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Crystal Park, Bottisham: The Construction Materials of a Roman Villa Complex – A Cambridgeshire Case Study

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ABSTRACT

The retention of 2.6 metric tonnes of building material from three rural masonry buildings from Bottisham, south-east Cambridgeshire, provided a rare opportunity for a thorough investigation into their fabric, form, construction style and function. A double-apsidal building may have been a bath-house and another building had evidence for an extensive box-flue tile heating system. Both buildings showed signs of either being unfinished or the heating element having never been used. A third building was a later construction that used rare red-slipped tegulae and imbrices. This article goes beyond suggesting the existence of a villa or villa-type complex at Bottisham to offer a detailed case study of the use of ceramic building materials

Keywords: Cambridgeshire; bath-house; red-slipped tile; rural; geological analysis; box-flue tile; villa; fabric

INTRODUCTION AND THE SITE

Bottisham lies in south-east Cambridgeshire in the East Anglian Chalk region. The surrounding topography is generally flat with a slight fall in ground to the north and west towards the Fens and a rise in elevation to the east towards Newmarket. The River Cam runs 5 km north-west of the site.

Excavations at the site of Crystal Park (FIG. 1) in 2016 revealed a series of early third- to early fourth-century enclosures and three buildings with stone and brick foundations, one of which was a possible bath-house.[1] This suggests that the site at Bottisham was part of a villa or villa estate. The full archive report of the excavation, including all specialist reports, is available via the Archaeological Data Service (ADS) Library.[2]

[1] Excavation was undertaken by Pre-Construct Archaeology Ltd (PCA) on land at Crystal Park, Bottisham, Cambridgeshire, CB1 9HR (centred on NGR TL 5452 6088: fig. 1), between 23 May and 19 August 2016. The archaeological work was commissioned by CgMs Consulting (now RPS Consulting) on behalf of Bloor Homes.

[2] Meckseper and Hayward 2018.

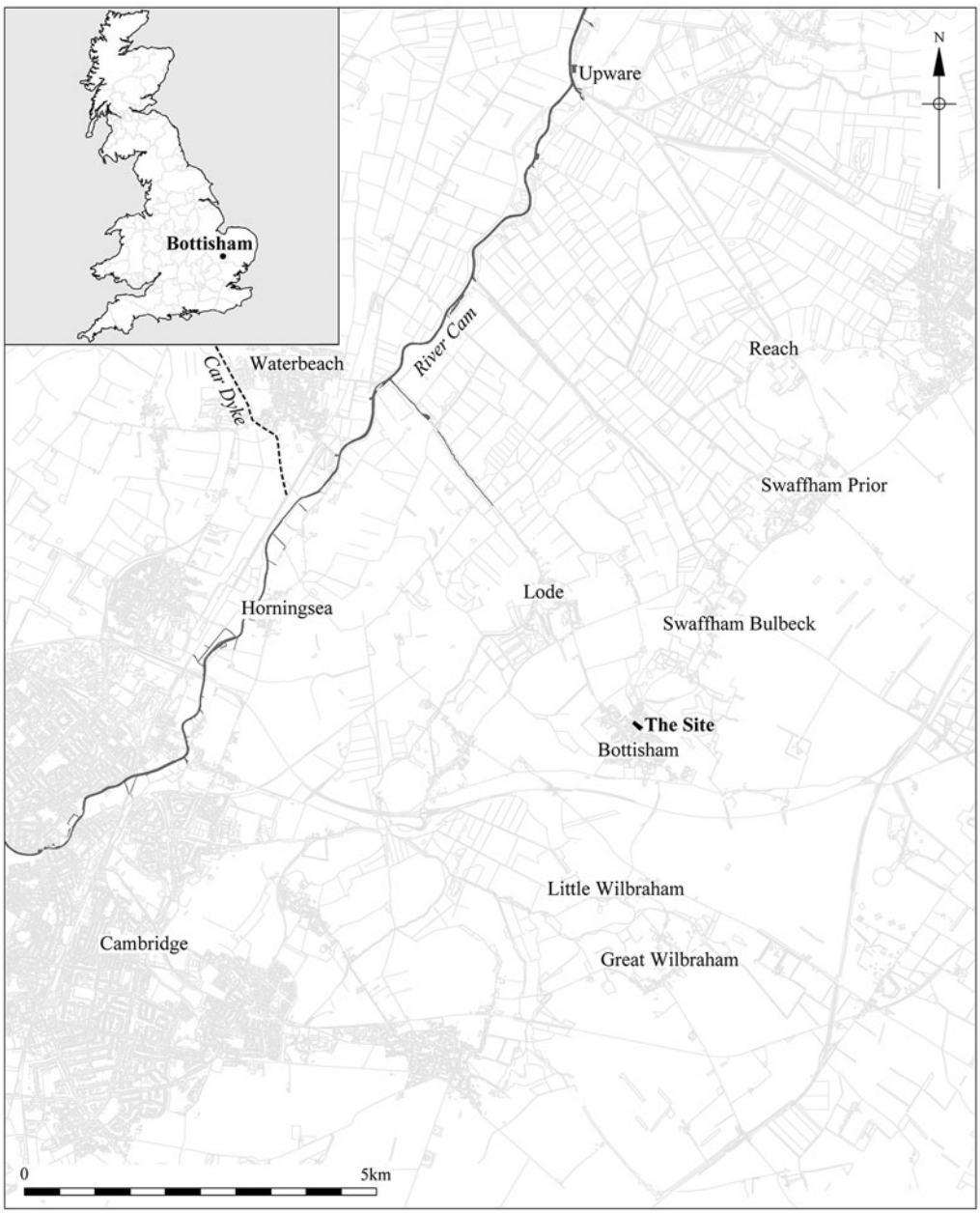

FIG. 1. Site location. (© *Pre-Construct Archaeology Ltd*)

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Although the Cambridgeshire Fen Edge, of which Bottisham is a part, has seen intensive levels of excavation, with large numbers of Roman rural settlements recorded, there are still gaps on the map.[3] The Cambridge Historic Environment Record (CHER) lists ten sites as possible 'villas' in a 10 km radius around Bottisham, the majority of which are identified through surface scatters of building materials, cropmarks and metal-detecting finds. Examples include the villa complex at Swaffham Balbeck *c.* 2 km to the north of Bottisham (CHER 11545), described as a 'large building with much roofing tile, concrete and *opus signinum*', and Great Wilbraham (CHER 06279), *c.* 4 km to the south, which has a cobbled floor associated with a rich finds assemblage. Excavated examples are the Roman villa at Hinton Fields (CHER 05099) where buildings with rubble walls and associated tesserae were found, and a courtyard villa with Roman wall plaster excavated in 1892 north of Reach Bridge (CHER 06809). Parts of a late Roman large rectangular aisled building with stone foundations, suggesting a settlement of some significance, were recently excavated at Upware, *c.* 9 km north of Bottisham.[4]

While Bottisham is a rural site that has seen excavation over several years and comprises many elements of a villa complex or rural farmstead, this article focuses on three buildings found at the site and their building materials, as these provide a unique insight into their construction, chronology, form and function and the sourcing, use and reuse of building materials on the Roman fen edge. It is also the first time that building materials in this part of Cambridgeshire have been extensively classified.

SITE SUMMARY

The excavation was the latest in a series of investigations that took place prior to development off Tunbridge Lane in the north-eastern part of Bottisham.[5] Tunbridge Lane is used here as a convenient geographical marker, but it is likely that it already existed as a routeway in the Roman period.[6] All investigations revealed parts of the same high-status Roman settlement, either a wealthy farmstead or part of a villa estate.

Villas in the east of England tend to develop from existing farmsteads with a peak of occupation in the later third century[7] and the settlement at Bottisham seems to conform to this type. An early phase of the settlement, dating to *c.* A.D. 70–270, was located north of Tunbridge Lane and is represented by pits, ditches and post-holes.[8] The focus of activity shifted southwards in the mid- to late Roman period. Excavations south of Tunbridge Lane in 2014 revealed the northern part of the later third- to early fourth-century settlement,[9] while the investigations at Crystal Park revealed its southern extent. The sites need to be seen in context with each other.

On both sites a system of enclosures, dating to the late second/early third century, was replaced by larger enclosures. At Crystal Park these included three buildings (Buildings 1, 2 and 3), dated to the third century, set around a possible courtyard (FIG. 2). Building 1 was a double-apsidal building and possible bath-house, Building 2 a simpler two-roomed structure with a clay tile roof and Building 3 a complex structure with at least three rooms and walls lined with box-flue tiles. Both the bath-house Building 1 and box-flue heating system of Building 3 show limited signs of use.

[3] Smith *et al.* 2016, 420.
[4] Robinson Zeki 2020.
[5] Gater and Stephens 1992; Seddon 2000; McDonald 2000; Wills 2003; Pearson and MacDonald 2001; Pearson and O'Brien 2006; Crowther 2007; Kenney 2008; Newton 2014; 2016.
[6] Newton 2014; 2016.
[7] Smith *et al.* 2016.
[8] Kenney 2002.
[9] Newton 2014; 2016.

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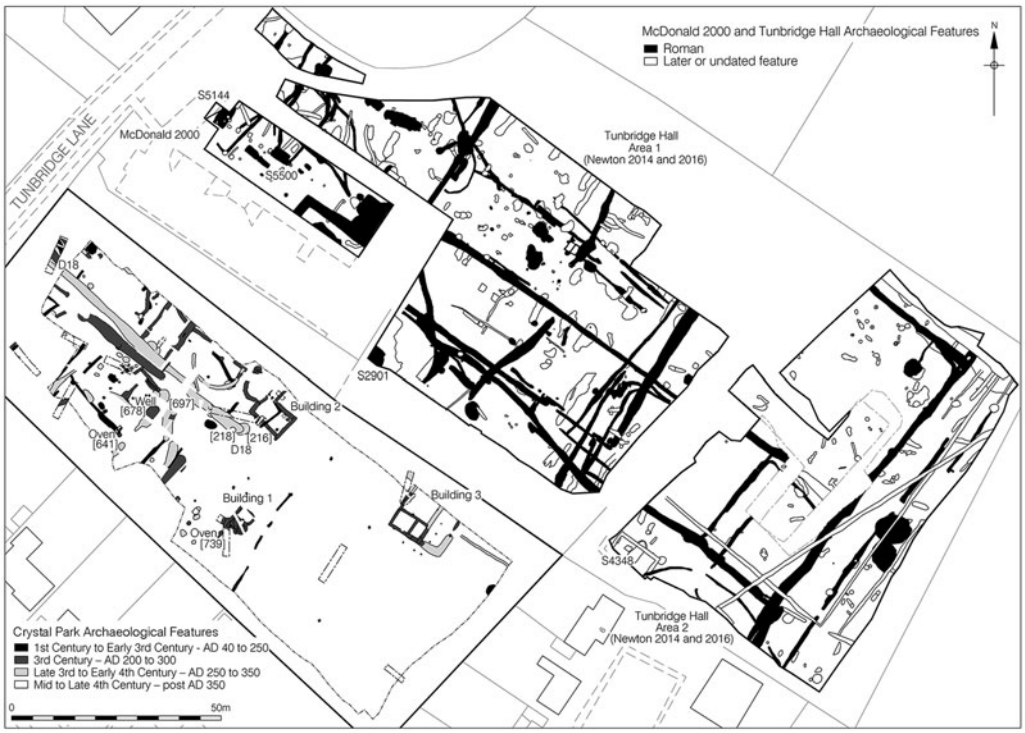

FIG. 2. Crystal Park, Bottisham, and adjacent sites. All features plans. (© *Pre-Construct Archaeology Ltd*)

Analysis of the building materials suggests that there were at least two phases of building, demolition and rebuilding on the site, with Buildings 1 and 3 built first with changes in their building fabric over time and Building 2 built at a later stage. This sequence is based on the comparison of use and reuse of building materials within each building (see separate building descriptions below).

There was little evidence to indicate the kind of activity that was going on inside the enclosures. The enclosure ditches and internal pits contained a sparse, mixed finds assemblage and modern truncation had made environmental sampling difficult. Two hearths were located on the site, one third-century keyhole-shaped oven [739] close to Building 1, with no signs of firing, and one late third- to early fourth-century L-shaped oven [641] which may have been a corn-drying kiln.

This is in contrast to the third-century A.D. enclosures identified on the Tunbridge Hall site to the north, which were closely associated with large hearths for the processing of produce and food, the malting of grain and the drying of corn. The site also yielded evidence for metalled surfaces and three buildings with stone footings or of a post and beam-slot type construction (S2901, S4348 and S5500), possibly used for industrial purposes and the storage of agricultural produce. It is therefore possible that any large-scale, possibly noisy and smelly, industrial and agricultural activity was located away from the main buildings.[10]

[10] Newton 2014; 2016.

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The buildings fell into disrepair and either collapsed, or were demolished and extensively robbed, in the late third and early fourth century, while the system of enclosures adjacent to them in the west was re-defined and continued in use. A large amount of building material from the buildings was dumped into adjacent features, most notably the well [678], Ditch 18, particularly its ditch terminus [418], and associated pit [416].

There is some evidence, in the demolition debris of the buildings, for possible occupation nearby into the fourth century, in the form of fourth-century coins and a small mid-fourth- to early fifth-century glass vessel.

METHODOLOGY: RECORDING, SAMPLING AND ANALYSIS

The retention of the entire building material assemblage from the excavation at Bottisham provided a unique chance to examine the fabrics and forms of the mortar, brick, tile and stone at a level of detail not previously possible at a Roman rural site in Cambridgeshire. It was hoped that a detailed review of its distribution would establish what the buildings were used for and whether their function changed over time.

The entire roofing tile, brick and box-flue tile assemblage was catalogued and quantified in-house by number of fragments and weight. The stonework underwent detailed hand specimen geological comparative analysis to establish stone types and where the material types were being quarried and supplied from.

The application of a 1 kg mason's hammer and sharp chisel to each example ensured that a small fresh fabric surface was exposed. The fabric was examined at ×20 magnification using a long arm stereomicroscope (Brunel Microscope TLA 250V) or hand lens (Gowlland ×10). Colour was recorded using a Munsell Color Chart.[11] In the absence of an existing Cambridgeshire Roman Ceramic Building Material Fabric Collection, analysis primarily aimed at establishing a site-specific reference collection as well as describing and relating the different fabrics to particular buildings and phases of construction. Stone samples compiled from earlier research[12] provided comparative reference material.

Consultation of the relevant 1:50,000 geological maps for this area, Sheet 188 (Cambridge) and memoir,[13] provided an understanding of the local clay and stone resources. An additional source of information was provided by the recently published volumes on the nearby Horningsea Pottery Industry,[14] which included a section on tile fabrics.[15]

Owing to the sheer size of the ceramic building assemblage (9249 examples, 2600 kg),[16] a targeted sampling strategy of the ceramic building material by fabric was a necessity. Targeted sampling focused on contexts relating to walls surviving *in situ*, robbed-out walls and demolition or collapsed roofing of the three buildings, and reused and dumped material in adjacent features such as the L-shaped oven [641], well [678], the terminus of Ditch 18 [418] and pit [416], which were key to understanding the function and chronological development of the site. Here a 25 per cent fabric sampling policy was initiated for each category of building material, already subdivided by form at assessment stage primarily to obtain quantifiable data on the fabric types.

[11] Munsell Color Group 1975.
[12] e.g. Hayward 2009.
[13] Worssam & Taylor 1969.
[14] Evans *et al.* 2017.
[15] Mills 2017.
[16] Including 282 tubs and four bread crates of Roman brick, roofing tile, *imbrex* and box-flue tile. A further 16 tubs of mortar were also examined.

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Detailed investigation of the form of 50 of the more complete examples also helped the study focus on the character and production of the individual brick, *tegulae*, *imbrex* and box-flue tile from the site. This included the form of some of the more unusual items such as the washed or red-slipped *tegulae* and *imbrex* from Ditch 18.[17] Each of these is commented on below.

CAMBRIDGESHIRE GEOLOGY AND RESOURCES FOR BUILDING IN STONE AND TILE

In Cambridgeshire, brick clay has been the building material of choice since the Roman occupation. At Bottisham, for example, approaching four times the amount of ceramic building material (2600 kg) relative to stone (466 kg) was recovered. This is due to the extensive Upper Jurassic, Cretaceous and Pleistocene clay cover that blankets much of this region.

There are numerous brick-clay reserves close by in Cretaceous Gault to the south-west and east of Cambridge, while Kimmeridge clay and the underlying glacial till have in the past been used as a source of clay for the brick in Cambridgeshire.[18] Despite an absence of Roman tile kilns, the clay associated with the pottery kilns associated with the nearby long-lasting Horningsea pottery industry[19] was seen as a likely source for the finer oxidised sandy Horningsea Fabric which characterises Roman ceramic building material throughout much of south Cambridgeshire. Detailed descriptions and definitions of the forms and a list of mortar fabrics can be found in the appendices below.

The geologically young underlying Upper Cretaceous (Lower Chalk) bedrock at Bottisham is usually too soft to be worked into rubblestone or dressed into cohesive, structurally sound building blocks. Instead, chalk is used as a major source of lime for mortar production, due to its almost pure 100 per cent $CaCO_3$ content. Harder building stone is a valuable commodity in eastern and southern Cambridgeshire as it is very rare, with the notable exception of harder Chalk Rock, also known as Clunch or Burwell stone.[20]

The opportunistic use of older, harder glacial erratics from the overlying Anglian Till as rubblestone walling is known. However, the impact of this array of highly dispersed, very hard to work, igneous (e.g. basalts, dolerites, granites), metamorphic (schists and gneiss) and Palaeozoic and Mesozoic sandstones and limestone was at best minimal. Instead, rock suitable for rubblestone and freestone use was often brought in from a distance. Bottisham has access via the River Cam and the Car Dyke to older more suitable freestone[21] outcrops to the west from Middle Jurassic escarpment (e.g. Barnack stone, Weldon stone; Blisworth limestone; Ketton stone) (FIG. 3). Included here is Collyweston slate, which supplied much of the stone roofing tile to villas and bath-houses from this region such as Haddon[22] and the nearby villa at Whittlesford.[23] This route also tapped into the wider provincial supply of portable utilitarian stone objects from much further afield, most notably quernstones from the Millstone Grit of South Yorkshire but also many other sources from West Sussex, Forest of Dean and even the Rhineland.

[17] Hayward 2018b.
[18] Worssam & Taylor 1969, 130.
[19] Evans *et al.* 2017.
[20] Worssam and Taylor 1969; Hayward 2018a.
[21] A limestone or sandstone with a soft, even-grained, porous texture which enables the rock to be worked in any direction.
[22] e.g. Upex 1994; Hinman 2003.
[23] Hayward, pers. obs. June 2018

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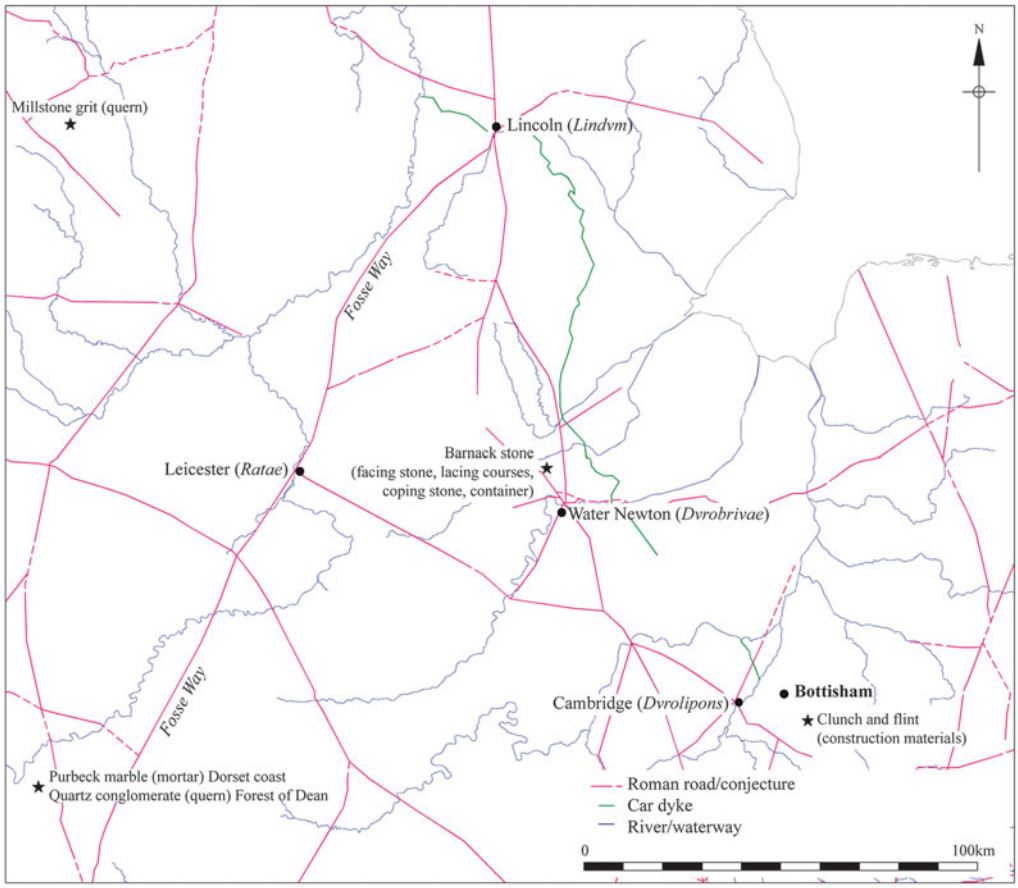

FIG. 3. Sources and transport routes of building stone. (© *Pre-Construct Archaeology Ltd*)

BUILDING MATERIALS

CERAMIC BUILDING MATERIAL

Form – overall distribution and condition

TABLE 1, which quantifies by weight the distribution of the three main types of ceramic building material retained from Bottisham (roofing tile, brick and box-flue), shows considerable variation from one building to another, each a reflection of a separate function and construction history. It can be seen, for example, that box-flue tile was especially common in Building 3 (85 per cent of all box-flue tile from the site and 50 per cent of building material specific to this building) and hardly present at all in Building 1 (2 per cent), while roofing material (*tegulae* and *imbrices*) characterises Building 2 (63 per cent of building material) and hardly features in Building 1 (18 per cent). Brick, on the other hand, much of it complete and with fresh mortar adhering, characterises the more robust structural Building 1 (64 per cent) and accounts for 92 per cent of material from well [678].

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TABLE 1. WEIGHT (KG) FOR EACH CATEGORY OF ROMAN CERAMIC BUILDING MATERIAL BY FEATURE AND BUILDING AT BOTTISHAM

Feature	**Brick**	**Box-flue**	***Tegulae***	***Imbrex***	**Undiagnostic broken tile**	***TOTAL kg***
Building 1	201	12	51	4	45	*314*
Building 2	48	116	146	57	59	*325*
Building 3	288	425	288	19	77	*1125*
Well [678]	444	1	36	<1	4	*485*
Oven [641]	35	0	0	0	0	*35*
Ditches and Pits	102	59	55	37	92	*316*
TOTAL kg	*1118*	*513*	*576*	*117*	*276*	*2600*

Fabrics

Six ceramic building material fabrics (*Bottisham 1-6*) can be distinguished, each characterised by a distinctive hue, inclusion type, grain-size and moulding sand (TABLE 2). This section highlights the overall distinguishing features of each, some idea of their clay source, and their frequency and distribution. Because of the targeted sampling strategy during fabric analysis stage, it is only possible to estimate the proportion of each fabric type.

Bottisham 1 is the most versatile and abundant fabric found in quantity in broken-up *tegulae*, *imbrex*, box-flue tile and perhaps to a lesser extent the brick from all buildings. It is comparable to finer oxidised red sandy Horningsea fabric T51/1 that is common throughout southern Cambridgeshire with inclusions of flint, chalk and quartzite inclusions that clearly indicate derivation from a Quaternary glacial clay.

Other fabrics show derivation from Upper Jurassic (Kimmeridgian or Oxfordian) or Cretaceous (Gault) clays. The softer, black organic core rich *Bottisham 5*, which is restricted mainly to the production of lydion sized bricks and roofing elements, has impressions of brachiopods in the core of the fabric in examples from [2012]. The calcareous rich fawn and yellow fabrics *Bottisham 3 and 4* were almost certainly dug from outcrops of Lower Cretaceous Gault which lie within 2–3 km of the site. Both fabrics were restricted to Building 2 and Ditch 18 and with a few exceptions nearly always used for the production of roofing tile (*tegulae* and *imbrex*).

Four distinctive mortar fabrics (M1–M4) were identified at Bottisham, each having a characteristic hue, inclusion type and grain-size, and it was possible to link the distribution of each mortar type to a particular building, feature or even style of construction. These are not discussed in detail here and the reader is referred to the archive report in APPENDIX 1.

BRICKS AND CURVED ARCHES

It is a feature of the site that there were no small *bessales* bricks and just a handful of fragments of larger bricks used to cap the *bessalis pilae*, typically *pedalis*, *sesquipedalis* or *bi-pedalis* size.[24] Instead, complete bricks, either dumped into well [678] or recorded *in situ* in the walls of Building 1 and Building 3, were nearly all found to conform in size to the standard rectangular lydion size measurement,[25] typically 380 mm (1 ft 3 ins) long by 280 mm (11 ins) wide, averaging 36.8 mm (1½ ins) thick and weighing 7–8 kg. It has long been recognised, especially by Gerald Brodribb,[26] that these brick shapes are highly versatile and at Bottisham they have been put to a range of uses. These include use as lacing courses, complete removal and reuse as paving floor materials, or the use of broken examples as walling rubble.

[24] Brodribb 1987.
[25] Brodribb 1987, 40.
[26] Brodribb 1987, 40; see also Lancaster 2015.

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TABLE 2. DESCRIPTION, SOURCE, FREQUENCY, FUNCTION, DISTRIBUTION, AND CONDITION OF BOTTISHAM FABRIC TYPES

Fabric type	Kiln source	Percentage of sample	Use number of fragments	Distribution and condition
Bottisham 1 Fine condensed sandy pale orange-red 2.5YR 5/8 fabric	Unknown but probably boulder clay/ brickearth tileries around Horningsea as comparable to the finer oxidised sandy Horningsea fabric 51/1	55.7%	80% of all *tegulae* 80% of all *imbrex* 95% of all box-flue tile with Mortar 3 20% of all brick (all lydion)	B1–3, well, ditches and pits. Reused & fragmentary. Used with Mortar 1–Mortar 3
Bottisham 2 Beige-orange 2.5YR coarse sandy fabric numerous glassy and milky white angular quartz burnt flint rare black clay (7.5YR 2.5/1) inclusions	Unknown; uses a mixture of glacial brickearth and Jurassic clays	4%	1–2% all *tegulae* and *imbrex* 4% box-flue tile mainly Building 3 5% brick including use in thicker brick 52 mm	Rare B2, present B1 1 and 3, well, ditches and pits. Fresh & fragments. Used with Mortar 2; Mortar 3
Bottisham 3 Fine medium grey cream yellow 10YR 7/6 biscuity texture	Unknown but from the calcareous-rich Gault clays which outcrop as close as 2–3 km from the site	0.2%	<1% of all *tegulae* and *imbrex* (some of which is dipped red) not used in box-flue tile or brick	B2 2 only Ditch 18. Fresh & fragments. Used with Mortar 1
Bottisham 4 Pale orange 5YR 7/8 biscuity fabric with fine fractured milky quartz occasional brown iron limonite black organic clay	Unknown but from the calcareous-rich Gault clays which outcrop as close as 2–3 km from the site with some flint inclusions from the chalk	2%	5% of all the *tegulae* and *imbrex* (some of which is dipped red) rising to 25% of all *tegulae* and *imbrex* for Building 2 rare brick and one box-flue tile	B2 2 only; ditches 18 and 47; pit 417; Fresh. Used with Mortar 1
Bottisham 5 Thick fine black 7.5YR 2.5/1 organic clay core, margins coarser grit size glassy quartz and flint	Unknown but uses a Jurassic or Cretaceous clay (brachiopod impression) [2012] and chalk and flint	29.5%	10% *tegulae* and *imbrex* 1% box-flue tile 60% brick Most of the offset archway bricks and lacing bricks and oven bricks B1; B3; well; oven	B1–B3 and especially well fill [756] with a thick low-density mortar. Used with Mortar 1 & Mortar 3
Bottisham 6 Busy beige to calf-brown 7.5YR 6/6 fabric fine yellow laminae 10YR 8/6 red iron oxide inclusions 10R 4/8 and black organic clay 7.5YR 2.5/1	Unknown; a mixture of Jurassic and Cretaceous clay and chalk and flint	8.6%	20% brick – lacing and offset archway bricks Some offset archway bricks, lacing bricks, oven bricks B1; B3; well; oven	B1 and 3 only well fill. Complete and used with Mortar 1 & Mortar 3

With brick and stone such a valuable commodity, and in short supply for an isolated farmstead such as Bottisham, the need for materials to be versatile and reusable becomes more important. One further example of the versatility of brick and its use for curved arches is noted by Brodribb, who states that 'It is possible to make curved arches with any size of flat brick from bessales to bipedales simply by adjusting the amount of mortar to induce a curve'.[27] Two potential brick arch components were identified at Bottisham, where lydion bricks were separated by increasing thicknesses (up to 70 mm) by low-density waterproof pale orange pink mortar (2.5YR 5/8) (FIG. 4). One was a definite arch fragment dumped into well [678], the other was a possible arch base *in situ* in wall [2048] of Building 1. It is likely that the arch fragment and arch base were part of the same structure. Both arch components correspond in form and dimension with the structure described by Brodribb, rather than usimg the more conventional brick shaping, or tapering called a *Cuneatus* or Solid Voussoir arch.

An identical brick arch to the fragments found at Bottisham was found *in situ* recently at the Silchester 'Neronian' bath-house where it topped a drain conducting water in or out from a latrine.[28]

PIGMENTATION ON ROOF-TILE

Detailed visual analysis of the ceramic building material assemblage has shown the identification of red pigment in a group of *imbrices* and *tegulae* from the demolition debris of Building 2, also dumped into adjoining Ditch 18 and Ditch 47. The red slip appears all over the flanged *tegulae* and curved *imbrices* but is especially prominent along the flange edges and top of the *tegulae* (FIG. 5) and the point of maximum curvature along the apex of the *imbrex*, as if meant to be seen. The decision to dip these different yellow-clayed roofing materials into a red-coloured solution may have been an aesthetic choice in keeping with the pre-existing red roof skyline for the bath-house and outhouse buildings (Building 1 and Building 3) of a possible courtyard area. Associated with the yellow Gault-rich *Bottisham 3 and 4* fabrics (TABLE 2), nearly all the *tegulae* were also found to have nail-holes.

Pigmentation of Roman ceramic building material occurs in only a few examples at villas in Northamptonshire (Piddington and Croughton) and at Southwark, where a deep red slip coats the finished tile.[29]

CAVITY WALLING

Tubulus or box-tile, the most efficient way of circulating heat into a space behind the walls and round the room, was concentrated in the demolition layers of the two westernmost rooms of Building 3. There is so much box-flue tile (365 kg) that *in situ* collapse would seem to be the most likely explanation, supported by the fact that there are many entire rectangular combed and vented faced elements in good condition, with complete examples measuring 220 × 170 × 21 mm in length, width and depth. Present in a limited range of standard combed designs on alternate faces, they are all made from the fine red sandy Horningsea Type fabric (*Bottisham 1*) and clearly form part of a single cavity walling.

An interesting feature of the assemblage is that there are no signs of soot, scorching and burning marks on the inside of the vents. Instead, the combing is fresh and there is sometimes a bulbous calcareous residue on the inside of the vent or the jacketing. Whether or not this is hard limescale precipitate from heated, hard, chalky water is not clear. The absence of soot may indicate that the box-flue tiles were only used a couple of times or indeed not at all.

[27] Brodribb 1987, 43.
[28] Hayward, pers. obs. June 2018.
[29] Ward 1999; Warry 2006; Mills 2008, 81–2; Pringle 2009, 193, fig. 147; Mills 2013, 72; Hayward 2019.

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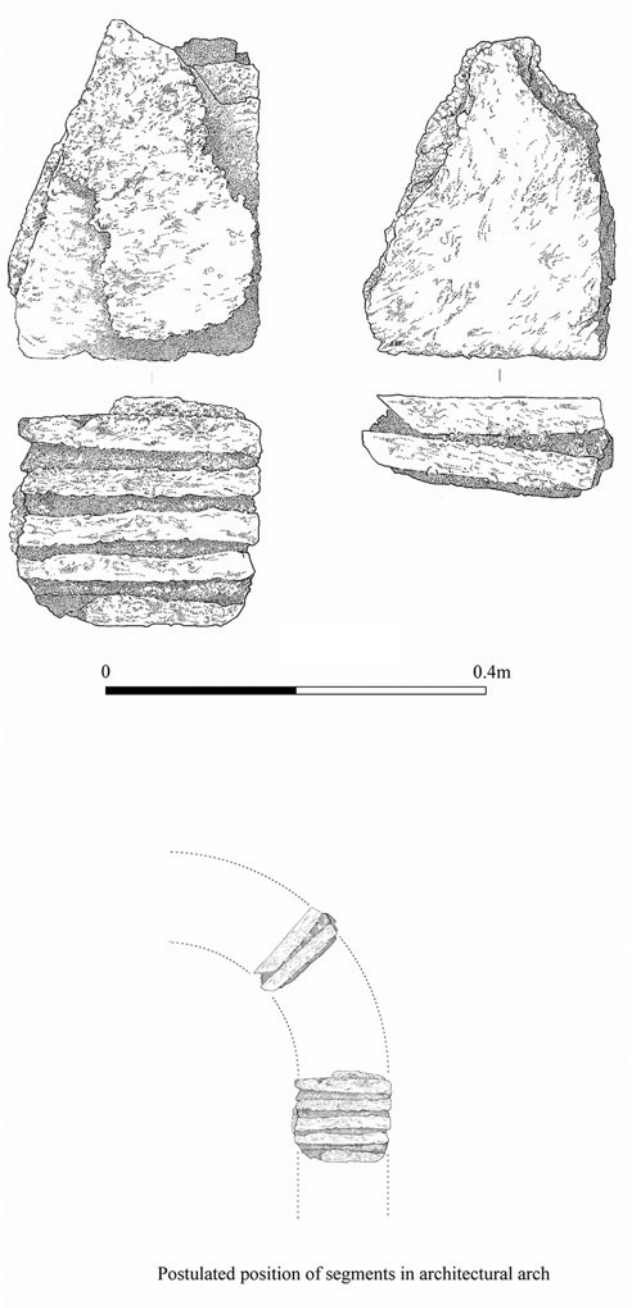

FIG. 4. Ceramic Building Material arch fragments. (© *Pre-Construct Archaeology Ltd*)

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FIG. 5. Red slip on *tegula*. (© *Pre-Construct Archaeology Ltd*)

THE STONE

TABLE 3 summarises the principal rock types, their geological source, distance from outcrop and function at Bottisham. These are stone types that are encountered again and again in Roman rural farmsteads and villas throughout Cambridgeshire.

Two roughly dressed stone materials were used in the construction of the three buildings at Bottisham. Barnack stone was used for their structural integrity, while Burwell stone, the accessible local very soft chalk rock, was used for decorative facing, like the small sub-square *petit appareil* facing blocks in Building 3. More unexpected was the significant quantity of Barnack limestone, of which 40 pieces were recovered with an individual block weight of 15–60 kg and a typical size of 300 × 280 × 160 mm. These were quarried and supplied from distances of over 65 km.

The use of Barnack limestone for very roughly tooled rectangular structural elements (FIG. 6) in the facing and lacing of the substructure of Building 1 contrasts with what is known of its use in later Roman Britain as stone for sarcophagi[30] and for architectural embellishment.[31] However, this limestone, which is extremely hard and durable and has a very low porosity, is ideally suited to the construction of a subterranean bath-house, with its resistance to the higher moisture content and temperature especially when it is bonded and coated using hard, waterproof, pink *opus signinum*-type mortars.

In an area of soft underlying geology, this demonstrates that the owners of Bottisham and other high-status masonry farmsteads were prepared to put in a significant effort to obtain desirable stone materials from quite distant sources.

[30] Hayward 2015.
[31] Dimes 1980.

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TABLE 3. PRINCIPAL ROCK TYPES, GEOLOGICAL SOURCE, DISTANCE FROM OUTCROP AND FUNCTION AT BOTTISHAM

Stone type	**Geological source**	**Distance from outcrop**	**Function at Bottisham**
Clunch or Burwell stone	Upper Cretaceous (Lower Chalk)	<0.5 km outcrops close as Bottisham, e.g. the Old Pit [558601] (Worssam and Taylor 1969, 130–1). The spring line also lies at the junction with the Burwell stone at Bottisham (Worssam and Taylor 1969, 130–1)	*Petit appareil* facing blocks 220 × 130 × 110 mm apse walls and wall group B1
Flint	Upper Cretaceous (can occur in Lower to Middle Chalk)	<0.5 km outcrops close as Bottisham	Rubble, pot boilers, hammerstones
Barnack stone	Barnack, Cambridgeshire Middle Jurassic (Bajocian)	65 km via the Car Dyke	Present as large structural facing blocks in south-west corner wall of B3 with brick and in B1 as lacing courses. These structural elements were dumped in the well along with a coping stone and large stone container
Millstone Grit	Namurian, Upper Carboniferous, Derbyshire, South Yorkshire	165 km via Car Dyke to Lincoln and then by road/water to Derbyshire	Principal quern and millstone material, large elements dumped in well
Quartz Conglomerate	Basal Upper Devonian, Forest of Dean	250–300 km via Car Dyke, Leicester, Fosse Way and Ermine Street to Gloucester. Boat from Forest of Dean. River Severn	Second quern type mainly in demolition fill of B3
Purbeck marble	Lower Cretaceous, (Purbeckian) Isle of Purbeck, Dorset	270–300 km via Car Dyke, Leicester, Fosse Way and then to east Dorset coast	Stone mortar

THE BUILDINGS

BUILDING 1: DOUBLE-APSED BATH-HOUSE

The sunken double-apsed Building 1 was a substantial masonry structure, 6.6 m long x 5 m wide x 0.9 m deep consisting of lacing courses of lydion brick made from *Bottisham 5* and *Bottisham 6* brick fabrics, used in conjunction with large structural blocks of Barnack stone (FIGS 7 and 8). Elsewhere, precisely worked *petit appareil* sub-rectangular blocks of clunch and chalk were used to define the outlines of two apsidal features [2012]/[2050] and [2015], each 2.15 m in diameter, as well as a rectangular section of wall [2044] that demarcates the north-east–south-west side of the building. The overall impression is of a sub-structure constructed with thought to aesthetics using fresh and carefully chosen brick and Barnack stone structural elements, the latter brought in over distances of 60 km from north-west Cambridgeshire. Two different mortars, the loose earthy-brown flint chalk mortar M2 and a very high-quality low-density pale orange pink mortar and render M3 define the apsidal and north-east–south-west side sections of wall from the south-west side and buttress, respectively. What is immediately apparent is how intact and pristine all these surviving subterranean elements are, completely undisturbed by subsequent robbing.

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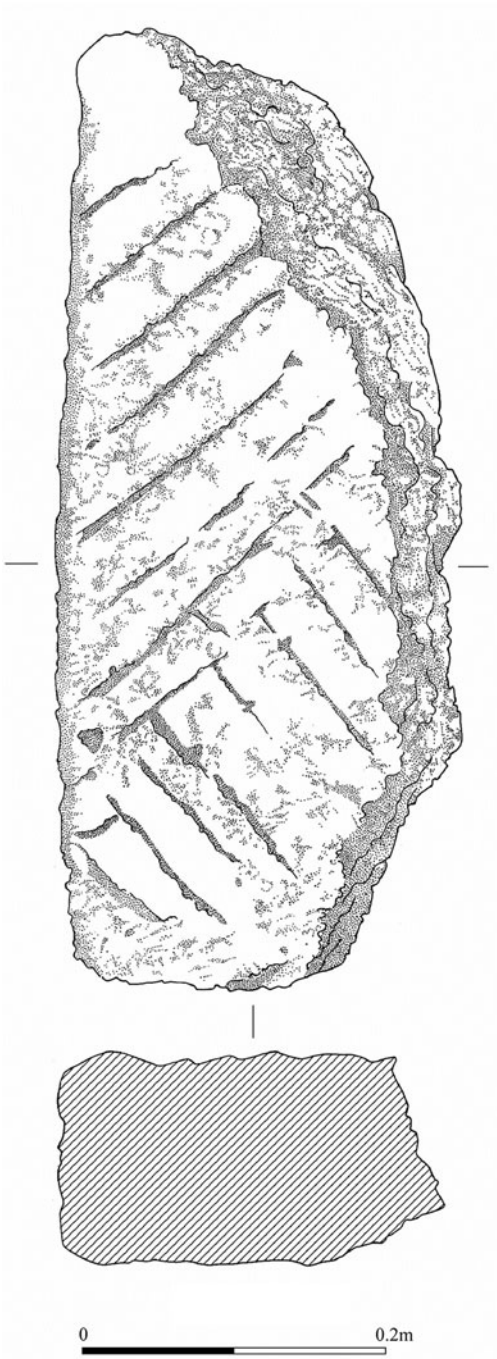

FIG. 6. Barnack stone architectural block with hammer and chisel tool marks. (© *Pre-Construct Archaeology Ltd*)

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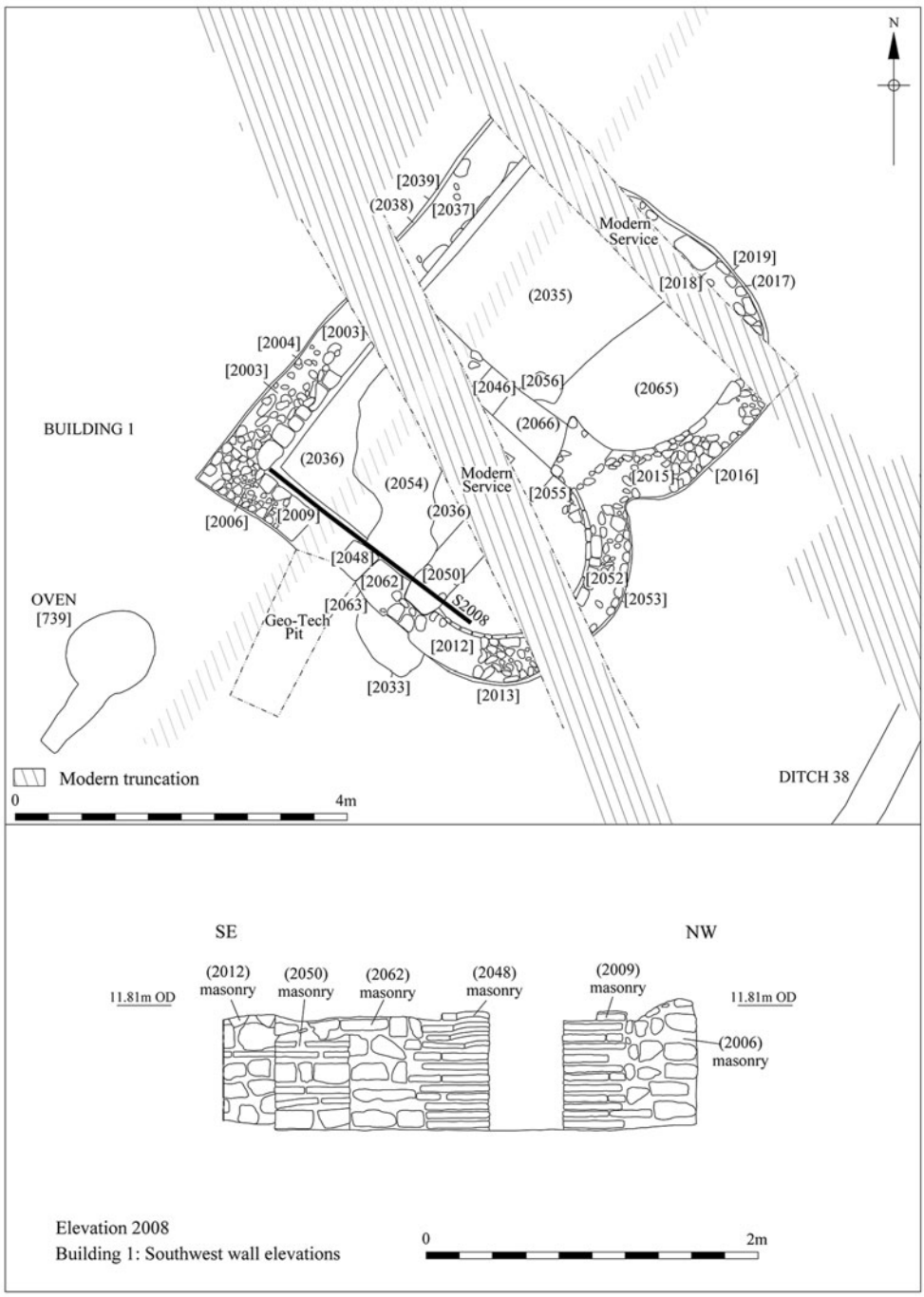

FIG. 7. Building 1 plan. (© *Pre-Construct Archaeology Ltd*)

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FIG. 8. Building 1. (© *Pre-Construct Archaeology Ltd*)

There are some elements in this building that are typical of a bath-house building. One is its apsidal plan. A very similar double-apsidal configuration of rooms, used as a *caldarium* and *tepidarium*, was found at the Truckle Hill bath-house in Wiltshire.[32] Structural elements supporting the function of the building as a bath-house are a small fragment of surviving *opus signinum* floor in the easternmost apsidal structure, a single coursed ledge or rim of 13 horizontally placed *opus spicatum* paving bricks encircling the apse and some relict *opus spicatum* or herring-bone flooring in the westernmost apsidal structure.[33]

An opening on the south-west side of Building 1, which is flanked by two twin lydion tile stacks [2009] [2048], has a comparable mortar (M3) and brick fabric (*Bottisham 5* and *6*) to an archway fragment dumped into well [678] as well as another internal wall of Building 1 [2046]. From this we may deduce that this opening was an archway, possibly to channel freshwater flow in or effluence out of Building 1, if there was a latrine present, as at the Neronian bath-house at Silchester.[34] More probably the arch would have formed a flue-opening for hot air to enter, or alternatively providing an exit for the draught and allowing smoke and hot air to exit like a chimney in a *caldarium*. There is no evidence for any features external to the bath-house, like a flue for firing or ditches or channels to transport water or effluence. All of the bricks near the opening and within the building are in very good, almost pristine condition with no evidence of sooting or burning. No evidence was found of hypocausts.

Low density tufa, the product of spring water deposition in a chalk- and limestone-rich area and used as vaulting for the roofing of numerous baths in villas, is also conspicuous by its absence. Decorative flooring elements such as stone and ceramic *tesserae* are entirely lacking, as is the evidence for decorative stone veneers. Finally, there is a complete absence of wall plaster fragments from this building.[35]

[32] Wessex Archaeology 2011.
[33] Nielsen 1993, 154–9.
[34] Hayward, pers. obs. June 2018.
[35] Seddon 2018.

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There is little sign of cavity walling (box-flue) being used to circulate heat into the space behind the walls in Building 1, with only 12 kg recovered, certainly in comparison with the large assemblage from Building 3 (503 kg). Furthermore, where it has been found in the demolition layers, e.g. (2031), it merely forms a handful of small fragments of background material by comparison with numerous examples of large structural lydion bricks and clunch from the substructure.

Due to their complete absence from the excavation, even in other features, it seems that, rather than being robbed out, the cavity walling, like the *bessalis pilae* stacks, the larger capping bricks, tufa for the vaulting and the more ornamental elements, was never added.

There is evidence, however, to suggest that Building 1 may have had a tiled roof at some point. Relatively small quantities of *tegulae* were recovered (55 kg, 17 per cent by weight) from the building, present in the earliest demolition layer (2031). The first stage in the failure and decay of any unoccupied masonry building would be the slippage and breakage of the heavy roofing tile, and it is possible the roof collapsed and many of its *tegulae* were re-used, possibly in neighbouring Building 2.

In essence, Building 1 appears to represent the surviving substructure of a never-completed bath-house. The basic structural brick and stone elements, the archways for the flues, the outline of the two elements of a bath complex and some of the flooring had been laid out ready for the installation of box-flue tiles, *pilae* and decorative elements, which were never added. The possibility exists, of course, that this was not a bath-house at all, but a building of some other, unknown use.

BUILDING 2: ANCILLARY BUILDING WITH RED-SLIPPED ROOF

The northernmost structure (Building 2) consists of a rectangular room and part of an external curved wall section, both defined by the surviving foundations of a heavily mortared thick (0.9 m) wall containing tile and Barnack stone fragments (FIGS 9 and 10). The walls that delineate the 8×4.5 m rectangular building and the curved wall are made in the same very hard concretionary flint mortar M1, or *opus caementatum*, suggesting a single build. This mortar, which was also identified in Building 3, is applied liberally both as a rammed foundation and as a construction material *per se*, making up perhaps for a dearth of recyclable stone and brick from other structures.

The defining feature of this building is a concentration of roofing tile, in particular fresh yellow and orange-beige Gault roofing tile (*Bottisham 3* and *4*) from the building's main demolition layer (5001). Many of the *tegulae* also have a nail-hole inserted. Common in later *tegulae*,[36] Brodribb suggests that the nail would been used to affix only those tiles forming the lowest course overhanging the eaves.[37] Quantities of *tegulae* are also present in the terminus [418] of Ditch 18 and pit [416], which both lie just a couple of metres from Building 2.

The tile (both *imbrex* and *tegulae*) had been treated with a red slip, which may have been an aesthetic choice in keeping with the pre-existing red roofs of Building 1 and Building 3, suggesting that Building 2 was a later addition. Other evidence for a later construction date of Building 2 is shown by the fragmentary condition of the 70 kg of Barnack stone in the foundation walls of both the rectangular room and curved wall. It has been shown that large blocks of Barnack stone were used in the earlier bath-house Building 1. Here, however, in the foundation of Building 2, they appear as reused rubble in walls (5002), (5006) and (5009), and as post pad (5060), and were clearly brought over as robbed stone to construct this building.

[36] Warry 2006, fig. 9.3.
[37] Brodribb 1987, 11.

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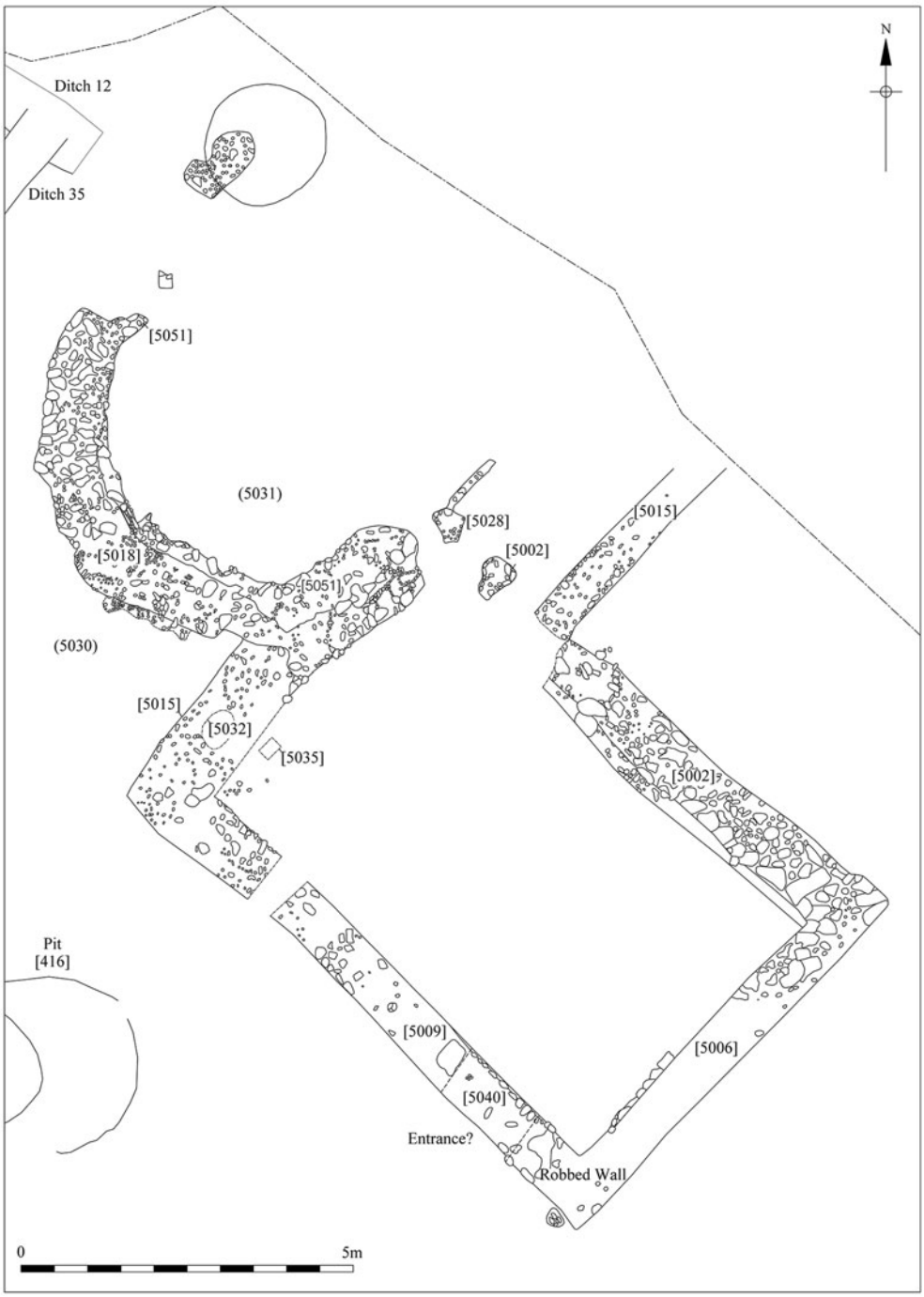

FIG. 9. Building 2 plan. (© *Pre-Construct Archaeology Ltd*)

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FIG. 10. Building 2. (© *Pre-Construct Archaeology Ltd*)

A limited quantity of brick (48 kg or 15 per cent by weight) was recovered, which may suggest that Building 2 was a timber-framed construction on stone footings or that the brick had simply been robbed.

Rapidly constructed, with copious amounts of *opus caementatum* and reused Barnack stone in its foundations, roofed with new yellow Gault tile supported by timber posts, the apsidal and rectangular rooms of Building 2 could have had a number of distinct functions. It has been shown that all the large Quartz Conglomerate querns and Millstone Grit (70 kg) from this excavation were identified either from the demolition layer (5001) in the rectangular room or dumped in a well [678]. Therefore Building 2 may have had a secondary (or even primary) use as a mill or an ancillary building with a raised stone footing, used as grain or fodder storage, a barn or even a domestic building.

It is interesting to note that Building 2 is the only structure on site to have wall plaster, albeit reused as building material. Fragments of painted wall plaster also came from Ditch 18. For a detailed discussion of the painted wall plaster, see Seddon 2018.

BUILDING 3: RECTANGULAR BUILDING WITH HYPOCAUST HEATING SYSTEM

The largest building from the excavation, the four-roomed 14.5 × 11.5 m Building 3 lay 34 m SE of Building 1 and 32 m SE of Building 2 (FIGS 11 and 12). The walls of Rooms 1–4 survive only to the lowest course within their foundation cuts but there is evidence for extensive robbing.

The walls are in the main constructed using the same type of very hard concretionary flint mortar (M1) as that of Building 2, although it is noticeable that the three walls delineating R1

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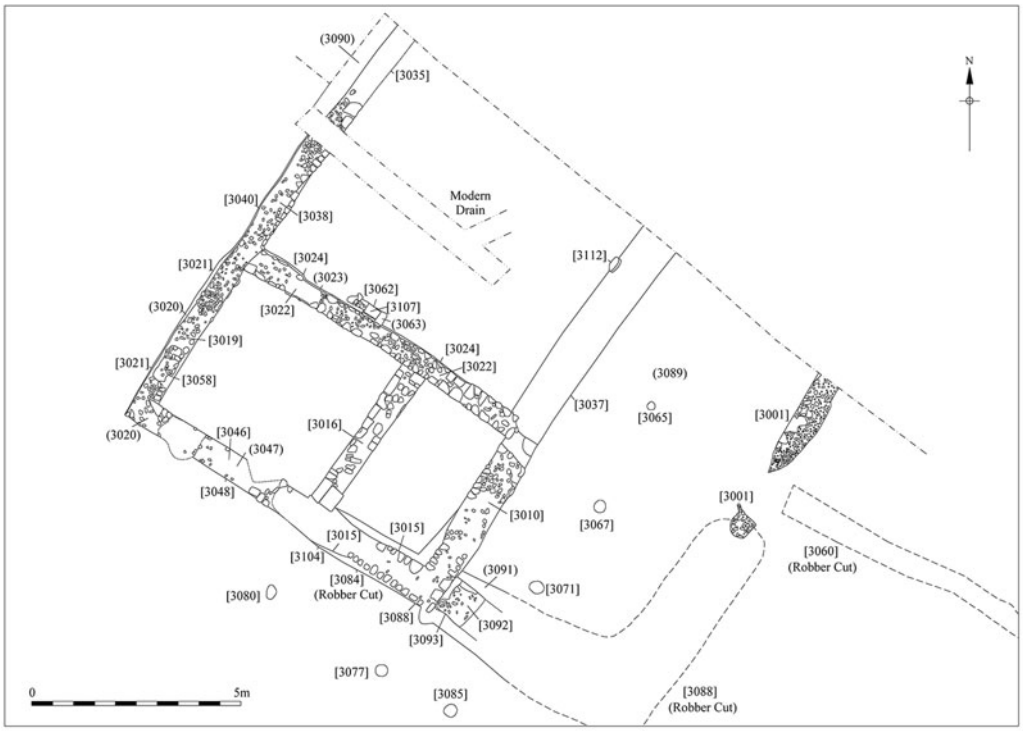

FIG. 11. Building 3 plan. (© *Pre-Construct Archaeology Ltd*)

and R2 [3018] [3021] [3024] are characterised by the similar/same pink light mortar M3 as that of Building 1. Similar to Building 1, the walls also contain appreciable amounts of complete lydion brick and, in the case of wall [3021], 108 kg of very large intact slabs of Barnack stone up to 400 × 300 × 150 mm in size.

The early phase of Building 3 may therefore be contemporary with Building 1. A second, later phase of construction is present in the walls of R1 [3040], R2 [3048] R4 [3001] using the same very hard concretionary flint mortar (M1) or *opus caementatum* as that used in all the walls of Building 2. Furthermore, it was used to repoint walls [3018], [3021] and [3024]. The mortar type would therefore indicate that Building 3 continued to be occupied or was refurbished at the same time as Building 2 was constructed.

It is in R1 and R2, too, that 376 kg of fragmentary combed box-flue tile was present in the demolition fills forming approximately 50 per cent of all building material (by weight) for Building 3, and 85 per cent of all box-flue tile from the entire site assemblage. These small (220 × 170 × 21 mm) box-flue tiles or *tubuli* have a standardised fabric (Horningsea very fine sandy *Bottisham 1*) and combed form (deep chevron or two inward facing circles) with large 50–70 mm sub-ovoid circular vents with the venting sometimes infilled with the same low density pink mortar M3 seen in the brick from walls [3018] [3021] [3024] and Building 1. The fills (3051) (3052) of robber cuts in other parts of Building 3, for example in the south-eastern corner of R4, also contained quantities of box-flue, most probably from these rooms too.

Such a concentration, albeit accentuated by subsequent robbing of the square and rectangular-shaped brick elements from these rooms, can only mean that the walls of R1 and

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FIG. 12. Building 3. (© *Pre-Construct Archaeology Ltd*)

R2 were lined with vertically stacked *tubuli* to circulate heat around the rooms. Accounting for the enormous quantities in such small rooms is easy as it has been calculated that 190 box-flue tiles are needed for a single room.[38] The thick mortar M3 attached to one side only, and sometimes as vent infill, would have insulated the circulated hot air for use as either a sweat room, *laconicum*, or the heated opulent *caldarium* of a bath-house. There is a notable lack of sooting on the *tubuli* from Building 3, but this could be the result of the distance of the box-flue from the heat source rather than a sign of complete non-use. The calcareous residue seen on some examples certainly suggests some exposure to heat, but the absence of *pilae*, as in Building 1, again calls into question how these two rooms were heated. However, only the southern part of R1 has been excavated and it is possible that the heat source (from the *praefurnium*) was situated in a part of the building located outside the area of excavation.

DISCUSSION AND SYNTHESIS

The 100 per cent retention policy of all the ceramic building material and stone from a large late Roman complex farmstead in south-east Cambridgeshire has allowed a detailed investigation of the fabric, form, construction style and function of the various elements used in three masonry buildings and associated features. This has been a useful analysis in an area where very little is known about the types and forms of stone and tile and where very few rural masonry buildings have been uncovered.

[38] Brodribb 1987, 73.

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How does this complex of masonry buildings fit into the existing classification of rural structures from this part of eastern England, defined in the recent nationwide survey as the East Anglian chalk zone (in which Bottisham is defined as a rare example of a farmstead with masonry buildings)?[39] The findings presented here have shown that the farmstead did have some elements of wealth and prestige, shown by the carefully planned substructure of the double-apsidal probable bath Building 1 and the two heated rooms (R1 and R2) of Building 3. The use of tough, very heavy 50–100 kg Barnack stone slabs, quarried 60 km away, for the structural elements of the double apsidal building would have been a major logistical undertaking.

Bath-houses of similar size belonging to bigger and more elaborate farmsteads have been identified at Haddon and Itter Cresent, both near Peterborough,[40] and Whittlesford, south Cambridgeshire (CHER MCB19295), as well as Linton, near Hadstock, Essex.[41] The bath-houses of those villas were similar in size to that at Bottisham and either stood alone or were incorporated into the main residential building.

However, on two counts the site falls short of what is expected of buildings associated with a larger villa. First is the near-complete absence of stone roofing tile, the nearest source being the flaggy, calcareous Collyweston slate from the Middle Jurassic of Northamptonshire. This stone tile is frequently associated with the more prestigious villa buildings, particularly at distance from the outcrop, a good example being the identification of a stone roof from the ongoing excavations of the 'villa' buildings at Whittlesford.[42] Second, there is an absence of opulent floor surfaces, most typically stone and ceramic tessellated pavements (again noted at Whittlesford), fine limestone pavement materials or low-density tufa used as archway vaulting. Instead, ceramic roofing tile was the chosen construction material. Suitable, though more brittle than stone, tile was for example dug from Gault clays as close as 2 km away to roof Building 3, rather than using the more robust stone roofing from 50 km away at Collyweston.

CONCLUSION

The excavations at Bottisham identified a number of buildings of a rural farmstead or possible 'villa' complex but the main dwelling or dwellings of the site are as yet elusive. It is possible that heated Building 3 may represent a 'wing' of a larger high-status building extending beyond the limit of excavation, or that the main building was located elsewhere. It is also possible that the settlement consisted entirely of smaller structures, predominantly for agricultural purposes, and with facilities for estate workers and other inhabitants.

The material culture of the site, other than the building material, suggests that the inhabitants enjoyed a degree of comfort, as shown by the presence of dress fittings, glass vessels and a stylus. However, there were also signs of frugality, as shown by the long-term use of dress fittings elsewhere on the site (Tunbridge Hall), and a bone pin possibly worn in imitation of a more expensive item (Crystal Park). Interestingly, the ceramic assemblage of Tunbridge Hall with a preponderance for bowl/dish forms over jars, indicating a more affluent 'urban''assemblage,[43] was not replicated at Crystal Park.

Bottisham may be seen, perhaps, as a high-status farmstead, with many buildings similar to a villa type complex but no traditional main villa building. It is also possible that the site was part of an agricultural estate associated with a villa building located elsewhere, such as the villa complex

[39] Smith *et al.* 2016, 228.
[40] Upex 1994; Henley *et al.* 2012.
[41] Ettè and Hinds 1993.
[42] Hayward, pers. obs. June 2018.
[43] Peachey 2016.

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excavated at Chignall, Essex, which included a possible detached bath-house and timber structures of agricultural and domestic function.[44]

Further investigations in and around Bottisham can only add to the narrative of this interesting site.

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[44] Clarke 1998.

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APPENDIX 1: MORTAR FABRICS

APPENDIX 1, TABLE 1. DESCRIPTION, FREQUENCY AND DISTRIBUTION OF BOTTISHAM MORTAR FABRICS

Fabric Fabric type	Distribution
Type 1 Concretionary Gravel Flint Mortar Small and fractured black and white flint nodules set in a pale yellow-brown 10YR 8/4 sandy lime mortar matrix, with occasional sub-circular white chalk inclusions 30 mm across	Very common bedding mortar Used to bond the entire walling foundation of B2 [5002] [5006] [5009] [5014] [5016] [5018] and repairs to westernmost rooms of B3 [3022] [3038] [3046] associated with fragments of Barnack stone
Type 2 Loose Earthy-Brown Flint, Chalk Mortar Looser paler 10YR 8/4 to rusty-brown 7.5YR 7/6 chalky flint mortar lacking the harder cement-like character of the superficially comparable T1 mortar	Very common bedding mortar Only used in the construction of the walling in the sunken double apsidal B1 [2012] [2018] [2048] [2050] [2052]
Type 3 Low Density Pale-Orange to Pink Render or Mortar Scattered very small, angular (0.1–0.5 mm) homogeneous quartz and angular red brick 2.5YR 5/8 brick fragments set within a white lime mortar giving the fabric its distinctive pale orange-pink 5YR 8/3 to off pink-grey 5YR 8/2 colour also very soft brown-green gley organic inclusions up to 20–30 mm across consisting of twigs that form the largest inclusions	Very common in walls throughout the site. But not in B2 B1 Coats of this mortar exceeding 70 mm, define the shape of the curved arched brick Flooring of [2054] [2056] Wall lacing courses lydion brick [2048] [2050]
Type 4 Low Density Yellow Render or Mortar This distinctive friable low-density yellow-beige 10YR 6/8 to calf brown (Gault like) mortar with white chalk inclusions 1 mm–3 mm across. Quartz inclusions are numerous small (0.1–0.5 mm) angular and coupled with some dissolved shell gives the surface its distinctive pitted appearance	B3 Wall lacing courses lydion brick [3016] [3019] [3092] Adheres Combed box-flue tile and infills vents (3033) (3041) (3050) Rare B2 only (5001) (5039) (5042) (5045)

APPENDIX 2: CERAMIC BUILDING MATERIAL FORM AND METRICS

Comment on the form and size of the individual Roman brick, box-flue tile, *tegulae* and *imbrex* used in the three buildings (B1–B3) was possible from the 50 complete or near complete examples recovered from the excavations. Information on the form and size (mm thickness) of the smaller box-flue tile fragments (including vent shape and keying) *tegulae* (cut-aways and flange profile) was recorded in detail (by Heidi Hauser) in a comprehensive review of the entire ceramic building material assemblage by form conducted during the assessment phase.

BRICK

APPENDIX 2, TABLE 1. SIZE, FORM, AND DISTRIBUTION OF BRICK FROM BOTTISHAM

Size	Distribution
Lydion size consistent in walls and arch fragments B1 and B3 and reused in well [678] 380–390 mm long × 270 mm wide × 30–36 mm throughout Smaller lydion size bricks L-shaped oven [641] 320 mm long × 290 mm wide × 36 mm throughout	B1 Complete lydion bricks forming arch to internal wall [2046] and (2009) as well as apsidal feature [2050]. Well Complete lydion bricks forming arch in fill (679) B3 fill (3052) of robber cut structural features [3018] [3021] [3029] L-shaped oven fills (642)

ROOFING TILE

a) *Tegulae*

APPENDIX 2, TABLE 2. SIZE, FORM, AND DISTRIBUTION OF *TEGULAE* FROM BOTTISHAM

Size	Form	Distribution
Larger forms 360 mm long × 273 mm wide × 49–52 mm height of flange Smaller forms 210 mm across with a flange height of 35 mm	High flange profile height 49–52 mm, sloping 45 degrees, profile sometimes slightly under turned like London flange profile 2 and Cut Away Type E rarely Type C Low flat wide flange profile height 35 mm. Vertical slope like London flange profile 1 Cut Away Type C	Widespread throughout site especially B3 used in lacing courses [3016] and often reused Restricted to B2 it has nail-holes and evidence for red slip over a pale cream Gault fabric (*Bottisham 3* and *Bottisham 4*)

b) *Imbrex* (no complete examples)

APPENDIX 2, TABLE 3. SIZE, FORM, AND DISTRIBUTION OF *IMBREX* FROM BOTTISHAM

Fabric	Distribution
All *imbrex* on site on average 16.5 mm thick *Imbrex* made from *Bottisham 1* fine condensed sandy pale orange-red 2.5 YR 5/8 fabric *Imbrex* made from pale cream Gault fabric (*Bottisham 3* and *Bottisham 4*).	Widespread throughout the site. Restricted to B2 it has evidence for red slip over a pale cream Gault fabric (*Bottisham 3* and *Bottisham 4*).

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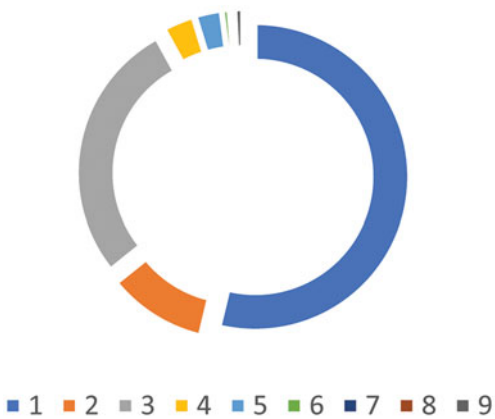
APPENDIX 2, TABLE 4. SIZE, FORM, AND QUANTITIES OF BOX-FLUE TILE FROM BOTTISHAM

Size	**Form**
Rare complete examples 220 mm × 170 mm × 21 mm (l × w × a)	All have medium combed keying, present on alternate sides
Length varies 200–235 mm	Patterns: 9 Types (APPENDIX 2, FIG. 1):
Width varies 100–90 mm	(1) Saltire 808 examples, (2) Diagonal 157 examples,
Thickness varies 11–22mm	(3) Linear 418 examples, (4) Wave 49 examples,
Vent Diameter varies 45–60 mm	(5) Curved 41 examples, (6) Semi Circle 10 examples,
Average 50.5 mm	(7) 'Bird Wing' 6 examples, (8) Letter D 2 examples,
	(9) Back-to-Back Letter C 12 examples
	Vent type:
	Circular: 335 partial vents, 14 whole vents only B1 and B3
	Square: 8 partial vents B2

CAVITY WALLING (BOX-FLUE TILE)



APPENDIX 2, FIG. 1. Doughnut chart showing proportions of different combed designs on box-flue tile fragments Bottisham 1 = Saltire 53.7%; 2 = Diagonal 10.4%; 3 = Linear 27.8%; 4 = Wave 3.3%; 5 = Curved 2.7%; 6 = Semi-Circle 0.7%; 7 = 'Bird Wing' 0.4%; 8 = Letter D 0.1%; 9 = Back-to-Back Letter C 0.8%.

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