

# ARCHAEOLOGICAL SERVICE

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## St. Margaret's, Leiston (LCS 018), A Record of Archaeological Work Associated with the Insertion of a New Underfloor Heating System

Report No. 2005/166



Removing Existing Floor Levels

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Thanks also to the diocesan archaeologist (Robert Carr) for his help and advice and to Colin Cunningham for his comments regarding Victorian heating systems.

The fieldwork was carried out by Stuart Boulter, with the help of Linzi Everett, both of Suffolk County Council's Field Projects Team.

## Summary

*Leiston*, St. Margaret's Church (TM 4387 6250; LCS 018) The insertion of a new underfloor heating system in the Victorian body of St. Margaret's Church, Leiston first involved the removal of *c.*0.4 metres from the existing ground levels. No evidence for *in situ* deposits relating to the earlier, medieval, phases of the church were recorded, although a number of medieval and post-medieval grave markers, ledger slabs and window masonry had been incorporated within structures associated with the redundant Victorian underfloor heating system. Repeated visits made during the reduced level strip facilitated the production of a comprehensive plan of the brick-built ducts, ventilation pipes, firebox pit and entrance tunnel that together formed the complex of structures relating to the Victorian heating system.

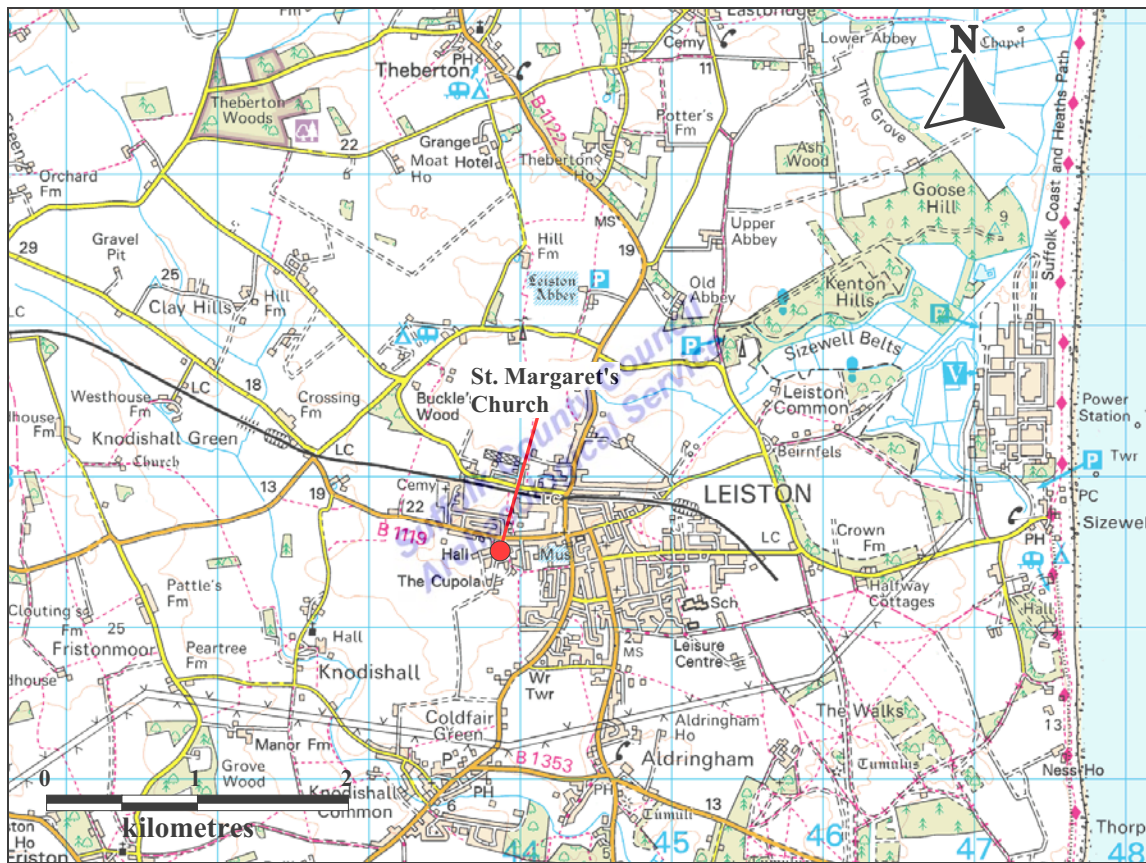
(Stuart Boulter for Suffolk County Council & Leiston Parochial Parish Council, SCCAS Report No. 2005/166)



# 1. Introduction

St. Margaret's (TM 4387 6250) (Fig. 1) is one of Leiston's three Domesday churches, although only the tower of the present building is medieval in date. Prior to its demolition and rebuilding in 1853, the main body of the church comprised a long thin continuous nave and chancel. The rapid expansion of the town during the 19<sup>th</sup> century, partially due to the success of the Garrett's engineering business, resulted in the church being unable to accommodate the increasing size of its congregation.

While a number of suggestions were put forward, the decision was made to demolish the extant structure, with the exception of the tower, and construct completely new building.



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**Fig. 1** 1:50,000 Scale OS Map Extract Showing the Location of the Church

Designed by the somewhat controversial architect Edward Buckton Lamb, the new church was cruciform in plan with two small chambers in the angles of the cross on its eastern side (Fig. 2).

The new building was heated by water from a boiler accommodated in a cellar located centrally to the church, effectively in the crossing. However, this was found to be so ineffective that it was replaced less than twenty years later, in 1871, by an underground hot air system which lasted until the middle of the 20<sup>th</sup> century when it too was replaced by Coleman oil heaters.

The present project involves replacement of the oil heaters with a new underfloor heating system.

Suffolk County Council's Archaeological Service Field Projects Team (hereafter SCCASFPT) were asked by the Diocesan Archaeologist (Robert Carr) and the project architect (Simon Merrett) to excavate two minor test-holes (carried out in April 2005) in which to assess the character of the deposits that would be encountered within the c.0.4 metres reduced level strip.

The results of the test-holes (Boulter, 2005) concluded that all of the material encountered within the c.0.4 metres deep holes was made ground and that no medieval floor surfaces survived at that level. However, a compacted layer of flints and clay encountered in the hole excavated close to the font, on the probable line of the medieval chancel wall, was interpreted as a possible medieval footing.

Subsequently, the diocesan archaeologist agreed that a satisfactory programme of archaeological recording would involve monitoring visits made during the reduced level strip. His brief was subsequently modified to include the recording of the Victorian heating system as it was a highly important part of the Victorian church and would clearly be almost totally destroyed by the current scheme. SCCASFPT were commissioned by the project architect to undertake the archaeological monitoring, the fieldwork for which was carried out during the September of 2005.

Funding for the archaeological works was provided as part of the Faculty Grant.

## **2. Methodology**

### **2.1 Fieldwork**

An initial extended recording visit was made in order to produce a plan of the existing floor features that included the tiled aisles, iron grates and the underfloor heating ducts, the latter where they had been exposed by the removal of the pews and wooden floors. Further periodic visits were made during the reduced level strip to add newly exposed features to the overall plan.

Where objects such as grave slabs and masonry fragments were uncovered, these were taken outside the church by the contractors where they were measured, photographed and when necessary, drawn.

The main floor plan was drawn at a scale of 1:50 in pencil on plastic drafting film using a copy of the architect's outline building plan as a base. Other drawings (sections & grave slabs) were drawn at a scale of 1:20.

A full photographic record was made that included monochrome prints, colour slides, but principally comprised digital shots. All photographs will be curated by Suffolk County Council's Archaeological Service with the rest of the project archive at Shire Hall, Bury St. Edmunds.

### **2.2 Post-Excavation**

The architect's ground plan was digitised along with the information recorded during the fieldwork. This information is presented as Figs 2 and 4 of this report. In addition, drawn sections and grave slabs were inked and are presented as Figs 3 and 5 of this report.

Photographs were allocated archive identification codes and were input onto Microsoft Access Database.

The observations made during the fieldwork and the subsequent archaeological interpretation were written up and form sections 3 and 4 of this report.

### 3. Results

The pews and wooden flooring were all removed from the church leaving the tiled aisles intact (Fig. 2). The material encountered beneath the pew floors varied considerably throughout the church. In the north and south transepts and the two large areas in the crossing the layer comprised relatively unconsolidated flint and mortar rubble while in the south side of the nave the composition was dominated more by mortar. However, in the north side of the nave the layer was far more consolidated as a formally lain slab.

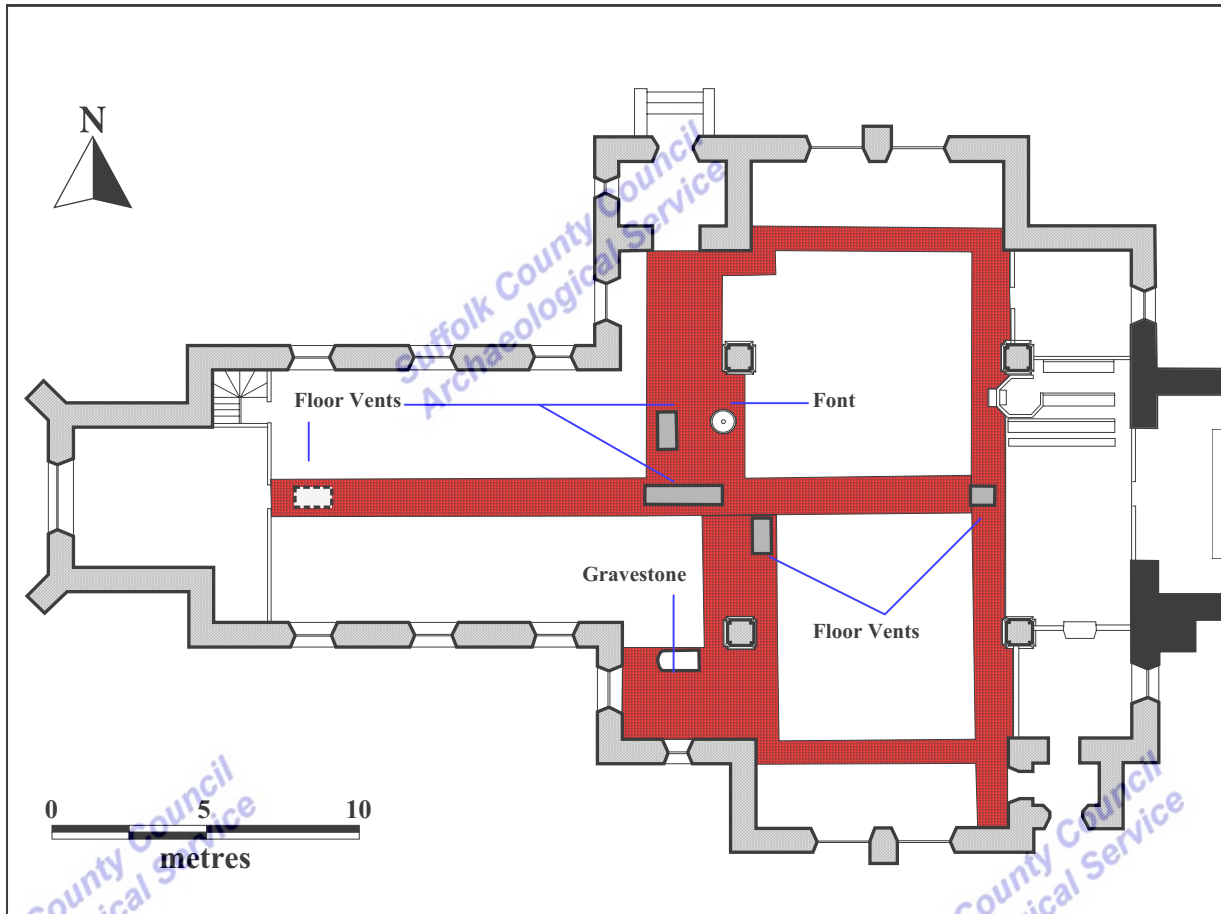


Fig. 2 1:250 Scale Plan Showing Tiled Floors

At this level, two parallel lines of bricks separated by a *c.*0.24 metre wide void, later found to represent part of the Victorian heating system (see pages 4-7), were recorded running down both sides of the nave and around the north and south transepts.

While the stripping was in progress it was difficult to assess the stratigraphy of the material being removed. However, a section was available at the edge of the

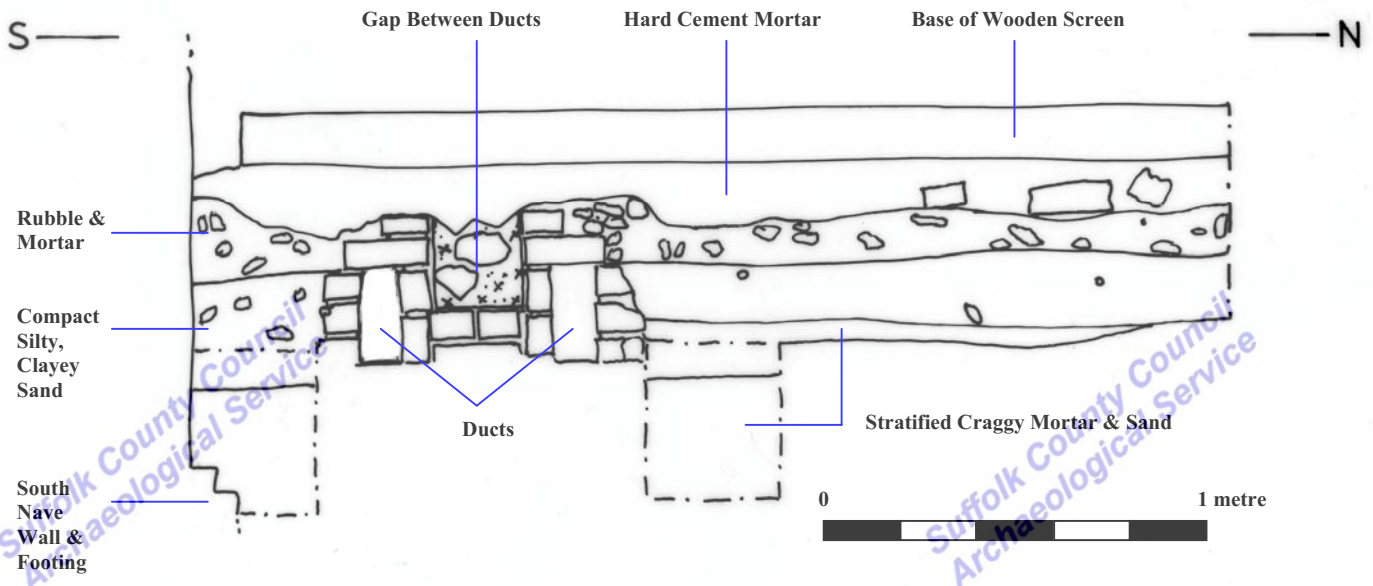




**Plate 1:** Section Through Brick-Built Heating Duct

excavation, parallel to the wooden screen at the western end of the nave (Fig. 3). At this juncture, three layers were recorded; a relatively consolidated 0.1-0.15 metres thick layer of mortar (forming a base for the screen) overlay a c.0.1 metre thick layer of unconsolidated mortar and rubble which in turn overlay a c.0.2 metres thick compact layer of mid brown clayey sand. The base of the latter effectively coincided with the reduced level strip. Two small

test-holes (Figs 3 & 4) were excavated for a further 0.4 metres through stratified deposits comprising predominantly of coarse lime mortar and mortar covered flints. At no stage was naturally occurring subsoil encountered and all of the layers appeared laterally extensive and representative of those observed throughout the church. The two test-holes had been excavated with the aim of finding vestiges of the earlier medieval walls or their associated footings. None were identified in the test-holes and were certainly not seen anywhere else within the 0.4 metres of the reduced level strip. However, one of the test-holes, that excavated against the standing wall, revealed the stepped out base of the brick-built footing. There was no obvious cut for the wall or its footing and the fill layers appeared to abut the wall rather than be cut by it.



**Fig. 3** 1:20 Scale Section Drawing Through Heating Duct

Attention then turned to recording the Victorian underfloor heating system (Figs 3 & 4). A series of brick-built ducts ran around the entire church. These had been constructed on a hard mortar base, effectively acting as a footing. The mortar base



was c.0.9 metres wide with a depth of 0.1-0.2 metres. As the surface of this base appeared to conform roughly with the required depth of soil-strip it was usually left in place. The ducts were constructed from frogless red bricks measuring 23.5 x 11.5 x 7 centimetres (9 ¼ x 4 ½ x 2 ¾ inches) bonded with a cream coloured lime mortar (Fig. 2 & Plate 1). Hot air circulated around the building in two parallel ducts each constructed from three courses of normally laid bricks (stretcher bond) externally and two courses internally, with the bricks lain on their sides similar to rat-trap bond, and lidded over with a single line of bricks. A further line of bricks arranged long-ways along the internal edge of the gap between the two ducts had been visible from the surface prior to the soil-stripping. The internal bricks were laid on their side to provide a thinner wall and, therefore, a shorter distance for heat to transfer through into the gap between the two ducts. The c.0.24 metre gap was remained as an open void in the area under the pews, with its faces and base covered in a thin layer of mortar. Warmed air was then free to rise and spread out beneath the wooden floor. However, the gap was blocked off with bricks at the point where ducts ran under the tiled floors and filled with earth from that point on until emerging into another area of pews.

While the ducting was recorded under the pews on both the north side and south side of the nave, there was also a continuation of the mortar base running the length of the central aisle. However, there was no apparent associated brick ducting recorded beyond a floor vent located towards its western end (Fig. 4). It is unclear whether this

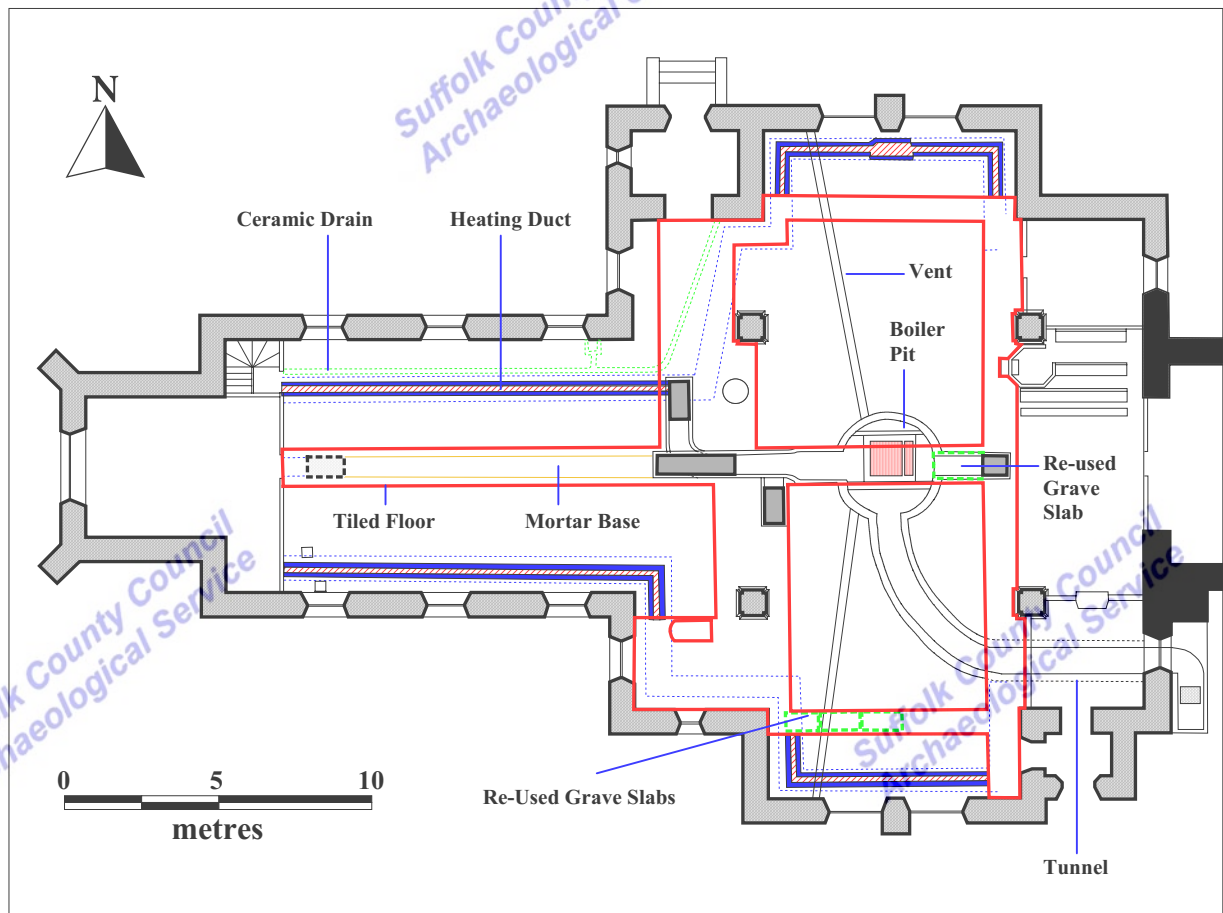


Fig. 4 1:250 Scale Plan Showing the Victorian Heating System

represents a change in design during the insertion of the heating system, or is part of the original hot water system that was later replaced.

The heating ducts faithfully followed the line of the interior walls of the church at a distance of approximately 0.5 metres, except on the north side of the nave where it was 1.5 metres, and to the south of the north porch where it ran diagonally towards the north transept. The reason for this eccentricity was the need to avoid the line of a ceramic pipe (Fig. 4). One of the features of the church is the minimal number of down-pipes taking water from the roof. Lamb designed the building in such a way that water from the roof was channelled into pipes within the wall itself and then down into the drainage system. The pipe running internally to the north wall of the nave drains some of the water from that side of the church, it then turning to the south before running under the south wall to a man-hole in the churchyard.

Where the duct was recorded running from west to east in the north transept, the central void had been widened into a small chamber with the two ducts simply opening into it. It is unclear whether this was an alteration or a contemporary feature.



**Plate 2** Firebox in Pit & Top of Firebox Seen From Vent

The hot air for the ducts was generated in a firebox situated in a circular (*c.*3.3 metres in diameter) pit located in the crossing, effectively the centre of the church (Fig. 4). This pit, which was roofed in brick supported by two iron girders, had previously housed the boiler for the earlier hot water heating system. Heat from the firebox was transferred by conduction to the air and was then drawn through the system. The brick ducts heating below the pews with the main body of the church heated through floor vents. Three substantial brick built passages lead away from the firebox, one to the east and two, one on top of the other, to the west. The lower of the two on the west side serviced two floor vents, while the others appeared run to one vent each. The only other floor vent recorded (access was not gained to the chancel or north chapel) was serviced by the smaller floor ducts and was located at the western end of the nave (Fig.s 2 & 4).

The firebox was situated north of centre in the circular pit behind an inserted brick wall with heavy iron doors providing access for fuel, stoking and raking out (the tools for which were still present in the pit). Ventilation to the outside of the building was

provided by two ducts, one to the north wall (constructed from masonry from a substantial medieval arch, possibly a window or door) and the other to the south built in brick. In addition, further ventilation was supplied by the curving entrance passage and a flue located at its eastern end that exits through a small, decorated turret.



**Plate 3** Firebox Pit Entrance Tunnel

Access to the firebox pit was afforded by a curving brick-built tunnel which is entered via a set of steps beneath a man-hole located outside the church adjacent to the south-eastern corner of the south transept (Fig. 4 & Plate 3). The vertical walled, 2.5 metres deep tunnel had been roofed over using a number of ledger stones (Plate 3) of various dates that had clearly, prior to the Victorian rebuilding, been set in the floor of the medieval church. These are listed and described in more detail in Table 1.

During the monitoring a number of gravestones and floor slabs were recorded. In addition to those used to roof the access tunnel to the firebox pit, others were recovered from the backfill in two of the redundant floor vents, one had been used to roof over one of the passages leading away from the firebox pit, three were recorded beneath the tiled floor in the south transept and one had been set within the tiled floor.

Three of the slabs used in the roof of the access tunnel were particularly interesting as they clearly exhibited evidence for the presence of monumental brasses (Fig. 5). The shapes of the brasses were still visible as shallow indents and the lead plugs into which they were set were also present, with the brass pins also surviving. In the church guide (Tricker, 1990) there are details of a visit by the antiquarian Davis Elisha Davey in 1843 where he notes the presence of two burial slabs in the church floor with indents for brasses. He also records other floor slabs of 18<sup>th</sup> century date including one of the Grimsby family which was also found during the soil-stripping where it had been used as the roof for the passage immediately to the east of the firebox pit (Fig. 4, Table 1 & Plate 4, No. 4).

Of the three slabs that had held brass plates, two were complete (although broke during removal). The shapes of the indents suggested that one (Table 1 & Fig. 5, No. 15) had two standing figures while the other (Table 1 & Fig. 5, No. 16) had two standing figures with three other rectangular plates. The third, partial stone (Table 1 & Fig. 5, No. 14) had provision for one *c.*triangular-shaped brass. All were Purbeck Marble and had suffered some surface damage in the area exposed in the roof of the tunnel. This area had also been painted.



**Table 1:** Details of Recorded Gravestones & Slabs

No.	Location	Dimensions	Inscription	Description
1	Set in tiled floor S.side of church (Fig.s 2 & 4)	1.35 x 0.65 m	SACRED TO THE MEMORY OF ANNA MARY DAUGHTER OF EDWARD AND SARAH DEWING OF THIS PARISH WHO DEPARTED THIS LIFE SEP <sup>R</sup> . 30 <sup>TH</sup> 1834 AGED 2 YEARS AND 11 MONTHS ALSO OF WILLIAM DEWING WHO DIED AN INFANT SUFFER THE LITTLE CHILDREN TO COME UNTO ME AND FORBID THEM NOT FOR OF SUCH IS THE KINGDOM OF GOD. MARK CHAP 10 ??????	Gravestone, probably originally set upright in ground. Simple curved top. Would be replaced in same position in new floor
2	In Rubble in bottom of S.most floor vent	?	G . R 1873	Small, brown york-type sandstone. Would have been set vertically at foot of grave.
3	South Transept under tiled floor, W.most of three (Fig. 4)	1.07 x 0.61 m, 0.07 m thick	JOHN ROBINSON DIED APRIL. 11 <sup>TH</sup> . 1750 AGED 53	Grave slab, brown york-type sandstone (Fig. 4 & Plate 4)
4	Under tiled floor, re-used as roof for passage immediately E. of firebox pit	1.58 x 0.76 m, 0.08 m thick	IN MEMORY OF JOHN GRIMSBY SON OF JOHN AND SUSAN GRIMSBY WHO DEPARTED THIS LIFE APRIL 30 <sup>TH</sup> 1770 AGED ?? YEARS	Grave slab, brown york-type sandstone. Has socket with lead in centre of stone below inscription (Fig. 4 & Plate 4)
5	Re-used in roof over tunnel entrance to firebox pit	Irregular; ends 0.26 & 0.48 m, sides 0.84 & 0.69 m, 0.08 m thick	Present but illegible	Fragment of grave slab (2 real edges), brown york-type sandstone
6	Re-used in roof over tunnel entrance to firebox pit	Irregular; ends 0.3 & 0.54 m, sides 0.44 & 0.8 m, 0.08 m thick	IN ME?????? SUSAN ???? WHO DIED J?????? AGED?????	Fragment of grave slab (2 real edges), brown york-type sandstone
7	Re-used in roof over tunnel entrance to firebox pit	Irregular; ends 0.37 & 0.55 m, sides 0.76 & 0.94 metres, 0.07 m thick	None visible	Fragment of grave slab (2 real edges), brown york-type sandstone, painted at least once
8	Re-used in roof over tunnel entrance to firebox pit	Ends 0.67 m, sides 1.3 & 1.32 m	None visible	Large fragment of grave slab (3 real edges), limestone. Some paint present
9	Re-used in roof over tunnel entrance to firebox pit	True end 0.67, tapering. Sides 0.7 metres	None visible	Large fragment of grave slab (3 real edges), Purbeck limestone? Some paint present. Rebated/decorated edge, part of top of a table tomb?



**Table 1 continued**

No.	Location	Dimensions	Inscription	Description
10	Re-used in roof over tunnel entrance to firebox pit	End 0.65 m, sides 0.34 & 0.39 m, 0.07 m thick	None visible	Fragment of grave slab, limestone (3 real edges)
11	Re-used in roof over tunnel entrance to firebox pit	Irregular; ends 0.3 & 0.28 m, sides 0.45 & 0.47 m, 0.11 m thick	None visible	Fragment of grave slab, Purbeck Marble (2 real edges)
12	Re-used in roof over tunnel entrance to firebox pit	Irregular; ends 0.24 & 0.5 m, sides 0.56 & 0.62 m, 0.11 m thick	None visible	Fragment of grave slab, Purbeck Marble, 1 small iron fitting. (1 real edge), possibly part of 11
13	Re-used in roof over tunnel entrance to firebox pit	1.6 x 0.61 m, 0.08 m thick	None visible	Complete grave slab, although 2 damaged corners, limestone
14	Re-used in roof over tunnel entrance to firebox pit	End 0.72 m, sides 0.68 & 0.8 m, 0.1 m thick	None visible	Fragment of grave slab, Purbeck Marble (3 real edges). Indent for brass (Fig. 5)
15	Re-used in roof over tunnel entrance to firebox pit	0.8 x 1.76 m, 0.07 m thick	None visible	Complete grave slab, Purbeck Marble. Indent for brass, 2 figures (Fig. 5)
16	Re-used in roof over tunnel entrance to firebox pit	0.88 x 1.8 m, 0.09 m thick	None visible	Complete grave slab, Purbeck Marble. Indent for 4 brasses, includes 2 figures (Fig. 5)
17	South Transept under tiled floor, middle of three	0.61 x 1.27 m, c.0.08 m thick	IN MEMORY OF HENRY CANHAM WHO DIED. 20. <sup>TH</sup> APRIL. 1728. AGED. 54. YEARS AND ELIZ. <sup>TH</sup> HIS LAST WIFE WHO DIED. 22. <sup>TH</sup> MARCH. 1739. AGED. 60. YEARS AND .7. OF HER CHILDREN	Complete grave slab, brown york-type sandstone, broken corner (Fig. 4 & Plate5)
18	South Transept under tiled floor, E. most of three	0.61 x 1.29 m, c.0.07 m thick	SACRED TO THE MEMORY OF THOMAS GARROD WHO DIED JUNE 18 <sup>TH</sup> 1819 AGED ?39 YEARS	Complete, although in 2 pieces. White limestone (Fig. 4 & Plate 5)
19	Recovered from first floor vent S. of N. doorway	0.34 x 0.46 m	A J C 1869 M . C 1877	Fragment, brown york-type sandstone. Would have been set vertically at foot of grave
20	Recovered from first floor vent S. of N. doorway	0.23 x 0.32 m	E . P 1865	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
21	Recovered from first floor vent S. of N. doorway	0.35 x 0.31 m	A + G 1810	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave

**Table 1 continued**

No.	Location	Dimensions	Inscription	Description
22	Recovered from first floor vent S. of N. doorway	0.25 x 0.3 m	? . B 1861	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
23	Recovered from first floor vent S. of N. doorway	0.34 x 0.36 m	T . G 1855 M A G	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
24	Recovered from first floor vent S. of N. doorway	0.38 x 0.47 m	S : G J806 R : G 1821	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
25	Recovered from first floor vent S. of N. doorway	0.30 x 0.54 m	A . L 1866 M . L 1866	Almost complete, brown york-type sandstone. Would have been set vertically at foot of grave
26	Recovered from first floor vent S. of N. doorway	0.33 x 0.4 m	C . B 1891 T . B 1914	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
27	Recovered from first floor vent S. of N. doorway	0.33 x 0.3 m	P : K 1851	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
28	Recovered from first floor vent S. of N. doorway	0.34 x 0.42 m	R . P 1866 A . P 1901	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
29	Recovered from first floor vent S. of N. doorway	0.4 x 0.36 m	H . J 1886	Small fragment, brown york-type sandstone. Would have been set vertically at foot of grave
30	Recovered from first floor vent S. of N. doorway	0.16 x 0.23 m	? 1837 M . A . ? ?	Small fragment, brown york-type sandstone. Paint in lettering. Would have been set vertically at foot of grave

**Table 1:** Details of Recorded Gravestones & Slabs

In addition to the gravestones and slabs, nineteen pieces of limestone moulding (Plate 6), from at least one arch forming part of either a medieval (?14<sup>th</sup> century) window or doorway, were found to have been used in the construction of an air vent running diagonally from the firebox pit to the north transept wall.

After recording, all of the gravestones, slabs and masonry fragments were placed back in the church in the south transept where they will be preserved beneath the new floor.

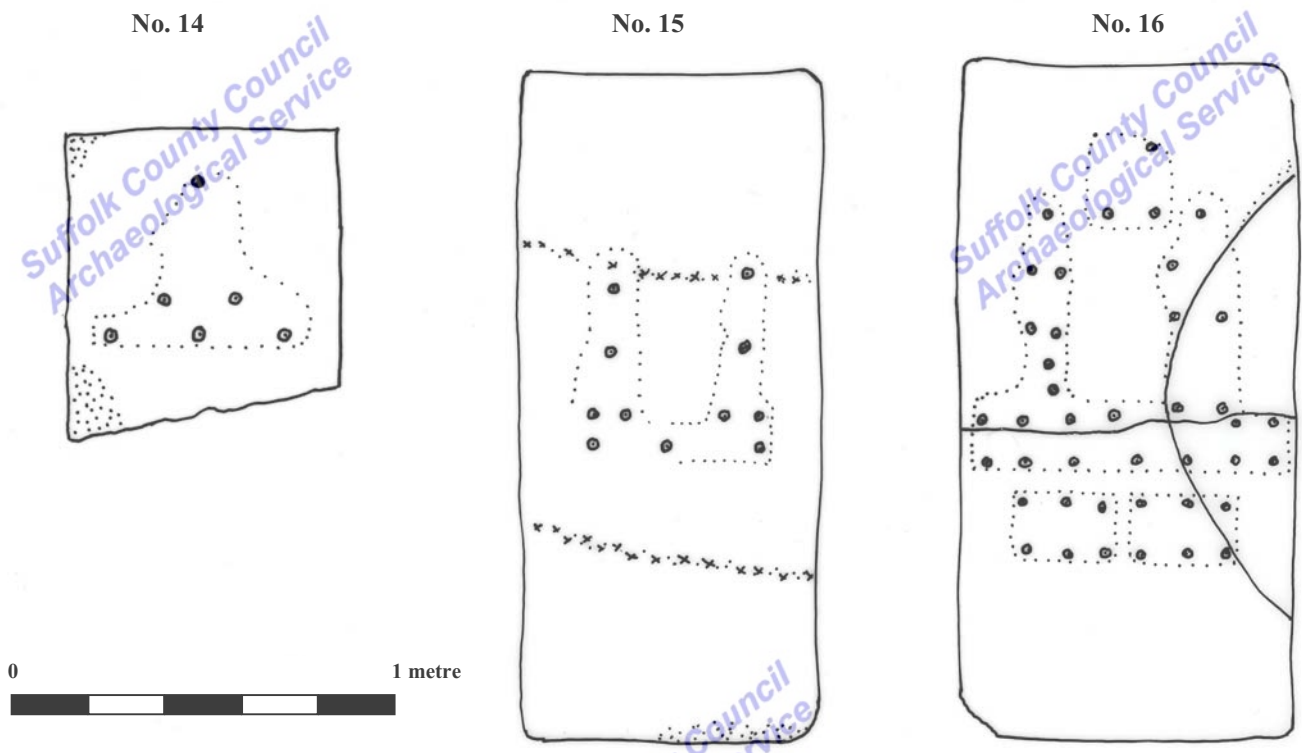


Fig. 5 1: 20 Scale Drawing of Grave Slabs No.s 14, 15 & 16



No. 3 John Robinson

No. 4 John Grimsby

Plate 4: Grave Slabs Recorded Below Tiled Floor (No.s 3 & 4)





No. 17 Henry Canham

No. 18 Thomas Garrod

Plate 5: Grave Slabs Recorded Below Tiled Floor (No.s 17 & 18)



Selection of pieces

Detail of moulding

Plate 6: Medieval Masonry Re-Used in Vent

#### 4. Archaeological Interpretation & Conclusions

Initially, the archaeological potential of the project had been perceived as an opportunity to recover evidence regarding the medieval nave and chancel of the church that had been demolished in 1853. However, during the *c.*0.4 metre reduced level strip it became clear that no intact medieval deposits would be encountered at that level with the majority of the removed material comprising demolition products from the earlier church. The results of the monitoring suggest that the demolition of the medieval church and removal of its associated floor layers had been total and if



medieval structural evidence (footings etc.) survives then it is relatively deeply buried below the rubble and mortar layers encountered during the stripping. It is unclear whether these represent material simply left where it lay following demolition, or material that was deliberately introduced to raise the level of the new floor.

The focus of the monitoring was then drawn to recording the complex of structures associated with the Victorian heating system.

While no intact structural evidence for the medieval church was recovered, a number of grave slabs from the pre-Victorian church had been incorporated into below ground structures of the new building as had masonry from at least one medieval arch.

The recent history of the church is well known and is presented in detail in the church guide (Tricker, 1990). However, the fact that the original Victorian hot water heating system was replaced less than twenty years later led to some complications with the interpretation of the surviving complex. It is stated (Tricker, 1990) that the church was closed for several months in 1871 during which time the defective roof was re-tiled and re-boarded internally a new hot air underfloor heating system was installed and a replacement floor of Newcastle Tiles was laid.

The exact form of the earlier hot water system is unknown, but its boiler was located in a cellar central to the church. It is likely then, that this cellar was incorporated into the new system with the boiler either changed or modified to heat air not water. It is not known, however, how much of the rest of the complex of ducts, flues and vents follow the route of the earlier water pipes. The presence of the mortar base under the central nave aisle with no associated ducting suggests that this was related to the earlier system as it performed no function within the later complex. It must then be considered a possibility that the similar base/footing seen below the brick hot air ducts was a survival from the earlier system and had been re-used.

Hot air generated in the central cellar was transferred to the main body of the church primarily through grilled vents in the tiled floor. In addition, the double brick ducts running round the church delivered heat to the voids beneath the pews floors by heat transfer into the open gap between the two ducts. Originally there had been a series of ventilation holes through walls of the church, the locations of which are still marked with iron grills on the external wall face. These have been blocked at some time, possibly when the hot air system was installed, to prevent loss of heat through the walls. The blocking of these vents may have contributed to subsequent problems with damp and rot within the pews and pew bases.

The hot air system was used until the middle of the 20<sup>th</sup> century when three Colman oil heaters were installed, one in the nave and one in each transept. However, the underfloor complex remained fundamentally intact until the reduced level strip for the present project, even the stoking and raking tools were still kept in the central firebox pit/cellar. The only change that had occurred was the total infilling of the deep floor vent south of the north doorway and the partial infilling of the other deep vent located south-west of the central cellar. Included in the backfill material were a number of gravestones the latest date on which was 1914 indicating that the infilling could not have occurred before that date. However, the fact that the hot air system was in

operation until the middle of the 20<sup>th</sup> century suggests that this actually occurred at a considerably later date following the redundancy of the complex.

Only one gravestone, that of Anna and William Dewing, predating the Victorian rebuilding had actually been incorporated in the new structure in such a way that it was still accessible. As this appeared to be headstone rather than a floor slab, it is possible that it had been set inside the new building close to where it had originally stood. This area would have been churchyard prior to the construction of the new building, the footprint of which covered a considerably larger area.

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