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Introduction

Project aims

The aim of this project is to assess the distribution and use of iron-bound or ferruginous gravels and sands, Roman tiles and (Leziate) grey quartzite stone in Norfolk's early churches. The author has approached this as a field archaeologist rather than as an architectural historian and he hopes that this will add some new perspectives to a fascinating subject.

There were at least 921 stone churches built in Norfolk between the eleventh and sixteenth centuries. Of these 610 are still in use (excluding Lothingland added during the 1974 local government reorganisation). That number is by far the largest for any English county. The next is Lincolnshire with around 600 and of these 445 are still in use. In Suffolk 580 were built and 460 are still in use (Batcock 2005, 58-9). Domesday recorded 270-2 in Norfolk (Butcher 2019) although it has been argued that the real figure was probably at least double that. The eleventh and twelfth centuries were a time when churches were being built in the county on a "ferocious" scale (Williamson 1993, 154-161). Every manor had to have one!

The survey area has included the whole of Norfolk east of the River Great Ouse and just a handful of Norwich churches which could show any signs of early work. So, 649 churches were visited between May 2021 and May 2023.

The survey evidence has been gathered usually from a single survey visit, but more if required. Technically it is only the gravels which should be described as ferruginous conglomerate but for the sake of brevity both the iron-bound gravels *and* the sands are collectively described here as 'conglomerate' since nearly all the ferruginous stone is derived from gravels. As will become clear, the use of these materials dates from the earliest period of church building before Barnack limestone from the Stamford area had become readily available. Locating all this material is one way of identifying some of Norfolk's earliest churches even when all doorways and windows have long been replaced.

While, of course, it is important to recognise that there are early churches where only flints were used for quoins, windows, tower arches and doorways, this corpus of early materials provides a fresh approach to our understanding of early church building in the county.

The dating of early churches can become confused when so many publications have asserted in the past without reservation that a building, particularly when it has a round tower, is 'Saxon' (especially Goode 1994). The evidence to support these assertions has to be questioned when we know for sure that double-splayed windows, triangular-headed doorways and long-and-short work continued throughout the eleventh century and probably into the twelfth. Great Dunham is a classic case where all these features described elsewhere as 'Saxon', were integral to an indisputably post-Conquest Norman structure (Heslop 2014). Great Dunham also contains Roman tiles, and round double-splayed windows are prominent in the west wall of the cathedral cloisters at Norwich.

So, the author is not tempted into a debate about which churches in the county are pre- or post-Conquest. Only scientific techniques, like dendrochronology, radiocarbon dating, Optical Stimulated Luminescence (OSL) and Oxygen Isotope Analysis, or coins and pottery from excavations, will now further this debate.

Where there has been scientific dating at the early square west tower at Hethel, which has both long-and-short work, double-splayed windows and Roman tiles, dendrochronology on a piece of timber forming the roof of a putlog hole showed that the tower is not likely to have been built before *c.* 1100 (report by Phil Thomas held in the NHER).

The recent architectural literature

The literature going back to the nineteenth century covering East Anglia's early churches, with and without round towers, is well summarised in Stephen Hart's *The Round Church Towers of England* (Hart 2003, 8-14), and there is no need to repeat it all here.

The starting point for research should be Stephen Heywood's 2013 classic paper 'Stone Building in Romanesque East Anglia'. In this he sets out a case for saying that there were no stone churches in the region before Cnut paid for the mud walls at the monastery at St Benet's at Holme to be replaced in stone in about 1020, and that no parish church in the county need be pre-Conquest (Heywood 2013). Stephen argues that the first *stone* parish churches were built in the period of Norman consolidation (*c.* 1070-1140), and he points out that whenever a pre-Conquest church has been excavated it has, every time, been shown to have been built of wood. Three such sites have been excavated in Norwich: under the north-east bailey of Norwich castle (Ayers 1985, 7-26), under St Martin-at-Palace church (Beazley 2001, 4-13 & 54-7) and under the main bailey of the castle (Propescu 2009, 135). Others have been found in Thetford (Dallas 1993, 79-92) and at Brandon (Tester, Anderson, Riddler and Carr 2014, 47-52). More recently, a small timber Middle Saxon church with an associated graveyard was excavated in 2016 at Great Ryburgh, not far from the existing parish church. The report on that excavation is eagerly awaited. In each of these cases the evidence consisted of postholes or trenches for upright posts cut into the subsoil. Similar techniques were used for both Middle and Late Saxon secular buildings excavated by the author at North Elmham (Wade-Martins 1980). So, we need to acknowledge that the building of minor churches in timber could well have continued significantly beyond the Conquest.

Timber was indeed central to the pre-Conquest building tradition. As Warwick Rodwell says in his important paper on Anglo-Saxon church building methods:

> '…the pre-eminence of a timber technology in Anglo-Saxon England needs no justification. Nor does the fact that the verb *timbrian* simply meant "to build". Stonemasonry was by far the lesser craft in the construction industry down to the end of the eleventh century' (Rodwell, 1986, 171).

Before Stephen Heywood, Richard Gem had made the point in 1988 that parish churches with 'Saxon' features were being built after the Conquest in his paper reviewing the Norman 'Great Rebuilding':

> '…at parochial level there was a tendency to retain old-fashioned traditions long after these had been left behind in national and international circles' (Gem 1988).

The one exception in Norfolk may well be the ruined church at North Elmham which the author argues elsewhere is the pre-Conquest stone cathedral (Wade-Martins forthcoming).

The great work of Harold and Joan Taylor in *Anglo-Saxon Architecture* Vols 1 & 2 (1965) and Harold Taylor in Vol 3 (1978) identified about 54 churches in Norfolk which they believed were either Anglo-Saxon or were likely to be Anglo-Saxon. This was based on architectural styles. They divided these buildings into three broad periods which they dated: A (600-800), B (800-950) and C (950-1100), and then they subdivided those further. However, they were the first to recognise that there was still much uncertainty about dating.

Then, we have Pevsner's equally impressive two volumes edited by Bill Wilson, *The Buildings of England Norfolk* I (1997) and II (1999) in which every church in the county is described. But these two volumes seldom focus on signs of early stonework. The same applies to the readable and popular guidebook to the county's churches by Mortlock and Roberts *The Guide to Norfolk Churches* (2017), which has gone through three editions. In both books reused Roman materials are seldom mentioned and ferruginous conglomerate, when it is mentioned, is usually identified incorrectly as 'Carstone'.

Round towers have caught the attention of several writers, in particular W.T. Goode in his book *Round Tower Churches of South East England* (1994). Goode, who founded the Round Tower Churches Society in 1973, had a strong inclination to describe these towers as 'Saxon', and to divide and to date them as 'Early' (800-900), 'Middle' (900-1000) and 'Late' Saxon (1000 to 1066). But that dating is not supported by the admittedly very limited evidence so far available. Archaeologists will also realise that Goode's use of his terms "Early", "Middle" and "Late" Saxon have a very different meaning to those used by archaeologists to divide the Anglo-Saxon period between *c*. 410 and 1066.

Goode's confident assertion that all walls containing ferruginous conglomerate appear to be pre-Conquest, except where it has been reused, needs to be treated with great caution (Goode 1994, 33). However, his church-by-church catalogue of round towers contains many useful insightful and helpful pointers for reviewing these buildings. Goode's book is always very helpful to have on hand while visiting round-towered churches.

Stephen Hart's own work on round towers takes a more balanced view about date, although he still identifies some 25 which are *probably* Anglo-Saxon (Hart 2003, 166-171). His chapter on round tower dating sets out his case for identifying pre-Conquest and post-Conquest towers, the main point being that if original openings or putlog holes are formed with limestone from the quarries at Barnack then that church will not be earlier than the twelfth century.

There is also Hart's book *Flint Architecture of East Anglia* (2000). Following Hart, the best indication of an early date is the absence of limestone, and if there is medieval brick in the original fabric then that cannot be earlier than the second half of the thirteenth century. A drawback of Hart's books is that, unlike Taylor and Taylor he does not provide a full descriptive catalogue, as does Goode (1994).

Perhaps the most significant piece of work on Norfolk's early churches has never been published. That is Stephen Heywood's 1977 University of East Anglia's MA thesis *Minor Church Building in East Anglia during the eleventh and early twelfth centuries.* The top copy with photographs cannot now be found, but the writer has, with the author's approval, put a photocopy of a carbon copy in the NHER now in the Norfolk Archive Centre within the Norfolk Record Office.

It is also important to say that the building reports held in the Norfolk Historic Environment Record (previously called the Sites and Monuments Record) by Stephen Heywood, Edwin Rose and others, and the official Listed Building descriptions, are important sources of unpublished information. The Historic Environment Record building reports are not usually available online.

The debate about the age of our early churches will not progress further than Hart's arguments until we have seen excavations linked to scientific dating of burials either *associated with, or cut by*, church foundations or by the dating of original timbers, as at Hethel.

Less recent, but of great significance, are the lithographs of churches in the county by the artist Robert Ladbrooke, a founding member of the Norwich School of Artists, published in five volumes in 1843. This must have been a major task before the days of modern transport, and they were clearly compiled over many years. Some of the drawings are dated between 1821 and 1832 and some are not. The importance of these sketches is that they provide a comprehensive record of churches before the Victorian alterations and before the advent of photography. Ladbrooke's lithographs of Melton Constable, Forncett St Peter and Newton by Castle Acre provide an invaluable record of the buildings before these alterations.

Of equal interest is a volume of sketches of 37 churches, the cathedral, chapels and various public buildings in Norwich by James Sillett in *Sillett's Norwich Edifices.* It is undated but is said to have been published in 1828. While the Ladbrooke lithographs are not signed, the Sillett sketches have JS in the bottom right-hand corner.

The study of early stonework in Norfolk churches

A working knowledge of local and regional geology is important for understanding church stonework. As Norfolk is one of the classic areas of British geology, it is well served by a diverse range of primary and secondary literature. The British Geological Survey (BGS) maps, memoirs and short guides provide a good overview. For the King's Lynn area the most useful guide is R.W. Gallois *Geology of the Country around Kings Lynn and the Wash: Memoir for 1:50,000 geological sheet 145 and part of 129* (1994). Further information about building stone is available through *A Building Stone Atlas of Norfolk* in the *Strategic Stone Study* published by Historic England (King and Collins 2019). The BGS has mapped the geology by distinguishing bedrock (solid) from superficial (drift) formations. Bedrock includes marine mudstones of the later Jurassic, sandstones and iron-bound mudstones of the early Cretaceous and chalk of the later Cretaceous containing flint nodules. It also includes marine sands and gravels of the early Pleistocene Crag. Superficial deposits include fluvial sands, gravels and clays, lacustrine deposits, peat and alluvium and coastal aeolian deposits. These mappable formations are represented on the surface by a complex mosaic of rocks and sediments often modified by weathering and mineralisation. They may all provide materials for church building including lime for making the mortar, to flint nodules and bedded stone.

For the study of stonework in early churches there are two significant publications in the British Archaeological Reports British series. There is J.R.L. Allen's *Carrstone in Norfolk Buildings* (1994) which covers the use of two types of West Norfolk stone, Carstone and grey quartzite. And there is John F. Potter's *Patterns in Stonework: The Early Church in Britain and Ireland. An Introduction to Ecclesiastical Geology* (2016), which provides a clear explanation of the origins and use of conglomerate as a building stone. Both books are essential reading for those interested in Norfolk's early churches. John Potter previously in a paper in *Landscape History* for 2001 presented a study on the use of iron-bound gravels in early churches in the Thames Basin. He found that there was a very close correlation between the inclusions in the iron-bound conglomerates in early churches with the gravels in the vicinity of each church. The gradual diminution downstream of pebble dimensions in the gravels in the London Basin could actually be seen in these churches: "The evidence, therefore, suggests that most ferruginously-cemented gravel or sand included in the church fabrics was extracted from shallow pits on, or very close to their particular church site." (Potter 2001, 14). He also made the highly significant discovery that of the 166 churches he examined in the Thames Basin which had more than ten fragments of ferruginous sand or gravel, 46% of them contained re-used Roman brick or tile. This helped to establish beyond doubt that the use of conglomerate as a building stone was an early technique, certainly in the London Basin.

A note on diagonal tooling. One feature to look out for in the stonework of early churches is the way the ashlar was dressed. Until towards the end of the twelfth century, stones were dressed using an axe which left close parallel grooves running diagonally across the face. With the change to a chisel no such marks were left (Stephen Heywood *pers comm*). This is a useful way to distinguish between Romanesque and Gothic, but because conglomerate often does not weather well, these diagonal tooling marks on exposed surfaces have frequently disappeared. The purpose of this tooling may also have been to provide a key for the lime plaster which probably covered all these early churches both inside and out.

The range of materials in early stone churches

Building stone is in short supply in the county. The most notable examples are ferruginous sandstones of the early Cretaceous Dersingham and Carstone formations, later Cretaceous pink, grey and white chalk limestones of the Hunstanton Grey and White Chalk formations, silicrete (probably Pleistocene) and Pleistocene and perhaps Holocene iron-pan from more recent times. They are of variable durability and workability. Further details are given below.

Flint is near-ubiquitous and is found as fresh nodules or as naturally transported and weathered debris in the topsoil. For medieval masons flint was the dominant building stone, used both as rubble and, from the late thirteenth century, knapped to form wall facing in decorative flushwork. For higher quality building stone the masons had to look beyond the Fens to the Stamford area, notably Barnack, where the oolitic limestones of the Middle Jurassic are abundant. Locally quarried stone went out of favour as soon as limestone became available and affordable. It was certainly used in Norwich Cathedral and some wealthier parishes before the end of the eleventh century.

The ruins of Roman buildings were an obvious source of quarried stone, wall and roof tiles of various types and rare pieces of distinctive Roman mortar (*opus signinum*) with inclusions of crushed tiles. These materials were still available in the early days of stone church building when there had been little need for building stone since the fifth century when the art of building with lime mortar seems to have been lost in the region. These ruins could be quarried for their stone and tiles, and with the tiles sometimes came the *opus signinum.*

Locally quarried stone

Bedrock

There are four types of local building stone in Norfolk classified as bedrock.

Dersingham Formation

Small Carr This is the oldest usable Norfolk stone and it occurs as irregular, flaggy, sometimes cinder-looking ferruginous sandstones and mudstones with colours varying between ochre-yellow and purplish-brown. It outcrops in west Norfolk between Roydon Common and Snettisham and has been termed 'Small Carr' locally (Gallois 1994, 176).

The Carstone Formation

Big Carr or Carstone This is a ferruginous oolitic sandstone, sometimes conglomeratic, with a distinctive gingery-brown colour. It has been termed 'Big Carr' locally (Gallois 1994, 176*)*. It outcrops in a limited area along a north-to-south line in west Norfolk broken only by the valleys of the Babingley and Nar rivers. The north end of the outcrop is visible in the cliffs and foreshore at Hunstanton (Gallois 1994. 102-112; Larwood and Funnell 1961, 20-2). North of the River Nar, Carstone forms well-drained rusty-brown sandy soils, particularly obvious in the reddish-brown fields to either side of the B1145 west of Gayton. It outcrops southwards from the Babingley River to the county boundary but is strongly weathered and obscured by superficial deposits. It is quarried today at Snettisham. 'Carstone' is best seen in the many buildings in the Victorian seaside resort at Hunstanton, quarried from Snettisham, and it was also used extensively on the royal estate at Sandringham. Many buildings in the villages in West Bilney, East Winch and Middleton on the A47 are built of Carstone. In his *Carrstone in Norfolk buildings* J.R.L. Allen has a map showing the relative abundance of this stone in settlements spreading as far east as Holt and as far south as Downham Market (Allen, 2016, 22), although it is seldom seen east of Castle Acre or south of the River Wissey. It is worth noting that Allen lumps together 'small carr' and 'big carr' (Gallois 1994, 176) under his term 'carrstone' (Allen 2016, 4), and the author has done the same here (but spelling it with one 'r').

In the monastic church at Castle Acre the alternating use of Carstone and limestone ashlar was used to great decorative effect in the eastern piers supporting the central tower begun in about 1090 (Impey 2016, 6).

Unless you are a geologist, distinguishing Carstone from the iron-bound gravels and sands described in this report under the general heading of 'conglomerate' (see below), is not easy. Even in Old Hunstanton village there are some buildings which do appear to have both. Further south in the area to the east of King's Lynn and to the east of Downham Market it can be challenging to distinguish between the two when they were frequently used together in churches. It is small wonder that the authors of most books on church architecture have found it easier to call all the brown stone 'Carstone'.

As a rule of thumb, and to keep the project simple, the light gingery-brown ferruginous sandy-textured mudstones and sandstones *from bedrock* have all been identified as Carstone. The many variations of the Pleistocene or Holocene ferruginous gravels and sands from *superficial deposits* are darker, sometimes almost black, and are all described below as conglomerate. A good place to see the difference between the two is the east wall of Bexwell chancel which has been rebuilt to incorporate the Victorian east window. Under the window the larger blocks of conglomerate are mixed in with smaller pieces of Carstone (Fig. 1.1). At Wimbotsham the two stones were interspersed decoratively with blocks of limestone in a Victorian restoration of the Norman nave and chancel (Fig. 1.2). In Wimbotsham there is also an interesting pair of Victorian cottages (Fig. 1.3) which are identical except that the one to the south (left) is built with conglomerate and the one to the north (right) with Carstone.

Hunstanton Formation

Red Chalk is a limestone varying from pink to brick-red, passing southwards into the calcareous clays of the Gault Formation in the Sandringham area (Gallois 1994, 112). Both Carstone and Red Chalk are built into cottages and garden walls in Old Hunstanton and in the church. However, Red Chalk does not weather well and was rarely used in churches, except decoratively in the south clerestory at Little Massingham (Fig. 1.4). It is seldom found outside West Norfolk, but where it does occur it should be regarded as having a glacial erratic origin.

Chalk or Clunch is found above the Red Chalk (Gallois 1994. 123-136) and consists in two lithostratigraphic units: the *Grey Chalk*, a tough lithological variant which outcrops in West Norfolk and does not contain flints. The overlying *White Chalk* is a softer, more friable flint-bearing variant. Both are found in Norfolk buildings although they are seldom seen as an external facing in churches because they do not weather well. It is interesting that much of the

1.1. Bexwell close-up of the stonework in the east wall of the chancel wall which has a mixture of light brown Carstone and larger blocks of darker ferruginous conglomerate.

1.2. Wimbotsham south wall of the chancel which has a decorative mixture of light brown Carstone, darker brown ferruginous conglomerate and limestone.

1.3. Wimbotsham pair of cottages with conglomerate to the left and Carstone to the right.

external facing of the early round tower at West Lexham is made of chalk. Conservation here of the friable chalk has been a particular problem and so the tower walls have been stabilised in recent restorations with lime water (Fig. 1.5). In the early round tower at East Lexham close by chalk was wisely used only for internal facing.

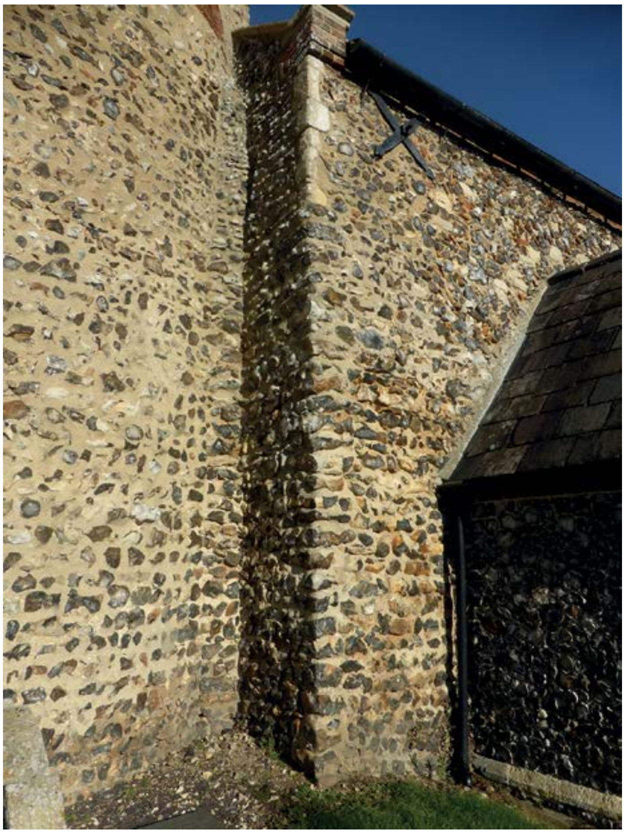
Nodule and ***unknapped flints*** are found in almost all over East Anglia. They can be quarried from the chalk, but they are more usually found in superficial deposits in sands and gravels and can be picked from the ploughsoil almost everywhere. Where Roman buildings were still available to be quarried as a source of flint rubble, the rubble would also have come with tiles, either wall tiles, flue tiles or roof tiles, mostly broken but some are complete. There are enough churches identified in this study which have Roman tiles in the fabric to show that Roman ruins, mostly villas, were a significant source of flints in the eleventh century and possibly even in the early twelfth century.

Flints were universal as an early building material. Framingham Earl (Fig. 1.6) is a conspicuous example of an early church, without any conglomerate or tiles where the quoins at the nave corners are all large flints. Surlingham church is another one which has mainly large squared flint nodule quoins except for one block of conglomerate in the south-west nave corner (Fig. 1.7). Others with just ordinary flint quoins, such as Themelthorpe, sometimes

1.4. Little Massingham with Red Chalk used decoratively with knapped flints in the south clerestory.

1.5. West Lexham tower after restoration with the chalk protected by multiple layers of lime water.

1.6. Framingham Earl nave south-west corner formed with large squared flints.



1.7. Surlingham nave south-west corner with squared flints, one piece of conglomerate and limestone near the top.

have herringbone flintwork which also can be a strong indicator of early work (Fig. 1.8).

Superficial deposits

Iron-bound or ferruginously-cemented gravels and sands known as conglomerate, breccia, ferricrete, puddingstone or ironpan

These are all names for superficial deposits where fluvial and glacial gravels and sands have been cemented together with iron oxide by groundwater fluctuation during the Pleistocene or Holocene. This oxide is described by Alan as limonite-goethite (Alan 2004, 5). Most church guidebooks still refer to it all as Carstone (Pevsner & Wilson 1997 & 1999; Mortlock & Roberts 2017). Harold and Joan Taylor in *Anglo-Saxon Architecture* (1965) also conflated Carstone with conglomerate. Future editions of Pevsner & Wilson will need to separate the two. The two stones are also confused in 'Building Stone in Norfolk', a chapter by A.P. Harris in *Stone* (Harris 1990, 210).

The many varieties of these iron-bound gravels and sands found in churches during the project are all collectively described here by the single word 'conglomerate' because nearly all are derived from gravels. A small proportion are from fine-grained sand, so this term is technically not quite correct in all cases, but it does save words. Sometimes it is

1.8. Themelthorpe nave south wall with areas of herringbone flintwork.

possible to find both sand and gravel in the same stone, as at Ketteringham (Fig. 1.9). Good examples of the gravelly conglomerate can be easily seen in the wall faces of the North Elmham ruin (Fig. 1.10). Fossil molluscs can on occasion be found alongside flints in the conglomerate as at South Wootton (Fig. 1.11). The presence of flint is a clear indication that a deposit is post-Cretaceous and therefore not of bedrock origin.

There are, of course, several other concretions which are bound together by different chemicals, such as quartz and calcite known as silicrete and calcrete (Tucker 2001, chapter 2). A conglomerate should contain grains (known as clasts) which are larger than 40mm and smaller than 64mm, but it is used here to cover all forms of iron-cemented gravels and sand, whether the clasts are rounded or angular. It can be distinguished from Carstone by the presence of flint clasts, derived from Cretaceous chalk deposits: flints are never found in Carstone. The use of conglomerate as a primary building material is indicative of early church building sometimes associated with reused Roman materials. It is worth stressing that the presence of conglomerate rubble in a church is not by itself proof of an early date because it was easily reused as rubble in later church rebuilding, sometimes several times. The Victorians also reused it decoratively.

1.9. Ketteringham nave north-west corner with sandy and gravelly versions of conglomerate in the same quoins.

1.10. North Elmham ruin nave south wall faced almost entirely with a rough conglomerate blocks and a few flints.

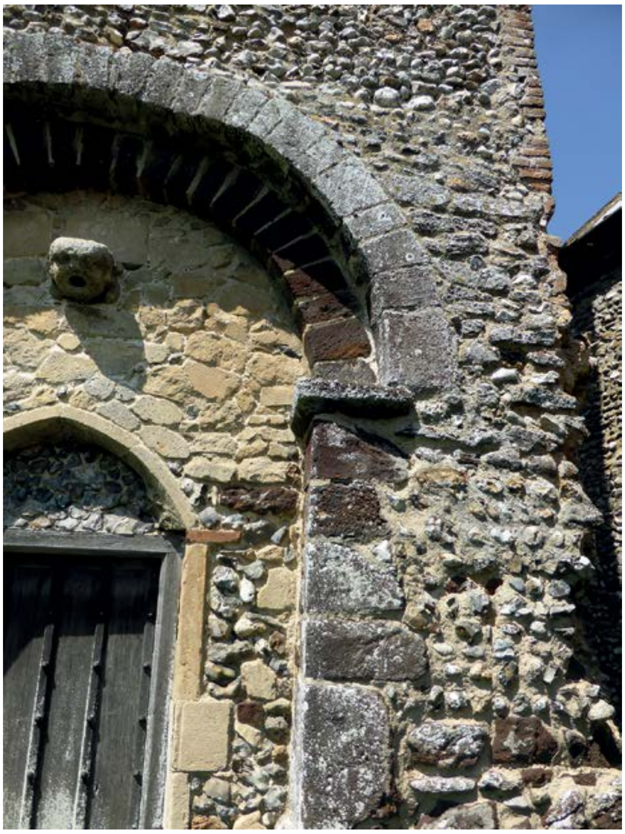
Conglomerate was used almost exclusively as a wall facing in the North Elmham ruin while flints were largely confined to the wall cores. At the west corners of the tower a sandier version was used to make sharp-cornered quoins. Swanton Novers church is an excellent example where both sandy and gravelly versions were used, actually in different nave corners (Fig. 3.164) There are just a few examples where conglomerate has been laid in herringbone, as at Thwaite All Saints (Fig. 3.172).

The gravelly version can be prone to some serious erosion, and an example of this is in the facing between the limestone ashlar corners of the Norman buttresses of the Ryston tower where up to 100mm has been lost over the last 800 years (Fig. 1.12). On round towers where the conglomerate does not usually abut harder limestone ashlar the erosion is almost as clear, as at Mautby (Fig. 1.13).

In the fabric of eleventh- or early twelfth-century churches there is a good chance of finding conglomerate in quoins at the corners, and less frequently in windows and doorways where it has usually been replaced. High quality examples of finely shaped sandy quoins and voussoirs were used exceptionally in the tower arches at Great Ryburgh (Fig. 3.74), Yaxham (Fig. 3.201) and Little Snoring (Fig. 1.14), in a nook shaft of a blocked doorway at Burgh Parva (Fig. 1.15) and Bessingham (Fig. 3.19).

1.11. South Wootton nave north-west corner with conglomerate quoins with a mixture of light brown Carstone and a piece of darker conglomerate containing some fossil molluscs.

1.12. Ryston tower south-west buttress with limestone ashlar and heavily eroded conglomerate.



1.14. Little Snoring blocked tower arch.

1.13. Mautby round tower with layers of eroded conglomerate.

Conglomerate was quarried both as a building stone and for iron smelting in the eleventh and early twelfth centuries (Tylecote 1967). When found in later medieval walls it has been reused as wall rubble.

Bexwell is an example of the complexity of this ferruginous material, and Tim Holt-Wilson with Gilbert Addison, has kindly provided the following detailed description of this stone in the tower (Fig. 3.23):

> Built from irregular blocks of muddy sandstone rubble cemented by iron minerals ranging in colour from

1.15. Burgh Parva nave blocked south doorway with conglomerate jambs and nook shaft.

ochre (limonite) to dark purplish-brown (goethite). The stone ranges from medium/fine-textured sandstone to coarsely-textured sandy breccia.

- The sandstone – medium to fine-grained, yellowish to purplish-brown, in slightly tabular-shaped blocks. They are highly-fissured with lenticular, wavy and blocky-shaped splits within the fabric defined by darker, more highly-cemented, ferruginous crusts; there are very occasional inclusions of flint grit.
- The breccia – resembling the sandstones in colour but much more coarse-grained, containing abundant pebbles of angular and subangular flint and rounded quartz, and forming more 'bouldery'-shaped blocks. It has a chaotically brecciated and pelleted fabric displaying evidence of internal disturbance/contortion; some voids are present.
- These lithologies contain flint clasts so must post-date the late Cretaceous. They are interpreted as a Quaternary - probably Pleistocene - ferricrete formed in wetland areas, where sands and gravels have been cemented by iron oxides of groundwater origin precipitated by bacterial action (Stevenson 2012). The contorted and fissured fabrics are most likely due to the effects of periglacial cryoturbation, varying in intensity of frost action, and voids may be due to rotted-out organic matter.

(Breccia is composed of coarse rock fragments held together by an iron oxide. Like conglomerate breccia contains at least 30 percent of gravel-sized particles but is distinguished from conglomerate because the rock fragments have sharp edges that have not been worn down: *source:* Wikipedia.)

The use of conglomerate within the study area depended on local availability. There is no other logic to the distribution of this stone, when Shereford has a lot while Tattersett, close by, and apparently of about the same date, has none. As Potter demonstrated for the Thames Basin 'The evidence … suggests that most ferruginously-cemented gravel or sand included in church fabrics was extracted from shallow pits on, or very close to, their particular church' (Potter 2001, 14).

How ferruginous conglomerate was formed It is likely that there were multiple sources of this stone in a whole range of fluvial and glacial deposits when the first churches were being built in stone. It occurs as an iron oxide pan in sands and gravels at water table level. Iron oxide when deposited as a mineral is insoluble but waterlogging with a high organic content provided by rotting vegetation can produce conditions in which micro-organisms change the oxide into a soluble form. The oxide is then leached out of the upper layers and carried down to a lower level where the acidity might be less, thus causing the iron to come out of solution to form nodules of insoluble hydrated iron oxide which bind together.

The first person to understand this process was R.F. Tylecote who excavated Late Saxon ironworking pits on the Cromer Ridge in 1967 (Tylecote 1967). The pits he excavated are in glacial deposits on the ridge near the 'Roman Camp' at Beeston Regis. More recently, ironworking quarry pits dug into sands and gravels, probably Middle Saxon, have been excavated at Laurel Farm, Mousehold Heath, near Norwich. With the quarry pits there was also clear evidence of the ore being processed on site (Bishop and Proctor 2011, 79-101). However, the overall distribution of conglomerate in churches shows that most of it came from the river gravels (Figs 1.16-7).

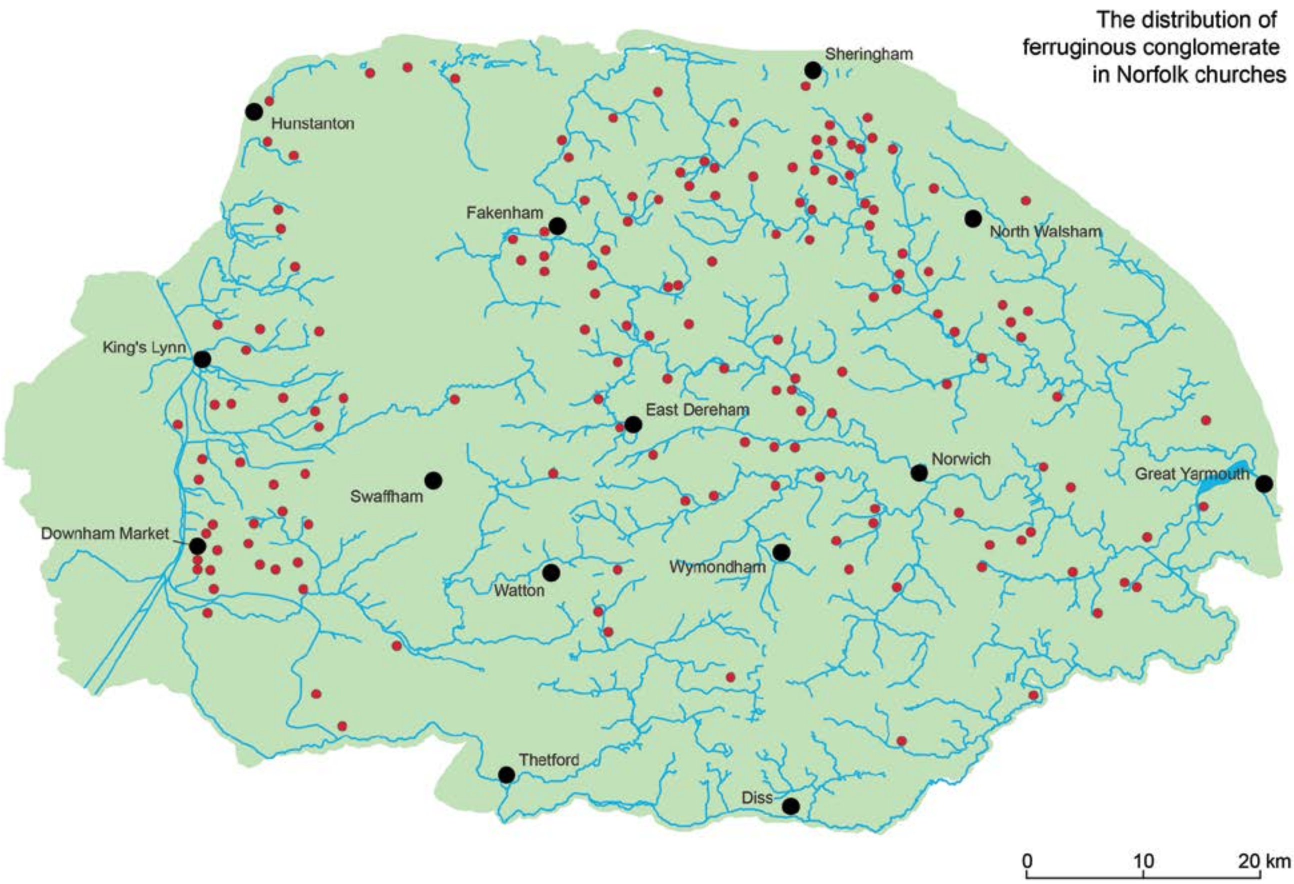
The iron oxide nodules usually occur at between 1m and 3m below the surface and can be up to 1m thick, formed where the particles of sand or gravel are held together by the hydrated iron oxides. The largest piece the author has seen is used as a gatepost at Reedham church (Fig. 3.147). The moist nodules are friable when first dug out but when they are dried they harden to form a remarkably robust ferruginously-cemented stone which can be shaped into building blocks. Deposits containing iron conglomerate cannot be readily seen today because in modern mechanised gravel workings it is broken up quickly in gravel crushers. Robin Stevenson recorded the material in the sides of freshly dug drainage ditches in three locations in west Norfolk, at Grimston Warren, West Winch Common and North Runcton Common (Stevenson 2012, 41-5).

This stone was a useful building stone in the east and south-east of England where other building stone was in short supply before the arrival of limestone ashlar imported from Barnack or from Caen in Normandy. When church building in the region began in stone in the eleventh century these conglomerate nodules provided the only low-cost relatively durable alternative to flints for quoins, windows and doorways. Why Carstone does not seem to be have been used so much, especially for corner quoins, may well have been because it was seen to be too friable. Conglomerate was also used as a wall facing, but only in the North Elmham ruin was conglomerate used almost exclusively in all wall facing.

In the major monastic complex at Binham Priory, founded in 1091, conglomerate was only included in the earliest phases of church construction, which also suggests that it was not used much beyond the end of the eleventh century. For architectural historians the value of this stone 'for determining the origins and dating of churches becomes obvious' (Potter 2016, 4).

It is interesting that where conglomerate can be found in church wall faces it is usually concentrated on the lower levels. This suggests that when work started on a stone church and loads of conglomerate were first delivered and sorted the best pieces were kept back for quoins and windows and doorways while the rest was mixed in with flints and used up early on as the building progressed.

Where to look for conglomerate in churches The first place to look for conglomerate blocks is in the west corners of the nave, as at Sustead (Fig. 1.18), and especially the



1.16. Distribution of ferruginous conglomerate in Norfolk churches in relation to all present-day watercourses (excluding the Fens).

north-west corner, because the north side was often altered less than the south. Most eighteenth- or nineteenth-century extensions are at the east end, while the location of the west wall of the nave and the west tower tended to remain static. The restless habit of rebuilding or extending chancels or replacing apses with square-ended chancels explains why so many early east ends have been lost. Great Dunham and Yaxham are examples where an apse was squared off. This constant rebuilding of east ends is the reason why early windows in chancels are rare, although there are blocked examples formed in conglomerate in the north walls at Hanworth (Fig. 3. 85) and Belaugh (Fig. 3.16). Rare examples of conglomerate quoins in chancels can be seen at Belaugh (Fig. 3.15) and Itteringham (Fig. 3.112).

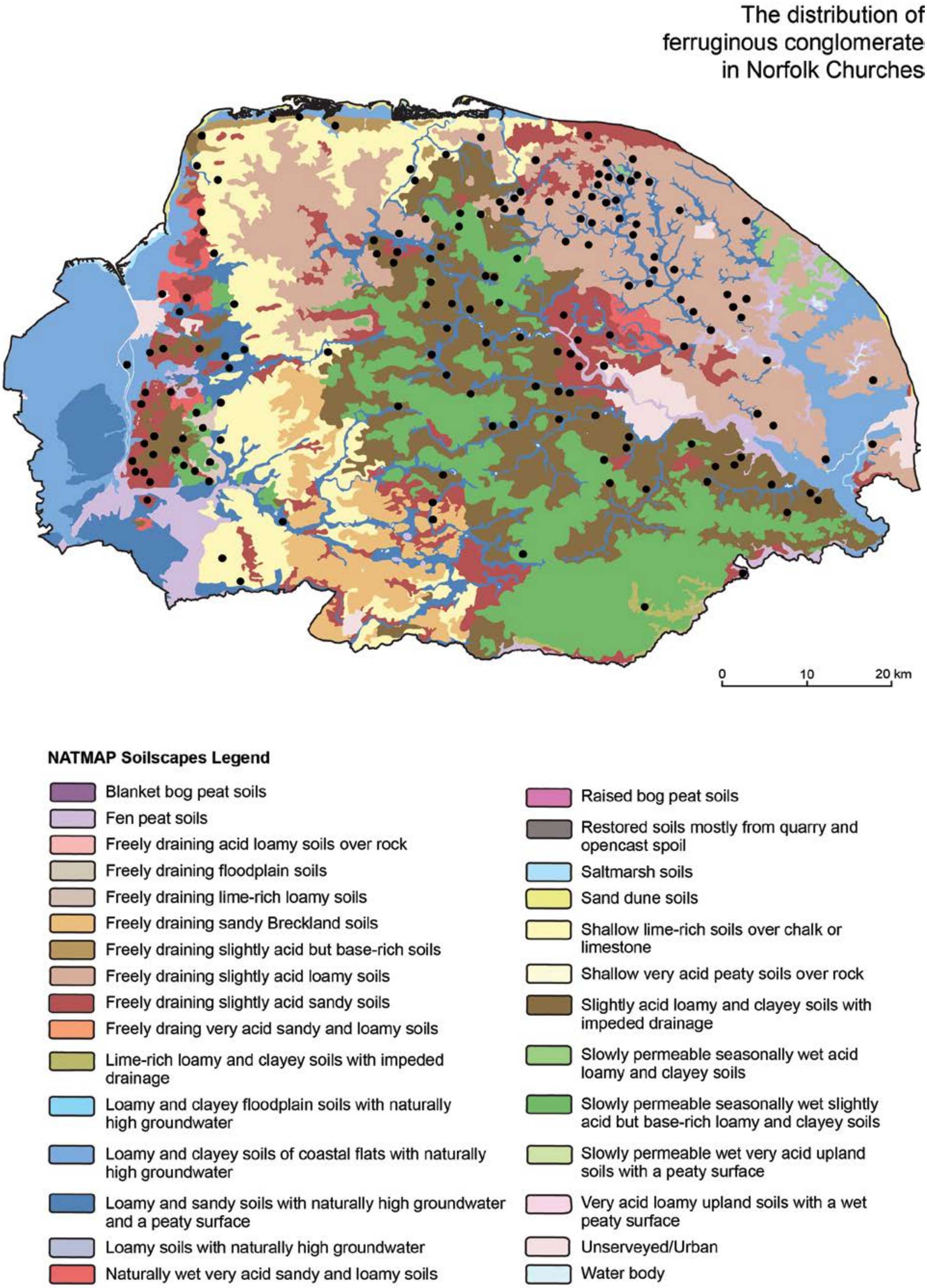
One might expect that most early stone churches had curved apses, but all excavated examples of pre-Conquest wooden examples in the region at Norwich (Ayers 1985, Fig.12; Propescu 2009, Fig.4.60), at Thetford (Dallas 1993, Fig.107), at Brandon (Tester, Anderson, Riddler and Carr 2014, Fig. 4.14) and in 2016 at Great Ryburgh (unpublished), actually had square east ends. So, we should not assume that all stone east ends were apsidal.

Where a nave and chancel are of the same width, the locations of the original east end of the nave can sometimes be identified as vertical lines of conglomerate quoins in otherwise flat wall faces, as at Twyford (Fig. 3.179) Ashby St Mary (Fig. 1.19) and in the north wall at Bessingham.

When first visiting a church, it is always good to start assessing its early history by checking the north-west corner.

The visibility of stone in early wall faces Bands of stone in early wall faces usually represent the use of a fresh delivery of stone to the builders or possibly a full season's building work if the band is wide enough. The time it takes for the mortar to harden determined how high a wall could be built in one season. There is some evidence to show that walls were rendered with lime plaster until knapped or more decorative flintwork was introduced in the late thirteenth or early fourteenth century. The survival of areas of lime plaster in the angle between the west walls of the nave and the round tower as at Little Snoring (Fig. 1.20), for example, or on the face of the tower at Brampton (Fig. 1.21) show that most stonework was rendered and was not intended to be seen. But lime plaster weathered and had to be repaired, although where it was protected by the overhanging eaves, as on the upper section of the north wall of Yaxham, it has survived. The best possible example of unweathered lime plaster is on the ruin at North Elmham. Here the church was converted into a manor house in the fourteenth century and under the earthwork defences piled against west wall of the tower the lime plaster has perfectly preserved (Rigold 1962-3, Plate XI D).

So, where there are bands of conglomerate, as in the round towers at Great Ryburgh and Yaxham, they were surely



1.17. Distribution of ferruginous conglomerate in Norfolk churches in relation to soils (excluding the Fens). Soils data copyright Cranfield University and for the Controller of HMSO 2023 used with permission.

1.18. Sustead nave south-west corner with conglomerate quoins with additional tiles of uncertain date above.

1.19. Ashby St Mary nave south-east corner showing as conglomerate quoins in the south wall where the nave and the present chancel south walls are aligned.

1.20. Little Snoring angle between the remaining west wall of the nave (to the left) and the tower with some surviving lime plaster.

1.21. Brampton tower with a small area of lime plaster surviving *in situ*.

not intended to be seen, although they are sometimes described as decorative (Potter 2009, Fig. 1). The use of a particular stone for wall facing was more a question of what stone was locally available for a season's work.

Render made it possible to use versions of conglomerate which were not so well held together by iron oxide and could weather easily. Friable stonework was not stable once the lime plaster had fallen off.

Grey quartzite or Silver Carr

This quartzite is thought to be derived from the sands of the Lower Cretaceous Leziate Beds in the Sandringham Sands Formation which was re-cemented by localised percolating silica-rich waters, most likely in the Pleistocene (Gallois 1994, 79). Today, having been worked out by quarrying, it is nowhere found as an outcrop.

It appears that the quartzite represents a highly localised silicretised variant of the Leziate member of the Sandringham Sands (Stevenson, unpublished). The heavy mineral composition of the quartzite has been analysed by John Allen to show that it is similar to that of the sandstone in the Leziate Beds at Castle Rising (Gallois 1994, 77 and 79; Rose 1985; Allen and Fulford 1999; Allen, Fulford and Pearson 2001; Allen 2016, 21-3 & 96-111). The material, broken into blocks, has been recorded in churches in three areas of Norfolk focused on Castle Rising, Brancaster and Reedham (Fig. 1.22).

The petrology and mineralogy of the rock is described by John Allen (Allen 2016, 96, but he did not identify a quarry site. So, I am grateful to Tim-Holt Wilson for identifying a heavily pitted area of the Sandringham Sands in places strewn with pieces of quartzite and also a large boulder of this material lying on the surface in woodland on Ling Common at TF6540524279, 1.4 km south west of Castle Rising church. This boulder is of the same size as those forming the foundation course of the nave and tower at Castle Rising St Lawrence's church (Fig. 1.22). It was also used extensively in the wall facing of Castle Rising Castle between the limestone ashlar buttresses (Fig. 1.24). So, Ling Common is likely to be at least one source for much of this material. Robin Stevenson said he had also found some of this stone in White Hills Pits, 3km to the east of the village (Tim Holt-Wilson *per comm.*), so there may have been more than one quarry in the area.

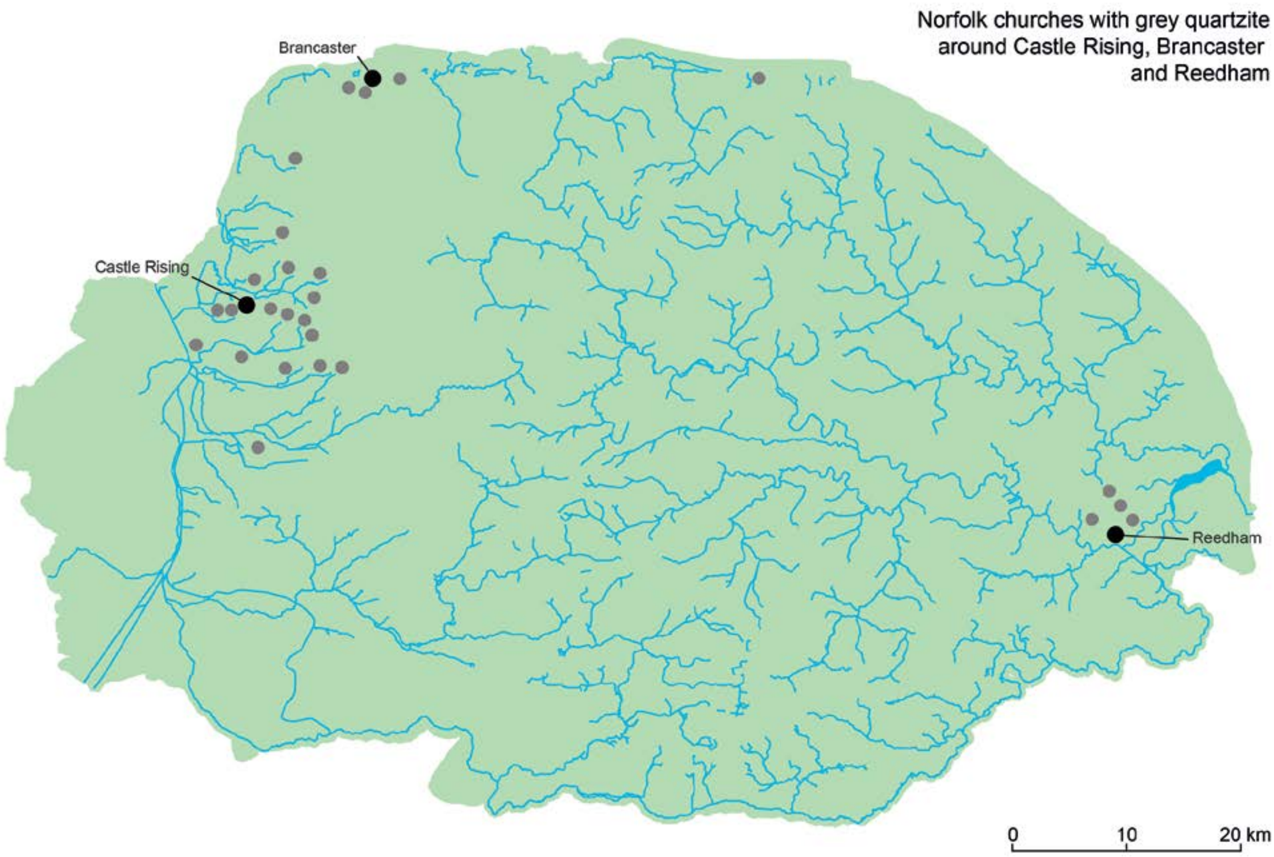
Imported stone

Limestone ashlar

Limestone imported from quarries at Barnack or from Caen in Normandy was highly prized as a building stone throughout the Middle Ages. Great Dunham is an excellent example of the eleventh-century use of high-quality limestone ashlar in a parish church where the money was obviously available. And at Great Dunham no conglomerate was used.

Reused lava querns from the Rhineland

A building material sometimes used as rubble or occasionally as quoins or as imposts in early belfry windows is broken lava querns. A thorough survey of the county by Andrew Rogerson and others located 425 out of 684 churches with one or more lava fragments. This survey showed that the use of lava was very much focused on churches which are in the catchment area of



1.22. Distribution of grey quartzite which can be easily seen in Norfolk churches (excluding the Fens).

the river system which flows out through Great Yarmouth, thus neatly demonstrating the main route by which querns were traded inland from the Rhineland Mayen and Niedermendig quarries in particular. There are large examples in the north-west corner of the eleventh-century nave at Colney and in wall faces in the north nave wall at West Somerton (Ashley, Penn and Rogerson 2001). Although the distribution of lava in churches is remarkably interesting as good evidence for trade, they don't appear so far to add much to our understanding of the architecture of early churches. Lava querns can be found in archaeological deposits from the Late Saxon period onwards.

There is half of a very large lava millstone, 1.10m across, which formed the threshold inside the south door of Buckenham church until 1981, now leaning against the north wall inside the nave (Ashley, Penn and Rogerson 2001, 31). For lava quern enthusiasts this millstone is well worth seeing.

Unidentified material

There is a single course of grey material near the bottom of Mautby church tower which has not yet been identified (Figs 1.50-1). This certainly deserves further research.

The reuse of Roman building materials

Grey (Leziate) quartzite (or Silver Carr)

Grey quartzite has been located in churches in three separate areas of Norfolk focused on Castle Rising, the Roman fort at Brancaster and a Roman structure partly excavated under Reedham church (Fig.1.22).

Castle Rising area: recycling the materials from Roman villas

The best starting point for identifying a source of grey quartzite for early church building in the Castle Rising area is the small, ruined and partly buried, church under the ringwork of Castle Rising castle. Although little of the exterior of the church can be seen today, excavations have shown that the outer wall face is almost exclusively constructed of grey quartzite with the occasional pieces of Roman tile. Both these blocks and the tiles had Roman mortar adhering to them, and the wall foundations are pure Roman rubble (Morley and Gurney 1997, 24-38, especially plate IV). So, it seems that much of this material came from an unlocated Roman building.

Close by is St Lawrence's church in Castle Rising village built as a part of the planned town next to the Norman castle in *c.* 1140. Here the foundation course of the nave is made of massive blocks of grey quartzite up to 1.5m across which could not have been carted far from the quarry site (Fig. 1.23). That same stone was also used in smaller pieces to build the castle keep (Fig. 1.24). The central tower at Lawrence's has one window with Roman tiles (Fig. 1.25). So, the quartzite used in St Lawrence's church and in the ruined church under the castle earthworks seems to have had two origins, from a Roman quarry or building and from a contemporary quarry.

West Norfolk has the best-known concentration of substantial Roman villas in Norfolk, stretching from Fring and Snettisham in the north down to Gayton Thorpe in the south, all close to the prehistoric Icknield Way trackway

1.23. Castle Rising St Lawrence nave south-west corner with a foundation course of large blocks of grey quartzite.

1.24. Castle Rising castle keep south side built with limestone ashlar buttresses separated by panels filled with blocks of grey quartzite of varying sizes.

1.25. Castle Rising St Lawrence nave south wall Roman tiles over a window.

(Gregory 1982, 360-6; Davies 2008, 187-193). There are eight recorded so far:

Snettisham,
Appleton,
West Newton,
Flitcham,
Congham,
Grimston,
Gayton,
Gayton Thorpe.

Grey quartzite blocks, some squared, are prominent in the walls of the ruined round tower at Appleton 4.5km to the north-east of Castle Rising (Fig. 1.26). Roman tiles were also used in the tower arch. The Appleton Roman villa at Denbeck Wood, 800m to the east, was excavated by Rainbird Clarke in 1947-8 (Gregory, 1982), but he did not publish his results. The only description of the villa published at the time was a very short note in the *Journal of Roman Studies* for 1948 under 'Roman Britain in 1947'. This described the villa as built of a 'local sandstone' with flints and tiles supporting a timber superstructure (Showers 1948, 98-9). Luckily, there are photographs of the excavation taken by the professional photographer Hallam Ashley which are held in the NHER (Fig. 1.27). These show that the excavation was not of a high standard, and the walls were not cleaned and therefore not well

1.26. **Appleton tower with grey quartzite blocks from Denbeck Roman villa nearby.**

1.27. Denbeck Roman villa 1948 excavation with walls believed to be built of blocks of grey quartzite, and a *tegula* rests on a wall foundation. *Photo by Hallam Ashley.*

recorded. However, they indicate that the surviving walls were built with a mixture of flints, tiles and rectangular blocks which can only be the grey quartzite.

In the Norman church at Flitcham grey quartzite was used extensively in the lower sections of the central tower together with Roman tiles (Fig. 1.28). Associated with the tiles is one lump of the Roman mortar *opus signinum* in the now blocked chancel arch (Fig. 1.29).

In 1906 the Roman villa close to Grimston church was excavated and, for its time, was surprisingly well planned and photographed by Major Bale. The villa had an elaborate layout with a bathhouse which was richly decorated with wall plaster. A report of this excavation was promptly published by Henry Laver in 1907, although the finds cannot now be traced. In Laver's account of the excavation he says that 'all stone worth removal had been taken out of the walls and other parts of the building, the pavement over the hypocaust even being broken up for the tiles and bricks it had contained.' (Laver 1907, 221). The remains of the villa had clearly been well and truly robbed and stripped out of all reuseable material.

At Gayton Thorpe is the best-known of these villas. It was first excavated by Donald Atkinson in 1922-3 (Atkinson, 1929), although the photographs in the report suggest that this excavation was not of a high standard for its day either. The site had an elaborate plan with mosaics, a bath suite and hypocausts, but he found that the walls had been heavily robbed and little remained above foundation level. 'Squared stone was found only in occasional use as quoins.' That is significant, although the few traces of the walls he could see suggested that they were largely faced with flints.

Since then, a geophysical survey and fieldwalking at Gayton Thorpe by Michael de Bootman in 1982-5 located a further three buildings including a possible detached bathhouse (de Bootman 1998). In 2006 there was a limited excavation by John Shepherd, commissioned by Michael de Bootman, to assess the survival of the main mosaic and other structures after ploughing. The results of that work have also not been published, and we have only a single photograph of the excavation published in Davies 2008, Fig. 164. Although Michael de Bootman has written to the author to say that no grey quartzite was found, there is a significant amount in the lower parts of Gayton Thorpe church tower 1km distant.

The fourteenth-century ruined church at Babingley has a lot of squared blocks which look Roman. If they are Roman, then the stone here was probably reused more than once.

So, the overall impression we have is that these villas, as a group, were heavily robbed, in some cases down to foundation level, and it may never be easy to establish how much grey quartzite was used in their construction.

John Allen identified the following churches in the westest Norfolk area in which he recorded grey quartzite (Allen 2016, 99-102 and Fig. 11.1). Listing them approximately from north to south they are:

Sedgeford (occasional lumps in W end of nave)
Dersingham
West Newton,
Flitcham,
Hillington,
Babingley (ruined church)
Appleton ruined church (round tower and nave)
Castle Rising (nave and tower and also in the ruined church)
Congham,
Roydon,

1.28. Flitcham tower north wall with blocks of grey quartzite, flints and a course of Roman tiles.

North Wootton,
South Wootton (nave)
Grimston,
Bawsey (ruined church)
Kings Lynn (All Saints)
Gayton,
Gayton Thorpe,
Ashwicken,
Wormegay (one lump in chancel)

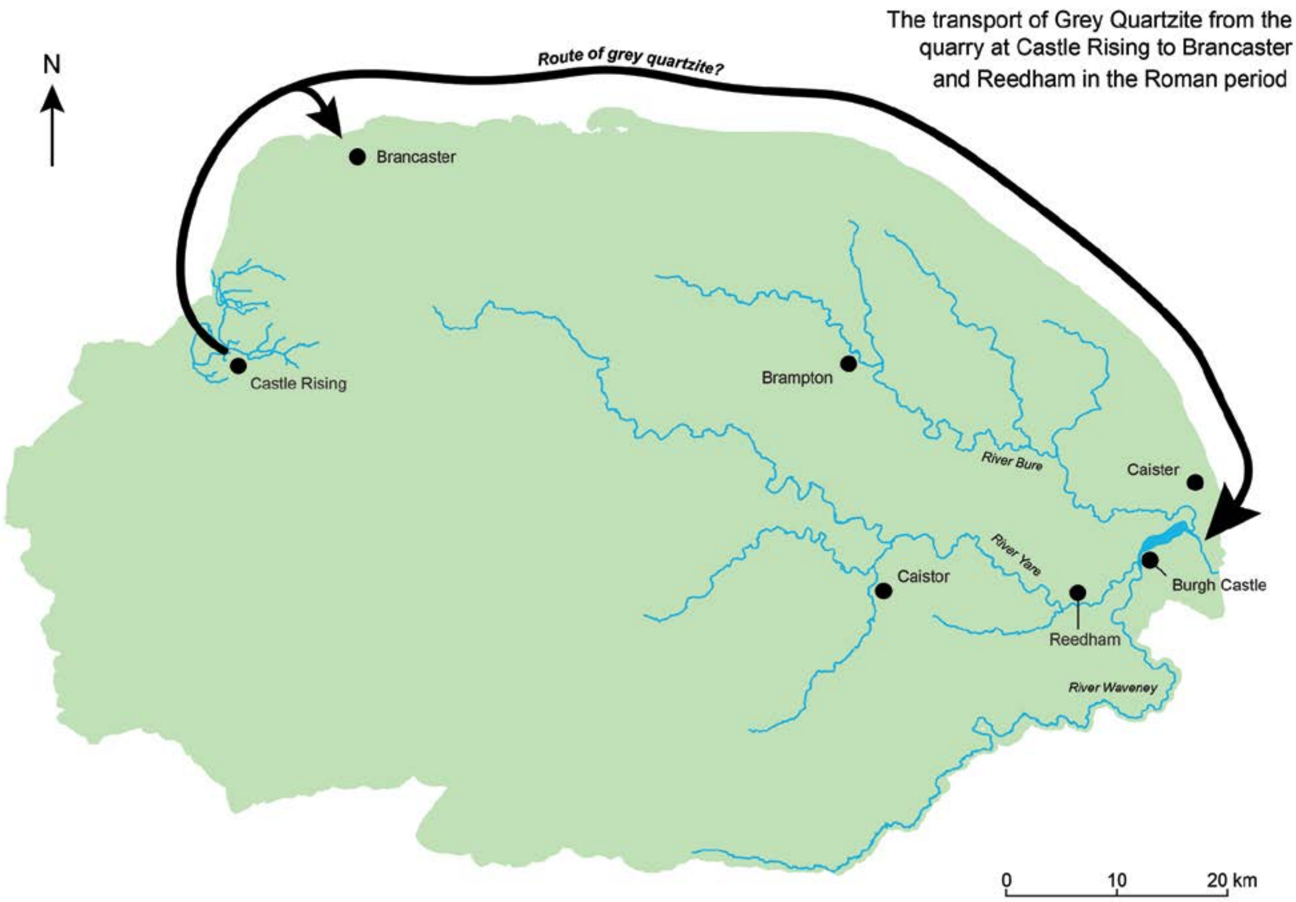
Sedgeford and Wormegay are clearly outliers from the main concentration.

So, at least six of the villas may well have contributed to the building, or rebuilding, of their local churches in the eleventh and possibly early twelfth centuries.

Materials could easily have been robbed from the ruins of villas in the eleventh and twelfth centuries to build some of the early churches in the area, although it is likely that for several of them the stone was freshly quarried. To establish now which of these churches had recycled Roman stone and which have later material would be very difficult.

1.29. Flitcham tower east side with Roman tiles and *opus signinum.*

What we can say is that the Castle Rising grey quartzite quarry was a source of building stone for the villas, and it was also certainly shipped by the Roman army to build the coastal fort at Brancaster and another structure at Reedham (see below and Fig. 1.30). Some of the same villas along the Icknield Way were then, centuries later, a likely local source of stone for the early churches.



1.30. Roman transport routes for grey quartzite from quarries at Castle Rising to the forts at Brancaster and Reedham (reproduced from Allen, Rose and Fulford 2003, Fig. 5).

The later use of grey quartzite near Castle Rising

The villas could hardly have been the only source of the stone for St Lawrence's church in Castle Rising village, where the massive unshaped quartzite boulders provide a foundation for the nave. In the rest of the church there are both smaller squared and irregular blocks all mixed with Carstone. The only Roman tiles in the church were the few used to form the head of the south window in the tower.

In the keep of Castle Rising castle quartzite was used extensively in the wall panels on the exterior between the limestone ashlar buttresses and also in the interior wall faces, but there are no Roman tiles to be seen. These freshly-quarried blocks are not regularly squared, so there is far less chance that they are of Roman origin. So, there certainly was a *pos*t-Roman source for this stone to explain why there was so much of it in about twenty churches in the area, like Babingley and South Wootton. Some of the Babingley stones are squared and look Roman in origin but are more likely to be medieval (Fig. 1.31). But the quarry was certainly reopened to provide the stone for the Castle Rising castle keep and was used until at least the fourteenth century. And indeed J.R.L. Allen in his key work on quartzite as a building stone showed that it continued to be used in some secular buildings into the nineteenth century (Allen 2016, 102-3).

Brancaster area

At Brancaster the grey (Leziate) quartzite blocks were robbed from the walls of the Roman Saxon Shore fort until it was finally demolished in the eighteenth century. When the fort was excavated before the last war by J.K. St Joseph he found that the fort walls were constructed with a core of flint, Carstone and chalk rubble but faced with grey squared blocks (St Joseph 1936; Allen 2016, 21-3 & 96-111). In the 2012 *Time Team* excavation of the site four trenches were dug within the fort, including Trench 4 which went across the fort's north wall. The published report in *Norfolk Archaeology* (Brennan 2016, 380) contains no description of the wall or of the stones within it. However, the full Evaluation and Assessment Report in the project archive (Wessex Archaeology 2014) records in para 4.4.33 "At the northern end of the trench was a defensive wall (403) constructed of micaceous stone and flint nodules." The trench description says the wall, 2.5m wide, was heavily robbed, but faced with pale white micaceous stone and flint nodules, so that is surely the grey quartzite.

Blocks from the fort have been found reused in three churches close to Brancaster along the north coast. The best places to see them is in the south wall of the chancel at Brancaster (Fig. 1.32) and in the round tower at Burnham

1.31. Babingley north wall interior of chancel with squared blocks of grey quartzite.

1.32. Brancaster chancel south wall with squared blocks of grey quartzite.

Deepdale (Fig. 3.38), where they were used to form now blocked belfry windows, and at Titchwell in the tower (Rose 1985; Allen 2016). Allen also identified some pieces in the south wall of Warham All Saints. The raised strip-work around the Weybourne belfry windows appears to be the same material, but that needs to be confirmed by closer inspection (Fig. 3.193).

Reedham area

Reedham church contains significant quantities of grey quartzite and Roman tiles. Following a visit to the church after a disastrous fire in 1981, Edwin Rose was the first to suggest that the grey quartzite in the church had been reused from a Roman building (Rose 1994, 5, pl. I & II). He noted that some of the stones showed clear evidence of being shaped by a stone dressing tool, and that they closely resembled those from Brancaster '.. the blocks at Reedham and Brancaster would seem to represent material that expresses a single, Roman, masonic tradition.' (Allen, Rose and Fulford 2003, 137).

John Allen then identified eight churches with grey quartzite in the Reedham area (Allen, Rose and Fulford 2003, Fig 1), and he listed them according to the quantity of grey quartzite they contain:

Reedham (dominant)
Halvergate (common),
Limpenhoe, (common)
Wickhampton (rare),
Freethorpe,(rare)
Cantley (rare),
Hassingham (very rare),
Beighton (very rare),

These all lie on the peninsular bounded by the Halvergate Marshes to the east and the valley of the River Yare to the south.

The largest quantity of grey quartzite is in Reedham church, along with a very impressive quantity of Roman tiles, some laid in a remarkable herringbone fashion not seen elsewhere to this extent in Norfolk (Fig. 1.33). Reedham is followed in quantity by Halvergate (Fig. 3.83) and Limpenhoe churches (Fig. 1.34) where it is also easy to find. In all the others in Allen's list it is extremely difficult to see any if you are not a trained geologist, and they have not been included in Fig. 1.22. He noticed that where the stones are present they appear to be restricted to the post-Norman and especially late medieval building phases. This is both surprising and highly significant, although not easy to interpret. It argues against the idea that the grey quartzite is from a Roman structure under the church and instead that it was from a building standing nearby not demolished until the fourteenth century.

1.33. Reedham nave north wall with Roman tiles laid herringbone and grey quartzite.

A geophysical survey using Ground Penetrating Radar in Reedham church and the churchyard organised by Mike Fulford in 2016 was followed by limited excavations in the churchyard over three seasons from 2016 to 2018. In one trench close to the north face of the tower there was foundation material of coursed un-mortared blocks of grey quartzite. In another on the south side of the nave the lower courses of a mortared curved wall of grey quartzite and Roman tiles was found partly sealed by the nave wall. And another wall of loosely mortared flint and Roman brick was located nearby (Lyons 2017, 387 and Lyons 2019, 443-4). A full report of this work is eagerly awaited, but it appears that Reedham churchyard is actually the source of this material. To identify the structure may well require further excavation, although opportunities for that could be restricted because the churchyard is still used for burial.

1.34. Limpenhoe tower south side with blocks of grey quartzite.

To reach Reedham from Castle Rising the shiploads of the stone were apparently taken in the late second or early third centuries down the Babingley River to the Wash and then around the north coast to Brancaster to build the fort there and then on much further around the coast into the Great Estuary, where Breydon Water now lies, and inland to Reedham (Fig. 1.30). The journey from Castle Rising to Brancaster was 35km and to Reedham it was a remarkable 130km! It was only the organising skills of the Roman military which could have made this possible.

Millstone Grit from the crags of the east Pennines

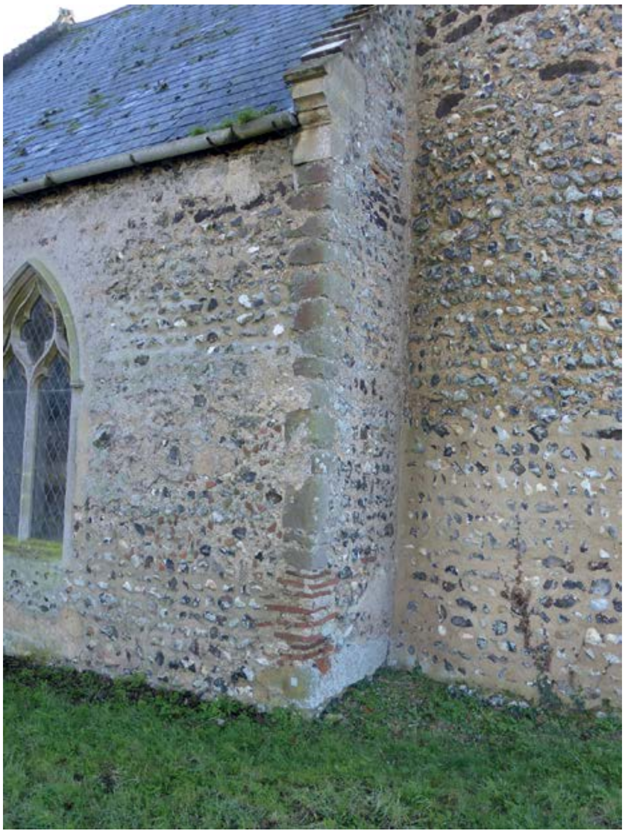
A remarkable discovery made during this project has been a set of Millstone Grit quoins in the north-west corner of St Peter's Brampton, close to Norfolk's second largest Roman town at Brampton (Figs 1.35, 3.30 and 3.31). There is no doubt that these stones are embedded in the original construction of the nave, so they could only have come from Roman building rubble. Tim Holt-Wilson has examined these stones, at the author's request, and reports as follows:

> Close examination of the sandstone under a hand-lens in situ and of a spalled fragment under my microscope shows the material to be composed of angular grains of medium to coarse quartz sand along with feldspar which is weathering to kaolin and also limonite, presumably weathered ferromagnesian minerals. There is no reaction to acid. There are sparsely scattered small, dark grains of other minerals. This is typical of the Middle Carboniferous sandstones of the Millstone Grit Group, composed of material originally derived from erosion of granitic uplands, and now outcropping in the Pennines. For further information on Millstone Grit lithology see Albert Gilligan 'The petrography of the Millstone Grit of Yorkshire' (Quart. J. Geol. Soc. LXXV, 1920; pp. 251-294). I think this is an unusual rock type to use in East Anglia, and its use doesn't look like an instance of later patching to me.

So, the source of these stones is likely to have been the east Yorkshire Pennines, the same stone used to build much of Roman York.

> "Many tens of thousands of tonnes of Millstone Grit sandstones were taken to York by the Romans, almost certainly from the outcrops between Leeds and Masham and transported along the rivers Ure, Nidd and Wharfe. Unfortunately, it is not possible to be more specific about precise provenance partly because virtually no Millstone Grit sandstone contains any features that distinguish it from other such sandstones, and partly because there are no certain quarry sites on the outcrops." (Gaunt and Buckland 2002, 134-5).

Microscope photographs were supplied by Tim Holt-Wilson to Dr Ruth Siddall, a building stone expert who is familiar with Millstone Grit lithology, and she has responded with the following comment:



1.35. Brampton nave north-west corner with Roman tiles and grey sandstone quoins identified as a Millstone Grit.

> I think this is most likely Millstone Grit from the east Pennines, where it is overlain unconformably by the Permian Magnesian Limestone (Cadeby Formation). Exposure and climate at the time led to reddening – though this is not always present - of the stone. This is the nearest outcrop of Millstone Grit to York and stratigraphically it is the East Carlton Member, Marsden Formation, Millstone Grit Group.
>
> It was quarried at Hetchell Crags and the wonderfully named Roman quarries at Pompacali (SE 375 421), which is just South of Hetchell Crags (Hetchell Wood Quarry). There are other potential quarry sites along this geological boundary. Shipping to the Humber estuary along various rivers would have been possible. Buckland (1988) alludes to this, but much of my knowledge comes from direct observation of the stone and conversations with geologists and archaeologists who are members of the Yorkshire Philosophical Society.

So, while there are a number of likely sources, no one quarry can be identified with certainty for the Brampton material. Shipping was by river to the Humber estuary, down the east coast, around the Norfolk coast and then inland, probably through the Horsey Gap between the Isle of Flegg and the mainland, and then up the River Bure to Brampton. That was quite a journey, and it shows that the Bure was navigable this far inland. These quoins are too thick to have come from millstones, so the possibility that

Millstone Grit was used in the construction of a building, or monument, in the Roman town deserves further fieldwork. The most likely route for the stone reaching Norfolk was as ballast on the return journey from corn or pottery manufactured at Brampton going north to the army on Hadrian's Wall (Buckland and Sadler 1990, 118). There appears to have been a trade in Black Burnished ware pottery from the kilns at Brampton for military use on the walls (Lyons 2022, 26-9), so we should not be surprised to find some building stone brought back on the return journey.

The only other known examples of Millstone Grit transported this far south are three Roman altars. One has been found in Bordeaux in France weighing almost a ton (Wacher 1995, 177-8). And there is one from Stanwick in Northamptonshire (Coombe, Hayward, Henig with Crosby, Lowerre, Neal and Paynter 2021) and one from Springhead in Kent (Coombe, Grew, Hayward and Henig 2015). No examples of Millstone Grit used as a building stone have been recorded further south than north Lincolnshire in parishes with river access to the Humber (Stocker and Everson 1990, 86).

A careful search of other churches close to Brampton has not produced any more of this material.

Roman tiles

It is particularly interesting that neither Brancaster, Burnham Deepdale nor Titchwell church, which have grey quartzite from Brancaster Roman fort, contain any Roman tiles, so it seems likely that the fort walls did not include tiles. In contrast, they were used extensively at the forts at Burgh Castle (Figs 1.36-7) and Caister-on-Sea (Fig. 1.38), and, to a lesser extent, in the town walls at Caistor St Edmund.

At Caister-on-Sea, where a section of fort wall and some of the internal buildings are on display, some tiles can be measured. Those in the fort gateway are between 30mm and 43mm thick, and in a hypocaust in the internal building they range from 25mm to 35mm thick and are 230-340mm wide (Fig. 1.38).

While the reuse of grey quartzite stone was limited to the three areas around Castle Rising, Brancaster and Reedham, Roman tiles can be found, often with conglomerate, in early churches in many parts of Norfolk (Fig. 1.39).

There was not much need for Roman building rubble after the early fifth century, so some villas may still have been standing as ruins and available to quarry for flints and tiles in the eleventh century. For tiles we are here talking about Roman roof tiles: the *tegula,* which was flat with upturned edges, and the *imbrex,* which was curved to cover the gaps between the *tegulae* (Fig. 1.40), warm air flue tiles forming heating ducts embedded in villa walls (Fig. 1.41) and the larger wall-bonding tiles as at Burgh Castle (Fig. 1.37).

Before the widespread availability of limestone ashlar these tiles were available to form arches, doorways and windows which could be plastered over inside and out.

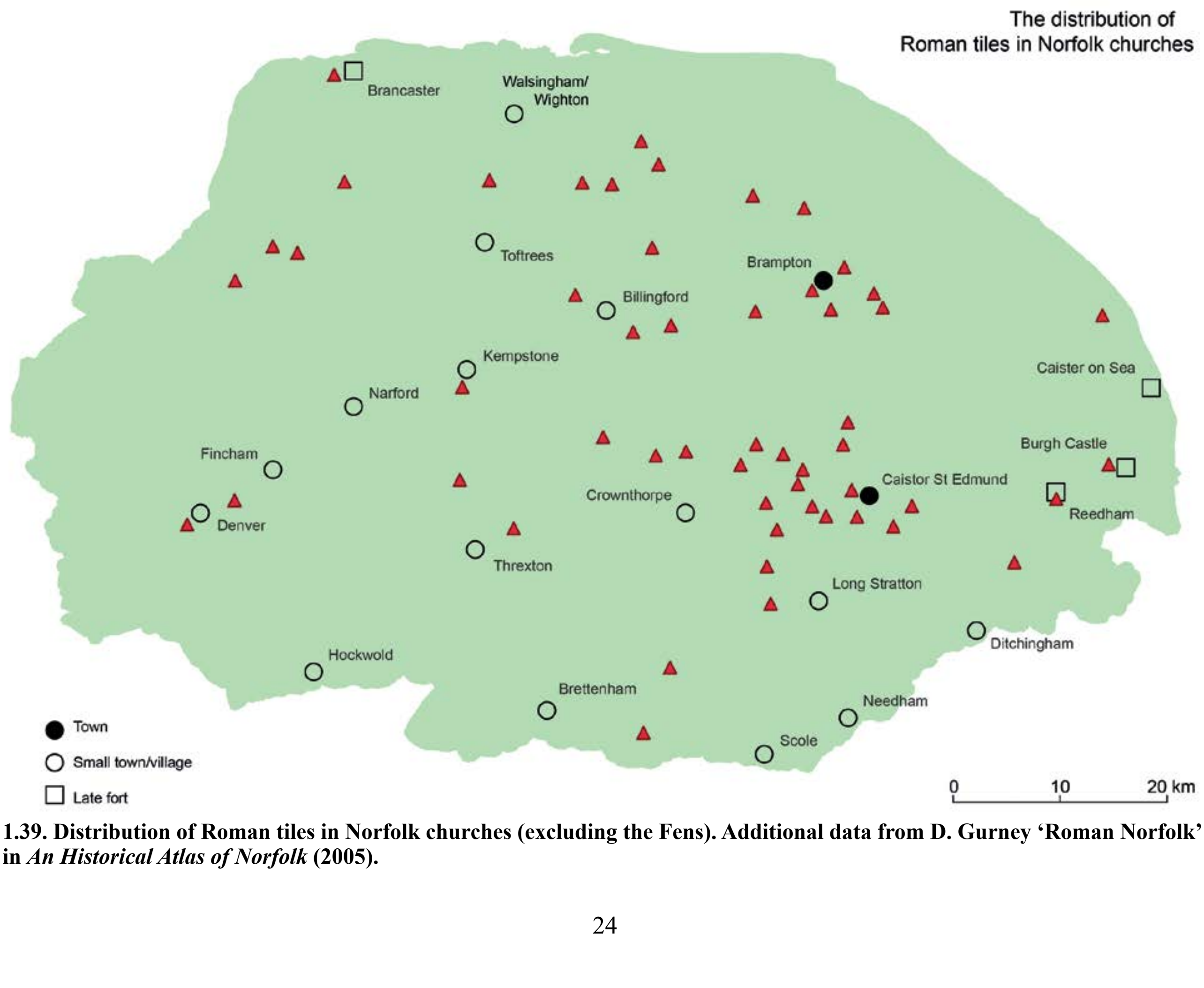
The church where Roman tiles can be seen best as quoins at nave corners is at Oxnead (Fig. 1.42), close to the Roman

1.36. Burgh Castle Roman fort south-east bastion with layers of wall bonding tiles.

1.37. Burgh Castle Roman fort an eastern bastion with both wall bonding tiles and *opus signinum.*

1.38. Caister-on-Sea Roman fort internal building with piles of tiles for the hypocaust heating system.

town at Brampton. Here, they are consistently 30mm thick and up to 380mm wide. They form remarkable decorative herringbone at Reedham (Fig. 3.43). Examples are visible in blocked doorways at Swanton Novers, Barney (Fig. 3.10) and elsewhere. Internal doorways and arches are more difficult to see because they are usually plastered, but at Houghton-on-the-Hill the plaster has partly fallen off the chancel arch and has not been renewed (Fig. 3.98). Great Dunham is believed to be a good example



1.39. Distribution of Roman tiles in Norfolk churches (excluding the Fens). Additional data from D. Gurney 'Roman Norfolk' in *An Historical Atlas of Norfolk* (2005).

1.40. How Roman roofing tiles were used, with flat *tegulae* with upturned edges and a curved *imbrex* to cover the gap between them.

1.41. An example of a Roman flue tile in Chedworth Roman villa, Gloucestershire: not easy to recognise in churches because the scratched surface would not be exposed, although a few examples were found in the North Elmham tile collection.

where they were used internally for the blind arcading in the nave, even though they are not now visible under the plaster (Taylor and Taylor 1965, 219), and also externally for window heads (Fig. 3.65).

The North Elmham Park Roman tile collection

During the 1967-1972 excavations run by the author at North Elmham the debris from a burnt-down Middle Saxon building contained almost 2,000 recognisable Roman tiles which were retrieved from one sealed deposit. Here the

1.42. Oxnead nave south-west corner built entirely of Roman tiles

1.43. Reedham nave north-east corner also built entirely of Roman tiles.

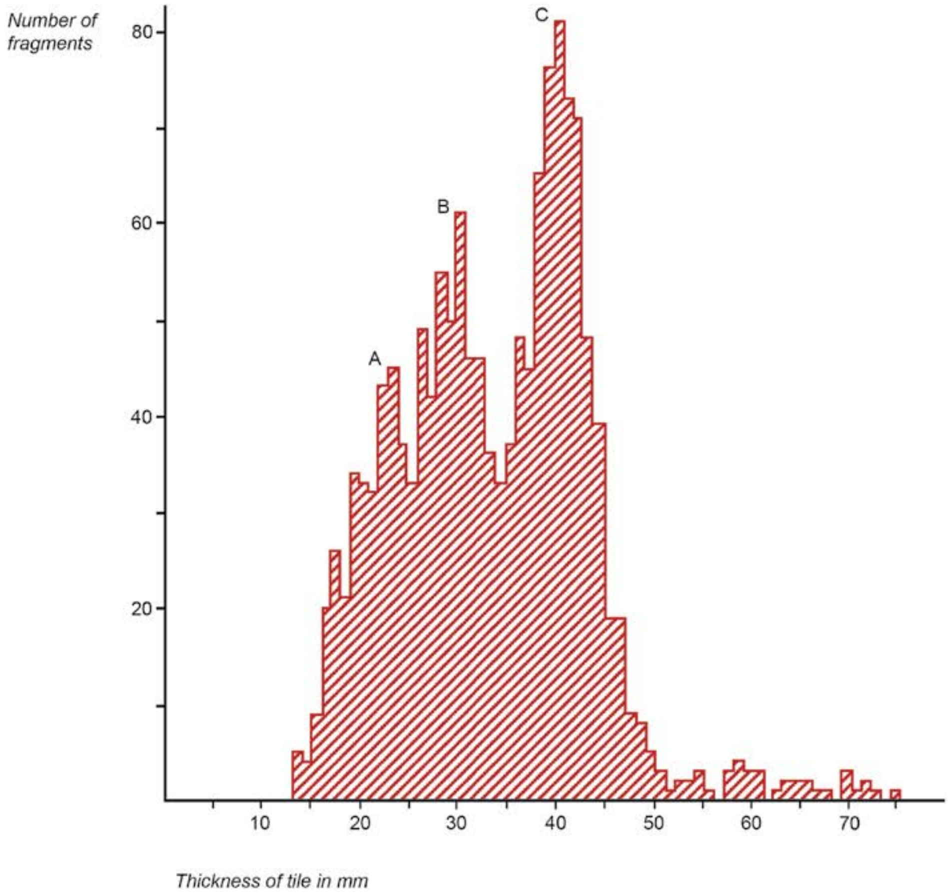
tiles which had been used as a filler with wattle and daub in a substantial timber-framed building destroyed by fire in the ninth century (Wade-Martins 1980, 479-484). Burnt wattles were found adhering to the clay daub, and some of the daub was still stuck to the tiles. Four types of tiles were identified: *tegula* and *imbrex* roof tiles, wall flue tiles (with scratched surfaces to hold plaster) and plain undecorated flat tiles, or wall tiles, of various thicknesses and sizes. They were all reused in a fragmentary state with no piece retaining more than one original corner. The clear association in a structure of daub and reused Roman tiles was demonstrated by the way burnt and unburnt daub was still adhering closely to tile surfaces. Furthermore, traces of white mortar on some of the tiles suggested a previous use in a masonry building. This evidence accords with the standard use of the tiles in a heated Romano-British masonry building roofed with tiles.

The tile surfaces were unabraded, so while they may have been deliberately broken to be reused in the daub, they were nevertheless derived directly from a standing ruin. North Elmham is only three to four kilometres from the small Roman town at Billingford, and that could well have been the source of these tiles.

The proportion of the types of tiles were as follows:

Tegulae 9.85%
Imbrices 4.25%
Flue tiles 4.14%
Plain flat tiles (presumably wall-bonding tiles) 81.76%

Most of the tiles were flat and undecorated and ranged in thickness from 15mm to 50mm, with three peaks at 25mm, just over 30mm and just under 45mm (Fig. 1.44).



Numbers of plain fragments of Roman tile from Well II.

Recognisable tegulae	190	9.85%
Recognisable imbrices	82	4.25%
Recognisable flue tiles	80	4.14%
Plain tile: Peak A	342	17.75%
B	508	26.35%
C	726	37.66%
	1928	

1.44. A histogram recording the thickness of plain Roman tile fragments recovered from Well II in the North Elmham Park excavations compiled at the time of the excavations by Andrew Rogerson and Andrew Jones (Wade-Martins 1980, Fig. 225).

So, assuming this is typical of the Roman tiles which were available as rubble to build the first masonry churches in Norfolk, the flat plain variety with an average range in thickness of 25mm to 40mm can be expected. However, there may be a few thicker ones as well.

This fits well with what we see in early contexts in churches where most tiles are flat and 30 to 45mm thick. Only a very few are distinctive *tegulae*, at as Hales (Fig. 1.45) and *imbrices,* as at Brampton (Fig. 1.46). No flue tiles have been recognised because their scratched surfaces are too embedded to be seen. In his book on flint architecture Stephen Hart describes the wall tiles at Burgh Castle as *tegulae* (Hart 2000*,* Fig. 73); but they do all appear to be flat.

Sometimes, on rare occasions, it is possible to find associated with Roman tiles *opus signinum,* which is a distinctive type of Roman mortar where crushed tiles have been mixed into the mortar to speed up the drying process. *Opus signinum* can be seen most clearly in the fort walls at Burgh Castle (Fig. 1.37). The mortar adhering to the tiles at North Elmham was plain white and not *opus signinum.* One of the best places to see *opus signinum* is in the round tower at Haveringland church where there are several fragments, and one piece looks more like a thick piece of concrete than mortar (Fig. 1.47).

Medieval bricks, usually 40mm to 50mm thick, were not used until the late thirteenth century, so the chances are that thinner, well-fired, tiles averaging 25mm to 40mm, when clearly embedded in eleventh- or twelfth-century walls, were recycled from Roman ruins. When Roman tiles occur in later structures they have presumably been reused at least twice. They are usually finer-textured and are harder fired than medieval bricks, which tend to be shorter and less well-fired. Medieval tiles can be twisted a little and fractured.

So, Roman tiles and conglomerate, particularly when used together in churches, can be strong indicators of early work. Alternatively, they can be in rubble which has been reused from an earlier church, sometimes reused several times. Certainly, in the fifteenth-century south aisle of Sparham church (Fig. 1.48) there are Roman tiles associated with *opus signinum.* Also, tiles which look Roman are incorporated into a fourteenth-century buttress on the south side of Whinburgh church. They were even recycled in the Victorian restorations at Great Melton (Fig. 1.49).

1.45. Hales nave north wall with Roman tiles, including a *tegula.*

1.46. Brampton nave west wall Roman tiles including a rare example of an *imbrex.*

1.47. Haveringland round tower with Roman tiles and a blocks of *opus signinum.*

1.48. Sparham south aisle Roman tiles with *opus signinum* stuck to it.

Thin (30-40mm) medieval tiles can be found, although they are unusual. So, while the difference in thickness between Roman and medieval tiles is small, it can be distinctive.

There is also a problem distinguishing some Roman tiles from nineteenth-century Norfolk floor tiles, or 'pamments' as they are known locally. These pamments are about 40mm (about 1.50 inches) thick and most are consistently 230mm (9 inches) square. But they usually have crisper edges and are well-fired to perform their function as a flooring material.

Identifying reused Roman tiles is fraught with uncertainty, and it may well always remain an imprecise science. Much depends on context. If they are set in what is clearly an undisturbed Norman wall, then it is reasonable to assume that they are Roman. But the author is the first to admit that his identifications in this report will not be correct in every case.

1.50. Mautby round tower with unidentified blocks of a white material near the base of the tower (*Photo by Tim-Holt-Wilson)*.

1.51. Mautby round tower a close-up view of one of the blocks of white material in Fig. 1.50 (*Photo by Tim-Holt-Wilson*).

Unidentified material

There is a single course of buff-coloured stones near the bottom of Mautby church tower of a type which have not yet been identified (Figs 1.50-1). This certainly deserves further research.

1.49. Great Melton nave south-east corner with a decorative arrangement of Roman tiles and flints believed to be Victorian.

1.52. Newton by Castle Acre tower belfry window with a possible Carstone mid-wall shaft and capital. This triangular window head was rebuilt in the 1929 restoration with a mixture of conglomerate, Carstone, brick, flints and pieces of lava quernstone.