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BRITISH BRICK SOCIETY

INFORMATION158

FEBRUARY 2025

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* *The annual subscription to the British Brick Society is £20-00 per annum. There are now no concessionary subscriptions.*

Telephone numbers and e-mail addresses of members would be helpful for contact purposes, but these will **not** *be included in the Membership List.*

British Brick Society web site:

http://britishbricksoc.co.uk

Contents

Cover Illustration

Two bricks from Cambridge each with more than one pressure mark.
See pages 19-26.

Editorial:
British Brick Society in 2025 and Beyond

The British Brick Society is a well-established member of the smaller specialist academic societies of the British Isles and has successfully turned the pugmill for more than fifty years. This year, 2025, it is expected to continue the good work.

The society's Annual General Meeting is to be held at Roman Circus House, Colchester, Essex, on Saturday 21 June 2025, starting at 11.15 a.m. The timing is to allow members coming via London for the day sufficient time to get from the railway station which is on the north side of the city; Roman Circus House is on the south side of the city.

Two visits to brickworks are in the process of being organised: one to W.H. Collier at Marks Tey, Essex, on Friday 20 June 2025, to fit in with the society's Annual General Meeting at Colchester on Saturday 21 June 2025, the second is to DSF Refractories and Minerals at Friden, Newhaven, near Buxton, Derbyshire, on Wednesday 16 April 2025. Further details on each are included in this mailing.

On Wednesday 24 September 2025, the British Brick Society is having a joint meeting with the Society for Lincolnshire History and Archaeology at Gainsborough, Lincolnshire, looking at the brick buildings of the town which include the late-fifteenth-century Gainsborough Old Hall and the brick buildings of Marshalls, a major early-twentieth-century engineering firm. The latter was amongst the fifty largest companies by value on the London Stock Exchange in 1912.

The writer is hoping to organise a visit to look at the brick buildings in Ockbrook and Risley, Derbyshire, in April 2026, possibly on Saturday 18 April 2026, two weeks after Holy Saturday. This a postponement from a possible Autumn 2025 date due to the need for pre-meeting visits and more background research. Ockbrook has the brick buildings of the still active Moravian settlement; in Risley are the brick buildings erected for members of the Willoughby family between the second half of the sixteenth century and the early decades of the eighteenth century. These also include the brick chapel attached to the church at Church Wilne where members of this branch of the Willoughby family chose to be buried.

So as not to further deplete the society's reserves (the money in the deposit account), the decision has been taken that *only* two issues of *British Brick Society Information* will be produced in 2025. *BBS Information,* **159,** 'Brick in Essex' issue, will therefore be produced with an August 2025 date on the cover. Please submit articles for consideration for inclusion to reach the Editor on or before Saturday 21 June 2025. This is partly due to the costs of using colour illustrations for part of an issue. *BBS Information,* **157,** October 2024, had minimal use of colour and cost £610-00 in printing costs; *BBS Information,* **158,** February 2025, with more than half the issue having colour illustrations, has cost £810-00 in printing costs.

When the society's finances permit — and the membership has been declining for the past two years due to deaths and, in some cases, dementia and other age-related illnesses and infirmities — it is hoped to return to three issues per annum. As it is, the finances allow for only two issues in a year with part of any issue having colour illustrations.

One of the potential papers in *British Brick Society Information,* **158,** August 2025, examines 'The Import of Flemish Bricks in Medieval Essex Parish Churches' and other possible papers look at 'Brick and Spectacle in Roman Colchester' and the re-use of Roman brick in later churches in Essex. A projected article on 'Colchester Brickworks' has been promised together with and account of the visit to W.H. Collier brickworks at Marks Tey. The issue had been designed to highlight 'Brick and its Uses in Essex' which it is hoped that all papers will be in the hands of the Editor at or before the Annual General Meeting on Saturday 21 June 2025.

The writer's presentation to session 334 on the International Congress of Medieval Studies at Western Michigan University, Kalamazoo MI, USA in May 2025 is entitled 'Bricks, Baptisms, and Burials: Imported Materials in Medieval English Parish Churches' will form the subject of a paper, 'Imported Flemish Bricks in Essex Parish Churches', in a future issue of *British Brick Society Information,* and, with slightly different emphases, under the conference title in *Peregrinations,* an American online publication about art and architectural history. An earlier paper on 'Building John Lord Wenlock's Chapel at the church of St Mary the Virgin, Luton, Bedfordshire', given in 2024 to a virtual session at the same gathering, will result in another paper for *Peregrinations*; part of it may also be used in a paper for a future issue of *British Brick Society Information* looking at the building activities of John, Lord Wenlock, both secular as in the brick-built Someries Castle, now Hyde but historically the southernmost house Stopsley township in the parish of Luton, Bedfordshire. the chapel was built of coursed chalk blocks but the charnel house beneath the chapel is lined with medieval bricks.

In part of the next three months, the writer is going taking part in the Visiting Scholar programme of the Vinson Centre at the University of Buckingham, to increase his theoretical knowledge when engaged on his on-going and long-standing research into 'The Kuznets Cycle and the Construction of the Gentry House in England *circa* 1400 to *circa* 1800' which examines the peaks and troughs in the building of gentry houses between the early fifteenth century and the beginning of the nineteenth century.

The working hypothesis is that whilst ransoms from the French wars helped finance major brick houses in the first half of the fifteenth century, but in the reigns of the Yorkist kings, from 1460 to 1485 and possibly for a decade after 1485, far fewer major brick houses were erected. In the sixteenth century, there was a trough in the two decades between the Reformation statutes of the 1530s and Elizabeth I's accession on 17 November 1558 but a peak in construction in the first three decades of her reign, up to the year of the Spanish Armada. Rain intervened across the 1590s but construction statistics picked up in the latter part of the first third of the seventeenth century. The English Civil War in the 1640s and the English Republic in the 1650s were both periods when few gentry houses were erected; new buildings seem also to have been relatively few in the 1660s. Ideas about gentry house construction in both the final third of the seventeenth century and the whole of the eighteenth century are currently fluid but may become clearer by the time members receive this issue of *British Brick Society Information.*

This issue of *British Brick Society Information* has been organised around papers and meetings reports concerned with making bricks and other ceramic building materials which are illustrated with colour photographs, with these items placed in the middle of the issue.

Various options have been suggested as possible themes for future issues of *British Brick Society Information,* one of which would be another issue concentrating on production matters, including clay winning, brickmaking, and terracotta production. Amongst the papers of the late Terence Paul Smith retrieved from his flat in Walthamstow was a well-crafted essay entitled 'Early Tudor Architectural Terracotta: Aspects of Production' which has full endnotes and illustrations; given that it is ready for publication and, amongst other buildings, discusses the making of the terracotta at Layer Marney Tower, Essex, would fit in well in an issue devoted to 'Brickmaking' or included in an issue with a more general focus. One social aspect of Layer Marney Tower was the subject of an essay in *British Brick Society Information,* **157,** October 2024. Other material has been submitted or suggested which could be used in another issue devoted to the production of bricks and other ceramic building materials.

Further contributions are invited from the membership to be part of the for the contents of *British Brick Society Information,* **160,** September 2025, and subsequent issues.

Articles and shorter contributions are invited for each of these issues, the submission dates for which are given at the end of this issue of *British Brick Society Information.*

DAVID H. KENNETT
Editor, *British Brick Society Information*
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New hands required to turn the Pugmill: The British Brick Society is need of New Officers

The British Brick Society is facing a crisis of members willing to help to run it. The long-standing honorary secretary died within a month after being forced to resign for serious health reasons in 2022. Voluntary societies cannot effectively function without the honorary secretary *not* holding another position among the officers.

The current honorary treasurer had indicated that he was willing to serve for 2024-2025 but definitely intends that this shall be his last year of service. He has been in post for sixteen years.

It has often been remarked that it is not healthy for a society to rely on officers remaining in post for long periods. All the current officers have passed the state retirement age; at least one is now beginning his ninth decade.

It is possible that with age and infirmity, other officers will wish to stand down in the next five years.

Any society needs the opportunity for officers to hand over to their successors.

Of no successors are forthcoming, the British Brick Society could be forced to fold and *British Brick Society Information* would have to cease publication.

So would members please consider offering to take on roles within the committee.

MICHAEL CHAPMAN
Chairman, the British Brick Society
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British Brick Society Information: 'Brick in Churches' issue in 2027

Terence Smith left a number of papers on brick and its uses; one of which, 'Practice Profile: Nugent Francis Cachemaille-Day FRIBA (1896-1976): A Response to Clare Price', was included in *British Brick Society Information,* **152,** February 2023. In a tribute to his long-standing friend, the Editor will be completing 'Car-Manufacturing Towns in Contrast: Brick and the Building of New Churches in Oxford and Luton, 1907-1945' in the course of the next few months. 'Churches' is loosely interpreted as building used for a religious purpose: to this end, the Editor has in preparation 'Moving on, Repurposing the Buildings: The Synagogues of St Louis, Missouri, USA' having seen each of the successive synagogues of the Jewish community of the city.

There are also several items, all less than a page in length, which includes potential contributions to a 'Brick in Print: Churches' section. To make an issue of 52 or 56 pages, the currently available material needs fleshing out with at least two more pieces, which need not be long articles but one could be. Members who feel that they could contribute to the issue are invited to contact the Editor, *British Brick Society Information,* by post or by email at *davidkennett510@gmail.com,* preferably the latter, by Tuesday 24 August 2025, and to submit completed articles and notes on or before Wednesday 15 December 2025; this information will also be given in *BBS Information*, **158,** February 2025 and subsequent issues.

DAVID H. KENNETT
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Review Article: A Master Bricklayer's Accounts

Anne McCormack, editor,
Account Book of John Yeomans, Bricklayer, 1696-1711,
being *Surrey Record Society,* **XLIX,** 2024,
Price £20-00; plus postage and packing, £3-50.
Available from Surrey History Centre, 130 Goldsworth Road, WOKING, Surrey GU21 6ND

John Yeomans (*c.*1653-1727) of Hampton Wick was already well-known to specialists in building history as the bricklayer at Winslow Hall, Buckinghamshire (fig.1),[1] the building accounts of which have been in print for many years.[2] The present work opens with a loose page summarising John's work at Petersham Lodge, Richmond-on-Thames, in 1696, for which he was paid a total of £800 11*s.* 3*d.* (page 1). The was volume found in the archives of the Royal Borough of Kingston upon Thames, being presumably a document from the private work of a former town clerk; in the seventeenth and eighteenth centuries, borough and county legal officials were also permitted to engage in private practice.[3]

Within the volume, John Yeomans' work on six projects — three in Surrey and three in Middlesex — is given in detail, including note of the craftsmen and labourers who worked with him and were paid by him, and the suppliers from whom he purchased bricks and other building materials. The Surrey projects were Petersham Lodge, Petersham, Richmond on Thames from late 1692 or early 1693 and up to 1711; Portmore House, Weybridge, also known as Dorchester House, in 1699, 1701, and 1703-1704; and Trumpeters' House, Richmond upon Thames, between 1699 and 1706 on a demolished part of Henry VII's Richmond Palace. On the Middlesex station,[4] John's work recorded in the volume is work at Hampton Court Mews, from 1698 to 1702; Teddington Place, between 1699 and 1703; and his own house at Hampton Wick in 1711. The last-named was clearly intended to create a good quality home for his retirement: John was then aged about 58, and beyond the age at which he would be liable for military service (55),[5] and there are no later entries in the volume.

Each of the houses is or was a brick house: Petersham Lodge was destroyed in a fire in 1721 but plans (pl.11 a-d) and a Kip engraving survives to give an idea of the size and context of this house (pl.12, the endpapers, and detail of the house on the paper cover).

In the modern Borough of Richmond on Thames, they were comparatively early examples of the house in the country, a retreat from the pressures of the patron's London life. An earlier example is York House, probably built for the second Earl of Manchester in the 1650s; the house was remodelled in the early eighteenth century.[6] Contemporary with John Yeomans' work is the original structure, a plain brick house with stone dressings, at Orleans Picture Galley, Twickenham.[7] Also in Twickenham is the slightly later Marble House, Twickenham,[8] erected between 1724 and 1729 to a design by Roger Morris (1695-1749).[9] In about 1775, David Garrick (1717-1779)[10] the actor, playwright, and impresario employed Robert Adam (1728-1797)[11] to update and refashion to the villa on the riverside in Hampton which he had purchased in 1754.[12]

Nearer to central London, the educational institutions which make up the University of Roehampton are based around the buildings or sites of buildings which began life as eighteenth-century villas.[13]

These houses were not country houses; they did not stand at the centre of a great estate. They were houses in the country, very much as the houses in Cumbria erected in the Edwardian era to designs by C.F.A. Voysey (1857-1941) or Baille Scott (1865-1945)[14] for comparatively rich businessmen in the wool trade in Bradford and on the floor of the Royal Exchange in Manchester, dealing in cotton: before the Great War, the Lancashire and Yorkshire Railway ran early evening trains on Fridays from both Bradford Foster Square and Manchester Exchange to Windermere for this clientele, with the return journey departing after high tea late on Sunday afternoons.[15]

Even Winslow Hall[16] is a house in the country designed to be a private house within a closely-defined rural space on the south-eastern edge of the building patron's home town where life for his family can be private, even if buttressed by a small army of live-in servants.

The projects had élite sponsors: Sir Charles Duncombe (1648-1711)[17] for Teddington Place; the Rev and Rt Hon Richard Hill of Hawkestone (1654-1727),[18] for Trumpeters' House; Laurence Hyde, first Earl of Rochester (1642-1711),[19] at Petersham Lodge; William Lowndes (1652-1724),[20] at Winslow

Hall, member of parliament for different constituencies throughout the last three decades of his life, who having begun his career as a Treasury clerk was Secretary to the Treasury from 1695 at Winslow Hall; Catherine Sedley, Countess of Dorchester (1657-1717)[21] for Portmore House at Weybridge; and Captain Samuel Chute Esq,[22] sometime Governor of the Commonwealth of Massachusetts, for the work at Hampton Court Mews. All of these had court connections, something which is evident in those employed on the design and construction of the houses.

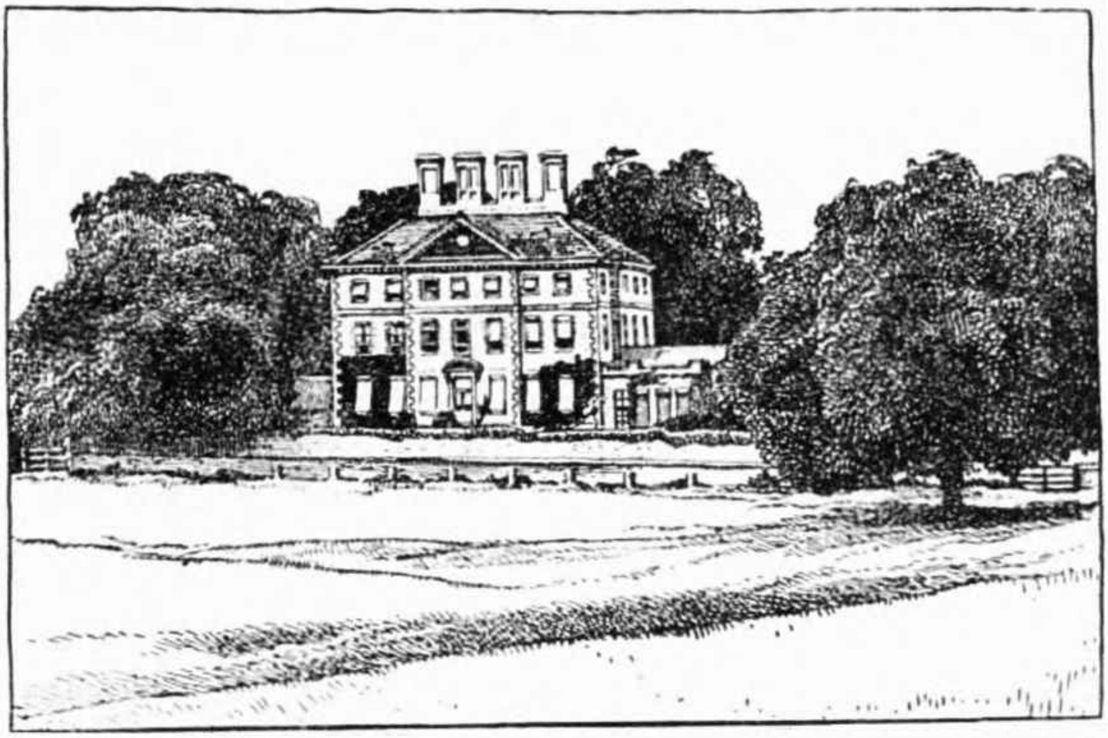


Fig.1 Winslow Hall, Sheep Street, Winslow, Buckinghamshire, built between 1683 and about 1700. John Yeomans worked here with Matthew Banckes, the king's carpenter.

Winslow Hall (fig.1) had been designed by Sir Chrisopher Wren (1632-1723)[23] where supervision of the construction was by Matthew Banckes (*c.*1637-*c.*1706)[24] who went on to design Petersham Lodge. Matthew Banckes was Master Carpenter in Office of Works from 1683 to 1706 and was succeeded in that post by his son-in-law, John Churchill (1666-1716). Like his father, Matthew Banckes senior (*c.*1602-*c.*1644), Matthew Banckes was Master of the Carpenters' Company: the father in 1636-37 and the son in 1698.

Winslow Hall is a double-pile house, two ranges placed back-to-back, whilst Petersham Lodge is a triple-pile house with three ranges, the central one of which provided a double-height principal reception room in the central range. Both houses have a continuous hipped roof. Teddington Place, later Udney Hall, was also a double pile house but with gables at the end of each range (pls.13 and 14).

The double-pile house is a compact house: Winslow Hall is two-and-a-half storeys tall, with a high, vaulted basement, where the south side at the front was a servants' hall and the north side used for storage; the attics with dormers were for servants' bedrooms. There is a spine wall between the two ranges, where the fireplaces are situated giving rise to four multiple chimney stacks. The four principal ground floor rooms had fireplaces but not all with the corner closets, and the four main rooms on the first floor were heated; this floor had four corner closets. Lowndes was married four times, the first three of whom all died within less than five years of marriage; with his wives, Lowndes fathered 25 children, whose sleeping quarters were in the half storey at the top of the house below the attics.

Petersham Lodge is a much larger house than Winslow Hall, being 'triple-pile' with two firm walls rising through the basement and two storeys to support the attics under the hipped roofs and to accommodate the 25 fireplaces shown on the plans (pl.11), supporting eight chimney stacks, each with

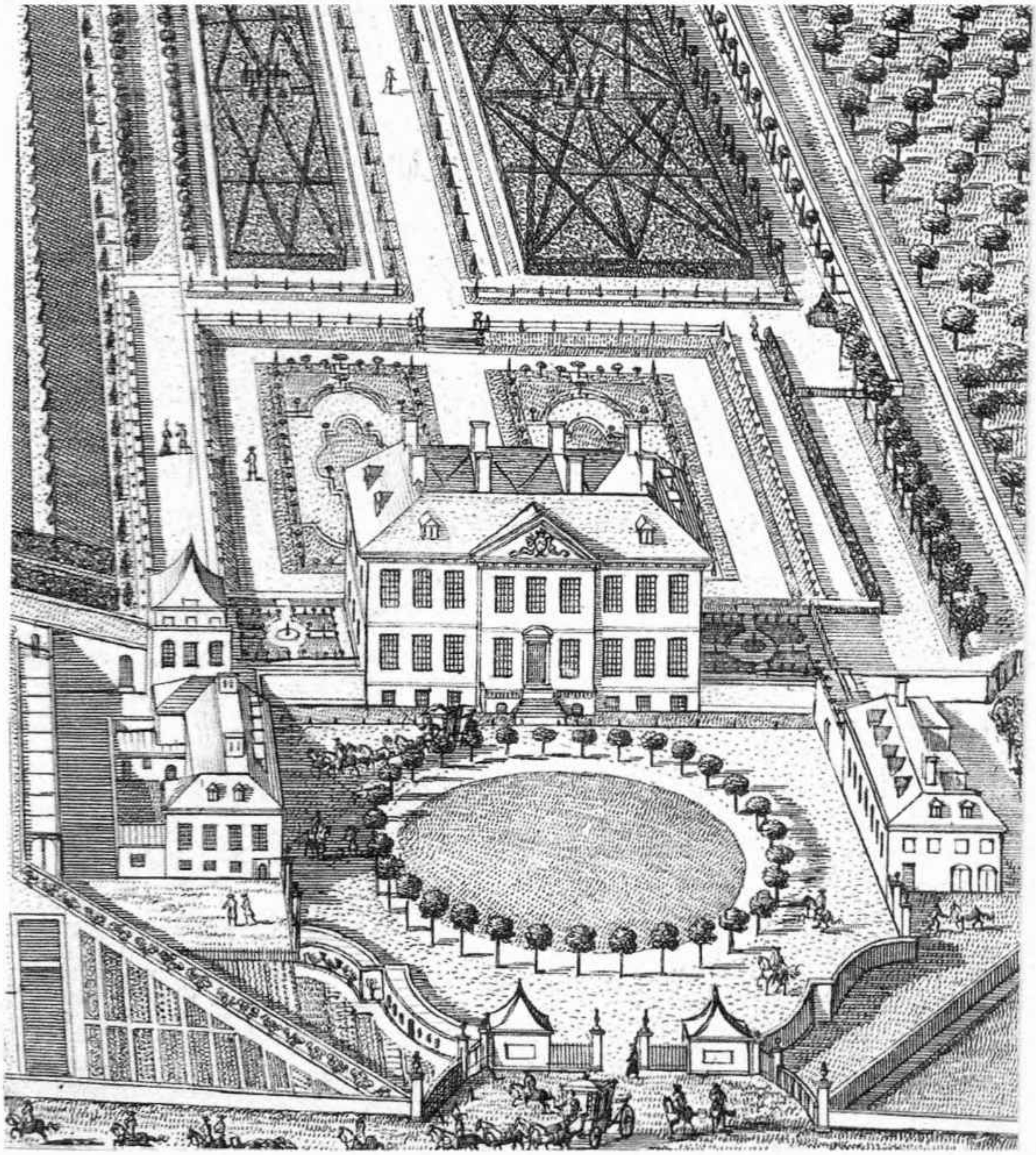


Fig.2 Petersham Lodge, Richmond on Thames, built for Laurence Hyde, first Earl of Rochester (1642-1711), as depicted in the engraving 'New Parke in Surry, the Seat of the Rt Honble the Earle of Rochester' by Johannes Kip and Leonard Kypff in the early eighteenth century. The house was designed by Matthew Bancks, the king's carpenter; John Yeomans was the master bricklayer.

multiple flues: the attics are assumed to be unheated, but only the servants slept there. Like Winslow Hall, Petersham Lodge had a flat top connecting the four hipped roofs; this obviated the problem of the gutter between the ranges.

Reamed Udney Hall, Teddington Place (pls.13 and 14) was demolished in 1940. Built in 1665 for Sir John Crofts, the house and estate was bought by Sir Charles Duncombe in 1683. Yeomans' work there for Sir Charles was to update the house.

The grounds surrounding each of these houses survive. The Udney Hall grounds are a public park; in contrast, those at Winslow Hall remain private. The Kip engraving of the grounds of Petersham Lodge (pl.12 and endpapers) shows a mound topped with trees in the top left-hand corner. Dr Cormack interprets this as either a prehistoric burial mound or an otherwise unrecorded early medieval castle. It is more likely to be a Tudor prospect mound of the type found on several estates. There was even one in central London in the garden of the Earl of Bedford's Covent Garden estate.

A valuable part of the introductory material is three lists: of workmen (pp. xxxiii-xxv), of suppliers (p. xxxvi), and an analysis of the contents giving details of each page of the original volume (pp. xxxvii-xxxix).

The workmen included labourers named John Stacey, already mentioned as a long-standing associate, and William Stacey. Both men worked on John Yeomans' house at Hampton Wick but only John Stacey on other projects. Neither is named in John Yeomans' will (pp.82-83) whereas both Henry Stacey and Michael Stacey are named as 'brothers-in-law', that is brothers of John's second wife Sarah Stacey. Could the labourers be how the testator met the lady and her brothers?

As Anne McCormack points out John Yeomans was supported by a close-knit group of craftsmen, particularly bricklayers like James Hearn and Abraham Whiting, and labourers like William Thomas and John Stacey who worked with him on several projects: James Hearn and William Thomas on five projects and John Stacey and Abraham Whiting on four projects (pp. xxvii-xxxi).

The suppliers includes three who supplied bricks: Mr Barratt, John Barlett, and Mr Rogers. William Redford of Teddington carried 'Flanders bricks' as did John Sanders who was a carter who transported other bricks and different building materials. Lime was supplied by Black (or Blake), Mr Potter, and Abraham Whiting, the last possibly the same man who worked as a labourer on various projects.

One intriguing reference among the suppliers is a William Inwood, who dealt in ironmongery and tools. At the end of the eighteenth century and in the early years of the nineteenth another William Inwood (1771-1843) and his son, Henry William Inwood (1794-1834), were respected architects in London: their work includes St Pancras new church, just off the Euston Road on the approach therefrom to Woburn Place. Is the early eighteenth century William Inwood an ancestor or relative of an ancestor of the architects?

The six houses are not the only work of John Yeomans. The 'great wind' of November 1703 had damaged the top of the tower of All Saints' church, Kingston-on-Thames, for which he provided a new brick top, work done between June 1708 and late 1710. Other work was also done for authorities in Kingston, then the county town of Surrey, not least on the Court Hall for the *nisi prius* court which dealt with civil matters. Anne McCormack's introduction also deals with John Yeomans as the churchwarden of Hampton Wick, each township of the parish of Hampton having its own people's warden.

The book prints a valuable document and the book will be mined by others for wages, for the cost of building materials, for specific information about individual houses. It is attractively produced, although beware the library which puts labels on the endpapers, thus obscuring the Kip engraving of Petersham Lodge and its park. The double-page spread allows the reader to fully appreciate the context of the house in the country.

DAVID H. KENNETT

NOTES AND REFERENCES

1. Royal Commission of Historical Monuments, *An Inventory ... Buckinghamshire volume* **2**, *North*, London: HMSO, 1913, pp.240-240, with pl.83, online at *www.british_history.ac.uk/rchme/bucks/vol2/ /pp339-345* [accessed 15 February 2025]. 'Winslow' in W. Page, ed., *Victoria County History of Buckinghamshire, volume* **3**. London: Constable, 1925, pp.465-470, online at *www.british-history.ac.uk/vch/bucks/vol3/pp.465-470* [accessed 15 February 2025]. N. Pevsner and E. Williamson, *The Buildings of England: Buckinghamshire*, London: Penguin Books, 1994, pp.754-757, with section and plan, and pl.63. The last-named lists the principal craftsmen involved in constructing the house.
2. 'Appendix: The Domestic Work of Sir Christopher Wren, 1674-1704, in A.T. Bolton and H.D., eds, *Publications of the Wren Society*, **17**, 1940.
3. The practice is not now permitted.
4. The analogy is with the Oxford-Cambridge boat race, held annually in May, where the line-up of the boats relates to the respective river banks.
5. Militia lists periodically record men as not liable for militia service due to age. At 55, men were excused service in he militia.
6. B.K. Cherry and N. Pevsner, *The Buildings of England: London 2:South*, London: Penguin Books, 1984, p.542.
7. Cherry and Pevsner, 1984, pp.541-542.
8. Cherry and Pevsner, 1984, pp.540542 and pl.60.
9. H.M. Colvin, *A Biographical Dictionary of British Architects, 1600-1840*, New Haven and London: Yales University Press, 3rd edition, 1995, pp.665-669.

10. For David Garrick *https://doi,org/10.1093/ref:odnb/10408* [accessed 27 February 2025] Other material is available online.
11. Colvin, 1995, pp.51-62.
12. Cherry and Pevsner, 1984, p.480; Colvin, 1995, p.60.
13. Cherry and Pevsner, 1984, pp.691-696.
14. W. Hitchmough, *C.F.A. Voysey,* London: Phaidon, 1997; D. Haigh, *Baillie Scott: The Artistic House,*
15. Railways in the late nineteenth century put on these types of special trains for a well-heeled clientele.
16. N. Pevsner and E. Williamson, *The Buildings of England: Buckinghamshire,* London: Penguin Books, 2nd edition, 1994, pp.754-757 with cross-section and plan and pl.63.
17. For Sir Charles Duncombe, banker and member of parliament, see The History of Parliament online.
18. Richard Hill, diplomat and civil servant, has a Wikipedia entry.
19. Laurence Hyde, Earl of Rochester has entries in Wikipedia, The History of Parliament Online, but not online easily accessible in *ODNB.*
20. William Lowndes has entries on Wikipedia, and The History of Parliament Online; a useful supplementary source is *http://winslow-history.org.uk* which prints his will [accessed 7 March 2025]
21. Sedley has a Wikipedia entry and other material (particularly paintings) online.
22. Capt. Samuel Chute, sometime Governor of the Commonwealth of Massachusetts, has entries both English and American online.
23. The literature on Sir Christopher Wren is wide.
24. Matthew Banckes is noted Colvin, 1996, p.98.

BRICK IN THE NEWS: REGENT THEATRE, ST HELEN'S STREET, IPSWICH

The Regent Theatre, St Helen's Street, Ipswich, was built in 1928-29 to a design by W.E. Trent, a man better known as a cinema architect: he designed several Gaumont Cinemas. The Regent Theatre is a cine-variety theatre and therefore was equipped to could show films. Seating over 2,000 people, it is the largest theatre in East Anglia.

Despite the capacity of the auditorium, a gig at the Regent Theatre can be sold out three months before the show is due to take place as has happened with the date for Squeeze as part of their 50th anniversary tour on 25 October 2024; 24 of the 36 advertised dates have been fully booked.

Built with external walls of red brick with stone quoins, the outer bays of the theatre's façade have a parapet topped with urns. Internally, there are echoes of Art Deco in the large, galleried auditorium beneath a shallow dome. The gallery is mounted on iron columns. To the rear of the theatre, Trent also provided a house for the manager using the same brick but with minimal use of stone.

Ipswich Borough Council have designated the Regent Theatre as a 'protected cultural asset' and have allocated funding of £3.45 million towards its refurbishment. Part of this will be recouped by an additional 20 pence on theatre tickets, already subject to a charge for the Restoration Levy, designed to help pay for the building work.

There is a brief notice of the Regent Theatre in James Bettley and Nikolaus Pevsner, *The Buildings of England; Suffolk: East,* New Haven and London: Yale University Press, 2015, page 343.

D.H. KENNETT

The development of 'Suffolk kilns' of late medieval to post-medieval date (*circa* 1500–1800), as represented by examples from Clare and Euston, Suffolk

Chris Fern and Rob Brooks
with Sue Anderson and Anna West

INTRODUCTION

This article describes three kilns for firing bricks and tiles discovered during two archaeological excavations by Suffolk County Council Archaeological Service. One kiln of late medieval date was found at Clare in 2013, and two of seventeenth- to eighteenth-century date were recorded on the Euston Estate in 2014, *circa* 1 km (1100 yards) north-east of Fakenham Magna. All were of similar form, rectangular in plan with twin furnace chambers, being characteristic of so-called 'Suffolk kilns'.[1]

They attest generally to the important role of the county in the manufacture of bricks from the late medieval period onwards. In each case, samples were taken from the kiln fabric and analysed by the archaeomagnetic technique, showing that the structures belong to broadly *c.* 1500–1550, *c.* 1650–1725 and *c.* 1750–1800.

LOCATION (Fig.1)

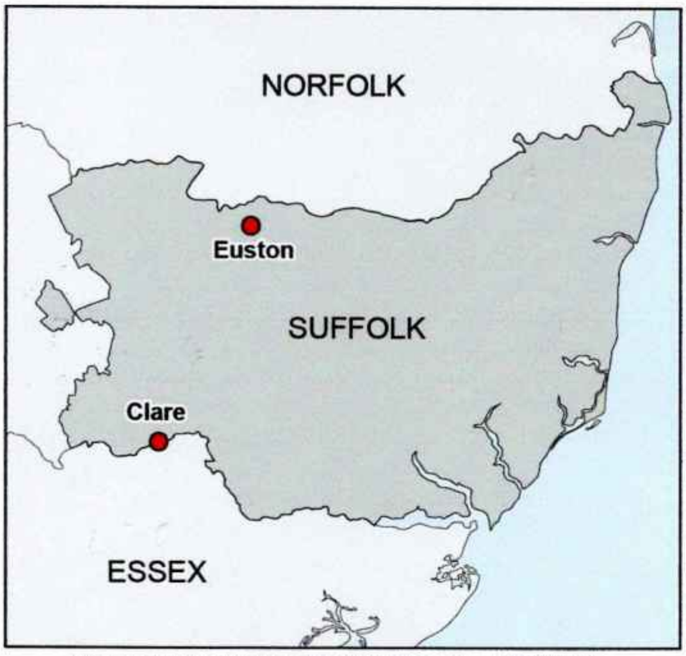
On the north bank of the River Stour, Clare was an important medieval settlement with an early Norman castle. The site of the kiln was on land between Stoke Road and Maxim Lane (NGR 576622 244955).[2] The archaeological evidence from the site (*c.* 0.65 ha) showed that dwellings had fronted Stoke Road from at least the thirteenth to fourteenth centuries, and the frontage might still have been occupied when the kiln was built some 20 to 30 metres to the rear. More than one phase of timber buildings was demonstrated with at least one having a brick chimney. Refuse pits and quarries were also recorded. Some of the quarries are likely to have been contemporary with the kiln.

The two kilns at Euston (NGR 592200 277100) were located on a site (*c.* 4.5 ha)[3] on the Euston Hall Estate, a landholding and house that already existed at the time of their construction.[4] Indeed, it is plausible that the bricks and tiles produced were used in two major phases of remodelling of the building. Historic maps and the excavation showed that several large ponds had been in the vicinity, which probably had their origin in clay quarrying, but thereafter were used in the preparation of the raw material.

Clare Kiln (Fig.2)

Only the below-ground portion of the kiln (feature no. 247) survived, immediately under the topsoil. It had been built within a prepared pit, cut through a late medieval buried ploughsoil or topsoil. The rectangular brick structure measured 6.25 metres by 3.73 metres and was aligned west-north-west/east-south-east. The width of the surviving outer walls was equal to the length of the bricks (*c.* 30 mm) used in construction. The openings for its two furnaces were at the east-south-east end, in front of which was a rake-out pit. Only a small section of an arch of mortared tiles remained (largely collapsed), but both chambers would have been fully vaulted with rows of spaced arches, each the width of the tiles used. The chambers were *c.* 0.9–1.0 metres in width. Each consecutive arch was placed to leave a slot, to allow the heat to be drawn into the oven (i.e. up-draught) from the furnace chambers below. This was in essence the same construction as for the Euston kilns (see below). The unfired bricks or tiles would have been placed on the flat tops of the arches forming the oven floor (that thus acted like kiln bars).

One sherd of fifteenth- to sixteenth-century pottery came from the rake-out pit, with a considerable quantity of tile and brick fragments (470 pieces), including wasters, found within the general backfill of the structure. Archaeomagnetic dating samples taken from the kiln were analysed at the University of Bradford



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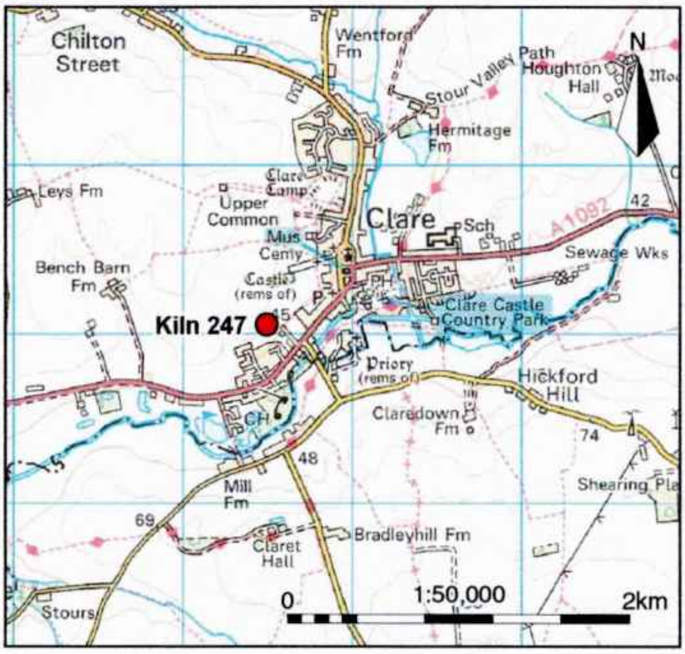
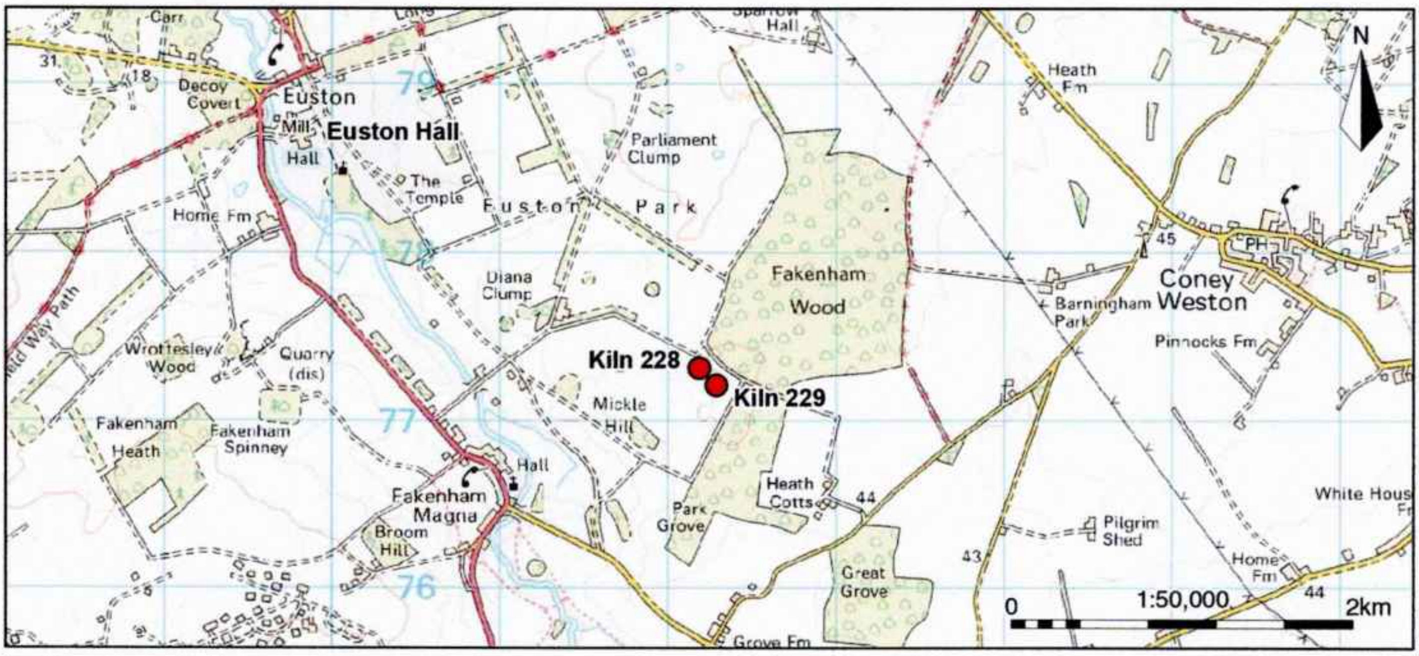


Clare kiln location



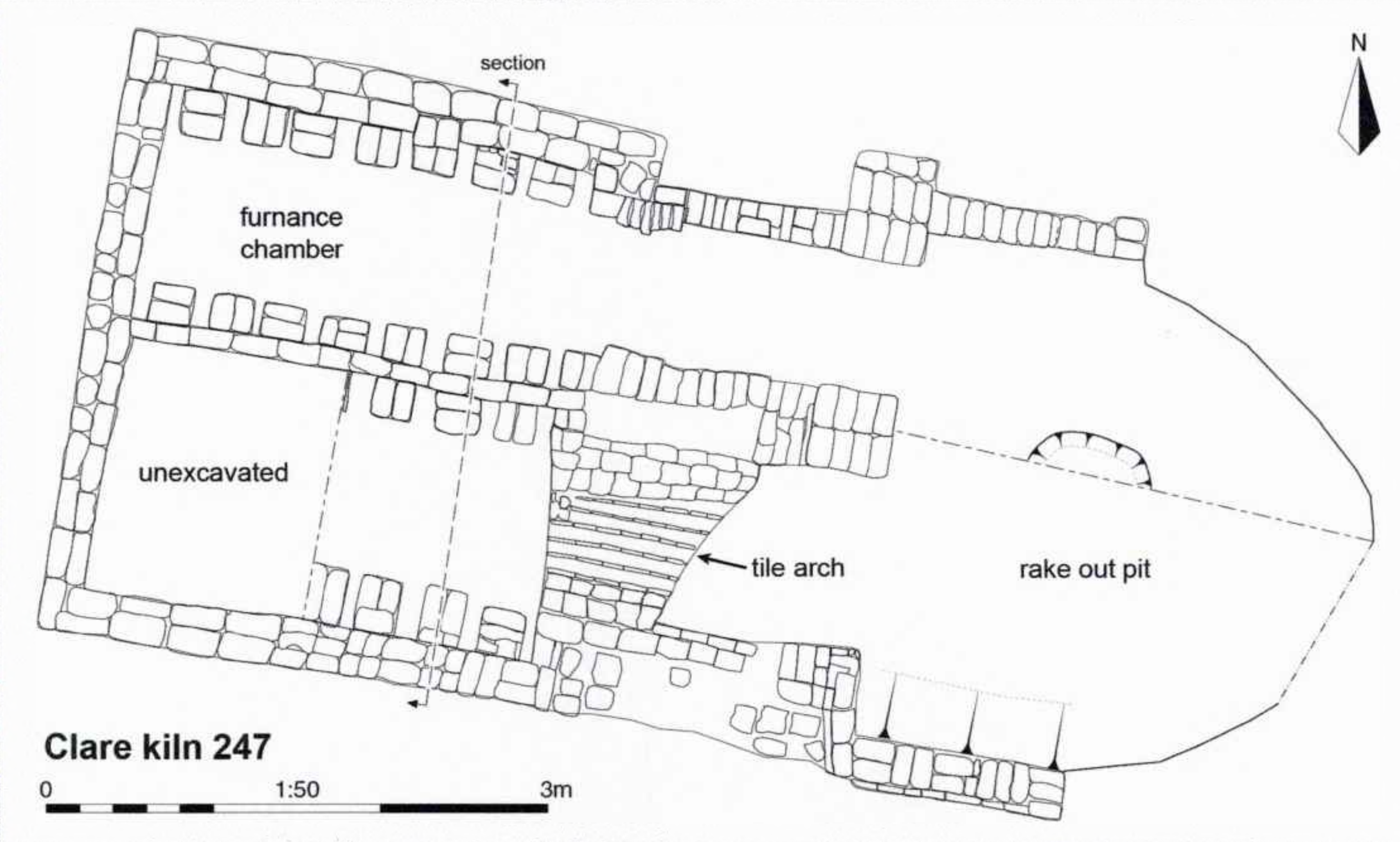
Euston kilns location

Fig.1. Location of the Clare and Euston kilns.

(GeoQuest Associates); the mean archaeomagnetic vector calculated from 17 samples, when compared with the UK Master Curve, suggests that the last firing occurred 1500–1550 AD.[5]

Euston Kilns (Figs.3 and 4)

The Euston kilns (feature nos. 228 and 229) were both aligned north-west/south-east. The older structure (228) survived to approximately 0.7 metres below the top of the clay subsoil. The second, later kiln (229) was deeper and constructed with a sloped base, to better facilitate raking out and/or mitigate the risk of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Clare kiln 247
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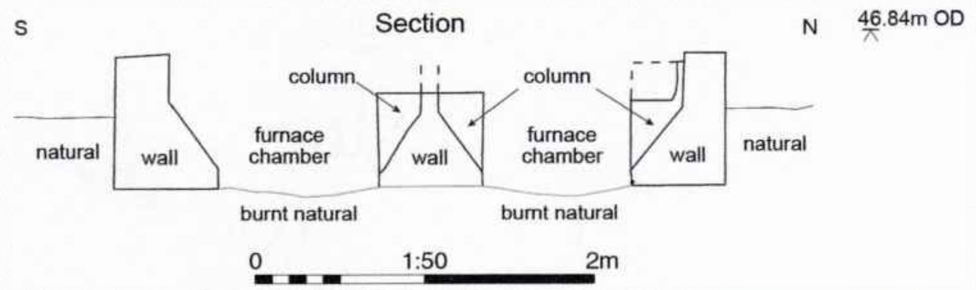
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burnt natural
0
1:50
2m

flooding; it survived *c.*1.5 metres below the level of the natural clay at its south-east end and it was 1.74 metres deep at the north-west end.

Kiln 228 (Fig. 3)

The outer dimensions of the kiln measured 7.35 metres x 3.9 metres. A central spine wall was built between the structure's two chambers with an angled top edge each side, at approximately 45 degrees, and a corresponding angled edge was incorporated into the interior of the bounding walls at the same height. The arches of the furnace chambers were struck off these sloped surfaces, a number of which survived, spanning the *c.*0.85 metres chamber width, spaced at 100 mm-120 mm intervals. There may have been up to twelve each side originally. As with the Clare kiln, the floor of each furnace chamber was formed of the natural clay into which the kiln was sunk. This had turned very dark red or black in places from firing and ash, and the surfaces had been worn concave from raking out.

Mortar was used in the construction of the arches, though the below-ground parts of the exterior walling might only have been bonded with clay; however, the effects of the intense heat of the firings (and subsequent leaching in the burial environment) made this difficult to determine with certainty. The bricks making up the structure tended to be quite irregular, fired red and unfrogged, measuring on average 226–236 mm x 107–119 mm wide x 52–60 mm. They were set in regular bond.

The impermeable clay subsoil made a means of drainage necessary. The line of a brick-lined and roofed culvert ran the length of each chamber, with the two lines converging to form a single culvert at the north-west end.

The kiln was backfilled with brick and tile rubble, and there were ashy deposits at the base. The rake-out pit/spread of ash and brick wasters formed a roughly circular area around the kiln, but on its north-west edge it extended outwards *c.* 45 metres. Environmental samples produced chaff, barley/rye (*Hordeum/Secale cereale* type) and rye rachis nodes, as well as charcoal/charred wood, bracken (*Pteridium aquilinum*) and heather (*Ericaceae*). All could represent fuel sources. Samples were taken for archaeomagnetic analysis with the results indicating a last firing of 1657–1724.[6]

Kiln 229 (Fig. 4)

The kiln occupied a rectangular area measuring 9.56 x 4.95 metres. As well as being somewhat larger than kiln 228 that lay to its south, its construction was technically more advanced and robust, and it showed clearly multiple brickwork repairs, suggesting a longevity of use. However, its general form presented clear similarities. The open end preserved two arched stoke holes (G) for the twin furnace chambers, a feature not apparent for kiln 228. Each was *c.* 1.4 metres wide and extended 2.6 metres beyond the kiln. They would have functioned to allow greater control of the draw (inflow of air) to the furnace chambers. The chambers of *c.*1.2–1.3 metres width and *c.*1.0 metres height had been vaulted, as for the other kilns, with rows of evenly spaced arches (*c.*100 mm–120 mm intervals), fourteen each side (only one survived). They were also similarly struck off of a pitched (i.e. pointed/angled) central spine (D1) with a corresponding angled surface on the interior of the kiln wall. The chambers were large enough to allow entry for stacking the fuel for the kiln.

The external walls (A–C) were thick (*c.*0.6 metres – 0.72 metres) and the floor was constructed of brick, unlike the earthen floors of the other kilns; features that would have enabled better thermal attainment and regulation. The brick floor at the end of the south-west stoke hole had been partly worn away, further evidence of considerable use.

At some point the rear wall (B) was repaired with a single skin of bricks in running bond, which later peel away, having not been tied in. The bricks in the original lower wall of the chamber were heavily vitrified and appeared to be in English bond or header bond. Parts of the spine wall (D1) may also have been repaired. Multiple further instances of vitrification were also noted.

The last firing of the kiln has been dated to 1740–1789 by archaeomagnetic analysis.[7]

Fig.2. (opposite) Kiln at Clare, dated by archaeomagnetic analysis to 1500–1550.
Plan (top); Section (centre); View looking west (below)

DISCUSSION

All three structures were up-draught kilns, in which the heat rose through the many narrow vents between the spaced arches of the furnace chambers.[8] The unfired bricks and/or tiles would have been stacked over the vents (upon the flat tops of the arches) in such a way that the heat was able to flow around them. The kilns would have been built without a permanent roof, but to protect the green bricks and tiles from the weather before the kiln was lit, and to attain the correct draw, a 'roof' of old bricks/tiles, turves or planks would have been used. This kiln technology, in both its structural form and firing method, was very like that of tile kilns seen centuries earlier in the Roman period.[9] An earlier medieval example of similar form, of thirteenth- to fourteenth-century date, is a tile kiln excavated recently by Cotswold Archaeology at Finchingfield, Essex. The up-draught kiln built of old tiles with twin furnace chambers had possibly supplied tiles for the building of a nearby moated site at Great Winsey.[10]

Likewise, it is possible that the Clare and Euston kilns were built to meet a need for materials for the constructing of nearby manors. Historical records show that the Clare kiln was sited on land that was part of the local medieval Erbury estate,[11] where a new manor house was built in the sixteenth century, just 130 metres to the north-east of the site, today known as Cliftons.[12] It is notable in particular for its two fine Tudor red brick moulded chimney stacks. Alternatively, the position of the kiln on the outskirts of the town may suggest that it was set up by a local tradesman to provide bricks for chimney construction and tiles to replace thatch on nearby dwellings, both of which were desirable in the late medieval period. One of the medieval structures on the site even had a fireplace constructed from the same brick types as those from the kiln, probably a sixteenth-century addition to an otherwise timber-framed house. Also, several fifteenth- and sixteenth-century houses along the south-western end of Nethergate Street still display plain roof tiles and large brick chimneys of the period.

Euston Hall (Grade II*) is located several kilometres north-west of the site of the two Euston kilns (228 and 229), but its immediate environs do not have suitable reserves of clay, and with good reason such industry might also have been deliberately located at a good distance from both the hall and other settlements (i.e. Fakenham Magna). In 1666–70, the manor house underwent a considerable transformation in a grand red-brick architectural style. A further major phase of remodelling was undertaken in 1750–56.[13] These dates align well with the two kiln phases at Euston, making it quite plausible that bricks made at the site were used to construct the hall.

At both sites there was evidence for extensive quarrying, presumably for clay and sand, as well as associated processes. Sand would have been used to dust benches and moulds to prevent the clay sticking.

At Clare the ground at the rear of the kiln had been opened, quarried out from the line of an old ditch boundary. There was also a spread of clay, which surrounded a circular pit (401) that had been clay lined for holding water. It is possible that these features related to 'treading' of the clay prior to its casting in wooden moulds.

At the Euston site, heavy quarrying had taken place around both kilns (estimated at up to 90 percent of the total ground area), suggesting their prolonged use and outputs on a considerable scale. This is undoubtedly also the origin of the several large ponds. Two that were conjoined were thought to represent a settling pond and a mixing pit, probably for kiln 228, and a further similar feature beyond the site's north-western limit might have been a settling pond/wash pit for kiln 229. On nineteenth-century maps of the estate the field was labelled 'Wash Pits', referring to this process.[14]

The internal floor area of each of the kiln ovens was different (based on measurements from the recorded plans): Clare: 3 metres x 2.6 metres; Euston 228: 4.5 metres x 3.1 metres; Euston 229: 4.1 metres x 3.5 metres. Whilst the heights of the above-ground walls cannot be known, for comparison, these dimensions can be compared with an account of 1833 that states 'a kiln to burn 20,000 bricks need not have the chamber more than sixteen feet [4.88 metres] by fourteen feet [4.27 metres], and eight feet [2.44 metres] high…'.[15] This described oven is bigger than those excavated, but with adjustment it is possible to give a rough estimate of the equivalent firing loads. The external wall of the Clare kiln suggests an above-ground structure that was possibly not as high, with a conservative estimate of perhaps 1.5 metres height. This would have created an oven chamber of 11.7 cubic metres, about a fifth of the capacity of the 1830s kiln. Euston kiln 228 had a similar wall thickness (and hence a similar maximum height may be modelled), even so its greater floor area would have allowed for approximately twice the capacity of perhaps 8000 bricks per firing. The later Euston kiln 229, with its stronger external wall construction, could easily have supported an eight-foot height, which would have given it a 35 cubic metres firing chamber compared to the 50.8 cubic metres area of the 1830s model, equalling a load of perhaps 14,000 bricks per firing.

These estimates do not take account of the changing dimensions of bricks over time. Brick and tile pieces were found associated with all the kilns, which in each case were studied by Sue Anderson.[16] All of the bricks and tiles from the two sites were in red-fired fabrics, but with a range of sub-fabrics: most common were fine and medium sandy fabrics, with flint, chalk, clay pellet and ferrous inclusions. Whole 'Tudor' (fifteenth- or sixteenth-century) bricks from the Clare kiln were mostly 233–235 mm long, 110–112 mm wide and 45–46 mm thick (but with some exceeding these dimensions; see Table 1). It is possible that some burnt fragments came from hearths or had been affected by accidental fires, but some were overfired and may have been kiln wasters. A few tiles also showed signs of sooting or burning, some of which (with the bricks) might have formed part of the kiln roofing. A few were overfired, and some of these were warped, perhaps again wasters from the kiln; these fragments were recovered from the kiln fill, as well as from the backfill of the clay-lined pit (401). The roof tiles associate with the kiln were between 162–180 mm in width and 14–17 mm thick, but there were no complete examples to provide length measurements.

TABLE 1. BRICK SIZES FROM FIFTEENTH- TO EIGHTEENTH-CENTURY KILN SITES IN NORFOLK AND SUFFOLK[17]
*ranges include single very thick outliers

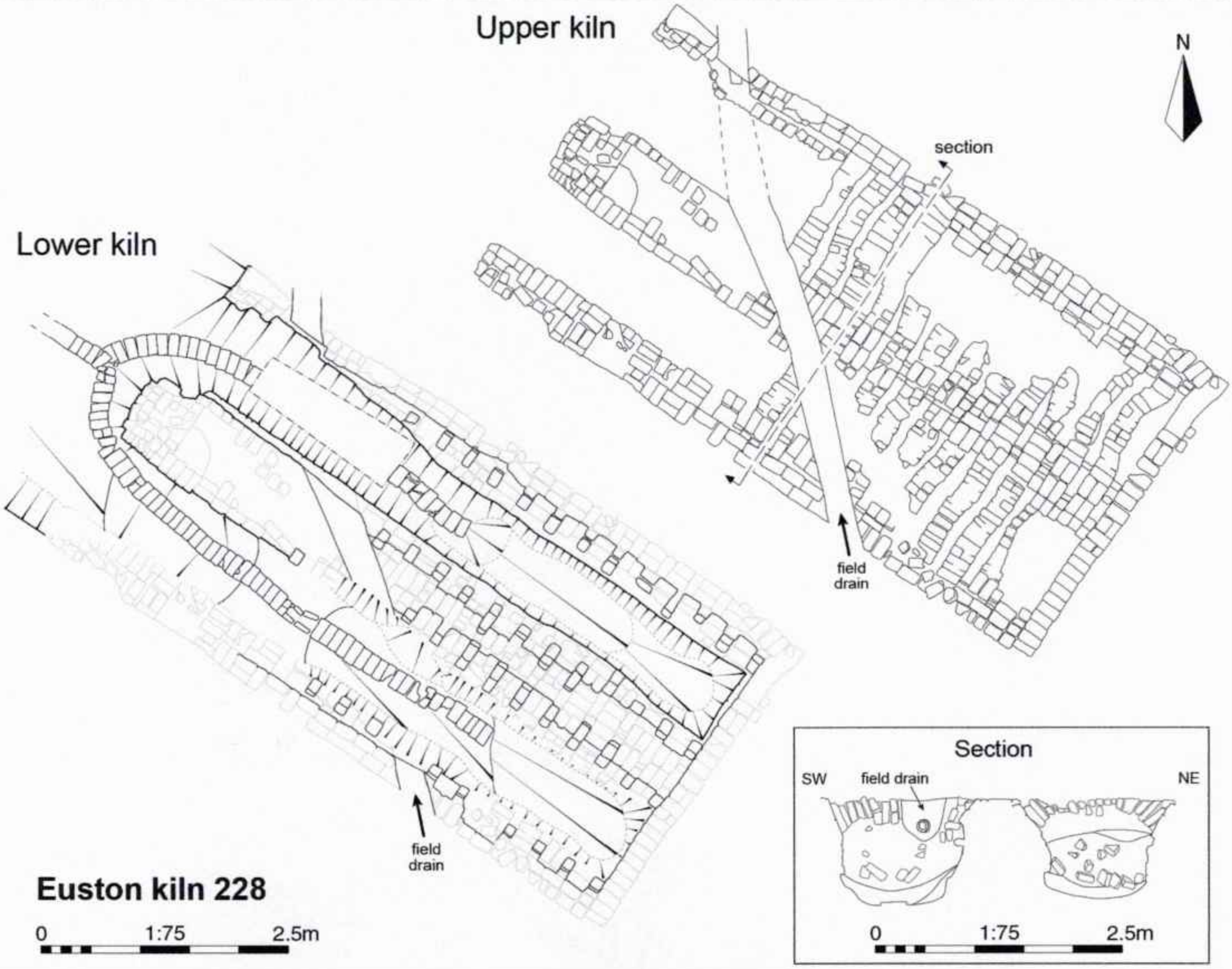
Site	Length (mm)	Width (mm)	Thickness (mm)	Date
Ellough, Suffolk	230-251	111-124	50-60	Late C15-C16
East Dereham. Norfolk	253	119-121	48-58	Late C15-C16
Gedding, Suffolk	230-243	111-126	45-70*	1480-1660
Clare, Suffolk	233-239	104-125	45-60*	1500-1550
Cringleford, Norfolk	226	106-116	48-58	C16/C17
Kelling, Norfolk	237-239	117-121	53-56	C16/C17
Reedham, Norfolk	245-255	105-128	54-65	Late C16
Euston, Suffolk (kiln 228)	226-236	114-119	53-56	1657-1724
Euston, Suffolk (kiln 229)	223-233	106-114	58-60	1740-1789

Complete bricks from the structures of both the Euston kilns provided measurements (Table 1). Although of broadly similar length, the two groups hardly overlap in width and thickness. The narrower, thicker bricks in the structure of kiln 229 are more typical of eighteenth/nineteenth-century types.
The material from both kilns again included tile.

In conclusion, the three kilns from the two Suffolk sites can be said to present evidence of the development of brick kiln technology in the east of England during a relatively short period, during which the use of brick as a building material exploded in popularity, *c.*1500–1800. From the kiln remains it can be seen that, beyond their formal structural similarities, technological advances had occurred, necessary to meet the growing demand. In particular, the latest structure (Euston kiln 229) demonstrates a brick and not an earthen floor, as well as thicker walls, and it had the largest oven capacity. Indications of repair also show that it was used for a succession of firings.

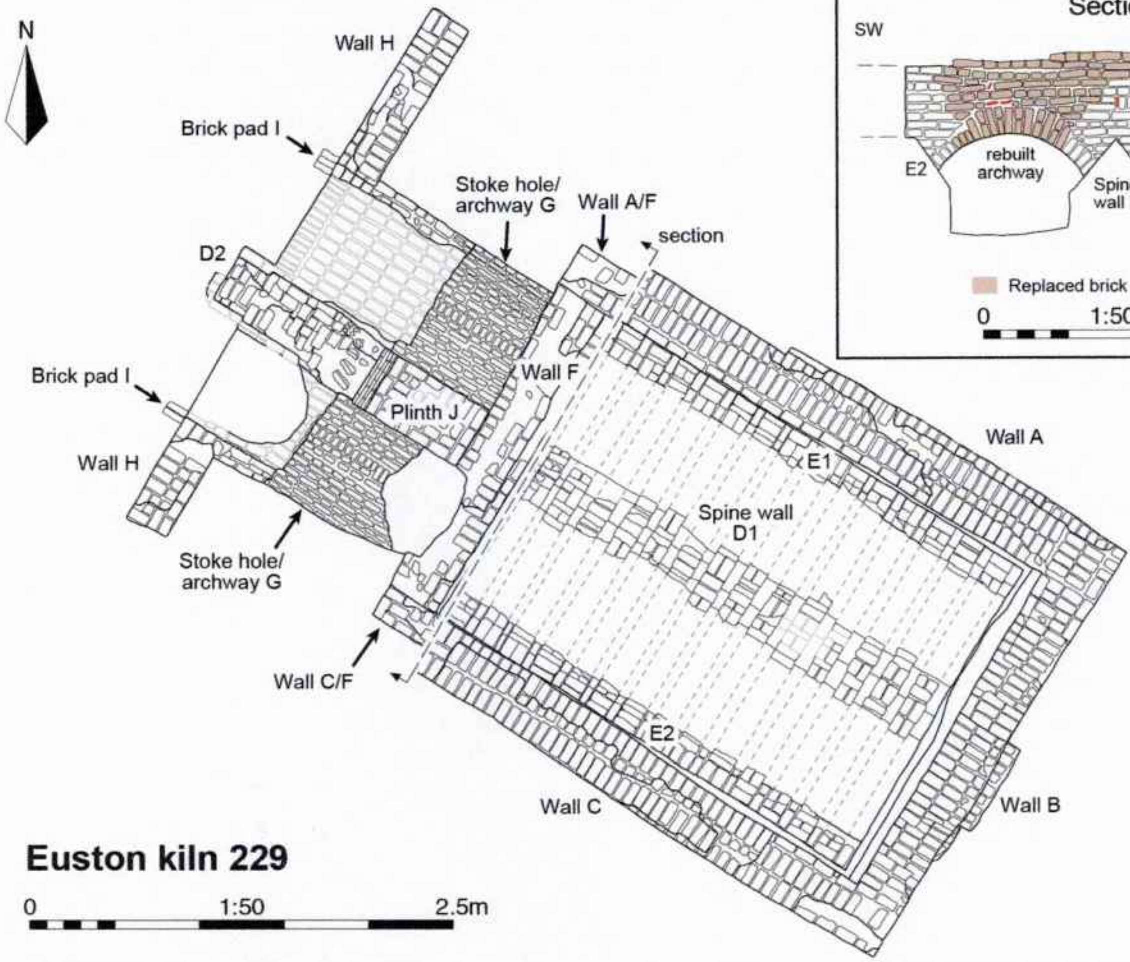
Fig.3. (page 16) Kiln (228) at Euston, dated by archaeomagnetic analysis to 1657–1724.
Plan (top); Upper kiln looking north-west (lower left) Lower kiln looking south-east (lower right).

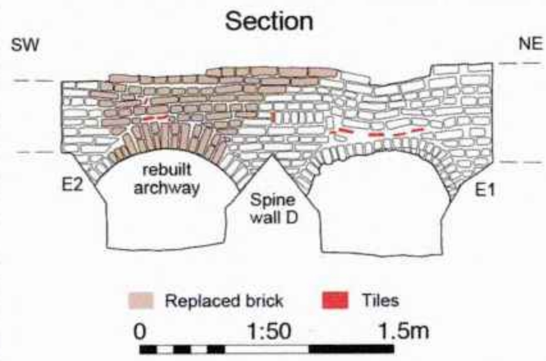
Fig.4. (page 17) Kiln (229) at Euston, dated by archaeomagnetic analysis to 1740–1789.
Plan (top); Looking south-east (centre); Wall B looking south east (below).

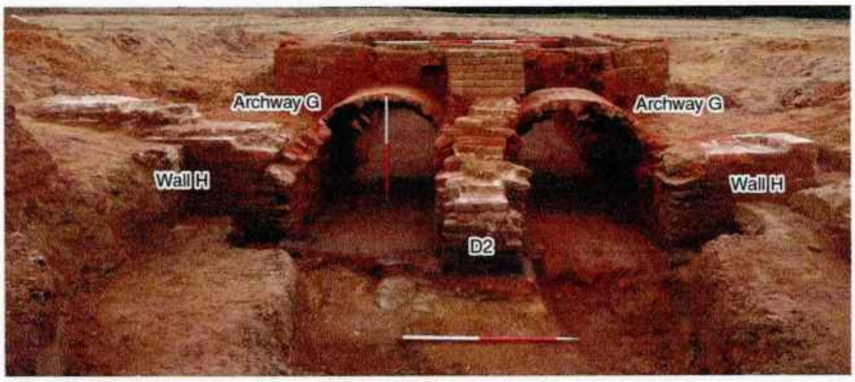


Overhead view of upper kiln (1m & 2m scales)

Overhead view of lower kiln (1m & 2m scales)







Kiln 229, looking south-east (1m & 2m scales)

Wall B brick repairs, looking south-east (1m scales)

ACKNOWLEDGEMENTS

This short article is a summary of the work of numerous individuals. It is not possible to mention all by name, but especial thanks are due to the following people. Rob Brooks directed the excavations at Clare and Euston for Suffolk County Council Archaeological Service and was the principal author of the technical reports that resulted (as Suffolk Archaeology CIC). Managerial oversight was provided by David Gill (fieldwork), Joanna Caruth (post-excavation) and Richenda Goffin (finds). Multiple specialists contributed to the analyses for both sites, but in particular this article has drawn upon the work of Sue Anderson (post-Roman pottery), Anna West (plant macrofossils), and archaeomagnetic analyses undertaken by GeoQuest Associates and University of Bradford. Ken Lymer produced the figures for this article. Persimmon Homes funded the excavation and post-excavation analysis for Clare. The Euston Estate funded the excavation and post-excavation analysis for Euston. This publication has been produced by Cotswold Archaeology (that merged with Suffolk Archaeology CIC in 2019). Abby Antrobus, Joanna Caruth and Martin Watts gave advice on drafts of this paper.

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The Existence of Multiple Pressure Marks on Cambridgeshire Bricks

Han Li

INTRODUCTION

This article is in relation to a 1997 publication by Terence Paul Smith in *British Brick Society Information,* **72**, and a response by Elizabeth M. James and Edwin J. Rose in *British Brick Society Information* **93**. It is commonly argued that bricks only have one set of pressure marks. In fact, a change in the direction of the marks can serve as a dating feature for bricks. For example, the change of direction from diagonal to vertical occurred circa 1780 in Norfolk,[1] and in the nineteenth century in Essex.[2] However, the present article addresses the existence of multiple sets of pressure marks that can be diagonal, vertical and horizontal, on a single post-medieval brick. Although James and Rose's response to Smith's article states that no writers have reported on the existence of two pressure marks,[3] many examples of brick stretchers bearing two or more sets of pressure marks have been identified in Cambridgeshire. However, the existence of such features on London bricks has not been seen by the author.

PRESSURE MARKS ON BRICKS

Terence Paul Smith's 1997 article for *British Brick Society Information* explains the reason and sequence for the restacking of bricks during the drying process. Pre-fired bricks were stacked for a period of drying, usually place on top of each other on the stretcher face. Smith states that they were then restacked in a more open arrangement for another phase of drying.[4] The post-fired result could be the existence of two sets of pressure marks on the stretchers of the bricks. Smith believes that the bricks would be stacked more openly once the structure of the brick was hardened because of the initial drying process.[5] He mentions examples of London Stock bricks with evidence of restacking visible in a warehouse wall in Ironmonger Row in London.[6]

It is important to note that pressure marks on bricks are different from the sunken margins, which exist as depressed areas on the upper edges of the brick. These sunken margins are the result of the brick maker or the assistant pushing down on the "clay lip" with the wooden mould.[7] The "clay lips" are pulled up on the sides of the soft brick when the brick was demoulded. In the London area, sunken margins tend to appear on London-made bricks that pre-date the Great Fire of 1666 and on Dutch yellow (Clinker) bricks of the seventeenth to eighteenth centuries, as observed by the author in large quantities in archaeologically excavated material.

CAMBRIDGESHIRE EXAMPLES

Multiple examples of bricks with multiple pressure marks have been seen by the author in the Cambridgeshire area. Two clear examples have been photographed and their locations published with the permission of the property owners. Other examples in Cambridgeshire are not as clearly visible on photographs, but are included in the list below.

ST IVES, CAMBRIDGESHIRE

A clear example of the restacking of a brick evidenced through two sets of pressure marks is visible on the garden wall at Burleigh House, a listed property opposite the Norris Museum in St Ives, Cambridgeshire. Burleigh House has existed since the eighteenth century and was consecutively modified in the following centuries.[8] The garden wall has brickwork that dates to *c.* 1850 and is likely to have replaced a railing.[9] Possible renovation of the wall was carried out during 2004.[10]

Fig.1 Restacked brick pressure mark on the stretcher of a brick found in the Garden Wall at Burleigh House, St Ives, Cambridgeshire.
(Author)

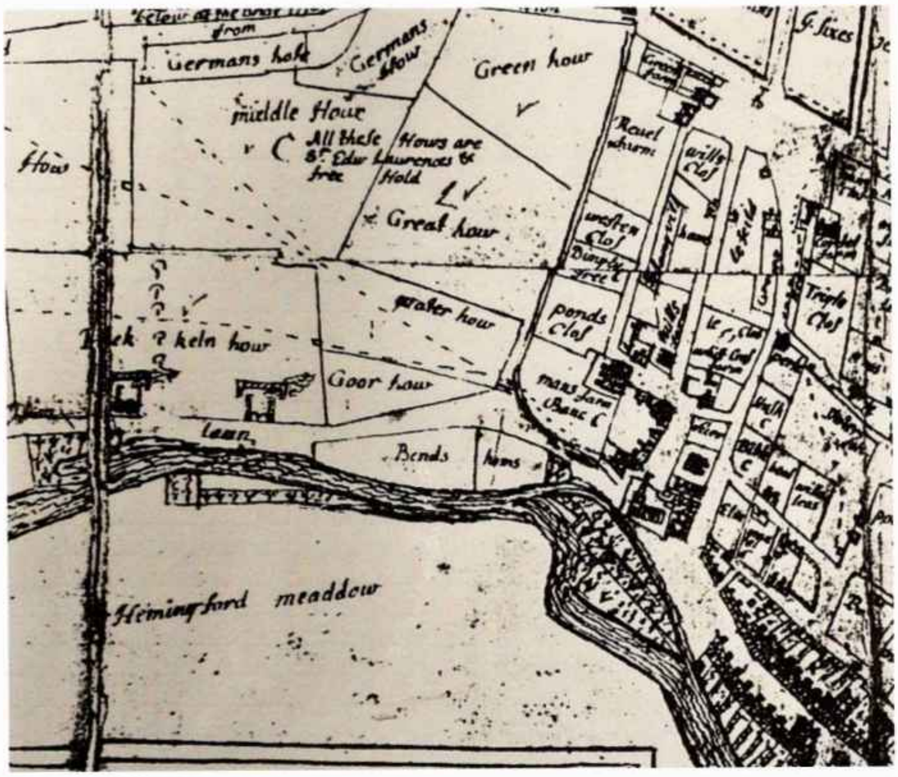

Fig.2 Map of St Ives, Cambridgeshire, surveyed by Edmund Pettis 1728[11]
(Norris Museum)

Two bricks were diagonally stacked on top of the brick's stretcher before being replaced by a brick stacked horizontally across. The brick is pale yellowish-beige in colour and is possibly made of either Kimmeridge or Gault Clay. Although Gault Clay was utilised widely in Cambridgeshire, it is likely that many bricks in the county were also made from Kimmeridge Clay.[12] Examples include the buildings in Ramsey, just north of St Ives.[13]

Brickmaking was a local and essential industry in St Ives, especially since Barnack stone was quarried out. The 1728 map surveyed by Edmund Pettis, provided by the Norris Museum, shows the brick kilns in operation around present-day Berman Park.[14] It is estimated that up to 1,300,000 bricks were utilised in the construction of New Bridges.[15] How Hill brickworks, which is located on the site of the modern-day golf course of St Ives, began producing pale or "white" coloured bricks by the nineteenth century after the clay deposits that produced red-brown bricks were worked out.[16]

Fig.3 Wall at Kettle's yard showing horizontal, diagonal and vertical pressure marks. (Author)

KETTLE'S YARD, CAMBRIDGE, CAMBRIDGESHIRE

Another example of pressure marks on two alignments was found in Cambridge city itself, on the wall of Harold Stanley Ede's Kettles Yard, behind the Cambridge Folk Museum. "Jim" Ede created Kettle's Yard by renovating old cottages in 1956.[17] However, this wall was likely the result of the 1970s extension in which bricks from older buildings were recycled into the structure. The brick shows a horizontal pressure mark and possibly a set of diagonal marks on the stretcher overlaid by two vertical pressure marks. The stretcher widths of two stacked bricks are visible on the bottom stretcher face.

This brick is also pale yellowish-beige in colour and likely made from local Gault Clay. Gault clay bricks were widely used in Cambridge from the late eighteenth to twentieth century.[18] Similar bricks were found during the 2016 excavation by Cambridge Archaeological Unit in the vicinity.[19]

DISCUSSION

Although multiple sets of pressure marks on bricks are very rarely observed on bricks in London, the existence of examples in separate locations in Cambridgeshire provides firm evidence of brickmakers restacking bricks on different alignments. It is logical that a brickmaker will restack bricks as many times as needed to achieve the desired pre-firing condition, since these marks would in no way jeopardize the integrity of the bricks or affect the aesthetic value of the walls. However, as no examples have been found by the author in the London area, it must be asked why many examples exist in Cambridgeshire. After all, the need to restack bricks could easily be imagined if the original arrangement did not suffice due to inadequate airflow or partial collapse.

It is likely that the rarity of multiple pressure marks on bricks is the result of what Smith describes as the initial and secondary drying process. Bricks would develop pressure marks during their preliminary stacking due to their soft form.[20] Their fabrics would be hardened so as to not develop further pressure marks when rearranged.[21] However, the odd bricks that were still soft due to poor placement and airflow in the stacking arrangement would remain soft enough to develop further pressure marks when restacked.

It is possible that pressure marks are more visible on these lighter-coloured Cambridgeshire bricks due to the type of clay used. It may be that most Cambridgeshire bricks took longer than local London bricks to harden during the initial drying process. The bricks would still be soft enough to form new pressure marks when restacked for another phase of drying. This theory could explain why some bricks, such as those from North Essex and Cambridgeshire, have more prominent pressure marks than the London-made post-Great Fire bricks of the same period. This assumption is further supported by Smith's description of a two-pressure-marked London Stock brick, usually light yellow in colour, which he identified in Islington.[22] London Stock bricks are usually made in Essex and Kent with a different clay source from locally-made London bricks. Whatever the cause may be, these examples, as well as others that have weathered away or have yet to be discovered, offer indisputable evidence of the existence of multiple pressure marks on brick stretchers.

CONCLUSION

The rarity of multiple pressure marks on post-medieval bricks has raised questions as to whether bricks were ever intentionally restacked during the drying process. It is natural to assume that the brickmakers would have been reluctant to rearrange brick stacks due to the efforts required for such as a task and the potential damage that might occur to the bricks. However, the evidence of these Cambridgeshire examples corroborates the evidence of Smith's sample at Ironmonger Row, Islington. These cases provide further evidence to support his thesis that bricks were intentionally dried using a two-stacked process.

ACKNOWLEDGEMENTS

Special thanks to Ian Betts for providing guidance on this matter and further thanks to the Norris Museum at St Ives, the Museum of Cambridge, Kettle's Yard in Cambridge, Jacqui Pearce for proofreading the article, and the owners of the aforementioned properties for providing valuable research material for this article.

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Fig.4 Examples of two pressure marks on bricks from Cambridge.

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Fig.5 Two examples from Cambridge of bricks with more than one set of pressure marks.

Fig.6 (page 25) Further examples of two sets of pressure marks on bricks from Cambridge.
Fig.7 (page 26) Further examples of two sets of pressure marks on bricks from Cambridge

Brick Query:
Apotropaic Brick from Greenwich Foreshore

Fig.1 Apotropaic Brick from Greenwich Foreshore

The image of the brick from Greenwich foreshore (fig.1) was found by me and published some time ago in the *Journal of the English Ceramic Circle.* The cobalt design on the base and sides might suggest that it was produced and/or decorated in either Cornwall or Cheshire, both counties where early production of cobalt occurred as a by-product of mining other metals.

Does any BBS member have any information which would narrow its date in the seventeenth or eighteenth centuries. Equally can anyone suggest a place of production.

BRIAN WATLING email: *brian.watling@msn.com*

RESPONSE

There may be a connection with Greenwich Palace and the discovery in the excavations of in 2016/ 2017 of the palace basement. The online photographs of the floor bricks are of a similar bright red colour.

A potential brickmaker is Richard Reculver who was involved with several royal palaces and also supplied St John's College. Cambridge.

DAVID CUFFLEY email: *davidrcuffley@btinternet,com*

Brick for a Day: York Handmade Brick Company
11 September 2024

—YORK—
Handmade

Since the Society last visited this unique works in September 2019, the company has undertaken a significant capital investment programme to change their brick manufacturing process.

In September 2019, the volume brickmaking was based around a semi auto mated production line where the prepared clay, divided into 'clots of clay' was delivered by conveyor belt to a team of hand makers, who then threw the clay into mould boxes, thereby still producing a handmade brick. This was a challenging process as the hand makers were required to work at a constant rate to keep up with the clay delivery.

Whilst the team of hand makers were rotated and rested to try to minimise repetitive strain injuries, it was not an attractive job with the role becoming harder to fill. Absences from the team were becoming disruptive and resulted in loss of output, thus affecting the overall productivity of the plant.

Whilst handmade bricks were in constant demand, the business found that an alternative 'Water Struck' product was gaining in popularity, with the existing process not able to produce this range of brick.

With the long-term supply of eminently suitable clay, secured, it was decided to radically change the brickmaking process from solely traditional handmade to an automated manufacturing machine designed to produce a versatile range of Handmade Style, Water Struck or Pressed Bricks.

The result has been a transformational move, being the largest and most significant in the 35-year-old history of the company In widening the product range to include Water Struck bricks and the overall investment has resulted in York Handmade being able to supply prestigious and award winning contracts.

The machinery has been supplied by De Boer B.V., a specialist supplier of brickmaking equipment, founded in 1936, based in the Netherlands and specifically designed to utilise the properties of clays suitable for soft mud brick manufacturing, and increase productivity and efficiency of the plant.

De Boer having grown by acquisitions and mergers are now a leading World supplier of this type of equipment and offer a design and build service ideal to satisfy the requirements of York Handmade Brick.

DE BOER

DE BOER MACHINES NEDERLAND B.V.
Bijsterhuizen 2402
6604 LL Wijchen
The Netherlands

The De Boer logo

In addition to the actual brick machine, the package included ancillary equipment integrating all the required materials supply, water supply and electronic control system.

Soft mud brickmaking requires a lot of water to both wash out the moulds prior to re sanding or for actual de moulding for water struck bricks. Once used the wastewater contains a high proportion of sediment that must be effectively cleaned. De Boer are acknowledged experts in this technology ensuring that both clean water and sand can be recovered and that to ensure that any water discharged from the site meets very strict environmental standards.

To compliment this investment improvements to drying and firing have ensured that overall plant efficiency has also been enhanced.

Fig.1 (left) Additive materials used in production. The centre bay holds coke breeze which is mixed into the clay body to aid kiln firing time and fired colour. The bays either side hold sands used for moulding.

Fig.2 (right) The Clay Shredder, an integral part of the clay preparation process which ensures consistency of moisture content and particle size.

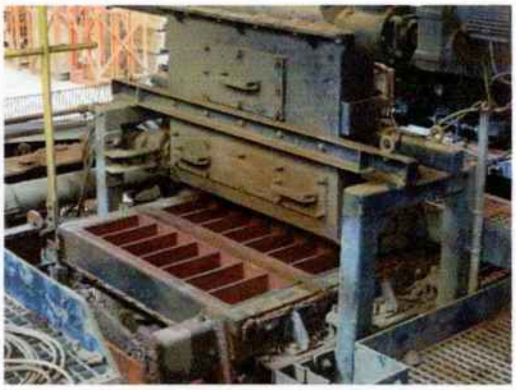


Fig.3 (left) The De Boer mixer where additional water is mixed with the prepared clay to ensure the correct moisture content is achieved. Typically, the Soft Mud Process requires around 21% moisture content. Any marked variation will result in either poor demoulding, if too dry or if too wet then slumping as the brick is de moulded.

Fig.4 (right) An integral part of the machine is the brick mould and mould chain system. To achieve the required output the machine was designed with individual mould boxes producing 7 bricks at a time. Each mould box joins a 'train' to ensure smooth and continuous operation. The photo shows 2 mould boxes, pre sanded, and ready to be filled with clay, achieved via a patented pressing action.

Fig.5 (left) Photograph looking down on the 'Striker Belt' which removes the excess clay from the mould boxes, with the material being re-cycled back into the mixer. The moulds are deliberately overfilled to ensure the actual mould box is filled with clay so that no air pockets exist.

Fig.6 (right) Stack of empty mould boxes ready to be fed into the system.

Fig.7 (left) Once the moulds are filled, they are assembled onto stillages in readiness for drying.

Fig.8 (right) A Dryer chamber being filled with stillages of wet bricks. The grey tubes are 'Rotomixair' units that circulate warm air within the dryer to ensure even distribution and consistent results.

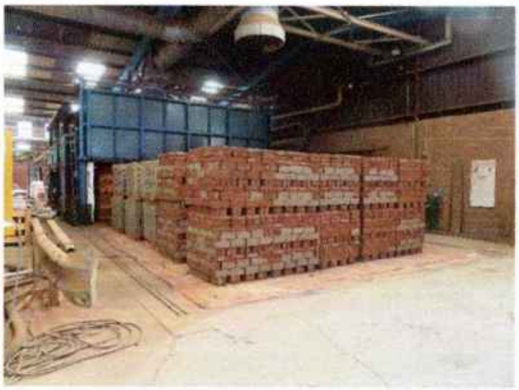


Fig.9 (left) Dry green bricks assembled into packs on the base of the Moving Hood kiln.

Fig.10 (right) With the kiln firing cycle complete, the packs are removed by forklift truck to the dehacking and packaging area.

Fig.11 (left) Overview of the hand making line showing the large mixer, painted green, and the hand maker's bench.

Fig.12 (right) Another batch of 'Plinth Stretchers' completed.

Whilst the production process has been transformed by the De Boer machinery, production of traditional handmade bricks, and special shapes remain as an important part of the overall product range.

For a small brick manufactuer,the capital investment of 1.5 million pounds was planned and justified to greatly improve plant efficiency and widen the product range, particularly into the 'Water Struck' market, a brick type already popular throughout Eastern England and the London area. This type of brick is already produced by other UK brick manufacturers, but with growing popularity,a gap was identified in the market which York Handmade have stepped in to fill.

Specifiers are now increasingly attracted to this type of brick in other,less traditional areas, with an example being the 3 Circle Square redevelopment in Manchester, where York Handmade have been awarded the contract to supply a water struck brick from their new Viking Range. This very valuable and prestigious contract could not have been supplied without the investment being made.

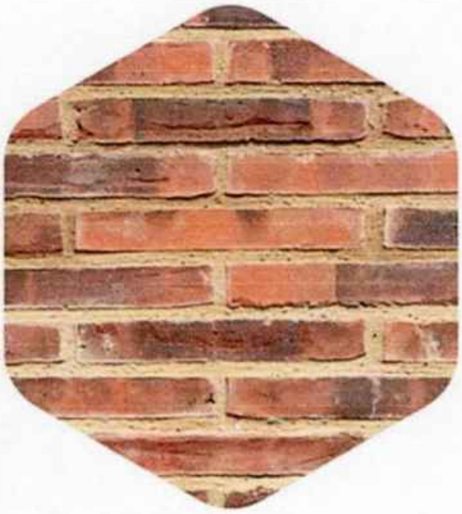
 

Fig.13 (left) Office development, 3 Circle Square, Manchester.

Fig.14 (right) The Viking Thirkleby range, produced in 'Maxima' size **327 x 102 x 50 mm.**

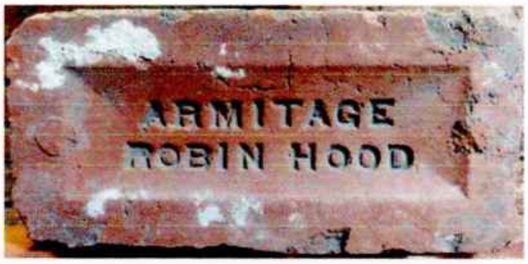


Fig.15 Bricks stamped 'Armitage Robin Hood' (left) and 'Elizabeth II 1953' (right).

The meeting concluded back in the showroom, where we were remined of a little of the heritage of the GA Armitage brick company, with two 'Stiff Plastic' pressed bricks made at the company's principal site at Robin Hood, West Yorkshire.

MICHAEL CHAPMAN

ACKNOWLEDGEMENTS

The British Brick Society is very grateful to David and Guy Armitage for arranging this most interersting and informative visit.

De Boer logo is taken from the company's web site.
Photograpghs in Figs.1 to 12 and 15 from Mike Chapman collection.
Photographs Fig 13 and 14, courstesy of York Handmade Brick Co., sales literature.

FORMER BRICKWORKS IN THE NEWS: STEWARTBY, BEDFORDSHIRE

The former kilns at what was 'the largest brickworks in the world' at Stewartby, Bedfordshire, are due to be demolished prior to the site becoming almost a new settlement with 1,000 homes, a school, and community facilities. Bats have taken over some of the former kilns as places to roost.

As all bats are protected species, in February 2025 the site's developer, Harworth Group, submitted plans to have a bat kiln constructed to provide new accommodation for the roosting bats.

Another recent instance of bats being discovered roosting in an historic structure is at Fort Henry, Studland, Dorset, where four different British bat species — long-eared, pipistrelle, soprano pipistrelle, and a so far unspecified type of mouse-ear bat — are known to roost in a World War II bunker. Metal grills have been fixed over the openings to the bunker so that the bats can fly in and out but humans cannot enter. A colony of a fifth species — the greater horseshoe bat — also roosts at Fort Henry.

Both items were reported on local news sites of the BBC and its Teletext service with associated entries on the BBC local news website. Thanks are due to Alun Martin for alerting me to the Stewartby story.

Brick and Tiles for a Day: Hathernware Ceramics Ltd

Report on a joint visit to Hathernware Ceramics Ltd organised by the Tile and Architectural Ceramics Society, 3 October 2024

TILES & ARCHITECTURAL CERAMICS SOCIETY

British Brick Society

The history of bricks, brickmaking and brickwork

Hathern Terra Cotta™

Hathern Terra Cotta Ltd is a company within Michelmersh Brick Holdings PLC Group and is the UK's leading manufacturer of traditional handmade architectural terra cotta and faience ware. The company, whose roots go back to 1874 to the establishment of the Hathern Station Brick and Terra Cotta Company by George and James Hodson, by now combining those traditional skills with modern design and manufacturing methods supply these traditional products into both restoration and new-build projects. The following definitions distinguish the different types of product:

> *Architectural Terra Cotta* used as load bearing masonry or cladding, with the blocks being, ashlar, moulded, enriched or ornate, with typical earthy colours of red, buff, tawny or grey
> *Architectural Faience ware*, is described as terra cotta, but with a surface coating using either a glaze or engobe usually of a different colour and texture to the substrate or underbody
> The word *Faience* originates from a French term used to describe a specific type of earthenware made at Faenza, Italy, in the sixteenth century; the ware had a tin-based glaze that resembled Majolica and Delft ware.[1]

Originally known as Hathernware Ceramics, the production facilities were based within the Charnwood Forest Brickworks site, which BBS visited in 2005.

Figure 1 below is of the brickworks site showing the clay pit the source of the Mercia Mudstone used for brickmaking and then the manufacturing site, including the original round Beehive kilns used for firing, by 2005 these kilns had been replaced by modern kilns, fired with natural gas and still in use

Fig 1 Aerial view of the brickworks and quarry in the 1970s

Since then, however brick manufacturing has ceased, and the opportunity taken to expand production of terra cotta and faience ware to meet a growing demand and still using some of the equipment and space once occupied by brick production. The manufacture of terra cotta products is a highly skilled craft which combines pottery and sculpturing practice with a thorough knowledge of ceramics and glazes to produce both authentic reproductions and new creations. In many cases individual pieces that require replacing are inaccessible, or would require expensive means of access, so techniques such as scanning and photography using drones allows both the state of the building to be assessed and replacement pieces designed and manufactured.

A scale drawing of the building project is made which will highlight the individual pieces or sections of the building that require replacement. Most failures are due to corrosion and failure of the fixing framework rather than the ceramic piece itself.

Figure 2 (below) is a computer-generated image of a section of the Harrods Building in London with the red coloured areas denoting sections of original faience ware that has failed.

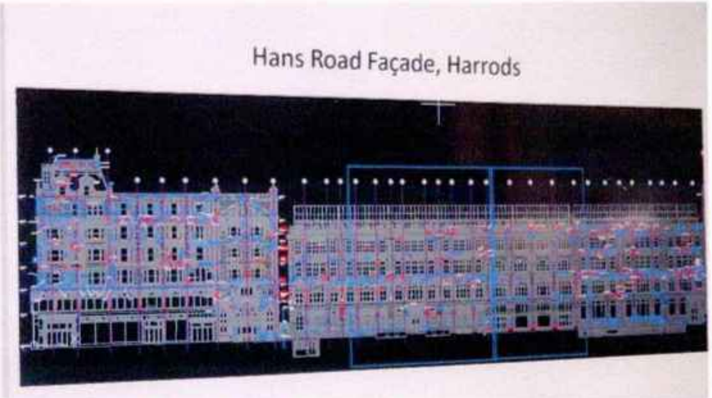
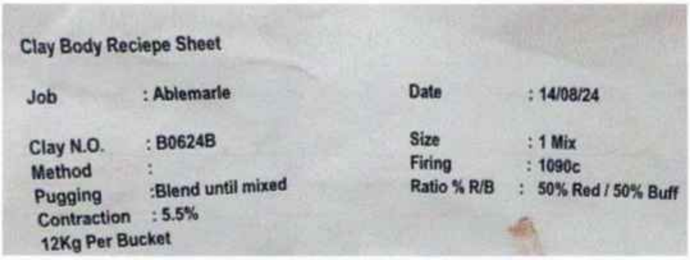


Fig.2 Harrods Building, Hans Road Façade, Knightsbridge, London SW3.

After the introductory talk the group was guided around the process starting with the preparations of the raw materials used, the original on-site clay source, Mercia Mudstone, is no longer used, with the quarry exhausted and that the products require refined clays and other pottery-related materials to achieve the very specific material recipe requirements. Although the clay source at Shepshed is exhausted, suitable clays, both fireclay and two types of red firing Etruria Marl, are both available from other Michelmersh sites; with these clays being selected and milled, to ensure they meet the quality criteria required they are then delivered in bulk bags to Hathern. These clays plus other additives that ensure optimal ceramic properties together with water are blended in a large weigh/mixer machine.



Clay Body Reciepe Sheet

Job	: Ablemarle	Date	: 14/08/24
Clay N.O.	: B0624B	Size	: 1 Mix
Method	:	Firing	: 1090c
Pugging	:Blend until mixed	Ratio % R/B	: 50% Red / 50% Buff
Contraction	: 5.5%		
12Kg Per Bucket			

Fig.3 (top) This is a recipe card detailing the project, Albemarle, the blend mix, 50:50 Red and Buff and the firing temperature 1090 degrees C. Albemarle refers to a job in Mayfair, Central London.

Fig.4 (below) The layout of the mixing/blending plant, with the green coloured bulk bags containing clays and the yellow painted equipment the mixer/blender.

Aside from the extreme care and accuracy taken to prepare a clay mix, the other key component is a mould of the piece required. Once a drawing has been approved this is given to a mould maker who, using Pottery Plaster (a Plaster of Paris mix) will manufacturer the mould to an exact size and shape. This is a highly skilled 'pottery procedure' and is an art form. The finished mould may consist of several individual pieces which fit together, or an individual one. The mould created becomes a 'mirror image' which is then used to produce the actual item required. The required piece is made by a highly-skilled craftperson working the clay, very carefully, into the mould. Occasionally, it is necessary to produce pieces by slip-casting, where the clay body is made into a viscous liquid and is poured into a plaster mould.



Fig.4 (left) The mould making Shop
Figs.5 and 6 (centre and right) Completed moulds ready for use

Whilst the accuracy of the mould enables the clay piece to be made, it is also vital that the fired piece matches the original in both colour and surface texture. With terra cotta this is achieve by ensuring that the clay constituents of the recipe are mixed to, not only achieve ceramic properties such as durability, but that the requirements of both colour and texture are met. For glazed Faience ware, it is also critical that a glaze body is produced which, once applied to the piece and fired that not only is the desired colour and texture achieved, but that the glaze achieves a 'ceramic fit' with the clay body.

> *A glaze* is defined as 'a thin glassy layer formed on the surface of the ceramic product by firing-on a prepared applied coating which can be initially applied to either a dried unfired piece, or to a fired piece, usually referred to a 'Biscuit Ware'. The glaze material can be either in powder form or as a water-based mix, known as a slop, with this being applied either by spraying or dipping.[2]
> A 'ceramic fit' is defined as when the substrate, or clay body, and the applied glaze match each other in their thermal expansion properties. to prevent 'crazing', or the development of random hair line cracks, the glaze must be held in compression as the piece is cooled from kiln exit to final room temperature and where the thermal expansion of the glaze must be less than that of the body.[3]

All this very specialised ceramic engineering takes place in an on-site laboratory, with test pieces made and fired until the required surface texture and colour is achieved. Over time an extensive library of test pieces has been established which provides an invaluable reference for future jobs.


Fig.7 (left) Examples of fired glaze colour.
Fig.8 (right) Examples of fired clay body mixes.

With the mould prepared, the next stage of the process is mould filling, where the soft prepared clay is carefully hand pressed into the mould. It is essential that all the exacting profiles are filled, and that air is not entrapped as this will spoil the surface finish leading to fired cracking. Aside from plaster moulds, wooden mould boxes are used for less complicated shapes.

Fig 9 (left) The completed pieces de-moulded and commencing drying.
Fig 10 (right) A complicated shape resting in the mould box, and one that has been de-moulded.

Fig.11 (top) Prepared mould of a frieze motif.
Fig.12 (below) The de-moulded clay shape being hand fettled for a perfect finish.

Once the pieces have been de moulded, they all need to be dried before being ready for glaze application and firing.

Depending on the size and complexity of the piece drying can take several weeks, and all carried out carefully monitored drying rooms where air flow, humidity and temperature are precisely controlled as an incorrect drying curve will result in cracking and failure.

Fig.13 (left) Plaster of Paris mould sets being dried prior to use.
Fig.14 (right) A selection of pices ready for entry into a drying room.

Fig.15 (left) A newly refurbished kiln car ready to be loaded.
Fig.16 (right) Kiln temperature controller,showing a target of 1200 degrees Centigrade.

Following drying the pieces are placed by hand onto kiln cars in readiness for firing. The kilns used are natural gas fired and are intermittent e.g. using a firing cycle from cold to top temperature and back to cold over a short period of time. These rapid temperature changes mean that the kiln structure and the cars are subjected to rapid thermal expansion and contraction which in turn causes the refractory structures to fail and require very regular maintenance.

MICHAEL CHAPMAN

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ACKNOWLEDGEMENTS

The British Brick Society records its thanks to both Hathernware Ceramics and the Tile and Ceramics Society for this visit.

The photographs used in Fig 11,12 and 14 are by Paul Rothery and Cynthia Church. All other photographs are from the Mike Chapman Collection

Fig.17 An example of workmanship achieved by Hathernware Ceramics. Statutary for the Elite Cinema building in Upper Parliament Street, Nottingham.

BRICK AT RISK:
THE GREAT WHITE HOUSE HOTEL, IPSWICH, SUFFOLK

The Great White Horse Hotel in Ipswich, a coaching inn, was originally a timber-framed building erected in the late sixteenth or early seventeenth century, but when Tavern Street was widened in 1821 was re-fronted in Suffolk white bricks with the ground floor covered with stucco and rusticated. The building, on the north side of Tavern Street at the junction with Northgate Street, is symmetrical of seven bays and three storeys. The two outermost bays are both wider than the others and once had through arches leading to the yard at the rear. Here the walls are timber-framed with a wattle-and-daub filling.

Charles Dickens stayed there more than once and it is thought to have been the inspiration for the hotel in his first novel, *The Pickwick Papers* (1837). Dickens wrote of the building that 'it was famous in the neighbourhood in the same degree as a prize ox, or a country-paper-chronicled turnip, or a prize pig.' A replica of the building was erected at the British exhibit at the delayed Columbian Quadri-centenary Exposition in Chicago in 1893 and 1894.

In 2023, the building was among 159 new entries placed on the 'Buildings at Risk' register of English Heritage. For the Great White Horse Hotel see J. Bettley and N. Pevsner, *The Buildings of England: Suffolk: East,* New Haven and London: Yale University Press, 2015, page 340.

D.H. KENNETT

Brick Roads in a Lincolnshire Village

Ken Redmore

Tetney, about six miles south of Grimsby, is one of Lincolnshire's larger villages, covering an area of 2200 Ha and having a population of 440 in 1801 rising to 869 by 1851. The parish lies in an area of low-lying marshland between the Wolds and the sea; the underlying alluvium is generally well suited to brickmaking. At the eastern extremity of the parish is Tetney Haven, a small estuary which was the starting point of the Louth Navigation (opened in 1767) and gives access to the North Sea. The village centre is approximately three miles inland and one mile from the navigation at its nearest point (Fig.1).

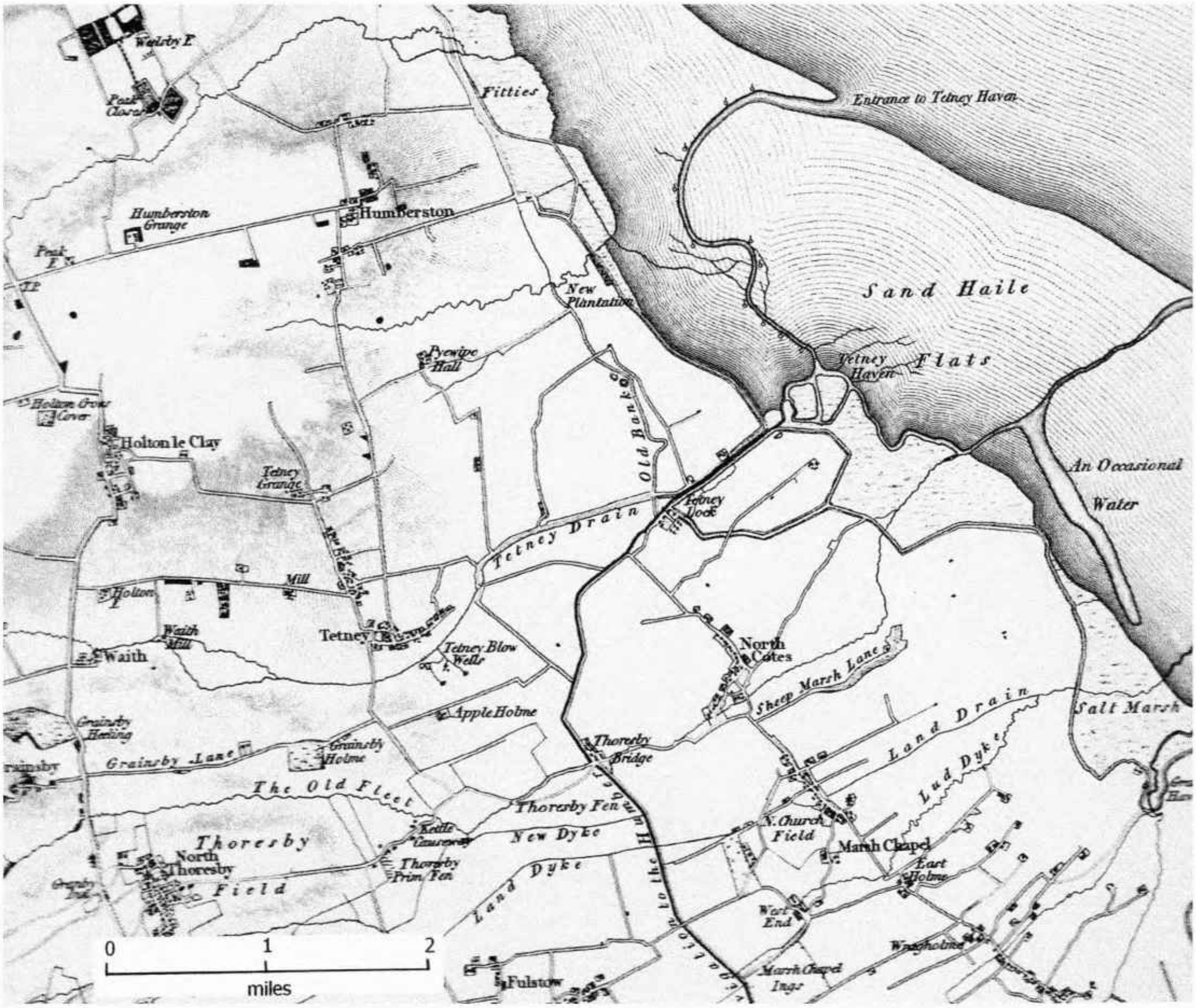

Fig.1 Tetney location map (from OS 1-inch map, 1824)

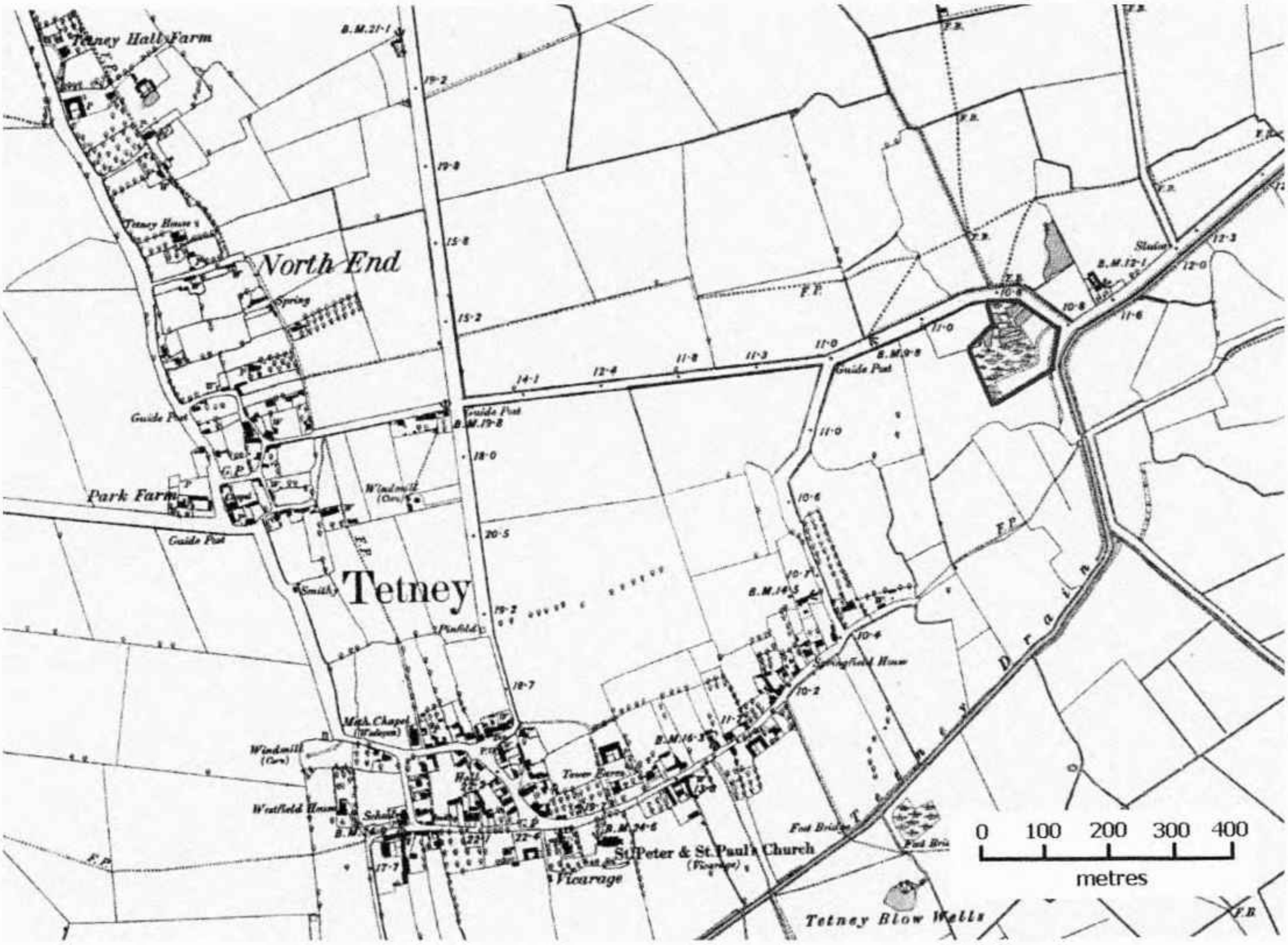

Fig.2 Location of 'gravel pit allotment' or brickyard in Tetney (TA 322016), outlined. (from OS 6-inch map, 1887)

The Enclosure of the parish in 1774 provided a 'Gravel Pit Allotment' of 3 acres, described as 'a parcel of land set out to be used for repair of highways and other roads, for making bricks for public bridges, tunnels, cloughs or other public works'.[1] The piece of land identified for this purpose was close to the centre of the village and, from the evidence of early OS maps, was developed as a brickfield and probably completely worked out and abandoned before1850 (Fig.2).

It is clear that bricks made at this village site were used for much more than the construction of bridges, tunnels and cloughs along the local roads. Bricks were also laid down as the road surface itself. The account books, maintained by the Surveyor of Highways and held now in the Tetney parish chest, give clear details of this roadmaking practice, which probably operated from the early years of the nineteenth century until about 1826.[2]

Over the period for which detailed highways accounts can be examined, several hundred thousand bricks were used in the parish each year to provide the surface material for village roads. For example, the accounts for October 1819 show that William Neave and John Hinch, the brickmakers who leased the parish-owned brickyard, were paid £83 18s 6d for making 167,580 bricks (at ten shillings per thousand). Twelve months later these brickmakers supplied a further 396,600 bricks.

The accounts also record the lengths of road being created or mended. In 1821 bricks costing £118 9s 9d were used in Humberston lane, North End road and Hoop End road, a total distance of 133 roods and 4 yards.[3] The cost of laying the bricks is given as 17/9 per rood. Half of Humberston road was laid in brick and sand in 1824 and in November the following year bricks burnt by William Neave were 'to make seventy or eighty Roods of new road ten feet wide and ten inches thick at eighteen shillings a Rood, and sixty or eighty thousand of bricks to mend the roads with at ten shillings and sixpence a thousand.'

In 1819 the parish specified the size of bricks for roadmaking to be 11½ x 5½ x 3 inches, considerably larger than normal. From these dimensions and the road specifications quoted above it seems likely that bricks were laid on edge, i.e. five and a half inches high, on a bed of sand about five inches thick. If these assumptions are correct, the length of new road laid in a single year would have been about two miles.[4]

After 1826 the Tetney highways account books contain no further reference to the use of bricks in roadmaking. Before this date, when bricks were still the principal road building material, relatively small amounts of gravel (33 tons in 1820, for example) had been purchased by the parish, but the quantity increased considerably later in the decade when the use of bricks ceased to be recorded. In the twelve months from March 1827, for example, almost 1200 tons of gravel were brought to the village at a cost of 3s 2d per ton, plus unloading costs at the Haven of 8d per ton. It is apparent that by this date gravel from Spurn or the East Yorkshire coast, brought by boat into Tetney Haven, had become the principal road making material used in the village instead of bricks.

Chalk, another material widely used for roadmaking in east Lincolnshire, was also mentioned in the highways accounts of this period. It was brought to the parish from the Wolds (about six miles distant), in small quantities and delivered at irregular intervals. Much larger quantities of sand (chiefly from neighbouring Humberston) were bought at one shilling per load, presumably to serve as a base layer beneath a wearing course of brick or gravel.

DISCUSSION

It is not clear whether Tetney was the only village in the coastal marsh area of Lincolnshire where bricks were used as a road surfacing material. In the vestry records of nearby parishes the only roadmaking material mentioned was gravel, and in the case of parishes further west, local stone was the material usually deployed. However, the apparent anomaly of Tetney's practice has to be treated with caution; there are relatively few early nineteenth-century records surviving for Lincolnshire parishes, especially any giving detailed accounts of road building comparable to those at Tetney.[5]

If Tetney was indeed rare or even alone among Lincolnshire villages in using bricks for roadmaking, how did the idea and the underlying technical knowledge reach the village? One suggestion might be that bricks were already being laid in the urban streets of Grimsby or Louth, the nearest towns to Tetney, but there is no evidence for this practice in the surviving records of either place. It is much more likely that by some means the Tetney vestry became aware of the well-established practice in Holland of using bricks extensively for making reportedly excellent roads.[6] Possibly, one of the village landowners brought the idea into the village through direct knowledge or by word of mouth through a shared social network, though there is no evidence to support this supposition.[7]

Building new roads in a village was an expensive undertaking.[8] In Tetney, when bricks were being used for road building, the annual expenditure on the highways, which included costs of labour as well as materials, exceeded £500 in several years. This high level of expenditure would conceivably have been even higher had the parish not owned the brickyard and as a consequence been able to purchase the bricks at about half the normal price.[9] The income for this work was raised through rates imposed on the land and property owners of the village.

The resolution of the Tetney vestry to specify bricks of an exceptionally large size is difficult to understand. The brick tax, first imposed in 1784, was a flat rate determined by the number of bricks fired. It had led, in several recorded instances, to an increase in the size of bricks in order to reduce the amount of tax payable. But from 1803, under new legislation aimed to curb this practice, any bricks larger than 8 x 5 x 3 inches were taxed at double the standard rate. Thus, at Tetney, any saving accrued by using fewer bricks as a consequence of their abnormal size was likely to have been offset by a higher tax bill. Nevertheless, despite the financial disadvantage, many instances are known across England of larger bricks still being produced and used after the 1803 tax change, and this seems also to have been the case at Tetney.[10]

Regardless of the cost benefits or penalties of using abnormally large bricks for roadmaking, there are technical reasons why the Tetney practice probably had limited success. A road surface, even for early nineteenth-century traffic, had to be stable and hard-wearing, and this implied the use of well-fired bricks of very good quality. Unfortunately, whatever their skill and experience, the local brickmakers would have found it difficult to make durable clamp-fired bricks from the local clay, especially of the size specified by the vestry.[11] By contrast, in Holland roads were paved with small over-fired bricks, known as clinkers, which were found necessary to create a hard-wearing surface.[12] Producing bricks of this type in the necessary quantities would have been impossible at the Tetney village brickyard and, regrettably, there are no other references to brick size in the account books, either before or after 1819, to indicate whether smaller bricks were deployed at any time. It is clear, in any case, that gravel became the favoured road surfacing material in the late 1820s, suggesting that using bricks, whatever their size, was no longer considered satisfactory, possibly in terms of cost as well as performance.

The experiment of using bricks for the surface of a rural road in an early nineteenth-century English village appears to be a very rare occurrence. No other contemporary examples have been identified. As we have seen, brick roads were laid down extensively in Holland at about the same time. It is also recorded that the technology extended to some urban streets in American cities in the 1870s, but not earlier.[13] Road engineers in England seriously considered following the American example in the 1920s, but no reference was made to the much earlier practice in their own country.[14]

Perhaps one should conclude that Tetney's bold use of bricks for roads was an isolated and unsuccessful experiment of little historical or technical significance.

NOTES AND REFERENCES

1. Lincolnshire Archives, Lindsey Award/215
2. An unbroken run of detailed highways accounts, covering most of the nineteenth century and starting in 1820, are held in the parish chest at Tetney. Quotations from earlier records, no longer extant, are made in John Wild, *Tetney, Lincolnshire: A History,* Grimsby: Albert Gait, 1901.
3. 'Rood' in these accounts is a linear measure, rather than one of land area. It was originally the same as a 'rod' and is usually equivalent to seven or eight yards (OED).
4. One rood would require 900 to 1000 bricks. One mile would require more than 200,000 bricks.
5. Lincolnshire Archives hold early nineteenth-century highway accounts for the following parishes: Frampton, Gedney, Heckington, Humberston, Marshchapel, Riby, Scartho and Wigtoft.
6. *A Handbook for Travellers on the Continent (Northern Germany),* John Murray, 7th edition, 1850, Section 1, p.3.
7. The principal landowners in Tetney were members of the Cholmeley, Sibthorp and Lumley (Earls of Scarbrough) families.
8. In 1774 the enclosure commissioners dealt with the laying out of new roads in the parish and the costs of this work were included within the charges that they levied at that time. It may be that the highway accounts of the 1820s refer to the creation of additional minor roads in the village not laid out at the time of enclosure, but in several instances well-established and significant village roads are described as 'new'. This suggests that the parish found it necessary to completely rebuild roads laid down almost 50 years earlier.
9. The Tetney vestry paid the local brickmakers between 9/6 and 10/6 per thousand. The price for bricks bought at the yard quoted elsewhere at this time was about £1 per thousand. For example, in 1789 Edward Greenwood of Billingborough charged 18/- for common bricks and 21/- for facing bricks (*Stamford Mercury*, 7 August 1789) and in neighbouring Humberston 12 shillings was paid for 600 bricks in 1820-21 (Centre for Buckinghamshire Studies: D-CN 18/1/5, ff. 90-3).
10. See T.P. Smith, 'The Brick Tax and its Effects – Part II', *BBS Information* **58**, Feb 1993, pp. 14-19.
11. To give a contemporary Lincolnshire example, the relative weakness of over-sized bricks (10 x 5 x 3 inches) was a factor in the collapse of locks and bridges built for the Horncastle Canal in 1793 (J. N. Clarke, *The Horncastle and Tattershall Cana*l, Oakwood, 1990, pp.23-26).
12. Murray, *Handbook for Travellers*, Section 1, p.3.
13. The first recorded use of bricks in road building in the United States was in the streets of Charleston, West Virginia in 1870.
14. P.E. Spielmann and E. J. Elford, *Road Making and Administration,* London: Edward Arnold & Co, 1934, p.172.

Quickness, cohesion and plasticity: Properties of ground materials (relevant to brick making)

John Howarth, Ian Smalley

Quickness, with reference to ground materials, is the ability or propensity to transform from solid state to liquid- as in quick sand or quick clay. In his submission to the Children's Employment Commission for the 1866 report,[1] Mr H.W. Lord, the inspector of brickfields, quoted verbatim some remarks by Mr. Wilson, the foreman at Mr. Wythe's Field in the Faversham area:

> This is a very decent field ... there are 16 stools here. Each stool employs at least seven persons. I do not think that machines would succeed for us; our dirt is too quick.

In the brickearth at Faversham the transition from solid to liquid is too rapid, too uncontrollable for the brick making machines to cope. This was ground material suited for manufacture of bricks by hand.

Most of the ground materials used in brick manufacture are relatively complicated and the interactions between the constitutive particles can be complex. It is the interactions which control the properties and have to be understood if the processes involved in actually making a brick are to be clarified.

What did Mr. Wilson actually mean? Can we deconstruct this interesting sentence? What does he mean by *quick*? What does *quick* mean in this context? This is unusual terminology in brick-speak. We are familiar with quick sand and quick clay but the quickness of brickearth is not a concept that is frequently encountered. Quick sand is defined as: Fine, loose sand that is usually saturated with water and semi-liquid, tending to suck down objects that rest on its surface,' that is the Oxford English Dictionary definition, and it tells us little about the nature of quicksand. This is a material which exists at the interface between solid and liquid, it is essentially a transitional material. This transitional region is defined in terms of water content.

Water is a key constituent of brick making materials. Water is a surprisingly complex material and this complexity is critical in determining the properties of raw materials for bricks- both clay mineral based clay bricks and brickearth based loam bricks. The water molecule is polarised; overall it is electrically neutral but it is asymmetric, one side is negatively charged and the other side is positively charged- this is one of the key factors giving plasticity to brick materials. The making of a clay based brick involves the shaping of a very complex material. There is the clay mineral material itself, there is the polarised water, there are dissolved cations in the water which can affect plasticity- usually $Na+$ and $Ca2+$; there is usually a small amount of silt and a small amount of sand. Sand and silt particles are usually quartz with mode sizes of around 300μm for sand and 30μm for silt. The clay mineral particles (-size around 2-3 μm) are by and large negatively charged, due to a lack of positively charged ions in the crystal structures. The brick making material forms a cohesive, plastic mass because the clay mineral particles attract each other via a network of polarised water molecules. It is a long distance bond between the clay particles; it is a mobile bond and this gives the system its plasticity.

Plasticity: the concept needs to be examined and defined and (out in the real world) measured. Plasticity-OED- 1727: n. The quality of being plastic; the ability to be easily moulded or to undergo a permanent change in shape.

Plastic clay n. 1811: clay particularly suitable to being shaped, specifically clay from any of the middle group of the Eocene clay beds, immediately underlying the London clay.

Dr Samuel Johnson 1755 plastic: Having the power to give form. Benign creator! Let thy plastick hand dispose its own effect.

Plastic deformation can be illustrated by reference to a piece of copper wire. Take a piece of copper wire, bend through 90 degrees- a demonstration of plastic deformation. The wire has undergone a permanent change in shape, but it is still essentially a piece of copper wire, unchanged in its major properties of strength and conductivity. It is able to accept this change in shape because the copper atoms (really copper ions) are held together in the copper structure by metallic bonds. The more familiar chemical bonds (e.g. covalent or ionic) are brittle bonds; deform the bonded system and the bonds break and the item fractures. Not so with metallic bonds; in the copper piece the copper atoms are all positively charged (by losing an electron each) and they exist in a sort of sea of electrons, which can move about. The copper atoms can be re-arranged but the bonding action still functions; this allows plastic deformation.

Something similar can be described for a clay/water system. Here is the classic plastic system – necessary for makers and sellers of ceramic items and bricks. The units are negatively charged clay mineral particles which exist in a watery environment which contains dissolved cations, each with a positive charge. The clay units can change position relative to each other when the system is undergoing shear stress.

Plasticity was discussed in Edward Dobson's pioneering work on brick manufacture;[2] this was first published in 1850 but in the seventh edition of 1882 there was added an essay on plasticity by Charles Tomlinson (material presented at a meeting of the Geologists Association on 3 February 1862) ...

> The Plasticity of Clay ... the more I consider this property the more wonderful and inexplicable does it appear. Take a mass of dry clay; it cracks easily, and crumbles readily: add to it a certain proportion of water, and it becomes plastic...
>
> All this is very wonderful ... Clay is almost the only substance in the mineral kingdom that possesses plasticity ...

In 1911 Alfred Searle[3] published his treatise on modern brickmaking and the opening pages emphasized the importance of plasticity:

> Bricks and tiles may be made from a large number of different kinds of material but they must usually possess a certain amount of plasticity.
>
> The plasticity of clay is a property which distinguishes it from nearly all other mineral substances, and may be defined as the property of a body which enables it to absorb water in such a manner that the properly moistened body yields to mechanical pressure, but, when the pressure has been removed, the shape of the body remains as though pressure were still acting upon it.
>
> The cause of plasticity is practically unknown, but it appears to be closely related to the ability of each clay particle to surround itself with a coating of water sufficiently large to produce plasticity, but insufficient to cause the body to lose its shape when the external pressure is removed.
>
> Clay or brick earth is almost the only substance of mineral nature which possesses this plasticity ...

At about the same time as the Searle book was published great advances were being made in the study and consideration and measurement of plasticity. These great and critical steps were due to Alfred Atterberg[4] (1846-1916), a Swedish chemist and agricultural scientist, mostly from the University of Uppsala (PhD Chemistry 1872). It was towards the end of his career that, while continuing his work on chemistry, he began to focus his efforts on the classification and plasticity of soils, for which he is most remembered. He found plasticity to be a peculiar characteristic of clay. He also proposed a system for measuring it, for giving the plasticity of the deforming system a number, quantification arrived in the world of clay and clayey materials. In terms of water content Atterberg set some limits; he defined the point of transition from liquid state to plastic solid state- the liquid limit (LL) and the point of transition from plastic solid to brittle solid (PL), and he produced an equation (not quite so earth-shattering as $E = mc^2$ but significant in farming, soil mechanics, ceramics and brick making):

PI = LL - PL

Plasticity Index PI is equal to the Liquid Limit LL minus the Plastic Limit PL. PI is a measure of plasticity of the material being tested; it is measured in terms of water content; it represents the extent of the plastic solid region- a high PI a very plastic clay, a low PI a non-plastic clay.

	sand	silt	clay	LL	PI
Brickearth	5	85	10	26	2
'Clayey' clay	6	22	72	67	40

Two examples can be considered (numerical data from Wikipedia). The brickearth is a default brickearth- used to manufacture London Stock bricks. This could be the brickearth in Mr. Wythe's field at Faversham, this is the material that Mr. Wilson thought was too quick to be manipulated by machine. The quickness is evident in that value of 2 for PI; this is a material without plasticity, the plasticity range is tiny; but this can be made into bricks by a team of co-ordinated brickmakers at their stool.

The clay mineral content is low, this allows the bricks to dry efficiently on the hack ground; the silt content is high reflecting the brickearth origin as loess.

The 'clayey' clay represents a normal clay mineral rich ground such as is used to make bricks in most of the UK. This is clay material for making clay bricks; the default clay brick. In the Searle book this is the clay which is being discussed; by 1911 the hand making of clays from loessic brickearth had more or less died out. Had Searle been writing in 1850 he would have needed to focus more attention on brickearth and the bricks for London. The clay mineral content is relatively high at 72% and the PI is consequently fairly high at 40; this is a properly plastic material. The LL is high, it can accommodate a substantial amount of water, and retain its useful plastic nature.

The great advance made by Atterberg was to define the limits of plasticity and to propose a measurement system. This system was amazingly effective and was adopted by the geotechnical community and was the backbone of soil mechanics for a century. The science of plasticity remained to be explored. To probe the secrets of the nature of plasticity a whole new science had to be invented: rheology- invented by Eugene Bingham early in the 20th Century and essentially predicated on the problem of plasticity.

Eugene Bingham[5] (1878-1945) was a professor of chemistry at Lafayette College in Easton, Pennsylvania, USA. His great work *Fluidity and Plasticity* was published in 1922. Many materials which exhibit plasticity are called 'Bingham plastics' in his honour. A Bingham plastic is defined as a viscoplastic material that behaves as a rigid body at low stress but flows as a viscous fluid at high stress. At low stress the material is resistant but a yield point is reached and then the flow regime changes. The existence of the yield point is important. The yield point phenomenon drove many early analyses and studies. The Bingham plastic is used as a common mathematical model of mud flow in drilling engineering, and in the handling of slurries. A common example is toothpaste; it works for brickclays.

The physical reason for this behaviour is that the liquid contains particles (such as clay) or large molecules (such as polymers) which have some kind of interaction, creating a weak solid structure- and a certain amount of stress is required to break this structure. Once the structure has been broken, the particles move with the liquid under viscous forces. If the stress is removed the particles associate again, this is the essence of plasticity.

Plasticity(in brick world) is a consequence of the electrochemical mix in the clay- water system. This also causes cohesion which gives the clay its strength, its ability to resist shear stress. Resistance to shear stress is measured in the Coulomb equation, another stalwart from the world of soil mechanics:

$$\mathbf{s = c + \sigma \tan\Phi}$$

where s is shear strength, c is cohesion, σ is normal stress and $\tan\Phi$ is the coefficient of plane sliding friction(the interaction of larger particles). Since brick clays and loams are essentially fine particle systems (i.e. no sand or gravel) the large particle parameters can be neglected in the Coulomb equation and it becomes:

$$\mathbf{S = C}$$

This is an agreeably simple equation to apply to the clayey material used for making bricks. The brickearth in Mr. Wythe's field has a clay mineral content of 10%, a relatively low clay mineral content; this brickearth is not particularly cohesive and as a result it has a low shear strength; it is easily moulded by hand at the stool. The experienced moulder can produce many bricks in a day's work. The 'clayey' clay has a clay mineral content of 72% and is definitely cohesive and has a high shear strength, but it has a large PI and is well suited for brick production in a brick making machine, this is a properly plastic material- a Bingham plastic; in no way quick but very cohesive.

NOTES AND REFERENCES

1. Children's Employment Commission (UK Government) 5th Report 1866. *Report on brickfields* by Mr. H.W. Lord.
2. Edward Dobson 1850. *A Rudimentary Treatise on the Manufacture of Bricks and Tiles: Containing an outline of the Principles of Brickmaking.* First edition 1850; 7th edition 1882; revisions by Charles Tomlinson. London: Crosby Lockwood, 276 pp.
3. Alfred B. Searle 1911. *Modern Brickmaking.* London: Scott Greenwood, 441 pp.
4. Albert Atterberg (1846-1916). Difficult to find good references for Atterberg. Bingham in 'Fluidity and Plasticity' gives six Atterberg references, indicating his importance in the development of the study of plasticity. Perhaps the critical reference is from 1911: 'Uber die physickalische Bodenuntersuchung, and uber die Plastizitat der Tone', *Internationale Mitteilungen der Bodenkunde* **4,** 10-43.

A biography by T.E. Blackall, 1952, 'A.M. Atterberg, 1846-1916', *Geotechnique*, **3,** 17-19.

5. Eugene Bingham (1878-1945). His great work was the 1922 book: *Fluidity and Plasticity,* Chicago: McGraw-Hill 440 pp. Bingham, E.C. 1916.'An investigation of the laws of plastic flow', *Bulletin of the Bureau of Standards*, **13,** 309-353.

BRICK IN PRINT

Between September 2024 and January 2025, the Editor of the British Brick Society has received notice of a number of publications on brick and its uses of interest to members of the British Brick Society. 'Brick in Print' has become a regular feature of *BBS Information*, with surveys usually two or three times a year. Members who are involved in publication or who come across books and articles of interest are invited to submit notice of them to the editor of *BBS Information*. Websites and television programmes may also be included. Unsigned contributions in this section are by the editor.

D.H. KENNETT

Elizabeth A. Murphy and J. Roley Snyder, 'Bound by Binders: Multicraft Organisation and Industrial Interdependence in Lime production for Mortar in the Eastern Mediterranean during Late Antiquity', *Journal of Late Antique, Islamic and Byzantine Studies,* **3** (1-2), September 2023, pages 179-208.

In the late antique period (fourth to seventh centuries AD) lime was produced and consumed in great quantities for use in building, medicine, tanning, fulling, mortuary practices, and as agricultural fertiliser. As a result, lime kilns (and associated slaking pits) were common features of late antique contexts, both in urban and rural environments and involving public institutions and private enterprise. The paper considers the archaeological remains of lime production and use in the eastern mediterranean, a region in which dozens of lime production sites have been recorded. Focusing on the example of lime mortar production specifically and following evidence for associated *chaîne opératoire,* the authors demonstrate the versatility of lime production processes and how it involved and even relied upon multiple industries.

AUTHORS' ABSCTRACT

Received for Review

Gavin Stamp,
Interwar British Architecture 1919-1939,
London: Profile Books, 2024,
vi + 570 pages; 16 pages plates with 38 colour photographs; numerous, unnumbered, black-and-white photographs,
ISBN 978-1-80081-739-5,
Price, hardback, £40-00

A Review will appear in a future issue of *British Brick Society Information.*

NOTES ON CONTRIBUTORS

SUE ANDERSON obtained a first degree in Archaeology at the University of Durham, followed by research in human bone for an MPhil. She became a specialist in finds, particularly ceramics, while working for Suffolk County Council Archaeological Service, and moved to Scotland to manage post-excavation work for CFA Archaeology Ltd. She returned to Norfolk to set up a freelance business (Spoilheap Archaeology) as a finds and post-excavation specialist in 2013, and later undertook PhD research at the University of East Anglia, focusing on the medieval pottery of East Anglia. She has contributed numerous reports on brick and tile to archaeological reports in this region over several decades.

ROB BROOKS read for a degree in Archaeology at the University of Southampton, addressing ritual behaviour in Iron Age East Anglia in his dissertation. He went on to work in Archaeology for Suffolk County Council, Suffolk Archaeology, and Cotswold Archaeology, setting up and managing excavations. He has published articles on Roman burial and industrial practices in Long Melford, as well as post-medieval settlement in Cambridgeshire. He subsequently obtained an MSc in sustainable building science and gone on to work on flood risk investigations for the Environment Agency.

MICHAEL CHAPMAN is Chairman of the British Brick Society. He spent his working life in the UK Brick Industry, gaining a range of professional qualifications enabling him to work in technical and managerial roles and gaining expertise in all aspects of brick production and general management. Since retirement, he has remained active as a consultant, working on environmental, training, and quarry projects. He also remains active in the industry's professional institution, the Institute of Materials, Minerals and Mining, being a Fellow of the Institute and through it a Chartered Environmentalist. His principal interests lie in all aspects of both historical and modern brick manufacture and the application of brick in the built environment and as a contributor to *British Brick Society Information.*

CHRIS FERN obtained a degree in Archaeology and History at the Univesity of Nottingham, followed by an MA in Early medieval Studies at the University of York. He is a specialist in Early Ango-Saxon art and archaeology, but he dabbles in all periods of the past, having worked since 2021 as a Post-Excavation Manager for Cotswold Archaeology. Contact *chris.fern@cotsworldarchaelogy.co.uk*

DAVID H. KENNETT is the Editor of *British Brick Society Information.* A retired lecturer in Sociology, he holds degrees in Archaeology, in Construction Management and Economics, and in Technology and Society from Prifysgol Cymru, Bristol Polytechnic, and Salford University, respectively. His brick interests centre on the relationships between building patronage, the building patron's wealth, and the resulting buildings; applying construction management skills to the documentary evidence about earlier buildings; and on the use of brick in religious buildings. In April 2025 he will be a Visiting Scholar at the Vinson Centre, University of Buckingham, researching 'The Kuznets Cycle and the Construction of Gentry Houses, *circa* 1400 to *circa* 1800'.

HAN LI is the building materials specialist at the Museum of London Archaeology and was trained under the tutelage of the now retired Dr Ian Betts. Han assesses ceramic building material from London and the surrounding counties. He is a specialist in bricks, tiles, and stones from the Roman to post-medieval periods. Han's role at MOLA also includes the analysis of Roman painted wall plaster and the assessment of standing buildings dating to the post-medieval period.

JOHN HOWARTH obtained his first degree in Mathematics at Peterhouse, Cambridge, and went on to gain an MSc in Statistics at London University. His career has involved mathematical modelling, first with the UK government and subsequently in the avionics industry. He developed a long-standing interest in modelling and hydroconsolidation of loess when he joined Ian Smalley and Hugh Nugent in the Brambledown Research Project. He is a native of north-west Kent.

KEN REDMORE is a retired local government officer with a degree in Chemistry. He taught in secondary schools and a college of education before joining Lincolnshire County Council working in curriculum development, school administration and capital construction projects. Since retirement he has developed his interests in industrial archaeology, especially agricultural engineering, the gas industry and nineteenth-century brick making. His articles 'Some Brick Kilns and Brickmakers of East Lincolnshire' and 'A Semi-Continuous Kiln at East Halton, Lincolnshire' were published in *British Brick Society Information,* **108,** September 2008, and *British Brick Society Information,* **149,** February 2022, respectively.

IAN SMALLEY was born in Crayford in north-west Kent, close to the fringes of the Crayford Brickearths. He studied at Battersea Polytechnic and City University, London, and has been investigating the nature and properties of loess ground since 1964. He was President of the INGUA Loess Commission, 1999-2003, and is currently an honorary professor at Leicester University. At Leicester, he worked with the Experimental Firing Group of Ann Woods and the Centre for Loess Research and Documentation. Contact: *ijsmalley@gmail.com* and *loessground.blogspot.com*

ANNA WEST obtained a BSc in Archaeological Sciences at Liverpool University. She now works un the Archaeology profession both excavating in the field and within post-excavation. Since 2009, Anna has specialised in Environmental Archaeology, on developer-funded and community-funded research projects, both across East Anglia and nationally.

Submission dates for future issues of *British Brick Society Information*

BBS Information, **159,** August 2025, please submit items by Saturday 21 June 2025.
BBS Information, **160,** February 2026, please submit by Wednesday 10 December 2025.
BBS Information, **161,** August 2026, please submit by Saturday 20 June 2026.

Contributions on brickmaking for a 'Brickmaking' issue in 2026 and/or on the uses of brick in religious buildings for a 'Brick in Churches' issue in 2027 would be particularly welcome.

Individual papers have been submitted on both subjects and the Editor is keen to make an issue which concentrates on each of these topics.

Please contact the Editor, *British Brick Society Information,* if you have any queries regarding these dates and would like a possible *short* extension thereto.

Thank you,
DAVID H. KENNETT
Editor, *British Brick Society Information*
davidkennett510@gmail.com

BRITISH BRICK SOCIETY
MEETINGS in 2025 and 2026

Wednesday 16 April 2025
Works Visit
DSF Refractories & Minerals Ltd, Friden, Newhaven, near Buxton, Derbyshire SK17 0DX
Contact: Mike Chapman: *Chapman481@btunternet.com*

Friday 20 June 2025
Brickworks Visit
W.H. Collier works at Marks Tey, Essex
To coincide with the AGM in Colchester
Contact: Mike Chapman: *Chapman481@btunternet.com*

Saturday 21 June 2025
Annual General Meeting
Colchester, Essex
The 52nd Annual General Meeting of the British Brick Society
Tour of the Roman circus in the afternoon.
Contact: Mike Chapman: *Chapman481@btunternet.com*

Wednesday 24 September 2025
Joint Meeting with the Society for Lincolnshire History and Archaeology
Gainsborough, Lincolnshire
To include talks and tour of Gainsborough Old Hall
Contact: Mike Chapman: *Chapman481@btinternet.com*

Saturday 18 April 2026
Spring Meeting
Derbyshire: East along the A52
Visiting the Moravian Settlement at Ockbrook and the buildings of the Willoughby family in Risley, including their brick-built chapel added to the church at Church Wilne
Contact: David Kennett: *davidkennett510@gmail.com*

Saturday 20 June 2026
Annual General Meeting
Crewe
Full details to follow. Tour of the town in the afternoon.
Contact: Mike Chapman: *Chapman481@btunternet.com*

Visits to Alcester, Warwickshire; Cardiff Bay; and Tewkesbury, Gloucestershire, are being planned for future years.

All meetings are subject to attendance at the *participant's own risk*. Whilst every effort is made to hold announced meetings, the British Brick Society is not responsible for unavoidable cancellation or change.

Full details of future meetings will be in the subsequent BBS Mailings.
The British Brick Society is always looking for new ideas for future meetings.
Suggestions of brickworks to visit are particularly welcome.
Offers to organize a meeting are equally welcome.
Suggestions please to Michael Chapman or David Kennett.