The Saxon Building-Stone Industry in Southern and Midland England

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IN Saxon England churches were virtually the only buildings of stone,[1] and their erection must have made very considerable demands on the available organization, bulk transport, and technological resources. Documentary sources reveal little about the Saxon building industry, and our understanding must come largely from study of the buildings themselves, including a comprehensive survey of the kinds of stone used for varied purposes by Saxon builders and carvers, and hence of the quarry resources exploited. The equivalent is almost equally true for the 12th century, and even into the later middle ages an adequate view of the stone industry and its relation to the building trade can hardly be attained without study of the stones themselves.[2]

The present survey of Saxon stonework is concerned mainly with the finer freestones used for ashlar, dressings, detail, and architectural or free-standing sculpture. Examples have been examined at nearly 500 places widely scattered over the southern half of England (FIG. 25),[3] and identification of the stone has been inevitably more adequate for some areas and stone types than for others. England provides an abundant variety of workable stone, and much research remains to be done on detailed surveys in particular regions,[4] such as Lincolnshire and the north midlands, Dorset, or Kent and the south coast. This is only a preliminary general survey, but the picture shown by the map (FIG. 25) is nevertheless a most revealing gloss on the life of Saxon England, especially for the later period. It emphasizes the importance of the Jurassic oolitic freestones of fine quality, carried 50 miles west into Devon and into the Welsh borderland, 70 miles east into Hampshire and to the lower Thames valley, over East Anglia (e.g. from Barnack, probably much by Fenland waterways) and along the eastern coasts. All this, however, largely repeats a pattern developed in Roman Britain.[5] The survey shows also the widespread Saxon use of Quarr stone from the Isle of Wight (Oligocene) and its coastal transport eastwards along the south coast (distant shipment from the Isle of Purbeck not being developed till later), and perhaps the

1 Larger monasteries in Britain evidently had some conventual buildings of stone, but royal domestic buildings (even of palatial scale), unlike those of Frankish and Carolingian times on the continent, seem to have had their rigid construction carried out entirely in timber, as shown by recent excavations at Yeavering, Old Windsor and Cheddar. Late in the Saxon period the building of isolated sections of stone walling (such as a gable) as anchoring for the timber construction has been shown at Sulgrave in Northamptonshire (*Med. Archaeol.*, VI–VII (1962-3), 333, fig. 100).

2 Cp. Jope, 1956 b; Jope and Hoskins, 1954.

3 An interim version of this map is printed in S. Piggott, *Approach to Archaeology* (1959), p. 124, fig. 12.

4 Regional surveys of the type carried out by Neaverson (1947; 1953) in north Wales.

5 Blocks of freestone in Saxon work may of course occasionally have been reused material from Roman work, and this dictates a little caution.

beginnings of the medieval maritime trading in stone from the Bristol Channel area, as well as up the Severn. It shows above all the extent to which bulk transport of stone over long distances (up to 70 miles), overland as well as by inland and coastal waters, became a regular part of Saxon building operations from at least the 9th century onwards. What evidence is available from documents, moreover, shows that carts and waggons were in use for such bulk transport over Saxon England;[6] the large blocks sometimes used, such as the half-ton imposts at Breamore in Hampshire, 70 miles from their source near Bath (PL. V, D), and found even in early structures such as Bradford-on-Avon (PL. IV, A), are not feasible pack-animal loads, and themselves imply heavy wheeled transport.[7]

This survey also emphasizes that the south-east of England has its own local supplies of good building stone, already well exploited by Saxon builders, and that it should not really be seen as a non-stone-building area.

Identification of stone used in Saxon work, besides showing the extent of bulk transport available, may also aid structural analysis,[8] and, in relation to a general survey, contribute to reasoned dating.[9] It may also reveal groupings of monuments,[10] possible sources of stylistic influences[11] or of sculptural work,[12] and even point to possible monastic or quarry workshop centres as known later.[13] It should, therefore, instead of being the exception, be a routine requirement in a definitive account of a building or monument.

ORGANIZATION OF SAXON STONE-BUILDING WORKS

Already in middle Saxon times building a stone church such as Bradford-on-Avon or Brixworth must have been a highly organized operation involving a varied community of craftsmen—carpenters and others as well as masons, a large-scale heavy industry[14] involving machinery such as lifting-gear, and quite

6 Jope, 1956 a, p. 251; cp. Knoop and Jones, 1938, p. 37, for later periods.

7 Sledges were occasionally used during the middle ages, but probably mainly for short haulage, as from wharf to near-by building.

8 The clearest examples so far available are later: e.g. Donovan and Reid, 1963; King's College, Cambridge (Roy. Comm. Hist. Mons., *City of Cambridge*, I (1959), pp. 99–103); Merton College chapel, Oxford (Jope, 1956 b, pp. 22–3).

9 E.g. Quarr stone from the Isle of Wight Oligocene was used along the south coast in Saxon work, but not the lithologically similar stone from the Purbeck Beds. It may turn out that Caen and other N. French stones were not being appreciably imported to England before the conquest (Dr. F. W. Anderson reports that some had been used in the pilaster strips of Sompting Church), though further research is needed; and it is still uncertain whether hard stones such as Tadcaster Magnesian Limestone were used in Saxon work (Clapham, 1948).

10 For instance, the widespread use over the east midlands and East Anglia of Barnack stone for long-and-short quoins, plaster strips, and tomb-slabs (Fox, 1921; Butler, 1957), and similarly Quarr stone in the south.

11 But such arguments must be used with caution; the Chichester reliefs themselves (Zarnecki, 1953) are now shown to be of Caen stone (not Purbeck Beds, see note 196) and the relation with the Toller Fratrum fragment must thus be viewed differently (see note 30 below).

12 Thus, the Winchester round shaft (Kendrick, 1938, pp. 191–5, pl. lxxxv), of a mainly Mercian type, is confirmed in its Winchester context, being made from a block of glauconitic sandstone from the near-by Greensand.

13 These emerge clearly from the study of the sculpture and records of the 13th century (Stone, 1955 a, pp. 106, 109 f.; Harvey, 1950, p. 18; Jope, 1956 b, p. 23; Salzman, 1952, pp. 22, 123) and are perhaps traceable in the work of the 12th century, above all in the rising Purbeck Marble industry (Stone, 1955 a, p. 104). Note here particularly the Barnack stone among the early sculptures at Breedon (Leics.), and consequent possible connexion also with Peterborough (p. 100).

14 Cp. D. Knoop and G. P. Jones, *The Medieval Mason* (1933), pp. 2 ff.

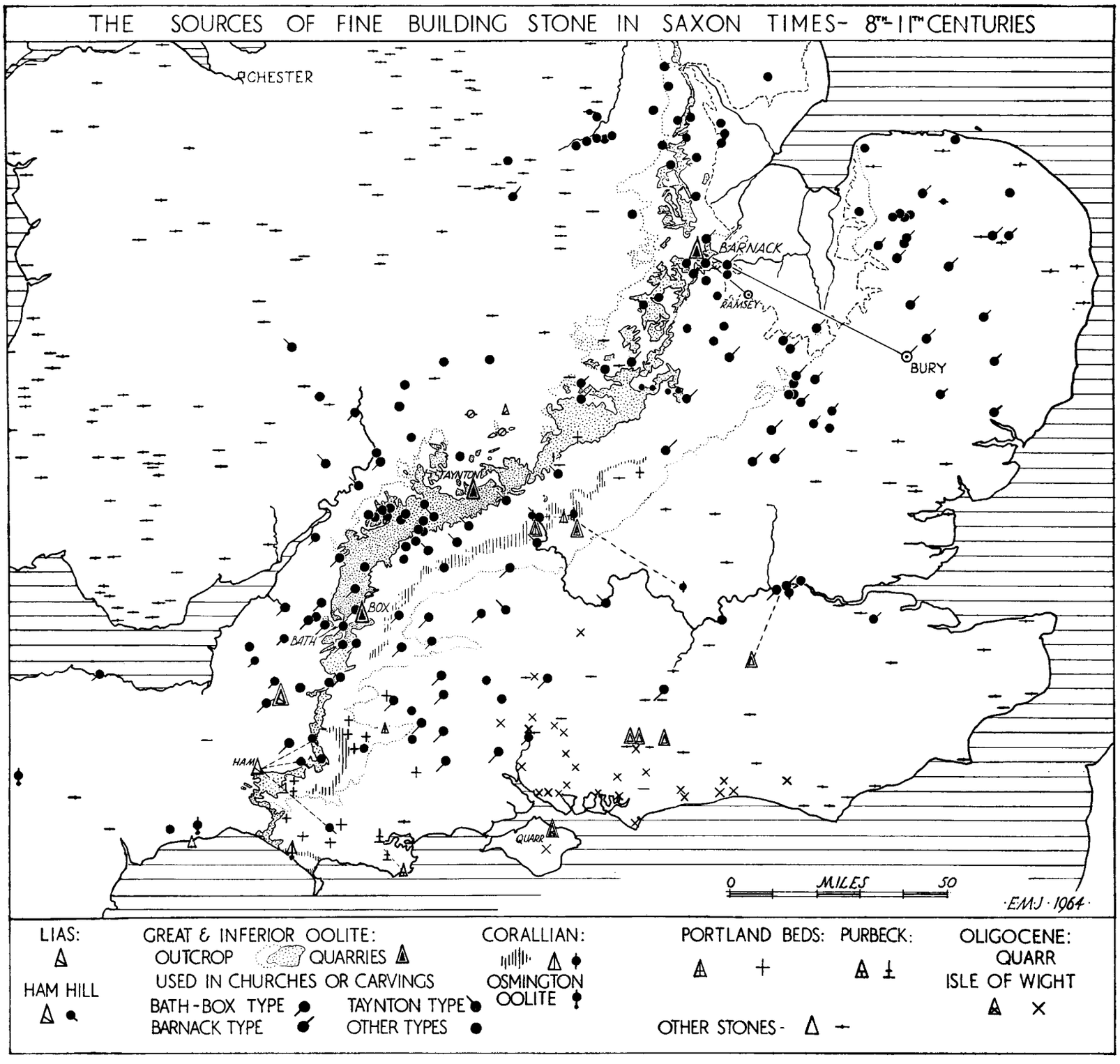

FIG. 25

BUILDING STONE IN SAXON ENGLAND SOUTH OF THE TRENT

Map differentiating general dispersal of stone from the Lias, Oolites, Corallian, Portland Beds, Purbeck Beds, Oligocene and some other sources. Note widespread use of limestones from Jurassic belt

[face page 92

different from the isolated work of most artisans. Such works were possible only for those commanding fair wealth; and many Saxon stone churches not sponsored by monastic houses were in fact 'minsters' or chapels erected on royal demesne estates,[15] or occasionally by wealthy laymen.[16] Larger monastic establishments such as Glastonbury had workshops and perhaps a works department, though there is no evidence that any Saxon kings maintained works departments, for their sporadic building work in stone was confined to minsters and chapels on their estates. Masons cannot have been numerous in Saxon England, and the scanty evidence suggests they were recruited as needed from the country at large, and controlled by a monastic or royal official[17] ('direct labour', the system most general in medieval stone building).

This survey also shows some widespread uniformities in the use of particular kinds of stone for specific structural purposes, such as Quarr (FIG. 26) or Barnack (FIG. 25) for pilaster strips and long-and-short quoins (the long verticals often face-bedded,[18] PL. V, A-B). This, as much as regional or national uniformities in design and construction,[19] suggests a body of transmitted technique with some degree of coherence and organization among masons in Saxon England, based perhaps on their contacts at quarries, which sometimes turn out later to be influential workshop centres. Most of the larger and better quarry resources were in royal or monastic ownership, in which ultimate control of the industry must mainly have lain.

Some assessment of *dating* criteria has been implicit in this survey of the expanding Saxon stone industry. Reasonably datable Saxon buildings or sculptures are all too rare;[20] for many of the remainder divergent views persist and are even now being newly propagated. In a few cases widely differing datings are proposed; for example, the recent views on what constitutes influence from Carolingian classical style (the Reculver shafts[21]), or from Ringerike style.[22]

[15] E.g. Brixworth was royal demesne in 1086 (R. H. C. Davis, 'Brixworth and Clofesho,' *J. Brit. Archaeol. Assoc.*, XXV (1962), 71) and Avebury can be shown to have been royal demesne (Jope, 1965). In Domesday Avebury appears only among a list of churches (most of them adjuncts of royal manors) entered at the end of the king's lands (fol. 65 b). The manor was given in 1114 to the abbey of St. Georges-de-Boscherville, near Rouen, by William de Tancraville who had received it from the king. Richard I's confirmation in 1189 expressly states that it was of his great-grandfather King Henry's demesne (J. H. Round, *Cal. Docs. preserved in France* (1899), pp. 66–9).

[16] E.g. Stoke d'Abernon (Radford, 1961); Aldbourne, Wilts. (*Vict. Co. Hist. Wilts.*, II (1955), 34; Jope, 1965): see also R. V. Lennard, *Rural England, 1066–1135* (1959), pp. 289–291.

[17] *Chron. Abbatiae Rameseiensis* (Rolls Ser., no. 83, 1886), pp. 88 ff., 168, 229; Baldwin Brown, 1925, p. 268 f. Ramsey and Bury St. Edmunds were disputing transport rights from the Barnack quarries before the conquest.

[18] This would nowadays be regarded as bad technique, but they have successfully withstood 1,000 years of exposure in widely separated buildings with only slight and very uniform weathering, testifying to the skilful selection of stone by the Saxon masons.

[19] Taylor, 1959; Taylor, 1963.

[20] Even then some of the arguments propounded seem tenuous (see Talbot Rice, 1952, pp. 1, 137 ff.); for discussion of analogous problems in dating metalwork see D. M. Wilson in *Archaeologia*, CVIII (1961), 106–7, 99 ff.

[21] E.g. Talbot Rice, 1952, p. 96 f., and Stone, 1955 a argue *contra* Peers, 1927 and Clapham, 1930: see below, p. 98.

[22] E.g. Talbot Rice, 1952, p. 128; this earlier 11th-century dating for several Wessex crosses (*contra* the 8th-century dating of Cottrill, 1935, and Kendrick, 1938). The apparent identity of the stone of the Dolton and Colyton shafts reinforces somewhat in this instance the early 11th-century dating.

Most disputes are, however, of the order of half a century, which is not unduly serious in this survey except when deciding what monuments are relevant to the later fringes of the Saxon stone industry. Here caution is needed, for, although much of the Saxon manner persisted into Norman England, the rapid Anglo-Norman drive in monastic and cathedral building on a grand scale,[23] as well as on some massive early stone castles,[24] soon created out of the Saxon an Anglo-Norman building-stone industry. It says much for the advanced state of the Saxon stone industry that the greatly increased demand for stone of high quality could have been supplied in the main from quarry areas already in operation. A few

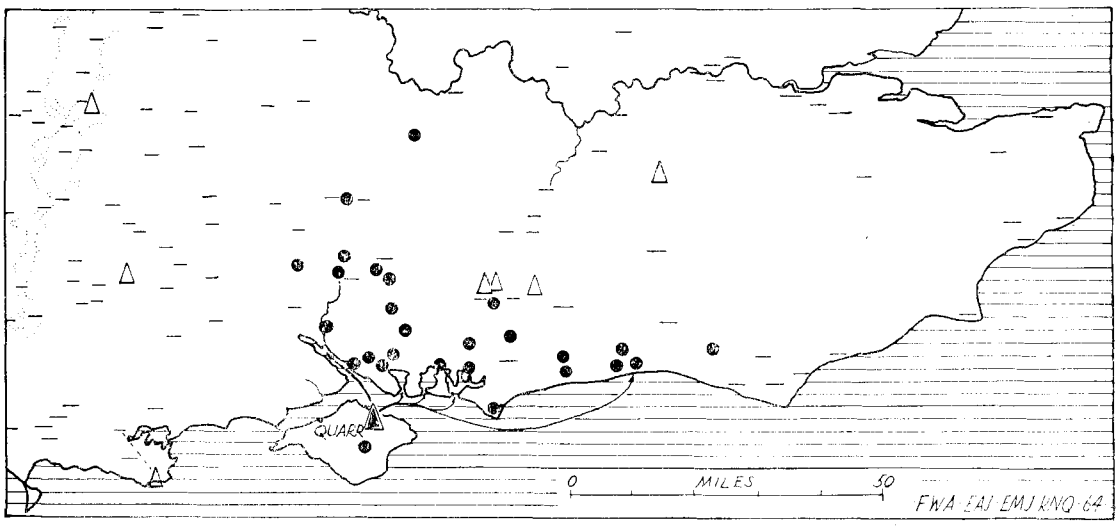

FIG. 26

DISTRIBUTION-MAP OF LATER SAXON STONEWORK

using Quarr 'featherbed' stone (shown by spots), from the Isle of Wight Oligocene. Sea transport is implied. Dashes show Saxon masonry with no evidence of Quarr stone; triangles show quarries in use in Saxon times. Identifications by Dr. F. W. Anderson (p. 101 f. and Appendix, p. 115 f.)

new hitherto untapped resources seem to have been opened up within a decade or so of the conquest[25] and more were being increasingly exploited through the 12th century.[26] Although robust persistence of Saxon traits in style and technique

[23] Clapham, 1934; Talbot Rice, 1952, p. 72; Conant, 1959, pp. 286 ff.; Webb, 1956, pp. 25 ff. The new building drive seems to have gained real momentum in the 1090s.

[24] Stone castles of the late 11th century are not numerous, but fairly massive: e.g. London, the White Tower; Colchester, H. M. Colvin, *The History of the King's Works* (1963); Richmond (Yorks.), with its later 11th-century hall almost complete; and Chepstow, Monmouth, Ludlow, and others listed by D. F. Renn (*J. Brit. Archaeol. Assoc.*, XXIII (1960), 4–9).

[25] The chronicle of Battle Abbey (ed. M. A. Lower, 1851) tells us that in building the Conqueror's new foundation from 1067 onwards, he at first undertook to provide stone from Normandy, but a woman through a dream located a near-by site for good quarriable stone (see also *Vict. Co. Hist. Sussex*, I (1907), pp. 26, 52). This is comparable with the Aldhelm story for Bradford-on-Avon (p. 99) and probably conceals much diligent prospecting.

[26] It seems that various stones from the Isle of Purbeck first began to be exploited outside Dorset during the 12th century, and assume their full medieval range. There is little suggestion that Doulting stone was used even locally in Somerset in late Saxon times (even for the near-by crosses at Nunney or Frome); not until the rebuilding after the fire of 1174 did it supplant Dundry (used in the early Norman work) and Bath stone as the chief supply for Glastonbury.

reflect a continuing native craft tradition, this was able to draw upon any improvements in supply resulting from the new Anglo-Norman demand, and would thus be misleading if taken to illustrate the later Saxon stone industry or its transport facilities. It is therefore important here to set the limits as soon after the conquest as possible.

Persistence of Saxon traits[27] and the introduction of some Norman influence into England from *c.* 1045 onwards (plain for all then to see in the Confessor's great new minster at Westminster, 1045–50)[28] may both cloud the picture.[29] Much detailed study is still needed on the interplay of influences in later 11th-century England on the work, alike, of a few master builders and sculptors and of numerous local craftsmen of limited experience, observation, skill and aesthetic sense (especially in relation to the ecclesiastical and social contexts). Such study is all the more important here as inferences from types of stone used (such as the importing of Caen stone) have tended to become incorporated in the train of the dating process (as with the Chichester reliefs or the York Virgin), with the ever-inherent risk of circular arguments.[30]

IDENTIFICATION OF STONE TYPES

Precise description of the stone and identification of probable quarry sources require close association between archaeological and geological field-workers and prolonged laboratory study in which the collaboration of palaeontologists, petrologists and mineralogists with wide range of experience is also needed.

The lithological character of a stone as observed by naked eye, hand-lens, and acid-bottle must be extended to include a full palaeontological, mineralogical, stratigraphic and tectonic understanding of the deposits concerned. It must be stressed that the character of stone may vary greatly through the depth of any one quarry.

The main supplies of stone for Saxon work in southern England have been taken from the sedimentary rocks—the limestones, the sandstones, the mudstones and siltstones (in varying degrees calcareous). When fossiliferous these may often be ascribed to their geological age, and thus to a source area within the limits

27 Although we may suspect that, for instance, a few examples of long-and-short quoining may be post-1066 (e.g. Claydon, Suffolk; N. Pevsner, *Suffolk* (1962), pp. 20–1, 151), the fact remains that no long-and-short quoins are known in structural association with detail or ornament of indisputable early Norman style. In sculpture the Danish areas, for instance, show long persistence of pre-Norman style (Kendrick, 1949, pp. 109, 120 ff., 139 ff.) as also the western borderlands (Taylor, 1963) and other outlying areas.

28 *Archaeologia*, LXII (1911), 81–100; LXXXIII (1933), 226–237. The vast nave was almost the length of the present nave.

29 It is doubtful, for instance, how much weight should be given to an allegedly Norman feature, the internal rebate, on the door surround of the otherwise entirely un-Norman-looking tower at Netheravon, Wilts. (*Vict. Co. Hist. Wilts.*, III (1955), 31), and there are many other parallel instances. Herring-bone masonry is also not so clearly a purely Norman feature (Taylor, 1963, pp. 230–3).

30 The Chichester reliefs are now shown by Dr. F. W. Anderson to be of Caen stone (see note 196), the possible importing of which in the later 11th century needs careful study; the arguments for a Norman dating (Zarnecki, 1953) are more convincing than those for an earlier date. The York Virgin, considered by Clapham (1948) on epigraphic grounds as probably pre-Norman, is carved on a slab of Tadcaster stone, from the hard fine Magnesian Limestone of the Permian, 9 miles SW. of York, generally thought not to have been worked in pre-Norman times; again a detailed regional survey is needed.

of outcropping (but often not precisely localized within it); their use beyond it implies transport, though possible minor outlying phenomena must be kept in mind (e.g. North, 1937, p. 106). Much of the work of identification is palaeontological, of macro- and of micro-fossil faunas and plant remains, though inclusions of mineral particles such as glauconite may be helpful. Micro-fossils (ostracods, foraminifera, sponge spikules), being more widely and uniformly dispersed through a deposit, are increasingly informative with samples of limited size, especially of the best freestones, whose very quality reflects their freedom from larger fossils (Arkell, 1933, p. 272).

The character of sedimentary rocks reflects the conditions of their deposition and subsequent deformation, and lithologically similar rocks may be found in widely separated places and be of different geological ages. Stones of diverse origins, such as the 'featherbed' of Purbeck age and of the Isle of Wight Oligocene (both shell-brash banks on a reef), not distinguishable to the naked eye or craftsman's tool, and causing confusion till recently, can now be differentiated through their micro-organism populations (ostracods) even though the debris is too finely comminuted to leave any identifiable fragments of macro-fossils (see Appendix, p. 115 f.).

The finest freestone from the Great Oolite is found between the Evenlode just north of Taynton near Burford in Oxfordshire and the Wellow Brook south of Bath, especially around the ends of this belt.[31] It consists mainly of a fine calcite matrix enclosing ooliths about 1 mm. across, many of which have come out to leave a honeycomb of hollow casts. The stone from the Bath area may often be distinguished from that of the northern end round Taynton by its predominating 'watermarks', veins of calcite meandering vertically down across the bedding planes, a feature hardly found in the Taynton area.[32] These veins have been formed by deposition of calcite in cracks, and are thus a reflection of a greater degree of deformation of the Great Oolite in the Bath area.[33]

Sandstones, usually lacking their faunal evidence, are more difficult to trace to specific sources, though even then the size and shape (rounded or angular) of the quartz grains and the inclusion of mineral particles such as chert, glauconite, mica or garnets, may indicate or eliminate certain deposits. Calcareous sandstones can also provide valuable building stones, such as Reigate Stone or Bargate Stone from the Greensand (the former much used in the Confessor's mid 11th-century church at Westminster) or Chilmark from the Portland Beds west of Salisbury (much used at Old Sarum and in Salisbury Cathedral).

Igneous and metamorphic rocks can sometimes be traced more precisely to their source; they have, however, contributed little to the Saxon stone resources of southern England, except occasionally as erratics (e.g. Brixworth).

Quarries. Little evidence about stone-quarrying can be derived from Saxon

[31] Arkell, 1947 a, p. 94.

[32] Except for one quarry which seems to have been used to provide stone for Blenheim and Glympton Park in the early 18th century (W. J. Arkell in *Oxoniensia*, XIII (1948), 50, and particularly *ibid.*, XVI (1951), 88–9). Such calcite veins are sometimes of course seen in other rocks, such as the Osmington Oolite in the Dorset Corallian.

[33] I am grateful to my colleague, Professor Alwyn Williams, for discussion on this point.

documents. The quarries recorded in Domesday (1086), however, presumably illustrate Saxon activity, especially if a substantial 1066 valuation is recorded. It is hardly possible now to identify the exact position of any Saxon quarries, or to determine the size and depth of each opening of a stone bed; even for major works in the middle ages the area of a quarry was surprisingly small, and the depth would depend on the thickness of the freestone bed.[34] The high quality of stone preserved in some Saxon work suggests high skill in quarrying, selecting and working the stone, and presumably good beds were exploited to full depth. Cliff- and fault-scarp outcrops, such as the Osmington Oolite at Abbotsbury near the Dorset coast, the Middle Chalk at Beer in E. Devon, or the Cotswold scarp, were obvious quarriable sources for early stone prospectors.

The normal Saxon word for building stone was *stan*, and for a stone quarry *stan-gedelf*, *stan-greet* or *stan-hiwet* (lapidicina vel lapidicedum),[35] but these are rare in place-names. A *stangedelfe* is listed in the bounds of an estate supposedly given to Glastonbury Abbey near by, at Pennard, by the Mercian King Baldred in 681; a quarry here could have provided the Lias rubble of the early masonry, but the charter as it stands must be a forgery of the 10th or even 12th century.[36] Standel in Oxfordshire (*Stangedelf*, 1002[37]) was an important quarry centre during the middle ages and later, exploiting the Portland Beds; its stone cannot however now be detected in any Saxon work in the district. A *Stanidelf* is also recorded (1202) in Warwickshire near Tamworth (Staffs).[38] The basic meaning of the commoner term *crundel* seems to have been a ravine or dip, usually with running water, and thus *cealc-crundel* was a chalk ravine; a chalk pit was *cealc-pytt* or *cealc-sēap*,[39] and *crundel* cannot be taken necessarily to indicate a quarry for stone.

Though good, well-tried stone types were persistently used even at great distances, the importance attached to prospecting for new and less distant resources for building stone is sometimes obliquely revealed, as in the stories of Aldhelm near Bradford-on-Avon (p. 99) or the woman at Battle (note 25), and the extent to which new types of good stone were progressively brought into use in Saxon England gauges the fair success of such prospecting.

Saxon churches: the earlier phase. The builders of the earliest churches in England in the 590s and early 7th century, working in a land with no tradition of building in stone for some two centuries and thus no quarries that were currently in use for good stone, took materials largely from Roman ruins.[40]

34 Knoop and Jones, 1938, pp. 30 ff. 'Quarry' sometimes meant the quarriable bed.

35 A. H. Smith, *English Place-Name Elements* (Eng. P.-N. Soc., 1956), p. 128, etc. I am grateful to my colleague, Mr. J. Braidwood, for discussions on this subject.

36 Birch, *Cart. Sax.*, no. 61; for this 'somewhat questionable' charter, see F. M. Stenton, *Anglo-Saxon England* (2 ed., 1947), p. 66, note 4: I am grateful to Mr. Nicholas Brooks for a critical discussion of this charter. See also Clapham, 1930: Dr. C. A. Ralegh Radford further confirms that the early work at Glastonbury is of Lias.

37 *Place-Names of Oxfordshire* (Eng. P.-N. Soc., 1953), p. 90.

38 *Place-Names of Warwickshire* (Eng. P.-N. Soc., 1936), p. 26.

39 A. H. Smith, *English Place-Name Elements* (Eng. P.-N. Soc., 1956). I am grateful to my colleague, Mr. J. Braidwood, for notes on these name-elements.

40 Peers, 1929, pp. 73–4; Peers and Clapham, 1927, p. 212.

Dressings and arches were worked up in Roman bricks, rubble for walling being supplemented from easily available flints and field-stones, or at most knocked from surface outcrops. Occasional blocks of freestone used at random could also have been derived from Roman buildings, and at Bradwell in Essex the blocks for the main wall faces (*c.* 653) were evidently taken from the wall of the Roman fort over which the church stands.[41] Similarly, Roman walling gave a good supply of squared blocks for the Northumbrian churches later in the 7th century.[42] The little basilica at Lydd on Romney Marsh in Kent should probably also be included in this early group.[43] Its surviving remains are of blocks of Kentish Rag (available from the Lower Greensand ten miles away), and small holes about $\frac{3}{4}$ in. across (some still with wood plugs), which are probably the marks of the jaws of the iron lewis or lifting-gear,[44] suggest that the stones came from a Roman building. The great late 7th-century church at Brixworth has dressings of Roman brick but no freestone, the walling being of hard boulders sorted out of the local Glacial Drift.[45]

Some later 7th- or early 8th-century work in the south, however, contains a few blocks of freestone less likely to have been found among Roman ruins. At Reculver in Kent fine stone from northern France was used for the cross-head,[46] but the remainder, and the great drum-built columns which carried the eastern arches,[47] have not yet been identified. At Stoke D'Abernon in Surrey, where it is argued that the upper doorway was for a western gallery in the original apsidal church,[48] the fair-sized blocks of Upper Greensand firestone used for the jambs and the single block of the lintel (3 ft. by 10 in.)[49] would imply quarrying near

41 Roy. Comm. Hist. Mons., *Essex*, IV (1923), 14–15, pl. opp. p. 16; Clapham, 1930, p. 22, pl. ii.

42 Clapham, 1930, pp. 38 ff.

43 F. C. Elliston-Erwood in *Archaeol. Cantiana*, XXXVII (1925), 117; for the nature of the building see Jackson and Fletcher, 1959.

44 A. G. Drachmann, *The Mechanical Technology of Greek and Roman Antiquity* (1963), pp. 104–6. Holes for the jaws of such lifting-gear are found in medieval work, but usually in vault stones (Salzman, 1952, pp. 322–3); several of these stones with holes at Lydd are low down and would not have needed hoisting into their present positions.

45 Jackson and Fletcher, 1961, pp. 1–15; Arkell, 1950, 'It is a museum of rock types, largely brought by ice from Charnwood Forest'. Tufa seems confined to later Saxon work at Brixworth.

46 Peers, 1927, pp. 241–256. The miscellaneous shaft fragments found at Reculver are not homogeneous in style, nor in diameter, and might almost have come from more than one primary monument. The mixture of styles and of qualities of carving might however represent the work of both Mediterranean-trained and native craftsmen. They can hardly be summarily dismissed as Carolingian replacements (Talbot Rice, 1952, p. 96 f.; Stone, 1955 a, pp. 19–20, 237) for they seem in Hellenistic styles and some might even have come from work of Roman age, even on the continent. The cross-head is shown to be of a non-British Middle Eocene limestone, probably from the Paris region. All these Reculver stones, and the great columns now in Canterbury, merit further study. I am grateful to Dr. Radford, Professor J. M. C. Toynbee and Mr. B. C. S. Wilson for discussions on these sculptures, and to Dr. F. W. Anderson on the stones used.

47 Baldwin Brown, 1925, pp. 97 ff., 384; Clapham, 1930, pp. 122–3, pl. iii. This engraving by H. Adlard has done valuable service towards reconstructing the original aspect of the early church of St. Martin at Angers (Forsyth, 1953). The columns are now set up in the infirmary cloister at Canterbury Cathedral.

48 Radford, 1961, pp. 165–174. For a newly-observed upper doorway implying a later 7th-century western gallery at Jarrow see Taylor, 1959, pp. 138–141.

49 P. M. Johnston in *Surrey Archaeol. Coll.*, XX (1907), 14.

by on a moderate scale in the late 7th or early 8th century, for such stone would hardly have been part of a Romano-British rural building.[50] The earliest work found at Glastonbury was of local Lias rubble, with apparently no oolite blocks.[51]

None of these early Saxon building enterprises, technically remarkable though they are, required any specialized understanding of the resources of English building stone derived from deep quarrying, as had been well developed in Roman Britain.[52] Not so, however, the earliest masonry of the church at Bradford-on-Avon (PL. IV, A), probably that of Aldhelm's foundation of *c.* 700 or soon after.[53] This is built systematically of large blocks of excellent oolite of *Bath* type (p. 114), to be won only by fairly deep quarrying.[54] Aubrey's old men's story, that 'St. Aldelme, riding over there, threw downe his glove and bade them digge, and they should find the greatest treasure, meaning the Quarry', may preserve a memory of the beginnings of the great medieval building-stone industry in this region. Little other surviving masonry of comparable quality in southern England can be so confidently ascribed to this period: perhaps the doorway at Somerford Keynes[55] (NW. Wilts.; of stone taken locally from the Great Oolite), and some other remains of single-splay windows (which might be before the 10th century but can hardly be uncritically accepted as of the 8th century). Bath-type oolite has been used 35 miles from the quarry area in the remarkable work of *c.* 800 at Britford,[56] near Salisbury, and for the fine 4-ft.-high carved cross-shaft at Codford St. Peter near by, probably of the earlier 9th century.[57] During the 9th century blocks of the finest oolite from the Bath area were being carried even farther afield, for cross-shafts at Newent[58] beyond the Severn (Glos.), at Amesbury[59] and Ramsbury[60] (Wilts.), and eastwards to Steventon[61] (NW. Hants) and as far as Surrey and London.[62]

Though the evidence is not at present so good as for Bradford-on-Avon and the Bath area, it is clear that in Northamptonshire the quarries in the Inferior

50 Unless possibly from a temple or a large county establishment such as that at Lullingstone.

51 Clapham, 1930; Peers, 1927; see above, p. 97.

52 R. E. M. and T. V. Wheeler, *Verulamium* (Soc. Antiq. Res. Rep., XI, 1936), p. 142; M. R. Hull, *Roman Colchester* (Soc. Antiq. Res. Rep., XX, 1958), pp. 33, 166, 173, 178; G. C. Boon, *Roman Silchester* (1957), pp. 84 ff.; K. M. Kenyon, *Excav. at The Jewry Wall Site, Leicester* (Soc. Antiq. Res. Rep., XV, 1948), p. 14 f. The great tombstone from Ludgate Hill (Roy. Comm. Hist. Mons., *Roman London*, p. 173, pl. 60) is of Bath stone, as is much other carved work from Roman London.

53 Jackson and Fletcher, 1953, pp. 41–58.

54 For an account of the restricted area round Bath yielding this high quality oolite see Arkell, 1947 b, p. 94; and above, p. 96.

55 Baldwin Brown, 1925, pp. 189–190, fig. 75; C. A. R. Radford in *Proc. Somerset Archaeol. Soc.*, CVI, (1962), 43–4; *Trans. Bristol and Glos. Archaeol. Soc.*, LXXXII (1963), pl. vii.

56 Clapham, 1930, p. 50, pl. x; Baldwin Brown, 1925, pp. 220 ff., 425; Kendrick, 1938, pp. 116, 180–1, pl. lxxvi; Talbot Rice (1952, pp. 90–1) suggests a later date.

57 Kendrick, 1938, pp. 180 ff., pl. lxxv; Stone, 1955 a, pp. 21, 237, pl. xi; Talbot Rice (1952, pp. 89–91) argues that this may be later (*temp.* Alfred), but the arguments are largely rejected by Stone (1955 a, p. 237).

58 Kendrick, 1938, pp. 182, 187, 284, pl. lxxvii; Talbot Rice, 1952, p. 143.

59 Kendrick, 1938, p. 187; Stone, 1955 b, p. 38.

60 Kendrick, 1938, pp. 145, 203, 211 ff., pl. xcix, c; Taylor, 1963, p. 249; see note 107.

61 Kendrick, 1938, p. 21, pl. xcviii.

62 *Vict. Co. Hist. London*, I (1909), 13 f., 167 f. See p. 105 below.

Oolite at Barnack, worked in Roman times,[63] were being used again by the 8th century for the Hedda stone[64] and other pieces at Peterborough. Again, it is worth noting that the earliest Saxon churches in this area also were built largely of miscellaneous local stones, or of reused Roman material, as was the earliest masonry at Peterborough itself;[65] and the dressings of the excellent large-scale structural work of *c.* 700 at Brixworth are of brick (presumably Roman), with no Barnack stone used.[66]

More local resources of good quarried stone for dressings and carvings were being increasingly opened up during the 9th century, though well-tried excellent stones such as Bath or Barnack never lost their popularity and were increasingly carried over great distances. Northwards from Northamptonshire the carved stones at South Kyme indicate that perhaps even before *c.* 800 the Inferior Oolite at Ancaster was being used.[67] Fifty miles away to the WNW. at Breedon-on-the-Hill (Leics.) is the outstanding series of friezes and other carvings arguably of the earlier 9th century[68] and stylistically related to carvings at Peterborough[69] and near by at Castor and Fletton.[70] It is therefore significant that the panels are of Barnack stone;[71] the majority are of a hard fine calcareous sandstone probably from the Permian of Nottinghamshire (e.g. Mansfield White) some 20 miles to the north-east.

Later Saxon churches. By far the larger proportion of surviving Saxon stonework is of the 10th and 11th centuries, for which a fairly comprehensive picture of an organized building-stone industry is beginning to emerge. Good stone must have been in ever-increasing demand, and a degree of organization is indicated by the repeated use of particular types of stone for specific kinds of monument or structural purposes in many widely-separated buildings (their rubble walls built otherwise of miscellaneous local materials), and by the considerable bulk transport thereby implied.

This is well illustrated by the kinds of stone chosen for ashlar structural elements, such as pilaster strips or long-and-short quoining, in otherwise less rigid flint or small-stone rubble walling. For these, over a wide area of eastern

63 *Vict. Co. Hist. Northants.*, II (1906), 293.

64 Clapham, 1930, p. 76, pl. xxx ('second half of 8th century'); Kendrick, 1938, pp. 175–8 ('early 9th century').

65 Baldwin Brown, 1925, pp. 170 ff.: but see Clapham, 1930, p. 91. There are also still preserved in the cathedral Roman pottery-kiln fire-bars from among the debris excavated from under the N. transept of the cathedral. I am most grateful to the Dean for his help at Peterborough.

66 Arkell, 1950, and further personal observation.

67 *Antiq. J.*, III (1923), 118; the stone was identified by the Geological Museum. For dating discussion see Kendrick, 1938, p. 171, who considers the South Kyme carvings even earlier than the Hedda stone, placing them in the 8th century.

68 Clapham, 1927, p. 240. Talbot Rice (1952, pp. 86 ff.) suggests that Carolingian prototypes are most likely, and hence a date after *c.* 820; but this is rejected by Stone (1955 a, pp. 20 ff., 238). I am most grateful to Professor P. C. Sylvester-Bradley (Geology Dept., Leicester University) and Dr. F. W. Anderson for their help with the Breedon stones.

69 Clapham, 1927, pl. xli.

70 Clapham, 1927, pp. 221 ff., probably from the near-by abbey of Peterborough itself; Roy Comm. Hist. Mons., *Hunts.* (1926), pp. xxxv, 98, pl. lviii.

71 The panels set on the inside of the E. wall of the S. aisle: Clapham, 1927, pl. xxxix.

England, Barnack-type limestone from the Inferior Oolite has been extensively used (FIG. 25), sometimes in preference to quite adequate stone available from nearer sources. Barnack has been used for long-and-short quoins as far south as Strethall in NW. Essex, and in Hertfordshire at Reed, Westmill and Walkern:[72] at the last, however, the Saxon rood inside the church is of hard chalk,[73] which has not so far been observed anywhere in long-and-short quoining.[74] Barnack was used for long-and-short quoins also at St. Peter's, Bedford,[75] and 10 miles to the south for the tomb-slab at Milton Bryan,[76] of a style probably produced at a limited number of centres (Fox, 1921, suggests Cambridge[77]), or even in the Barnack quarry shops. Only a further 5 miles to the SW., however, the pilaster strips round the 10th-century apse at Wing (Bucks.) are of stone from the northernmost quarriable outcropping of the Portland Beds,[78] within some 5 miles. Good local stone for dressings was thus known in this area in the 10th century, a stone which was much used in local Norman work.[79]

Along the south coast a shell-brash limestone of very characteristic appearance ('featherbed',[80] PL. V, E) has been used almost universally[81] for pilaster strips (a feature in the area), long-and-short quoins and other dressings in the 10th- and 11th-century churches of the Hampshire basin and along the Sussex coastlands as far east as Lewes (FIG. 26). It is now clear[82] that this stone was being quarried from the Oligocene formation in the Isle of Wight, above all at Quarr (see Appendix, p. 115 f.). Both sea and land transport are implied; as well as its coastal distribution it was carried inland for a tomb-slab at Stratfield Mortimer[83] (6 miles SW. of Reading) and for long-and-short quoins at Laverstoke,[84] 10 miles W. of Basingstoke (FIG. 26). This excellent and pleasing stone

72 Jackson and Fletcher, 1949, pl. i, a, b, c.

73 Baldwin Brown, 1925, p. 483. Noted as of hard chalk by Roy. Comm. Hist. Mons., *Herts.* (1910), pp. 224–5. The 'Saint' at Sompting (Talbot Rice, 1952, pl. xv, b) is also of hard chalk.

74 This corrects the impression given by Jackson and Fletcher, 1949, p. 7; their pls. i, a, b, c, ii, d, iii, a, b, c, iv, a–d, vi, a, b, viii, b, are all of finest quality Barnack stone. Quoins of a hard chalk, apparently of the 12th century, with tool marks still visible, do, however, survive at Woolstone, Berks.

75 Jackson and Fletcher, 1949, pl. ii, d.

76 Kendrick, 1949, p. 82, pl. liv; Fox, 1921, p. 15.

77 See also L. A. S. Butler in *Proc. Cambridge Antiq. Soc.*, L (1957), 98–100; *Vict. Co. Hist. Cambs.*, I, 321–2; *Vict. Co. Hist., Hunts.*, I, 279.

78 Jackson and Fletcher, 1962, pp. 1–20; Arkell, 1933. The stone of the Wing pilasters was identified by Dr. W. J. Arkell.

79 E.g. at Stewkley, Twyford, Water Stratford, Ashendon, and Brill: see note 167.

80 W. J. Arkell in *Proc. Dorset Nat. Hist. and Archaeol. Soc.*, LXVI (1946), 162, 164; Arkell and Tomkieff, 1953.

81 Jope, 1956 a, p. 254, note 80, for list; Green, 1931.

82 I am most grateful to Dr. F. W. Anderson for allowing me to use his identifications of this Quarr stone from the Oligocene. The map and observations previously published (Jope, 1956 a, p. 253; Jope, 1958) are thus now clarified by distinguishing the stone from the Isle of Wight and from around Purbeck respectively; but reliable identifications must still be palaeontologically established through micro-fauna (e.g. ostracods) as well as macro-fauna.

83 *Vict. Co. Hist. Berks.*, I (1906), 248; in the 12th century this stone was being brought regularly inland into the north of Hampshire, e.g. to Kingsclere and Burghclere.

84 Baldwin Brown, 1925, p. 464: 'The NE. quoin of the nave is in good long-and-short work and dates this at any rate as Saxon'. Omitted from list in Jackson and Fletcher, 1949, p. 3. Just west of Salisbury, at N. Burcombe (Baldwin Brown, 1925, p. 445; Jackson and Fletcher, 1949, p. 3, pl. i, d) the long-and-short quoins are of excellent quality Bath-type oolite (with 'watermarks').

had been used in Roman times, and the late Saxon sphere of use was intensified (though not much extended) through Norman times into the later middle ages.[85] A stone often not distinguishable from this to the eye or tool, and also called by quarrymen 'featherbed', was quarried from the Purbeck Beds in the Isle of Purbeck; it can be differentiated, however, under the microscope by its microfauna (ostracods), and the Purbeck 'featherbed' has so far been identified in Saxon work only at Wareham[86] (St. Martin's, quoins) a mere 5 miles from the source. There is little Saxon structural work surviving in this area of E. Dorset, but the Purbeck Beds 'featherbed' has not so far been noted in Saxon work farther eastwards along the south coast, where all Saxon stone of this character so far identified by its microfauna is of Quarr[87] (FIG. 26), and the distant sea transport from the Isle of Purbeck was evidently developed only later, as with Purbeck Marble in the 12th century.

Westwards from the Isle of Purbeck other stone resources were being used. A number of Saxon carvings in both north and south Dorset are of a fine whitish limestone (with local pockets and veins of 'hard-row' ooliths)[88] like the well-known Portland Stone. There are a limited number of areas where this stone could have been quarried, in a belt along the south coastal strip of Dorset, in the Isle of Portland itself, in a strip north of Weymouth, and in the Isle of Purbeck,[89] all worked to some extent during the middle ages. The Purbeck area yields a better weather-resisting Portland Stone than Portland itself, and became earlier renowned for a large-scale stone industry (particularly Purbeck Marble, much exported from the 12th century onwards) than did Portland, whence stone was used in the 12th century only locally in churches, and in the 14th century exported a little (to Exeter and London).[90] This south Dorset stone seems therefore to have been carried into north Dorset in Saxon times, though care must be taken not to overlook other possible sources of good local stone in north Dorset, such as the Marnhull and Todber Freestone of the Corallian Osmington Oolite[91] (used locally in medieval churches). In the Vale of Wardour the Portland Beds yield a fine-grained glauconitic sandy limestone[92] (Chilmark Stone) used extensively for Salisbury Cathedral, and stone of this type was

85 The quarries are said to have been worked out in the 13th century (*Vict. Co. Hist. Hants*, v (1912), 462–3), but the stone appears in later medieval or 16th-century work, as at Sompting, Shoreham, Old Basing and Westhampnett; Edward I granted a licence for its use at Quarr Abbey in 1292 (see also *Proc. Hants Field Club*, II (1894), 167 ff.).

86 Baldwin Brown, 1925, p. 484; Roy. Comm. Hist. Mons., *Dorset*, II (1964). Identification by Dr. F. W. Anderson.

87 Identifications by Dr. F. W. Anderson.

88 S. Dorset: Winterbourne Steepleton (angel), Whitcombe; N. Dorset: Gillingham, East Stour (*Archaeol. J.*, CXVII (1962), 82–7), Melbury Bubb, Melbury Osmond, probably Yetminster, and perhaps Batcombe and Cattistock. I am grateful to Mr. Peter Hutton for allowing me full access to the East Stour shaft.

89 Arkell, 1933, pp. 481 ff.; Arkell, 1947 c, pp. 89 ff.

90 *Vict. Co. Hist. Dorset*, II (1908), 338 f.; locally used for Rufus Castle, Portland, *c.* 1080 (Arkell, 1947 c, p. 118).

91 Arkell, 1933, p. 381; Arkell, 1947 c, pp. 60–3; C. Reid, *Geology of the Country round Salisbury* (1903), p. 71 f. For other stones in Dorset medieval churches see E. T. Long in *J. Brit. Archaeol. Assoc.*, n.s. IV (1939), 36–7.

92 C. Reid, *Geology of the Country round Salisbury* (1903); Arkell, 1933.

already used in later Saxon times at Cranborne,[93] Knook,[94] and Mere.[95] The Osmington Oolite of the Corallian yields good building stone also from some of its exposures along the Dorset coastlands, the freestone bed reaching a thickness of some 13 ft. round Abbotsbury, whence probably came by easy sea transport the block for the cross-shaft at Colyton,[96] 20 miles away (and that 40 miles beyond, inland, at Dolton[97] also), a few pieces of similar stone at Sidbury, where most of the structure of the Saxon crypt is of Beer or Salcombe stones,[98] and a fragment of a cross-head built into the W. wall of the S. transept is of fine quality oolite more like Bath type. The Saxon and medieval building stones of Dorset still need detailed study.[99]

The ochreous Ham Hill Stone, a limited deposit of comminuted shell in the Upper Lias[100] at Hamdon Hill, 5 miles west of Yeovil in SE. Somerset, was also used in Saxon times, carried eastwards to the eastern fringes of Somerset at Maperton[101] and into Dorset for work at Sherborne[102] and at Stinsford,[103] just east of Dorchester. The later development of its use towards the west is discussed below (p. 105 f.).

In Wessex, and beyond, the fine Cotswold oolites of Bath or Taynton type evidently dominated the supply for refined work and were carried considerable distances (FIG. 27). The best Cotswold building stone comes mainly from the 50-mile extent between the Evenlode, a few miles north of Taynton and Burford, and the Wellow Brook just south of Bath; beyond this range the quality of stone deteriorates. The finest freestone of all, especially for carved work—thick beds of fine oolites set in a honeycomb matrix of pale yellow or orange calcite, the best containing few fossils—comes from two restricted areas at the ends of this range, round Bath and Box (Hazelbury) to the south, and round Burford, Taynton and Milton in the north.[104]

These can be in some measure differentiated, for much stone from the Bath area shows characteristic 'watermarks' (vertical veins of translucent calcite threading downwards across the bedding planes,[105]) which are virtually not found

93 Brit. Mus. list.

94 Kendrick, 1949, p. 40, pl. xxxv; Clapham, 1930, p. 137, fig. 44; Talbot Rice, 1952, p. 153; Stone, 1955 b, p. 38; *Archaeol. J.*, CIV (1947), 163.

95 If indeed any parts of the tower can be taken as late Saxon work.

96 Kendrick, 1949, p. 40, pl. xxxix; Arkell, 1947 c, pp. 61–3.

97 Harbottle Reed, 1935.

98 Clapham, 1930, p. 157; Radford, 1957. I am grateful to Dr. R. J. G. Savage for his observations on Sidbury and Colyton.

99 Roy. Comm. Hist. Mons., *Dorset*, II (1964), and E. T. Long in *J. Brit. Archaeol. Assoc.*, n.s. IV (1939), 36–7. Dr. F. W. Anderson is now working on these in conjunction with the Royal Commission on Historical Monuments.

100 Arkell, 1933, p. 169.

101 Kendrick, 1949, p. 40.

102 J. Fowler, *The Stones of Sherborne* (1938).

103 Talbot Rice, 1952, pp. 94, 97, pl. x, b.

104 Arkell, 1947 b, pp. 75 ff. and fig. 27 (folder). But we should not overlook the possibility that fairly good Great Oolite freestone was being already quarried round, say, Minchinhampton or Cheltenham in Saxon times.

105 Arkell, 1947 b, p. 94; p. 96 above. The term 'watermarks' was used for these veins in Bath stone by Oxford masons.

in the Taynton-Burford area.[106] Differential mapping of the examples with 'watermarks' (FIG. 27) thus gives an indication of the distance over which fine stone was supplied from the quarries of the Bath-Box area; though not complete (for not all stone from the Bath area shows 'watermarks'), it is probably repre-

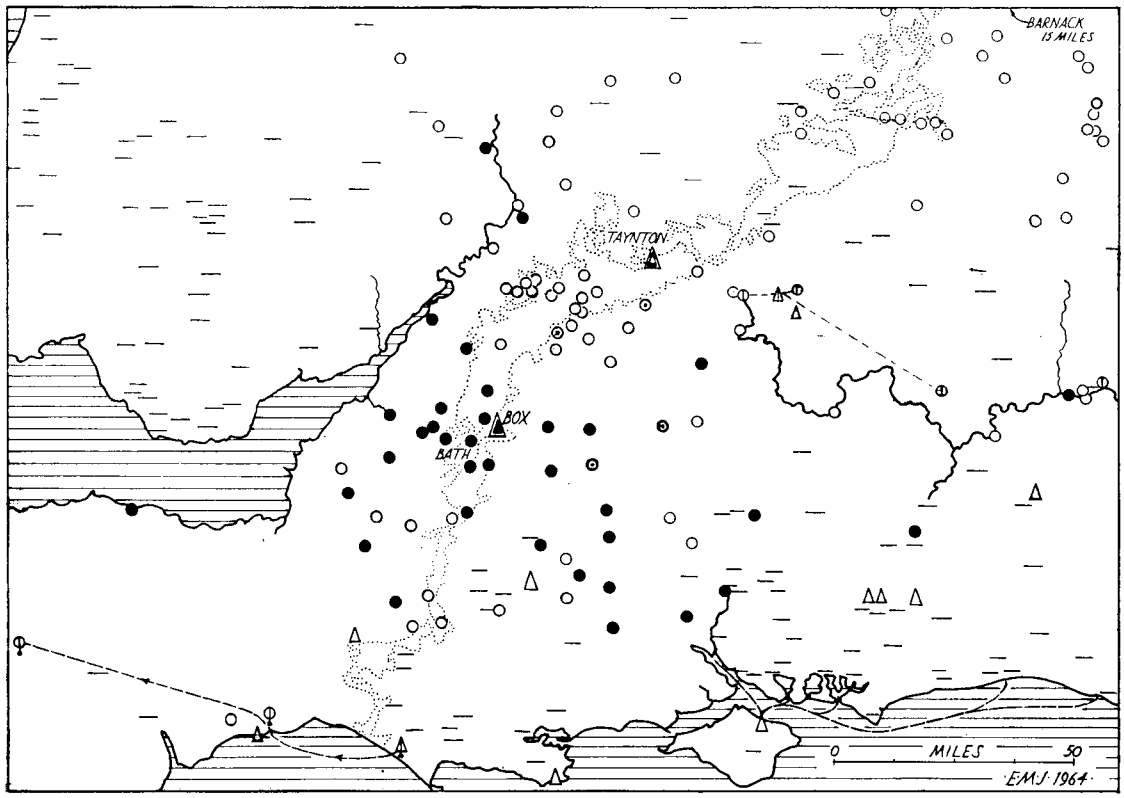

FIG. 27

DISTRIBUTION-MAP OF SAXON STONEWORK

using fine-quality oolite with 'watermarks' (black spots). Open circles represent similar stone without 'watermarks'; those with central dot, stonework in which very few stones show 'watermarks'. Osmington Oolite from the Dorset Corallian can have 'watermarks' (subscript tail). Saxon work in other types of stone is shown by a dash (pp. 103 ff.). The River Thames is shown only for the extent known to be navigable in the 11th and 12th centuries.

sentative. This stone was carried extensively into the Wiltshire chalklands to Ramsbury[107] (crosses), Avebury (cross-fragment in S. face of tower, and church

106 But see W. J. Arkell in *Oxoniensia*, XVI (1951), 88–9, for a bed from Taynton quarry showing 'watermarks' used at Cornbury in the 18th century. The very distribution of 'watermarks' in Saxon and medieval work suggests, however, that this bed was not significantly worked till the 18th century. Most stone with 'watermarks' in basically 12th-century masonry north-east beyond the Bath area seems to be Victorian renovation in Bath stone—with one exception, the 12th-century capitals of the S. door at Cholsey, Berks., which are weathered and look original; perhaps these are an outlier of the medieval Bath-stone distribution which extended into the Kennet valley (e.g. at Avington).

107 Kendrick, 1938, p. 211; Taylor, 1963, p. 249. These, however, show comparatively little trace of 'watermarks'.

dressings[108]), Netheravon (tower detail[109]), and beyond to Godalming[110] in Surrey, and probably Kingston[111] (70 miles) and London (100 miles), to Breamore[112] in NW. Hampshire (the great blocks for the abaci, PL. V, D), and to Winchester for the old minster,[113] but it only reached the north fringe of Dorset which had its own well-developed resources for good stone (p. 102 f. above). To the south-west, stone of Bath type was carried south into Somerset only as far as Glastonbury[114] and West Camel[115] (though perhaps used for the cross-head fragment now at Sidbury). The fine cross-shaft at Colyton[116] and that now used as a font at Dolton[117] seem to be of Osmington Oolite (Corallian), probably from around Abbotsbury.[118] To the west, stone of Bath type reached the coast, but does not seem to have been carried beyond to south Wales till later, when from the 13th century onwards a fair maritime trade was developed in stone from the Bristol-Somerset area,[119] though it is possible that the fragment of a shaft with interlace at Porlock[120] on the north Somerset coast may represent the beginnings of this trade. Other stone resources of the north Somerset area, though sometimes used for local work, did not supply at a distance till later. Thus Doulting Stone (very recognizable by its crinoid debris from the Carboniferous cliffs[121]) seems not to have been used even for crosses at near-by Nunney and Frome;[122] not until the later 12th century (after 1174) did it begin to be used alongside stone of Dundry and Bath type at Glastonbury.[123]

The ochreous Ham Hill Stone from the Lias, widely used through the middle ages, has been discussed above (p. 103) for its eastward distribution in Saxon work. Westwards from the quarries it has not so far been noted in Saxon work, but was being carried at least as far as Taunton[124] in the 12th century, to Exeter by

108 C. E. Ponting in *Wilts Archaeol. Mag.*, XXI (1884) 188–93.

109 Baldwin Brown, 1925, p. 473; Clapham, 1930; as this great tower has rebated door jambs it may possibly be post-conquest, though it does not look like a Norman tower. R. R. Darlington in *Vict. Co. Hist. Wilts.*, II (1955), 31; Talbot Rice, 1952, p. 145.

110 P. M. Johnston, *Schedule of Antiquities of Surrey* (1913), p. 32; the Godalming carved stones are made of Bath-type oolite with 'watermarks', and not, as P. M. Johnston's remarks (*Vict. Co. Hist. Surrey*, II (1906), 447) would imply, of Quarr.

111 D. C. Whimster, *Archaeology of Surrey* (1931), pp. 207 ff.; *Surrey Archaeol. Coll.*, XLVIII (1943), 11 ff.; *J. Brit. Archaeol. Assoc.*, XXXII (1926), 253.

112 *Archaeol. J.*, LV (1898), 84 f.; Baldwin Brown, 1925, p. 351.

113 From Mr. Biddle's excavations in 1962: Bath-type stone with 'watermarks' is used in the 12th-century chapter-house entrance, and stone from Hazelbury was carried to Winchester in 1221 (Salzman, 1952, p. 133).

114 D. P. Dobson, *Archaeology of Somerset* (1931), p. 187 f.

115 Cottrill, 1935.

116 Kendrick, 1949, p. 40 f., pl. xxxiv; Harbottle Reed, 1935.

117 Harbottle Reed, 1935.

118 Arkell, 1933, pp. 380–1; Arkell, 1947 c, pp. 60 ff.

119 D. M. Waterman (forthcoming); Jope, 1956 a, pp. 196–7, and further observations.

120 N. Pevsner, *South and West Somerset* (1958), pp. 19, 275.

121 Arkell, 1947 b, p. 102 f.

122 Kendrick, 1949, p. 40; Cottrill, 1935, p. 151. This and the Nunney piece appear to be of a rather coarse Bath-type stone. I am grateful to Dr. R. J. G. Savage for looking at these stones.

123 Donovan and Reid, 1963.

124 *Proc. Som. Archaeol. Soc.*, XCVIII (1955), 60. I am grateful to Mr. A. D. Hallam for his comments on these stones.

1301,[125] and in the later middle ages was being used at Hartland[126] in north Devon and in north Cornwall (Stratton).[127] Some local freestones of the south-west were being quarried in late Saxon times. Stone from the quarries at Beer and at Salcombe were used, for instance, in the structure of the crypt at Sidbury.[128] For crosses and slabs the granite 'moorstone' (surface boulders) and other local rocks such as slates were used, the latter also particularly for early building work of this age.[129]

Some oolite freestone of Bath type was evidently carried northwards into the Cotswolds, but stone with 'watermarks' was not generally used in Saxon work farther than 15 miles north of Bath (Wotton-under-Edge, cross now in Gloucester Museum); for the possibility of carriage up the Severn, however, see below, p. 107). The conclusion is unavoidable that the numerous surviving Saxon churches and carvings clustered[130] midway between Bath and Burford were being largely supplied either from the quarries of the Taynton-Burford area (for the best freestone, as at Cricklade or Inglesham[131]), or in some cases from quarries nearer at hand, for the most part in the Inferior or the Great Oolite[132] (e.g. cross-shaft at Minety;[133] doorway at Somerford Keynes[134]). The quarries round Taynton (that at Taynton itself is recorded in Domesday) must have supplied the finest quality oolite freestone found in Oxford and Abingdon, and this was perhaps carried down the Thames to Sonning,[135] possibly to Kingston,[136] and some to London[137] (though the Thames was an erratic waterway for barges above about Wallingford[138] and in the 14th and 15th centuries cart transport was used to Windsor). Taynton quarries must also have supplied some good oolite for Saxon work west of the Cotswolds, along the Severn valley, at Gloucester, and perhaps beyond the Severn, at Newent,[139] at Acton Beauchamp[140] in Herefordshire, and

125 H. E. Bishop and E. K. Prideaux, *The Building of Exeter Cathedral* (1922), p. 44; G. Oliver, *Hist. Exeter Cathedral*, p. 379.

126 Personal observations: at Frithelstock Bath-type oolite was also being used, *Proc. Devon. Archaeol. Explor. Soc.*, II (1935), 23.

127 Personal observations: in medieval Cornwall other imported limestones were also used, such as Beer and Caen.

128 I am grateful to Dr. R. J. G. Savage for these observations.

129 E.g. Tintagel; C. A. R. Radford in *Antiq. J.*, XV (1935), 401 ff.

130 Baldwin Brown, 1925; Dobson, 1933.

131 Taylor, 1961; Talbot Rice, 1952, pp. 85, 106, pl. clix; Kendrick, 1949, p. 43.

132 For instance, the now famous quarry areas above Cheltenham, or indeed right along the edge of the Cotswold scarp, where the Inferior Oolite stands exposed in craggy outcrops; F. B. A. Welch and R. Crookall, *The Bristol and Gloucester District* (Geol. Survey Regional Handbook, 2 ed., 1947), pl. viii, etc.

133 *Wilts. Archaeol. Mag.*, XXX (1899), 230.

134 Baldwin Brown, 1925, p. 190; Clapham, 1930, p. 50; *Trans. Bristol and Glos. Archaeol. Soc.*, LXXXII (1963), pl. vii; C. A. R. Radford in *Proc. Somerset Archaeol. Soc.*, CVI (1962), 403.

135 Carved stones set in outside of church tower.

136 Though that at Godalming has 'watermarks' (see p. 105 above): for Kingston see P. M. Johnston in *Surrey Archaeol. Coll.*, XXXVII (1926), 211 ff.

137 E.g. St. Paul's churchyard slabs (Stone, 1955 a, p. 38); also *Vict. Co. Hist. London*, I, 13–14. Even in Roman times massive slabs of Bath stone were being brought into London, as for the great tombstone, 7 ft. high, from Ludgate Hill (Roy. Comm. Hist. Mons., *Roman London* (1928), pl. lx) which has 'watermarks'.

138 Jope, 1956 a, p. 250; 1956 b, pp. 20–22.

139 Kendrick, 1938, p. 77, pl. lxxvii.

140 Kendrick, 1938, p. 186, pl. lxxx; Roy. Comm. Hist. Mons., *Herefordshire*, II (1932), 1, pl. xviii.

reaching 55 miles NW. for the cross at Tenbury[141] in NW. Worcestershire. These show no 'watermarks', but the 'watermarks' in the fluted piers at Deerhurst (Glos.)[142] and in the 'Lechmere' stone[143] at Hanley Castle (Worcs.) just north-west of Upton-on-Severn suggest some barge transport of stone from the Bath area up the Severn, possibly thence supplying occasional blocks to the country west of the north Cotswolds generally, for not every piece of stone from the Bath area will show 'watermarks'. Farther west and north into Herefordshire the local sandstones were mainly used (as for the carved frieze fragment at Cradley[144]), and they there continued to provide the main stone supplies in those areas during the middle ages. The northern limit of the supply range of the Taynton quarries is probably seen in the cross-shaft fragment at Leamington,[145] which is less than 20 miles west of the area apparently receiving stone from the Barnack quarries for dressings and long-and-short quoins (Pattishall and Greens Norton, Northants.[146]).

In the north Cotswold area other quarries were being worked in late Saxon times, yielding coarser freestone, dark ochreous stones out of the local Inferior Oolite (as apparently used for the early 11th-century crucifixion at Wormington,[147] Glos.) or the Lias (e.g. Hornton stone) in the Saxon window-dressings at Swalcliffe (Oxon.)[148] and Tredington (Worcs.).[149] The rich ochreous oolite used for the Saxon central tower at Wootton Wawen (Warws.)[150] could hardly have been obtained nearer than the outlier of Inferior Oolite 12 miles to the south round Chipping Campden.[151] Most of these do not seem particularly good stones, but it is noticeable that freestones of the finest quality did not seem to penetrate into their immediate area very effectively, either in Saxon or later times, though a few blocks of fine oolite for carved work were carried occasionally far beyond it even in Saxon times (e.g. the 'Lechmere' stone at Hanley Castle; Leamington; Tenbury). Some good freestones were available, however, in the NW. Cotswold area; Worcester Cathedral in the 12th and 13th centuries took supplies not only from the Severn valley sandstones and the calcareous tufa deposits round Stanford-on-Teme or in NE. Herefordshire, but also from the Inferior Oolite at Cutsdean above Winchcombe and at Comberton on the western edge of the

141 Kendrick, 1933, pp. 180, 212; Cottrill, 1935, pl. xvi.

142 *Archaeologia*, LXXVII (1928), 147, fig. 9.

143 *Antiq. J.*, XI (1931), 226–8; Talbot Rice, 1952, p. 89; Kendrick, 1938, pp. 186, 207, pl. lxxxi. This fine tombstone is now kept at Severn End, and I am most grateful to Mr. Berkley Lechmere for allowing me to examine it. The original location is not known with certainty, but it was presumably found on the estate.

144 Roy. Comm. Hist. Mons., *Herefordshire*, II (1932), 61, pl. xviii; of fine green sandstone.

145 Brit. Mus. list.

146 Baldwin Brown, 1925, pp. 475, 454.

147 Talbot Rice, 1952, pp. 85, 99, pl. cxvi.

148 Baldwin Brown, 1925, p. 481.

149 Baldwin Brown, 1925, p. 483; the Saxon window-heads are of compact white Lias, and the door-dressings high up are of Ironstone.

150 Baldwin Brown, 1925, pp. 360 f., 488; this tower with its long-and-short quoins and arch-dressings is of an ochreous oolitic stone, ironshot, and weathering to a somewhat friable texture.

151 Arkell, 1933, pp. 206–7; L. Richardson, *Geology of the Country round Moreton-in-Marsh* (Geol. Survey Memoir, 1929), pp. 54 ff., 143.

Bredon outlier, e.g. for building the lady chapel in 1224.[152] These limestones seem to have been already in use by the Saxon craftsmen, as is shown by the cross-head at Cropthorne[153] and the early 11th-century cross-shaft from Rous Lench (Worcs.).[154] The earliest surviving examples of Herefordshire calcareous tufa seem to be very early Norman,[155] though it would be surprising if this light, corky, easily-worked and easily-won stone had not been used by the pre-Norman builders, as it was in Kent;[156] it is rarely, of course, suitable for fine carving.

Northwards from Wootton Wawen and Leamington sandstones available locally were predominantly used for both structural work and carvings, and generally they have weathered well, as seen on the great 15-ft.-high round shaft at Wolverhampton,[157] in Warwickshire at Rugby[158] and Kinwarton,[159] and in Shropshire at Diddlebury, Stanton Lacy, Barrow, Shrewsbury and Wroxeter.[160] In the NW. midlands and towards the Welsh borderland little but the sandstones has been used in early work (FIG. 28); even when the older limestones were available locally they were little used, for they were often coarse or intractable; a little of the Ordovician was used at Wenlock.[161]

Yet further north-east in the midlands little but locally available sandstones seems to have been used in Saxon work, except a few isolated large blocks of oolitic limestone (probably from Barnack or the limestones of Lincolnshire) used for the crosses at Rolleston[162] in Nottinghamshire and Spondon[163] near Derby, and the Barnack slabs which occur among a majority apparently of Permian calcareous sandstone at Breedon (Leics., 2 miles from the middle Trent). A white 'hard-row' limestone (perhaps of south Lincolnshire Inferior Oolite origin) has been used for the slabs or crosses[164] at Shelford, Hawksworth, Screveton and East Bridgford, and a pebbly limestone for that at Shelton; all

152 *Assoc. Archit. Soc. Reps.*, XXXI (1911), 257 ff.

153 Kendrick, 1938, p. 186, pl. lxxx; of an ochreous pebbly hard rather coarse stone with oolitic veins and patches.

154 Talbot Rice, 1952, p. 128, pl. ccxxxvi; W. K. W. Chafy in *Proc. Soc. Antiq. London*, XXVII (1897) 99. This 'hard-row' oolite stone is probably from the Inferior Oolite, either round Chipping Campden or on the Bredon outlier round Comberton, both within 8 miles.

155 Taylor, 1963, pp. 229–235, 244: Roy. Comm. Hist. Mons., *Hereford*, II (1932), 186. Calcareous tufas are of recent (even current) formation, widespread in wet hollows or on draining from limestone country; some have been used in Norman work (and Roman) in Oxfordshire (e.g. Duns Tew).

156 Archibald, 1934.

157 M. M. Rix in *Archaeol. J.*, CXVII (1960), 71–81. The original cross was probably 25 ft. high, a further length of shaft above that now surviving. It has however been suggested that this is a reused Roman column.

158 *Antiq. J.*, XV (1925), 475: 'A fine-grained felspathic grit, which may be matched in the Upper Keuper sandstone occurring a few miles away . . . ' (K. P. Oakley).

159 Now in the garden of a private house in Kinwarton. I am grateful to Mr. Jephcott for allowing me to examine it.

160 For these Shropshire churches see Taylor, 1963, pp. 228 ff., 241 ff., and Jackson and Fletcher, 1949, p. 15, pl. vii, a.

161 D. H. S. Cranage in *Archaeologia*, LXXII (1922), 105–132 (for excavation).

162 This cross has an inscription RADULPHUS ME FECIT, and is probably 11th-century; Talbot Rice, 1952, p. 137; W. Stevenson in *Reliquary*, n.s. III (1897), 181.

163 *Archaeol. J.*, XCIV (1937), 35. I am grateful to Dr. L. A. S. Butler for some observations on stones in this area.

164 Kendrick, 1949, p. 78, pl. li and p. 81; Talbot Rice, 1952, pp. 107, 142; A. du Boulay Hill in *Archaeol. J.*, LXXIII (1916), 203 ff.

these (mostly of the 11th century) are in the Trent valley SW. of Newark, suggesting transport along this waterway and the Foss Dyke and Car Dyke.[165] Away from the Trent the Saxon work in this area is mainly of sandstone (FIG. 28). The carved stonework at South Kyme, Lincs. (p. 100) suggests that quarries in the Inferior Oolite at Ancaster had already been opened in the 8th century.

In the Oxford region later Saxon masons and carvers were using several other types of freestone besides the fine oolites of Taynton type. The systematic construction of the pilasters and other dressings at Wing (Bucks.)[166] with stone ('a compacted shell brash') from the local Portland Beds (the most northerly outcrop being within about 5 miles[167]) has already been noted (note 79). Some 20 miles to the south-west on this same formation is Standel in Pyrton (Oxon.), which is referred to in 1002 as *Stangedelf* (=a stone quarry),[168] and was a well-known quarry locality (Milton and the Haseleys) in the middle ages and later.[169] This is one of the few references in Saxon documents to a quarry (as compared with 'crundel', a pit), and it is unfortunate that there is no Saxon work of this stone preserved immediately near by, that at Waterperry, 5 miles NW., being from the Corallian Wheatley Stone.

Wheatley Stone,[170] so extensively used in and around medieval Oxford and at Windsor, is not actually documented till the late 13th century.[171] The surviving buildings in the region make it clear, however, that it was being widely used especially south and east of Oxford during the 12th century.[172] A few examples of stonework show that it was already being quarried in the early 11th century (Waterperry Church, Oxon.[173]) and indeed that it was already being carried fair distances, anticipating its full medieval range, eastward down the Thames valley to Iver (Bucks.)[174] and London (All-Hallows-by-the-Tower,[175] and St.D unstan's,

165 For Fenland waterways see M. W. Barley, *Lincolnshire and the Fens* (1950), pp. 33–4, 42 ff., and in *Lincs. Archit. Archaeol. Soc. Rep.*, I (1936), 10. The Roman canal, the Foss Dyke, joining the Witham at Lincoln with the Trent at Torksey, was said by Simeon of Durham to have been reopened by Henry I in 1121, 'though the importance of Torksey at the time of Domesday, and its close relationship with Lincoln, suggest that the channel had only recently silted up'. This is supported by the late Saxon use of Barnack stone along the Trent valley.

166 Jackson and Fletcher, 1962.

167 Arkell, 1933, pp. 508–9; Arkell, 1947 b, p. 125. This stone was much used in Norman work in this area, as at Stewkley, Twyford, Water Stratford, Ashendon and Brill (these identifications, including Wing, were by Dr. W. J. Arkell).

168 *Boarstall Cartulary* (Oxf. Hist. Soc., LXXXVIII, 1930), p. 41; Jope, 1956 a, p. 253.

169 Arkell, 1947 b, p. 90, and *Quart. J. Geol. Soc.*, C (1944), 47–8; Jope, 1956 a, p. 253.

170 A deposit composed of ground-up coral and shell debris, formed as a reef and of limited area: Arkell, 1947 b, pp. 40–2, and Arkell, 1943, pp. 189–91.

171 Jope, 1956 b. The quarry recorded at Forest Hill, 1 mile west of Wheatley, Oxon., in 1163–73 (*Cart. Oseney*, IV (Oxf. Hist. Soc., XCVII, 1934), 240) would probably not have given any great depth of good freestone, as the Wheatley Limestone thins out westwards towards Forest Hill (Arkell, 1943, p. 191). Headington freestone, again a limited occurrence of a shell-detritus limestone, was almost certainly not significantly worked before the late 14th century (1396; Jope, 1956 b, p. 24).

172 Jope, 1956 b, p. 20, fig. 7.

173 As shown by the high arch built of this stone uncovered in 1950; *Vict. Co. Hist. Oxon.*, V (1957), 306 and plate. Observation in a strong glancing light reveals that the west face of each impost probably had a regular carved frieze, now largely cut away, but still standing lumpily forward from the smooth surfaces of the jambs and arch.

174 Roy. Comm. Hist. Mons., *Bucks.*, I (1912), 219 f. (dressings of double-splayed window).

175 *Antiq. J.*, XXIII (1943), 14; Jope, 1956 a, p. 252.

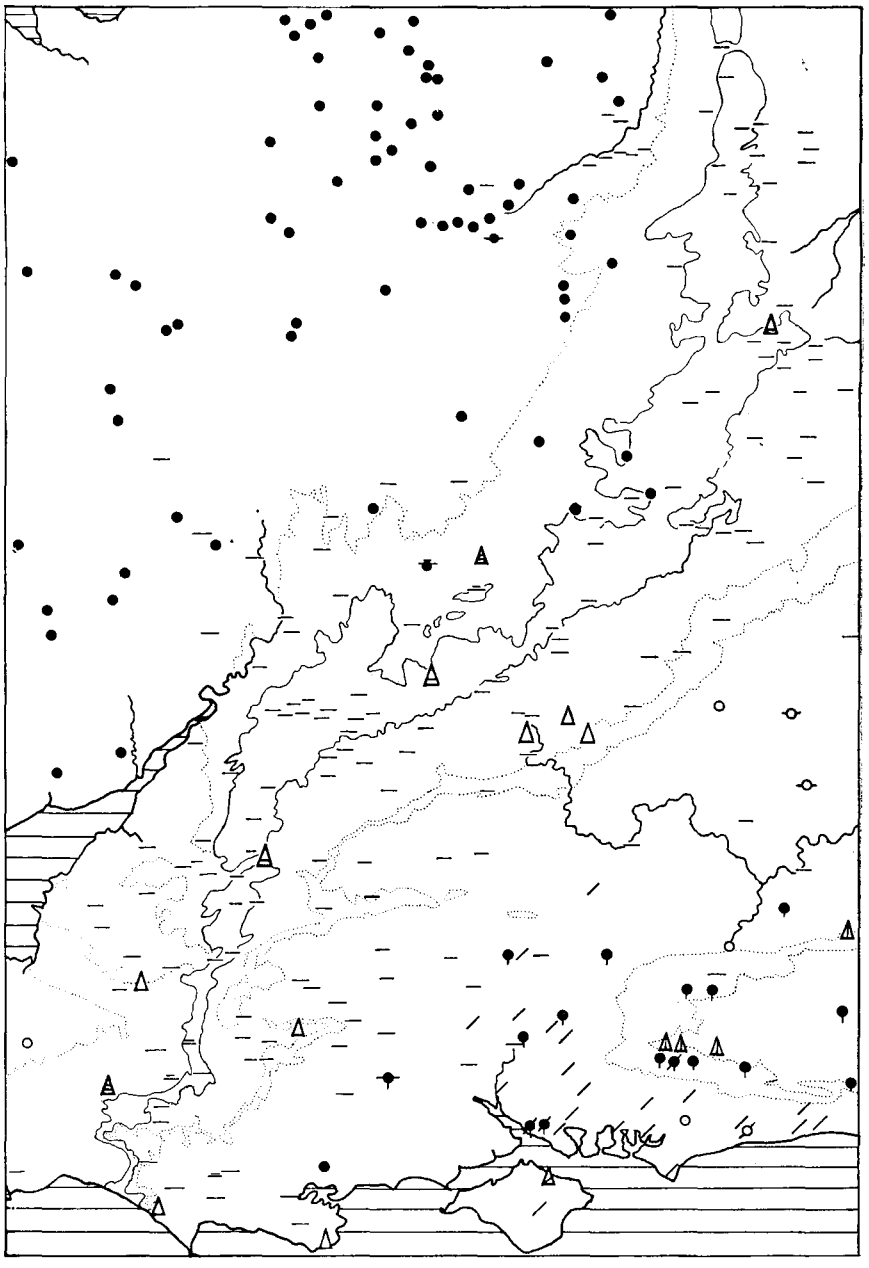

FIG. 28

DISTRIBUTION-MAP OF LATER SAXON STONEWORK IN SANDSTONE (pp. 107 ff., 111 f.)
Sandstones (black spots) are mostly from fairly local sources and occasionally calcareous. Those from the Greensand are shown as black spots with short vertical tails (outcrop delineated by dotted line in SE. corner of map). Stone from Oolite belt shown by dashes (outcrop marked by full line). Stone from Lias, =. Stone from Quarr, / (see FIG. 26). Other materials, such as flint, are shown by open circles.

Stepney[176]); and similarly to the west, stone of this type is used in the tower at Wickham, Berks.[177] Wheatley Stone is a deposit of limited area composed of ground-up coral and shell debris, providing a good freestone. The rougher Coral Rag and Calcareous Grits from the Corallian ridge on either side of Oxford towards Wheatley to the east and Cumnor to the west were also being used for rubble walling from the early 11th century (St. Michael at Northgate, tower[178]) and no doubt earlier, for the quarry mentioned in a charter of 985 concerning Wootton, Berks.,[179] would have provided just such Coral Rag or Calcareous Grit for rubble walling, not freestone.

Stones available locally were also much used over the nominally non-stone areas of eastern and south-eastern England. In the south the Greensand provided much suitable freestone, some of high quality, such as Reigate (used much in London, e.g. for the Confessor's church at Westminster[180]), 'malmstones', or stones of Bargate type[181] as used for the vertical members of the pilasters on Sompting tower[182] (the horizontal members being of Quarr 'featherbed', PL. V, E) and for the Jevington figure[183] and the Bexhill tombstone.[184] Even coarser, more friable stones were much used, as for the pilasters (PL. V, C) at Worth, Sussex[185] (Hastings Beds), or Breamore, Hants[186] (Greensand), or the long-and-short quoins at Bishopstone, Sussex[187] (of a friable olive-green sandstone), or Titchfield, Hants[188] (of coarse material from the Greensand). Calcareous tufa, of quite recent formation in many localities, could also sometimes provide a good material for dressed quoins, as at Leeds and Northfleet (Kent),[189] or in early Norman work in NE. Herefordshire or at Worcester (probably from Stanford-on-Teme, Worcs.). East Anglia was less well served than was the south-east by the Greensand, and the local stones were either less serviceable or less favoured; hard chalk ('clunch', a Cambridgeshire term) was hardly used until later times.[190] Large chunks of

176 Kendrick, 1949, p. 47, pl. xl, 2.

177 Baldwin Brown, 1925, pp. 60, 259, 486.

178 Arkell, 1947 b, p. 33, pl. iii; the city wall (*ibid.*, pl. ii) is however work of the 13th century, not 11th.

179 *Berks. Archaeol. J.*, XXXI (1927), 57.

180 L. E. Tanner and A. W. Clapham in *Archaeologia*, LXXXIII (1933), 227 ff.

181 A shelly and sandy limestone, sometimes glauconitic: this is strictly defined as of limited occurrence in the Bargate Beds of the Lower Greensand in the Godalming area (H. G. Dines and F. H. Edmunds, *Geology of the Country round Aldershot and Guildford* (1929), pp. 22–30, 161 f.), but similar stone of this type is of wider occurrence in the Lower Greensand. The Wealden area is in fact rich in a variety of sandstones, calcareous, ferruginous or otherwise, which give some character to its buildings of all periods.

182 Jackson and Fletcher, 1944, pl. xxv.

183 Kendrick, 1949, pp. 120–1, pl. lxxxv. Kendrick argues from the Urnes-style ornament that this is a work of *c.* 1100. Talbot Rice, 1952, p. 95, suggests *c.* 1050.

184 Kendrick, 1949, p. 86, pl. lvi; of a fine-grained creamy sandstone.

185 Jackson and Fletcher, 1944, pls. xxiii, xxiv.

186 *Archaeol. J.*, LV (1898), 84 f.; Baldwin Brown, 1925, p. 350 f.

187 *Sussex Archaeol. Coll.*, II (1849), 276 ff.; Baldwin Brown, 1925, pp. 191 ff.

188 Jope, 1958. These sandstones are also used in Saxon work in Surrey (e.g. Witley, greenish; D. C. Whimster, *Archaeol. of Surrey* (1931), p. 211).

189 Archibald, 1934, pp. 15, 23. Tufa is used in the upper stages of the added stair turret at Brixworth: Baldwin Brown, 1925, p. 115.

190 It was used for the late Saxon rood at Walkern, Herts: see above, p. 101.

intractable puddingstone were sometimes used for quoins and window-dressings, as at North Elmham (Norfolk)[191] and Inworth (Essex).[192]

Features that were more usually of dressed stone, such as pilasters or quoins, were sometimes built up in flint or stone rubble in a mortar matrix, thus defeating the structural purpose, as at St. Mary's, Guildford (PL. IV, B)[193] and Inworth and Little Bardfield, Essex.[194] Presumably they were finished in plaster.

IMPORTED STONE

There is virtually no evidence that freestone was being imported into Saxon England. Of the north French stones, apart from the Reculver cross-head (p. 98), there are occasional suggestions, which need confirmation, that Caen stone can be found in work of late Saxon style in Norfolk.[195] Cross-channel trade and coastal sea transport of building stone were well developed in the 11th century, and the inference is that the demands of Saxon building were being adequately met by native supplies.

It has now been shown that the Chichester reliefs are of Caen stone,[196] which may serve to strengthen the argument that they are 12th-century work rather than later Saxon (and the same is true of the Majesty at Sompting), though a detailed survey of the rise of Caen and the north French freestone imports into the British Isles is needed before this can be taken as an accepted tenet. Similar argument concerning the 12th-century date of the York Virgin relief[197] must also rest upon a detailed survey of the rise of use of the Yorkshire Tadcaster stone (from the Permian). North French stone is said to have been imported at first for the Conqueror's foundation at Battle, till a local source was miraculously revealed.[198] Caen and perhaps other north French limestones were being increasingly and ever more widely used during the 12th century in England, and even in Ireland,[199] where Somerset limestones were also being brought from Bristol.[200]

OTHER MATERIALS

Some Saxon work (notably in the 10th century at Winchester and Glastonbury) shows by comparison of the materials used that builders in Saxon England were aware of the main stream of continental methods. Modelled and carved

191 A. W. Clapham and W. H. Godfrey in *Antiq. J.*, VI (1926), 402–9; Clapham, 1930, pp. 88–9; it is now argued that considerable remains of an early church survive here (S. E. Rigold in *Med. Archaeol.* VI–VII (1962–3), 67–108). A few quoins are of Barnack.

192 Clapham, 1930, pl. xlix.

193 P. M. Johnston in *Vict. Co. Hist. Surrey*, II (1906), 446 ff.

194 Roy. Comm. Hist. Mons., *Essex*, I (1916), 170–1; III (1922), 139–140; IV (1923), xxiii ff.

195 Baldwin Brown, 1925, pp. 266, 422; *Norfolk Archaeology*, XVII (1913), 31. The balusters at Dover are also said to be of Caen stone: Baldwin Brown, 1925, p. 265.

196 Dr. F. W. Anderson kindly tells me that a detailed examination of the actual reliefs *in situ* shows that they are of Caen stone; an earlier provisional statement (*Archaeol. J.*, CX (1953), 118) was based on examination of fragments from other reliefs said to have been found with the main reliefs. This must modify views on the Dorset connexions of the sculptural style, though stylistic analogy with the Toller Fratrum piece remains. Dr. Anderson reports that a little Caen stone is used in the pilasters at Sompting.

197 A. W. Clapham in *Archaeol. J.*, CV (1948), 6 ff.

198 *Battle Abbey Chronicle* (ed. M. A. Lower, 1851), p. 11, and see note 25; Salzman, 1952, p. 119.

199 Used in late 12th-century work at Mellifont (identified by Dr. F. W. Anderson).

200 Salzman, 1952, p. 38.

stucco work, a feature of Carolingian architectural ornament,[201] was used at Glastonbury,[202] and later at Milborne Port (Somerset).[203] Glazed relief wall-tiles, which are outstanding for their time in the European tradition in general, have recently been found in a 10th-century context at Winchester.[204] Glass of high quality, coloured as well as plain, was being made in the 10th century at Glastonbury, and there is evidence for the use of glass in windows of timber-built royal residences, as at Old Windsor.[205] There is evidence for brick-making on the continent in Carolingian times,[206] and though it is always assumed that bricks used in Saxon work in England are reused Roman material, the bricks themselves do not always carry full conviction as Romano-British; the possibility of early brick-making in England deserves examination, especially in the light of the evidence of the Winchester relief-tiles.

Saxon mortars used in the body of the wall are usually rather coarse and sometimes friable, though strong lime-mortars are sometimes responsible for holding intact the thin, tall, small-rubble walling.[207] Finer mortars may however have been used in pointing (probably little original Saxon pointing now survives), since very fine, delicately coloured mortars were sometimes used for that purpose (and are still well preserved) on the continent.[208] Brick-dust mortars were used in the flooring of the early Kentish churches, erected presumably under control of continental masons (probably of Italian experience).

Most Saxon churches were probably roofed with straw or reed thatch,[209] or sometimes wood shingles.[210] No stone slates have been found in Saxon levels[211] (though they were much used in Roman Britain) and indeed the tall thin walls seem hardly suited for them; some lead was however used in roofing even in the 7th century.[212]

The shapes and sizes of tools may sometimes be inferred from the stonework. Saxon masons' tools appear to have been rather coarse, dressing being done usually with axe or adze; by contrast on the continent very fine chisels (blades

[201] Forsyth, 1953, p. 133 and note 211; R. de Lasteyrie, *L'Archit. Rélig. en France* (1927), pp. 139, 199 f.; *Bull. Mon.* (1925), pp. 21–32; Clapham, 1930, pp. 6, 81.

[202] Clapham, 1930, p. 139.

[203] Taylor, 1962, pp. 162–5; Taylor, 1963, pp. 246–8.

[204] I am grateful to Mr. M. Biddle for showing me these tiles.

[205] D. B. Harden, 'Domestic window-glass,' in *Studies in Building History* (ed. E. M. Jope, 1961), pp. 43, 52–4.

[206] Forsyth, 1953.

[207] Davey, 1961.

[208] Forsyth, 1953, pp. 96–7, 26.

[209] Even royal domestic buildings were still being roofed with thatch in the early 13th century: systematic replacement of thatch and shingles by stone slates can be traced at Woodstock in 1239–43 (*Cal. Liberate R., 1226–39*, 414; *1240–5*, 25, 304). In London there was legislation in 1212 against *unplastered* thatch roofing, and all existing thatched roofs were to be plastered (Salzman, 1952, p. 223).

[210] A lease of land at Kilmeston, Hants, A.D. 961, mentions 'dues of the church, i.e. one church scot and five shingles and one plank every year'. (D. Whitelock, *Eng. Hist. Docs., 550–1042* (1955), p. 516). For shingles see M. Biddle and R. N. Quirk, *Archaeol. J.*, CXIX (1964), 193.

[211] Nor are they usually found in 12th-century levels (e.g. Ascot produced none, *Antiq. J.*, XXXIX (1959), 219–273; *Oxoniensia*, XIV (1949), 94; XVI (1951), 86–8).

[212] Bede, *Hist. Eccles.*, III, 25; Adam of Damerham, *Historia* (ed. T. Hearne, 1727). Lead was also being used for window kames in Saxon buildings (D. B. Harden in *Studies in Building History* (ed. E. M. Jope, 1961), pp. 53–4).

as little as 3 mm. wide[213]) were being used in the 10th century, and though perhaps not initiating a lasting tradition, evidence of sporadic use of such fine chisels in England should be sought when observing carved stonework earlier than the 12th century—the period when chisel-work became more usual in England.[214]

CONSTRUCTIONAL METHODS

Little evidence survives to reveal the constructional procedures of the Saxon builders. Competent timber construction is however a necessary preliminary for masonry of any scale, and adequate scaffolding must have been used in building the tall, thin Saxon walls. This was probably tied at intervals to the rising wall structure, as in general medieval practice (it is unlikely to have been free-standing[215]), but the Saxon walling is often of random small rubble, in which putlog holes may be plugged with a stone on withdrawal of the timber, to leave little trace;[216] and the same is true of small cube ashlar. In the massive ashlar of Bradford-on-Avon, however, a few putlog holes carefully plugged with squared stone can be seen cut out of the corners of large ashlar blocks[217] in the upper walling and might represent the scaffolding of the 10th-century rebuilding (PL. IV, A).

Some tall Saxon walls, notably Bradford-on-Avon (and also some towers such as Langford or Netheravon), are built to full height with large ashlar blocks, which would have needed lifting-gear to raise them, probably a large wheel set on the wall-head, as was the practice later.[218] Some blocks at Bradford-on-Avon weigh about a ton, and even some in the upper door jambs at Stoke D'Abernon are nearly $\frac{1}{4}$ ton[219] and would have needed such gear to raise them the 12 feet.

Timber shoring[220] was probably also used during construction, though evidence is even more elusive. Shuttering may have been used at times in rubble-wall work, especially for tower angles as at Clapham (Beds.), or detailed forms such as the narrow pilasters carried out entirely in flint rubble, at St. Mary's, Guildford (PL. IV, B).[221]

Though Saxon churches have virtually no stone vaults (and their thin unbuttressed walls show there was no intention of vaulting in stone), there are many

213 Forsyth, 1953, p. 66.

214 Though deep-cut work like the Breedon sculptures, or the open-work stone window-grilles at Barnack (Baldwin Brown, 1925, p. 274) would seem to have needed chisels.

215 Fitchen, 1961, p. 170.

216 The pluggings may sometimes fall out when a wall in poor repair and leaning is pushed back to the vertical, as recently with the south wall of the small 11th- to 12th-century south church at Derry on the Ards near Portaferry, co. Down; the holes here penetrate the wall, presumably to tie external and internal scaffolding systems, and there is a timber-lacing system embedded in the east gable (*County Down Archaeological Survey* (1964), p. 291, fig. 189). Such timber-lacing systems embedded in the walling are known in 11th-century Burgundy (Conant, 1959, pp. 143–4), but have not been noted in pre-conquest masonry in England, though they were observed by Sir Charles Peers in the late 11th-century east curtain-wall at Richmond Castle, Yorks. (E. M. Jope, in *Shropshire Archaeol. Soc.*, forthcoming).

217 Jackson and Fletcher, 1953, pl. xv, a; cp. Fitchen, 1961, p. 16 f., fig. 4.

218 Fitchen, 1961.

219 See measured drawing by P. M. Johnston in *Surrey Archaeol. Coll.*, xx.

220 Fitchen, 1961.

221 Jackson and Fletcher, 1949, pl. ix, b.

arches of fair span which must have been built on a fairly elaborate and accurately constructed falsework timber centering, the basal horizontal member of which would presumably have been carried on the imposts or abaci, which in Saxon work are often massive and boldly projecting.[222] The peculiar appearance of the chancel arch at Broughton (Lincs.)[223] may perhaps be explained in terms of the centering on which the main arch (of through stones) was built: the arch of the inner order, which needed inserting to complete the design, has either come away or has never been built. Arches as at Sompting, St. Botolph or Bosham (Sussex),[224] with a rounded inner order, are built in this manner, with the second order as through stones, the roll order being inserted inside this.

APPENDIX

NOTE ON THE QUARR STONE

By F. W. Anderson and the late R. N. Quirk

Few building stones have proved so difficult to identify with certainty as the Oligocene (Tertiary) limestone found in the area just west of Ryde in the Isle of Wight and known as 'Quarr Stone'. In the first place the stone, a creamy limestone composed of comminuted shells, resembles very closely a similar rock found in the Middle Purbeck beds of Dorset, and both have been known to quarrymen as 'Featherbed Stone'. Secondly, in both the included fossils are so fragmentary that their identification is generally impossible, so that these two building stones cannot be distinguished by the usual palaeontological methods except, rarely, when microfossils are present. Thirdly, the quarries at Quarr were worked out centuries ago and very few exposures of the rock remain, so that it has been difficult to determine its stratigraphical relationships.

The resemblance between the Quarr and the Purbeck 'featherbeds' is, however, largely superficial and in most cases the experienced eye can distinguish them without too much difficulty. The Quarr Stone is lighter and less compact than the Purbeck Stone and has a faint greenish tinge. The Purbeck Stone is greyer and harder and occasionally contains ostracods, which identify it as being of Jurassic (Middle Purbeck) age.

Quarr Stone, Tertiary in age, is at the same stratigraphical level as the Bembridge Limestone, a rock which is, however, quite different in appearance—a compact, white, tufaceous and brecciated limestone in which the fossils usually appear as casts. The Bembridge Limestone, extensively exposed in the Isle of Wight, is a well-known freshwater limestone and most museums include specimens of it. But, although in the first edition of the Geological Survey Memoir, *The Geology of the Isle of Wight* (1892), this rock at Quarr (referred to as the 'Binstead Limestone') is noted as having been much esteemed as a building stone, the description of the section then seen in a quarry west of Binstead Church does not include that of any rock type which can be identified as the Quarr Stone. The area round Binstead was mapped on a six-inch to the mile scale by Clement Reid in 1886–7 and his original field maps show that by this date even that quarry was overgrown (*Isle of Wight Memoir*, 2 ed., 1889, p. 166). Indeed, the Geological Survey collection includes no specimens of the Quarr Stone.

[222] Fitchen (1961, pp. 160 ff.), however, suggests that in the main stream of masonry tradition it was not usual to carry the centering on the imposts; this is occasionally borne out when the notches cut for the horizontal member can be traced in the springer just above the abacus.

[223] Baldwin Brown, 1925, pp. 292–3.

[224] Clapham, 1930, pl. xlvii; *Vict. Co. Hist. Sussex*, IV (1953), 185-7.

Once the initial difficulty of recognizing the Quarr Stone was overcome and the records of its use checked as far as was possible by personal observation, it became apparent that the original outcrop of the rock must have been extensive. Yet, although there is documentary evidence that the material came from the area round Quarr, its occurrence *in situ* there had not been demonstrated. Accordingly, we decided to investigate the area in detail with the help of Father S. F. Hockey of Quarr Abbey, who has studied records of the quarrying of Quarr Stone and who has an intimate knowledge of the area.

Two small, overgrown quarries were found, one about 300 yards SW. of Holy Cross Church, Binstead, and the other 400 yards S. of the church. Once the quarry faces were cleared of vegetation and debris it was established beyond doubt that stone of the Quarr type was here in place. At Wootton Creek to the west, and only a few hundred yards E. of Binstead, where the Bembridge Limestone was seen, it proved to be of the normal type found elsewhere in the island.

It is first of all essential to clarify the nomenclature of these rock types before going on to discuss the relationship between them. It is proposed, therefore, that the name 'Quarr Stone' be strictly limited to the shell brash which was used so extensively as a building stone under the name of 'Featherbed Stone'; that limestone of the normal Bembridge type be referred to as 'Binstead Stone'; and that both be included in the formation name of 'Bembridge Limestone'.

Later, one of us (R.N.Q.) spent some time searching at the margins of the apparent limits of the Quarr Stone with important results. In a stream crossing the Ryde road 600 yards E. of Binstead cross-roads and between 150 and 200 yards S. of the road, most of the rock seen was of the Binstead type but with some Quarr Stone and some intermediate between the two. Most significant were three specimens of Binstead Stone within which were included rounded masses of Quarr Stone each surrounded by a coating of tufaceous limestone. This evidence suggests that the Quarr Stone represents an early phase in the deposition of the Bembridge Limestone, probably as a shell bank which was the lateral equivalent of the nodular shelly limestone described by Bristow (1862) as occurring at the base of the Bembridge Limestone in the quarry west of Binstead Church. The Quarr Stone appears to have been laid down as a roughly elliptical bank of shell debris, extending from where Binstead village now is at least as far as the present sea coast.

That the Quarr Stone was contemporary with at least part of the Binstead Stone is clear, since every gradation can be found between the typically cavernous aggregate of shell fragments which is Quarr Stone and the compact even-textured Binstead Stone. The Quarr Stone itself is very variable, ranging from coarse, in which the shell fragments average $\frac{1}{4}$ in. across, to fine in which the fragments are less than half that size. Characteristically the shell fragments themselves have usually been removed by solution, as normally happens in the Binstead Stone, leaving cavities in the tufaceous cement.

Quarr Stone was not used extensively outside the Isle of Wight, except in the Hampshire Basin and Sussex, where a good building stone was not readily available. There is, for example, no record of its use in Dorset, where Purbeck and Portland Stone appear to have been used since Roman times.

It seems likely that Quarr Stone was first used by the Romans, since there is much of it, as well as Binstead Stone, in the Roman work in Portchester Castle.

Quarr Stone was extensively used in Saxon churches in Hampshire and Sussex for such features as quoins, pilaster strips, windows, chancel arches, etc. Its use in Saxon churches was noticed by us in Hampshire at Little Somborne, Headbourne Worthy, Tichborne, Hinton Ampner, Corhampton, Boarhunt, Fareham and Titchfield, and in Sussex at Bosham and Sompting.[225] It was used extensively in the

[225] See also E. M. Jope, *Antiq. J.*, XXXVIII (1958), 246, who points out that most of these Saxon churches used this type of 'shell-brash' stone.

Norman tower and transepts of Winchester Cathedral (begun 1077), for the old abbey at Quarr (begun 1293), Arreton Church, Yarmouth Castle, the Norman keep and church at Portchester, Romsey and Titchfield Abbeys. It seems to have been less common in Sussex, but it occurs, notably, in Chichester Cathedral and Lewes Priory.

The quarries at Quarr appear to have been virtually exhausted by the middle of the 14th century.

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ACKNOWLEDGEMENTS

The earlier stages of this work owe very much to the encouragement and collaboration of the late Dr. W. J. Arkell, with whom I examined many examples of stonework. I am also most grateful for collaboration from Dr. F. W. Anderson (Chief Palaeontologist, Geological Survey), and from my wife who has accompanied me throughout this work. The following have kindly contributed by identifying stone or by supplying stone samples:

Mr. M. W. Barley, Mr. Martin Biddle, Mr. John Braidwood, Dr. L. A. S. Butler, Prof. P. C. Sylvester-Bradley, the late Mr. R. R. Clarke, Prof. D. T. Donovan, Mr. A. R. Dufty, Mr. G. C. Dunning, Mr. J. M. Edmonds, Sir Eric Fletcher, Mr. E. D. C. Jackson, Dr. F. J. North, Dr. J. Preston, Dr. C. A. Ralegh Radford, Mr. R. E. M. Reid, Dr. P. A. Sabine, Dr. R. J. G. Savage, Prof. J. M. C. Toynbee, Dr. F. S. Wallis, Prof. Alwyn Williams, Mr. B. C. S. Wilson, and Mr. D. M. Wilson.

I am also extremely grateful to the numerous members of museum staffs and owners of Saxon stonework and incumbents who have been so helpful in allowing examination of the material in their charge, to Mr. E. D. C. Jackson and Sir Eric Fletcher for the photographs used in PLS. IV and V, A–C, and to Dr. E. A. Johnson for PL. V, E.

DETAILED DESCRIPTION OF PLATES IV AND V

IV. A. N. porch of St. Lawrence's, Bradford-on-Avon, Wilts., built of large blocks of Bath-stone ashlar. Putlog holes, some of which may be original, are cut in the ashlars (pp. 99, 114).

B. Tower of St. Mary's, Guildford, Surrey, showing pilasters and angles made from flint nodules set in mortar, presumably formed in shuttering (pp. 112, 114).

V. A. NW. angle of tower, Earls Barton, Northants., showing long-and-short quoins and pilasters of Barnack stone, the verticals being face-bedded (p. 93).

B. NW. angle of tower, Debenham, Suffolk, showing long-and-short quoins in Barnack stone (p. 93).

C. Apse, Worth, Sussex, showing pilasters of coarse ferruginous sandstone from the Lower Greensand (p. 111).

D. Arch into S. transept, Breamore, Hants, showing large blocks of Bath-type stone used as abaci (pp. 92, 105).

E. SW. angle of tower, Sompting, Sussex, showing pilasters of Bargate Stone combined with Quarr stone, the long verticals being face-bedded (pp. 101, 111).