

Building Stone from the East Midlands Quarries: Sources, Transportation and Usage

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QUARRIES IN THE EAST MIDLANDS supplied building stone to a large number of the cathedrals, castles, monastic buildings and parish churches both in the region and further afield. Stone from Nottinghamshire was mostly used locally but the Lincolnshire Limestone quarries, which included Barnack, supplied a large number of buildings in East Anglia and the south. The documentary evidence is lacking in most cases and in this paper building accounts and place-name studies are examined to identify the sites of the medieval quarries, to demonstrate the widespread use of the stone, and to discover the means by which it was transported.

The quarries of the East Midlands, defined here as the counties of Lincolnshire, Nottinghamshire, north Leicestershire including Rutland, and parts of north Northamptonshire have provided the building stone for a considerable range of buildings from the medieval period to the present century, and in some cases their use has been attested from the pre-medieval period as well. The use of the stone was not limited to the region of the East Midlands, although the builders of its churches, cathedrals and abbeys exploited the quarries, but major building campaigns in the S. and E. of England also used the quarries extensively and made arrangements for transportation over considerable distances.

No contemporary documentary material has survived from the quarries in the region and information has to be found in the building accounts of those structures that used the quarries. The evidence for the transport of stone from quarries to sites is mostly contained in the same sources. A second source that has been consulted to identify the sites of quarries is the published and unpublished researches of the regional place-names societies. Some areas have been studied in greater depth than others and this means that not all the information on the area of the southern quarries is yet available but work on the northern area has provided a considerable amount. Specific quarries such as the Weldon stone fields have been studied in depth and the whole area of stone production and use reviewed with monographs on the stone used at individual buildings such as Ely cathedral.¹ However, the purpose of this paper is to bring together material from a greater

range of sources to demonstrate the widespread extent of quarrying in the region, the destination of the stone from particular quarries, the means of transporting the stone and the factors affecting the choice of methods (Fig. 1). The period under consideration here is primarily that of the 11th to 15th centuries when the quarries were utilized for the great cathedral and castle building projects of the bishops and nobility. Stone continued to be extracted from a number of these quarry-sites in the subsequent periods and a necessarily selective listing of these uses, for secular buildings in particular, is included.

GEOLOGY

The geological map of the East Midlands region is divided into a sequence of bands running N.-S. that are composed of rocks decreasing in age towards the North Sea coast. The western and southern edges are bounded by low ground in which the Trent and Ouse flow before eventually joining the Humber. Underlying the Trent valley is the Mercia Mudstone bordered to the east by Liassic clays and the scarp of the Lincoln Edge. This narrow belt of high land runs from the Humber to Grantham and is breached in two places, the Lincoln and Ancaster Gaps. The Lincoln Edge is the continuation of the Jurassic limestone belt that stretches from the lower Cotswolds to the Yorkshire coast. It is a region consisting of thick clay layers and Oolitic and Liassic limestone. Not all the stone produced is of building quality, the region between Market Harborough and St Ives (Cambridgeshire) for example is particularly poor, and the best building stone is found in the Cotswolds and the area of Northamptonshire, Rutland, Kesteven (south Lincolnshire) and the Soke of Peterborough.

To the E. of the Lincoln Edge lies the Lincolnshire Wolds with the broad clay valley drained by the Ancholme and Witham rivers. The Wolds are a low range of hills, not rising much over 120 m above OD, running NW. across the county and largely composed of chalk. Building stones have been used from both the clay area, from the eastern edge where it rises into the Wolds around Wragby and Horncastle where a brown iron-bearing limestone has been quarried, and the Wolds where two building stones were used. These were the chalk and the greenish Spilsby Sandstone that weathers to a brown colour. Brown ironstone was also extracted in the area around Scunthorpe and used extensively in local buildings.

Further W. the Nottinghamshire area has two types of limestone formation although neither is Oolitic. The Magnesian limestone quarried in the N. of the region is the best quality and was used extensively for buildings around Blyth (Nottinghamshire). However, most of the building stone of the region is sandstone, with the Permian 'New Red' from the Mansfield area used for churches in the region, although the lighter coloured variety is unsuitable for outside use. Central Nottinghamshire drew on the Triassic sandstone from the Mercia Mudstone series, locally called 'skerry', for its churches. In the SE. of the county Lower Jurassic or Blue Lias was used although this was only available in narrow bands at the quarry and was best suited to interior work.

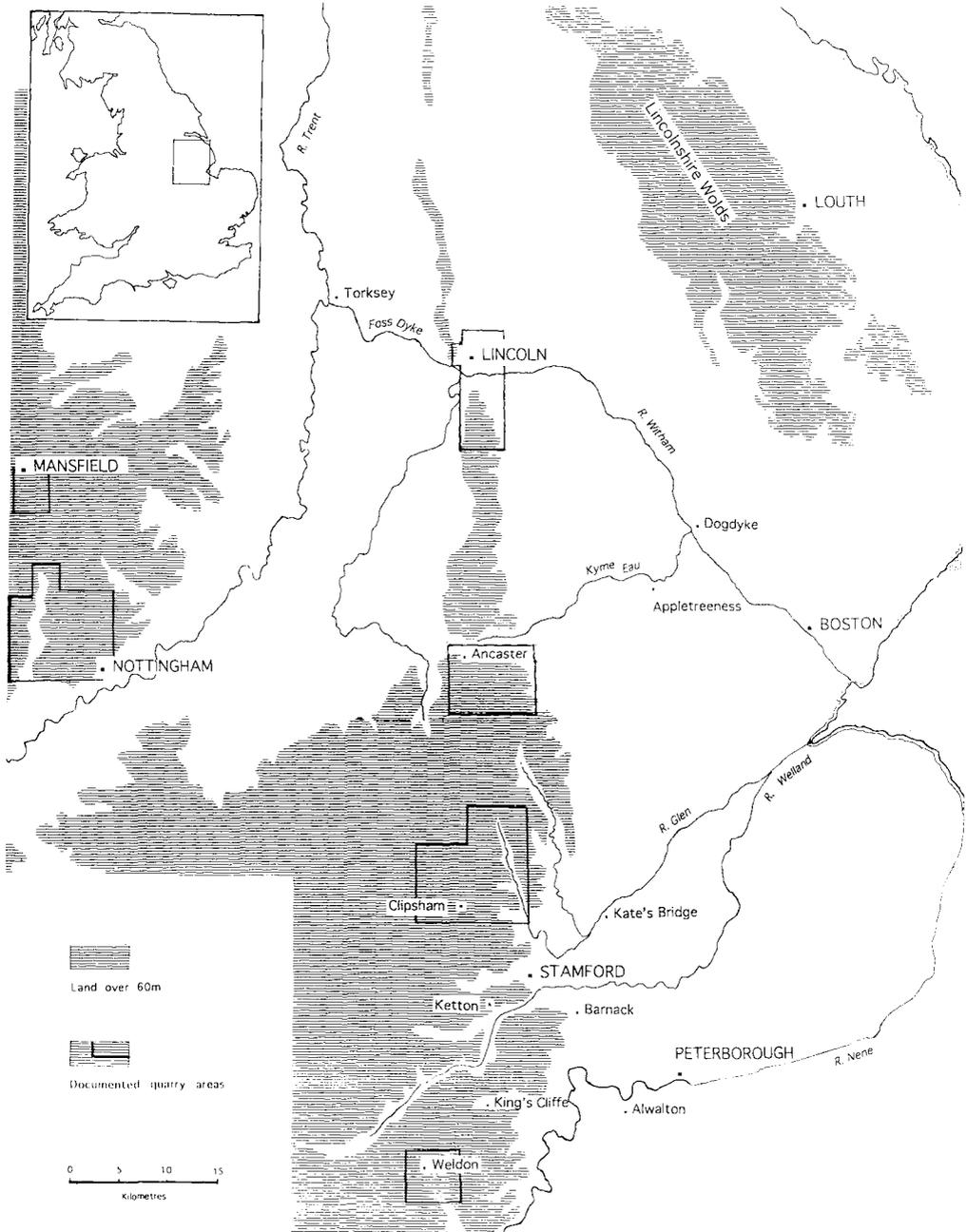


FIG. 1
Quarry sites in the East Midlands

Leicestershire is not a major stone area and building stone is found only in the districts bordering Lincolnshire and Rutland. Other deposits of stone are either too deeply buried beneath the boulder clay or too soft. In E. Leicestershire Marlstone from the Middle Lias was used for churches on the ridge between Market Harbrough and Belvoir, but the Lincolnshire Limestone, from the Rutland quarries and those found in a small area in the NE. of Leicestershire, was a much more suitable material. There were sandstone quarries in W. and NW. Leicestershire providing a buff-coloured stone from the Triassic Keuper series but again this was not a durable exterior material.²

QUARRY SITES

The vernacular architecture of the East Midlands clearly shows where the main stone producing areas are. A comparison between villages in the area around Stamford, which are built almost entirely of stone with boundaries marked by stone walls rather than hedges or fences, and the villages of NE. Lincolnshire where such stone as is available is only used for the church, demonstrates the importance of having access to the material in the immediate area. When transport is involved stone becomes an expensive material, and so the usual practice was to use locally available stone. On the Nottinghamshire/ Leicestershire border at the edge of the Vale of Belvoir, for instance, there is a group of ironstone churches around Eastwell where open cast quarrying and later iron ore extraction were carried out until the second half of this century. It is not an ideal building stone, since it is extremely soft and unsuitable for fine detail work, and its use for this group of churches shows that ready availability was the main consideration.³

Demand for stone from the areas of the Lincolnshire Limestone where the stone is of the highest quality came from building projects further afield and there is considerable evidence that stone was transported over long distances, for work on the royal castle at Windsor in the 14th century, for example, or for the Louth spire campaign in the early 16th century (see further below). Quarries were also leased or bought by monasteries undertaking building works and the stone transported to the site, for example the quarries at Barnack which supplied stone to buildings over a wide area in East Anglia in the 11th and 12th centuries.

The state papers of the 13th and 14th centuries demonstrate that a number of building stone quarries in the region were under royal control (see further below). The reasons for this are not hard to find, with the excellent properties of the stone utilized by the Crown for projects in different locations. These documents also provide evidence for quarry sites that are not otherwise obvious, such as those in Sherwood forest for example.

THE LINCOLNSHIRE LIMESTONE QUARRIES

The name 'Lincolnshire Limestone' refers to a particular type of stone formed in the Jurassic period that is found not just in Lincolnshire, in the range of low hills in Kesteven, but also in Rutland and Northamptonshire. It is Inferior (i.e. lower)

Oolitic limestone of very high quality, suitable for ashlar and for fine carving and has good weathering properties. Quarries worked in the medieval period were situated in Kesteven, around Ancaster, in the parish of Castle Bytham, and further S. around Stamford. There was also a northern quarry area that supplied the cathedral of Lincoln.

LINCOLN CATHEDRAL QUARRIES

The present Lincoln cathedral quarry, known as 'Dean and Chapter' quarry, is situated in the N. of the city on Riseholme road. It is the most northern of the Oolitic limestone quarries in the diocese. The cathedral is clearly built of the Lincolnshire Limestone, but the exact source of this stone has not been established and the date of the opening of the Dean and Chapter quarry is uncertain. A quarry was owned by the Dean and Chapter in the 18th century but it was not used for repairs to the cathedral and restorers of the building acquired supplies of building stone from other sources. James Gibbs used stone taken from the ruins of the Bishop's Palace for the work on the interior of the west front in the 1720s and James Essex brought stone from Yorkshire in the later 18th century.⁴ Stone described as 'Lincoln stone' was bought in 1794, although since this was to be used for paving it need not have come from a building stone quarry. Larger amounts of this 'Lincoln stone' that clearly was intended for building work were bought in 1834, but the majority of stone supplied to the cathedral during the 1830s came from the Ancaster quarries.⁵ The Dean and Chapter quarry in Riseholme road was in operation from at least 1872 when it was fenced in and quarrymen's wages appear in the annual audits from then on, although stone was again purchased from the southern quarries of Little Bytham and Ancaster during this period. Limekilns were built in the quarry in 1874 and this may have been the main use of the site at that date. In 1902 the Riseholme road quarry was extended and the medieval beds were rediscovered on this site. The site was described at the time as having been 'disused for many years'.⁶

The one documented reference to the source of the cathedral building stone in the medieval period points to the area in the immediate vicinity supplying the stone. In 1231 permission was granted for the cathedral to quarry stone in the ditch of Lincoln castle. This may have been a chance find by the cathedral stonemasons but there were quarries under royal control nearby, situated to the N. of the castle in Newport, from the evidence of a land grant of 1240 where the king's quarry adjoined a parcel of land in question '*... stratem regiam ex parte australi a lapifodina ibidem versus occidentem*'.⁷ The promontory on which the cathedral and upper city lie is part of the limestone belt, and there is documentary evidence for medieval quarrying in the area of the Arboretum on its SE. slopes.⁸ Placename evidence additionally locates pits and lime-kilns in the parish of St Peter Eastgate, to the NE. of the cathedral, and strongly suggests that the triangle of land immediately to the E. of Minster Yard, adjoining the 19th-century Nelthorpe's quarry site, was the site of quarries from the 13th century. The area between Eastgate and Winnowsty Lane was the site of an area called Les Pyttes from 1245

until the end of the 15th century, close to the site of the lime kilns documented from 1324. Although the name 'Les Pyttes' could refer to natural hollows in the land, its closeness to limestone extraction does suggest that these may also have been quarry pits. The hospital of St Giles that lay further E. again also had quarry pits sited nearby that are documented as such in the 17th century, and recorded in the 14th century.⁹ The cathedral stone-cutters would therefore have had good sources of building stone in the area around the site.

Other stones that have been identified in Lincoln cathedral are a Blue Lias, perhaps from the western part of Lincolnshire, that was used for the infill of the Angel Choir vault and two types of black 'marble'. Purbeck marble from Dorset is the predominant marble used, found throughout the cathedral from St Hugh's work to the Angel Choir and Chapter House entrance. The other marble is from Alwalton near Peterborough and seems to be confined to the work of the Early Gothic period (see below). Despite its poor weathering qualities, Purbeck marble was used on the W. front of the cathedral, replaced by freestone in post-medieval restorations and is currently being re-instated. The removal of the Purbeck was first undertaken by Essex in 1761, according to Buckler who continued it in the 1860s.¹⁰

ANCASTER QUARRIES

The name Ancaster is given to the stone produced in the immediate area and is not restricted to output from the village of the same name. The quarrying region lies within an approximate rectangle bounded on the W. by Ermine street, on the S. by the Grantham to Boston road, on the E. by the road from Bourne to Sleaford and on the N. by the Ancaster to Sleaford road, with the village of Ancaster occupying the NW. corner. The medieval quarry sites lay in the parishes of Wilsford, Dembleby and Heydour.

Stone from the quarries was used by the Romans for both sculptural and architectural work, and its use continued in the Romano-British period with sculpture of a vigorous if rustic nature produced at Ancaster.¹¹ Evidence for Saxon extraction of Ancaster stone is its use for the carved stone sculptures of the 7th–8th centuries now built into the wall of the chancel of South Kyme church. The geological report made in the 1920s concluded that the stone had come from a quarry in the Lincolnshire Limestone series, most probably Ancaster.¹² Kyme is *c.* 25–30 km from the quarry site, connected by watercourses, and during the later medieval period was the site of a wharf used by stone barges (see below).

The fine cutting qualities of the stone were also exploited for sculptural work during the 12th and 13th centuries when the Ancaster quarries were a centre of production of monumental work in the form of grave slabs, effigies and figures. The market for this work was more local than for that of the Barnack sculptors with distribution of the work limited to a 50 km radius of the quarry site and restricted to the area east of the river Trent.¹³

Ancaster stone has been identified in the arcades of the naves of the parish churches of Ancaster and Wilsford which both date from the 12th century, but the

main documented period of activity seems to be the 14th century when the quarries came under royal control. The Wilsford group of quarries supplied stone for Windsor castle in 1363 and 1364.¹⁴ Wilsford provided worked stone for Tattershall castle in the 1430s, for the church at Tattershall in the 1470s, and for St James' church Louth in the early 16th century. The quarry at Heydour is documented by an assessment of the manor in 1343 that found it to have a freestone quarry within its boundary.¹⁵

The abbot of Revesby had quantities of Ancaster stone in store in the early years of the 16th century which he was able to sell to the spire works at Louth. Partial excavation of the NE. corner of the cloister and the adjacent parts of the nave and transept at Revesby found evidence of Ancaster stone used together with the local green sandstone. The excavation report was unable to provide firm dating evidence for the excavated stonework but the sections of Ancaster stone were stylistically attributed to the Perpendicular period and the circumstantial evidence would support this being the work in hand in the 16th century.¹⁶

An important quarry that supplied stone to building projects from the 14th to the 16th centuries was sited at a place called Heselburgh, which has not been firmly located by previous writers. The site is, however, mentioned in several documents together with the Wilsford quarry and is clearly part of the Ancaster group. A quarry at Heselburgh was part of a gift of a parcel of lands and rents given to Lincoln's Dean and Chapter by a group of prebendaries in 1352, and there the place is described as Heselburgh by Heydour. The siting of Heselburgh in Heydour parish has also been confirmed by placename research.¹⁷

Stone from Heselburgh was used at Southwell Minster in 1429–30 for work in the Chapter House and its vestibule, although the main walling stone that had been used for the building was Mansfield and stone roof tiles from Mansfield were used for roofing the new work. The fragmentary fabric accounts for 1429 and 1430 name Peter de Hasilbargh as master mason for the work and it is reasonable to assume that the choice of stone was his. It is difficult, otherwise, to explain the change from the locally available material, the Mansfield stone, to the much more expensively transported stone from Lincolnshire.¹⁸ There are two further references in the 15th century that may refer to Heselburgh, these are to quarries at 'Hasilbarow' and 'Hasilborowe'. The first is from the summarized accounts for Nottingham castle of 1476–80, where it is listed amongst quarries of Magnesian limestone from the immediate vicinity of the castle and hence may be from a more local source. It is unlikely, however, to be the similarly named place in the village of Norton in north Derbyshire as Colvin suggests since this is within the region of the millstone grit. The second is listed with Weldon stone for work on King's College Chapel in 1480 and is much more likely to be the site in the Ancaster group.¹⁹

The sites of the Ancaster quarries can still be seen on Wilsford Heath, about a kilometre SW. of the village, and Heydour quarry was also recorded on the same site but a little further S. in the 1824 Ordnance Survey. Later expansion of the quarry workings lay to the N. and W. A second quarry site at Wilsford was recorded in the 1824 survey, in Wilsford Warren to the NE. of the village, as well

as two further sites in the parish of South Rauceby, close to the Sleaford road. The same map also shows a quarry in Carlton Scroop, next to Carlton Ashes, that was presumably part of the Ancaster group, although outside the rectangle of the medieval quarries.²⁰

Wilsford quarries were worked in the 20th century. At Wilsford in the 1960s Gregorys No. 2 quarry (SK 992410) had 10m beds of freestone suitable for general walling work, of a cream to light brown colour, beneath the oolitic Hard White bed suitable for exterior work and the darker coloured Weather Beds used for paving.²¹ The stone produced in the earlier periods was presumably similar. Dembleby was described in mid 19th-century trade directories as having an 'excellent limestone quarry' on the heath although its owner was listed in the same entry as a limeburner. The new church at Dembleby that was built in the 1860s utilized stone from local quarry pits. Heydour was also worked in the 19th century. The Ancaster stone specified by G. G. Scott for the new chapel for St John's College Cambridge in 1862 must have come from one of these quarry sites.²²

CLIPSHAM QUARRIES

The Clipsham group of quarries lie S. of the Ancaster quarries. They were first opened by the Romans and were used extensively by medieval builders. There were seven Clipsham stone quarries in Lincolnshire and Rutland producing a rather coarse grained stone with a high proportion of shelly fragments and other irregularly shaped material that gave the stone a greater strength. The stone varied in colour from pale cream to pale brown or an occasional blue. It was also a very hard stone to cut with a toothed handsaw.²³ The quarries are situated in a broad band that stretches from Greetham to Careby and from Castle Bytham to Pickworth. Placename evidence extends the quarry field to the N. and E. with stone extraction sites at Burton Coggles by the 17th century, Corby Glen by the 14th, and Edenham in the 12th and 13th centuries, the latter presumably supplying Vaudey Abbey in the parish.²⁴ Clipsham stone was used outside the immediate area from the 14th century when stone from Holywell and Careby was ordered for work on Windsor castle at the same time as stone was ordered from the Ancaster quarries. A Clipsham slab has been identified in Stamford from shortly after 1380.²⁵ The quarry at Holbeck in Greetham supplied ashlar for a tower on the S. side of Bolingbroke castle in Lincolnshire in 1444.²⁶ Large amounts of Clipsham were bought for King's College chapel, together with Weldon, between 1508/9 and 1511, although after 1511 Clipsham no longer appears in the accounts. Clipsham stone has recently been used for the replacement of a number of carved figures for the exterior of Windsor castle.²⁷

The quarry at Holywell in Castle Bytham parish (Lincolnshire) seems to have had a long working life, still producing stone in the second half of the 20th century. The site of the medieval pits is thought to be marked as 'Old Pits' on the 6 inch OS map, NE. of the 20th-century Medwells Quarry. The other extraction sites are in the same immediate area, Big Pits quarry at SK 968142 was reported by Purcell to have been first opened in the 11th–12th century and reopened in 1923, and Old

Quarry, at SK 979154, was used until the 1930s. A quarry S. of the parish church at Castle Bytham (SK 990180) was still in production in the 1960s.²⁸

BARNACK QUARRIES

The village of Barnack is in the Soke of Peterborough SE. of Stamford on the edge of the limestone range. Barnack stone was one of the most durable of the Lincolnshire Limestone series and was greatly in demand as a building stone. The quarries seem to have been sited in one area S. of the village, obviously long disused, marked as 'Hills and Holes' at TF 075048. The site demonstrates the quarrying methods of the medieval stone cutters to have been a series of shallow pits dug into the surface rather than a face cut back. Quarrying of Barnack stone was also carried out at Walcot S. of the village; in 1335 the monks of Bury St Edmunds had rights to the quarry there.²⁹

The Barnack stone was in three deposits, a hard walling stone, a limited amount of fine textured oolite and the famous ragstone that was in use throughout the quarries' working period as building stone. This was a ragstone that could be faced and used as ashlar. The rag was a coarsely bedded and coarse grained freestone mostly composed of rounded or concretionary coated shells or fragments bonded by carbonate of lime.

There is evidence from surviving sculpture that the Romans extracted stone from Barnack, and that it was used by them outside the region. Documentary evidence exists for quarrying by the Saxons for the abbey at Ramsey, in a charter of Edward the Confessor that also makes it clear that the abbey of Peterborough held the rights to the site. The Saxon builders of Peterborough abbey had themselves used the stone for the church building that survives beneath the Norman south transept, constructing it out of roughly squared blocks identified as Barnack.³⁰ The earlier building is undated, it has been placed in the second half of the 10th century with possible traces of 7th-century masonry. Barnack stone has also been recognized in the long and short quoins, and pilaster strips of Saxon churches over a wide area in the Midlands and East Anglia lying to the S. and E. of the quarry site. The Barnack quarries do not seem to have come under the Crown's control at all during their working life since there are no references to them in the state papers.³¹

Barnack was the centre of a major sculptural workshop for figure sculpture and decorative panels from the Anglo-Saxon period through the 13th century, with distribution over a wide area from the Thames to the Wash. Evidence for the production of tomb slabs in the 12th century can still be seen in the churchyards of Barnack and Tallington where the shaped stones are in use as coping stones on the churchyard wall. The production from Barnack has been identified on stylistic grounds and its influence traced to other areas and stone types.³²

Quarrying rights were granted at various times to the abbeys of Ramsey, Croyland, Thorney, Bury St Edmunds, Sawtry, Spalding, Norwich, and Ely, as well as Peterborough.³³ Purcell noted that the builders of the Cambridge colleges made no use of stone quarried at Barnack, since by the 15th century it was no

longer available. He also noted however that Barnack stone can be seen on certain college buildings and explained this as a re-use of stone from the East Anglian abbeys. Willis and Clark³⁴ provide the evidence for this in the various college accounts, which Purcell acknowledged but which he did not investigate in full. He found Barnack at Caius, Peterhouse, Corpus Christi, Emmanuel, and Jesus Colleges. In the cases of Caius and Corpus Christi the Barnack stone was reused from Ramsey abbey in the 16th century, and itemized in the building accounts. Caius spent over £250 on 'culling' and transporting stone from Ramsey, over twice the amount that they spent on new stone from Weldon. The Barnack used at Corpus Christi came from Thorney abbey as a gift of 146 tons from the Earl of Bedford. Emmanuel also had access to Barnack stone, but not from an abbey site. The college was given permission to take stone from Cambridge castle site in 1588 and the Bursar's account for that year includes payment to carters for moving it and, as noted above, Cambridge castle had been built from Barnack stone bought in the late 13th century. Neither Jesus or Peterhouse have records of acquiring Barnack stone from redundant sites but its presence at both places means that they had access to it. Additionally King's and Trinity colleges bought stone from Ramsey in the 1560s, for use on their chapel and hall respectively. Trinity bought the stone from a dealer, the Junior Bursar's account for 1560–61 refers to payment to 'William Aungier for a bargaine of Ramsaye stone to the nombre of iijti lodes at iijs iiijd ye lode xiiijli', whereas King's had bought a standing building at Ramsey which they had demolished. The Mundum book for 1560–61 records 'sol . . . pro destructione totius conventi de la freestone empt' apud Ramsey liijs iiijd'. In the next year, 1562–63, Trinity bought stone to the value of £5 3s. 10d. from Aungier and this is described as 'three greate buttrises in the Este ende of the chauncell at Ramsei and of the northe side' which the college had to pay to have demolished. Barnwell priory and the Greyfriars in Cambridge were also quarried for building stone. Barnack has been recognized in both the Romanesque and Gothic parts of the church at Ely, with documentation of its use for the new work supporting the octagon built after 1322.³⁵ The quarry site was abandoned in the 15th century, apparently exhausted, although subsequent borings have found stone of good quality.³⁶ The Barnack quarries were producing stone again in the early 19th century, although it was used for road stone not building.

WELDON QUARRIES.

The Weldon quarries are in Northamptonshire, beside the Stamford–Kettering road, and are first recorded in use in the mid 13th century when stone was obtained from Weldon for the nearby castle at Rockingham. It has been suggested that Weldon stone was used for the Eleanor Cross at Geddington.³⁷ Large quantities of Weldon stone were used in the building of the Cambridge colleges in the late 15th and 16th centuries, in particular for King's College chapel. The Weldon stone was used for both walling stone, together with stone from Clipsham, in the period 1508/9 to 1511 and for the high vault which John Wastell contracted to build in 1512. A further contract for work on the chapel in 1513 also specifies

the use of Weldon stone for the 'chappelles' between the buttresses. Weldon on its own was used to build the Provost's lodge at King's in 1536. It was used with King's Cliffe stone for Trinity College's new chapel in 1560, for Gonville and Caius 1564–73 and for Corpus Christi College chapel doorway 1583–84. Christopher Hatton gave large amounts of Weldon for the building works of 1637–38 at Jesus College. The stone had also been used there during the 1490s.

The Weldon stone is a coarse grained oolite of a yellowish colour inclining to red, with the best rag even in texture and comparatively soft when first cut. It hardens rapidly on exposure to air and is then a very durable stone. Its resistance to frost is due to its open texture on a microscopic level which allows water to drain through. Further quarries at the neighbouring parish of Stanion seem to have produced a different stone, identified at the churches of Geddington, Deene, and Weldon itself.³⁸ Quarries at King's Cliffe also produced a similar stone to Weldon that was used with it at Cambridge in the late 15th century. Stone from King's Cliffe itself was used at King's College chapel from 1460. It was used at Trinity College for the new tower gateway built in 1518–19, when 15 tons were bought from a quarryman there and again in 1605 when the kitchen was built. 'Cliffe' stone was specified in a building contract of 1598 for the works at St John's College.

The Weldon quarries continued in use throughout the post-medieval period, supplying the building stone for Kirby Hall in the 1570s and for Sir Thomas Tresham's buildings at Rushton in the 1580s and 1590s. Documentary evidence from the 17th century reveals that the stone was particularly sought for the construction of house chimneys as well as for walling stone for houses. The subsequent period seems to have been one of neglect with little evidence of stone extraction and the revival of large-scale quarry workings only began when the railway line from Kettering to Manton was opened in 1880. Weldon was in demand for buildings such as the University Library Cambridge, 1888–1934, the new buildings at Merton College Oxford in 1904–05 and for restoration to a number of medieval buildings such as the Chapter House of Lincoln cathedral and the crossing tower at Rochester. Stone extraction has continued into the second half of the 20th century with some of the old workings re-exposed.

The earliest documented quarry sites at Weldon are those mapped in 1585. The sites lay in Mill Field SW. of the village, in three separate groups of pits. They were clearly worked as shallow pits with the spoil cast up in mounds and remained visible until destroyed by extraction of the ironstone at the extension of the Longhills quarry (SP 925892). A second series of 'hills and hollows' at SP 926893 and at SP 930893 may well be early extraction sites on the south-east side of the village.³⁹

LESSER QUARRY SITES

The quarries at Ketton are now better known for cement production than stone, but a high quality freestone has been produced there since Roman times. In use in the medieval period, with a charter granted by Edward I for stone working, the Ketton quarries only seem to have been a major supplier of stone in the 16th

century.⁴⁰ Ketton was one of the stones used in the construction and repair of the Cambridge colleges. It was first used in the 17th century, at Clare Hall in the 1630s–40s where it was used with Weldon, and on its own for two buildings by Wren from the second half of the century. These are the chapel of Emmanuel College of 1667–68, where its use was specified in the building contract with two masons, one of whom, Nicholas Ashly, was from Ketton, and the library at Trinity College of 1675–76. It was used in far greater quantities in the 18th century both as a facing stone, for Trinity Hall in 1727 and for Christ's in 1738, and as a building stone. James Essex used Ketton for his rebuilding of the hall of Trinity Hall in 1742–43 as well as for paving Emmanuel College hall in 1760. In the early 19th century it was again used as a facing stone, for William Wilkin's New Court for Trinity College of 1823–24. It was also specified by Essex for repaving the choir at Ely in 1757.⁴¹

Ketton stone is very even textured with only occasional small fragments of shell amongst the oolite. It is an excellent stone for carving and varies in colour from pale cream to brownish yellow or a pinkish colour that weathers to cream. Quarries at Casterton and Stamford produced a similar stone to Ketton that was used in the 15th-century buildings of Stamford, although a coarse shelly ragstone resembling Barnack was also quarried at Stamford. Major quarrying at Great Casterton was started in 1834 at TF 013082. Subsequent quarries have been opened at Edith Weston, Wing, Lyndon, and Uppingham for small scale operations that have produced a similar stone to Ketton.⁴²

Stone quarrying was carried out in the town of Stamford during the medieval period. The town lies on an outcrop of the Lincolnshire Limestone and this was exploited from at least the 12th century for work on the castle. The area of Scotgate contained stone pits that had fallen out of use by the 17th century. 19th-century quarrying was carried out on the NW. side of the town, near Great Casterton. Stamford marble was also won here. Stone pits were opened in the surrounding fields and this method of quarrying stone has been documented in the late 13th century as well as in the 18th. A quarry site at TF 036069 that was opened before 1796 was worked as a pit that was later found to be 10 m deep. This site, SE. of Stamford, is close to Burghley Park and presumably produced the same Barnack-type limestone. Outside the town, the Earls of Exeter owned quarries at Wothorpe, worked in the 18th century. This site lies S. of Stamford, next to Burghley and may again be related to the Barnack stone.

ALWALTON MARBLE QUARRY

There are a number of fossil limestones that will take a high polish, of which Purbeck is the best known. These limestones are close-grained and deeply coloured and will polish readily in the presence of a light cutting compound used with an abrasive. One method for polishing marble columns, using vinegar as the cutting medium is mentioned in the *Metrical Life of St Hugh*, written in the 1220s.⁴³

Stone of a harder material than the marble was used as an abrasive as the Westminster Abbey accounts show. In 1253 six shillings was paid for two stones 'ad

marmor polisandum', the large sum suggesting that these were a special type of stone. Where marble was used on a large scale, for buildings such as Salisbury or Lincoln, bringing all the shafts, capitals and bases to a high finish would have been a considerable job and at Westminster Abbey, polishers, distinct from marblers, are specified in the wages lists in the 1250s.⁴⁴

When polished, Purbeck marble varies in colour from the familiar black, which can itself range from a dark grey through shades of yellowish green and blue, to red and brown.⁴⁵ The marble from Purbeck was transported over large distances to sites in England and Wales in the 13th and 14th centuries whereas the other limestone marbles are mostly found close to their quarry areas, such as the Forest marble used in Oxfordshire and southern England, and Frosterly which was used in the north-east.⁴⁶

The Alwalton quarries supplied buildings in East Anglia and the East Midlands and its use has not been reported from further W. than Bedford. It can be distinguished from the other marbles by its constitution. Purbeck marble can be recognized by the incorporation of freshwater snail shells, of winkle-like shape, whereas Alwalton marble is made up of poorly sorted oyster shells set in a microcrystalline calcite matrix. From the examples seen it does not have the variety of colours found in Purbeck but is mostly a brownish-grey. It was formed by compaction and recrystallization of oyster beds in the Great Oolite Limestone overlying the variegated clays and thin limestones of the Upper Estuarine Series.⁴⁷

The village of Alwalton lies on the outskirts of Peterborough and the quarry site has been identified on the Alwalton Lynch escarpment on the banks of the river Nene. Quarrying was carried out in a series of excavations and the river was used to transport the stone.⁴⁸ Several large blocks of roughly squared stone were still visible at the water's edge in 1986 at TF 136964 although the extraction sites were not obvious. In the 19th century the stone beds were visible on the road from the village down to the riverside and in the railway cutting further north. Although the quarry was described as no longer working by 1875, further extraction seems to have been possible until the 1920s.⁴⁹

Alwalton marble has been found at Peterborough cathedral where it was used for the detached shafts of the W. portals and for the bowl of the font as well as for a series of effigies of Peterborough's abbots that were recovered from the Chapter House site. The manor of Alwalton had been in the possession of Peterborough since the Saxon period and it is therefore to be expected that Peterborough would be a major user of the marble.⁵⁰ There is, however, little building work surviving at Peterborough from the period when dark marble was in demand as a building material, that is the Early Gothic period, with the exception of the unfinished W. block and some claustral buildings.⁵¹ On the W. block Alwalton marble can be found on a higher level as well as in the porch, used for the detached shafts on the N. aisle tower. In common with the other limestone marbles Alwalton is not an ideal exterior stone, crumbling away faster than other limestones. Once the stone has lost its original surface it can be hard to distinguish it from other limestones except by the advanced state of its weathering.

The five Alwalton effigies of the abbots are thought to be provincial work and vary in the skill of their execution. There is also a fragment of a monumental effigy that is now in Great Staughton church in Huntingdonshire that has been identified as Alwalton. It had been recorded in the wall of Gaynes Hall in the village in 1926 and its original site is unknown.⁵² These are the only known effigies in this material, although other dark marble figure sculpture may prove to be of Alwalton marble, and it seems likely that they were made in the Peterborough region.⁵³ Additionally a further Alwalton slab has been recognized at Crowland. It is a coffin lid with a long stemmed cross in relief on its top. The slab is on uniform thickness and tapers in width towards the foot. It has been placed on top of a freestone table tomb that has no connection with and overhangs it on all three visible sides. The parish church at Crowland has been created out of the north aisle of the abbey church and this slab may well have come from that site, although nothing is known of its history. It probably dates from the 13th century, on the evidence of the style of the cross, but there is no inscription or other means of identification.⁵⁴

Alwalton marble has also been identified in an architectural context at three other sites in eastern England. At Bury St Edmunds two bases for small detached shafts have been recognized, presumably part of the shipment exempted from tolls in the second decade of the 13th century. The Galilee porch at Ely also had Alwalton bases recorded from its W. front.⁵⁵ Additionally there are two Alwalton shafts amongst the dark marble in the arcade within the porch and it is possible that other exterior marble bases, now too weathered to be identified, may be Alwalton. The marble was also used on the interior of the building in Bishop Northwold's presbytery. The majority of the marble used for the main piers, which have cores of coursed marble with a ring of detached shafts, and for the shafting of the upper level arcades of the choir is Purbeck. The marble effigies, including that of Northwold, are also Purbeck. However there are sections of Alwalton used within Purbeck piers and tombs. Piers 4 and 5 from the E. on the N. side have single courses of Alwalton between the Purbeck for the pier cores and pier 1 from the E. on the S. side has an Alwalton base that has been repaired with Purbeck. The tomb canopy associated with either Bishop Hotham's tomb or the shrine of Etheldreda on the choir N. side has three of its marble capitals carved from Alwalton with the rest of the monument in freestone and Purbeck.

The combination of Alwalton and Purbeck within architectural elements in this way suggests that the Alwalton at least was being delivered to site in an unworked, block form. The inclusion of only three carved Alwalton capitals on the Hotham canopy and only one large pier base in the choir arcade argues against these being prefabricated. It seems much more likely that blocks of Alwalton marble were available in the workshop and that these were used when there were problems with the Purbeck.

As Purcell has noted, the main building to use Alwalton marble is Lincoln cathedral, in the period of Bishop Hugh (1186–1200). What has not been realized is how precisely its use was associated with the first Gothic building campaign, that is the E. end work as far as the main transepts. Both Purbeck and Alwalton were used at ground level for the detached shafts of the double wall arcading, and

even used together on one pier in the case of the 'Trondheim' pier in the SE. transept. Purbeck predominates above ground level with only one or two minor abaci made of Alwalton.⁵⁶ Most significantly, in the main transept, the Alwalton is only found in the double arcading of the bay next to the tower on each side. This is the point at which the double arcading changes to a hybrid, single, form and it is assumed that the first master was replaced by the second. It strongly suggests that the first master had personal control of the stock of Alwalton and was responsible for bringing it to Lincoln. After his departure its use ceases, with the exception of one or two shafts to be seen in the nave and Angel Choir that must have remained in the stone store. There is also a further use of Alwalton at Lincoln, where it has been used in block form. The base course of the Chapter House, probably in building from before 1220,⁵⁷ consists of slabs of Alwalton marble that extend around the whole Chapter House but not its vestibule. The attached buttresses also have this base course although the projecting corners, which are more vulnerable to damage have been repaired with Purbeck. This is the only use of Alwalton in this form that has been encountered.⁵⁸

At St Kyneburga's church, Castor, the shafts of the 13th-century double piscina are made of Alwalton marble. The village lies along the river Nene between Alwalton and Peterborough and was the site of a wharf for stone loading in the 13th century. Castor was also a Roman site and Alwalton marble has been reported from there, used in the dwellings.⁵⁹ Further use of Alwalton marble has been noted at Ramsey Abbey (Hunts.) for the plain hexagonal bowl of the font, and at Anglesey Abbey (Cambs.) where the octagonal shafts of the piers of the monks' parlour, that date from the mid 13th century, are of Alwalton marble.⁶⁰

A later use of Alwalton marble is at Southwell Minster on the doorway from the N. choir aisle to the Chapter House vestibule. The moulded jambs with attached shafts and the central trumeau with its closing-beam slot carved in the form of a long-tailed dragon in high relief are both made of Alwalton marble. The doorway belongs to the Chapter House and vestibule building campaign and therefore dates from the end of the 13th century. This is the latest known architectural use of the marble.

Two other possible Alwalton pieces have been recovered archaeologically. A Romanesque corbel head from *c.* 1120 that was found in a re-used context in St Mary's church Bedford has the characteristic shelly appearance of Alwalton and may represent an early use of the marble.

The second piece had been re-used as hardcore beneath a bridge pier at King's Ripton in Cambridgeshire. The bridge was built in the 16th century and the fragment was undateable.⁶¹

Purcell's original paper on Alwalton marble suggested, on the basis of the marble's use at Ely, Bury St Edmunds, Lincoln, and Peterborough, that the quarry was only in use between *c.* 1180 and 1230. The examples described above demonstrate that its period of working was more likely to have extended into the later medieval period. Detailed examination of all the black marble used for tombs and in parish churches in the eastern area, beyond the scope of this study, is required to extend further the period, and area, of its use. In particular the

exploitation of Alwalton marble as a matrix for monumental brasses requires assessment.

THE NOTTINGHAMSHIRE QUARRIES

Nottingham lies at the extreme end of the Permian band of Lower Magnesian limestone that extends southwards from Darlington and outcrops between Leeds and Worksop. The Upper Magnesian limestone is also present and begins to die out between Worksop and Mansfield. Bunter sandstones occur in this region in the form of the Lower Mottled sandstone as well as the coarser Pebble Beds. The stone is fine-grained and soft, often red in colour.⁶²

The sites of the medieval quarries in the county are not precisely known but a certain amount about the earlier extraction of stone can be inferred by reference to later, documented, sites. In the case of Linby the one viable quarry in the early 1990s, known as 'Yellowstone' quarry, is the only surviving part of an extensive system of quarries that followed the limestone N. from the village. In the 19th century there were seven quarries and at least one limekiln in Linby (OS Old Series, 71 1892). The proximity of the quarries to Newstead priory and the similarity of the stone type currently being extracted to the medieval stone of the priory would support the case for the 19th-century quarries being in the same immediate area as the medieval quarries. Placename evidence is also informative about quarry sites, although mostly about the post-medieval period.

Two major projects of the mid 13th century that had access to royal quarries in Nottinghamshire are Lenton priory and Nottingham castle. The prior of Lenton was given permission to extract stone on six separate occasions, but the location of the quarry sites is not given precisely in the documentation. In each case it is described as either the quarry in Sherwood forest or the quarry beneath the royal wood in Nottingham. At this date, the mid 13th century, the forest of Sherwood extended as far S. as the city of Nottingham itself and so the quarries may have been quite close to the priory site.⁶³ Stone of the type extracted in the suburb of Bulwell has been identified in the remains of Lenton priory, dating from either the 12th or 13th century, and this would place the quarry site in the northern part of the city.

The Close Rolls record that Nottingham castle also used stone from the royal quarry outside Nottingham in 1250, again from an unspecified site. The building accounts of the castle provide more information about the stone sources, and excavation and recording of the castle have confirmed their use.⁶⁴ In 1321–22 stone was brought from Basford and Stanton and from the quarry at 'Odelinge'.⁶⁵ Other accounts specify the intended use of the stone; Mansfield stone was to be used for corbels for the 'Morres chamber' in the upper bailey in 1357, a mantelstone for the 'Damoisel chamber' came from the Basford quarry and stone from Basford and 'Sedling' was employed in building Romylowe's tower in 1366. The summarized accounts from the period 1476–80 mention stone from Wollaton, Basford, Trowell, Swarkestone, and 'Hasilbarow'.⁶⁶

The archaeological examination of the castle reported the use of Magnesian limestone as coursed rubble in the NE. tower (from early in the reign of Henry III) and a fine grey Magnesian limestone in ashlar blocks for the late 15th-century Richard's tower. Further use of Magnesian limestone was found in other areas of the site, a cess pit on the eastern side of the green, the middle bailey curtain wall from the late 12th century, and the middle bailey bridge where it was used with a coal measure sandstone.⁶⁷

The stone sources cited for Nottingham castle lie within the area N. of the city that was still active as a quarrying region in the 20th century, with Mansfield the most northerly site. The largest area of quarries in the 19th century was in Bulwell, with extraction sites spread over a wide area between the NW. suburbs and Hucknall.⁶⁸ The stone produced was a sandy limestone of a pinkish-yellow colour that can be seen in large quantities in the northern suburbs of Nottingham, used particularly for garden walling in the 19th and 20th centuries. Bulwell lime was much in demand in the 19th century for mortar and the trade directories list nine limekiln operators in the area in 1864, at the time that the Bulwell lime was described as being the finest available in the county. Bulwell adjoins the parish of Basford to the N. and it seems likely that the Basford quarries cited in the Nottingham castle accounts would have produced a similar stone to the later Bulwell ones. The absence of any reference to quarrying in Basford in the 19th century suggests that the pits were exhausted by that date and that the stone beds had been pursued into the neighbouring parish.

The suburbs of Broxtowe and Bilborough, SW. of Basford and Bulwell, were both producing stone in the 16th century. Stone from Broxtowe was used for the Nottingham bridge in 1503 and Bilborough had a site listed as 'le Stonepitte' in the 1572 Court Rolls.⁶⁹ Neither was still active in the 19th century. The fieldname 'Stonepit Plantation' on the current streetmap of Strelley suggests a quarry site and the pits that provided stone for the parish church have been identified at SK 505423.⁷⁰ All three of these suburbs are within the area of the Lower Magnesian limestone. The stone brought from the adjacent village of Trowell for use on the castle was also presumably of the same type. Limestone was no longer extracted for building in the 19th century but there were still lime-kilns in the village (OS Old Series, 71, 1867). The area of the stone extracted from Wollaton for the castle is commemorated by the 'Quarry Plantation' between the Trowell road and the railway line that is marked on the OS Old Series 71, 1892 and has since been built over. There was a limekiln in the vicinity at the same time.

The area around Mansfield has been quarried since the medieval period with both limestone and sandstone available in the vicinity. The earliest recorded quarry is that of Mansfield itself which was referred to as 'le Quarels' in 1315.⁷¹ Southwell Minster was getting stone from Mansfield in 1337, as the licence to cart stone toll-free testifies.⁷² As noted above, Nottingham castle used stone from Mansfield in the 14th and 15th centuries. Mansfield lies within the area laid down in the Permian period where the sandstones of the Marl overlies beds of the Magnesian limestones and both types of stone have been exploited in the recent past.⁷³ The sandstone seems to have been the main stone exploited in the medieval

period, used for example in Southwell's Chapter House.⁷⁴ The quarry leased for four years at Mansfield for repairs to the Minster in 1663 must also have been one of the sandstone quarries.⁷⁵ Quarries in Mansfield also produced roofing slates, used both at Southwell in the 15th century (see above), and for the king's hunting lodge at Clipstone in the 14th.⁷⁶

There is placename evidence for quarrying on the E. side of Nottingham during the 17th century, at Arnold and Lambley where the name 'Quarry Wong' appears at both places in a document of 1609, that at Lambley is also marked on the OS Old Series 71, 1892 map. Gedling was also a quarry site in the medieval period, supplying stone for St Peter's church, Nottingham at the end of the 15th century and for repairs to the castle in the mid 14th century.⁷⁷ The location of the pits is unknown, there are no obvious sites in the village or fieldnames that would indicate where the extraction took place. However, the neighbouring district of Carlton used to be in Gedling parish and placename evidence establishes that quarrying had taken place there by the late 18th century.

The area N. of Mansfield was also a stone producing area, with fieldnames suggesting quarry sites and lime-kilns at Hodsock and Bilsthorpe by the 19th century and earlier workings at Everton, and Warsop, the latter supplying lime for restoration work at Southwell Minster in the 1660s.⁷⁸

TRANSPORT OF STONE FROM THE EAST MIDLANDS QUARRIES

There is documentary evidence that transport of stone from the Lincolnshire Limestone quarries was by both land and watercourse. The latter method is the most efficient and was the least expensive but there is evidence that overland transport of stone was undertaken and that for major projects this was not a deterrent. River transport was clearly regarded as the main means by which building materials were delivered to site in the region.⁷⁹ In 1192 an agreement was drawn up between the abbots of Ramsey and Sawtry in Cambridgeshire by which the monks of Sawtry were to close up all the channels they had made in the marsh of Whittlesey with the exception of the 'great channel which runs from Whittlesey Mere to Sawtry . . . for by it the monks of Sawtry bring stones and such necessaries for the building of their monastery'.⁸⁰ A stone barge has been found at Whittlesey, its cargo was still visible at Engine House farm in 1967, that may have been intended for the abbey.⁸¹

WATER TRANSPORT

The major waterways serving the quarry sites in the region in the medieval period were the Trent and the Witham that connected the cities of Lincoln and Nottingham with the North Sea at Boston, with the Humber in the north and with the midland waterways system. The Witham had been joined to the Trent by the Foss Dyke canal dug by the Romans and this essential watercourse was kept open during the medieval period, recut in the early 12th century, and in regular use in the 14th century. An inland port serving Lincoln had grown up by the Anglo-Saxon period at Torksey where goods were transferred from the Trent on to

smaller vessels for passage along the Foss Dyke.⁸² A commission in 1365 described merchants' vessels using the Foss Dyke to travel from York, Hull, and Nottingham to Lincoln, although the commission was set up to investigate claims that the channel was obstructed.⁸³

River Witham

The river Witham rises near Grantham and flows north via Claypole to Lincoln where it passes through the Lincoln Gap before running SE. towards Boston. The river describes a long loop and although nearly 112 km in length outflows less than 48 km from its source. Its original course was different, flowing from Dogdyke to the North Sea at Wainfleet but this course had been lost by the 12th century and Boston had become its outfall.⁸⁴ The Witham suffered from obstructions in the 14th century which were ordered to be cleared from the west, Claypole, section on three occasions, in 1363, 1375, and 1382.⁸⁵ The later commissions give the required dimensions of the river, it was to be between 9–12 m wide and 3 m deep. The river Brant, which flows parallel to the Witham before joining it near Lincoln, was also to be cleared to the same dimensions. Both rivers would thus have been capable of handling the transport of stone from the Ancaster quarries. The commissions dealt with the rivers as far S. as Claypole which lies about 19 km from the Ancaster quarries, although the Witham itself continues S. and E. to pass within 7–8 km of the quarries. Road transport for at least part of the journey would have been necessary. Transport of stone by river from these quarries is documented for the later period but travelling E. rather than W.

Kyme Ferry

The Kyme Eau, which was the eastward continuation of the Old River Sleas, was navigable in the medieval period and was used to transport stone from the Ancaster quarries to the eastern, Boston, section of the Witham. The Kyme Eau and Old Sleas river would have been an important waterway if they had been navigable for their whole length since they run between the two sides of the Witham and pass through the Ancaster gap in the Lincolnshire Limestone. The watercourse was clearly not navigable in 1479 when Ancaster stone for Tattershall church had to be brought overland from the quarries to a loading point called Appletreeness on the Kyme Eau beyond the Old Sleas for river transport to Dogdyke near Tattershall.⁸⁶ Appletreeness was also used for loading the stone from Wilsford and Heselburgh for Louth spire in the early 16th century.⁸⁷ It was clearly a main loading wharf for river transport, serving more than just the Ancaster quarries. Plaster of Paris was transported overland for more than 40 km from Londonthorpe near Grantham to Appletreeness for river transport to Tattershall castle in 1438–39.⁸⁸ Appletreeness has disappeared from the current OS 1:50 000 map no. 130 but was marked on the Old Series map 70 (19th-century first edition of the One Inch maps) at a site equivalent to TF 136495. Haverholme Priory held lands at Ewerby and 'Ousthorpe' and was thus responsible for maintaining the S. side of the watercourse from Appletreeness to Kyme since at least 1316 when the

Prior was accused of failing to keep it clear,⁸⁹ although the wharf itself was not listed amongst the possessions of the Priory at the Dissolution. There was also a wharf at Kyme that was listed in a perambulation of 1241⁹⁰ and tolls were charged for stone barges coming from Appletreeness in the mid 15th century with Ancaster stone for Tattershall castle.⁹¹ Ancaster stone continued to be transported by this route until the 19th century. In 1834, for example, 13 blocks of Ancaster stone were loaded onto Captain Winter's boat at Sleaford Wharf for delivery to the cathedral at Lincoln.⁹²

Dogdyke is a small settlement at the confluence of the rivers Witham and Bain and is now slightly upstream of the junction between the Witham and the Kyme Eau. It was used as a wharf for the unloading of stone barges for Louth spire from 1500–15 and seems to have had storage areas as well. The nearby villages of Tattershall, Tumbly and Coningsby also provided temporary storage space for the stone before its transport to Louth and men from Coningsby acted as carters for the work.⁹³

River Welland

The Clipsham and Holywell quarries lie too far S. to use the Witham for transport and the Glen, which flows into the Welland has been cited as the watercourse used.⁹⁴ The Welland was certainly an important route for the transport of stone, a boat loaded with stone was discovered in the river in 1840 that was claimed as a medieval barge,⁹⁵ and Clifton-Taylor and Ireson quote the mid 19th-century figures for the value of stone moved on the river, but the use of the river Glen is less certain. The river runs S. through the quarry fields of S. Lincolnshire, passing within a few kilometres of a number of important sites such as Burton Coggles and Careby. It was clearly not navigable in these upper reaches as the 14th-century state papers show. Stone for the royal works at Windsor in the 1360s was taken from Holywell and Careby to 'Catebrigg' before being dispatched to Windsor. A different pair of commissioners were then responsible for taking the stone to Windsor. 'Catebrigg' is the place now called Kate's Bridge at TF 106149, c. 8 km S. of Bourne where the road to Peterborough crosses the river Glen.⁹⁶ The river was clearly only usable from that point onwards. Clipsham stone was used at Lincoln cathedral in the 19th century for restoration work but by that period was transported by railway.⁹⁷

River Nene

The river Nene was used to transport stone from the Northamptonshire quarries. Stone intended for Bury St Edmunds abbey was moved by road from Barnack to the river at Castor where a rood of land had been granted to provide access to the waterside. The grant was confirmed in 1222–26 by Abbot Alexander of Peterborough and recorded in the lost Precentor's Register.⁹⁸ The abbey was also given the right to transport marble and other stone from Alwalton to Peterborough along the Nene in return for an annual rent of 6s. Two standing stones on the river bank at TL 139984 mark the wharf site. These stones are now

known as 'Robin Hood and Little John' but are named in earlier documents as 'St Edmund's stones'. The wharf was known as Gunwade Ferry from at least the 14th century and is associated with Ferry House at Milton, a hamlet of Castor.⁹⁹ The manor of Milton was the subject of a land grant in 1502 and the wharfage at Gunwade on the river Nene was specified as part of the grant.¹⁰⁰

Gunwade wharf was also used for loading stone from the quarries at King's Cliffe in the 1580s. Transport of stone from King's Cliffe that was to be used to build the porch of Corpus Christi College chapel in 1583–84 is itemized in the building accounts for the chapel.¹⁰¹ Seven tons of freestone was transported overland from the quarry by carts to 'Gunworth' where it was stored, and wharfage charges paid, until it could be moved by water to Cambridge. The wharf is also called 'Gunwell in Northamptonshire' and this can be identified as Gunwade ferry. The journey from the quarry site to the river is over 16 km and the cost of moving it by cart amounted to 75% of the purchase price, exactly the same as the price per ton for shipping it to Cambridge by water from the wharf. The college additionally sent a mason to supervise the movement of the stone as well as to select it at the quarry, which took him a total of eight working days. Stone from the quarries at Weldon was also transported via Gunwade ferry in the 16th century for use on Trinity College's new chapel. The Nene provided a better route between the quarry at Barnack and sites in East Anglia than the River Welland did, being closer to Barnack and providing direct access to the Great Ouse.¹⁰²

Car Dyke

The Roman Car Dyke, a water course stretching 122 km, was not intended for use as a canal by its original builders but there is evidence that it was used, in part at least, for transport in the medieval period. The Car Dyke was not continuous but was interrupted by the Roman roads that crossed it. It seems to have been intended as a drainage channel and confusion as to its use probably stems from the fact that sections of it were based on natural watercourses.¹⁰³ The lower sections of the Car Dyke in Cambridgeshire, which seem to be earlier in date (dated from pottery to A.D. 50–60 with the Lincolnshire section from A.D. 125), were perhaps intended to be used as a canal. The depth and width of the water course was comparable to that of 18th-century canals (7.5–9 m wide at base and 12–15 m wide at top with a depth of about 1.5 m, the Car Dyke was measured in the 19th century at 9 m wide at base, 15 m wide at top and 2.5 m deep) and it has been suggested that the road ways that cross the lower sections belong to the later Roman period when it had passed out of use.¹⁰⁴ Medieval use of part of the Lincolnshire section for transport is attested by the discovery of a stone barge carrying Barnack stone in the bed of the Car Dyke at Morton by Bourne.¹⁰⁵

TRANSPORT OVERLAND

Direct evidence is lacking for the majority of sites using the stone from the East Midlands quarries that would have detailed the actual breakdown of transport

into land and river passage but a certain amount can be inferred. One instance, cited above, that details the supply of stone from the Lincolnshire quarries for Windsor castle in the 1360s, reveals that both road and river transport were involved. Stone was moved from the quarries at Holywell and Careby, in the Clipsham group, by road to the loading point on the river Glen at Kate's Bridge, south of Bourne on the Peterborough road. The team of commissioners responsible changed at this point which suggests that the form of transportation also changed, from carts to boats. As noted above, the river Glen passes within a few kilometres of the Careby quarries but it was not navigable in its upper reaches. The road distance involved is about 15 km.

In the case of the Louth spire, the churchwardens' accounts describe the journey in detail. The accounts refer to river transport being used solely for the trip from Appletreeness to Dogdyke, where the Kyme Eau meets the Witham. The first part of the journey, from the quarry at Wilsford was overland by cart. The accounts refer again to overland transport from 'gonysby' (Coningsby), a village near the wharf at Dogdyke, to Louth at a cost of 20*d.* a load in 1500. This was the same as the cost of transport by land and water from the quarry to Dogdyke. The costs can be broken down further and, as is customary, transport by water is the cheapest. The stone cost 12*d.* a load from the quarry to Appletreeness and 8*d.* a load from there to Dogdyke by the Kyme Eau. The distances are Wilsford to Appletreeness about 24 km, Appletreeness to Dogdyke about 19 km and from there to Louth about 56 km. The river Bain joins the Witham at Dogdyke but there is no reference in the accounts for its use, although it would have taken the materials as far as Horncastle, nearly half the remaining distance to Louth.¹⁰⁶ The route from Wilsford to the river is straightforward with no major variations in level but the route N. would almost certainly have involved crossing the Lincolnshire Wolds. The route can be estimated from payments in the accounts. The town of Horncastle was used as a stopping place with payments for food for men and horses included in the transport costs of 1502/3. From there the Lincolnshire Wolds intervene and must have presented a considerable obstacle for the stone carts. In 1502/3 one load was brought via Belchford and this added 17*d.* to the cost of the load. The village lies on a direct line between Coningsby and Louth but is in the centre of the Wolds and was clearly not the route usually followed.¹⁰⁷

The payments to carters are summarized in the accounts for most years so it is not possible to determine whether stone transport continued across the winter, but in two entries, for 1503/4 and 1504/5, the months are given. In both cases the season started in May and ran until August although there were payments for three loads moved in the winter of 1503/4 (month unspecified) and in 1504/5 stone transport to Louth continued until November. In most years a total of about 50 loads was moved. One entry, for 1505/6, refers to the cost of moving a load weighing one ton and since this is the same figure as that for one load in all the other entries up to that date it seems reasonable to assume that one load equalled one ton.

Similar problems must have confronted the earlier builders of Louth Park abbey who had also used stone from the Lincolnshire Limestone quarries. The

documentation does not survive from the period of the abbey's construction (12th–13th centuries) to describe the means of transporting the stone. Louth Park's community was originally granted a site at Haverholme, whose subsequent inhabitants were later involved with the wharf used by the Ancaster quarries, and they remained there for two years before moving N. It is possible that quarrying rights were included in the abbey's original endowments and this would explain their use of stone from a distant source. A short length of canal called 'Monk's Dyke' was dug by the monks of Louth Park to bring materials to their site at Keddington outside Louth by water.

Building accounts from other regions reveal that road transport of stone was carried out when a particular demand required it. At Vale Royal abbey in Cheshire, founded by Edward I in 1278 in a remote setting in the Delamere forest, the building accounts of the first three years of the building work describe transport of stone for the site exclusively by road. Teams of carters brought the stone the distance of 8 km from the quarry site at Eddisbury, and despite the obvious difficulties, continued working throughout the winters of the first three years. Water transport was not available and the distances involved were not great.¹⁰⁸ Professor Pounds has analysed the materials used for the rebuilding of the parish church at Bodmin in Cornwall in the second half of the 15th century and for the work at Exeter in the late 13th and 14th centuries. Bodmin lies inland with a plentiful supply of granite in the nearby moor but the church builders chose instead to use a building stone from quarries at Pentewan on the S. coast and transport it the 16 km overland from the wharf at St Winnow. The difficulties of the project were increased by the height that Bodmin lies above the river, 122 m. At Exeter cathedral the building accounts of the period 1279–1353 reveal that the largest amount of building stone was brought to Exeter by sea from quarries on the coast of Somerset, Devon, and Dorset and only small amounts moved on carts from inland quarries at Ham Hill and Silverton. Stone from Salcombe in particular was moved by sea to the mouth of the river Exe and thence upstream to the cathedral wharf, although the quarry lay less than 10 km from Exeter by land.¹⁰⁹ Clearly road transport was not a preferred option when any distance was involved.

An integrated road system of well maintained roads would have been necessary to permit the transport of heavy building materials by carts. The 14th-century Gough map shows such a system of roads connecting towns within the Lincolnshire Limestone area to places in East Anglia and the SE., with Grantham and Stamford sited on the Great North Road.¹¹⁰ Communication along lesser roads, not shown on the Gough map, seems to have improved during the 13th century with the appearance of graveslabs from the Barnack school in villages in upland Cambridgeshire not accessible by water. Their absence in the earlier period has been attributed to transportation problems.¹¹¹ As Hindle as pointed out,¹¹² Lincolnshire was unusually well served by waterways in the Middle Ages and road transport may not have played an important part in the movement of building materials within the region. Once outside it though roads will have doubtless been used.¹¹³

TABLE I
SUMMARY OF QUARRY SITES AND PERIODS OF USE

LINCOLNSHIRE LIMESTONE QUARRIES

<i>Lincoln Group</i>			<i>Barnack</i>		
Dean & Chapter Quarry	Med. and 1872 >>	N. Lincoln	Hills and Holes	>> 15thC, 19thC	TF075048
Castle Ditch	1231 >>	Opp. cathedral	Walcot	14thC	S. of Barnack
Newport	Mid-13thC >>	N. Lincoln	<i>Weldon</i>		
Canwick	12thC		Weldon	13thC >>	SP925892
Bracebridge	Post-Med. >>		Stanion	Med.	
Branston	Post-Med. >>		King's Cliffe	15thC >>	
Waddington	Post-Med. >>		<i>Ketton</i>		
Blankney	16thC >>		Ketton	Roman, 16thC >>	
Potterhanworth	16thC >>		Great Casterton	19thC	TF0130820
Washingborough	16thC >>		Stamford	12thC >>	Scotgate
<i>Ancaster Group</i>			Wothorpe	18thC	S. of Stamford
Ancaster	Roman >>	Wilsford parish	Edith Weston	19thC	
Wilsford	12thC >>	Wilsford parish	Wing	19thC	
Heydour	14thC >>	Heydour parish	Lyndon	19th	
Heselburgh	14thC >>	Heydour parish	Uppingham	19thC	
S. Rauceby	19thC		Alwalton	12th-13thC, 19thC	TF136964
Wilsford Warren	19thC	Wilsford parish			
Carlton Scroop	19thC				
Dembleby	Med. & 19thC				
<i>Clipsham Group</i>					
Edenham	12thC >>				
Corby Glen	14thC >>				
Greetham	15thC >>				
Holywell	14thC >> 20thC	Castle Bytham			
Burton Coggles	17thC >>				
Big Pits	11th, 20thC	SK968142			
Old Quarry	?Med. & 20thC	SK979154			
Castle Bytham	20thC	SK990180			

NOTTINGHAMSHIRE QUARRIES

Nottingham	13thC >>	N. Nottingham	<i>Mansfield Group</i>		
Basford	14thC >>	N. Nottingham	Le Quarels	14thC	Mansfield
Bulwell	19thC >>	N. of Basford	Gregory's	>> 20thC	SK534600
Wilkinson's	19thC	Bulwell Hall	Hodsock	19thC	
Broxtowe	16thC >>	W. Nottingham	Bilsthorpe	19thC	
Bilborough	16thC >>	W. Nottingham	Everton	19thC	
Strelley	Med.?	SK505423	Warsop	17thC	
Trowell	15thC	W. Nottingham	<i>Derbyshire</i>		
Wollaton	15th-19thC	W. Nottingham	Swarkestone	15thC	SK370274
Arnold	17thC	E. of Nottingham	Stanton	14thC	?by Dale ?by Bridge
Lambley	17th-19thC	E. of Nottingham			
Gedling	14thC >>	E. of Nottingham			
Linby	Med. 20thC	N. of Linby village			
Sankey's	19th-20thC	Hucknall			

CONCLUSION.

The area of the East Midlands was clearly an important region for the supply of building stone both within the area and further afield. Stone from the Lincolnshire Limestone belt, which included Barnack stone, was particularly sought-after for cathedral, castle and monastic building projects in and outside the

region. Direct evidence for the exploitation of specific quarry sites, in the form of documentation of their working, has not survived and most of the information has to be sought from the building accounts of those sites that used them. This is of course a partial record since few medieval sites in this country have accounts surviving. This study has made use of the researches of the regional place-name societies and further work by these groups will doubtless enhance future studies, especially of the Northamptonshire area. Further work by geologists to identify building stones in standing structures would be a valuable extension to this study, particularly if it could be coupled with precise location of stone samples to individual quarries.

ACKNOWLEDGEMENT

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NOTES

¹ The main study of the exploitation of a quarry area is that of J. A. Best, S. Parker and C. M. Prickett, *Using the Environment* no. 6. *The Lincolnshire Limestone a) Quarries — Weldon and Ketton*, 2nd edn. (1981). The fundamental work remains that of Sir Alec Clifton-Taylor, with his *Pattern of English Building* (London, 1972), and with Arch. Ireson, *English Stone Building* (London, 1983). The Ely building materials were studied by D. Purcell, *The Stones of Ely Cathedral* (Ely, nd).

² Clifton-Taylor op. cit. in note 1, T. Miller and D. Robinson, 'Geology and Building Materials' in N. Pevsner, J. Harris and N. Antram, *The Buildings of England. Lincolnshire* 2nd edn. (Harmondsworth, 1989); A. Clifton-Taylor and M. W. Barley, 'Building Materials' in N. Pevsner and E. Williamson, *The Buildings of England. Nottinghamshire* 2nd edn. (Harmondsworth, 1979); A. Clifton-Taylor, 'Building Materials' in N. Pevsner and E. Williamson, *The Buildings of England. Leicestershire and Rutland* 2nd edn. (Harmondsworth, 1984).

³ Evidence for the use of locally available stone in building projects carried out throughout the medieval period is detailed in D. Knoop and G. P. Jones, 'The English Medieval Quarry', *Econ. Hist. Rev.*, 9 (1938), 17-37, 18, fn 1. An overview of the supply of building materials is given in chapter 3 of the same authors' *Medieval Masons* (Manchester, 1933). 3rd edn. 1967.

⁴ Clifton-Taylor, op. cit. in note 1, 86. The quarry site was near Langworth road and a section of it was leased out during the 18th century, memo of 24 September 1731 Lincolnshire Archives Office D&C (henceforth L.A.O. D&C) D vij/3/B/51. Presumably the stone available was not of sufficient quality for building work. There are receipts for Yorkshire stone, for gritstone and for an unspecified type, in the late 1790s, one giving the quarry loading point as Bramley Fall, L.A.O. D&C Audit vouchers. This is probably the Bramley that is now a suburb of Leeds on the N. side, in the area of the millstone grit that supplied the builders of Kirkstall. Essex's estimate for materials in 1775 specified Yorkshire gritstone was to be used for repairs to the Great Tower, L.A.O. D&C A/4/13. This proved to be an unsuitable material at Lincoln. The stone weathered badly and had to be replaced in restoration work in 1905-06, *Assoc. Architectural Soc. Reports and Papers* (henceforth *A.A.S.R.P.*) 28 (1905-06), xvii, LXXVI. The 18th-century restoration of Lincoln cathedral is summarized by J. W. F. Hill, *Georgian Lincoln* (Cambridge, 1966), 39.

⁵ L.A.O. D&C gen. receipts CIV 49. The 1834 purchase was from William Nelthorpe, the owner of Nelthorpe's quarry listed in 1842/1868 and situated between Wragby road and Greetwell road, K. Cameron, *The Place-Names of Lincolnshire. Part 1, The Place-Names of the City and County of Lincoln*. English Place-Name Society 58 (1985), 29. L.A.O. D&C gen. receipts CIV 55.

⁶ L.A.O. D&C audit vouchers CIV/70. *A.A.S.R.P.* 26 (1901-02), LXXII, 28 (1905-06), xvii.

⁷ *Cal. Close Rolls* 1227-31, 472. Land grant dated 22 August 1240. *Registrum Antiquissimum of the cathedral of Lincoln* Add. Chart. 2200.

⁸ The site on Monks Leys Terrace was called Black Monks Quarry in documents of 1310 and 1327 and must have belonged to the Benedictine cell of St Mary's abbey York that occupied the site now called 'Monks Abbey', Cameron op. cit. note 5, 179.

⁹ Cameron, op. cit. in note 5, 33.

¹⁰ Clifton-Taylor, op. cit. in note 1; J. C. Buckler, *The Restorations of the Exterior of Lincoln Cathedral* (Oxford, 1866).

¹¹ M. W. Barley, *Lincolnshire and the Fens* (London, 1952); S. S. Frere, 'Some Romano-British Sculpture from Ancaster and Wilsford', *Antiquaries J.*, 41 (1961), 29-31, 31. For a more recent study see Janet Huskinson, *Roman Sculpture from Eastern England* (Oxford, 1994).

¹² E. M. Jope, 'The Saxon Building-Stone Industry in Southern and Midland England', *Medieval Archaeol.*, 8 (1964), 91-118.

¹³ G. Platts, *Land and People in Medieval Lincolnshire* (Lincoln, 1985), 133.

¹⁴ Barley, op. cit. in note 11, *Cal. Pat. Rolls* 1361–64, 394, 482.

¹⁵ For Tattershall castle see W. D. Simpson, *The Building Accounts of Tattershall Castle, 1434–72*, Lincoln Record Society 55 (1960); for Tattershall church see R. Marks, 'The Glazing of the Collegiate Church of the Holy Trinity Tattershall', *Archaeologia*, 106 (1979), 133–56 and for Louth parish church, R. C. Dudding, *The First Churchwardens' Book of Louth 1500–1524* (Oxford, 1941). Heydour quarry is also discussed by A. C. E. Welby, 'The Manors of Haydor and Culverthorpe 1343', *Lincs. Notes and Queries*, 20 (1919), 91–92.

¹⁶ Dudding, op. cit. in note 15, for the excavation of Revesby abbey see T. Barker, 'Recent Excavations on the Site of Revesby Abbey', *A.A.S.R.P.*, 10 (1869), 22–26. Additionally Wollaton Hall in Nottingham that was built by Robert Smythson in the 1580s used Ancaster as its exterior walling stone, M. Girouard, *Robert Smythson and the Elizabethan Country House* (Yale, 1983), 81–108.

¹⁷ *Cal. Pat. Rolls* 1350–54, 378, 468, M. Perrott, *The Place-names of the Kesteven Division of Lincolnshire*. Unpubl. MPhil thesis. University of Nottingham (1979), 497.

¹⁸ The work that was carried out in 1429–30 had not been determined, but further examination of both the accounts and the vestibule reveal what was done. There can be no doubt that the eight windows in the vestibule are those for which 23/8d. was paid for stones at Heselburgh, described in the 1429 account as being 'for the clerestory (illegible) in the entrance to the Chapter House'. The wages bill for the work, paid in 1430 to Peter de Hasilbargh, was for six weeks work, and there were further payments to several ordinary masons and eight contractors including a clerk. This strongly suggests that the windows were only part of the project. A scar on the rear of the wall at the entrance to the vestibule from the choir aisle reveals that the vestibule wall opposite the windows was also raised at this point, and a roof of lower pitch built at the new level (the current wooden roof looks like a more recent structure but the roof built over the new clerestory windows cannot have sprung from a lower level. The scar on the wall is from the period before the clerestory was built). The accounts specify that one of the stonemason contractors, Robert Eperston, was cutting joist holes for a roof and rebating the stonework preparatory for the carpenters and plumbers to cover it and an earlier reference is to workmen removing beams. The top two courses of stonework for the whole length of the vestibule have had to be built to support the new roof. The Chapter House itself was also included in the project, with two tons (?) of 'sclatstones' bought at Mansfield and wages paid to two tilers to fit them, as well as quicklime and sand, obviously for mortar, for a wall 'in the interior of the Chapter House rebuilt'. This second reference to the Chapter House is hard to understand. The interior walls all appear to date from the original, late 13th century, building and there is no obviously later work. The last bay of the vestibule, immediately outside the entrance to the Chapter House, does have some later work, associated with the raising of the passageway roof. This last bay rises to nearly twice the height of the vestibule and has a quadripartite stone rib vault instead of a wooden ceiling. There is a second, lower arch on the wall that corresponds to the end of the ceiling, and this arch must have been modified when the ceiling was raised with the building of the new clerestory windows. This, and the walling above, is perhaps the wall described in the account and may even be the site of the six 'vancers', read as voussoirs, bought from Heselburgh. The account has been published by R. M. Beaumont, 'A Reassessment of the Construction of the Passage and Vestibule to the Chapter House of Southwell Minster', *Friends of Southwell Cathedral Annual Report* (Southwell, 1989).

¹⁹ H. M. Colvin, *History of the King's Works* 1–11 (London, 1963), 765, 278, fn 5.

²⁰ Placename research suggests that neighbouring parishes were also quarry sites, although not necessarily exploited in the medieval period, Newton and Haceyby parish for example, which borders Dembleby on the S. Honington, Marston, Allington, and Syston also had quarry sites, although they may not all have been part of the Ancaster group. A more northern group that must have been exploiting the very edge of the limestone was at Blankney, Potter Hanworth and Washingborough, the latter worked in the 16th century, Perrott, op. cit. in note 17. Other villages near Lincoln on the S. side, such as Bracebridge, Branston, and Waddington have evidence in fieldnames for stone extraction in the post medieval period, and in the case of Canwick for the 12th century, Cameron, op. cit. in note 5.

²¹ D. Purcell, *Cambridge Stone* (London, 1967).

²² R. Willis and J. W. Clark, *The Architectural History of the University of Cambridge* 3 vols. (Cambridge, 1886) II, 327–31.

²³ Clifton-Taylor, op. cit. in note 2.

²⁴ Perrott, op. cit. in note 17.

²⁵ *Cal. Pat. Rolls* 1361–64, 482; 1364–67, 132, R.C.H.M.E., *The Town of Stamford* (London, 1977), lxxv.

²⁶ Colvin, op. cit. in note 19, 572.

²⁷ F. Woodman, *The Architectural History of King's College Chapel* (London, 1986), 161–62. There was clearly a stock of Clipsham still remaining in the works yard in 1512–13 when it was listed in an agreement between Wastell and the King's surveyor, Willis and Clark, op. cit. in note 22, I, 611; *The Guardian* 27 Dec. 1986.

²⁸ Purcell, op. cit. in note 21; W. J. Arkell, *Oxford Stone* (London, 1947); P. C. Sylvester-Bradley and T. D. Ford (eds.), *The Geology of the East Midlands* (Leicester, 1968).

²⁹ V. C. H. *Northants.* II, 294. The documentary evidence for the volume of stone produced from Barnack demonstrates that there must have been a more extensive network of quarry sites in the area than that now visible at 'Hills and Holes'. It is hard to envisage that site producing sufficient stone for even one complete building, such as Peterborough cathedral, and yet the stone has been identified at numerous other sites as well. It is possible, but surely unlikely, that the working out of the quarries in the later Middle Ages has removed all trace of the extraction sites. A more plausible explanation may be provided by the landscape itself. Barnack village is situated at the edge of a scarp overlooking the Welland valley, with the quarry site lying on the 40m

contour. It is possible that, as in the case of the Ancaster quarries, villages lying on the same contour at the edge of the scarp may have also had quarries. Possible sites are Helpston, which still has evidence of quarrying, Ufford, Upton, and Wittering, Southorpe, and perhaps Thornhaugh. The quarries around the town of Stamford produced a hard shelly limestone of the same type, also from the beds of the Upper Lincolnshire Limestone, that seems to have been very similar to Barnack (see below).

³⁰ V. C. H. *Northants.* II, 293, 434.

³¹ H. M. Taylor and J. Taylor, *Anglo-Saxon Architecture* (Cambridge, 1965); 491–93, Jope, op. cit. in note 12, 92 fn 10. Barnack stone was used for royal building works however. In the 1280s–90s large quantities were used in Edward I's rebuilding of Cambridge castle, Colvin, op. cit. in note 19, 587. This must have been a direct purchase of the quarried stone.

³² The term 'Barnack school' was used to describe the output of sculptural work from the quarry in the period 1050–1300, L. A. S. Butler, 'Minor Medieval Monumental Sculpture in the East Midlands', *Archaeological J.*, 121 (1964), 111–53.

³³ Clifton-Taylor, op. cit. in note 1; Purcell, op. cit. in note 21.

³⁴ Willis and Clark, op. cit. in note 22.

³⁵ Payments of 6l 18s. were made for the carriage of stone from Barnack in 1322–23, as well as payments for stone from Swaffham, D. J. Stewart, *On the Architectural History of Ely Cathedral* (London, 1868), 93.

³⁶ Working out of the quarries is one explanation offered for the 14th-century decline in the monumental sculpture industry, Butler, op. cit. in note 32, 141. Burghley House appears to have been built from Barnack stone, despite its 16th-century date, from quarries within the estate, Clifton-Taylor and Ireson, op. cit. in note 1. In the 1830s Barnack Mill, a white-brown coloured freestone and a coarser wall-stone was quarried, apparently on the site of the earlier quarries, J. W. Judd, *The Geology of Rutland* (London, 1875). More work is needed on the later history of the quarries.

³⁷ V. C. H. *Northants.* II, 295. The Weldon quarries have been studied by Best *et al.* op. cit. in note 1. For the work at Cambridge see Woodman, op. cit. in note 27; Colvin, op. cit. in note 19; and Willis and Clark, op. cit. in note 22.

³⁸ Best *et al.*, op. cit. in note 1.

³⁹ *ibid.*

⁴⁰ Best *et al.*, op. cit. in note 1. The parish church, that dates from the 12th–14th centuries, is built from Barnack rather than Ketton stone, Pevsner and Williamson, op. cit. in note 2 (Leics.), and it is noticeable that none of the village houses built of Ketton are earlier than the 16th century in date.

⁴¹ P. Moore, *Three Restorations of Ely Cathedral* (Ely, 1973).

⁴² Purcell, op. cit. in note 21; R. C. H. M. E., op. cit. in note 25 V. C. H. *Rutland* I, 235–36.

⁴³ '... Quando superficies nimis laxatur arenae pulsibus, et solidum forti penetratur aceto.' *Metrical Life of St Hugh*, ed. Charles Garton (Lincoln, 1986), lines 877–78.

⁴⁴ H. M. Colvin, *Building Accounts of King Henry III* (Oxford, 1971), 262.

⁴⁵ The highly polished effigy of a civilian from Ramsey Abbey of c. 1250 is almost the colour of cold tea (illus. J. J. Alexander and P. Binski (eds.), *The Age of Chivalry. Art in Plantagenet England 1200–1400* (London, 1987), 209. The Purbeck marble industry has been the subject of considerable study, for example C. H. Vellacott, 'Quarrying', in V. C. H. *Dorset* II (London, 1908), 331–36; E. Benfield, *Purbeck Shop. A Stoneworker's Story of Stone* (Cambridge, 1940); G. D. Drury, 'The Use of Purbeck Marble in Medieval Times', *Proc. Dorset Natural Hist and Archaeol. Soc.*, 70 (1949), 74–98; R. Leach, *An Investigation into the Use of Purbeck Marble in Medieval England* (Priv. Pub, 1978); with discussion of the sculptural effigies in L. Stone, *Sculpture in Britain: the Middle Ages*. 2nd edn. (Harmondsworth, 1972).

⁴⁶ See the distribution maps in Leach, op. cit. in note 45, additionally it can be seen in the entrance to the refectory at Beauport abbey on the N. coast of Brittany and at Coutances cathedral in Normandy and this indicates that Purbeck marble was also transported to France.

⁴⁷ Judd op. cit. in note 36, 208–09; A. Horton, *Geology of the Peterborough District* (1989), 11.

⁴⁸ D. Purcell, 'A Forgotten English Marble', *Country Life*, 168 no. 3575 (1965), 620–21. The carriage of Alwalton stone by river Nene is documented in a confirmation of grant by Abbot Alexander of Peterborough to the abbey of Bury St Edmunds of river passage for marble and Barnack stone between Alwalton and Peterborough in the early 13th century. Alwalton fragments have been identified in the ruins at Bury St Edmunds.

⁴⁹ Judd, op. cit. in note 36, 209; Purcell, op. cit. in note 1.

⁵⁰ Purcell, op. cit. in note 48.

⁵¹ For an examination of the 13th-century work at Peterborough see M. Dean, 'Architecture at Peterborough in the Thirteenth Century', *J. British Archaeol. Assoc.*, 137 (1984), 114–29, where the lost buildings are considered. The building materials are not mentioned however.

⁵² R. C. H. M. E., *Huntingdonshire* (London, 1926), 253. The effigy was of an abbot or prior. There is no monastic house known in the Great Staughton parish although there were a number of houses nearby. I am grateful to Philip Lankester for bringing this fragment to my attention.

⁵³ There is a certain amount of confusion in the literature about the identification of Alwalton effigies. Pevsner, for instance, in the introduction to the *Buildings of England: Bedfordshire Huntingdon and Peterborough* (Harmondsworth, 1968), 184, having identified the Peterborough and Great Staughton effigies as Alwalton also (wrongly) places the Ramsey figure in the group and remarks that where Purbeck is mentioned in the gazetteer 'it may well be Alwalton instead'.

⁵⁴ Alwalton has also been suggested as the marble used for the slab of the brass to Margaret, daughter of John Elmes, of 1471 in the church of All Saints Stamford, R.C.H.M.E. op. cit. in note 25, 10. This would represent a very late use of the material, or possibly a re-use of an earlier matrix. I am grateful to Dr Ron Firman for this suggestion.

⁵⁵ Purcell, op. cit. in note 48.

⁵⁶ As at Ely, the presence of only a few carved architectural elements, in this case the abaci that have the same profile as the majority, Purbeck, ones suggests that the stone was carved at Lincoln rather than at the quarry site. Alwalton waste was encountered in the fill of the trenches at the corner of the south east transept, further supporting the working of the material on site, noted in D. A. Stocker, 'Excavations to the South of Lincoln Minster 1984 and 1985', *Lincs. History and Archaeology*, 20 (1985), 15–19, 18.

⁵⁷ Pevsner *et al.*, op. cit. in note 2, 480.

⁵⁸ I am grateful to Keith Murray for pointing it out to me. He suggested that it may have been intended to act as a damp proof layer.

⁵⁹ *V. C. H. Northants*, II, 293. Shafts on the N. wall of the chancel of Castor church are thought to come from the Roman site and it is possible that the piscina shafts also did. Pevsner, op. cit. in note 53.

⁶⁰ Firman, pers comm. 1994. The capitals, bases and ribs of the vault that they support are of freestone.

⁶¹ G. Zarnecki, J. Holt and T. Holland (eds.), *English Romanesque Art 1066–1200* (London, 1984), 166; D. Haigh, 'Excavations at King's Ripton, Cambridgeshire in 1983', *Proc. Camb. Antiq. Soc.*, 73 (1984), 55–63.

⁶² W. Edwards and F. M. Trotter, *The Pennines and Adjacent Areas*. (London, 1954).

⁶³ H. E. Boulton (ed.), 'The Sherwood Forest Book', *Thoroton Soc. Record Ser.*, 23 (1965), 36.

⁶⁴ *Cal. Close Rolls 1247–51*, 307; E. Green, 'Nottingham Castle', *Archaeological J.*, 58 (1901), 365–97; C. Drage, 'Nottingham Castle. A Place Full Royal', *Trans. Thoroton Soc.*, 93 (1989), 1–151.

⁶⁵ Either Stanton by Dale, or Stanton by Bridge, both of which had stone quarries in the early 19th century (O.S. Old Series 71, 1867). Stanton by Bridge is close to Swarkestone that supplied stone to the castle in the late 15th century, see below note 66.

⁶⁶ Green, op. cit. in note 64, 382–84; Colvin, op. cit. in note 19, 765. For discussion of the site of Hasilbarow quarry see above under 'Ancaster group'. Swarkestone was obviously an important quarry in the 15th century, supplying corbels for Kirby Muxloe castle in 1483. The quarry is sited in the castle accounts at Swarkestone bridge, A. H. Thompson, 'The Building Accounts of Kirby Muxloe Castle', *Trans. Leics. Archaeol. Soc.*, II (1919–20), 193–345, 208. The quarry sites at 'Odelinge' and 'Sedling' are probably both Gedling, a village NE. of Nottingham, see below.

⁶⁷ Drage, op. cit. in note 64, 88–90.

⁶⁸ The main quarries were at SK 531452 and SK 532453, last worked as Sankey's quarries in the 1960s, and Wilkinson's quarry at SK 535460 in the grounds of Bulwell Hall, Sylvester-Bradley and Ford, op. cit. in note 28. There is considerable evidence of quarrying still visible in the area of Bulwell between SK 531454 and SK 536458.

⁶⁹ E. M. Hewitt 'Building Stone', in *V. C. H. Notts* II (1910), 300. J. E. B. Gover, A. Mawer and F. M. Stenton, *The Place-names of Nottinghamshire*, English Place-name Soc. 17 (1940).

⁷⁰ Sylvester-Bradley and Ford, op. cit. in note 28.

⁷¹ Gover *et al.*, op. cit. in note 69.

⁷² Hist. MSS Comm. Rep. XII, App. IX, 539.

⁷³ Gregory's quarry at SK 534600 produced Mansfield White Sandstone, a good quality building stone, and rather confusingly the Red Sandstone Quarry at SK 532631 was exploiting a sandy dolomitic Lower Magnesian Limestone, Sylvester-Bradley and Ford op. cit. in note 28.

⁷⁴ Clifton-Taylor and Barley, op. cit. in note 2.

⁷⁵ A. Rogers, *Southwell Minster after the Civil Wars* (Nottingham, 1974), 29.

⁷⁶ Colvin, op. cit. in note 19, 920.

⁷⁷ Gover *et al.*, op. cit. in note 69; Hewitt op. cit. in note 69, 330.

⁷⁸ 'Ye lyme men of Warsope for 4 quarter of lyme 6.0d. Disburstments about repaires since ye Audit being No. 3rd 1661 until this instant No. 3rd 1662', Rogers, op. cit. in note 75, 38.

⁷⁹ The economic implications of river transport of goods have been considered by J. F. Edwards and B. P. Hindle, 'The Transportation System of Medieval England and Wales', *J. Historical Geography*, 17 (1991), 123–34. Their findings suggest that the proximity to a navigable water course was an important contributor to the wealth and growth of a large proportion of the planned medieval towns.

⁸⁰ H. C. Darby, *The Medieval Fenland* (Newton Abbot, 1940), 101.

⁸¹ Purcell, op. cit. in note 21, 98.

⁸² F. M. Stenton, 'The Road System of Medieval England', *Econ. Hist. Rev.*, ser. I no. 7 (1936), 1–20; M. W. Beresford and K. St. Joseph, *Medieval England an Aerial Survey*. 2nd edn. (Cambridge, 1979), 211–12.

⁸³ *Cal. Pat. Rolls 1364–67*, 138.

⁸⁴ S. B. J. Skerchly, *The Geology of the Fenland* (London, 1877), 99.

⁸⁵ *Cal. Pat. Rolls 1361–64*, 371; 1374–77, 151–52; 1381–85, 202. The same type of complaint was made each time, that the course of the river had been obstructed by tree planting, weirs and stanks of mills, and this suggests that the commissioners had little success. The absence of later commissions may indicate that the 1382 attempt succeeded.

⁸⁶ Marks, op. cit. in note 15, 136.

⁸⁷ Dudding, op. cit. in note 15.

⁸⁸ Simpson op. cit. in note 15, 26.

⁸⁹ *V. C. H. Lincs.* II, 187–88.

⁹⁰ *Cal. Close Rolls* 1237–42, 353.

⁹¹ Simpson, *op. cit.* in note 15, 5.

⁹² L.A.O. D&C Gen. Rec. 1833–34, CIV 55. It seems that in most cases the boats and boatmen were hired at the embarkation point although the Tattershall castle builder took charge of the water transport himself, buying boats, and having his own boatmen on the payroll. Considerable use was made of the waterways for moving other heavy materials for the site such as bricks as well as bulky loads, firewood, and faggots for the brick kilns for example, see Simpson, *op. cit.* in note 15.

⁹³ In 1513–14 Thomas Maunfild was paid 16*d.* for 'ridyng to Conysby for to geet careers for to care ston to Louth', Dudding, *op. cit.* in note 15, 161.

⁹⁴ Clifton-Taylor and Ireson, *op. cit.* in note 1, 71.

⁹⁵ *Lincolnshire Chronicle* 10 September 1840.

⁹⁶ *Cal. Pat. Rolls* 1361–64, 394; 1364–67, 440.

⁹⁷ In 1873 stone was delivered by the G. N. R. to Lincoln for the cathedral from the Clipsham quarries, loaded at Little Bytham station, L.A.O. D&C audit vouchers December 1863–January 1875.

⁹⁸ Purcell, *op. cit.* in note 48.

⁹⁹ Gover *et al.*, *op. cit.* in note 69, 232–33.

¹⁰⁰ *V. C. H. Northants.* II, 476.

¹⁰¹ Willis and Clark, *op. cit.* in note 22 1, 293.

¹⁰² 'item paid to diuers persones for cariage of the said xxxijti toone of freestone from Weldone vnto Goonwoord ferry at iijjs the toone . . .' Junior Bursar's account 1560–61 quoted in Willis and Clark, *op. cit.* in note 22 II, 566–67; Skertchly, *op. cit.* in note 84, 68–69.

¹⁰³ The section from Sleaford to Bourne was crossed by seventeen tracks or roads of the Roman period and there was evidence in a number of cases that the roads were continued on causeways across the water course. B. B. Simmons, 'The Lincolnshire Car Dyke: Navigation or Drainage?', *Britannia*, 10 (1979), 183–96.

¹⁰⁴ J. G. D. Clark, 'Report on Excavations on the Cambridgeshire Car Dyke', *Antiquaries J.*, 29 (1949), 145–63.

¹⁰⁵ C. W. Phillips, 'The Present State of Archaeology in Lincolnshire', *Archaeological J.*, 90 (1933), 106–49; 91 (1934), 117–23. There are several instances of stone barges recovered from river beds, this one and the Whittlesey and Welland examples quoted above, probably only represent a fraction of those lost. The Louth spire account for 1511–12 itemizes 6 tons of stone that was lost in the passage from the quarry to Dogdyke, Dudding *op. cit.* in note 15, 139.

¹⁰⁶ The Bain does not seem to have been a major watercourse at this date, it is not mentioned in the commissions for repairs to rivers in the region in the 14th century for example, and was therefore probably not regarded as navigable.

¹⁰⁷ The Wolds were crossed by roads and trackways known to have been in use during the medieval period but none of these would have greatly facilitated movement of stone carts between Horncastle and Louth. The Blue Stone Heath Road ran from E.–W. across the Wolds N. of Horncastle before turning N. towards the Humber. The main route along the spine of the Wolds was known as the High Street. It started at Horncastle and headed NW. to the Humber at South Ferriby. Its course had been laid down in prehistoric times and the stone carts for Louth may have followed its lower section as far as Donington on Bain before turning NE. for Louth. The evidence for the Wolds trackways was considered by Phillips, *op. cit.* (part 1) in note 105.

¹⁰⁸ The situation at the start of a major building project such as this one is probably not representative of general working practice and may indicate an urgency not apparent later in the campaign. The Vale Royal building accounts have been published as *The Ledger Book of Vale Royal Abbey*, J. Brownbill (ed.), *Record Society for Lancashire and Cheshire*, 68 (1914).

¹⁰⁹ N. J. G. Pounds, 'Buildings, Building Stones and Building Accounts in South-West England', 228–37 in D. Parsons (ed.), *Stone Quarrying and Building in England AD 43–1525* (Chichester, 1990). The Exeter accounts also demonstrate that stone was moved by land and sea for the whole year, excluding the month of January, although the number of journeys made in the period from September to March was only half that of the other six months. For the Exeter accounts see A. Erskine, 'The Accounts of the Fabric of Exeter Cathedral 1279–1353', *Devon and Cornwall Record Soc.*, ns 24 (1981), 26 (1983).

¹¹⁰ Stenton, *op. cit.* in note 82; E. J. S. Parsons, *The Map of Great Britain, c. A.D. 1360*, known as the Gough Map (London, 1958).

¹¹¹ L. A. S. Butler, 'Medieval Gravestones of Cambridgeshire, Huntingdonshire and the Soke of Peterborough', *Proc. Cambridgeshire Antiquarian Soc.*, 50 (1956), 89–100, 96–98.

¹¹² B. P. Hindle, 'Roads and Tracks', 193–217 in L. Cantor (ed.), *The English Medieval Landscape* (London, 1982). The evidence for the routes taken by the medieval roads is also considered in C. Taylor, *Roads and Tracks of Britain* (London, 1979), Chapter 4.

¹¹³ The earlier medieval period, the 11th–13th centuries, when the largest amount of building work was undertaken in this country is also the period from which the evidence of the transportation of materials is most absent. Most of the direct evidence for the transport of stone by road comes from the later medieval period, such as the use of carts to move the sections of the alabaster retable from Nottingham to Windsor in 1367. This undertaking required the use of ten carts each pulled by eight horses and took 17 days for the journey of 192 km, L. F. Salzman, *English Trade in the Middle Ages* (Oxford, 1931), 204.