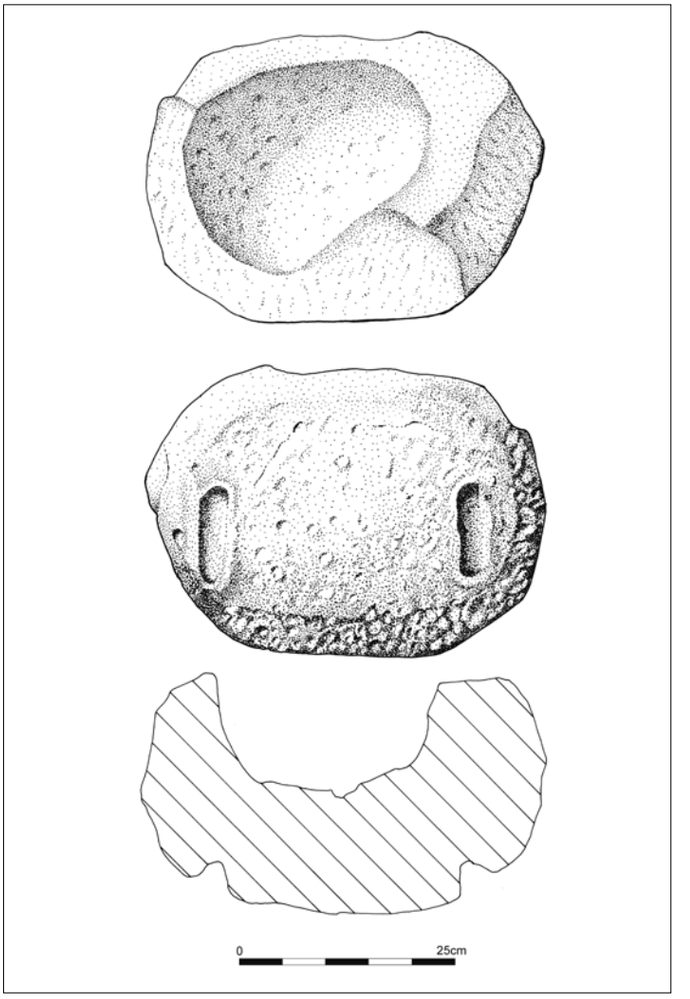

Illustration D6.1.8

Vellum pebbles [241 examples, see OLA 7.1.3.2] Illustrated: 24/6244, 6294 [Illus D6.1.6; Illus 5.6.11 and 15].

Bone pegs [These are the most evidently worked of more than 20 examples of cattle metapodials thought to have served as stretcher frame pegs in the vellum yard; see Digest 6.4 at 3.2.2; Illus 5.6.10].

Bone peg cut from the distal end of a cattle metapodial, nutrient foramen visible, much of shaft and condyles worn down, mid-shaft is thinned, and features irregular cut marks, 72mm L × 46mm W (incomplete) × 22mm Th (14/4499; F393 C1957) [Illus D6.1.7].

Bone peg cut from the distal end of a cattle metapodial, nutrient foramen visible, 64mm L × 46mm W across condyles (Bd), but incomplete, 22mm Th (14/4500; F393 C1957) [Illus D6.1.7].

Styli (Digest 6.4 at 4.1).

Bone stylus with expanded head, with flat upper edge, two conjoining pieces; 61mm L × 7mm W (head) × 3mm Th (shank) (24/7190 and 7665; F507 C2844) [Illus D6.1.7].

Polished bone stylus 95mm L × 9mm W (head) × 3mm (max (shank) Th (13/53) [Illus D6.1.7].

Pins

Pig fibula pin, MacGregor's Group 1 (head unperforated or trimmed), 98mm L × 15mm W (head) × 5mm Th (shank) (24/7189; C3157) [Illus D6.1.7].

Pin, probably of postcranial bone, finely made and highly polished from use, shank of subcircular section and waisted profile, 130 L × 6–7mm W (head) × 5mm Th (24/746, F132 C1354) [Illus D6.1.7].

Pin, probably of postcranial bone, finely made and highly polished from use, shank of evenly tapering profile and subcircular section. Head decorated with five dots, unevenly arranged, under head decorated with parallel incised lines containing zig-zag ornament, 57mm L × 5–6mm W (head) × 5mm Th (24/747, F132 C1354 [Illus D6.1.7].

Needles [Illus D6.1.7].

Needle, bone or antler, head broken at mid-point across perforation; otherwise complete, 83 L × 3mm Th (14/3560; C2435).

Needle, bone, largely complete, short and straight in profile; slight faceting on head, which features a round, 2 × 2mm perforation, gently tapering profile, blunt tip, 52 L × 4mm Th (14/3680; F395 C2447).

Needle, bone or antler, complete, curved profile, ovoid section, finely pointed tip, and lozengiform head with longitudinally extended perforation (4mm × 1mm) 83mm L × 3mm Th (24/4616; C1877).

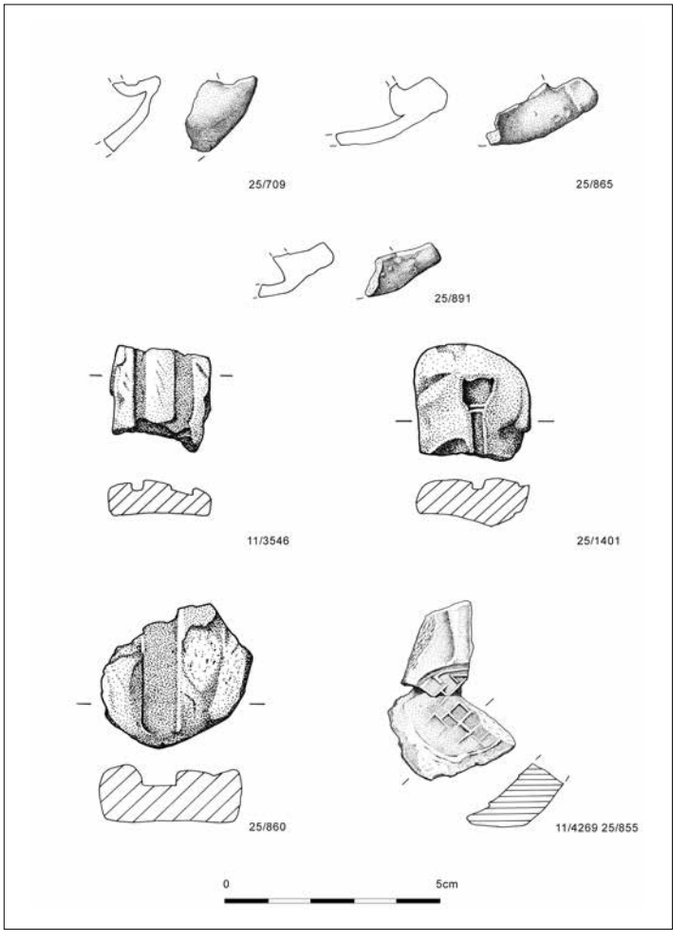

Illustration D6.1.9

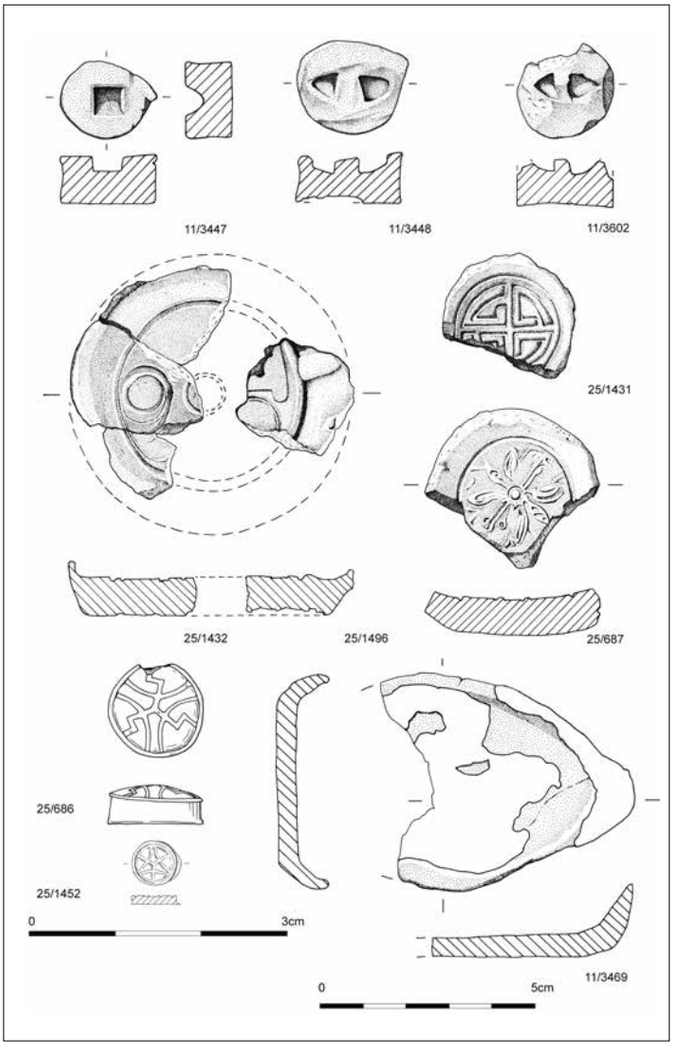

Illustration D6.1.10

Wood-working chisel

Iron, long-handled wood-working chisel, with socketed handle and mineral-preserved ?alder handle 243mm L × 24mm Diam (24/4716; C2109) [Illus D6.1.5].

Iron hoops

Group of five iron hoops, corroded together, of varying circular, sub-rectangular, sub-oval and D-shaped form, 53mm × 40mm × 7mm Th; 54mm × 4mm × 7mm Th; 56mm × 39mm × 5mm Th; 59mm × 45mm × 5mm Th; 49mm Diam × 7mm Th (24/4718; C2109) [Illus D6.1.7].

Stone basin or mortar

Near-complete mortar or basin pecked from large sandstone boulder with deep smooth central bowl and two parallel recessed slots on the underside. Possible basin supported by a trestle in the manner of a folding seat. 470mm L × 320mm W × 290mm Th (24/4707; C1868) (S9) [Illus D6.1.8; Illus 5.6.18].

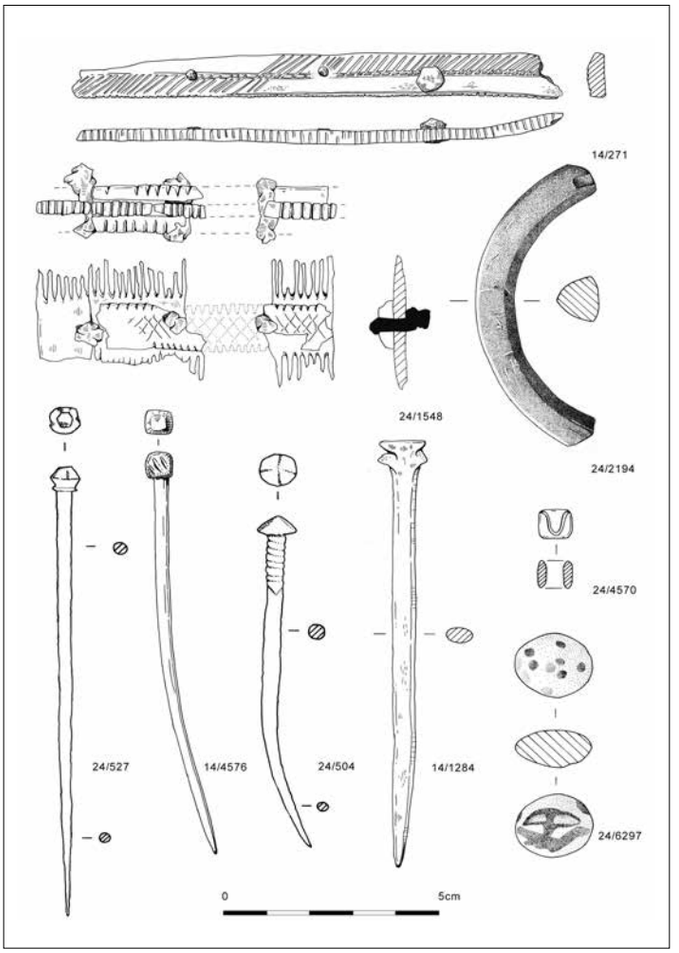

Illustration D6.1.11

Book plaque?

Fragment of copper alloy cast with insular ornament 33mm L × 27mm W × 1mm Th. Wt 3.6g (14/1286; C1002) [Illus 5.6.19].

Objects associated with Period 2 Glass and Metalworking (Sector 1), excluding slag, for which see 6.9

Crucibles (Spall in Digest 6.5)

Crucible, Type G1, handle and part body 4.5mm Th × 12mm W × 7mm L (25/865; C1001) [Illus D6.1.9].

Crucible, Type G2, 3.5mm Th (25/709; C1002) [Illus D6.1.9].

Crucible, Type G1, handle and part body, 5mm Th × 6.5mm W × 10mm L (25/891; C1002) [Illus D6.1.9].

Crucible body sherd, with opaque yellow glass on interior surface. Fabric white, gritty, rather crumbly, wheel-thrown. Exterior grey/orange. Possible inclusions of metal ore in glass, 41mm L × 31mm W × 7mm Th (11/3551; C1250).

Two-thirds of a low-walled heating tray, eye-shaped heating tray with flat base. Patches of opaque yellow glass on interior surfaces, but also spreading to exterior in places. Stirring marks visible where trails have been lifted out. Fabric as 11/3551, hand-modelled, 62mm L × 45mm W × 17mm H (11/3469; C1250) [Illus D6.1.10; Illus 5.7.9; Illus D6.8.3].

Moulds (Spall in Digest 6.6)

Geometric disc mould, two conjoining fragments of upper mould with part ingate derived from the casting of a small domed disc bearing an eroded geometric interlace pattern on a disc 23mm Diam (11/4269 and 25/855; C1002 and F176 C1250) [Illus D6.1.9; Illus 5.7.8].

Four conjoining fragments of spiral decorated glass disc mould, circular disc measuring *c* 44mm Diam (25/1432 and 1496) [Illus D6.1.10; Illus 5.7.9].

Circular glass mould with floreate cross matrix, mould Diam 50mm, stud Diam 32mm (25/687; C1002) [Illus D6.1.10; Illus 5.7.9].

Circular glass mould with interlace cross matrix, domed profile, mould Diam 32mm, stud Diam 25mm (25/1431; F179 C1377) [Illus D6.1.10; Illus 5.7.9].

Square glass, two conjoining fragments of small drum of rolled clay mould 23.5mm L × 20.5mm W × 10.5mm Th (11/3576 and 3651; F176 C1250).

Square glass stud mould on small drum of rolled clay, domed stud profile, mould 19mm L × 17mm W × 10.5mm Th, stud 5mm L × 5.5mm W × 2.5mm D (11/3447; F176 C1250) [Illus 6.1.10; Illus 5.7.9].

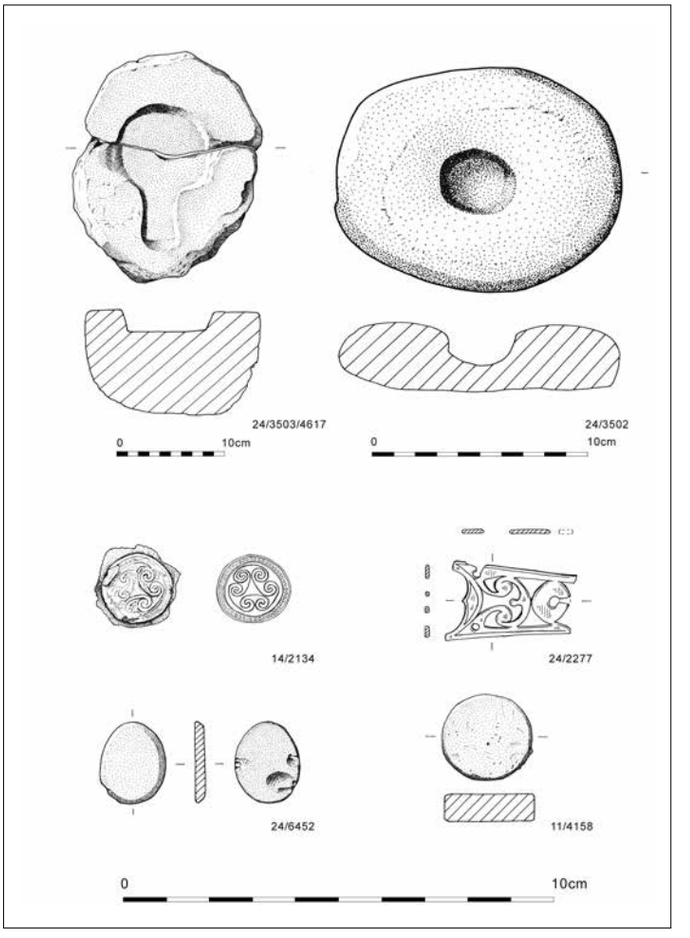

Illustration D6.1.12

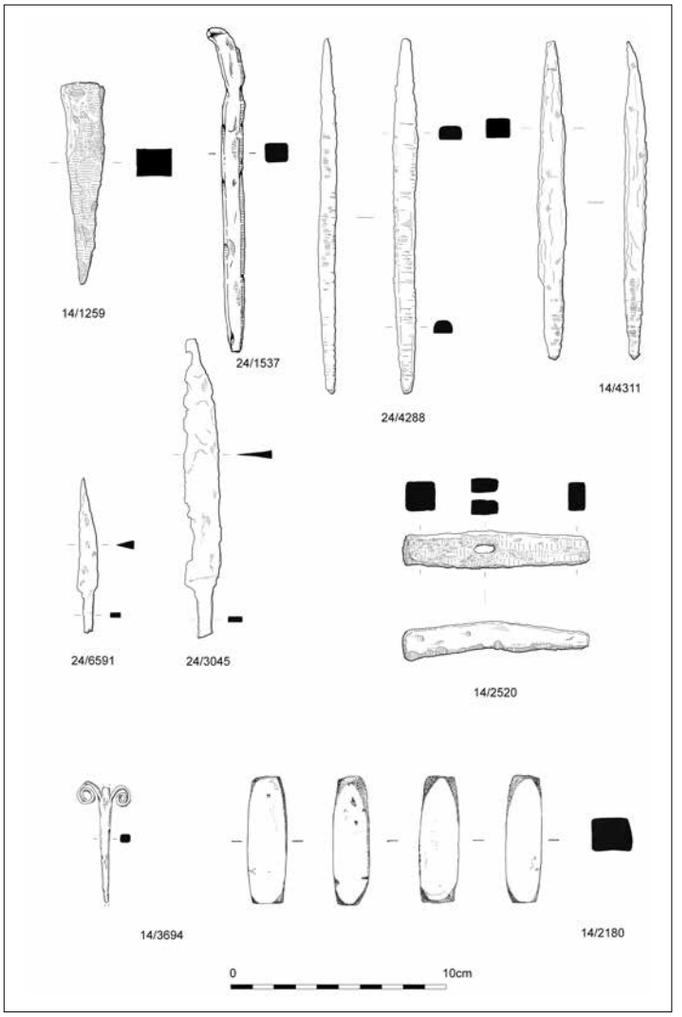

Illustration D6.1.13

Double triangular glass stud moulds on small drum of rolled clay, domed stud profile, mould 23mm L × 21mm W × 11.5mm Th, studs 5mm L × 5.5mm W × 2.5mm D (11/3447 and 3602; F176 C1250) [Illus D6.1.10; Illus 5.7.9].

Lower valve mould fragment for small buckle or link (11/3546; F176 C1250) [Illus D6.1.9].

Lower valve mould fragment for dress pin with possible horned head and collar (25/1401; F179 C1377) [Illus D6.1.9].

Lower valve mould for bar. The bar would measure min. 32mm L × 6.5mm W (25/860; C1002) [Illus D6.1.9].

Lower valve mould fragment for simple strap end and link (11/3643; F176 C1250).

Upper valve mould fragment for plain disc or rear valve of decorative escutcheon (11/3569; F176 C1250).

Complete lower valve mould for plain disc or rear valve of decorative escutcheon (25/1486; F179 C1377).

Lower valve mould fragments for plain disc or rear valve of decorative escutcheon (11/3548; F176 C1250).

Lower valve mould fragment for plain disc or rear valve of decorative escutcheon (25/759; F179 C1377).

Lower valve mould fragment for plain disc or rear valve of decorative escutcheon (25/761; F179 C1377).

Lower valve mould fragment for plain disc or rear valve of decorative escutcheon (25/899; C1002).

Lower valve mould fragment for plain disc or rear valve of decorative escutcheon (25/1433; F216 C1459).

Glass studs

Blue glass stud with silver wire inlay. Main body of stud is of cobalt blue bubbly transparent glass, with a Y-shaped inlay formed by three arcs of silver wire, filled with opaque whitish glass, now discoloured by corrosion, possibly originally red or yellow. Between the arms of the Y is another tripartite division formed by three zig-zags, also formed by silver wire. The circular border also holds silver wire. On the upper surface, the glass is decayed and devitrified in places, particularly the white, probably due to contact with the metal. The upper surface is convex, with vertical sides. The rear surface is not flat and has part of a flange and indentations showing where the soft glass was pushed into the mould. There is a small flake missing from one edge, 11mm Diam × 4mm Th (25/686; C1002) [Illus D6.1.10; Illus 5.7.10].

White glass stud with moulded decoration on upper face. Opaque white glass, with a few bubbles. The grooved decoration, 0.3mm wide and intended for silver wire inlay as in 25/686, consists of a Y-shape overlain by three curved lines forming a triangle with concave sides, all lying within a circular border. Upper surface convex, lower uneven with flange on one side, 5mm Diam × 1mm Th (25/1452; F216 C1459) [Illus D6.1.10; Illus 5.7.10].

Glass-working debris

Spall from lump of cullett. Pale blue transparent glass, surface opalescent, 20mm × 6mm × 3mm (11/362; C1002).

Irregular dribble of molten glass, colour varies from olive green to opaque yellow, irregular lumps of opaque yellow inclusions, 30mm × 4mm × 4mm (25/1385; F179 C1457).

Irregular rod of opaque yellow glass, broken at one end, rounded at the other; waste from trail production, 12mm × 2mm × 2mm (25/1458; F222 C1471).

Droplet of molten glass, broken, cobalt blue, very bubbly, abraded, 3mm × 3mm × 4mm (11/4136; F34 C1048).

Muscovite mica sheets: 16mm × 25mm (11/4467; F426 C1655); 14mm × 14mm (11/4468; F455 C1733); 13mm × 18mm (11/4469; F429 C1662); 18mm × 12mm (11/4470; F429 C1661).

Period 3 Scotto-Norse

Ninth-eleventh century (Chapter 6)

Objects from Period 3A contexts in Sector 2

Personal objects

Comb, probably antler. Connecting plate with one iron rivet, one perforation close to end. Not easily assignable to type; probably Type 2 (seventh–ninth century AD) or 7/8c (tenth–twelfth century AD). 47mm L × 12mm W × 2mm Th (24/48; C1284) [see Ashby in Digest 6.4].

Double-sided composite comb, antler, Type 11 or 12 (*c* seventh–ninth-century AD). Three fragments of connecting plate, four toothplates, 13 teeth (24/1548; C1284) [Illus D6.1.11; see Ashby in Digest 6.4].

Comb connecting plate, antler, from single-sided composite comb (Type 8a; *c* tenth–twelfth century AD), with five iron rivets, evenly spaced (*c* 25mm between each). Decorated with pair of central lines along apex. Decorative toothcuts, indicative of six teeth per cm. 113mm L × 13mm W × 4mm Th (14/271; C1002). [Illus D6.1.11; see Ashby in Digest 6.4].

Copper alloy stick pin with mushroom-shaped head incised with four lines, shaft decorated with spiral terminating in zig-zag, 87mm L × 9mm Diam (head) × 4mm Th (shank) (24/504; C1002) [Illus D6.1.11].

Copper alloy stick pin 105mm × 7mm Diam (head) × 3mm Th (shank) (24/4576; C1878) [Illus D6.1.11].

Copper alloy stick pin with faceted head and collar, 115mm L × 3mm Th (shank) (24/527; C1292) [Illus D6.1.11].

Decorated wound glass cylinder bead. Glass cobalt blue, very bubbly and streaky. Decorated with single marvered running swag trail, now completely decayed, but with traces of colourless glass, perhaps indicating original reticella twisted trail. H 7mm; Diam 8mm; hole Diam 4mm (24/4570; F432 C1877) [Illus D6.1.11; Illus 6.4; Campbell in Digest 6.7).

Bone pin, with ornate head 110mm L × 11mm W × 4mm Th (24/1548; C1284) [Illus D6.1.11; see Ashby in Digest 6.4].

Stone gaming board with unfinished incised layout; 200 × 132 × 17mm; (14/3932; C1660) [Illus 6.6; see Hall in Digest 6.18].

Stone lamp or mortar 110mm Diam × 57mm H × 35mm Th (24/6847; F149 C1415).

Iron pricket of three welded strips forming tapering shank and central spike, with curled arms 58mm L × 24mm W × 4mm Th (shank) (14/3294; C1663) [Illus D6.1.13].

Objects associated with working jet-like material [see Hunter in Digest 6.3].

Cannel coal bangle (24/2194; C1501) [Illus D6.1.11].

Bangle roughout, possible albertite (24/3591; C1538).

Gaming piece roughout, shale (14/4192; C2117).

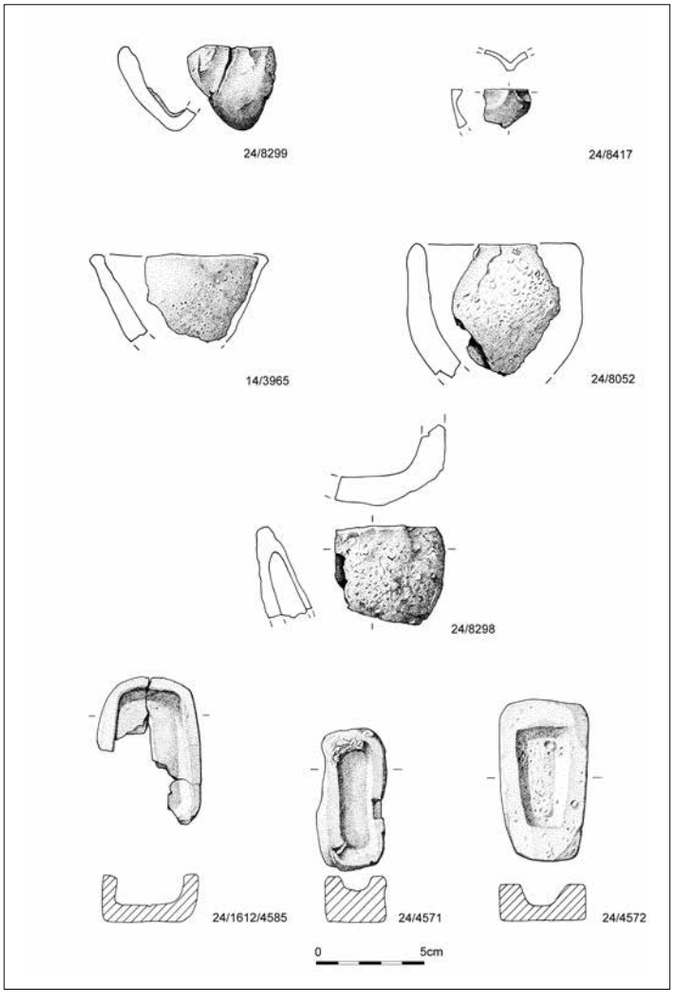

Illustration D6.1.14

Objects associated with metal and glass working in Sector 2 (excluding slag, for which see 6.9)

Painted pebble, small, quartzite, one side bears six small spots, the other a diamond enclosing two crossing lines, 17mm L × 16mm W × 9mm Th. From levelling over Period 2 strata (24/6297; C2578) [Illus D6.1.11; Illus 6.4].

Bodysherd of decorated glass vessel, yellowish-green colour. The decoration is a single reticella trail, of opaque yellow and transparent yellow-green, partially marvered. The yellow trails have bled into the body of the vessel forming a row of spots along both margins, 13mm L × 9mm W × 0.5mm Th, trail 3mm W, Diam of vessel (?)50–60mm (24/2885; C1501) [Illus 6.4].

Roman carnelian cabochon, oval with bevelled rear and three spalls from removal from setting on top face, 20mm L × 13mm W × 2mm Th, second century AD (24/6452; C2701) [Illus D6.1.12; Illus 6.4].

Silvered, copper alloy disc decorated with six interlocking C-spirals and pelleted border with riveted iron stud to rear, 16mm Diam (14/2134; C1225) [Illus D6.1.12; Illus 6.4].

Copper alloy complete but damaged fretwork mount, based on C-spiral with circular disc and connecting peltae to either side picked out with fine lines, peltae and disc marked by rivet holes, 29mm L × 15–20mm W × 2mm Th (24/2277; C1501) [Illus D6.1.12].

Oil lamp mould. Two conjoining fragments of complete oil lamp mould, red ferruginous sandstone, 220mm L × 168mm w × 100mm Th; lamp matrix 150mm L × 88mm W × 22mm deep (24/3503 and 4617; C1545) [Illus D6.1.12; Illus 6.15].

Fire-gilding mortar

Possible fire-gilding mortar, natural rounded flat pebble with small depression ground in, very smooth interior, surface heat-affected, 120mm L × 100mm W × 25mm Th; hole 30mm Diam × 20mm deep (24/3502; C1545) [Illus D6.1.12; Illus 6.15].

Tools

Iron whittle tang blade, 52mm L (blade) × 20mm L (tang) (24/6591; 2578) [Illus D6.1.13; Illus 6.17].

Iron whittle tang blade, 118mm L (blade tip missing) × 22mm L (tang incomplete) (24/3045; 1520) [Illus 6.1.13].

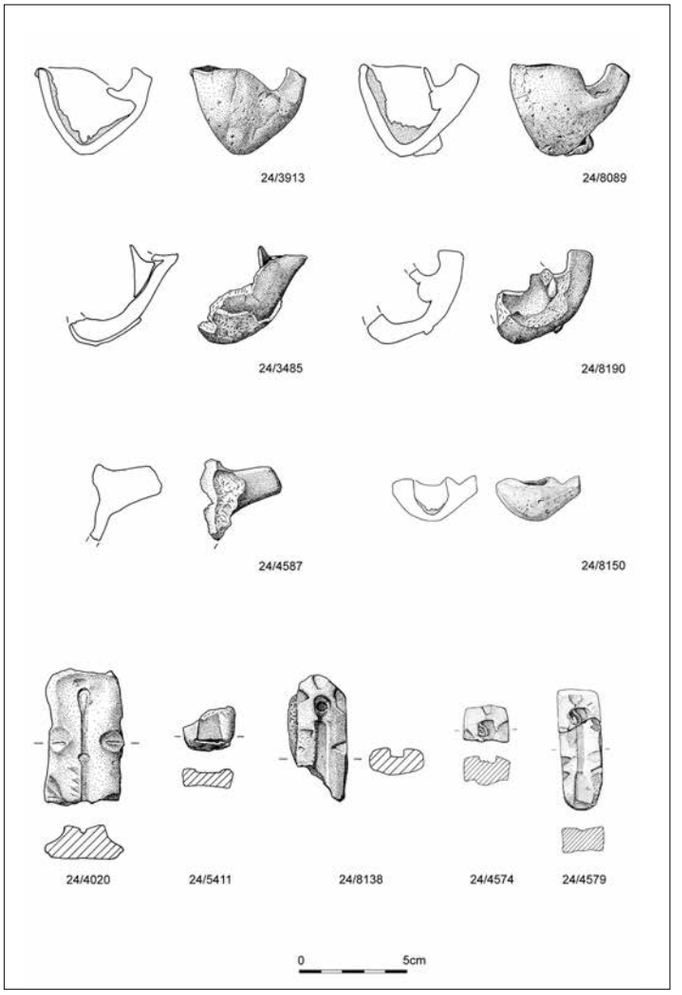

Illustration D6.1.15

Iron handled hook, broad curved hook with mineral-preserved wooded handle with clenched end, 220mm L × 100mm L (handle) × 8mm Th (hook) (24/4804; C1545).

Iron hammer head, sub-square and slightly burred face with chisel-shaped peen and sub-oval eye for a wooden handle, 86mm L × 17mm W × 12mm Th (14/2520; F199/1548) [Illus D6.1.13; Illus 6.17].

Iron punch, burred head, sub-square cross-section, 151mm L × 10mm W × 8mm Th (24/1537; C1419) [Illus D6.1.13; Illus 6.17].

Iron punch, slightly burred end, waisted, square cross-section, 95mm L × 20mm W × 16mm Th (head) (14/1259; C1002) [Illus D6.1.13; Illus 6.17].

Iron file, D-shaped in section, tanged with vestigial file teeth visible, 164mm L × 10mm W × 7mm Th (24/4288; C1613) [Illus D6.1.13; Illus 6.17].

Iron file, sub-square in section, tanged with vestigial file teeth visible, 147mm L × 11mm W × 10mm Th (14/4311; C1384) [Illus D6.1.13; Illus 6.17].

Touchstone (?), complete small rectangular form with rectangular profile made in dark metaquartzite 58mm L × 19mm W × 15mm Th (14/2180; C1607) [Illus D6.1.13].

Clay *tuyère*, complete. Wt 90.2g (24/7116; C2867) (OLA 7.1.6.4).

Crucibles [see Digest D6.5 and OLA 7.1.6.2 for details].

Type A1 (24/8299; 8417) [Illus D6.1.14].

Type A2 (24/8298; 8052; 14/3965) [Illus D6.1.14; Illus 6.9].

Type G (24/3485; 4587) [Illus D6.1.15].

Type G1 (24/3913; 8089; 8150; 8190) [Illus D6.1.15; Illus 6.9].

Type I crucibles or trays (24/4585 conjoins 1612; 4579; 4571; 4572) [Illus D6.1.14; Illus 6.9; Illus 6.14].

Moulds [see Digest D6.6 and OLA 7.1.6.3 for inventory]

Mould for possible dress pin of brooch-pin style (24/4020) [Illus D6.1.15].

Moulds for zoomorphic dress pins or stud-heads (24/4020, 5411; 8138; 4574; 4579) [Illus D6.1.15; Illus 6.10].

Mould for possible styli form dress pin (24/5411) [Illus D6.1.15].

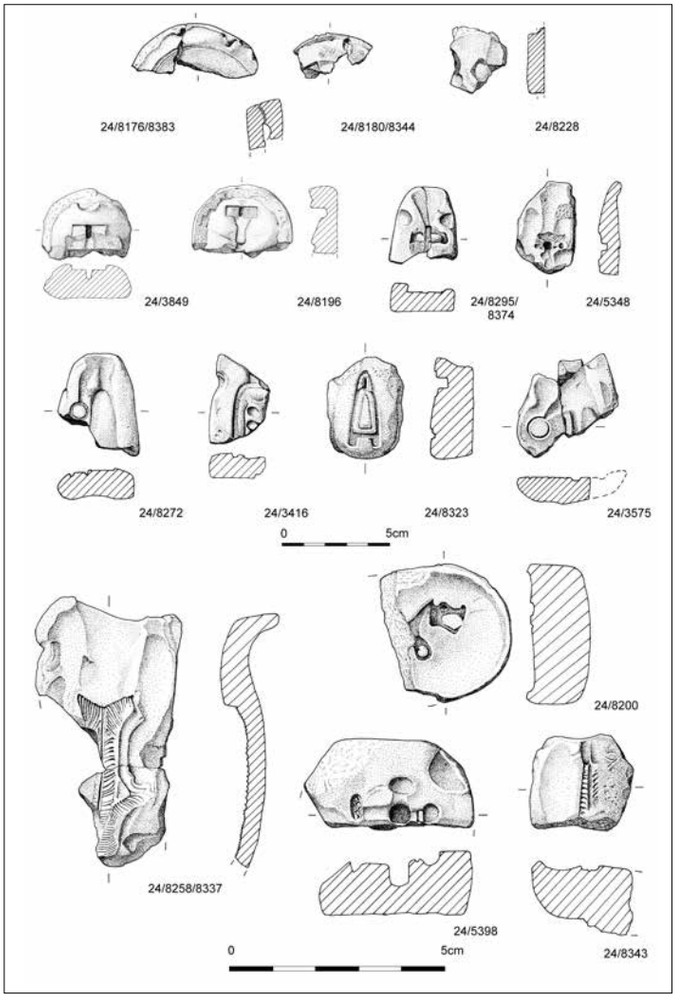

Illustration D6.1.16

Mould fragments for ?brooch (24/8344 conjoins 8180, unites with 24/8176, conjoins 8383) [Illus D6.1.16; Illus 6.11].

Mould for rings (24/8228) [Illus D6.1.16].

Moulds for buckle plates? (24/3849; 8196; 8374) [Illus D6.1.16].

Moulds for belt fittings? (24/5348; 8323) [Illus D6.1.16].

Moulds for strap ends (24/3575; 8727; 3416) [Illus D6.1.16].

Moulds for zoomorphic mount – dragon (24/8200) [Illus D6.1.16; Illus 6.13a].

Moulds for zoomorphic mount – fish. Two conjoining fragments of upper valve bear the part matrix of a fish with symmetrical tail, part body and fin defined by parallel ridged decoration. (24/8258 conjoins 8337) [Illus D6.1.16; Illus 6.13b].

Mould for zoomorphic mount consisting of an upper valve with the impression of a tapering strip with gilled decoration from a central spine leading to possible animal-head terminal (24/8343) [Illus D6.1.16].

Lower valve with part object (24/5398) [Illus D6.1.16].

Moulds for finger rings (24/8368; 4573; 5410; 8121; 8432) [Illus D6.1.17].

Matrices for rings (14/371 and 3736; 24/1310; 3850; 4734; 5440, 5770; 8107; 8219; 8236; 8287).

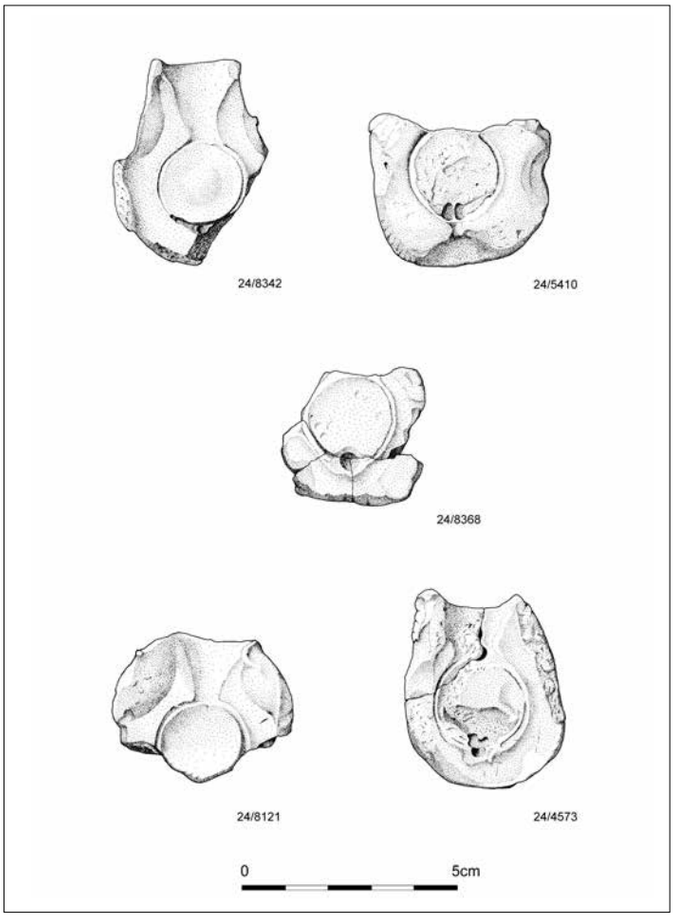

Illustration D6.1.17

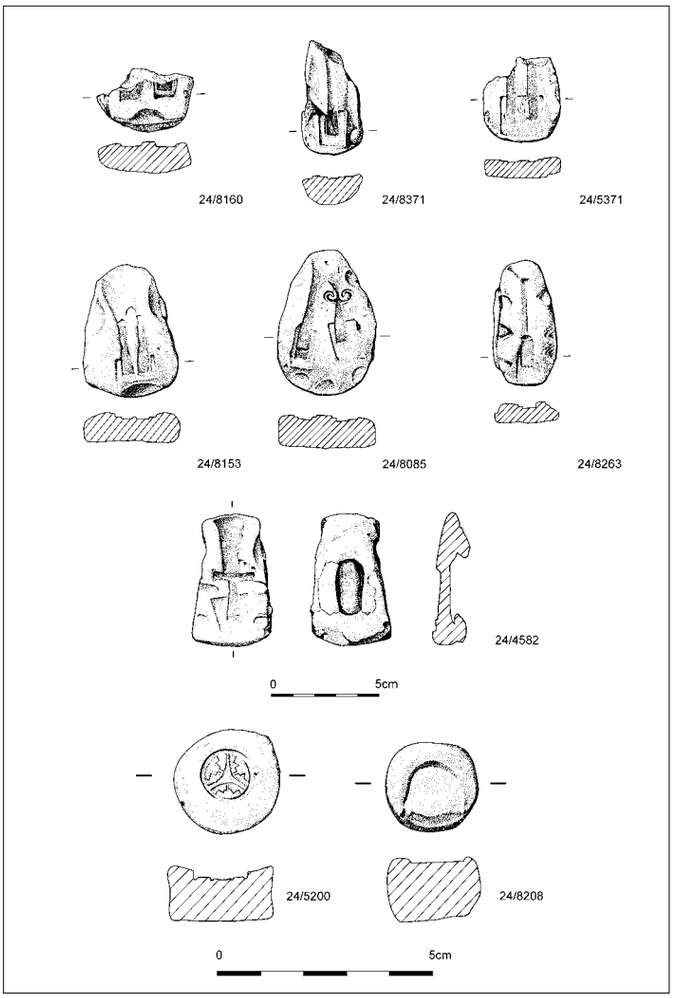

Illustration D6.1.18

Moulds of tabbed objects (24/8106; 8372; 5371; 8020; 8153; 8085; 8263; 4582) [Illus D6.1.18].

Mould for a glass stud, elaborately decorated and bears the matrix of a small circular stud containing a tripartite Y-shape division and three pairs of stepped lines radiating from the centre, 24mm Diam Stud 12.5mm Diam (24/5520) [Illus D6.1.18; Illus 6.16].

Mould for a glass stud, badly eroded shallow, small oval matrix measuring 11mm × 9mm (24/8208) [Illus D6.1.18].

Moulds for weights

Weight moulds of Type A (24/8195 conjoins with 8221; 24/8172 unites with 8270; 24/8319 unites with 8292; 8086; 8273; 8130) [Illus D6.1.19; Illus 6.14].

Weight moulds Type B (24/8194; 8152; 8206) [Illus D6.1.20; Illus 6.14].

Stone ingot moulds

Flat sandstone tablet with part elongated sub-rectangular ingot, heat affected, medium to coarse-grained, red, ferruginous sandstone,

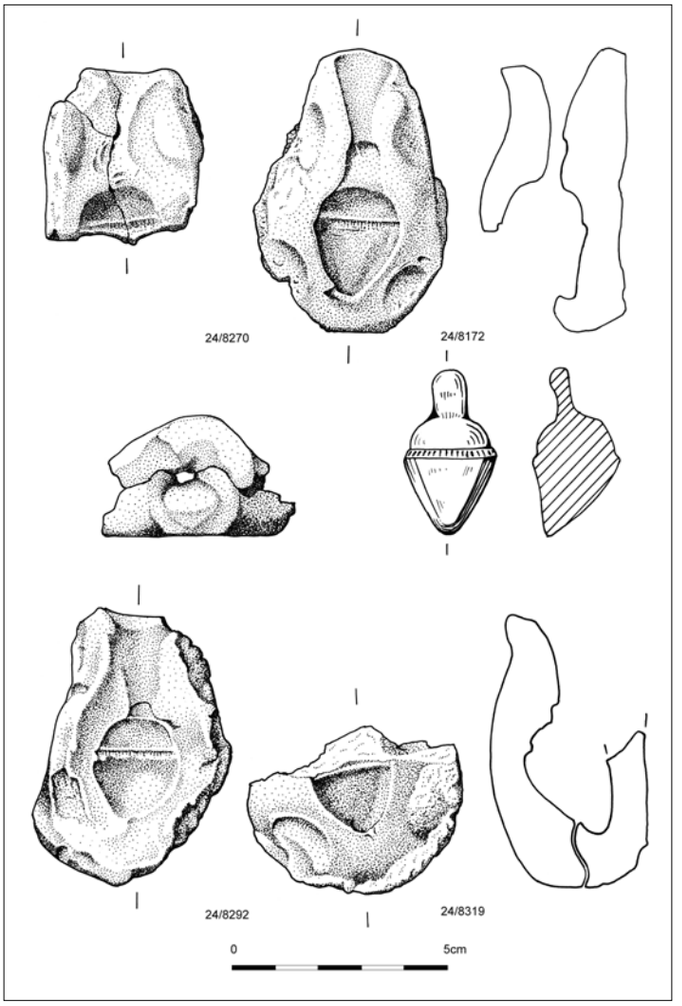

Illustration D6.1.19

100mm L × 60mm W × 18mm Th; ingot min. 92mm L × 10mm W × 2mm deep (24/3505; C1538) [Illus 6.15].

Three conjoining pieces of broken natural flat elongated sandstone pebble with double ingot mould matrix (24/4594 and 4618; C1501 and C1545) [Illus 6.15].

Flat, thick trapezoidal sandstone ingot mould with complete ingot matrix, heat affected, two damaged corners, possible vestiges of ingot matrix on reverse, medium to fine-grained, buff, ferruginous, sandstone, 120mm L × 60 to 30mm W × 35mm Th (24/4619; C1545) [Illus 6.15].

Roughly shaped tile of sandstone with small, shallow oblong ingot matrix, heat affected, fine to medium-grained, buff, ferruginous sandstone, 97mm L × 80mm W × 23mm Th; matrix 55m × 8mm × *c* 2mm deep (24/7849; C3581).

Two conjoining fragments of faceted sandstone slab with sub-circular shallow matrix measuring 59mm Diam, possibly heat-affected interior, medium to fine-grained, buff sandstone, 120mm L × 78mm W × 26mm Th (24/7846 and 7900; C3478 and C3581).

Lead weight retrieved from plough by a metal-detectorist in Sector 1, at the north end. Cylindrical in shape, Wt 26.3g, 21.8mm Diam × 7.1mm Th (11/4158) [Illus D6.1.12].

Rotary quern re-used in flue of S1 (11/627; F79 C1106) [Illus 6.20b].

Period 4 Medieval

Twelfth–sixteenth century (Chapter 7)

[Medieval pottery, see Digest 6.15].

[Coins, see Digest 6.14].

Fishing equipment [Illus D6.1.21]

Iron netting tool, complete with forked point and drop-shaped eye handle, 114mm L × 12mm W (head) × 8mm Th (shank) (24/611; C1345) [Illus 7.28].

Iron fish hook 115mm L × 5mm Th (24/896; C1376).

Iron barbed fish hook fragment, 35mm L (24/1882; C1421).

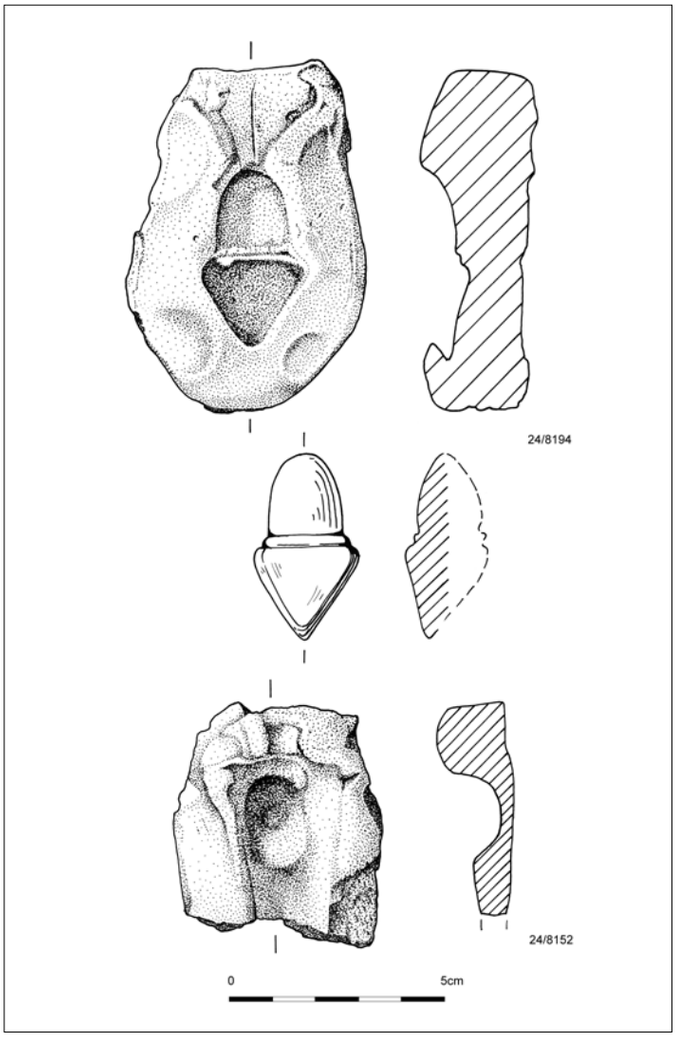

Illustration D6.1.20

Iron barbed fish hook, 75mm L × 2mm Th (shank) (24/2665; C1462).

Lead fishing weight retrieved from ploughsoil by metal-detectorist in Sector 2 (24/4650) [Illus D6.1.21].

Lead fishing weight retrieved from ploughsoil by metal-detectorist in Sector 2 (29/40) [Illus D6.1.21].

Objects associated with metalworking in Sector 2

Grindstones

Grindstone, smoothed from use, with part of central square hole. Reconstructed Diam 328mm × 72mm Th (24/1659; F137 C1332) [Illus D6.1.22].

Grindstone, fragment of edge, smoothed from use. Reconstructed Diam 240mm × 80mm Th (24/2175; C1339) [Illus D6.1.22].

Grindstone, large fragment with edge and central hole with iron staining. Reconstructed Diam 260mm × 55mm Th (24/2196; C1342) [Illus D6.1.22].

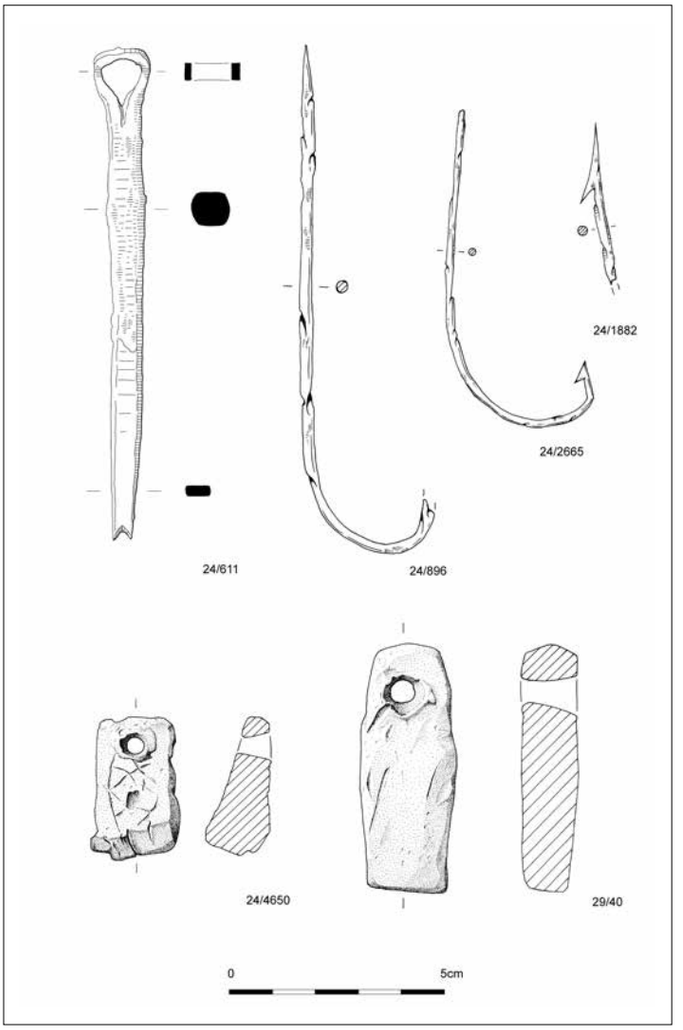

Illustration D6.1.21

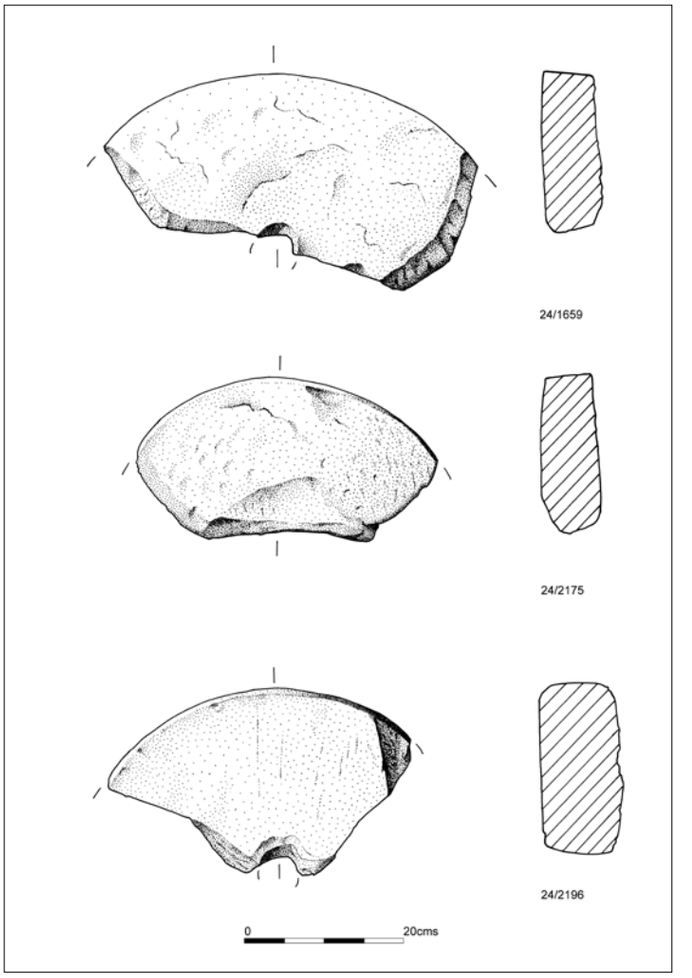

Illustration D6.1.22

Mortar

Two conjoining halves of complete large stone mortar or metal-working mould for wrought sheet-working, made from pecked large natural cobble of medium to fine-grained, buff, ferruginous sandstone, with circular depression and four corresponding channels in rim, all heat-affected, 208mm Diam × 119mm H, depression 110mm Diam × 50mm H (14/1480 and 1577; C1099).

Horse equipment [Illus D6.1.23]

Iron horseshoe, Clark Type 4, complete, branch badly corroded, four tapering, sub-square nail holes on quarter, ?three on branch, plain heel, right-angle calkin, nails in situ, 140mm L × 120mm W × 7mm Th (24/2514; C1343).

Iron horseshoe, Clark Type 4, toe, quarter and heel, four tapering, sub-square nail holes on quarter, one further surviving on toe, plain heel, 120mm L × 120mm W × 7mm Th (24/2871; C1462).

Iron horseshoe, small Clark Type 3, branch, toe – very worn – and part quarter, three nail holes on branch, at least three on quarter, right-angled calkin, 95mm L × 96mm W × 8mm Th (24/3019; C1462).

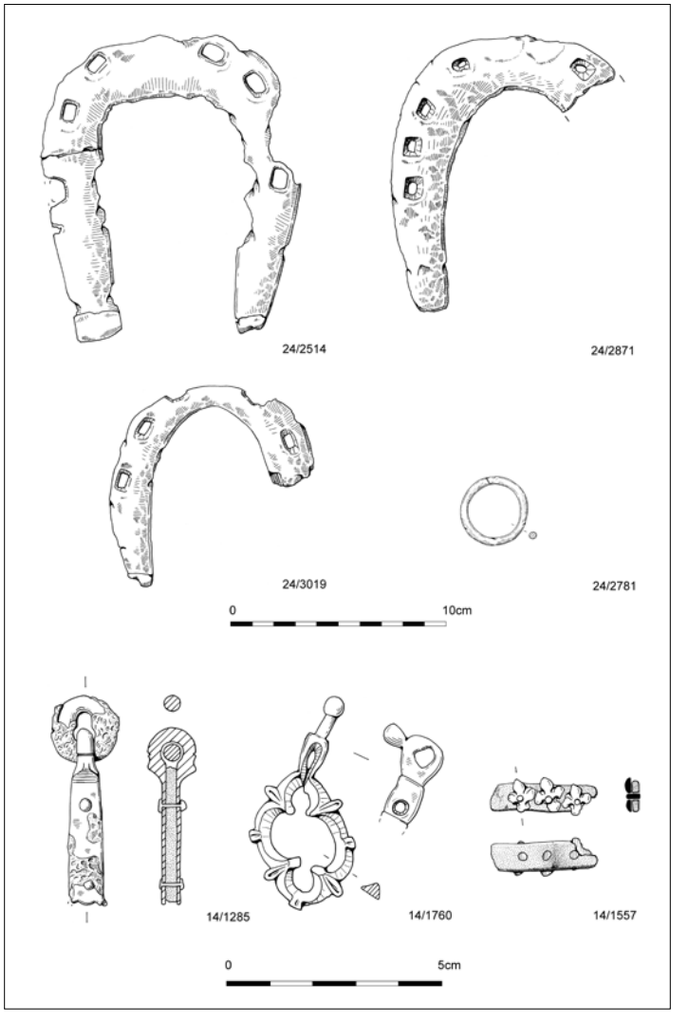

Illustration D6.1.23

Iron ring, possibly snaffle cheek piece. 32mm Diam (24/2781; C1462).

Leather spur strap with three copper alloy fleur-de-lys mounts 24mm L × 8mm W (14/1557; C1008).

Copper alloy link and strap connector with mineral-preserved leather strap 50mm L × 8mm W (14/1285; C1002).

Harness pendant; copper alloy, quatrefoil openwork pendant with angular projections and drilled hole for swinging from suspension mount (14/1760; C1153).

Domestic items [Illus D6.1.24]

Sliding bolt for casket, iron 73mm L (14/1267; C1002).

Pricket, iron, welded strips one with folded terminal. 102mm L × 15mm Th (14/1628; C1099).

Personal Items

Iron key with cruciform ward and simple slot cut into bit, hollow stem flush with bit, part shank and bow missing, 62mm L × 27mm W × 17 (bit) × 5mm Th (stem) (24/412; C1242).

Iron key, brassed, notched ward (25/511; C1002).

Pin, copper alloy, wire-wrap headed 58mm L (15/2; C1003).

Pin, silver, wire-wrap headed 31mm L (15/4; F17 C1020).

Pin, silver, wire-wrap headed 24mm L (15/112; C1025).

Pin, silver (15/25; C1020).

Buckle and plate, copper alloy, wire-wrap headed, 21mm L (14/485; 487; C1002).

Zoomorphic oval buckle, copper alloy, 37mm L × 27mm W × 2mm Th (25/750; C1000), retrieved from ploughsoil by metal-detectorist in Sector 1.

Strap end, copper alloy, paired sheet plates, one side with chip carved line decoration and decorative terminal, 40mm L × 17mm W (11/4552; C1000).

Bar mount, copper alloy, with D-shaped cross-section and two copper alloy rivets in situ 16mm × 4mm (14/1279; C1002).

Bar mount, copper alloy, with D-shaped cross-section and two copper alloy rivets in situ 13mm × 3mm (14/1449; F2 C1004).

Strap connector, copper alloy, strip folded and with two rivet holes, decorated with punched zig-zag of double dot rows 28mm L × 8mm W × 0.5mm Th (11/659; C1002).

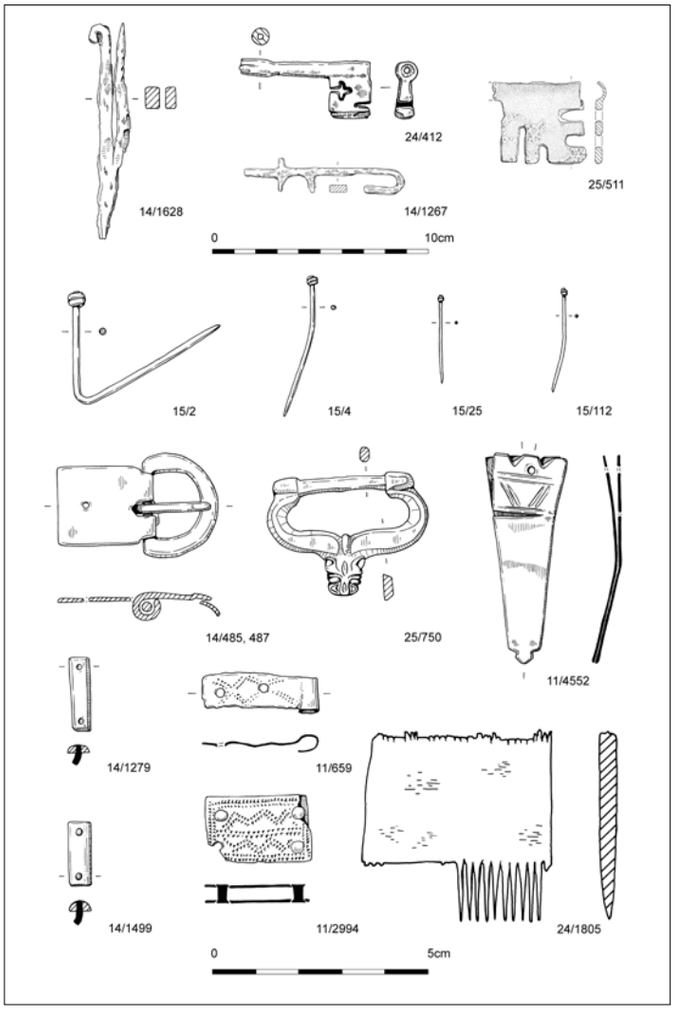

Illustration D6.1.24

Belt fitting, copper alloy, two rectangular sheets connected by four rivets, three in situ, decorated with punched zig-zag and lines of double dots, from same item as 11/659 (11/2994; C1002).

Comb, bone, miniature. Type 14b (*c* fifteenth century or later) W 23mm H 24mm Th 4.2mm (24/1805; C1000) [Illus D6.1.24]. See Ashby in Digest 6.4.

Glass hanging lamp

Fragment of rounded vertical rim from a hanging lamp, potash-rich glass, Diam uncertain, thirteenth–fifteenth century (17/168; F51 C1153) [see Wilmott in Digest 6.15].

Rotary querns

Fragment of upper rotary quernstone; garnet mica schist; 330mm Diam × 50mm Th (14/1696; F2 C1125) [Illus 6.1.25].

Small fragment of upper rotary quernstone with part central and handle hole, garnet mica schist, *c* 250mm Diam × 30mm Th (14/1938; F121 C1329) [Illus 6.1.25].

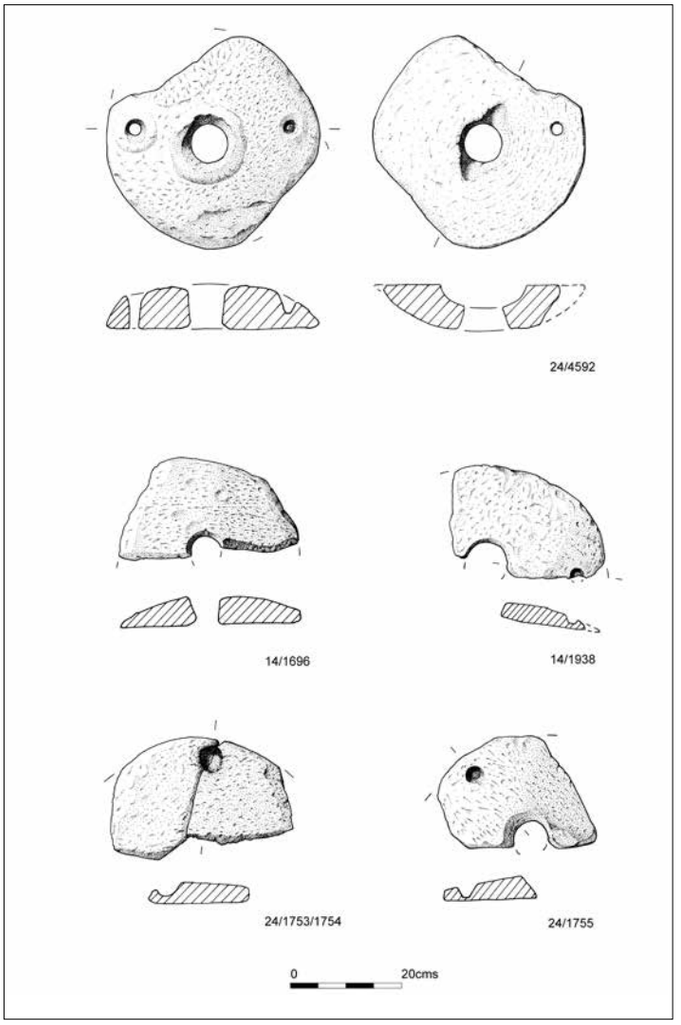

Illustration D6.1.25

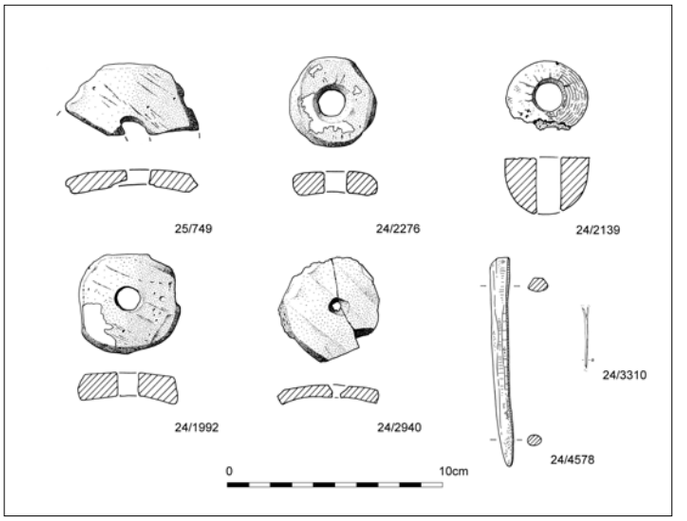

Illustration D6.1.26

Four fragments of two conjoining pairs of ?lower rotary quernstone, garnet mica schist, *c* 300mm Diam × 40mm Th (14/1947; 1999; 2000; 2001; C1074).

Fragment of upper rotary quernstone, garnet mica schist, 460mm L × 330mm W × 40–110mm Th (24/1755; C1280) [Illus 6.1.25].

Fragment of upper rotary quernstone with handle hole, garnet mica schist. 300mm L × 220mm W × 50mm Th (24/985; C1000).

Near-complete upper rotary quernstone with two handle holes and central hole with notched underside, mica schist. Reconstructed Diam 380mm × 30–70mm Th; central holes 80mm Diam narrowing to 60mm Th (24/4592; C1326) [Illus D6.1.25; Illus 7.28].

Two conjoining fragments of upper rotary quernstone, coarse-grained garnet mica schist, 190mm L × 190mm W × 30mm Th (24/1753 and 1754; C1280).

Three small fragments of upper rotary quernstone, coarse-grained garnet mica schist. Reconstructed Diam 340 × min. 25mm Th (24/1756 and 1757; C1280).

Possible fragment of lower rotary quernstone, coarse-grained sandstone conglomerate, 320mm L × 250mm W × 60mm Th (24/1451; F92 C1369).

Textile-working

Spindle whorl of re-used sherd of Scottish Redware ceramic, central drilled cylindrical perforation 10mm Diam whorl 45mm Diam × 10mm Th (24/1992; C1483) [Illus D6.1.26].

Spindle whorl, made from cattle femur head central cylindrical perforation (not hour-glass-shaped) of 13mm Diam, 37mm Diam × 23mm H (24/2139; C1000) [Illus D6.1.26].

Spindle whorl of re-used sherd of Scottish Redware ceramic, central drilled perforation 12mm Diam 40mm Diam × 11mm Th (24/2276; C1284) [Illus D6.1.26].

Spindle whorl of re-used sherd of Scottish Redware ceramic, 44mm Diam × 6mm Th (24/2940; C1378) [Illus D6.1.26].

Half-fragment of spindle whorl of re-used sherd of Scottish Redware ceramic, central drilled perforation 7mm Diam, reconstructed Diam whorl 48mm × 6mm Th (24/1366; C1378).

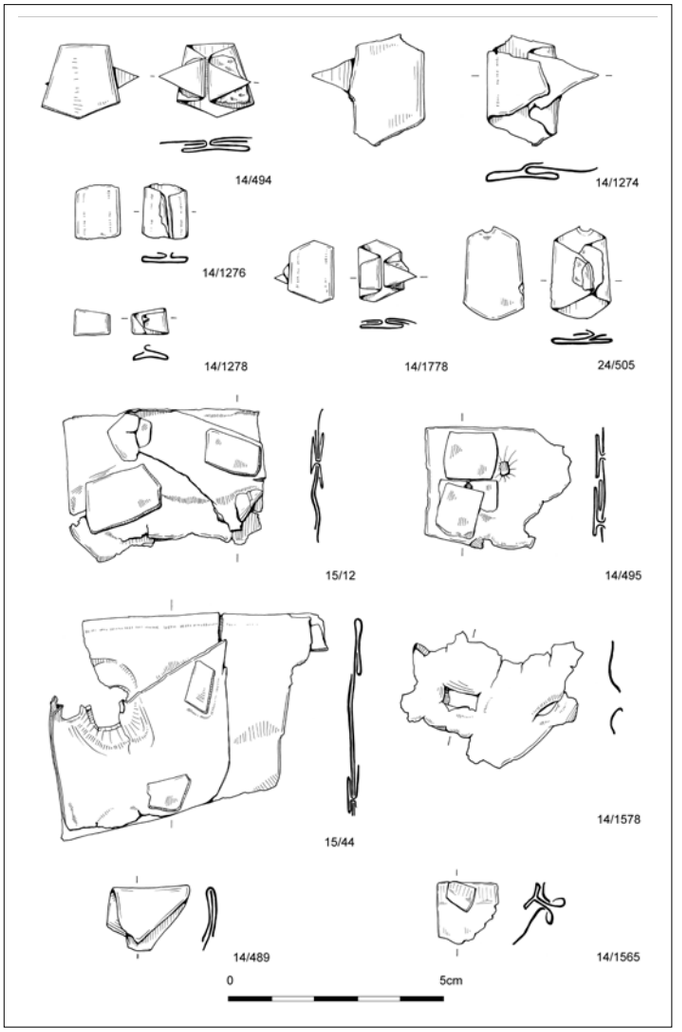

Illustration D6.1.27

Half-fragment of spindle whorl of re-used sherd of Scottish Redware ceramic, central drilled perforation 10mm Diam, reconstructed Diam whorl 64mm × 9mm Th (25/749, C1000) [Illus D6.1.26].

Picker-cum-beater, probably red deer antler, curved profile, slightly faceted section, 97 × max 6mm Th (24/4578; C1877) [Illus D6.1.26].

Iron needle, eye damaged, tip missing, 29mm L (24/3310; C1408) [Illus D6.1.26].

Boots and hose (17/367; Burial 43 F83 C1228)

Boots: Two turnshoes, with an upper attached to a single sole with an edge-flesh seam. 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, fifteenth century [see Thomas in Digest 6.16; OLA 7.1.9].

Hose: Fragments of a yellowish-fawn textile were found in association with the leather shoes. The textile is a heavily felted wool tabby. fifteenth century (ie plain weave) [see Walton Rogers in Digest 6.14; OLA 7.1.10].

Tinkering waste [Illus D6.1.27 *illustrated]

Copper alloy vessel rim fragment (14/492 C1002).

Copper alloy paperclip rivets (14/494* C1002; 14/1274* C1002; 14/1276* C1002; 14/1278 C1002; 14/1778* C1094; 24/505* C1002).

Copper alloy vessel repair patches (14/489* C1002; 14/1563 C1007; 14/1565* C1008; 14/1578* C1097) 15/12* C1018; 15/44* C1025; 24/56; C1242).

Copper alloy folded sheet scrap (14/1562 C1007; 14/1561 C1007; 14/1579 C1079.

Leaded copper alloy waste dross (14/1868 C1175).

Copper alloy droplet (14/1813 C1071).

Copper alloy folded sheet waste (14/1903 C1094).

Copper alloy waste dross (14/1448 C1002; 14/1501 C1002; 14/1503 C1002; 14/1505 C1004; 14/1560 C1008; 14/1815 C1204).

Copper alloy sheet scrap (14/60 C1002; 14/61 C1001; 14/490 C1002; 14/493 C1002; 14/500 C1002; 14/511 C1002; 14/1275 C1002; 14/1277 C1002; 14/1498 C1002; 14/1504 C1002; 14/1506 C1004; 14/1555 C1006; 14/1558 C1008; 14/1559 C1008; 14/1564 C1008; 14/1570 C1008; 14/1892 C1072; 24/1 C1002; 24/19 C1002; 24/57 C1002; 24/1540 C1409).

Digest 6.2 AN EIGHTH-CENTURY COIN FROM PORTMAHOMACK

MARK BLACKBURN† (Fitzwilliam Museum, Cambridge)

The discovery of a small eighth-century coin in the 1998 excavation season has a significance that is far wider than the light it sheds on the settlement at Portmahomack, for it is the most northerly pre-Viking coin from the British Isles.

Throughout the early Middle Ages, Scotland was essentially without coinage – the first coins produced in Scotland were struck for David I (1124–53) – although the Vikings, who were used to using a mixture of silver coin and bullion in Scandinavia, brought this practice to the areas of Norse settlement, principally in the Northern and Western Isles. Before the first chronicled raids on the British Isles – starting in AD 789 – only a very few Anglo-Saxon and related coins reached Scotland, and those have all been found south of the Firth of Forth. They form two groups, one from the south-west (Whithorn Priory and nearby Mochrum) and the other the south-east coast (Aberlady and Dunbar). The Tarbat find is, then, a good 220km further north than Dunbar as the crow flies, or more than 300km as one would sail around the coast.

Significantly, the Tarbat coin was produced not in England, but in the Low Countries. It is of the very plentiful variety of early penny known as the 'Porcupine' type, named after the enigmatic design on the obverse, which summons up connotations of quills bristling from a curved back. Within the 'Porcupine' type (Series E), the Tarbat find belongs to the middle phase dated AD 715–35. Coins of this phase have been found mainly in Frisia and the lower Rhineland, where they are thought to have been made. At least 780 specimens were present in the Kloster Barthe hoard in eastern Frisia and there were some 400 examples among the prolific site finds from Domburg, a port in the Rhine mouth, but they also reached England and Merovingian France in fair numbers.

The interesting question to ponder is how did this Continental coin reach the Tarbat peninsula? By sea, of course; but was it in a ship plying across the North Sea and up the Scottish coast, or had the coin already reached England and circulated there before moving northwards up the coast? The chances weigh quite strongly in favour of direct shipment, for in England in the 720s, Continental coins would have been a minority. The argument is reinforced by the Dunbar find, which was also a Continental issue, in this case of the 'Woden/Monster' type (Series X) from western Denmark (EMC 1999.0148). Together these two finds – the most northerly from the British Isles – provide important evidence for contact between eastern Scotland and the Continent, fifty years or more before the traditional date for the beginning of the Viking Age.

Context

From a Period 3 pit (F185). The 3-D position of the find and subsequent sequencing of strata suggests that the coin had been redeposited from layers cut by the pit and assigned to the make up or use of the Period 2/3 road S13 (OLA 6.2.1/3.3; 1.2.3, p 32). But its precise original context remains unknown. The coin dates to *c* AD 715–35.

Editor's Note

After the sad death of Mark Blackburn, an update on the Portmahomack sceatta was sought from Dr D M Metcalf. He kindly reported that in a recently published corpus of 3,500 specimens (Metcalf & Op den Velde 2009, 2010) the coin is classified as a Series E secondary phase variety *c* Metcalf notes that the bold dots at the root of the 'quills' are an irregular and unusual feature, suggesting the coin might be an imitation. He examined the coin to see if there was a test cut across the raised parts of the design, which would indicate that the coin had been in Scandinavia, but such signs were missing. He concluded that 'where the coin originated we cannot say' (pers comm 1 December 2014).

Reference

Metcalf, D M & Op den Velde, W 2009, 2010 *The Monetary Economy of the Netherlands c 690–c 760 and the Trade with England. A Study of the 'Porcupine' Sceattas of Series E.* Vols 96 and 97. Netherlands: Jaarboek voor Munt- en Penningkunde.

Digest 6.3 THE JET-LIKE MATERIAL

FRASER HUNTER (National Museums of Scotland)

Tarbat produced a small but interesting collection of six black organic-rich stone finds which indicate on-site working of this material. There are three broken fragments of unfinished bangle roughouts (24/3591, Period 3; 24/6238, unstrat; 24/6237, ?Period 2) and a discoidal roughout probably intended for a gaming counter (24/2117; Period 2). A further object is a bangle that had been reshaped after breakage, probably for use as a pendant, although it was abandoned before completion (24/5078). The quantities are small and scattered, but clearly indicate on-site working beyond the excavated area. From their visual characteristics a range of raw materials is represented. The shale and cannel coal are likely to come from the Brora shale deposits, only 15km away across the Dornoch Firth; this is the only local source of such raw materials (Gibson 1922, 32–6), although they have not yet been analytically discriminated. More unusual is the highly compact black material with a clean conchoidal fracture, represented by 24/3591 and 6238; this is visually similar to albertite, known from Strathpeffer (Sheridan et al 1998, 127).

Such black organic-rich stones were popular for jewellery in the early medieval period in areas where the raw material was available, as they could readily be polished to take a fine shine. The tradition was a long-lived one, continuing from later prehistory. It was common on both religious and secular sites (Hunter 2008, 200–2); the availability of the raw material at Brora created a local hotspot for its use in eastern Sutherland and neighbouring areas. Analysis of early medieval material from the Clyde estuary suggested that the religious sites were producer rather than consumer centres (Hunter 2008, 202, fig 6.51); the Tarbat evidence supports this model, as one of the two finished items was in the course of being reworked. Unfortunately, insufficient survives to characterise the production technology in detail.

Catalogue

24/2194

Bangle fragment, D-sectioned, the interior slightly rounded; well finished and polished to a high lustre, with fine abrasion scratches from polishing. Material: black, compact, laminar structure, conchoidal fracture; probably cannel coal. 70.5mm L × 8.5–0.5 W × 10–10.5mm H; internal diameter 60–65mm (35% surviving) (C1501; Period 3 dumping over boundary wall) [Illus D6.1.11].

24/3591

Working debris. Accidental flake from a part-prepared roughout, preserving the natural face and two perpendicular sides rounded by cut facets; the corner has also flaked off accidentally. The fragment probably broke off while making the perforation, as the inner edge is curved in plan and worked by chisel-like vertical cuts. The curve suggests it was a bangle roughout. Material: black; conchoidal fracture with little 'scallops'; perhaps albertite. 43.5mm × 24mm × 23.5mm Th (C1538; late Period 3 dumping over boundary wall).

24/4192

Discoidal roughout, probably for a counter or gaming piece. Rather faceted in plan, with the vertical edges and faces abraded. A small protruding crystalline inclusion is central to one face; the positioning suggests this is unlikely to be accidental, and it was probably incorporated as a deliberate feature. This would suggest there was no intention to perforate the piece, and indeed at this stage in finishing a perforation would normally have been started, so a role as a counter or gaming piece is most likely. The abrasion traces show it was unfinished. Material: laminar nature indicates it is shale. Diam 30.5mm, Th 7.5mm (C2117; Period 3 dumping in eastern roadside ditch).

24/5078

Bangle fragment reworked after breakage. D-sectioned, well-rounded bangle with some residual circumferential polishing scars. The bangle split horizontally and was modified for re-use, with the ends neatly cut square and one of them collared; further reshaping was in progress when the piece was abandoned, with circumferential facets cut from the outer edge and along one inner edge. It was perhaps intended as a pendant. Deep scallops along the facets are probably natural conchoidal fractures as the piece was worked. The fracture pattern and deep black colour suggest it is a cannel coal, slightly laminar in nature. L 30mm, W 10mm, Th 8*mm, internal diameter 55–60mm (14% survives) (C1000, ploughsoil).

24/6237

Fragment from a part-prepared squared roughout with parts of three surviving edges: one naturally rounded, one flaked, one flaked and knife-trimmed. Some slight abrasion on surviving face; other lost. Laminar, coarse – shale? 48.5mm × 28.5*mm × 11.5*mm (C2074, early Period 2 construction dumps at base of boundary wall; residual from Period 1 or early Period 2).

24/6238

Accidentally broken roughout, irregularly fractured with no original edges, but one of the faces preserves what is probably a curving incised marking outline. Too little survives to estimate its diameter accurately, but the size indicates it was intended for a bangle. This surface has been abraded to smooth it; only a little of one surface survives, but remains of abrasion indicates it was original; this preserved width indicates the bangle would be rather narrow. Material: black, conchoidal fracture, very like 3591; perhaps albertite. 28mm × 18.5mm × 7.5mm Th (C1002, ploughsoil).

References

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Sheridan, A, Davis, M & Hunter, F 1998 'Objects of cannel coal and similar materials', *in* McCullagh, R P J and Tipping, R (eds) *The Lairg Project 1988–1996: the Evolution of an Archaeological Landscape in Northern Scotland*, 123–7. Edinburgh: STAR.

Digest 6.4 BONE AND ANTLER OBJECTS

STEVE ASHBY (University of York)

1.0 Introduction

A small group of bone and antler artefacts (thirty-four individual objects) were recovered from excavations at Portmahomack. Most date to the early medieval period, and they provide an interesting insight into activities that took place on, or close to, the site. The objects may be broadly divided into three categories: personal items, those that relate to particular crafts or activities (textile manufacture, vellum production, and writing) and a number of 'miscellaneous' items for which no single function can be confidently asserted. Below, each of these categories of object is catalogued and discussed in turn, before the implications of the collection as a whole are discussed.

2.0 Personal items

2.1 Combs [Illus D6.1.11]

Of the six combs and fragments from Portmahomack, three that are sufficiently well preserved for discussion fit easily into an early medieval (Anglo-Saxon and Pictish) tradition. Though fragmentary, they comprise combs that are probably of Types 11/12, 2a/b, and 8a (dating broadly between the seventh and twelfth centuries; Ashby 2006; Ashby 2007; Ashby 2011). 24/1805 is probably best explained as a later medieval one-piece comb (Type 14b) than as the toothplate from an early medieval composite form.

As far as is visible – and with the possible exception of 24/1805 – the combs seem to be manufactured in antler (probably red deer, though this could not be confidently ascertained in most cases) rather than post-cranial bone. The process by which composite combs are manufactured has been detailed elsewhere (see Ambrosiani 1981; Galloway & Newcomer 1981; Ulbricht 1978; cf Ashby 2013) and herein it suffices to say that the Portmahomack examples were fabricated through the assembly of several small toothplates and pairs of longer connecting plates, these being fixed together with a rivet at every other toothplate edge (what I have termed elsewhere the 'alternating-edge' method), as seems to have been the tradition in early medieval England and Scotland (see Ashby 2011). The combs are unornamented or simply decorated with incised motifs such as cross-hatch and opposing obliques. Microscopic analysis of surviving teeth demonstrates the presence of low-level beading and striation, suggesting that these combs were used, but in the absence of experimental investigations into use wear, it is impossible to quantify the extent or intensity of use that these phenomena represent.

24/1548 Composite comb

Antler. Fragmentary. Three fragments of connecting plate, four toothplates. Double-sided, composite, type 11 or 12 (*c* seventh–ninth century AD). Connecting plates straight in profile and flat in section, and decorated with sawn cross-hatch ornament. Connecting plate edge features decoratively sawn toothcuts. Thirteen teeth remain partially complete and show evidence of minor wear in the form of transverse striations. Teeth are undifferentiated and arranged with five teeth per cm on each edge. Iron rivets. Connecting plate attached to one toothplate by a rivet at one edge. Two other toothplates indicate 'alternating edge' riveting, while one features staining on both edges; this may have been positioned centrally, next to the endplate, or simply represents a repair. Not measured: fragmentary (C1284).

24/1805 Simple comb

Probably postcranial bone. Very fine one-piece miniature comb (no evidence of rivets), Type 14b (*c* fifteenth century or later). Bone. Teeth undifferentiated; fourteen teeth per cm. Ten complete teeth preserved, 8mm long. Central area between teeth is 16mm in height. 23mm W × 24mm H × 1.8mm Th (C1000).

14/271 Comb connecting plate

Antler. From a single-sided composite comb (Type 8a; *c* tenth–twelfth century AD). Five iron rivets, evenly spaced (*c* 25mm between each). Section slightly triangular. Decorated with a pair of central lines along apex, dividing plate into two horizontal panels, decorated with alternating fields of saw-cut obliques. Execution of ornament is simple, but aesthetically effective. Decorative toothcuts, indicative of six teeth per cm. 113mm L × 13mm W × 4.2mm Th (C1002).

24/48 Comb

Probably antler. Connecting plate with one iron rivet, one perforation close to end. Oblique lines from rasping on reverse. Not easily assignable to type; probably Type 2 (seventh–ninth century AD) or 7/8c (tenth–twelfth century AD). 47mm L × 12mm W × 2mm Th (C1242).

24/1563 Comb tooth

Indeterminate bone/antler. Minor beading close to tip. Rectangular section, tapering profile. 17mm L, 2mm Diam (C1284).

14/3105 Comb tooth

Indeterminate bone/antler. Short and broad. Minor striation close to tip. Rounded section, tapering profile. 11mm L, 3mm Diam (C1002).

2.2 Pins

Thirteen pins and related points, representing a variety of forms, were recovered from Period 2, 3 and 4 contexts. Roman and early-medieval pins are classified by MacGregor (1985, 113–22), though not all of the Portmahomack examples fit easily into this classification. Well-preserved examples include: 24/7189, a pig fibula pin of MacGregor's Group 1, characterised by the head being neither perforated nor narrowed (see MacGregor et al 1999, 1950); four pins (14/59, 2645, 24/746 and 747) that might be best described as flat- or nail-headed; and one example (14/1284) distinguished by the remains of what appears to have been an ornately carved thistle-or vase-shaped head, broadly paralleled at Whithorn (Nicholson 1997b, fig 12.138, 7.1 and 7.2). The pins also display a variety of forms of shank. Though none are of the 'hipped' type characteristic of many early medieval sites in England and Scotland (see MacGregor 1985, 116), there is nonetheless some diversity. 24/747 has a gently tapering shank, while 14/1284 is parallel-sided, 24/746 displays a clear swelling at the waist, and 14/3196 is distinguished by the characteristically curved profile of the antler tine from which it is cut. Other examples are incomplete or poorly preserved (14/4539 is highly fragmented, while 14/1796 has been damaged by burning) and comment on their shank or tip form cannot be confidently made. 24/746 and 747 are long pins and display an extremely high level of polishing. In addition, pin 24/747 is unique within the context of the collection in that it features conspicuous decoration. Its head is decorated with an uneven arrangement of five circular impressions, while just below the head, a pair of incised circumferential lines form a collar, and roughly cut obliques decorate the area that lies between them.

The chronology of bone pins is not one of high resolution, given the potential for conservatism in design once a model has been found to be fit for purpose. Nicholson dates nail-headed pins to the tenth century (Nicholson 1997b, 496) on the basis of examples from Jarlshof (Hamilton 1956, 148) and Lincoln (Mann 1982, 10), but such pins are known from contexts as early as the Roman period (MacGregor 1985, 117–18), and the type does seem to have had an early medieval currency in Scotland in particular (see MacGregor 1975; MacGregor 1985, 118). An eighth- or ninth-century date for these pins certainly does not seem out of the question. Pin 14/1284, with its complex vase- or thistle-shaped head is equally difficult to date, but broad parallels are known from Norse contexts in Orkney (Smith 2007, 479) and Shetland (Hamilton 1956, 125). It is notable that neither this, nor the nail-headed form is well represented at York (MacGregor et al 1999; Rogers 1993; Ashby & Spall 2005).

The function of pins cut in skeletal materials has been the subject of uncertainty over a considerable period; one might argue that we know little more about their diversity of function than could be said in MacGregor's (1985, 113) review.

Some were clearly employed as dress fasteners, others as hair pins; testament to both uses comes from their recorded position in a number of Anglo-Saxon burials (see MacGregor 1985, 113–16 for the classic review). This uncertainty is paralleled in the study of copper alloy pins (see review in Rogers 2009, 40–1), and a definitive answer does not seem imminent in either case. However, it might be argued that burial contexts are not illuminating in terms of the use of these objects in life, and we instead have to draw deductions from the objects themselves. Thus, morphological traits of these pins have been interpreted in functional terms; the 'hipped' shanks characteristic of early medieval pins might indicate a use different to those with a more regular shank profile, while shank and head diameters might also relate to diverse means of use (see Rogers 2009, 41). However, one must take care not to interpret all morphological variation in functional terms. Indeed, the attempt to isolate a single use for these sorts of items may not actually be productive and may not reflect the ways in which they were perceived by their makers and users (cf Pestell's [2009, 126] discussion of the legitimacy of drawing a distinction between 'styli' and 'styliform pins'). If a clear classification relating to function is not obvious to us, then it is possible that this was also the case in their period of use. Nonetheless, it is possible to speculate a little on at least some of these items. For the large, highly conspicuous pins 24/746 and 747, one might propose a function in dress, hair arrangement, or a similar highly visible context. Though the ornament on 24/747 is roughly executed, it nonetheless represents an active attempt to embellish the object, which – given its size and polish – would already have been quite noticeable.

14/1284 Pin

Complete. Ornate, complex-head form, straight, untapering shank. Postcranial bone. Slight curved profile. Head dimensions 11mm × 4mm. L 110mm. Max shank diameter 5.3mm (C1002).

24/746 Pin

Probably postcranial bone. Complete. Finely made and highly polished from use. Shank of sub-circular section and waisted profile. Oval head, 7.4mm × 6.5mm. Undecorated. Fine point. L 130mm. Max. shank diameter 4.8mm (F132 C1354).

24/747 Pin

Probably postcranial bone. Complete. Finely made and highly polished from use. Shank of evenly tapering profile, sub-circular section. Oval head, 6mm × 5.5mm. Head decorated with five dots, unevenly arranged. L 130mm. Under the head there are a pair of parallel circumferential lines (2.5mm apart), and zig-zag ornament connects them. Fine point. L 57mm. Max shank diameter 5.1mm (F132 C1354).

14/4541 Pin

Faceted section. Probably postcranial bone. Truncated below head. L 52mm, Max. W 2mm, Th 5mm (C3455).

14/4539 Pin/needle

Probably postcranial bone. Round section, curved profile. Truncated below head. L 41mm, Diam 2mm (C3305).

14/307 Pin or Point

Postcranial bone. Circular section, pointed. Gently tapering profile. Perhaps made of split rib. Truncated below head. L 46mm, W 3mm, Th 2mm (C1002).

24/4639 Pin

Indeterminate bone/antler. Highly fragmented pinhead and upper portion of shank. Not measured. L < 10mm; W unknown (C2004).

24/916 Pin

Probably postcranial bone. Broken into two halves, round section, straight tapering profile. L 73mm, Max Diam 3.5mm (F137 C1367).

24/7189 Pig fibula pin

MaGregor Group 1 (head unperforated or trimmed). L 98mm, Head W 15mm, Shank mid-point Diam 5mm (C3157).

14/59 Pin

Probably postcranial bone. Nail-headed, sub-circular section, waisted profile. Head 6mm × 8mm, L 47mm inc, shaft max Diam 5mm (C1001).

14/1796 Pin

Indeterminate bone/antler. Circular section, burnt (calcined). 3 shaft frags. Large frag L 25mm, Diam 4mm (C1002).

11/2645 Pin

Probably postcranial bone. Nail-headed, flattened section. Head 4mm × 5mm, L 37mm inc, shaft Diam 3mm (C1370).

14/3196 Pin or Point

Antler. Curved profile. Round, but slightly faceted section. L 91mm, W max. 6mm, max. Th 5mm (1915).

3.0 Craft-working items

3.1 Textile tools

3.1.1 SPINDLE WHORLS

A single spindle whorl (24/2139) was recovered unstratified. Bone and antler spindle whorls are common finds from early medieval settlement excavations, and the corpus is sufficiently well understood for us to confidently identify a little diversity in form. The Portmahomack example is of rudimentary manufacture, being cut from the head of a large bovid femur. Cattle femora do appear to have been the skeletal element of choice for this form of whorl, though miniature skeuomorphs manufactured on pig femora are also known (Walton Rogers 1997, 1741). In most cases, femurhead whorls seem to have been rudimentarily manufactured; examples at Coppergate were roughly cut prior to drilling; and, going on the presence of gnawing marks and other phenomena, some do not seem to have been cleaned fully prior to disposal (Walton Rogers 1997, 1742–3). The Portmahomack example displays similar puncture marks, as well as the distinctive crackalure that is diagnostic of sub-aerial weathering. One might thus propose that it ended its life exposed on open ground, or perhaps on an open dump or midden. The practice of cutting whorls from the heads of cattle femora (as opposed to the more time-consuming process of carving discoidal whorls from bone, antler, or pedicle) seems to have become common from the Late Saxon

period (Walton Rogers 1997, 1743). However, as Nicholson (1997b, 496) points out, decisions regarding such expeditiously produced items must have been fundamentally driven by raw material availability. It is thus unwise to load them with too much chronological, cultural, or technological significance, and in truth, there is little more that can be said of the single example from Portmahomack. Nonetheless, it stands as a key piece of evidence for the production of textiles on site.

24/2139 Spindle whorl

Cattle femur head. Cylindrical perforation (not hour-glass-shaped) of 13mm diameter through centre. Articular surface shows crackalure and gnawing marks. Broken away on one aspect, revealing cancellous tissue. Basal edge is straight, but roughly removed. Diam 36.8mm, H 23mm (C1000).

3.1.2 WEAVING IMPLEMENTS [Illus D6.1.26]

The only confidently identifiable object of this category is the pin beater (24/4578) from C1877. This item would have been employed in the lifting of warp and beating of weft threads. On morphological grounds, Walton Rogers (1997, 1755–75) has identified three types of pin beater, each with distinctive wear patterns: the cigar-shaped pin-beater (associated with the warp-weighted loom, thus dating between the Roman period and the Viking Age, but being particularly common at Middle Saxon sites), a flattened, chisel-ended 'picker-cum-beater' (dating between the late ninth and fourteenth centuries, and no doubt associated with the two-beam loom), and a longer, more curved form (broadly contemporaneous with the picker-cum-beater, and probably also associated with the two-beam loom (Walton Rogers 1997, 1756–7).

The Portmahomack example fits best into Walton Rogers' 'picker-cum-beater' type. Many examples of this form feature cross-hatch or other simple ornament mid-way down the shaft of the object. It has been speculated that the requirement was for a rough surface so that the user was easily able to grip was as important a rationale for the incision of such decoration as any aesthetic concern (see MacGregor et al 1999, 1966). In the present case then, it is interesting that this example does not feature decoration of this kind, but that the central area is marked by a natural groove that no doubt had its origin in the rugose outer surface of red deer antler. The preservation of morphology in this area of the object alone is thus telling. Together with the spindle whorl (24/2139), this object is evocative, notwithstanding the fact that it is the only example from the site.

24/4578 Picker-cum-beater

Probably red deer antler. Preserved natural groove close to shaft mid-point. Curved profile, slightly faceted section. L 97mm, max W 7mm, max Th 6mm (C1877).

3.2 Objects associated with the production of vellum and manuscripts

3.2.1 NEEDLES [Illus 5.6.14; Illus D6.1.7]

Identification of bone needles is less straightforward than one might imagine (Walton Rogers 1997, 1783). A large collection of 'needle-like objects' is known from Anglo-Scandinavian York, but, on the grounds of a pervasive polish, and distinctive wear around the eye, Walton Rogers identifies only three as clear examples of needles. Her caution is well founded; many of the heavy, wide-headed perforated points frequently referred to as needles would be unfit for purpose.

However, in the case of Portmahomack, it is possible to make a reasonably confident identification on three objects (24/4616, 14/3560 and 3680). Although they do not preserve the extensive polish identified by Walton Rogers on her three York examples, in terms of morphology and overall dimensions, the Portmahomack artefacts are closer to her 'needles' than they are to her other 'needle-like objects', and their heads certainly seem sufficiently narrow to pass easily through cloth or hide. Their round section would also facilitate such a use (cf Walton Rogers 1997, 1785). It is of course possible that these objects played a role in the postulated working of hide and vellum at Portmahomack, but it is impossible to empirically confirm this.

24/4616 Needle

Indeterminate bone or antler. Complete. Curved profile, ovoid section, finely pointed tip, and lozengiform head with longitudinally extended perforation (4mm × 1mm). Traces of wear at base of perforation. Not highly polished. L 83mm, max. Th 3mm (C1877).

14/3560 Needle

Indeterminate bone or antler. Head broken at mid-point across perforation; otherwise complete. Not highly polished. L 83mm, max. Th 3mm (C2345).

14/3680 Needle

Largely complete. Short and straight in profile; slight faceting on head, which features a round, 2 × 2mm perforation. Gently tapering profile, blunt tip. L 52mm, max Th 4mm (F395 C2447).

3.2.2 PEGS [Illus D6.1.7]

These pegs (14/4499 and 4500) have been cut from the distal ends of cattle metapodials and show signs of wear around the condyles. Though they are not diagnostic in isolation, they are arguably consistent with a use in the stretching out of hide that constituted a key component of the process of vellum manufacture. The smooth areas between the condyles of the distal articulation and the broken point at mid-shaft may relate to wear from a thong or cord of some sort; this is consistent with the proposition that the pegs were turned in order to increase the tension under which a hide was being held, in a manner somewhat akin to the tuning pegs of a stringed musical instrument. They were found in a right-angled alignment of metapodials worked to differing degrees 14-24/F393 C1957.

14/4499 Metapodial peg

Cut from the distal end of a cattle metapodial. Nutrient foramen visible. Much of shaft and condyles worn down, revealing cancellous material. Mid-shaft is thinned and features irregular cut marks. L 72mm, max W 45.9mm (incomplete), Th 22mm (F393 C1957).

14/4500 Metapodial peg

Cut from the distal end of a cattle metapodial (metacarpal). Nutrient foramen visible. Condyles worn down, revealing cancellous material. L 64mm. Width across condyles (Bd) 46mm, but incomplete. Th 21.7mm F393 C1957).

4.0 Writing equipment

4.1 Styli [Illus 5.6.14; D6.1.7]

Styli – implements used to inscribe writing on wax writing tablets – are now relatively well-known from Roman and early medieval sites (the tablets themselves are considerably less well represented). Styli are known in iron, non-ferrous and precious metal, as well as bone, and have been comprehensively reviewed in a recent survey by Tim Pestell (2009). It is not my aim to recapitulate that review herein, and it suffices to say that several received wisdoms regarding styli – notably their assumed monastic associations and 'Middle-Saxon' date are now much less secure. This revision comes as a result of both the accumulation of single finds and the recovery of an unprecedented haul of twenty-two examples from Flixborough. Bone styli are less well-known than their metal counterparts, but concerns that the material is unfit for purpose are unfounded (see MacGregor 1985, 124 for discussion).

Two objects (13/53 and 24/7190, 7665) from Portmahomack are herein identified as

styli (a third, less likely candidate (24/7189) is catalogued above as a pin). Both 13/53 and 24/7190 have the broad, straightsided shanks and well-defined, sharply tapering tips that one would expect of a stylus, but while 13/53 has clearly defined shoulders and a sub-rectangular eraser-head, the head of 24/7190 takes a more sub-triangular form. The significance (chronological or otherwise) of such morphological variation is as yet unascertained. Indeed, the general lack of stratified examples means that no detailed chronology exists for the morphological development of this class of object (Pestell 2009, 125). At the time of writing, Pestell is developing a classification based on the form of the expanded head that was used as an eraser. It would be interesting to see where the Portmahomack examples fit within this scheme, but we await publication in order to compare them against the diagnostic criteria of each class, and to ultimately draw information related to their chronological range, geographical distribution and cultural implications. In the present context, though it has been shown that the occurrence of styli is not limited to monastic sites, it is interesting that a close parallel for the Portmahomack example comes from Whitby (Peers & Radford 1943; MacGregor 1985, 124). In Scotland, objects of similar form are known from the multi-period settlement site of Skaill, Deerness in Orkney, though here they are identified as 'spatulate-headed pins' (Porter 1997, fig 8.3).

Ewan Campbell has observed that finds of styli are rare in Celtic monastic sites in comparison to England (there are none from Iona or Clonmacnoise), and he draws attention to the use of scratching on slates as a way of learning how to write, as at Inchmarnock (Campbell 2010, 140; Lowe 2008). On the other hand, as in England, correlates of writing and manuscript production are spreading to secular sites in the eighth century: madder, orpiment, seaweed and neonatal bones have been recovered at the Dalriadic capital of Dunadd, which may also be the place of origin of the Loch Glashan book satchel (Campbell 2010, 142; Lane & Campbell 2000, 223, 226–7).

13/53 Stylus

Bone. Quite polished. Oblique striations on spatulate head. Indentation in centre of head on one face. L 95mm, Head width 9mm, max shaft diameter 3mm (from crypt clearance).

24/7190, 7665 Stylus

Expanded head, with flat upper edge. Traces of vivianite. L 61mm, Head W 7mm, max Shank Th 2.7mm (conjoins 24/7189; F507 C2844).

5.0 Miscellaneous items

In addition to those objects for which, on the grounds of either morphology or context, an identification can be made with some confidence, there exists a small but diverse collection of objects of insecure identity and/or function. Some of these items are idiosyncratic objects that cannot be securely identified, while others fit into recognised typologies but which sadly lack an understood function. It is of course possible that some of these objects had functions related to those discussed above, but this cannot be unambiguously ascertained, and one might note that these items tend to lack the distinctive polish characteristic of the tools we know to have been used in textile manufacture (see above). Thus, herein the objects are briefly discussed, and only tentative suggestions as to function are made. A number of undiagnostic pointed objects were recorded. These are described below, though little can be confidently suggested regarding their function (for further discussion of similar objects, see MacGregor 1985, 174–6; MacGregor et al 1999, 1989–91). Of a little interest is 24/4749, which is the roughly worked proximal end of a small bovid metapodial. The diaphysis has been chopped through obliquely, close to what would have been the mid-point of the bone, and the resultant fractured end worked with a knife to form a point. Similar objects are well represented in early medieval contexts across Europe, and display a surprising degree of morphological regularity, which may perhaps be suggestive of some identity of function.

A similar group of tools has been identified by MacGregor (and referred to by him as 'socketed points'). These objects, usually manufactured on the proximal ends of large mammal metapodials, are distinguished by the removal of epiphyseal material and cancellous core, such that a hole drilled in the proximal articulation connects with the medullary cavity to form a continuous channel. On the basis of their presence in association with a leather workshop in York (MacGregor 1982), MacGregor (1985, 175) suggests a role for these objects in craft or industrial activity. Roes (1963, 47) goes one step further, arguing that similar objects may have acted as tallow horns, used in the lubrication of thread in order to ease the effort of needlework, while Mann (1982, 31) suggests that examples from Flaxengate, Lincoln, could have been used as gouges. MacGregor (1985) is cautious not to easily accept such a specific function for what is a morphologically undiagnostic and technologically rudimentary object, and we would be well served by doing likewise.

Moreover, only a single example is known from Portmahomack, and this is cut on the metapodial of a small mammal (sheep/goat), and lacks the socket of MacGregor's tools. Nonetheless, the working of coarse materials such as leather and hide would necessitate the use of sturdy tools, and 24/4749 may have found utility in just such a role.

Indeed, in the context of evidence for needlework and parchment production at Portmahomack, one might tentatively suggest that its presence here is best interpreted in this light. Also of note is a *Bos* scapula (24/6900), which although showing little sign of active working, may be best interpreted as a shovel of some sort (being recovered, as it was, from the ashy silts used to raise and level the ground surface), and a worked tine from the antler of a red deer (24/7862). The latter has a very even, square-sided, 3mm-wide groove incised into it (presumably developed through wear) and a function as some sort of peg, on which a rope or thong was tied off, seems most likely. Interestingly, its surface has been removed towards its distal end, in a way analogous to that seen on the socketed metapodial points discussed above. No precise function is assignable, but the object would not be inconsistent with a use in pegging out vellum, in a way akin to that which has been proposed for 14/4499 and 4500 above. Indeed, Radley (1971, 5) proposed that similar worked tines recovered from Anglo-Scandinavian deposits at Ousegate, York, were used in a tannery to peg out hides, and it is not too much of a stretch to imagine this item being used to hold recently tawed vellum under tension at Portmahomack.

Two further objects (14/4540 and 24/7863) merit close consideration here. These are split longbones (an equid metapodial and a *Bos* tibia respectively), and their treatment is similar: they have been split axially. This initial splitting was presumably undertaken with an axe, but the pieces were subsequently worked with knife and rasp to form regular objects of angular C-shaped section. The edges are smooth and square, such that the objects form long, narrow, open-ended 'trays'. The type does not seem to be well-represented in early medieval English and Scottish contexts, though it is known in early medieval Ireland (J Boyle pers comm). One might speculate on a role as a vessel or channel for a fluid of some sort.

24/6900 Cattle scapula

Spinus and proximal articulation complete. A small (18mm × 12mm) sub-circular perforation in blade area, and damage to the edge probably represent recent breaks. Vivianite on ventral aspect. L 300mm; W 164mm. Articulation: 46mm × 57mm (C2991).

14/4401 Unidentified object

Bone. Cut from the distal end of a small bovid femur. The condyles have been roughly cut to form a smooth, curved surface. Function unclear. L 21mm, W 19mm, Th 22mm (C1384).

24/4749 Bone point

Cut from diaphysis and proximal articulation of sheep/goat metatatarsus. Hollowed diaphysis, but unsocketed at proximal articulation. Pointed edge is marked with a series of parallel notches formed during manufacture. L 85mm, Head width 18mm, Head Th 16mm (C1000).

24/7862 Worked antler tine

Probably red deer; grooved and halved above, revealing spongiose core. Parallel and straight-sided circumferential wear groove (3mm wide). L 123mm, max W 21mm, Th 14mm (C3338).

14/4540 Split equid metapodial

Shallow, angular, C-shaped section. Distal end of bone has been sharpened to a point and features a number of rough, parallel cutmarks. Function unknown. L 115mm, W 33mm, Th 16mm (C3428).

24/7863 Split *Bos* tibia

Angular, C-shaped section. Distal end of bone has been sharpened to a well-defined point. Function unknown. L 195mm, W 33mm Th 7mm (C3468).

6.0 Discussion

Assessing the extent to which the Portmahomack material might be described as having a 'monastic' character is less easy than might be expected. Chris Loveluck (2007) has demonstrated the difficulties of attempts to identify assemblage characteristics particular to high-status monastic or secular sites, and his arguments need not be rehearsed here. It suffices to say that broadbrush generalising models are unhelpful, that temporal change must be taken into consideration, and that any particular site must be assessed within its own regional context. However, direct comparison with northern Britain's other early medieval monastic sites is unenlightening. Other than a putative manuscript stamp, there is nothing particularly 'monastic' about the collections of worked skeletal material from Monkwearmouth and Jarrow (Riddler 2006). The same might be said of Whithorn (Nicholson 1997a; Nicholson 1997b), while the corpus from Inchmarnock is diminutive (Franklin 2008). More generally, few monastic assemblages contain significant quantities of ivory, or relate to the kinds of activities traditionally ascribed to monasteries by historians (one thinks in particular of the production and illumination of manuscripts). In this sense at least, the collection from Portmahomack might be said to be more distinctively monastic than many such assemblages, given its evidence for writing (in the form of styli) and parchment production (metapodial pegs and needles). Of course, in isolation such phenomena are far from diagnostic, and it is rather the accumulation of evidence at Portmahomack – including other finds (such as the *lunellarium* and pumice rubbers) and structures (such as the metapodial rows) – that makes a convincing case for this activity. In the absence of such evidence, comparable artefactual evidence may have been interpreted differently. Nonetheless, the presence of three identifiable bone sewing needles is in itself of note, as genuine needles are rarely identified (see above).

In more general terms, the collection from Portmahomack fits well within the repertoire of early medieval northern British boneworking. The combs, pins, textile and (possible) leatherworking equipment are closely paralleled in: York (eg MacGregor et al 1999; Rogers 1993; Spall & Toop 2005) and Yorkshire (eg Stamper & Croft 2000); Lincoln (eg Mann 1982) and Lincolnshire (eg MacGregor 1987; Evans & Loveluck 2009); Orkney (eg Curle 1982) and Shetland (eg Hamilton 1956); and beyond the British Isles (eg Roes 1963). However, it is within the much more immediate context of the Portmahomack excavations that these objects will ultimately be most illuminating.

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Digest 6.5 CRUCIBLES

CECILY SPALL (FAS Heritage) with CATHERINE MORTIMER (OLA 7.1.6.2)

1.0 Introduction

A total of 325 fragments of crucible and complete or near-complete crucibles and heating trays were recovered during excavation in Sector 1 and 2. The fragments were individually recorded and the results form the catalogue. The crucibles were categorised using Heald's crucible typology of Scottish Iron Age crucibles (Heald 2003, 47–59). The results of fifty-nine EDXRF analyses of crucibles were also used (after Heald 2003: Appendix C). A further programme of EDXRF analysis was undertaken for the project by Dr Craig Kennedy, Senior Conservation Scientist, Historic Scotland, on a further nine crucibles and trays and seven droplets of metal from hearths and working surfaces and the results are reported here.

2.0 Typology

The following crucible types were identified: A1, A2, B2, G1, G2, G3 and I1 and I2 along with a variant form of Type I. Complete or near-complete crucibles (11) were easily assigned to type and a further 172 fragments were sufficiently diagnostic to also be assigned confidently to type. Where type could not be identified, the fragment was recorded as body, base or rim and wall thickness was measured.

Crucible fabric was also visually recorded with notes taken on clay, temper, relining, vitrification, slag deposits and visible metallic residues.

2.1 Type A1, A2 and B2 [Illus D6.1.14]

Heald Type A crucibles are pyramidal or triangular crucibles, being three-sided with a V-shaped profile with pointed or slightly rounded bases, common throughout the Scottish Iron Age. They are also known from a range of Early Historic sites in Ireland, including Lagore, Cathedral Hill, Armagh, Garranes and Garryduff among others (Comber 2004). The type is subdivided by Heald based on height and wall thickness: Type A1 is most frequently recorded and forms a cohort of crucibles measuring between 35–45mm high, in use throughout the Scottish Iron Age until the end of the eighth century; Type A2 are less common and larger measuring 60–70mm high.

Heald Type B crucibles are conical, being circular in plan with a V-shaped profile. Like Type A, Type B crucibles are subdivided by size with Type B1 assigned to vessels measuring *c* 40mm high and Type B2 measuring over 70mm high.

Unless sherds are large, the distinction between Type A1 and B1 and A2 and B2 is often not possible and the types are reported here together. A total of eighty-seven Type A/B1 and A/B2 crucibles were identified in the assemblage and greater numbers of both types were probably represented in the assemblage.

Type A/B1

Twenty-four Type A1 crucibles and a possible Type A1 were recorded. A further eighteen fragments were assigned Type A/B1. Four of these belonged to a small A1 type crucible, notable for their thin walls, small capacity and finely pinched spouts. Wall thickness for Type A/B1 was recorded as up to 9mm, but more frequently were considerably thinner, often being recorded as 4 to 5mm, and in some instances as thin as 2mm. Type A/B1 crucible fabric was commonly recorded as either fine with scarce mineral inclusions, particularly in thin-walled examples, or with mineral inclusions of rounded quartzose – presumably derived from a coarse-grained sand, which may have been washed and sorted prior to inclusion in the fabric – or crushed quartz or quartzite.

Capacity of Type A/B1 crucibles could be judged in the complete or near-complete examples and appears to have been between *c* 10 and 15cc. The small Type A1 noted clearly had a much smaller capacity closer to *c* 3 or 4cc.

Type A/B 2 [Illus 6.10]

Six Type A2 crucibles were identified, with a further possible example, including a near-complete, smashed example. A single Type B2 was identified, and then only because it was almost complete. A total of thirty Type A/B2 and 8 probable Type A/B2 were recorded, but the fragments were not large enough to be more diagnostic. Wall thickness for these crucibles was recorded as slim as 8mm, in a few examples, but generally, thick walls were a characteristic of the type and were recorded as more than 10mm thick, with many examples exceeding that and being up to 19mm thick (including re-linings).

Type A/B2 fabric was commonly recorded in cross-section as comparatively coarse with a frequent mineral temper of rounded quartzose, again probably a coarse, washed sand, or with crushed quartz or quartzite and notably with frequent voids. A large spall of a Type A/B2 crucible provided a section across rather than through the fabric, where impressions of burnt-out vegetable matter – possibly grass – could be identified. The frequent voids noted in cross-section in many other examples are considered likely to represent burnt-out vegetable matter.

Relining was noted on several Type A/B2 crucibles and, in one example, more than once. Extensive vitrification of the fabric, rim and exterior was commonly noted with glassy crucible slags and oxides ranging in colour from red, grey, black and pale green.

Capacity of Type A/B2 crucibles was clearly much greater than Type A/B1 and, where it could be judged using the largest sherds, it appeared likely to have been *c* 20cc.

2.3 Type G [Illus 6.10; Illus D6.1.9]

Heald Type G crucibles are identified as small, deep vessels formed around a thumb or finger, with a handle modelled by pinching overlapping wall fabric into a small lug handle. Type G1 crucibles have handles horizontally pinched, Type G2 are vertically pinched and Type G3 has a handle pinched from the side to form a tear-shaped vessel. A total of fifty-two fragments could be identified as from Type G crucibles, and a further seventeen were probably from Type G crucibles.

Heald does not give a date for this type of crucible, but Campbell and Lane suggest they are a seventh-century innovation with northern or western origins, being recorded at Dunadd in deposits of that date (Campbell & Lane 2000, 141). They have been recorded in quantity at the Brough of Birsay in eighth-century levels (Curle 1982, 40–1).

Type G1

Among this total of sixty-nine, nine complete or near-complete Type G crucibles were recorded as Type G1 and a further twenty-three Type G1 handles indicate a minimum of thirty-two examples in total. Rim, base and body sherds of fragments recorded simply as G-type crucibles suggest many more examples are probably represented. Single possible examples of Type G2 and Type G3 were identified, although examples of both types are rare nationally and their significance is therefore difficult to assess.

Wall thickness of Type G1 crucibles could be broadly grouped into thick-walled, where

crucible walls were measured as between 8 and 11mm thick, and thin-walled crucibles, which were recorded more commonly and generally between 3 to 5.5mm thick.

The handles of Type G1 were formed by pinching the clay of the walls into a small lug, but in several instances this resulted in a deep internal void and a likely point of weakness in the finished vessel. Small clay plugs moulded by hand and pushed into this void were noted in several examples, often marked by part fingerprints.

Six Type G1 crucibles were notably small, including one complete example, but other likely examples could be identified by the slightness of the handles. These vessels were too small to have been formed around a thumb or finger and must have been formed over a fingertip or formed freehand. The complete small Type G1 is notably thick walled and appears to have been knife-trimmed, producing a number of facets. Its use resulted in vitrification of the fabric and a covering of red cuprous oxides.

By contrast, a notably large sub-rectangular lug handle, measuring 27mm wide and 15mm thick, was recovered with a body sherd that appears to have belonged to the vessel but does not conjoin. The lug and body sherd appear to belong to the broader family of Type G crucibles, and the handle appears likely to have been set close to the rim of the vessel. The fragment is unique and cannot be associated with further likely body sherds in the assemblage, but clearly represents a notably large crucible.

Fabric of Type G crucibles was much the same as for Type A and B crucibles. The clay was often reduced to dark grey and mineral temper recorded as crushed quartz or quartzite or sand. A small group of crucible sherds were made in a white to pale grey-firing fabric. Vitrification over the exterior, rim and handle was noted in most examples and tended to be red, possibly cuprous, oxides, with black, grey and pale green also noted. Internally, purple staining was noted in some examples, and small droplets of copper alloy sometimes trapped in the fabric, with one example from which the molten metal had not been poured quickly enough and much of its charge remained in the base and up to the pouring lip.

Capacity of most complete or near-complete Type G1 crucibles was calculated as between *c* 4.5 to 9cc, while the capacity of the complete small Type G1 was as little as 1cc. A large body sherd and part handle of a Type G1 indicated a considerably larger example, however, and could conceivably have held up to 20cc of molten metal. The large lug handle is also generally indicative of a large capacity vessel.

2.4 Type I [Illus 6.10; D6.1.14]

Five Type I crucibles or trays were identified in the assemblage from nine fragments.

Type I1 and I2

Five tray fragments consisted of rim fragments of apparently shallow circular or sub-circular/sub-oval vessels formed by hand. Three of these could certainly be a vessel family and have been assigned as Type I2. These possibly conjoining fragments describe a shallow tray, sub-oval in plan, perhaps up to 90mm long, flat bottomed and low walled. None of the sherds display any clear evidence for use in high-temperature processes. A fourth example has been identified as Type I1, being a rim sherd of a smaller dog-bowl type crucible, and which is completely reduced with some vitrification.

Type I variants

A total of four fragments cannot be assigned to Type I as the typology is currently defined by Campbell's site typology for Dunadd, where all examples were circular in plan form (equivalent to Dunadd Type B1 to B5). Nevertheless, the Tarbat examples are considered to belong within a broader group of mainly shallow, flat bottomed crucibles/trays, despite the sub-rectangular plan.

Three such fragments are clearly a vessel family, with two fragments conjoining and a third possibly conjoining (24/4585 and 1612). Notably, the two definitely conjoining fragments show a close fit on the interior with a wide gap on the exterior, suggesting the break was coincident with a large crack caused by distortion and stress under high temperature. The three fragments belong to a flat bottomed, sub-rectangular tray with rounded corners and straight-sided, relatively shallow walls measuring *c* 48mm long × 42mm wide.

3.0 Crucible type and metal-working practice

Some correlation between crucible type and different metal-working practices was identified by Heald in his survey of Scottish Iron Age crucibles (2003, 47–59). The results of EDXRF analyses undertaken towards this thesis have been transposed into the catalogue in the form of major, minor and trace levels. However, and most regrettably, these results, and those from a subsequent programme to analyse all Tarbat crucibles ongoing in 2006, have not been made available to the project, nor was a description of EDXRF hardware and technique provided for the former, making any quantitative statements impossible, and comparison with new EDXRF data problematic. The results of a second programme of EDXRF undertaken for the project by Historic Scotland have also been used in the following discussion.

Table D6.5.1 presents EDXRF results from Heald's thesis, while Table D6.5.2 and 3 present the results of analysis undertaken by Dr Craig Kennedy, Senior Conservation Scientist, Historic Scotland.

3.1 Type A and B

Analysis of Scottish and Irish Type A crucibles suggest they were used primarily for copper alloy working although silver alloy and silver-working, with a single known example of use in gold-working, have also been recorded (Heald 2003, 50). Type B crucibles are thought to be used for the working of copper alloys, possibly quarternary alloys (Heald 2003, 51).

EDXRF results for Type A crucibles from Tarbat support their use in working copper and silver alloys. Copper alloys (possibly quarternary alloys) were detected in Type A/B 1 (1) and 2 (3) crucibles and in Type A1 (2) crucibles. Two Type A1 crucibles had also been used to work leaded bronzes. The casting of silver alloys was recorded in Type A/B 1 (1) and Type A2 (2).

3.2 Type E

A single example of Type E or G crucible was recorded by Heald and analysed, but the fragment was absent on recording during 2011. EDXRF analysis detected the presence of copper and tin, suggesting bronze casting.

3.3 Type G

Analysis of Type G crucibles from Dunadd, Tarbat and Birsay showed them to have been used for working with copper and silver alloys and gold (Heald 2003, 54). Bronze and leaded bronze has also been detected. Results from Type G1 crucibles from Tarbat indicate leaded bronze (2) and silver alloy working (2), with those only identifiable as Type G suggesting silver alloy (6), bronze (1), copper alloy (1) and leaded bronze (2) were melted in them. Results from the analysis of a single Type G2 crucible suggested copper alloy casting.

3.4 Type I

Analysis of three Type I crucibles or trays was undertaken. Two Type I variants (sub-rectangular trays) reported comparatively high percentages of lead and tin, which may represent enrichment of the fabric during refining of precious metals. Results from a further Type I variant and a Type I2 crucible/tray suggesting the working of copper alloy.

3.5 Droplets

Seven metal droplets recovered from Period 3 metal-working hearths and working surfaces

Table D6.5.1
EDXRF results (after Heald 2003)

Period	Find	Type	Major	Minor	Trace	Casting
2	25/703	A/B1	Cu**, Sn, Pb	Sn	Br; Ag	silver alloy
2	25/708	G1	Cu, Pb; Cu, Pb	Sn		leaded bronze
2	25/709	G2	Pb**, Cu; Pb*, Cu			copper alloy
2	25/771	?G	Cu**, Zn*, Pb; Cu**, Pb, Zn	Ag, Sn; Ag		silver alloy
2	25/797		Zn, Cu, Pb, Ag, Sn; Cu**, Pb**, Sn, Ag, Zn			silver alloy
2	11/1137	G1	Cu; Cu	Sn, Pb; Sn, Pb		leaded bronze
2	11/3560			Cu; Cu; Zn, Cu	(Zn); (Pb)	copper alloy
2	11/3563	G1	Cu**, Ag**, Zn, Pb, Sn; Ag**, Br**, Cu, Sn	Zn		silver alloy
2	11/3572	E/G	Cu**	Cu; Cu	Sn; Sn	bronze
2	11/3585		Cu**; Cu**	Cu; Sn; Sn		bronze
3	14/2547	?G		Cu	(Zn, Pb); (Cu, Zn); (Cu, Zn)	?copper alloy
3	14/2737	A/B2			(Cu, Zn); (Cu, Zn)	?copper alloy
3	14/2583	–	Cu**; Cu**, Sn; Cu**, Sn; Cu, Sn	Pb; Pb	Pb	leaded bronze
3	24/1175	A1	Cu**; Cu**; Cu**		Sn, Pb, Zn; Sn, Pb, Zn; Sn, Pb, Zn	copper alloy
3	24/1509	A/B1		Cu, Sn	Cu; Pb, Zn	copper alloy
3	24/3477	–		Cu, Ag, Zn; Cu, Ag, Zn	Sn, Pb; Sn, Pb	silver alloy
3	24/3485	G variant	Cu		Sn, Ag, Zn, Pb	silver alloy
3	24/3913	G1	Cu**, Zn, Pb, Sn; Cu**, Pb, Sn, Ag; Cu, Pb; Cu**, Sn, Pb	Zn; Zn, Sn	Zn, Ag	silver alloy
3	24/4033	G	Cu**, Ag, Sn, Zn, Pb; Zn**, Br**, Cu, Ag, Sn; Cu**; Zn, Cu	Br, Pb	Pb	silver alloy
3	24/4548	?G	Cu; Cu**, Sn**, Pb**, Zn**, Cu*	Ag	Sn	silver alloy
3	24/4569	G1	Br**, Ag**, Sn**, Cu, Zn, Pb; Br**, Ag**, Sn**, Cu;	Cu		silver alloy
3	24/4584	G1	Sn*, Cu*, Zn, Pb	Ag		silver alloy
3	24/4585	I variant	Pb**, Sn; Pb**, Sn; Pb**, Sn			?separating residue
3	24/4620	A2	Cu**; Cu**, Sn; Cu**, Sn, Ag	Sn		silver alloy

were also analysed using EDXRF. The droplets were mostly identified as leaded bronze, with bronze also indicated.

4.0 Discussion

The results of crucible recorded and EDXRF analysis allow some insight into metal-working processes for Period 2 and Period 3, although the fragmentation of crucibles from Period 2 was markedly higher, which makes a discussion of differences in metal-working practice a little problematic. Overall, technology in terms of both crucible form and alloys worked remains broadly unchanged between these periods, nevertheless, different emphases can be detected in the data.

A total of thirty crucible fragments from Period 2 deposits could be identified to type and a further seventy-eight undiagnostic fragments were recorded. By contrast, a total of 143 fragments were identified to type from Period 3 deposits, with a further eighty-two undiagnostic fragments recorded. Some of the difference in the number of identifiable examples relates to the contrasting depositional history of crucibles by period, but is so large it is also a measure of the intensity of activity. The incidence of crucibles identified to type from Period 3 is much greater than from Period 2, which, given the fragmentation of Period 2 assemblages, is likely to be significant.

4.1 Period 2

The most commonly identified crucible from Period 2 deposits was Type G, or probably Type G (19), which may indicate an emphasis on silver-alloy working. Where Type G1 crucibles were clearly identifiable (7), the number included three notably small examples. Type A1 or A/B1 crucibles were also clearly in use during Period 2 (5) and likewise have associations with the working of silver and copper alloys. The capacity of

Table D6.5.2

Period	Find	Type	Cu%	Zn%	Pb%	Ag%	Sn%	Other%	Casting
2	11/4102	A1	5.19	0.11	5.51	–	0.93	88.22	copper alloy
2	25/1459	I variant	1.79	–	26.30	–	44.81	27.00	?separating residue
3	24/3480	I2	1.40	0.05	0.30	–	–	97.94	copper alloy
3	24/4620	A2	6.72	0.85	2.39	2.58	8.28	78.56	silver alloy
3	24/8223	A/B2	1.53	–	0.02	–	–	98.42	?copper alloy
3	24/8227	A/B2	0.58	–	0.02	–	–	99.26	?copper alloy
3	24/8314	A1	6.31	1.08	4.73	–	5.99	81.89	leaded bronze
3	24/8360	I variant	17.59	–	17.65	–	0.23	64.42	copper alloy
3	24/8416	A1	17.00	0.09	10.63	–	7.61	64.48	leaded bronze

Table D6.5.3

Period	Find	Type	Cu%	Zn%	Pb%	Ag%	Sn%	Other%	Casting
3	24/5565	droplet	46.39	0.08	2.88	–	27.15	22.96	leaded bronze
3	24/5661	droplet	48.24	–	8.95	–	13.64	28.77	leaded bronze
3	24/5662	droplet	51.85	–	0.19	–	18.66	29.17	bronze
3	24/6585	droplet	47.86	0.15	1.91	–	9.13	40.64	leaded bronze
3	24/6606	droplet	47.13	0.15	5.15	–	27.37	20.04	leaded bronze
3	24/7131	droplet	48.04	0.05	2.98	–	10.31	38.50	leaded bronze
3	24/7132	droplet	44.18	0.09	5.23	–	24.26	26.10	leaded bronze

both these crucible types is generally small and correspondingly small objects must have been cast. The crucibles point to the working of small individual quantities of silver and copper alloys.

There is a notable absence of Type A/B2 crucibles in Period 2 deposits and this does not seem to be because the crucibles were so fragmented that none could be identified, but rather that they were not in use. Type A/B2 crucibles are comparatively large capacity and suited for casting into correspondingly larger objects.

4.2 Period 3

Notwithstanding possible bias of the excavated sample at Tarbat, a real shift in intensity appears to be signalled in Period 3. Greater numbers of crucibles were in use, with a total of 143 identified to type. A total of thirty-four A/B1 type (including probable examples of Type A1) and forty-six A/B2 type (including probable examples, of both A2 and B2) were recorded. A further fifty Type G crucibles were represented, along with the majority of Type I crucibles/trays.

Not only was the number of crucibles recorded greater, but the types identified tended to be those with greater capacity, ie Type A/B2 and large G1 types. Analysis of both crucibles and droplets indicate that the same range of alloys was being worked, and castings clearly included silver alloy, but bronze, copper alloys, leaded bronzes and probably quarternary alloys were also being cast, and apparently more commonly.

At Tarbat, radiocarbon dating of a Period 3 metal-working hearth suggests the activity was taking place in the early to mid-ninth century, and this extends the chronology for Type A/B and Type G crucibles slightly.

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Digest 6.6 CLAY MOULDS

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1.0 Introduction

A total of 709 fragments of clay mould were recovered during excavation within Sector 1 and 2. Each fragment was individually recorded and the results form the catalogue. The moulds derive from the working of non-ferrous metal and glass. In the case of metal-working, the moulds are characterised as bivalve and were recorded, where possible, as either lower (primary) or upper (secondary) moulds, lower or upper ingates or combinations of those. Where the fragment was not diagnostic, it was recorded simply as a mould fragment. Many fragments were severely eroded and could only be broadly identified as undiagnostic clay, although the fabric and character was the same as identifiable pieces and the clay could be differentiated from unspecialised daub fabric. In 117 instances, sufficient of the object matrix was preserved, allowing a range of castings to be identified including dress pins, finger-rings, studs, discs, mounts, escutcheons, as well as a range of newly identified objects.

2.0 Bivalve mould fragments

The technology of the bivalve mould is well understood and discussed in detail elsewhere (Curle 1982, 37–9; Lane & Campbell 2000, 201–2; Laing & Longley 2006, 32–5). The method of mould preparation did not differ at Tarbat from that identified at these sites (the Brough of Birsay, Dunnadd and the Mote of Mark).

At Tarbat, the lower valve was prepared on a flat surface and the model impressed deeply into it. The valve was keyed, normally in opposed pairs and singly at the bottom of the valve, executed with the tip of a knife or with fingertips (fingernail impressions were noted) and a flat, comparatively shallow ingate formed. The upper valve was then formed over the lower valve and model producing a convex mould with positive keys and a wide-mouthed, funnel-like ingate. The model was then removed and the valves sealed with luting clay, which appeared to have been applied in a wet or semi-liquid state, as smears from smoothing were commonly noted, often with sticky fingerprints. Once cast, the mould was broken open, resulting in higher fragmentation of the upper mould.

As a reflection of the breaking open of moulds, among the 709 fragments recorded, only twelve complete lower valves and four complete, or near-complete, upper valves were recorded. A total of 137 lower valve fragments were recorded, of which three retained part of the ingate, as well as seventeen further lower ingates. Upper valves were identifiable in 114 cases of which twenty-three retained part or all of the ingate. Upper valve fragments are likely to account for the majority of the fragments recorded simply as mould and undiagnostic clay.

3.0 Glass moulds

A total of nine glass moulds were identified in the assemblage. The moulds are distinguished from metal moulds as they are 'open', ie they do not show signs of uniting with another mould. Nor do the interiors of the moulds show signs of reduction, which is common in moulds that have received molten metal. An example of a one-piece mould was recovered from Lagore, Co Meath, with a stud of pale green glass in situ (Hencken 1950, 129–32, fig 62).

Two glass stud moulds from Tarbat are very similar to that from Lagore and have elaborate cross-ornament on small circular studs (25/687 and 1431) (Illus D6.1.9) and also find parallels with three stud moulds of identical design found at Iona (Graham Campbell 1981, 24, fig III.Ib). 25/1431 bears an interlace cross design, which George and Isabel Henderson identify as so familiar as to 'go unremarked on Insular cross-marked stones', and which can also be found in repoussé form on the underside of Bowls Nos 5 and 6 from the St Ninian's Isle treasure (Henderson & Henderson 2004, 109; Small et al 1973, Bowls Nos 5 and 6).

Two stud moulds appear to form a group, the best preserved is also elaborately decorated and bears the matrix of a small circular stud 12mm in diameter, containing a tripartite Y-shape division and three pairs of stepped lines radiating from the centre (24/5520) (Illus D6.1.17). The mould reflects the decoration on two glass studs from Tarbat, one with a diameter of *c* 12mm, and both of which are paralleled on a number of finished composite items from Scotland and Ireland, often used in conjunction with silver grilles and enamel. The bichrome glass and metal grille studs on the front of the Tara brooch from Co Meath are almost an exact match in terms of ornament and size. The second mould is badly eroded and no more than a shallow, small oval matrix, measuring 11 × 9mm, can now be discerned (24/8208).

Four fragments of the same spiral-decorated disc mould were recovered from Sector 1 (25/1432 and 1496). The reconstructed diameter suggests the casting was of a flat, circular disc measuring *c* 44mm. The spiral and peltae decoration is partly legible (Illus 5.7.9) and the disc would have been mounted onto a larger object, probably in a metal setting. Here again, the basal escutcheon from the St Ninian's Isle hanging bowl provides a close match. The escutcheon is similarly ornamented and the diameter within 10mm of the Tarbat mould, although the disc is *pressblech* not cast (Small et al 1973, Bowl No 8).

No glass studs of similar composition and size survive on contemporary pieces of metalwork and it is difficult to assess exactly how they would have been used. It may be significant that the only other known Scottish parallels come from Iona, particularly in light of the fact that access to glass-working, including window glass, is biased in favour of ecclesiastical sites in Britain. This reflects the high patronage enjoyed at sites such as Glastonbury, Whitby, Jarrow and Monkwearmouth, Whithorn and Iona. Glass-working from early medieval Ireland is also known from early Christian sites at Dunmisk, Movilla Abbey and Cathedral Hill, Armagh, but has also been recovered from high status secular sites enjoying comparable patronage, such as Lagore.

Four glass moulds form a clear group. Each mould appears to have been sliced off a rolled tube of clay, and where the matrices survive, small simple cells can be identified and the finished product appears to have been small domed square, circular or triangular glass studs (11/3576 conjoins 3651, 3447, 3448 and 3602) (Illus 5.7.9). Similar moulds were recovered from the glass stud making workshop at Lagore, where again, simple circular, triangular, square and sub-rectangular studs were being produced (Hencken 1950, 129–32) and many items of high status insular metalwork are embellished with simple studs imitating semi-precious gemstones. No other examples of such moulds are known from Scotland, but glass studs of similar form and size can be identified on Pictish metalwork – such as the glass studs on a number of silver and silver-gilt penannular brooches, including from St Ninian's Isle treasure (Small et al 1973, Brooch Nos 10, 18 to 20, 23 & 24) Rogart, Aldclune and Clunie (Henderson & Henderson 2004, 99–105).

4.0 Non-ferrous metal castings

4.1 Dress pins [Illus D6.1.12; 6.1.14]

Twelve valves bore the impressions of dress pins or part pin shanks (25/708 and 908; 24/3479, 3486, 4030 (double) and 8225). Identifiable pins included that of a stick pin with a horned head and collar (25/1401). A further example was fragmentary and appeared to be a part pin head matrix of possible styliform type (24/5411). A near-complete lower valve, missing the top end and ingate, appeared to represent a stick pin with scooped head, or a toilet implement such as an ear scoop (24/4020).

Three valves appear to relate to pins with zoomorphic heads. A near-complete lower valve retains a matrix of pin shank and irregular form head, which is eroded but may have been zoomorphic (24/8138). A complete lower valve matches a lower valve fragment and both appear to have been impressed with the same model. The complete valve describes a short pin *c* 20mm long with a zoomorphic head ornament, while the less complete example retains only part of the zoomorphic head (24/4574 and 4579) [Illus D6.1.14].

4.2 Finger rings and other rings [Illus D6.1.16]

Moulds for rings included five clear examples of finger-rings with integral cast bezels, which formed simple decoration either as a small group of lobes (24/4573, 5410 and 8360) or triangular (24/8121 and 8342). The diameters of all rings fell close together and were recorded as between 20.5 and 22mm. All the Tarbat finger-rings are closely paralleled at the Brough of Birsay (Curle 1982, 32–3).

Eleven simple ring matrices were identified and probably belong to finger-ring moulds, but not enough survived for clear identification (14/371 and 3736; 24/1310, 3850, 4734, 5440, 5770, 8107, 8219, 8236 and 8287). In support of this, where measurable, ring diameters were recorded as 17, 19 and 20mm.

One exception was a fragment of mould in a distinctive pale-pink-firing, very fine clay, which was unlike the clay used in the majority of moulds (24/8228). This fragment was very fragmentary but bore the part impression of three small possible ring or disc matrices and may be related to a possible brooch mould formed in the same distinctive clay fabric.

A further smaller valve appeared to be for the casting of a small ring or link, the cast object measuring *c* 10mm diameter.

4.3 Possible brooch mould [Illus D6.1.15]

Four valve fragments were found to conjoin to form two valve fragments (24/8180 conjoins 8344 lower and 8176 conjoins 8383 upper) and also to unite with each other. The fragments were identified initially as a group by the unusual pale-pink-firing, very fine clay fabric, and can be associated with a further valve fragment with three possible disc or ring matrices. The conjoining and uniting fragments appear to form part of a brooch hoop with possible facets and, while it is not clear how valve fragment 24/8228 relates to the possible brooch mould, the pieces form a distinct family. The unusual clay fabric, and the care with which the mould was made, suggest a fine and accomplished high-status product, which may well have been composed from a number of separately cast elements.

A further lower valve fragment was severely eroded but retained the deeper parts of a complicated, possibly bossed item (24/3598). The fragment bears four depressions, one sub-oval with vestigial possible fine interlace and possible neck, connecting to a deeper sub-circular depression, in turn connected by a collared neck to a smaller sub-oval depression, with a further separate depression. The exact item intended cannot be clearly identified, but the piece could represent an elaborate brooch terminal intended to be fastened to a separately cast hoop.

4.4 Buckles, belt fittings and strap-ends [Illus D6.1.15]

Seven valves, which may be related to the manufacture of buckles or belt fittings, were identified in the assemblage. A small sub-rectangular hoop may represent a small buckle or link from Sector 1 (11/3546). A group of four similar lower valves from Sector 2 bear the impression of a possible small buckle plate and part tongue, a simple bar with projecting tab (24/3849, 8196, 8373 and 8295 conjoins 8374). Two further valves appear to bear the impression of small possible belt fittings (24/5348 and 8323).

A small group of valves, which appeared to be related to the simultaneous casting of simple strap ends and links, were identified (11/3643; 24/3575, 5417 and 8272). A further valve bore a more complex impression of a tab with raised rim, containing a series of lobate impressions and may represent part of a strap end (24/3416).

4.5 Escutcheons, discs and mounts [Illus 5.7.8; Illus D6.1.9; Illus D6.1.15]

A total of nineteen escutcheon or disc moulds were identified. Many were eroded but appeared to represent simple plain discs or the backs of escutcheons, along with a smaller group of four highly decorative escutcheons and mounts.

Plain discs and escutcheons

Eleven plain discs or escutcheons were identified, although some may have borne decoration now lost (11/3548, 3569; 25/759, 761, 899, 1433, 1486; 24/3850, 4062, 5932, 8197). A possible bossed disc valve was among the group (25/1433), and a further four fragmentary escutcheon moulds were concave, suggesting they formed the back of a casting (24/5415, 8264, 8284, 8268 conjoins 8283).

Decorated escutcheons

Four fragmentary decorated escutcheons, discs and mounts were identified.

One example consisted of part of the upper mould of an escutcheon of possible sub-oval form, impressed with the part matrix of a dragon-like creature, including its head with open jaws and part spiral limb (24/8200) (Illus 6.13a). This animal form is already known in the Tarbat menagerie, being represented on TR20 and TR205.

Two conjoining fragments of upper mould with part ingate derived from the casting of a small domed disc bearing an eroded geometric interlace pattern, which would have resulted in a sunken grille-like pattern, probably to receive an inlay (11/4269 conjoins 25/855) [Illus 5.7.8].

Two zoomorphic mounts were suggested in the assemblage. Two conjoining fragments of upper valve bear the part matrix of a fish, with symmetrical tail, part body and fin defined by parallel ridged decoration (24/8258 conjoins 8337). The cast item may have been three-dimensional or flat-backed. As the former, the complete item may have been mounted onto a large composite piece of metalwork, perhaps the interior of a hanging bowl, or as the latter, as an appliqué mount. The ribbed style of decoration is similar to that employed on zoomorphic escutcheons on the hanging bowl from the St Ninian's Isle treasure (Small et al 1973, Bowl No 8). The other zoomorphic mount consists of an upper valve with the impression of a tapering strip with gilled decoration from a central spine leading to possible animal-head terminal (24/8343).

4.6 Possible weights [Illus D6.1.19; Illus D6.1.20]

A noteworthy group of moulds are unique in Scotland and are tentatively identified as for casting weights and fall into two types. A further lower valve with deeply impressed object appeared similar in overall form, but was unique in the assemblage (24/8152) [Illus D6.1.20]. This valve bore the impression of an object with a squat sub-cylindrical shaft leading to a bulbous terminal with crude similarities to doorknob spearbutts but, given the date and function of such objects, is unlikely to be meaningful in the context of Tarbat.

Type A [Illus D6.1.19]

Type A was represented in nine valves, both upper and lower (24/8195 conjoins 8221, 8086, 8273 and 8130), including four valves which unite to form two near-complete Type A matrices (24/8270 unites to 8172 and 24/8319 unites to 8292). Type A consists of a shape best described as acorn-like with a pyramidal lower half and small rounded knop, and in the case of Type A, sometimes with a circular tab at the top of the knop, which may have been drilled through following casting.

Type B [Illus D6.1.20]

Type B was represented by eleven valves, again both upper and lower, although none could be united (24/8194, 8096, 8140, 8093, 8128, 8222, 8324, 8235, 8094, 8206 and 8363). The objects cast in Type B valves clearly represent a very similar type of object with a pyramidal bottom half and a much taller knop, without clear evidence for a tab.

4.7 Objects with tabs [Illus D6.1.17]

A new group of fifteen valves and fragments are grouped here by a distinctive trapezoidal tab integrated into the object matrix. The items being cast included small tabbed individual tapering strips (24/8106, 8169, 8174, 8240 and 8371), sometimes paired and united by a single trapezoidal tab (24/5371, 8153 and 8335), tabbed strips with spiral terminals (24/4581 and 8085) and a tabbed strip with T-bar (24/4582). A further three valves could be grouped here since they bore fragmentary trapezoidal tabs (24/4580, 5397 and 8203).

A valve fragment from the Brough of Birsay was identified as having a trapezoidal tab integrated into the matrix (Curle 1982, 35, no 374) and other examples of tabbed matrices can be identified from the site (Curle 1982, 34, nos 343 and 348). Curle suggested the tab was designed to be folded round another object, which seems a reasonable suggestion, although it does not aid with deciding upon an identity for the Tarbat objects.

5.0 Discussion

The deposits which yielded mould fragments from Sector 1 are assigned to Period 2 activity because of their position overlying the infilled enclosure ditch and their spatial association with S1. In addition, the dating of two glass studs from the assemblage to the eighth century provides a date for the wider assemblage. The deposits which yielded assemblages of Period 3 were within Sector 2 where they were stratified above the ruins of Period 2 buildings, layers and features and were recovered along with fragmentary Period 2 sculpture.

Throughout both periods there are strong affinities with the technology, and in some cases the products, of the Pictish workshop at the Brough of Birsay. There are also artistic links with the St Ninian's Isle treasure, along with a number of other high status composite objects from Pictland and beyond. There are, however, distinct differences in the repertoire and the emphasis at Birsay appears to have been the production of small items of personal display, including small penannular brooches, stick pins, finger rings and small tacks or studs, whereas in both periods at Tarbat, highly accomplished craft-working is evidenced.

The Period 2 items at Tarbat included multiple examples of highly decorative castings in glass or non-ferrous metal, with evidence for inlaid metal grilles of the kind that adorn contemporary masterpieces. There is, however, a shift in Period 3 where smaller commodities are also produced with the finger rings providing a close – if not exact – connection to the Birsay workshop. Nevertheless, more specialist work is also evidenced in this period and the possible large brooch mould with its distinctive fine fabric, and the small glass stud mould that matches the Tara brooch, suggest that a brooch of that calibre could have been made at Tarbat in Period 3. Notably, this is the only brooch represented within the assemblage and this marks the Tarbat workshops apart from those at Birsay, Dunadd and Mote of Mark where smaller brooches were being produced, and likely in some number. The same can be said of dress pin moulds. The ornament on the small Period 3 glass stud mould matches the glass studs from Period 2 very closely, which is particularly noteworthy. Clearly, something of the Period 2 repertoire, if not the craftworkers themselves, persisted into Period 3 and the production of fine mounts and escutcheons is equally accomplished. Newly identified items also make their appearance in Period 3, including possible standard weights and tabbed items – again paralleled at Birsay but essentially unidentified in terms of purpose or function.

5.2 Period 2

Identifiable products from the Period 2 assemblage are dominated by the assemblage of seven glass stud moulds and nine decorative and plain escutcheons or mounts. The glass moulds belong with other forms of evidence for glass-working at the site, which so far is unique in early medieval Scotland. The manufacture of small glass studs with metal grilles and enamel inlay are found on high-status insular metalwork, but the larger glass studs being produced are not so easily paralleled. The evidence for the casting of items of lesser status was indicated by the dress pin and buckle moulds, but these are not numerous enough to constitute evidence for the mass production of small, low value items or commodities.

5.2 Period 3

A greater number of moulds were recovered from Period 3 deposits and the range of cast items was correspondingly more diverse. Items being produced clearly included finger-rings, dress pins, buckles, strap-ends and strips and in greater quantities by comparison with Period 2. In addition, a number of highly decorative items were also being manufactured, represented by the possible brooch mould, possible brooch terminal, small inlaid glass stud mould, the fish mount and items with tabs likely to belong to composite items. The possible casting of weights was also confined to this period.

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Digest 6.7 EARLY MEDIEVAL GLASS AND GLASS-WORKING WASTE

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Vessel glass

Sherds from three very different types of vessel are present in the assemblage. The easiest to identify is 2885, decorated with a reticella glass rod of twisted opaque yellow and self-coloured glass. Vessels decorated with reticella rods are a hallmark of the eighth and ninth centuries, and are found distributed in Scandinavia and around the North Sea littoral, with a scatter further afield (Näsman 1984, 81–2, fig 9; Evison 2000a, fig 7). The place of manufacture has been widely debated (Evison 1988), and there may have been several production centres, but only *Hamwic* and Åhus have been fairly certainly identified as a source (Hunter & Heyworth 1998, 38, 61). Scottish examples are known from the Brough of Birsay (Campbell 2007, Pl 26; Hunter 1982, 47), Whithorn (Price & Hill 1997, 314–15, illus 10.12, no 83), and Inchmarnock (Campbell forthcoming). These, and the English examples from Whitby, Monkwearmouth, Barking Abbey, Flixborough and Beverley, are mostly from ecclesiastic contexts, but more recently examples have turned up on secular settlements such as York, Trowbridge, and Wicken Bonhunt (Evison 2000a, 86–8). Unused reticella rods have also been found at western monastic sites such as Iona, Armagh and Movilla, as well as secular sites such as Dunnyneill Islands. However, these rods were also widely used in bead manufacture, so their presence does not necessarily imply vessel manufacture. The Tarbat sherd cannot be assigned to a form, as it is too small, but reticella trails were applied to a wide variety of forms, such as jars, bowls and funnel beakers. Of these, the curvature of the sherd suggests a jar or bowl as the most likely form. It has been suggested that the Scandinavian distribution of reticella-decorated vessels can be correlated with that of Tating ware and the wine trade (Gaut 2008, 35), but there is no way of confirming this suggestion at Tarbat, where no imported pottery was recovered.

The blue sherd, 11/1901, comes from near the base of a narrow vessel, perhaps a cone or funnel beaker (see Digest 6.8, for colour photograph). This deep cobalt blue colour appears in Anglo-Saxon England in the seventh century, and was used in a restricted range of vessels associated with elite princely graves, possibly as diplomatic gifts (Campbell 1990). If the vessel was a cone beaker, it is likely to date to the seventh century. If it was a funnel beaker, an eighth- or ninth-century date would be appropriate, but this deep blue colour would be unusual at this period. The sherd is markedly abraded, and is not certainly ancient, so its status must remain equivocal.

The third sherd, 11/2471, is equally difficult. Decolourised glass with wheel-engraved decoration was produced in Late Antique contexts in the Mediterranean (Price 2000, 24–6), and a few sherds have been found in fifth- to seventh-century contexts in Britain, including Whithorn (Campbell 2007, 56–8). However, the decorative technique of the Tarbat sherd differs from these imports in that the engraving has not been done with the edge of a wheel, but in ground-down patches and deep scores with a pointed tool, possibly diamond-tipped. It is therefore perhaps more likely that this sherd is post medieval, but its antiquity cannot be ruled out.

Catalogue

24/2885

Bodysherd of decorated glass vessel. The glass is good quality, few bubbles, and a yellowish-green colour. The decoration is a single reticella trail, of opaque yellow and transparent yellow-green, partially marvered. The yellow trails have bled into the body of the vessel forming a row of spots along both margins. Trail 3mm wide. Diam of vessel (?)50–60mm; Th 0.5mm: size: 13mm × 9mm (C1501) [Illus 6.5e].

11/2471

Bodysherd of decorated glass vessel. The glass is of high quality, no bubbles, colourless (decolourised). The decoration is engraved, consisting of three deeply abraded sub-circular patches and three deeply incised lines, one with a series of deeper cross-hatches. Outer surface abraded. Size: 15mm × 8mm × 1.5mm. Possibly Late Antique or post-medieval. Found in medieval or post-medieval context 24/1368. Not illustrated.

11/1901

Bodysherd. The glass is high quality, no bubbles, light cobalt blue. Sherd from near narrow base of ?cone or funnel beaker. Th 2–4mm, size: 16mm × 7mm. Heavily abraded edges. Not certainly ancient. (C1369) [Illus D6.8.3].

Glass-working debris

The collection of glass-working debris from Tarbat is the most extensive in Scotland for the entire medieval period, and is important in showing the range of glass-working processes which took place in the early medieval period as it includes raw glass, molten droplets and trails, crucibles and heating trays. Similar collections are known from contemporary monastic sites in England and Ireland at sites such as Glastonbury (Bailey 2000), but the same range of glass-working activities also took place on secular high status sites such as Lagore and Garranes (Henderson 2000, 144–7). Glass was almost certainly not made from its mineral constituents in north-west Europe at this period, but was manufactured in the Mediterranean area on an industrial scale, and the raw material exported as lumps of cullett, broken from massive slabs. The cullett was then melted down to make vessels or other items such as beads and inlays (Freestone et al 2008, 32–3). The material can be divided into two groups, one of deep blue glass, and the other of opaque yellow.

The first stage in the glass-making process was the acquisition of cullett. Lumps of raw glass rarely survive from this period. There is one large block of red glass from near Tara, and a yellow one from Moynagh Lough crannog excavations, both in Co Meath, Ireland (Youngs 1987, 201), and much smaller shaped slabs from Glastonbury Abbey (Bailey 2000, 171; Evison 2000b, 189), but all that is usually found are glass mosaic cubes and selected sherds of glass, collected and destined for melting down (Campbell 2007, 92–6; Hill 1997, 296).

The large piece of blue cullett, 11/1000, is therefore an important addition to our knowledge of the raw materials available to early medieval Insular craftworkers (see Digest 6.8, for colour photograph). A small spall, 11/362, and a glass droplet, 11/4136, are probably derived from melting down this cullett. The glass stud, 25/686, may have been one of the products of this blue glass-working.

The other pieces are related to working of opaque yellow glass. The crucible fragment 11/3551 would probably have been used to prepare the opaque yellow glass by mixing lead-tin ores with raw glass, as was found at Dunmisk, Co Tyrone (Henderson 2000, 144). There are traces of metal ore within the glass adhering to the crucible wall. The thickness and curvature of this crucible show that it would have been quite large - the ones from Glastonbury held up to two litres of glass (Bailey 2000, 170, fig 13). This is larger than the general metalworking crucibles of the

period, such as those from Dunadd (Lane & Campbell 2000, illus 4.40). The driblet of yellow and green glass, 25/1385, may have been associated with this stage of the process (see Digest 6.8 for colour photograph). The heating tray, 11/3469, would then have been used to re-melt the prepared opaque yellow glass (see Digest 6.8, for colour photograph). The stirring marks where trails of glass have been lifted are still visible on the base of this tray. The 'eyed' shape of this tray is unusual, though it is clearly related to 'dog-bowl' types found on many sites (ibid 134, type B), and some of the Birsay and Clatchard Craig examples are oval (Curle 1982, illus 25; Close-Brooks 1986, illus 27, 107). The fragment of trail or rod, 25/1458, is a remnant of one the trails lifted from this type of tray, possibly used to create a reticella rod by twisting with another of natural-coloured glass (see Digest 6.8, for colour photograph).

Catalogue of glass debris

11/362

Spall from lump of cullett. Pale blue transparent glass, surface opalescent. Size: 20mm × 6mm × 3mm (C1002).

11/1000

Large fragment from sub-spherical lump of cullett. Opaque blue glass, banded lighter and darker from turquoise to blueish white, very bubbly. Surface opalescent, devitrifying in places. Size: 36mm × 20mm × 9mm (C1145).

25/1385

Irregular dribble of molten glass. Colour varies from olive green to opaque yellow. Irregular lumps of opaque yellow inclusions. Size: 30mm × 4mm × 4mm (F179 C1457).

25/1458

Irregular rod of opaque yellow glass, broken at one end, rounded at the other. Waste from trail production. Size: 12mm × 2mm × 2mm (F222 C1471).

11/3551

Crucible body sherd, with opaque yellow glass on interior surface. Fabric white, gritty, rather crumbly, wheelthrown. Exterior grey/orange. Possible inclusions of metal ore in glass. Size: 41mm × 31mm × 7mm (C1250).

11/3469

Two-thirds of a low-walled heating tray. Eye-shaped heating tray with flat base. Patches of opaque yellow glass on interior surfaces, but also spreading to exterior in places. Stirring marks visible where trails have been lifted out. Fabric as 3551, hand-modelled. Size: 62mm × 45mm, Height 17mm (C1250).

11/4136

Droplet of molten glass, broken. Cobalt blue, very bubbly. Abraded. Size: 3 mm × 3mm × 4mm (F34 C1048).

Beads

The fact that only two beads were recovered from the extensive excavations might be seen as surprising, but given that beads were predominately female attributes, this is understandable in a monastic context. Both beads from the site are in a bubbly blue glass, and it is possible they were manufactured on site, given the droplet of similar glass (11/4136). One of the beads, 14/3559, is tiny, of a type sometimes referred to as spacer beads for necklaces (Hunter & Heyworth 1998, 26). These are uncommon, presumably because they are so easily overlooked, but appear to have been made at *Hamwic* in the eighth/ninth centuries (ibid). The other bead, 24/4570, decorated with running swags, is a common type in both Anglo-Saxon and Scandinavian contexts, over a wide time range. The marvered trail decoration has almost completely decayed, leaving a groove, which suggests it may have been in opaque white glass, which is prone to decay. There are traces of colourless glass at places within this groove, which might suggest that the decoration was originally a bichrome twisted reticella trail of white and colourless glass. If that was the case, it indicates a connection with a later tradition of reticella beads found in Ireland, Scandinavia and later Anglo-Saxon England (Brugmann 2004, 41), from the seventh to tenth centuries. Given that the trail is missing, there is little more specific that can be said.

Catalogue of beads

14/3559

Tiny blue spacer bead. Wound, bubbly glass, opalescent decay. 3mm Diam, hole 2mm diam (C1941).

24/4570

Decorated wound glass cylinder bead. Glass cobalt blue, very bubbly and streaky. Decorated with single marvered running swag trail, now completely decayed, but with traces of colourless glass, perhaps indicating original reticella twisted trail. Height 7mm; Diam 8mm; hole 4mm diam (F432 C1877) [Illus 6.5d; Illus D6.1.11].

Studs

The two decorative domed glass studs from the site are the most spectacular glass finds, and are important in showing the type of material that was produced at Tarbat. The similarities in design of the two studs suggest they derive from, or were intended for, a single composite piece of metalwork. Both designs are based on a tri-partite division of the circular stud using a combination of arcs and straight lines to form pseudo-cloisons which would have been filled with silver. The smaller of the two, 25/1452, in opaque white glass, has grooves for silver wire decoration, but this is now lost or had not been applied, while on the larger, 25/686, the wire survives and can be seen on X-ray to be almost complete (see also Digest 6.8, for colour photograph. The pattern of decoration, a doubly tripartite division, one of arcs and one of straight lines, sometimes stepped, is paralleled in more elaborate versions on some of the smaller studs from the Derrynaflan patten (Ryan 1993, 30, pl 14; Ryan & O' Floinn 1983, pls 55, 57, 59, 61), and the same decorative elements are used in other studs. While the some of these studs have a quadripartite decorative scheme, many others are tri-partite. The central triangle with concave sides, which is so prominent in the Tarbat stud, is a particular feature of the Derrynaflan studs on Frames 1, 12 and 5 (ibid). These studs use blue and red for the decorative scheme, and this may have been the original colour scheme of 25/686 (as red enamel often fades to white), but blue and yellow is another possibility. The larger stud, 25/686, is similar in size to the Derrynaflan studs, and the Tarbat stud is clearly in the same workshop tradition, if not from the same craftworker. Very similar studs are seen on secular metalwork on the back of the 'Tara' brooch from Bettystown, a piece conventionally dated to the early eighth century, but otherwise, most surviving artefacts with these studs are ecclesiastical, such as the Ardagh chalice, Moylough belt-shrine and the Derrynaflan wine-strainer.

The smaller Tarbat stud has a similar decorative scheme, but in its most simplified form, without any stepped elements. The small size would seem to preclude its use on large items like a patten or chalice, but slightly smaller studs, almost identical to those on the Derrynaflan patten, are seen on the rear of the 'Tara' brooch (Youngs 1989, pl on 77 upper), though it is difficult to find a parallel for such a small stud. It may have been from a small brooch such as that from Co Westmeath (Youngs 1989, 206, no 211), which has small studs of about 7mm in diameter on its front face, or may have been a subsidiary stud like those on a possibly ecclesiastical mount also probably from Westmeath (Youngs 1989, 147, no 141). Most of the parallels quoted above probably date to the eighth century. The only piece from a well-dated archaeological context is a detached stud with gold wire inlay, which was found in an early eighth-century deposit at Deer Park Farms, Co Antrim (Youngs 1989,

206). An eighth-century date is the likely for both the Tarbat studs. The production of inlaid glass studs is attested at a number of secular and monastic sites, including Lagore and Iona, where moulds have been found, and at Garryduff and Dunmisk where unfinished studs were found (Henderson 2000, 146). Thus it seems that this type of stud was not made in an exclusively ecclesiastic milieu, but was also produced on high status secular sites.

Catalogue of Studs

25/686

Decorative glass stud with silver wire inlay. Main body of stud is of cobalt blue bubbly transparent glass, with a Y-shaped inlay formed by three arcs of silver wire, filled with opaque whitish glass now discoloured by corrosion, possibly originally red or yellow. Between the arms of the Y is another tripartite division formed by three zig-zags, also filled with silver wire. The circular border also holds silver wire. On the upper surface, the glass is decayed and devitrified in places, particularly the white, probably due to contact with the metal. The upper surface is convex, with vertical sides. The rear surface is not flat, and has part of a flange and indentations showing where the soft glass was pushed into the mould. There is a small flake missing from one edge. Diam 11mm, Th 4mm (C1002) [Illus 5.7.10].

25/1452

Tiny glass stud with moulded decoration on upper face. Opaque white glass, with a few bubbles. The grooved decoration, 0.3mm wide and intended for silver wire inlay, as in 686, consists of a Y-shape overlain by three curved lines forming a triangle with concave sides, all lying within a circular border. Upper surface convex, lower uneven with flange on one side. Diam 5mm, Th 1mm (F216 C1459) [Illus D6.1.10].

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Digest 6.8 ANALYSIS OF THE GLASS AND GLASS-WORKING WASTE

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An assemblage of glass fragments from the Tarbat monastery excavations were analysed by SEM-EDXA. Of the blue glasses, two are modern. The third is a natron-type glass of Roman type, which is likely to represent re-use of early material by early medieval craftsmen. The remaining three glasses (all opaque yellow) are unambiguously consistent with early medieval glass technology. However, it was not possible to establish whether opaque yellow glass was being made at Tarbat, or simply being worked there.

Introduction

A small assemblage of glass and glass-working debris from the Tarbat monastery excavations was provided for analysis, the majority of which were assumed to be of early medieval date. This included one glass stud, two vessel fragments (one decorated with a reticella trail) and five fragments of glass-working waste – including crucible fragments, cullet and driblets. Unfortunately, the reticella fragment could not be sampled for analysis due to its fragility. This is the only assemblage containing glass-working waste from early medieval Scotland. It was hoped that compositional analysis would give further insight into glass production during the period.

Materials and methods

A list and brief description of each of the samples analysed is presented in Table D6.8.1, and images of the glasses and glass-working waste are presented in Illus D6.8.3.

Small samples were taken, mounted in epoxy resin and polished. They were coated with a thin layer of carbon and examined in the scanning electron microscope (CamScan Maxim). The chemical compositions of the samples were determined using an Oxford Instruments ISIS energy-dispersive X-ray analyser (EDXA) attached to the SEM. Relative analytical accuracy is believed better than ±2% for silica and ±5% for other elements present in concentrations greater than 10%, but greater for elements present in lower concentrations. Detection limits were 0.2% for most of the components analysed, 0.3% for lead and tin and 0.4%–0.7% for antimony, depending on the glass matrix. Results were taken from an average of three analyses, and were normalised to 100% to improve precision and comparability. Oxide compositions for the six glasses analysed are presented in Table D6.8.2.

Results

Blue glass

Samples 25/686 and 11/1901 are soda-lime-silica glasses, made using a relatively pure source of alkali, as indicated by their low potash and magnesia contents (Table D6.8.1). However, they have significant compositional differences, which suggest that they originate from different manufacturing traditions. The 18% soda, 2.2% alumina and small but significant amounts of manganese and antimony oxides in the stud 25/686 are fully consistent with weakly coloured Roman glass that was made between the first and fourth centuries AD. These glasses were decoloured using manganese and antimony oxides (eg Jackson 2005). The blue colour of this glass may derive from small amounts of cobalt present in the glass not detectable by EDXA (Freestone et al 2008).

Vessel glass 11/1901 is a particularly pure glass, containing lower levels of iron and aluminium oxides than the other glasses analysed, and is especially distinguished by a lack of chlorine. On the other hand, its lime content of 13.1% is high relative to soda-lime-silica glasses of the first millennium ad. The unusual composition, particularly the low chlorine content, strongly suggests that this soda-lime-silica glass dates to after the introduction of the Leblanc process for the production of synthetic soda in the early nineteenth century and that it is intrusive.

Opaque cullet 11/1000 is also unlikely to relate to the early medieval period. It is distinguished by a very high lime content (25.4%) and low soda (1.2%). The chlorine content is also very low (0.2%). Its composition is characteristic of post-medieval glasses of the high-lime low-alkali (HLLA) compositional type, which was in use between the sixteenth and nineteenth centuries (Dungworth et al 2006; Dungworth & Loaring 2009). The alumina and iron oxide contents and the presence of a small amount of phosphate are typical for HLLA glasses (Dungworth & Loaring 2009). No opacifier was observed in this sample, suggesting that its opaque appearance is due to the thickness of the fragment and the presence of bubbles.

Opaque yellow glass

All of the yellow samples analysed are coloured and opacified with lead-tin oxide, visible in the SEM as small crystals dispersed throughout the glass matrix (Illus D6.8.1 and 2). In all three samples, spot analyses identified these crystals as consisting of approximately 30–35% tin oxide and 60–65% lead oxide, corresponding to the cubic phase $PbSnO_3$ (Rooksby 1964; Tite et al 2008). It is apparent from the compositions (Table D6.8.1) that the two glass trails, 25/1385 and 25/1458, are essentially mixtures of soda-lime-silica glass and a component rich in lead and tin oxides. This is confirmed by the microstructures of the glasses, which are heterogeneous on a coarse scale. For example, Illus D6.8.2 shows large regions rich in lead and tin, with abundant tin oxide crystals, in a matrix which is richer in silica. Tin-oxide opacified yellow glasses, with high lead, are typical of the early medieval period in north-western Europe (Tite et al 2008).

Table D6.8.1
Glass and glass-working debris analysed

Find No	Description	Glass colour
25/686	Decorated glass stud with opaque white inlay	Transparent blue
25/1385	Irregular waste trail of glass	Opaque yellow
25/1458	Irregular driblet of glass	Opaque yellow-olive green
11/1901	Vessel glass	Transparent blue
11/1000	Large fragments of waste glass/cullet	Opaque blue
11/3469	Heating tray fragment containing glass patches	Opaque yellow

Table D6.8.2
EDX analyses of glass and glassworking waste[1]

Oxide (wt%)[2]	Find No					
	25/686	25/1385	25/1458	11/1901	11/1000	11/3469
Na_2O	18.0	8.1	5.5	12.1	1.2	0.0
MgO	0.7	0.4	0.3	0.3	2.0	0.3
Al_2O_3	2.2	2.0	2.3	1.0	3.2	5.8
SiO_2	66.9	36.7	27.9	71.3	58.5	13.2
P_2O_5	0.1	b.d.	b.d.	b.d.	1.7	10.2
SO_3	0.5	0.4	b.d.	0.6	0.6	0.5
Cl	0.6	0.6	0.5	b.d.	0.2	0.6
K_2O	0.6	0.5	0.4	0.4	2.8	b.d.
CaO	6.3	3.5	2.3	13.1	25.4	4.9
TiO_2	b.d.	b.d.	b.d.	b.d.	0.3	0.6
MnO	0.6	0.2	0.2	0.1	0.2	b.d.
Fe_2O_3	1.0	1.4	3.3	0.3	2.2	5.6
CuO	0.8	0.6	0.7	0.6	0.6	0.6
ZnO	b.d.	b.d.	0.2	b.d.	b.d.	b.d.
SnO_2	b.d.	2.7	6.9	b.d.	0.4	8.8
Sb_2O_3	0.9	b.d.	b.d.	b.d.	0.6	1.2
PbO	0.2	42.6	49.3	b.d.	b.d.	47.0

[1] Average of three area analyses normalised to 100%; see text for details
[2] b.d. = below detection. Detection limits were thought to be about 0.2% for most of the elements analysed, although this is marginally higher for lead and tin at about 0.25–0.3% and rises to over 0.5% for antimony in glasses with high calcium. Barium oxide and cobalt oxide were analysed for, but not detected

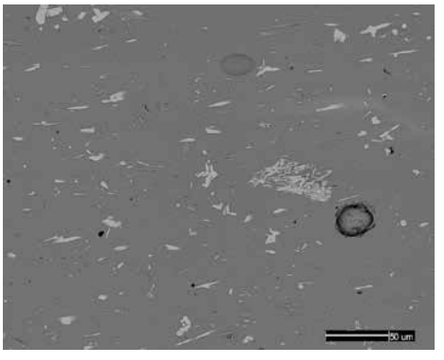

Illustration D6.8.1
A backscattered electron image showing crystals of lead-tin oxide dispersed throughout the glass matrix of sample 25/1458

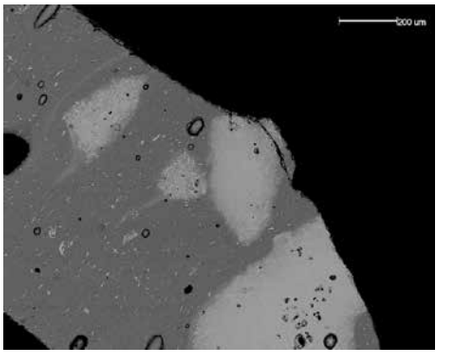

Illustration D6.8.2
A backscattered electron image showing crystals of lead-tin oxide dispersed throughout the glass matrix of sample 25/1385. The glass is very heterogeneous, as shown by sub-angular patches of lead-tin oxide opacifier crystals. The glass matrix appears brighter in the crystal-rich regions because it contains much more lead than the darker grey regions

The yellow deposit on the heating tray, 11/3469, differs from the other samples in terms of its high phosphate and low soda and silica contents. Removal of sodium and deposition of phosphate from the environment is typical of weathering processes observed in some glasses (Freestone et al 1985) and our interpretation is that this yellow material, rich in lead and tin, has resulted from the weathering of an opaque yellow glass, similar to those of the trails.

Discussion

The results indicate that two of the three blue glasses are post-medieval, so only the stud is of particular interest here. There is now a wide range of evidence in support of models of glass production in the first millennium AD which interpret soda-lime-silica glass to have originated largely in the Levant and Egypt, where it was made from its raw materials – on a scale of many tons – in large tank furnaces (Freestone 2006). This raw glass was distributed across the Mediterranean and Europe to be remelted and shaped into vessels, windows and other artefacts (Freestone 2003; Freestone & Hughes 2006; Freestone et al 2008).

As indicated above, the composition of the stud is characteristically Roman. Its soda, lime and alumina contents do not match the compositions of primary glass prevalent after the fourth century and the presence of antimony argues for an early date. Roman glass was re-used for inlay and enamelling until as late as the fourteenth century, including in the jewellery of Anglo-Saxon Britain (Bimson & Freestone 2000). Given that the design of the stud is characteristically early medieval (Campbell, pers comm), this is almost certainly the case here. Compositional parallels to the blue stud may be found from the Dalriadic capital of Dunadd (Henderson 2000a) and from the assemblage at Dunmisk, County Tyrone (Henderson 1988).

The yellow glasses are all opacified and coloured by crystals of lead-tin oxide, or lead stannate ($PbSnO_3$). Glass of this type was used in Europe from the second century BC and continued in use throughout the first millennium AD, and has been interpreted by Henderson to represent the continuity of a Celtic rather than a Roman tradition (Henderson 2000a; Henderson 2000b; Henderson & Ivens 1992). The minor compositional differences between the yellow glasses analysed are probably due to slight variations in the quantities of raw materials used in the glass recipes, combined with the notable heterogeneity of these glasses (Illus D6.8.2).

Table D6.8.3
Comparison of opaque yellow glass from Tarbat to published analyses of contemporary glass from elsewhere

Oxide (wt%)[1]	Sample		
	Schleitheim[2]	Dunmisk: 13[3]	Tarbat: 25/1385[4]
Na_2O	7.8	9.1	8.1
MgO	0.3	0.4	0.4
Al_2O_3	2.9	2.2	2.0
SiO_2	33.9	43.6	36.7
P_2O_5	<0.1	2.1	<0.1
Cl	n.a.	0.8	0.6
K_2O	0.2	1.2	0.5
CaO	2.7	2.9	3.5
Fe_2O_3	0.8	0.9	1.4
SnO_2	1.7	4.7	2.7
Sb_2O_3	n.a.	0.4	<0.4
PbO	49.5	32.9	42.6

[1] n.a. = not analysed
[2] Opaque yellow glass bead from Schleitheim, Switzerland. Mid-seventh-century Merovingian date (taken from Heck et al 2003)
[3] Opaque yellow crucible glass from Dunmisk Fort, Co Tyrone, Ireland. Early Christian date (taken from Henderson 1988)
[4] Opaque yellow waste trail of glass from Tarbat (taken from Table D6.8.2, this report)

Heck et al (2003) investigated a crucible and bead (Table D6.8.3) of Merovingian date from Schleitheim, Switzerland, and found that the yellow glass was prepared in two stages. First, lead-tin yellow pigment was prepared by heating a mixture of the oxides of lead and tin, which reacted with the crucible fabric to form crystals of lead-tin oxide in a lead-silica glass. This was then mixed with a pre-existing soda-lime-silica glass to form the yellow glass used to make beads. A similar process was used in post-medieval Venice to make yellow glass (Moretti & Hreglich 1984) and was probably widely used throughout the medieval period (Tite et al 2008). The sub-angular nature of the aggregates of lead-tin oxide crystals in sample 25/1385 (Illus D6.8.2) suggests that they were directly added to the soda-lime-silica matrix as crushed lumps of a lead-tin-silica material and that the resultant hybrid glass was not heated for long enough to fully disperse them. The duration of heating would have been minimised as lead-tin yellow is unstable, and the yellow glass can readily lose its colour at high temperatures.

The compositions of the soda-lime-silica glasses used to manufacture the yellow glasses cannot be determined accurately as the compositions may reflect contamination from a number of sources. However, the presence of antimony oxide in the relict glass on the heating tray (Table D6.8.1: 11/3469) suggests that the re-use of Roman material is a strong possibility.

Sample 11/3469 was the only glass analysed directly from a refractory ceramic. The flat, open shape of this heating tray is paralleled by heating trays associated with potential glass-working debris found elsewhere, for example, in early medieval Ireland, although the evidence for glass working is far from unambiguous in many cases, as noted by Henderson and Ivens (1992). It has been suggested that they were only used for softening glass prior to shaping it, as more closed shapes would have been necessary to melt it completely (Henderson & Ivens 1992). No evidence was observed in the SEM of partially fused primary raw materials that might suggest the making of glass, rather than its manipulation.

Overall, these results provide evidence only for the manipulation of opaque yellow glass at Tarbat. There is no evidence for primary glass making from raw materials and, as the lump of blue cullet is no longer considered early medieval, no evidence to support the manipulation of other colours. The opaque yellow glass appears to have been made using a technique which is closely paralleled in Merovingian Switzerland. We are unable to determine if it was made on site or brought in from elsewhere; the deteriorated condition of the glass on the heating tray limits our ability to speculate here.

This interpretation differs considerably from that previously put forward for glass industrial debris from Dunmisk, where it has been suggested that yellow glass was being made directly from its raw materials, including soda, and that the craft activity is a continuation of a specifically Celtic technological tradition (Henderson & Ivens 1992). This difference may relate simply to the character and positions of the sites, but we note the close similarities of the opaque yellows from Dunmisk and Tarbat, and that from Switzerland (Table D6.8.3), which strongly suggest a common technology. It may be that the quartz grains upon which so much depends in the interpretation of the crucible deposit from Dunmisk (Henderson 1988; Henderson & Ivens op cit) are relicts from the production of the lead-tin yellow pigment, rather than the soda-bearing glass.

Conclusion

Of the six glasses analysed, only four appear to be early medieval, and we have no evidence for the working of colours other than opaque yellow. The compositions of the glasses are strongly paralleled at Dunadd and Dunmisk, and are interpreted as evidence for an industry based largely on the re-use of soda-lime-silica glass which, at least in part, had its origins in the Roman period. Before the fourth century, opaque yellow glass was largely based upon the use of antimony oxides, and the lead-tin yellow pigment found here is characteristically early medieval. It was produced by adding pre-formed yellow pigment to a soda-lime-silica glass which, in some cases at least, was recycled material. The technique to produce the yellow pigment seems to have been quite widespread and was certainly carried out at Schleitheim in Switzerland (Heck et al 2003) and Dunmisk in Ireland (Henderson & Ivens 1992). However, we are unable to determine if this procedure was undertaken at Tarbat or if the yellow glass was imported. At present, the evidence at Tarbat seems to be limited to the hot manipulation of yellow glass.

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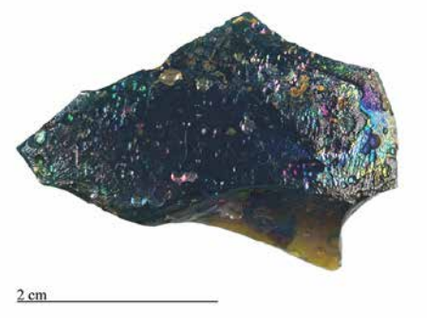

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Illustration D6.8.3
Analysed glass from Portmahomack

Digest 6.9 IRON-WORKING SLAGS

CECILY SPALL (FAS Heritage) with CATHERINE MORTIMER (OLA 7.1.6.4)

1.0 Introduction

A total of *c* 590kg of slag was recovered from excavation across Sector 1 and 2 between 1994 and 2007. The assemblage recovered up to 2004 was assessed rapidly by Dawn MacLaren and Gemma Cruikshanks, National Museums Scotland, in 2006 and slags associated with smelting and smithing were identified and full cataloguing was recommended. A further three seasons of excavation also produced slag and vitrified material and the entire assemblage was subsequently catalogued in 2011–12.

2.0 Summary of assemblage

2.1 Recovery method

No on-site sub-sampling regime was implemented during fieldwork and the assemblage represents all slags excavated, collected either by hand (3-D positioned or recovered by feature) or recovered by the site soil sampling strategy. For a full description of the strategy, see Data Structure Reports; in summary, deposits were bulk sampled for coarse-sieving (100% or min.100l whichever was the greater) and further samples passed through a Sirāf tank (1mm mesh; min 10l or 100% if associated with metallurgical processes) capturing smaller grade slag and micro-slags which were collected by scanning a magnet through dry flotation residues sieved to 2mm and 500µm grade.

2.2 Recording methodology

The Tarbat material was identified visually and sorted into type, weighed, measured where appropriate and as far as possible identified as belonging to one of the following categories:

> dense slag (*ds*); ferruginous concretion with hammerscale (*fc*); flake or spheroidal hammerscale (*hs*); fuelash slag (*fs*); smithing hearth bottom (*shb*); tap slag (*ts*); tuyère (*ty*); undiagnostic iron-working slag (*uis*); vitrified furnace lining (*vfl*).

Hearth bottoms/slag cakes were measured (Diam or length and width × thickness) and weighed, or where incomplete, the diameter and/or the percentage of the whole represented were estimated, allowing the weight to be estimated. The *shb* dimensions were then tabulated to allow comparison of dimensions in relation to mass and density. Assemblages of hammerscale were scanned visually and estimates of the ratio of flake to spheroidal hammerscale recorded (noted as f:s in the catalogue). Good examples of smithing hearth bottoms illustrating the range of sizes, tap slag, hammerscale, vitrified furnace lining with evidence for tuyère holes and diagnostic tuyère fragments were selected for photographic recording and illustration.

2.3 Reconstructing metallurgical processes

Iron working begins with the bloomery process of smelting ore to win an iron bloom, followed by primary smithing whereby the slag-rich, spongy bloom is consolidated into a billet by hammering, followed by secondary smithing of a billet into objects. The first two stages happen at one site and are immediately sequential, while secondary smithing, ie the production of wrought objects from consolidated billets, can take place at a later stage and at a different site, along with the maintenance and repair of items and recycling of scrap. Each stage requires a range of resources and in turn produces a range of waste products, some diagnostic, allowing these metallurgical stages to be identified in overview.

Smelting produces diagnostic tap or rake slag, the former being a liquid 'gangue' of non-iron minerals, primarily silicates, released in a liquid state from the furnace shaft through a tapping arch in the furnace base or allowed to pool at the base, producing dense slag cakes. Tap slag was identified within the assemblage by its characteristic blue-black appearance, probably indicative of high manganese content and its flowing surface morphology and vesicular structure. Tap slag is relatively brittle and at Tarbat was often recovered in angular fragments, which conjoined within context groups. Raked slag is the product of the gangue being manually removed from the furnace shaft while still hot and plastic, although none was identified among the Tarbat residues.

Smelting slag cakes are plano- or concavo-convex in form and can sometimes be differentiated from smithing hearth bottoms on morphological grounds as they tend to be less vesicular or denser and can have run surfaces similar to tap slag. Where the distinction can be made visually, identification has been reinforced by comparing mean density (McDonnell 1994, 230). Morphologically, differentiation between these types of slag at Tarbat was difficult. Tap slag was recorded on the surface of plano-convex and concavo-convex or bowl-shaped slag cakes, but very rarely. Differentiation within the Tarbat assemblage was attempted by calculating density of all the slag cakes (*shbs*). Volume was calculated using πr^2 or πab (a = half length, b = half width) × thickness; density was then calculated by m/v = g/cm^3. Unfortunately, distinct cohorts were not identified, with density ranging across a spectrum from 0.3 to 2.3g/cm^3 with rare outliers. Comparison with data from Howe, where the mean density of smelting cakes and smithing hearth bottoms was recorded (here using the above calculation) as 1.7g/cm^3 and 1.3g/cm^3 suggests that both types of slag cakes are in fact present in all periods at Tarbat, but the actual point of departure between the two is not clear within the recorded data.

Primary smithing produces amorphous smithing slags and large thick flake hammerscale and high relative percentages of spheroidal hammerscale. Flake hammerscale is formed by oxides dislodged from the surface of hot iron by hammering, both during consolidation of a bloom and during secondary smithing; spheroidal hammerscale is formed when molten droplets of oxides are expelled under pressure and harden in the air during primary smithing of a bloom and during fire welding (McDonnell 1984; 1986a; Starley 1995).

Secondary smithing also produces flake and spheroidal hammerscale, amorphous smithing slag and smithing hearth bottoms (*shbs*), which are characteristically plano- or concavo-convex in form. Compositionally, they are primarily fayalitic (iron silicates). In a couple of instances, double *shbs*, one formed on top of the other, were recorded, indicating two episodes of smithing had taken place before removal of the slag cake from the smithing hearth. Where pieces of slag were clearly derived from a fragmented *shb*, it was catalogued as dense slag; these were recorded frequently since *shbs* are characteristically brittle and easily shattered (Bachman 1982, 5). Where recorded, the make-up tended to be vesicular throughout. Ferruginous concretions (*fc*) were recorded, characterised by brightly coloured rust deposits, and hammerscale could sometimes be discerned within the make-up. These are considered to be smaller grade smithing residues, including amorphous slag and hammerscale, which have become fused into a single mass by post-depositional processes, but may represent the floor surfaces of iron-working areas.

Recent studies using high-speed film have confirmed that spheroidal hammerscale can be the result of molten oxides expelled during the closing of a fire weld (Dungworth & Wilkes 2009; McDonnell 1986a, 146; Young 2011). A range of spheroidal microslags, some known as combustion spheres, can also be produced during primary smithing by accidental burning of the iron when over-heated; these can only be differentiated from spheroidal hammerscale by microscopic examination, but it has been assumed that the Tarbat spheroidal scale is indicative of fire welding techniques.

All stages of iron-working can produce residues which are not diagnostic of smithing stages or other high temperature processes. Vitrified furnace lining (*vhl*) has the characteristic appearance of a black to grey vitrified, glassy interior and brightly coloured (red to orange) oxidised exterior, with grey cinder margins. *Vhl* is not necessarily diagnostic of any stage of iron-working or actually metal-working per se. Nevertheless, the material was sometimes noted adhering to the edge of slag cakes and was almost exclusively recovered from features and deposits which also yielded other iron-working residues. Blowing holes for tuyères were frequently recogniseable in the Tarbat examples, demonstrating as a minimum that the hearth linings derived from a structure which required concentrated oxygen input, and therefore probably not domestic in nature.

Other material was more broadly indicative of high-temperature processes not necessarily connected with iron working, including a quantity of 'fuelash slag', sometimes recorded at other sites as 'cinder'.

3.0 Catalogue

3.1 Overview of the assemblage

Sector 1 produced an assemblage of *c* 21kg of slag and by contrast, Sector 2 produced *c* 560kg, being the focus for craft-working throughout all periods (Table D6.9.1). A catalogue was compiled during recording and forms part of the online archive for the project (OLA).

Most bloomery and smithing sites normally produce less than 200kg of slags (McDonnell 1989; 1991; Photos-Jones 2006, 137; 2010a) and the Tarbat assemblage can be considered to be substantial, one of the largest recovered in Scotland. Comparison with other sites, including multi-period sites and from urban and rural locations, confirms the comparatively sizeable assemblage (Table D6.9.2).

4.0 Metallurgical activity by period

The data recorded are presented in Table D6.9.3 by period and metallurgical process.

Table D6.9.1
Summary of slag by sector and intervention

Sector	Int	Weight (kg)
1	11	20.82
	25	0.53
	Total	21.35
2	8	17.11
	14	263.40
	24	269.10
	26	19.19
	Total	568.80
	Grand total	**590.15**

The majority of material derived from late Period 4 deposits (fifteenth to sixteenth century) and included slags indicative of both iron smelting and smithing (73%). A possible smelting hearth and the stance of a smiddy were identified in the field. Overall, much less material derived from deposits and features of Period 1 to 3 (sixth to eleventh century) (3%; 11%; 14%), but iron smithing was identified in all these periods with a relative emphasis on this activity during Period 3, along with some evidence for smelting.

4.1 Period 1

A group of Period 1 features yielded small quantities of smithing slags (*ds*, *uis* and *shbs*). Several features which produced these slags belonged to S11 or lay close-by. S11 hearth F535, gulley F547 and adjacent slag-filled pit F560 yielded just over 2.3kg of undiagnostic iron-smithing and dense slag, which indicates that secondary smithing was probably being undertaken in the building. Other slags recovered from Period 1 backfills and layers included four smithing hearth bottoms (F435, C3529 and C3177).

4.2 Period 2

More than half of the iron-working slags recovered from Sector 1 derived from Period 2 deposits and frequently from features belonging to S1 (*c* 11kg). The range of slags indicates secondary smithing was being undertaken in the building or nearby, although the quantity recovered does not indicate intensive activity. The make-up of the assemblage from nearby Period 2 features reflects that recovered from features belonging to S1, and the assemblage recovered from the building has therefore been assigned to Period 2 occupation. Features from within S1 (F49, F53, F65, F114, F130, F135, F138, F147, F390, F408, F426, F429, F472 and F484) produced about 1kg of slags, primarily fragments of dense slag and undiagnostic smithing slag, along with four incidences of flake hammerscale, recorded

Table D6.9.2
Slag quantities from sites in Britain and Ireland

Site	Quantity of slags	Period (Tarbat equivalent period)
Coppergate, York	248kg	Roman, Anglo-Scan to medieval (McDonnell 1992) (3/4)
Fishergate, York	220kg	Roman, Anglo-Saxon to medieval (McDonnell 1993) (2–4) Roman, Anglo-Saxon to medieval (Mortimer 2005) (2–4)
Walmgate, York	138kg	medieval and late-medieval (MacNab 2003) (4)
St Andrewgate, York	95kg	medieval and late medieval (Mortimer 2004) (4)
Eilean Donan Castle, Ross-shire	120kg	medieval (Mortimer 2009; Starley 2010)(4)
Killickaweeny, Co Westmeath	86kg	ninth to tenth century (Photos-Jones 2010b) (3)
Hoddom, Dumfriesshire	250kg	tenth to twelfth century (Photos-Jones 2006)
Brough of Birsay	14kg	eighth to twelfth century (McDonnell 1986b) (2/3)
Dornoch, Sutherland	12kg	eighth to fifteenth century (Coleman and Photos-Jones 2008) (2/3)
Johnstone I, Co Westmeath	2,000kg	sixth to sixteenth century (Photos-Jones 2010a) (1–4)
Lowpark, Co Mayo	1,372kg	early medieval (Wallace 2010) (2/3)
Seafield, Inverness	9kg	Iron Age (Heald, McDonnell & Mack 2011) (0)

Table D6.9.3
Summary of activities implied by slags by period

Activity	Classification	Weight by period (kg)				
		Period 1	Period 2	Period 3	Period 4	Total
Smelting	tap slag	–	0.13	1.29	4.31	5.73
Smithing	smithing hearth bottom	2.82	12.38	19.98	192.13	227.31
	dense slag	3.91	5.50	25.69	107.97	143.08
	hammerscale	–	0.01	0.88	0.06	0.94
	ferruginous concretion with h'scale	–	0.14	1.83	2.86	4.83
Undiag.	undiagnostic ironworking slag	2.64	9.73	56.18	115.24	183.80
Metallurgical/high temperature process	vitrified hearth/furnace lining	–	0.12	3.07	7.28	10.47
	fuelash slag	0.02	3.68	8.65	0.86	13.20
Grand total		**18.79**	**63.38**	**82.17**	**430.71**	**590.15**

in small quantities, and a smithing hearth bottom. Nearby Period 2 deposits trapped in the sinking fills of early Period 2 ditch S15 produced over 4.5kg of slags, including dense slag (recorded with adhering vitrified furnace lining), smithing hearth bottoms, vitrified furnace lining and a single possible instance of tap slag, although, as the fragment is isolated and small, it most probably represents fayalitic run slag from smithing, given the make-up of the associated assemblage. Nearby Period 2 features F34 and F401 produced 5.6kg of slags, including five smithing hearth bottoms and vitrified furnace lining.

Within Sector 2, just over 12kg of slags were recovered from Period 2 features and deposits. Too little was recovered from Period 1 for the Period 2 assemblage to be considered residual, indicating that smithing activity continued. The slags were recovered from secondary deposits and the locus for the activity was not identified, with only 4.4g of flake hammerscale recovered. Fuelash slag was frequently recorded (3.5kg) and may relate to a range of high temperature craft-working and domestic processes, and to the firey destruction of structures which marks the end of the period.

Slags recovered from Period 2 deposits and features included seven *shbs*, *ds*, *uss* and *vfl*; again small occurrences of possible tap slag were recorded, although fayalitic run slag is a more likely identification.

Slags were recovered from the backfill of the Period 2 enclosure ditch (S16, F36) where the feature was sampled within Int 8, but these are assigned to Period 4 activity; elsewhere the feature is levelled early in Period 4.

4.3 Period 3

A more significant component of the assemblage (109kg) was recovered from deposits of Period 3 origin, notably including from primary metal-working dumps. The assemblage was restricted to Sector 2 and indicated that both iron smelting and smithing was being undertaken.

A total of nearly 3kg of *ts* was recorded from Period 3 strata, indicating that smelting was being undertaken, although none could be associated with specific features. A similar quantity of *vfl* was also recorded, along with 0.8kg of *ty* fragments, including a single, complete tuyère recovered from deposits which made up the Period 3 metal-working terrace. The tuyère may be related to small, clay-built non-ferrous metal-working hearths which characterise the Period 3 metal-working complex.

The period also produced the most hammerscale (876g), accounted for largely by a single deposit from a pit (F288 C1667) which was extremely rich in hammerscale, producing 0.61kg. The quantity and ratio of 1:10 spheroidal to flake *hs* signals fire-welding was taking place nearby, although no features directly associated with iron-working were identified.

The Period 3 assemblage comprised *c* 20kg of *shbs* and *c* 26kg of *ds*, some of which is likely to represent shattered *shbs* along with 56kg of *uss*. A notably large *shb* was recorded measuring 240mm × 200mm × 80mm Th and weighing 3.1kg. The cake may represent a large smelting furnace base or indicate that large objects were being smithed. Comparison of the mean mass and dimensions of all Period 3 cakes with those recorded on other early medieval sites indicates that the Tarbat cakes are significantly larger overall (Table D6.9.4).

Period 3 also produced the greatest quantity of fuelash slag (over 8.5kg).

Table D6.9.4
Mean mass and diameter of slag cakes from early medieval sites in Britain

Site	Mean mass	Standard Dev	Mean diam	Standard. dev
Tarbat n = 25	991g	747	132mm	35
Coppergate (McDonnell 1992, 475) n = 163	385g	304	95mm	30
Fishergate (McDonnell 1993, 1225) n = 46	460g	265	100mm	20
Wharram Percy (McDonnell 2000, 156) n = 22	369g	–	95mm	–
Brough of Birsay (McDonnell 1986b, 201) n = 21	158g	–	57mm	–

This material generally consisted of very lightweight vitrified material, predominantly with a high silica content, where this could be discerned. The deposits which yielded quantities of the material could largely be identified with the primary burning horizon at the site, suggesting the origin of the material could have been the site-wide conflagration that destroyed S9 and affected upstanding features across the northern part of Sector 2.

Table D6.9.5
Mean mass and diameter of slag cakes from medieval sites in the Highlands

Site	Mean mass	Standard dev	Mean diam	Standard dev
Tarbat n = 77	1242g	682	132	28
Eilean Donan Castle (Starley 2010) n = 39	1165g	723	139	28

4.4 Period 4

The majority of the material was recovered from deposits of Period 4 origin. The material was recovered from secondary soil layers, which characterise the period across Sector 2, and also from isolated deposits traps, such as the late fills of Period 3 ditches and hollows created by subsiding Period 2 feature fills. The material was distributed fairly widely across the infilled monastic pool and within a concentrated area identified as the floor of a medieval smiddy associated with the remains of drystone walls. Unfortunately, the smithy was identified during post-excavation and no recovery of microslags in the field was undertaken.

Evidence for smelting took the form of a single possible smelting hearth (F11) and was recorded as a stone-lined shallow pit measuring *c* 0.6m in diameter. A total of 1.5kg of *ts* was recovered from the feature along with 0.65kg of *uis* and 0.20kg of *vfl*. Other evidence for smelting was recorded in the form of 1.25kg of tap slag and a slag cake with tap slag on its surface.

Evidence for secondary smithing was dominated by a smithy identified as an open-fronted stone-built structure measuring 9 × 10m in plan, abutting a stone-walled enclosure (S18). The walls enclosed a large spread of concreted slag, which included patches of in situ burning and some lenses of discolouration from copper alloy, perhaps from brazing. Slag recovered from this deposit (F109) and from nearby features included thirteen *shbs* – including two double *shbs* – along with 6.6kg of *ds*. Hammerscale was recorded from associated slag spread C1496. The wall core of an adjacent wall was filled with complete *shbs* (F189), while thirty-two others were recovered from a nearby spread of rubbly hardcore (C1326).

Examples of excavated smithies are few and comparable rural smithies include fourteenth and fifteenth-century examples from Goltho and Burton Dassett. The dimensions of the Tarbat smiddy are broadly comparable with the structures identified at these two sites (Goltho 8mm × 4m; Burton Dassett 14mm × 15m) (McDonnell 2000, 165).

Again, the size and weight of the Period 4 *shbs* are exceptionally large and compare well with an assemblage of *shbs* recovered from Eilean Donan Castle (Table D6.9.5). The *shbs* from Eilean Donan are associated with a late medieval episode of smithing of large iron items; a hearth filled with slags was radiocarbon-dated to 1450–1640 (95%) (Starley 2010). Items smithed at Tarbat are also likely to have been sizeable and, although speculative, may have included the manufacture of arms. Evidence for late medieval clan-based ironworking has been detected at Highland sites and is thought to have been stimulated by inter-clan warfare and conflict (Atkinson 2003).

4.4.1 Iron sources

The iron smelted at Tarbat during Period 3 and late Period 4 was almost certainly won from roasted bog ore. Alternative sources of iron ore from geological strata – carbonate, haematite and limonite – are not found nearby (Tylecote 1986, 124–5). The underlying solid geology of iron oxide-rich Old Red Sandstone, coupled with the wet, boggy conditions of parts of the site from the Iron Age onwards, would probably present ideal conditions for bog ore formation.

Iron smelting was identified across the firth at salvage excavations within the historic core of Dornoch, in deposits of eighth to fifteenth-century date, from which fragments of bog ore were positively identified (Coleman & Photos-Jones 2008, 13–15). A study of iron ore exploitation in the Highlands concluded that prior to the seventeenth century, small-scale iron smelting won ore from regenerative bog deposits (Photos-Jones et al 1998).

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Digest 6.10 GEOLOGY OF STONE USED FOR SCULPTURE AND BUILDING

NIGEL RUCKLEY

Method

A project designed to identify the type and sources of stone used in carving and building at Portmahomack was undertaken from 1998, and included the following tasks:

(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;

(c) Literature search for former quarry sites and geological notes pertaining to the project;

(d) Brief examination of the sandstones used in Tarbat Old Church;

(e) The establishment of a database of magnetic susceptibility readings from geological samples and carved stones;

(f) The establishment of a database of published geological data on carved stones.

The local geology

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 Tain 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 places 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 eighteenth century.

Stone used for Pictish sculpture

Only one of the stones from the group so far recovered at Tarbat can be said, with some degree of certainty, to come from the exposures in the immediate neighbourhood of Portmahomack; this is TR28, the 'Calf' stone.

A group of stones, defined by the presence of iron blebs or of Liesegang rings, include the finest of the Tarbat sculptures (TR1, TR10 and TR20), as well as the other monumental stones sited elsewhere on the Tarbat peninsula: Nigg, Shandwick and Hilton of Cadboll (this also applies to the additional flaked fragments recovered at the Hilton chapel in 1998). On this basis, the petrological verdict is that TR10 (the inscription) and TR20 (the Apostle Stone) could have come from the same geological formation. However, TR2 (and TR7) do not match TR10 and TR20 geologically and thus are unlikely to have formed part of the same monument. No rock exposures examined so far on the Tarbat peninsula showed the presence either of the iron blebs or the Liesegang rings, so the source for the major Tarbat monuments is as yet unidentified and may lie beyond the peninsula (Note: they have since been found by sculptor Barry Grove at Geanies. Ed).

Other stones likely to have been brought from further afield are the bosses TR5 and TR6 and the interlace panel TR2, which are of sandstone that might have affinities with the Triassic deposits on the south side of the Moray Firth.

The grave-marker TR21 is also probably imported. It is composed of clast-free colour-laminated fine grained sandstone. The broken surfaces exhibit 5YR7/1 'light grey' and darker 2.5YR5/2 'weak red' laminated bands. The darker bands, between 5mm and 10mm thick, are rich in biotite mica. The high mafic content of this sandstone gave a comparatively high magnetic susceptibility average reading of 0.1225 (compared with, for example, the 0.015833 of TR1). Although the quarry at Shandwick has reddish laminated sandstones with mica-rich bedding planes, TR21 bore no resemblance to the range of stone in the quarry and does not seem to come from the Tarbat peninsula.

Stone used for church building

Tarbat Old Church (St Colman's) contained a variety of sandstones from known and unknown sources. Most of the stone does not appear to be from the immediate vicinity of the building. Evidence of fire-burnt stones was apparent in the crypt. The resultant damage to the stones would invalidate any magnetic susceptibility readings.

South exterior wall

The basal stones forming the first visible horizon of the wall on the south side of the church (F63 C1180) (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 (F64 C1181) (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 eighteenth century) (Church 6) immediately below the roof line are again not found locally.

Mica was evident on the bedding planes. Mudstone clasts varied from pea-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. It is of ORS appearance, possibly from the Black Isle/Cromarty Firth area.

Threshold stone

The threshold stone (F108 C1253) (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.

Crypt

The east wall of the crypt (F3 C1002) (Church 1 or 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 of the crypt (F4 C1003) (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.

West end of nave

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 north-west 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.

Conclusion

The stone outcropping on the west coast in the neighbourhood of the site is UORS, of reddish hue and often weathered. The stone outcropping on the east side of the peninsula is MORS, of yellowish hue and of higher quality.

One stone used for carving Pictish sculpture was obtained in the immediate locality (UORS TR28). Two of the grander carvings used stone from the east coast (MORS: TR1 and TR10 with TR20). A third (TR2, 5 and 6) may have used stone from triassic deposits on the south side of the Moray Firth. The grave marker TR21 was certainly imported from an unknown origin beyond the Tarbat peninsula.

If Church 1 survives in the east wall of the crypt, it was built in MORS (east coast). Church 2, the first medieval church, was built in UORS, apart from its threshold, which was of the better quality MORS. Church 4 (thirteenth century) was of MORS, as were Church 5 and 6 (post-medieval) including the Belfry. The pillars for Church 5 were imported.

[Ed. CAS & MOHC July 2013]

Digest 6.11 SOURCE OF THE PUMICE

ANTHONY NEWTON (University of Edinburgh)

All of the pumice is light grey to brown in colour and most of the pieces show signs of wear. In Scotland, pumice finds are most numerous in the Western Isles and in Orkney and Shetland. Pumice has also been found in the Easter Ross area, including a pumice pendant in an Iron Age cist at Golspie and a single piece was retrieved from a late Neolithic chambered cairn at Embo (Binns 1971) and Golspie (Newton 1999). All of the Tarbat pumice is morphologically similar to other pumice pieces found at over 150, mainly coastal, archaeological sites in Scotland, ranging from the Neolithic to the Norse and later medieval periods (Dugmore et al 2000; Newton & Dugmore 2003; Newton 1999, 2001; Dugmore & Newton 2012). The grey to brown pumice variations are not significant and do not indicate different sources. Pumice similar to the Tarbat pumice when analysed are dacitic in composition and have been related to eruptions from the Katla volcanic system in southern Iceland. It is likely that the pumice was retrieved from either local contemporary or raised shorelines.

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Digest 6.12 UNFINISHED GAMING BOARD

MARK HALL (Perth Museum) (OLA 7.1.3.4)

This broken piece of sandstone, measuring 200mm × 132mm × 17mm is incised with a graffito of an unfinished grid of lines that is most likely to have been intended to serve as a gaming board design (14/3932; C1660) (Illus 6.6). The design comprises six parallel incised lines, some doubly or triply incised, spaced at *c* 20mm intervals, crossed at one end by three parallel lines at *c* 15mm intervals, forming a partial grid containing ten complete or partial cells.

Although incomplete, it is comparable to boards from across Scotland (Hall 2007), particularly Orkney (eg Buckquoy (Ritchie 1979, 198–9), the neighbouring site of Red Craig house (Brundle 2004) and the nearby settlement site of Howe, Stromness (Ballin Smith 1994, 188)) and Shetland (eg Jarlshof (Hamilton 1956: plate xxxi, no 1)). The three Buckquoy farmstead examples are all incised on similar sized fragments of flagstone (2) and sandstone, measuring 190–2235mm × 170mm–175mm × 24–32mm. From the dun site of Dun Chonallaich, near Kilmartin, Argyll (Dal Riata), comes a further stone example, slightly bigger in size (Ritchie 1987, 62 and fig 2).

From a monastic context, we should note the flat beach pebble, measuring 235mm × 193mm × 20mm, from Inchmarnock, off Bute, and incised on both sides with gridded or cellular gaming boards. Face 1 has a neat design of 6 × 6 cells, with a distinctive central cell indicated (as per the examples already cited). Face 2 carries an erratic and unplayable design, similar in appearance to the board from Jarlshof cited above (which also carries a neatly executed board on its other face). From Inchmarnock, there are a further five boards with similar designs in various stages of completeness and size (from 60mm × 50mm × 3mm to 345mm × 265mm × 25mm), two of them found in re-use contexts as packing stones in a post hole and part of the lining of an early medieval grave (for a full discussion and catalogue of the boards see Ritchie 2008). The Inchmarnock boards can be interpreted as evidence for both play by the brothers and the teaching of elite pupils as part of its school function (Hall 2011, 150).

Such boards were not confined to graffiti-on-stone examples. Perhaps the finest example of a high status board of this type is that from Ballinderry crannog, Ireland, and dating to the tenth century. Made of wood and elaborately carved, it measures 249mm × 243mm (Graham-Campbell 1980, 23; Wallace & Ò Floinn 2002, 31 and pl 6, 22). Not quite as elaborate but undoubtedly special looking when complete, is the fragment of whalebone board (like Ballinderry marked with peg-holes) from the Brough of Birsay (Curle 1982: illus 50. 274).

As far as material, size and incompleteness go, there is no objection to the example from Tarbat being an unfinished example of a board for *gwyddbwyll*, *fidcheall* and *brandubh* or *tafl* (especially *hnefatafl*). Arguments have been advanced recently for these respectively British, Irish and Scandinavian games as being variants derived from a common Roman ancestor, Ludus Latrunculorum (Hall & Forsyth 2011). The dating and the north British, not to say Pictish, context of the Tarbat example would strongly suggest the game intended was *gwyddbwyll* or *brandubh*. The limited descriptions of *gwyddbwyll* suggest it may have been akin to the Irish version *brandubh*, which lacked the designation of special corner cells, a feature of the Scandinavian version (and also of *fidcheall*, probably the Irish adaptation of the Viking version).

The context and its dating have been described by the excavators as 'recovered from C1660 which was a layer overlying the "primary burning" horizon … associated with the destruction of the eighth-century monastery (Period 2), which was followed by landscaping – including layers such as C1660 – which marks the beginning of re-use of the site in Period 3 (ninth-century craft-working)'. The other finds from this context comprise animal bone, several pieces of slag and a whetstone, nothing really that sheds light on the context of use (though we might note that the board from Dun Chonallaich mentioned above had its back used as a whetstone and that a whetstone was also found with a possible whetstone (Morris 1989, 156)) but perhaps confirms the site destruction disturbance, interpreted as Viking attack.

Description

14/3932

Unfinished gaming board, broken medium to fine-grained, red, ferruginous sanstone tile with six parallel incised lines, some multiply incised, spaced at *c* 20mm, crossed at one end by three parallel lines spaced at *c* 15mm, forming partial grid, 200mm L × 132mm W × 17mm Th (C1660).

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Digest 6.13 VIKING AGE WEIGHT

MONICA MALESZKA-RITCHIE

Description [Illus D6.1.12]

The lead bullion weight recovered from the monastic site at Portmahomack is very well preserved (11/4158; C1000). It is cylindrical in shape and weighs 26.3g (before conservation) It measures 21.8mm in diameter and 71mm in height. The top of the cylindrical weight has a small dent or cut, probably the result of damage in antiquity or during deposition. Two small markings are also visible, which may be the remains of two hollow-punched decorations. Both surfaces have slight cracks and scratches. As the weight has little evidence of corrosion and only minimal damage, it seems likely that its present weight (26.3g) is close to its original weight. On this basis, the weight generally conforms to the Viking Age metrological system, it was almost certainly intended to indicate the imprecise Viking øre (Owen 1999).

The context

The lead weight was recovered from the ploughsoil of the site by metal-detecting, where the archaeology was heavily truncated by ancient and modern ploughing. Although this ploughing has removed artefacts from their context, it is interesting that the weight seems to derive from an industrial zone of the site where some of the best-preserved artefacts have been recovered and a known workshop building exists. The focus of activity in this area is thought to have occurred during the eighth and ninth centuries AD.

Weight systems

Throughout the Viking period in Scandinavia (*c* late eighth–eleventh centuries AD), silver and gold was treated as bullion and there was no coin-based economy. Silver was obtained in vast quantities from the east in the form of Arabic silver coins, these were normally melted down in Scandinavia and recast into ingots for compact storage, or made into jewellery. Both ingots and jewellery could be cut up later if small change was required (the resulting fragments known as hack silver). Silver hoards, some of immense value and containing a variety of coins, objects and hack silver, were buried for safekeeping and were occasionally not retrieved. Payments for goods or services were made in silver measured by weight; any silver, whether coin, ornament, hack silver or ingots, was valid in this metal weight economy. The silver was often weighed using a small pair of scales, which were designed to fold up and fit into a small box for portability. Weights of lead, iron and other metals were used by merchants and chieftains to weigh out silver as required. Viking Age weights from archaeological contexts are normally found either in male graves or at trading centres such as Birka, Hedeby, Wolin, Truso and Dublin It is exceptionally rare to find a whole set of weights and the scales that accompany them (Owen 1999, 120–1).

In late medieval Scandinavia, the standard unit of weight was the mark, divided into eight øre (or ounces), each of which consisted of three ørtugar (singular ørtog) (eg Kruse 1988, 286; Owen 1999, 121) However, a number of archaeological studies have identified units apparently equivalent to half an ørtog, or one sixth of an øre, Kruse notes that a weight unit of one sixth of an ounce allows for the convenient division of the ounce both into halves and into thirds. A division into sixths is also consistent with the Viking tendency towards a duodecimal system (Kruse 1988, 289–9). There is little doubt that variations of this system were in use in the Viking Age. However, the actual systems underlying the exchange of Viking silver is not clear and it seems likely that weight systems varied across the Viking world.

A number of studies concerning weight systems have been undertaken on the basis of archaeological evidence. A W Brøgger's classic study, based on Norwegian finds, identified two separate øre standards, one of 26.5g and one of 24g. According to Brøgger, the heavier standard was used in the early Viking Age, with a later shift to the lighter standard (Brøgger 1921, 77–85, 102–3). Another early study by T J Arne, based on Swedish finds, identified a smaller weight unit of *c* 4g – and possibly another of *c* 4.25g – or half an ørtog (Arne 1914, 176–96). Both versions of these units find some corroboration in more recent studies. Kyhlberg identified units of *c* 4g and 4.266g on the basis of weights from Birka (1980, 259) while Steuer suggested units of *c* 4g and 4.26g on the basis of weights from Hedeby (1973, 10–17). Sperber came to similar conclusions, having studied the Swedish evidence. The system was adopted and adapted from the Islamic world as a result of the inflow of Arabic silver to the Baltic Sea region (Sperber 1996, 42–54).

The Islamic system was defined by the Caliph Abd ai-Malik in the year AD 696–7 and was based on the Islamic weight unit for gold, the mitqal, a coin weight established to be 4.233g (Hinz 1970). It was a dual system, intended to be used for both silver and gold without elaborate conversion of the weight figures, provided that gold was exactly 14 times more expensive than silver. Its sub-unit, the dirham, was set at 0.7 of a mitqal. However, the gold and silver prices changed and so did their relative values. The factor 0.7 became irrelevant and the simpler factor of two-thirds of a mitqal replaced it; this system is known as the Islamic trade system. The standard *mitqal* remained unchanged, but the dirham fluctuated by as much as 5% from 2.96g to 2.82g (Sperber 1996, 54).

The Swedish/Islamic system described by Sperber was based on the three-mitqal unit (12.7g). The actual weight sets used by merchants and traders were fractions based on these systems, and the standard unit weight was the ounce, or øre. Deviations within the standard øre of the Viking period weight systems are relatively small, the lowest being about 24g and the highest about 28g (Sperber 1996, 55). This Swedish/Islamic system in Scandinavia and the Baltic region has been recognised in the main in the type of weight that is spherical with flat poles or polyhedral ('cubo-octahedral') in shape. These weights probably had Islamic prototypes and were probably used for weighing precious metals on small portable scales (Sperber 1996, 61). However, in the Viking homelands there were other forms of weights. At the early Viking market place in Ribe, Denmark, a large number of cylindrical weights have been recovered through excavation around a bronze workshop. Some of them are very small, weighing about 1g, and none are much heavier than the equivalent of about one Scandinavian øre. It has been suggested that these small and simple weights from Ribe may have been used not only for weighing small quantities of precious metals in trade, but also for weighing out base metals in the workshop (Owen 1999, 124–5).

The north-west of the expanded Viking world also commonly used many different types and shapes of weight. One of the most interesting assemblages comes from Dublin, containing more than 200 lead weights. Discs, bowls, hemispheres and cones of both plain and perforated varieties, as well as rings, hammer-finished lumps and lead-filled copper alloy containers were recovered. The basic standard unit of the great majority of the

weights from Dublin was 26.6g; with multiples or fractions of this weight being prevalent, no mater what their shape (Wallace 1987, 212–14). This is slightly heavier than the most common Scandinavian standard unit (24.4g ± 0.8g), an observation that, together with the absence of Scandinavian-type polyhedral weights, of stamped weight markings and the apparent infrequency of the one-third (ørtugar) unit in Dublin, strengthens the argument that the weight system of Viking Age Scandinavia and the Baltic was slightly different than that of Dublin (Owen 1999, 123). The basic standard unit from Dublin (26.6g) was close to the Roman and Carolingian ounces of 26.8g and 25.6g respectively. The weights from the Dublin excavations probably emphasise and underline Dublin's trade links with the ports of western England (the 'fuzzy unit of 26g': see Kruse's (1988) analysis of ingots from hoards found in England) and the north-west Continental region, and indicate the region's relative economic independence from the Scandinavian world (Wallace 1987, 213). Indeed, a possible changeover in the weight systems of Viking Age Ireland (from a lighter to a heavier øre standard) may be visible as a result of the excavations at the Kilmainham/Islandbridge (Dublin) ninth century cemetery, where weight specimens of both the light and heavy øre standard were recovered (Wallace 1987, 213).

A number of possibilities thus arise from the (albeit limited) archaeological evidence: a single øre standard of somewhere in the 24g–26.6g range, but only very approximately applied, two main standards of *c* 24g and 26.6g, both subject to considerable variation in different times and places; or no single standard across the Viking world, but a variety of similar local standards, with potential for some variation in weight standards over extended periods (Williams 2000, 33).

Discussion

The weights used during the Viking period vary a great deal in size and shape. However, the most common weights in the Baltic Viking Age were polyhedral and spherical weights with flat poles, which appear to have been used across a large geographical area. Lead weights similar to the Portmahomack weight are also very common in both Scandinavia and regions with a Scandinavian influence. These lead weights could be cast by almost anyone, anywhere. In many cases they were not subject to the same rigid control as the bronze weights, which were evidently manufactured in a very limited number of well-equipped workshops – such as that attached to the royal centre of Sigtuna.

There are only three comparable finds to the Portmahomack weight in the Scottish archaeological record, a lead disc-shaped weight of about 9.9g from Buckquoy, Birsay (Ritchie 1977, cat no 96) and the two lead weights from Scar, Orkney (associated with the excavation of the fine Viking boat burial) are both cylindrical in shape and both weigh 26.65g. They are decorated with what are probably weight markings (Owen 1999, 124). Unfortunately, neither of the weights was discovered in situ, although their association with the burial (thought to date to sometime between AD 875 and 950) is not in doubt (Owen 1999, 118). Elsewhere, the simple cylindrical form can be found in the weight assemblages from both Dublin and Ribe (Owen 1999, 125). Given the rarity of the Viking weight in the archaeological record of Scotland, the similarities between the Portmahomack weight and the Scar weights are both striking and intriguing, indeed, the correspondence of these weights to the Dublin øre standard may reward further research.

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Digest 6.14 MEDIEVAL AND LATER COINS

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Sixty-eight items have been examined, comprising both excavated and metal-detector finds, and these are here treated as a single group for the purpose of analysing the numismatic evidence for activity in the area. Notably absent from the assemblage are any coins minted before the beginning of the thirteenth century. Since finds of coins of this early period are scarce across Scotland as a whole, the fact that there are none in a relatively small group such as this is not necessarily significant, but it may be worth bearing it in mind in conjunction with the evidence from other types of datable artefact.

There are groups of silver pennies and halfpennies from each of the three major issues of the thirteenth and early fourteenth centuries, the majority being English issues, as is normal. From the Short Cross period (up to 1247 in England and 1250 in Scotland) there is one English penny and four cut halfpennies, with a single Scottish penny of William the Lion. Of the subsequent Long Cross coinage, there are three English pennies and three cut halfpennies of Henry III, but no specimen of the contemporary coinage of Alexander III. Of note is the issue from the small Somerset mint of Ilchester – an indicator that not only issues from the major urban mints found their way across the border into Scotland through normal trading activity. There are six pennies of the ubiquitous English Edwardian coinage, together with a single Scottish round halfpenny of John Baliol.

The presence of these nineteen coins is consistent with a continuous period of relatively small-scale human activity during the thirteenth century and the first half of the fourteenth, but coinage issues of the next hundred years or so are represented by just a single penny of Robert III. Hoard evidence indicates that Edwardian pennies continued to circulate in Scotland until well into the second half of the fourteenth century, but that they were increasingly replaced as the century progressed by Scottish issues of David II and Robert II, with some English issues of Edward III. In the first half of the fifteenth century, the coins in circulation seem to have been largely those of Robert III and James I, together with early issues of Henry VI. The presence of just one coin of any of these kings in Tarbat, while not in any way conclusive, might be a clue to reduced economic activity in the area in the later fourteenth and early fifteenth centuries.

The next concentration of coin finds comprises base metal Scottish issues of the later fifteenth and early sixteenth centuries. By this time, the coins held by ordinary people and used for everyday transactions would have been largely of billon, and in some cases pure copper. (As a result of the rising price of silver bullion, successive Scottish kings from David II onwards had reduced first the weight of their coins and then the fineness of the lower denomination issues.)

The Tarbat finds include small groups from the two most common of the billon penny issues – Class C of James III, minted during the later 1470s and early 1480s, and the second issue of James IV, which seems to belong approximately to the first decade of the sixteenth century. There is also a single example of the copper 'Crux Pellit' issue (formerly known as Crossraguel or Bishop Kennedy pennies). The exact period of issue of these coins is still not certain, but they appear more likely to belong entirely within the reign of James III than earlier, and they are considered to have been drastically devalued, probably from three pence to a farthing, in 1482.

The second issue pennies of James IV, which are exceedingly numerous, seem to have satisfied Scottish requirements for small denomination coinage until the reign of Mary, for whom small numbers of billon pennies were struck, followed by very large issues of lions/hardheads, tariffed at one and a half pence Scots, both prior to and during Mary's marriage to the French *Dauphin*, and briefly king, François. Both these denominations are represented at Tarbat, along with a single plack (four pence) of 1557. By this time, almost the entire population must have had access to low-value coins of various denominations, and the issues from the reigns of Mary and of James VI, prior to the Union of the Crowns in 1603, are regularly found in large numbers across Scotland. Of interest here is the French *double tournois* of François I. Coins of this type entered Scotland with French troops during the reigns of James V and Mary, and they are fairly frequent finds in areas close to where those troops were stationed, but the fact that one reached Tarbat is perhaps a little unexpected.

The list of coins below does not tell the full story of post-Union coin finds, since post-1603 Scottish copper issues are excluded from the Scottish Coin Finds Record, on account of their huge numbers and consequent low value as evidence for economic activity in a particular location. The metal-detector finds from this later period have not been examined therefore, and the list includes only those coins found during excavations, with the exception of the Dutch and Swedish issues. Low value issues from both these countries are found in Scotland from time to time, the Dutch issues, however, normally comprising copper *duits*. Finds of billon *stuivers* seem to be more common in the Highlands and the Northern Isles.

List of coins

From Sector 1 (ploughed field) and Sector 2 (middens and smithy)

SCOTLAND (41)

William the Lion Silver penny, third coinage, phase B (*c* 1205?–30), Hue Walter.

John Baliol Silver halfpenny, second ('smooth') issue (1292–6) (Furrow 25/F41 of rig and furrow).

Robert III Silver penny, heavy coinage, second issue (1390–1400), Aberdeen.

James II–III Copper 'Crux Pellit' issue (*c* 1450–82), type IIR.

James III Billon penny (1475–82), class Ci-Ciii; Another, class Ciii; Another, class Civ-Cv; two others, class Cvb.

James III ? Billon penny (*c* 1467–88?).

James IV three × billon pennies, second issue (*c* 1500–10), type III; two others, type IVd; Another, type IV(d?); Another, uncertain type.

Mary Billon penny, first issue, type 1a (1547+); Another, type 3 (1554–5); Billon plack (1557).

Mary or Mary and Francis Billon lion/hardhead (1555–60).

Mary and Francis two × billon lions/hardheads (1559), type 2; Another similar (1559–60), countermarked with star in heart.

James VI two × billon placks (1583–90), type 2; Billon hardhead, first issue (August 1588) three × others, second issue (November 1588); Copper twopence, first post-Union issue (1614); two × others, second post-Union issue (1623).

James VI or Charles I Copper twopence/turner (1614–29).

Charles I Silver 20 pence, uncertain issue (1636–42); Silver 2 shillings, fourth coinage (1642); Copper turner, second issue (1632–9); Another, third issue (1642–50).

Charles II Copper turner (1663–8); Copper bawbee (1677–9).

UNIDENTIFIABLE

Copper, probably a Scottish turner or bodle (1642–97).

ENGLAND (17)

Henry II–Henry III, silver short cross series Cut halfpenny, class Vb1 (1205), Ricard, uncertain mint; Penny, class Vb2 (1205–7), Willelm L, London; Cut halfpenny (fragment), class Vc (1207–*c* 1210), Walter, London; Cut halfpenny, class VIIb (uncertain sub-class) (1222–*c* 1236), uncertain moneyer, Canterbury; Cut halfpenny, uncertain class (1180–1247), uncertain moneyer, London.

Henry III, silver long cross series (pennies unless stated) Penny, class 3b (1248–50), Walter, Lincoln; Penny, class 3c (1248–50), Nicole, London; Cut halfpenny, class 3, uncertain sub-class (1248–50), Randulf, Ilchester; Another similar, Henri, London; Cut halfpenny, class 5b–c (1251–72), uncertain moneyer, London; Penny, class 5c–h (1251–72), Robert, Canterbury.

Edward I–II silver pennies Class 3(d?) (1280–1), London; Class 4a2 (*c* 1282–3), Durham; Class 10cf2b (*c* 1306–7), Canterbury; Another similar, London; Class 10cf3a1 (*c* 1307–9), Canterbury; Otherwise unidentifiable (1279–1322).

GREAT BRITAIN (4)

Unidentifiable copper, probably a halfpenny (late seventeenth–eighteenth century).

Two × George III copper halfpenny (1806).

George III silver shilling (1820).

FRANCE (1)

François I Billon double tournois du Dauphiné, first period (1515–40), mint of Roman.

NETHERLANDS (2)

Overyssel Billon *stuiver* (1628).

Zeeland Brass coin-weight for an English gold noble, uncertain maker, *c* 1585–1625.

POLAND? (1)

Silver or billon 12 *groschen* (probably seventeenth century).

SWEDEN (1)

Frederik I Copper *1 ore* (174[ ]).

UNIDENTIFIABLE (1)

Copper disc of diameter 23.5mm.

Coins from Tarbat Old Church

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

From Tarbat Old Church (see also Table 7.2)

SCOTLAND

1. James III billon penny, class Ciii (*c* 1475–84) 13.0 × 14.0mm; 0.35g; edge ragged, slight surface corrosion; moderate wear (17/41/C1091).
2. ? James III billon penny (*c* 1467–88?) 14.0 × 13.0mm; 0.47g (0.31 after cleaning); much corrosion and surface accretion (17/95/C1132/F43).
3. James IV billon penny, second issue, type III (*c* 1500–10) 16.0 × 17.0mm; 0.77g; die axis 6.5 obv.: + I0coBVSDeIGR0:R[ ] rev.: + VIL / L0:e / DInB / VRGT slight surface corrosion; fairly worn (context not recorded).
4. James IV billon penny, second issue, type IV(d?) (*c* 1500–10) 14.0 × 15.0mm; 0.40g; die axis 1.5 obv.: + I0coBVS[ ] rev.: + V[IL] / L0De / eDIn / BVRG broken in two; some surface corrosion and accretion; fairly worn (17/94/C1132/F43).
5. James VI copper twopence, second post-Union issue (1623) 19.0 × 18.5mm; 1.83g surfaces corroded; degree of wear uncertain (17/11/C1061).

ENGLAND

6. Henry III silver penny, long cross 3b, by Walter at Lincoln (1248–50) 18.5 × 18.0mm; 1.47g; die axis 5.0 obv. * henRIcVSReX. III' rev.: WaL / TeR / ONL / INc; aL, eR and ON ligatured moderate wear (13/5).

Tarbat Old Church crypt 1991

SCOTLAND

Charles I turner, first issue (1629) 18.5 × 18.0mm; 1.61g; die axis uncertain. Partly corroded; fairly worn (19/66).

Charles I turner, second issue (1632–9) 16.5mm; 0.90g; die axis 330°. Some corrosion; slight to moderate wear (19/62).

Another similar

16.0 × 16.5mm; 0.70g; die axis 90° Chipped; some corrosion; moderate wear (19/63).

Another similar

16.0 × 16.5mm; 0.95g; die axis uncertain Much corrosion (19/64).

Charles I turner, third issue (1642–50) 20.0 × 19.5mm; 2.20g; die axis 180°. Some corrosion; fairly worn (19/58).

Charles I or II turner (1642–50 or 1663–9) 19.5mm; 1.71g; die axis uncertain. Active corrosion (19/59).

Two similar coins, fused together

Worn and corroded (19/60).

Charles II bawbee (1677–9) 6.58g. Some corrosion; very worn (19/69).

Inverness halfpenny token (1796), Dalton and Hamer Inverness-shire 4 or 5 9.66g. Some corrosion; fairly worn (19/71).

GREAT BRITAIN

George II halfpenny, otherwise illegible 7.79g. Very worn and corroded (19/68).

Illegible halfpenny, George II or III 6.89g. Worn flat (19/70).

George III halfpenny (1806) 9.27g Active corrosion (19/72).

FRANCE

Copper double tournois, otherwise unidentifiable (late sixteenth or seventeenth century) 19.5 × 20.0mm; 1.83g; die axis uncertain. Corroded (19/57).

Unidentifiable copper / copper alloy 18.5 × 19.0mm; 1.94g; die axis uncertain Corroded (19/61).

Unidentifiable copper / copper alloy 16.5mm; 1.05g; die axis uncertain. Corroded (19/65).

Digest 6.15 REPORT ON MEDIEVAL AND LATER GLASS

HUGH WILLMOTT (University of Sheffield) (OLA 7.1.2.3)

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 Description

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 from a hanging lamp, made in a potash-rich glass. 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 thirteenth century, they are a form that does not survive beyond the sixteenth century. The other two vessels 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 eighteenth-century mineral water 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 nineteenth-century mould-pressed jar rim.

2.1.2 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 thirteenth-century in date. Although extremely fragmented and without any edges, it is clearly painted 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 fifteenth 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 seventeenth or even eighteenth-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 sixteenth or seventeenth 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 sixteenth 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.

Catalogue

Vessel glass

The Nave

17/6

One fragment of rim from a press-moulded jar. Colourless glass. Rim diameter 80mm. Late nineteenth century (C1000).

17/168

One fragment of rounded vertical rim from a hanging lamp. Potash-rich glass. Diameter uncertain. thirteenth–fifteenth century (F51 C1153).

17/45

One fragment of rim and neck from a possible mineral water bottle. Green, high lime low alkali glass. Rim diameter 28mm. Early eighteenth century (C1011).

Window Glass

The Nave

17/5

Two miscellaneous fragments. seventeenth–eighteenth century? (C1002).

17/33

One miscellaneous fragment. seventeenth–eighteenth century? (C1003).

17/8

Three miscellaneous plain fragments, one edge. Late medieval (C1004).

17/14

One miscellaneous fragment. seventeenth–eighteenth century? (C1061).

17/15

One fragment of painted border 50mm wide. Decorated with the lower portion of Gothic black lettering and a line edging (C1061).

17/16

Three joining fragments from a rectangular border 51mm wide. Late medieval (C1061).

17/5

Fragments from a rectangular border of uncertain width. Late medieval (C1061).

17/2

One miscellaneous fragment of thick 'bull's eye'. seventeenth–eighteenth century? (C1065).

17/39

One curved and rounded crown glass edge. Late medieval (C1095).

17/161

One fragment of painted stickwork border, with no edges remaining. thirteenth–fifteenth century; one fragment of rectangular border 25mm wide. Late medieval; seven fragments of rectangular border of uncertain width. Late medieval; thirty-three small miscellaneous plain fragments, some edges but unreconstructable. Late medieval.

17/258

One fragment of rectangular border 33mm wide. Late medieval (C1147).

17/3

Two miscellaneous plain fragments, one edge. Late medieval (F7 C1099).

17/69

Twelve tiny miscellaneous plain fragments. Late medieval (F7 C1099).

17/79

One straight and rounded cylinder glass edge. Late medieval (F35 C1100).

17/202

One miscellaneous plain fragment. Late medieval (F59 C1166).

17/463

One straight and rounded cylinder glass edge. Late medieval (C1208).

The Crypt (Int 13)

Eighty miscellaneous quarry fragments, some portions of edges. Sixteenth–seventeenth century.

Four fragments from a rectangular quarry. Maximum surviving dimensions 52mm × 43mm. Sixteenth–seventeenth century.

Eleven fragments from a rectangular quarry. Maximum surviving dimensions 75mm × 66mm. Sixteenth–seventeenth century.

One complete small triangular quarry. 33mm × 33mm × 47mm. Sixteenth–seventeenth century.

One complete small triangular quarry. 28mm × 35mm × 45mm. Sixteenth–seventeenth century.

13/9

One miscellaneous quarry fragment, no edges. Sixteenth–seventeenth century.

13/11

One quarry edge. Sixteenth–seventeenth century.

13/12

One complete square quarry. 38mm × 38mm. Sixteenth–seventeenth century.

13/13

One corner from a rectangular or square quarry. Sixteenth–seventeenth century.

13/14

One miscellaneous quarry fragment, no edges. Sixteenth–seventeenth century.

13/15

Two miscellaneous quarry fragments, no edges. Sixteenth–seventeenth century.

Digest 6.16 MEDIEVAL LEATHER FOOTWEAR

CLARE THOMAS

D6.16.1 EARLY MEDIEVAL SHOE, 24/7810 (not illiustrated)

Description

A leather fragment (24/7810) was found in F431, a stone culvert within S7. It was identified as cattlehide and conserved as five separate fragments.

1. Irregularly shaped item, now in at least two separate pieces, with two almost straight edges which meet almost, but not quite, in a right angle. The shorter edge is defined by a flattened line, parallel to outer edge and 4mm from it. This makes it appear as if edge has been folded and hemmed, which is not the case. Item has various irregularly spaced holes, but none of these seem to be traces of either stitching or slots for thongs. Item is very fragile and is extremely delaminated, now consisting of separate grain and flesh layers. Maximum dimensions 231mm × 140mm; thickness not measured because of delamination.
2. Irregularly shaped item with one curved edge, defined by a flattened line, as in item 1. Item 2 has various holes, but none of them appear to be either traces of stitching or slots for thongs. Item is very fragmentary and delaminated. Maximum dimensions 135mm × 145mm; thickness not measured because of delamination.
3. Irregularly shaped item, with 30mm long edge, slightly folded as if for a hem, and with a suggestion of stitching, consisting of two grain-flesh holes, stitch length 5.5mm. Item also has an irregularly cut, slightly curved edge, as well as torn edges. Item also has various other holes but none of them appear to be either traces of stitching or slots for thongs. Item is very fragmentary and delaminated. Maximum dimensions 95mm × 103mm.
4. Irregularly shaped item with all edges torn, no cut edges survive. Item is fragmentary and delaminated. Maximum dimensions 80mm × 125mm.
5. Five small pieces, with no cut edges and no stitching. All fragmentary and delaminated. Maximum dimensions: 42mm × 25mm; 37mm × 30mm; 22 × 15mm; 25mm × 14mm; 26mm × 10mm.

There are no obvious joins, yet the excavation photographs suggest that these fragments originally formed one object.

Discussion

Only one item has even a suggestion of stitching, and that consists only of two possible stitch holes. Three pieces do have cut edges, suggesting that they have been worked, and could be offcuts. However, the photographs from the excavation suggest that these fragments were originally one item. The leather was found adjacent to a leather and vellum-working complex, which included appropriate tools. Thus, leather-working waste would not be unusual.

However, it is worth considering whether the fragments are part of some object, such as a shoe. Shoes from the late seventhth to early ninth centuries are most likely to be of one-piece construction, and are often referred to as 'hide shoes'. In this method, one piece of leather comprises both sole and upper, acting as a bag for the foot. The shoe is tightened by a thong threaded through slots at the top edge of the upper. Seams are usually short, and occur at the front of the shoe, up the middle of the vamp, and at the back of the shoe.

Small, incomplete fragments of such shoes often have few diagnostic features, apart from slots for thongs, as they have no obvious soles, and neither sole seams nor lasting margins. Furthermore, such a shoe is very likely to break up into unrecognisable 'scraps'. An attempt has been made at reconstructing this item as a shoe, based on a tracing from an excavation photograph. The cut edges, which appear to be visible in the photograph, have been assumed to be the top edges of a vamp; two short, possibly stitched, edges have been interpreted as the opposing edges of a central vamp seam. The reconstruction suggests a low slip-on shoe. However, this reconstruction is very tentative, and is only based on the information in the photograph.

Examples of 'hide shoes' survive from Scotland, England, Ireland and the Continent. The Scottish examples include Loch Glashan, Buiston, Dowalton Loch and Dundurn (Thomas 2005, 74–5). However, the closest parallels come from York's Anglo-Scandinavian assemblage. Of particular interest is Style 1. Shoes 15354 and 15357 have a cutting pattern that might be similar to the Tarbat fragment. These shoes came from contexts dating to mid-tenth century and late tenth to mid-eleventh century, respectively. (Mould et al 2003, 3275–79, figs 1598 and 1599).

Accordingly, this piece of leather might be a remnant of such a shoe; on the other hand, it could just be waste from cutting out some other item.

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D6.16.2 MEDIEVAL SHOES [Illus 7.18]

Introduction

A pair of shoes was found during excavation of a skeleton interred within the nave of Tarbat Old Church (Burial 43, F83, C1228). 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 D6.1.17).

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 sorted into 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.

Description

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.

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.

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 is accidental and of no significance. The top edge of the quarters has possibly been oversewn. The back edge of the quarters is represented by a fold. The quarters end with 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 recognisable.

Right shoe

Parts of both sole and upper of this shoe survive.

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.

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 fifteenth-century date (Grew & de Neergaard 1988, 37, fig 59; 41, figs 63–5, 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 & de Neergaard 1988, 37, fig 59; 42, figs 67–8). 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 known from Reading (early fourteenth century – 1539) and Poole (early fifteenth century) (Mould 1997, 111, fig 63, no 17; Mould 1994, 71–3, fig 53, no 14, fig 54, no 20a).

According to Grew and de Neergard, most London shoe buckles of the early fifteenth 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 & de Neergaard 1988, 75–6, 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 fourteenth 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 legcoverings were found in graves that dated from the thirteenth to sixteenth 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 fifteenth to early sixteenth-century date (Thomas 1991, 102–11). 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 fifteenth century (Thomas 1991, 110–11; 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 twelfth to fourteenth-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, 1975–7, had a felt lining, while a calf-high boot from the same site, of twelfth-century date, had stitching for a lining (Thomas 2012, 224, 221–4).

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Digest 6.17 MEDIEVAL TEXTILE

PENELOPE WALTON ROGERS (The Anglo-Saxon Laboratory) (OLA 7.1.0)

Introduction

Fragments of a yellowish-fawn textile were found in association with the leather shoes in Burial 43 (F83 C1228). The largest fragments were in the ankle region (17/373, 374), but a small area was also noted peeping out of the decayed toe area of the left shoe [the shoe with the buckle] (Illus 7.18). The textile is a heavily felted wool tabby (ie plain weave). The yarn is Z-spun in one direction and S-spun in the other and there are 10/Z × 8/S threads per square cm. Microscopy of the fibres (× 100 and × 400 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 (17/373). 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 fourteenth to sixteenth centuries. In the twelfth to fourteenth centuries, most clothing fabrics were made in twill, but during the course of the fourteenth century there was a shift to tabby weaves, first of all in English urban textile centres (Walton 1991; Crowfoot et al 1992, 434) and then in places with less well developed textile industries, such as Scotland and Norway (Walton Rogers 1999).

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 fourteenth-century man from Bocksten bog, Sweden (Nockert 1997, 104–7). There are also discarded single examples from late fourteenth-century London (Crowfoot et al 1992, 185–9) and another of uncertain date from Papa Stour, Shetland (Walton Rogers 1999). The London ones are made from wool tabbies with Z × 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 sixteenth century, although there are some later examples in existence (Bennett *in* Walton Rogers 1999). The shoes in the Tarbat burial are of a style which was worn in London in the early fifteenth century and a similar date would be appropriate for the hose. The obvious wear on the textile indicates that they were probably the hose that the man wore in life.

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Digest 6.18 MEDIEVAL CERAMICS

DEREK HALL (OLA 7.1.4)

6.18.1 POTTERY FROM THE MEDIEVAL TOWNSHIP
Sectors 1 to 3

Introduction

The ceramic assemblage [from Sectors 1 to 3] comprises 2,116 sherds from 249 contexts, ranging in date from the twelfth to nineteenth centuries. The entire pottery assemblage has been examined by eye and identified to an accepted fabric name where possible. A selection of fabrics was submitted for ICPS (Chemical Sourcing).

Clay sourcing

The MacAulay Soil Survey Map of Easter Ross indicates the presence of a large deposit of potentially workable clay less than two miles to the south-west of the site, close to Toulvaddie. Field prospection by the author in 2011 identified a deposit of blue-grey lacustrine clay in this vicinity and a sample was submitted to SUERC for ICPS analysis and comparison with the potential locally produced redwares from the excavation.

Pottery fabrics

Scottish Redwares

This assemblage is dominated by sherds in variations of this fabric type, being represented by 1,701 sherds. Recent analysis has indicated that from at least the early thirteenth century, this pottery tradition is prevalent in medieval Scotland where there are riverine red firing clays available – essentially all the main river valleys (Haggarty et al 2011). In recent years, Redware fabrics have been identified from excavations at Dornoch and Hilton of Cadboll and from fieldwalking at Tarradale on the north side of the Beauly Firth (Hall 2009, 9, 10; Hall 2010; E Grant pers comm). Although the Portmahomack assemblage is very fragmented, sufficient evidence is provided by handle, rim and base fragments to attempt to reconstruct the vessel forms. Splash-glazed jugs with strap handles are the most common form represented, with some sherds suggesting that the potters are copying imported vessels from Yorkshire, this is best represented by ribbed rod handles, decorated bridge spouts and a fragment of a decorative arm from a figure jug. Some sherds are smoke blacked and may be from jars used for cooking, although it would appear from other Scottish assemblages that, due to their poor resistance to heat shock, Scottish Redware fabrics were not normally used for producing such vessels. Unusual vessel types in this assemblage include a small skillet/ladle handle and heavily rilled bodysherds (C1318, 24/3234) for example). There is also evidence for bodysherds in this fabric having holes drilled in them and being re-used, possibly as spindle whorls (C1343, 24/2940; C1378, 24/1366). Some of the redware fabrics have a very high quartzite content (visible as white spots) (C1318, 24/3236 for example), something that has previously been noted for the Redwares from Inverness (MacAskill 1982) and some of the north-eastern Scottish redwares that have recently been recorded from excavations by AOC Archaeology at the Bon Accord Centre in Aberdeen (Haggarty & Hall forthcoming). A very distinctive purple heat skin is also visible on some sherds, something that has been identified as a distinctive trait of Scottish Redwares, indicating the leeching of iron from the fabric during firing, interestingly, there are also Redware fabrics present that do not exhibit this effect. There are occasional sherds which appear to be crosses between Organic tempered wares and Redwares (very micaceous) (C1293, 24/1057) for example) also (F137 C1367, 24/1281). There is also an unidentified fabric with large red sandstone inclusions (C1007), which could be a Redware variant, and occasional sherds have very large white quartz inclusions (C1877, 24/5307 for example). Generally, these redwares are quite highly fired. Based on our current knowledge of the Scottish medieval pottery industry, these Redware fabric types and vessel forms would seem to date no earlier than the thirteenth and fourteenth centuries, and no later than the fifteenth/sixteenth centuries (Haggarty et al, 2011).

Organic Tempered Wares

This broad range of handmade fabrics is found on the Scottish west coast and in the Highlands and Islands and represents a pottery tradition that covers at least 2,000 years (Cheape 1993; Lane 2007). This assemblage contains eighty-two sherds in this fabric type. The handmade nature of these vessels makes the reconstruction of complete forms difficult, but perhaps the most distinctive sherd from the assemblage is the 'looped' rod handle from C1366 (24/1363) (ICP sample 3), which seems to be trying to copy an imported vessel form. Such a wide date range for this tradition makes accurately dating sherds of the earlier part of this industry difficult, if not impossible, unless they are found in association with other datable material, or from scientifically dated levels. This small group from Portmahomack is found in association with medieval Redware fabrics and would therefore seem to be of that date.

Whitewares

Recent analysis and study suggests that white firing clays have always been hard to find in Scotland – or may even have not ever been present north of Fife and Strathclyde (Jones et al 2006). This means that any Whitewares from this excavation are likely to be imported rather than locally produced. The small number of such sherds (22) are quite small and difficult to provenance, but included amongst them is a Scottish White Gritty Ware basesherd from a very distinctive flat-bottomed, straight-sided jar of Scottish Borders type (C1366, 11/2422) (ibid 2006). These vessels are thought to be of twelfth-century date, are very well thrown and have now been found from sites at Robert's Haven, Caithness, and Quoygrew, Orkney, indicating that they were being traded up the Scottish east coast (Hall 2011 and forthcoming). This vessel type forms the basis of the as yet unproven argument for a strong monastic involvement in pottery production and trade in twelfth century Scotland (Haggarty 1984). There is also a bodysherd from a splash-glazed Scottish White Gritty Ware jug from the fill of post-hole F260 (C1694, 14/2590), which is liable to date to the thirteenth or fourteenth centuries. Two joining bodysherds from C1078 (14/1896) are from a well-glazed jug, decorated with applied scales, in a fabric which is liable to be of northern English origin and of thirteenth or fourteenth-century date. A further small bodysherd from a vessel that is well-glazed, light green with brown flecks and green streaks resembles Stamford Ware C1264 (24/239), which would date to the eleventh or twelfth centuries (Kilmurray 1980).

Yorkshire Type Wares

Vessels in these distinctively glazed fabrics are the most common imports in the Scottish east coast burghs in the thirteenth and fourteenth centuries (McCarthy & Brooks 1988, 227–52; Jennings 1992). These ornately decorated

vessels seem to have had a marked effect on the local redware potters as it is quite plain that they tried very hard to copy them (see Scottish Redwares above). The Portmahomack assemblage continues with a small number of sherds from vessels in this fabric type, largely from C1000 and C1002. Although there are a very small number of sherds (5), they all come from well-glazed, highly decorated vessels of fairly high status, such as jugs with facemasks and tubular spouts (C1002, 25/111; C1000, 11/992), an aquamanile (C1002, 11/191) and a small, narrow-necked vessel (C1000, 24/7669). Excavations within the church at Portmahomack also produced sherds from an aquamanile (Hall 1998).

Paffrath Type Ware

There is also a single small rimsherd from C1426 (F125, 25/1163), which may be a product of the Paffrath (Blue Grey) pottery industry in northern Germany. Ladles in this fabric are known from excavations in Perth and Aberdeen and are dated to the eleventh/twelfth or early thirteenth centuries (Verhaege 1983). A single bodysherd from C1284 (24/1661) is in a similar slightly thicker, hard-fired fabric and may also be a product of the Paffrath kilns.

Rhenish Stonewares (Raeren)

From the mid-fourteenth century, vessels in these very highly fired stoneware fabrics become fairly common imports into Scotland. The three sherds from Portmahomack are all from Raeren Type stoneware vessels and one of them is from a Raeren jug with a splayed frilled footring (C1000, 24/1477) that dates between 1475–1525 (Hurst et al 1986).

Unidentified

The unidentified material (282 sherds) is largely made up of small bodysherds that are difficult to accurately provenance, but does include an everted rimsherd from a small unprovenanced greyware jar used for cooking, with splashes of external lead glaze (C1368, 11/2505) (ICP sample 21).

Tile

There is a single piece of thin (14mm) flat unglazed redware tile from C1368 (11/2035), which is difficult to date but could potentially be medieval.

ICPS sampling of pottery fabrics (chemical sourcing)

Twenty-six samples of Redwares, Organic Tempered Wares, Yorkshire Type Wares, Whitewares and unidentified fabrics were chosen by the author and George Haggarty for submission to SUERC (East Kilbride) for analysis.

Statistical interpretation of chemical sourcing data

Dr Simon Chenery (British Geological Survey)

The Portmahomack samples have been divided into three groups: *redware*, organic tempered ware (*OTW*) and *other* which includes Scottish White Gritty Ware, Yorkshire Type Wares and an unprovenanced greyware.

Simple x–y graphical plots of data are the first and most rapid method of interpreting the chemical relationship between samples. Bi-variate plots of Th versus U and Th versus La, Portmahomack *redware* and *OTW* appear inter-mixed. The *other* ware has a greater spread and in particular Portmahomack samples 19, 20 and 21 separate. All samples except these fall within the main body of north-east Scotland redware, but seem to most closely match Rattray (Aberdeenshire) and Quoygrew (Orkney).

Date and provenance

Generally, the assemblage of pottery from Portmahomack would seem to date consistently to the thirteenth and fourteenth centuries, with a very small element present suggesting activity in the twelfth century, there are no sherds of Scottish Post Medieval Oxidised or Reduced Wares present, suggesting that occupation dates no later than the sixteenth century (Haggarty et al in press). All of the Organic Tempered Wares would seem to be of medieval date and there would seem to be a hiatus in pottery use at Portmahomack as there are no ceramics present from the early monastic horizons. Apart from a few sherds of Tin Glazed Earthenwares and Brown Glazed Earthenwares from the ploughsoil horizons, there are no ceramics any later than early sixteenth century present on the site either. The ceramic evidence would seem to consistently be suggesting that the major medieval phases at Portmahomack date between the thirteenth and early sixteenth centuries. There are no imported wares present from France, the Low Countries or Iberia, trade connections are only suggested between the rest of mainland Scotland, northern England and the Rhineland.

Conclusions

The pottery assemblage from Portmahomack is one of the largest such assemblages from excavations in the Scottish Highlands and is of value in the continuing study of the development of Scotland's medieval pottery industry. The domination of the assemblage by a variety of Redware fabrics is of interest and the interim results of the chemical sourcing suggest that local production may be taking place. The absence of any ceramics from the early monastic phases is of interest and can be paralleled by a similar absence from the early deposits across the firth at Dornoch (Colman & Photos-Jones 2008).

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6.18.2 POTTERY FROM THE CHURCH (Sector 4)

Introduction

Excavation in Sector 4 produced a small assemblage of pottery (forty sherds) (Table D6.18.1), ranging in date from the early medieval period to the nineteenth century. All the material has been examined by eye, and where possible, assigned a recognised fabric name.

Assemblage

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 nineteenth century in the Hebrides and West Highlands but normally in identifiably modern forms such as cups and teapots (Quail 1979, 39). There is a single sherd from the backfill of a grave (F3 C1006, 20/343), which is from a handmade cooking vessel.

Scottish 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 thirteenth to the fifteenth century (Hall 1996, 126). The assemblage from Tarbat Old Church is dominated by this fabric (thirty-one 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 is from glazed jugs, and it of interest that the glaze is of a

Table D6.18.1
Medieval pottery from the church (Sector 4)

Int No	Context	Find No	Grass	Scot Red	Yorks	China	Tile
17	1004	7	0	0	1	0	0
17	1061	42, 44, 145	0	3	0	0	0
17	1065	43	0	1	0	0	0
17	1112	244, 459, 461	0	3	0	0	0
17	1131	146	0	1	0	0	0
17	1147	164, 229, 245, 246, 275	5	0	0	0	0
17	1150	189, 228, 230	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	318, 462	0	0	6	0	0
17	1212	288, 299	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
22	1001	2, 8	0	2	0	0	0
22	1013	10, 11	0	0	0	0	2

Fabric Codes: Grass = grass-marked pottery; Scot Red = Scottish Redwares; Yorks = Yorkshire Ware

much higher quality than normal and is very lustrous. Apart from jugs, there are two sherds from cooking pots (C1178 20/341) and one rimsherd that may be from a chafing dish (C1147, Cat 4, 17/164).

Yorkshire Ware

Vessels in these distinctively glazed fabrics are the most common imports in the east coast burghs in the thirteenth and fourteenth centuries (McCarthy & Brooks 1988, 227–52). There are six sherds in this assemblage, one from a glazed water jug and the other five from the front half of a zoomorphic aquamanile (C1004, Cat 7, 17/318) (McCarthy & Brooks 1988, 228, fig 651).

China

There is one rimsherd from a china teacup that has the remains of a stamped 'heart' decoration around its rim (C1064, Cat 8). This dates to the eithteenth or nineteenth century.

Tile

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

Discussion

Recent work on Scottish ceramics has concentrated on trying to locate the sources of the Scottish 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 & Phillips forthcoming). What is most striking about this small assemblage from Portmahomack is that it contains yet another variant of the Scottish 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, 355–68) and more recently in Dornoch (Hall 1998).

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

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Catalogue

Scottish Redware

1. Rimsherd and rod handle junction from jug, glazed lustrous brown on a purple wash (C1150; 17/189)
2. Rod handle fragment from jug, glazed lustrous green on a purple wash (C1112; 17/461)
3. Unglazed basesherd from jug (C1001; 22/8)
4. Rimsherd from chafing dish(?) with traces of internal lustrous brown glaze and slight external smoke blackening (C1147; 17/164)
5. Rimsherd from open vessel form(?) internal glazed lustrous green brown on a purple wash (C1075; 20/106)

Yorkshire Ware

6. Fragment of small strap handle glazed lustrous green (C1004; 17/7)
7. Front end of zoomorphic aquamanile glazed lustrous green and decorated with scales. Junctions for spout and two legs are visible (C1208; 17/318)

China

8. Rimsherd from teacup(?) decorated with stamped pattern around rim (C1064; 20/281)

Digest 6.19 COFFIN WOOD IDENTIFICATION

STEVE ALLEN (York Archaeological Trust) (OLA 7.1.5)

Objectives

This report is the summary of the species identifications of a number of fragments of wood.

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.

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.

Listing

The material is listed in burial number order. All species identifications follow Schweingruber (1982).

Reference

Schweingruber, F 1982 *Microscopic Wood Anatomy.* Teufen: F Flücke-Wurth.

Table D6.19.1
Catalogue of coffin wood

Burial No	Feature No	Context No	Find No	Species identification
9	45	1134	17/192	Not identifiable
17	7	1100	17/71	*Pinus sylvestris L*
21	75	1195	17/263	Not identifiable
26	55	1161	17/180	Not identifiable
26	55	1161	17/181	Not identifiable
30/36	76	1215	17/289	*Quercus* sp
43	83	1228	17/375	?*Fraxinus excelsior L*
43	83	1230	17/490	*Quercus* sp
93	28	1114	17/152	*Pinus* sp
101	47	1104	17/153	Not identifiable
112	69	1174	20/136	*Quercus* sp
112	69	1174	20/136	*Quercus* sp