

Plate I. Red Castle Plantation with the River Little Ouse in the background and line of Town Ditch in centre foreground.

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## EXCAVATIONS AT RED CASTLE, THETFORD

By GROUP CAPTAIN G. M. KNOCKER

### SUMMARY

**D**URING the search for the original site of the Anglo-Saxon settlement at Thetford, the plantation and earthwork at Red Castle, west of the town, were excavated, to reveal occupation from Romano-British times to the beginning of the thirteenth century. A ringwork of the eleventh or twelfth century had been thrown up astride the line of the town ditch, and covered a burial ground (eighty-five bodies being excavated) and a church of the early eleventh century. Spoil from the ditch of the ringwork had filled in an earlier ditch on the west side.

### THE SITE

About a quarter of a mile west of Canons' Farm, on the south side of the road from Thetford to Brandon, lies a strip of woodland known as Redcastle Plantation (Grid Reference TL 8683 : Fig. 1). It is some 500 yards long and 150 wide, and is separated from the Little Ouse river by a strip of water-meadow. It lies at the northern end of a belt of pine trees which runs from the London Road opposite St. Margaret's cemetery and coincides with the line of the Thetford town ditch, from which at 8608 8295 a raised causeway runs across the open space, Redcastle Furze; trial trenching across it in two places revealed nothing (Plate I).

At the east side of the plantation lies a tree-clad earthwork, an irregularly oval-shaped area of about  $1\frac{1}{4}$  acres bounded to the north at present by the Brandon Road, but probably extending originally beyond its line, and on the other side by a bank and ditch, the latter still 11 ft. deep to the west but ploughed out to the east and south. A large hollow has destroyed the north-west corner, probably the result of eighteenth-century sand and gravel digging (Fig. 2).

### ACKNOWLEDGEMENTS

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# BLOCK PLAN RED CASTLE

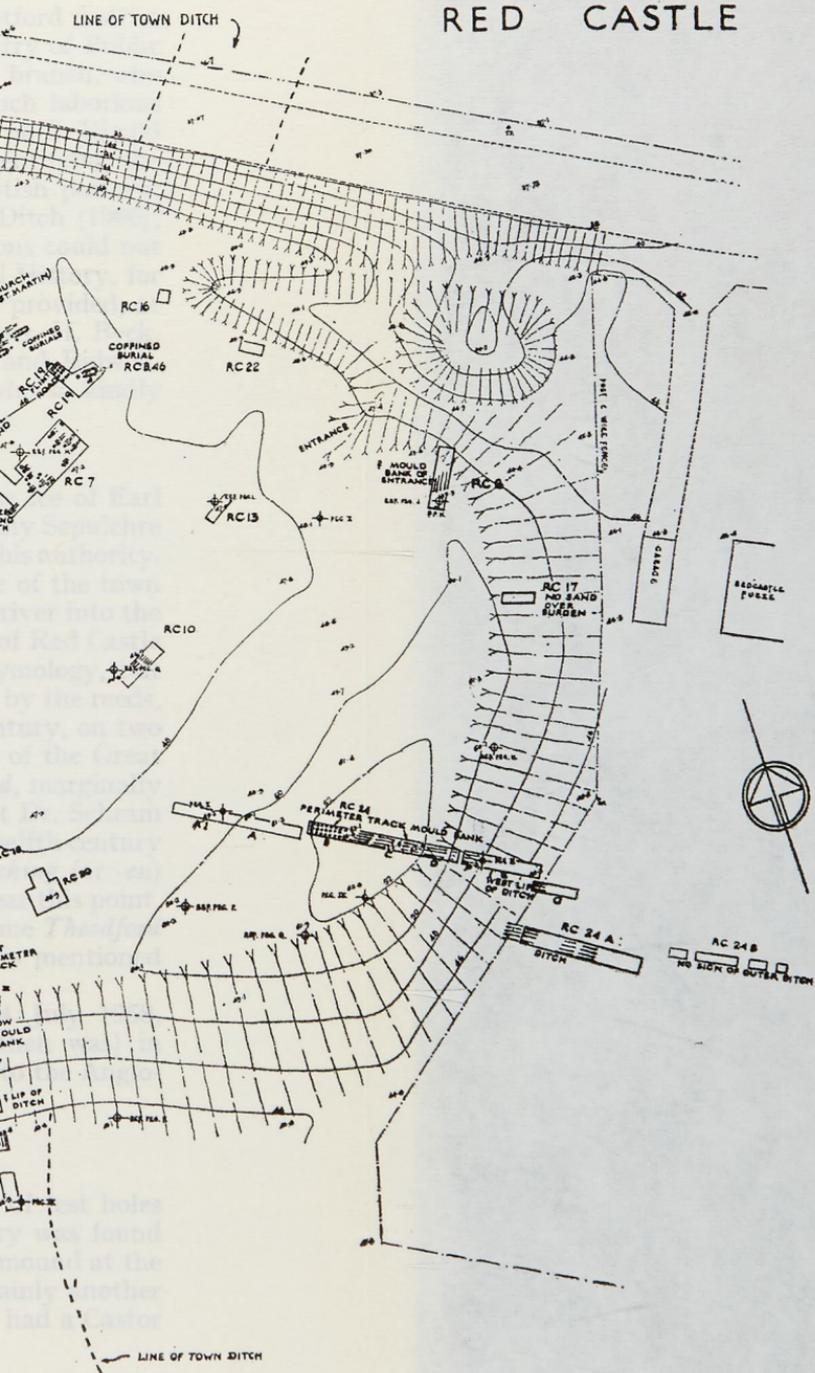


Fig. 2



Edinburgh for his research into the early place names of the Thetford district and Red Castle in particular; the author's colleagues in the Ministry of Public Building and Works, especially the members of the Land Survey branch, who did the surveying, the tracing staff in the drawing-office for much laborious work, Mrs. Elizabeth Fry-Stone, who drew all the small finds, Mr. S. E. Rigold for his report on the *sceatta*, Mr. J. G. Hurst for his help in identifying the pottery and Miss S. A. Butcher for identifying the Romano-British pottery; Mr. B. K. Davison for information about the line of the Town Ditch (1966); Mr. J. R. C. Hamilton, without whose co-operation the excavations could not even have started; Mr. S. E. Ellis of the British Museum, Natural History, for identifying the stone; and last but not least to the following who provided, at various times, the labour force and did all the work so ably, Messrs. H. Beck, S. Vincent, S. Hall, W. Smith, A. Rutherford, Langley, Lister and Bidwell. Lastly, the writer's especial thanks are due to Mr. D. F. Renn who so kindly undertook the editing and recasting of the whole paper and plans.

#### EARLY HISTORY

Blomefield<sup>1</sup> says that Red Castle belonged to and stood in the fee of Earl Warren who, in King Stephen's time, founded the Canons of the Holy Sepulchre (at what is now Canons' Farm), but unfortunately he does not give his authority. Martin<sup>2</sup> speaks of the site as being an earthwork on the west side of the town lying near *Ditchingford* "which was the principal passage over the river into the town which then stood on the Suffolk side". He relates the name of Red Castle to the Celtic *rhyd*, a ford. Dr. O. K. Schram discounts this etymology, but agrees that Blomefield, who derives it from *Rede Castle*, the castle by the reeds, may be right. Roger of Wendover, writing in the late twelfth century, on two separate occasions refers to a place (connected with the invasion of the Great Army of the Danes and the martyrdom of St. Edmund) as *Redford*, marginally glossed in one place "*Thetford*".<sup>3</sup> This may be a scribal error, but Dr. Schram thinks that *Redford* would be a perfectly satisfactory eleventh or twelfth century spelling for O.E. *Hreodford*, "reed-ford". It is possible that *Ditching* (or *-enford*) meant Ditch-end ford, since the town ditch joined the river near this point. The original settlement may thus have been called *Redford*, the name *Theodford* being adopted in Late Saxon times. "Land lying at redcastell" is mentioned in the earliest reference so far found (1574).<sup>4</sup>

Between 14 May and 29 August 1957 and 30 June and 24 July 1958, excavations were carried out for the Ministry of Works (as it then was) in order to discover the nature of the earthwork and its relationship to the Anglo-Saxon settlement of Thetford.

#### REPORT

##### *Excavations outside the earthwork*

In order to ascertain the extent of early occupation, a series of test holes was dug in the plantation west of the Castle proper. No pottery was found within 100 yards of the Brandon Road, even in the likely-looking mound at the south-west end of the depression bordering the road (almost certainly another sand-quarry). R.C.54 (some 370 feet due west of R.C.53) (Fig. 2) had a Castor

# THETFORD RED CASTLE

## SYMBOL CHART

 TOPSOIL	 SAND	 CHALK	 R.B. POTTERY
 DARK BROWN SOIL	 NATURAL SANDY GRAVEL	 ROAD	 PAGAN SAXON POTTERY
 VERY DARK SOIL	 ASH	 LARGE STONES	 MIDDLE SAXON POTTERY
 CHOCOLATE OR RED BROWN SOIL	 SOIL AND ASH MIXED [Using appropriate soil symbol]	 BONES	 LATE SAXON POTTERY Thetford ware
 LIGHT BROWN SOIL	 BURNT BLACK SOIL	 OYSTERS	 S.N. LATE SAXON St.-Neot's WARE
 SOIL AND SAND MIXED [Using appropriate soil symbol]	 RED BURNT EARTH	 MUSSELS	 S LATE SAXON Stamford ware
 LIGHT BROWN SOIL AND SAND [SECTION 3 ONLY]	 PUGGY SOIL	 IRON SLAG	 12/13 CENTURY POTTERY
 UNBURNT CLAY	 CHARCOAL [ON SOIL SYMBOLS]	 COPPER SLAG	 R RECENT POTTERY 16th—18th CENTURY
 RED BURNT CLAY	 PEBBLES	 Q QUERN FRAGTS	 UNCERTAIN
 GREENISH YELLOW CLAY	 RED SAND	 * RUN-OUT IRON	 SMALL FINDS
 BAKED CLAY	 WATTLE AND DAUB	NOTE: SHERDS WITH TAGS ARE ILLUSTRATED  ,  etc.	
 LIGHT GREENISH SOIL			

ware sherd lying on natural light sand, with two postholes, one with three Late Saxon sherds, and burnt clay above. Below a band of darker sand at 2 ft. 6 in. were two Romano-British and two St. Neots' sherds, with a lava quern fragment and an ox-vertebra. 100 ft. further west, R.C.57 contained a Roman storage jar (Fig. 8.4) and a rimsherd just above natural and a Castor ware sherd a little higher, associated with several Late Saxon sherds, a bronze fragment and an iron nail. A thin layer separated two sand layers at 2 ft. 6 in., containing charcoal, a Roman tile fragment and much Thetford and St. Neots ware, together with a fragment of early medieval pottery. Other test holes, with a varying occupation level under an almost ubiquitous sand overburden, revealed much the same pattern of a later disturbance of Romano-British occupation material.

*Excavations within the earthwork*<sup>5</sup> (Figs. 2, 3)

A number of trial trenches were dug within the earthwork wherever trees and undergrowth permitted. R.C.10, almost in the centre, had a trench (perhaps a foundation trench), with two medieval sherds above it, running across the cutting, with a boar's tusk and a Middle and a Late Saxon or medieval sherd just above natural.

R.C.18 had a 9-in. deep posthole near its northern edge. A twelfth/thirteenth-century sherd just above natural (at 4 ft.) was probably intrusive, since a dark sandy layer 15 in. thick above contained a sooted Middle Saxon cooking pot rim (Fig. 9.5) with two others and a medieval one just above it (Figs. 9.3, 4; 11.12); two other twelfth/thirteenth-century sherds appeared in the filling above.

In R.C.20, the whole trench bore signs of disturbance. A Middle Saxon sherd was found on natural (at 5 ft.), covered with a 12-in. band of sandy mould with a few spots of burnt clay and two Late Saxon sherds on top. A foot of lighter mould above contained bones, two Middle Saxon sherds, a twelfth/thirteenth-century and a fourteenth-century sherd and was capped with a layer of scattered flints over the southern part of the trench.

Natural in R.C.13 was at 2 ft. 6 in., the filling containing only one Pagan Saxon and three Middle Saxon (Fig. 9.7) sherds.

*The Burial Ground* (Fig. 4, Plate IV)

Very few grave goods occurred with the burials excavated in trenches R.C.7, 15, 19 and 19A: an iron buckle with the child R.C.B.12, a bronze fragment with R.C.B.20, charcoal in the mouth of R.C.B.13, an animal bone in the mouth and another on the pelvis of R.C.B.39, charcoal by the head, a human tooth in the left hand<sup>6</sup> and a Late Saxon glazed sherd on the pelvis of R.C.B.46 in his chalk sarcophagus, with other burials above and below.<sup>7</sup>

Whether or not any burials were early, they were certainly buried through early occupation material. Witness the pottery: 7 Pagan Saxon (Fig. 8.5), 20 Middle Saxon (Fig. 9.6, 16) and 6 Late Saxon (Fig. 10.5) sherds, with a few medieval ones. Three thirteenth/fourteenth-century sherds (Fig. 11.18) lay near a bronze-smelting hearth.

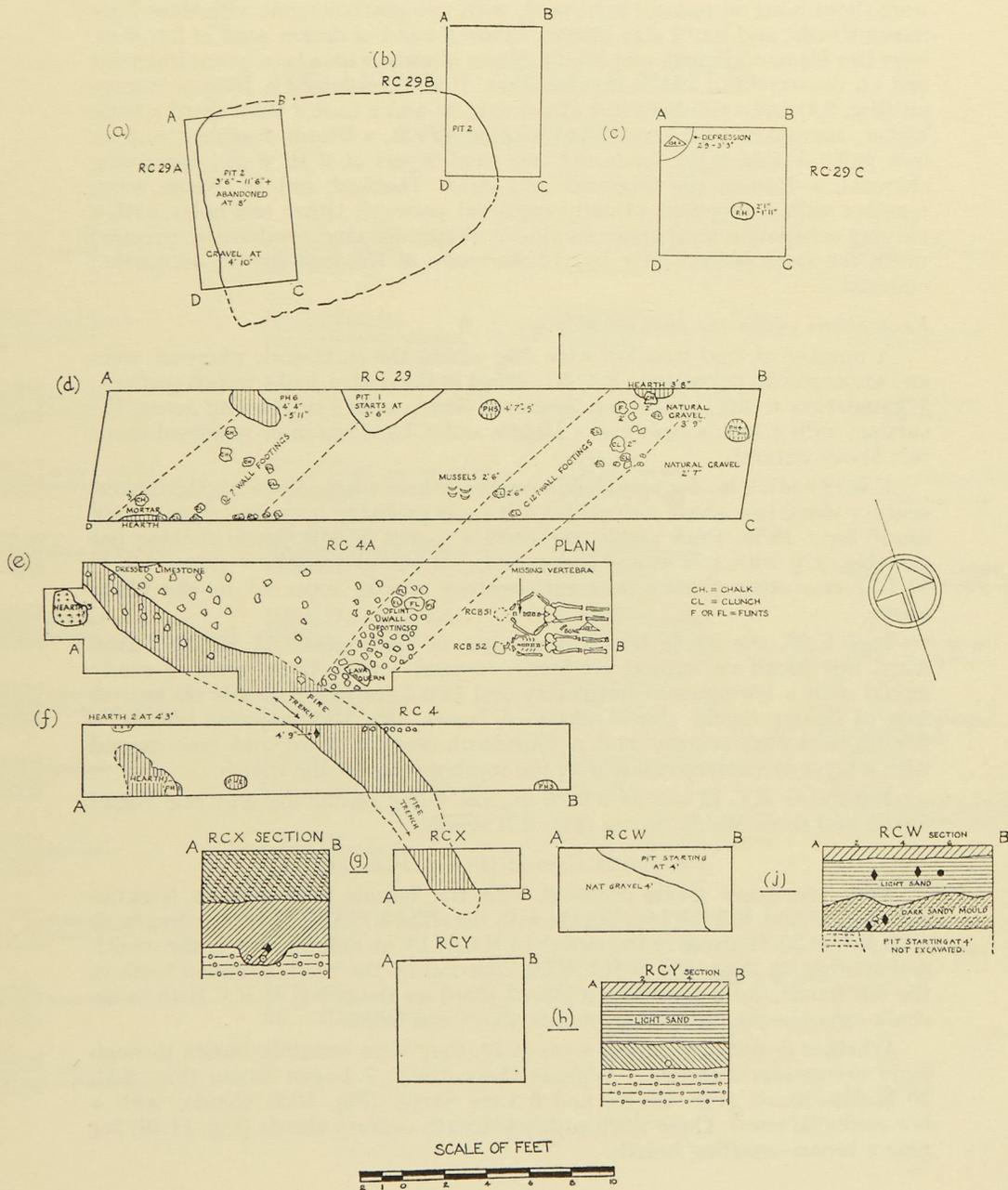
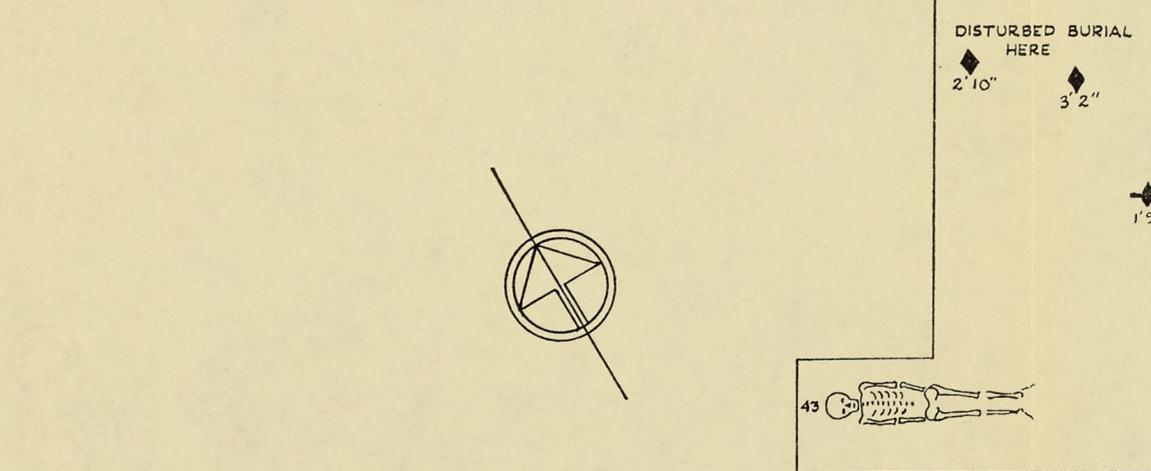
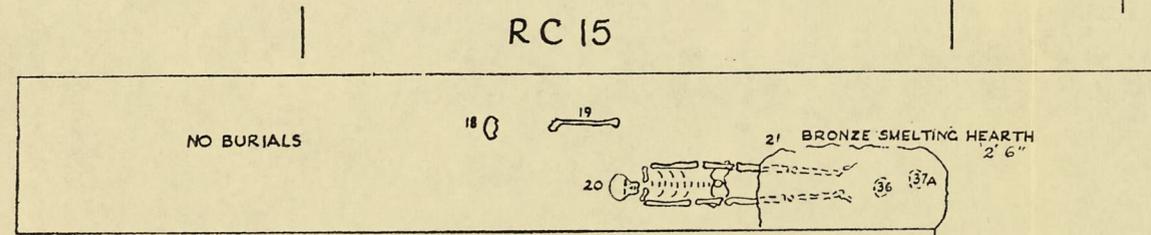
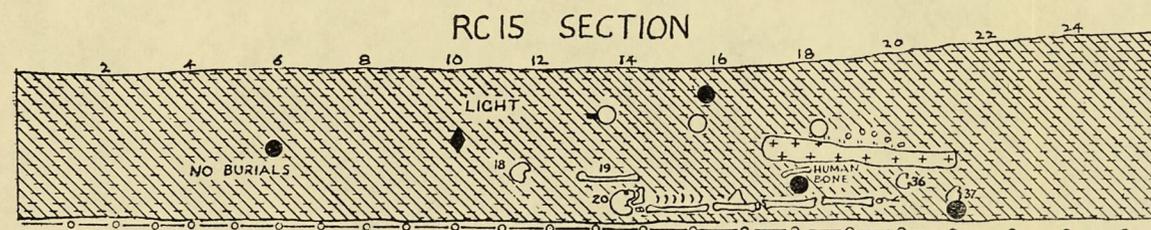
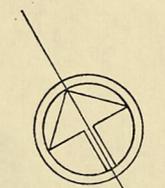
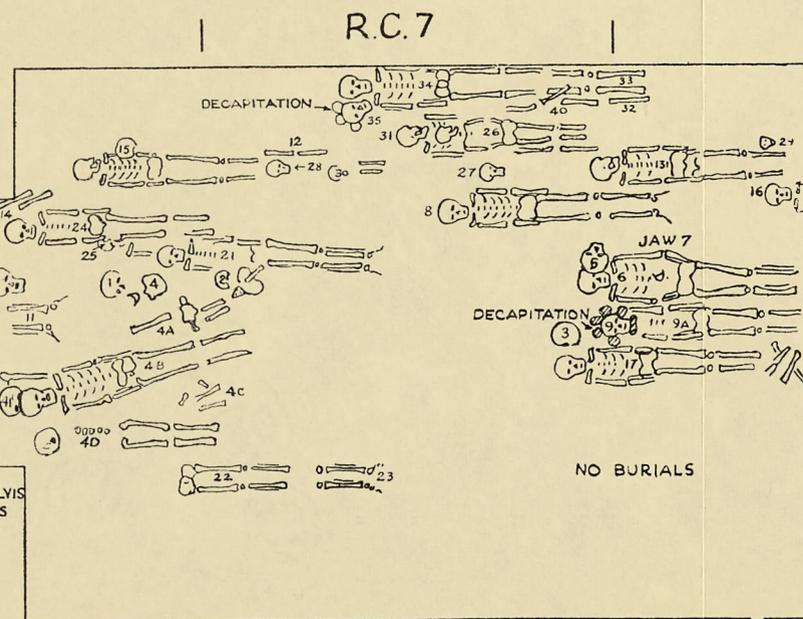
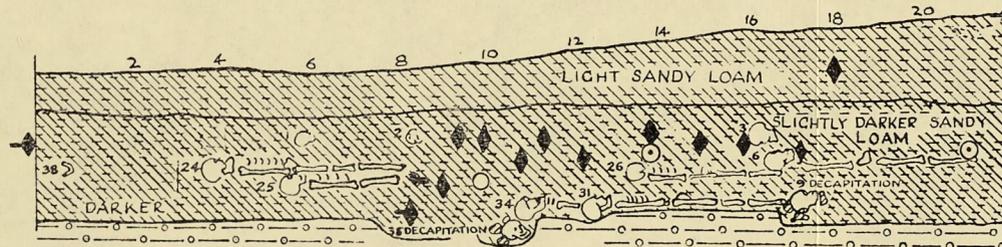


Fig. 3 (see Fig. 7a)



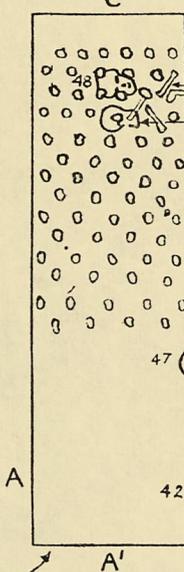
# BURIAL GROUND ~ RED CASTLE

RC 7 SECTION  
 IT IS OBVIOUSLY IMPOSSIBLE TO SHEW ALL THE BURIALS (NUMBERED 1,2,3 ETC). A COMPOSITE SECTION HAS THEREFORE BEEN DRAWN SHEWING A NUMBER TO ILLUSTRATE RELATIVE DEPTHS. THE POTTERY HAS BEEN SHEWN AT ITS CORRECT DEPTH BUT NOT NECESSARILY AT ITS CORRECT POSITION IN PLAN.

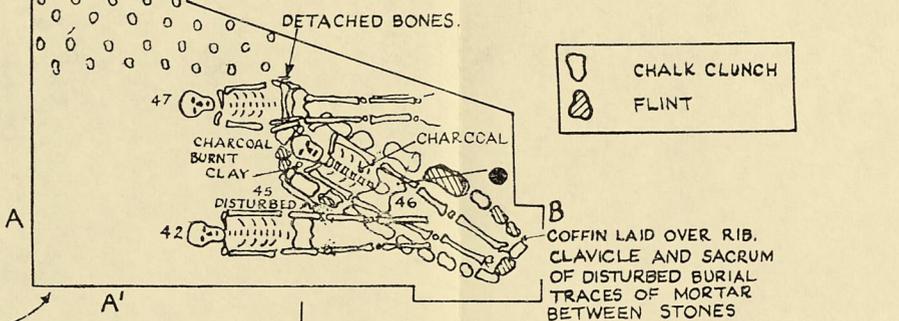
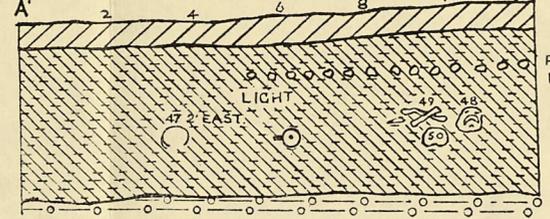


RC 19

RC 19 A



RC 19A, SECTION A'-C



RC's 7 & 19 ARE IN THEIR CORRECT RELATIVE POSITIONS

RC 19, SECTION A-B

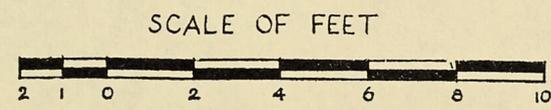
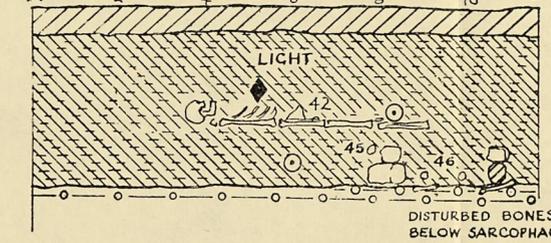


Fig. 4

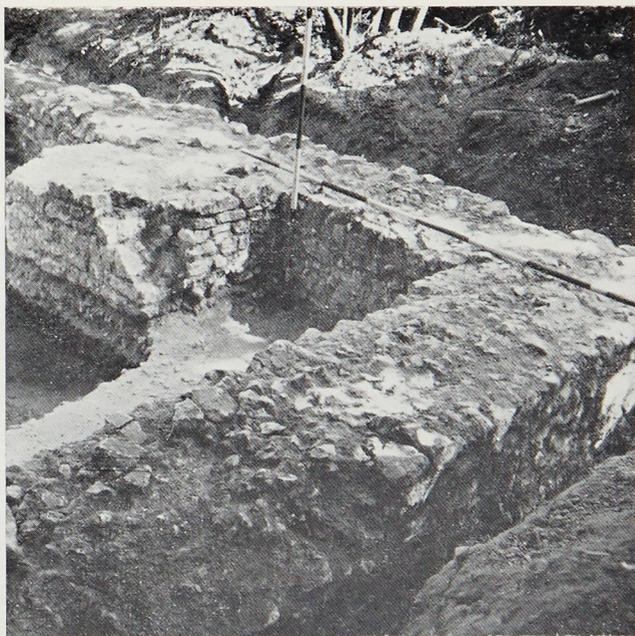


Plate IIa. Church Chancel looking N.E.

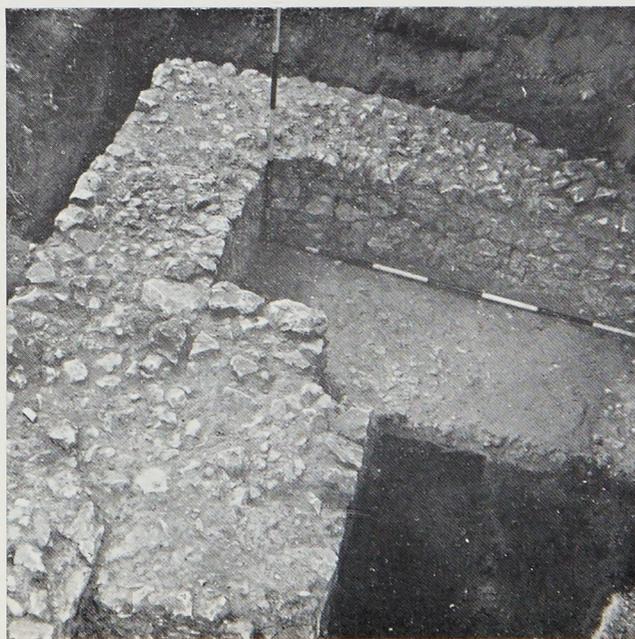


Plate IIb. Chancel with part of floor cut away looking S.E.

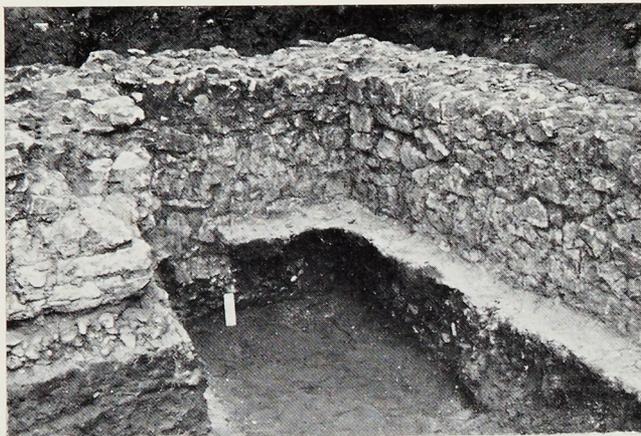


Plate IIIa. S.E. corner of chancel showing traces of wooden plinth stake and internal quoin stones.

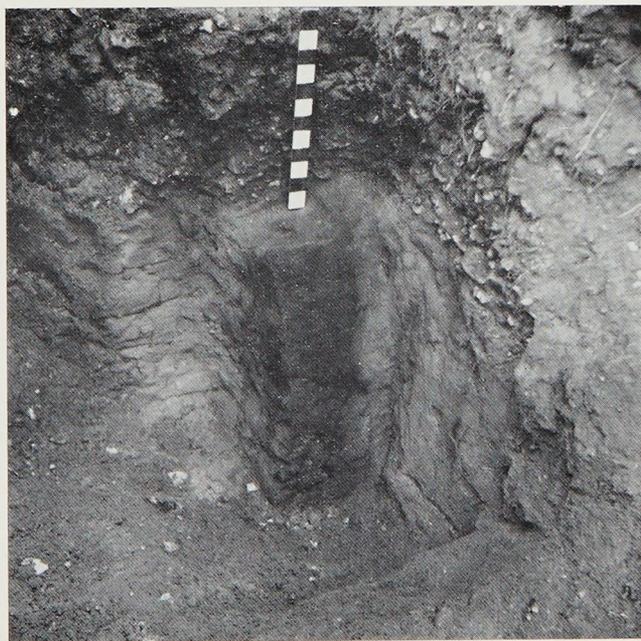


Plate IIIb. RC 24 showing vertical face of "pan" (p. 133).

## THE CHURCH AND ITS SITE (Figs. 2, 5, 6)

North of the burial ground, on the very edge of the sand and gravel quarry, were found the altar and south and east walls of the chancel of a small church. These walls stood some 2 ft. high above floor level, their tops being a foot or so below modern ground level. A few stones of the north chancel wall and the east wall of an adjoining vestry, together with the foundations of the south-east angle of the nave and chancel arch also remained; all the rest had been dug away (Fig. 5; Plates IIa, b).

The chancel was about 12 ft. 9 in. wide and 13 ft. 9 in. long internally, the east wall (2 ft. 6 in. thick) and the south wall (2 ft. 9 in. thick) meeting at an angle of 93 degrees. On the inner side of the south wall were marks which seem to have been made by vertical stakes 15 in. apart (Plate IIIa). The foundations were sectioned along the line AB (Figs. 5, 6b). A 3-in. mortar layer had been bedded on to a shallow spread of flints sunk slightly into the natural gravel and covered with a 10-in. thick layer of loose flints capped with a 4-in. mortar layer. Above this the walls were faced in more or less regular courses of small clunch stones, internally irregular for the first foot or so, and thence upward in neatly squared blocks with internal quoins bonding with the south (but not the east) wall. The lowest and uppermost remaining courses of the exterior face of the south wall were of flint.

A hearth 2 ft. 6 in. across, scratched out of the natural gravel, underlay the east wall (Fig. 6c) and the natural was covered with a foot-deep layer containing animal bones, a lead fragment and eighteen sherds of Pagan Saxon pottery (including Fig. 9.18, 19) and fifty-four of Middle Saxon pottery (including Fig. 9.20-23), but no Late Saxon or medieval sherds. A *sceatta* of the 740's was found just above natural (Figs. 5, 6b, d, 13.1). This dark layer was very different from the light chalky soil beyond the walls.

The explanation seems to be as follows. The hearth was associated with an early wooden building, perhaps Pagan Saxon. A later wooden building had walls either of hurdling set in sleeper plates, as elsewhere in Thetford, or half-round vertical logs, as at Greenstead in Essex. The north and south walls were protected against eaves' drip by a plinth set against their lowest foot or so. When the stone church was built, its walls were erected round the wooden ones, abutting against the hurdle plinth; the southern wall still bears the marks of the plinth stakes. The east wall being a gable end would not have needed a plinth. The upper part of the stone walls stood clear of the wooden ones and so could be internally faced. When the wooden walls were removed, the trench thus made was filled with rammed flints and capped with mortar. This mortar ledge provided a useful datum for the subsequent floor (Fig. 6 b, d, g). Thus three successive buildings stood on the site, with their walls never quite in the same place.<sup>8</sup>

At the eastern angles of the stone church, a tooled oolite block rested upon the mortared flints just above the upper mortar bed. The south-east block measured 24 by 21 in., being 10 in. thick at the south-east angle and 9 in. at the south-west. That to the north-east was 21 in. square, 8½ in. thick at the north-east angle but only 7 in. to the south and west, with a hollow chamfer





along its western edge. Both blocks had slight chamfering along their eastern edges, and this, together with the method of tooling may indicate re-use of Roman material. Built into the angles of the walls were pilaster strips 18 in. wide, extending as far west as the start of the upper flint courses and with their outer faces flush with the corner blocks (Fig. 6, a, e).

Sixteen feet west of the outer face of the east wall of the chancel, the nave quoin projected 16 in. southward: within was found part of the flint foundation of the chancel arch which, contemporary parallels suggest, may have been 6 ft. 6 in. wide. Mr. Whittingham instances: Strethall, Essex (5 ft. span, early eleventh century); Great Dunham, Norfolk (6 ft. 6 in., mid-eleventh century); Guestwick, Norfolk (7 ft. 3 in., late eleventh century); Framingham Earl, Norfolk (6 ft. 9 in., early twelfth century). At Howe, south of Norwich, the tower has just such an arch as is suggested for Red Castle, as well as a smaller west doorway of similar construction.

The internal wall facing continued behind the respond of the arch, which would be the natural course if the stone church was built around a wooden building, the latter having to be removed before the chancel arch could be built. A floor of chalk cobbles covered with sand (perhaps as a bed for paving tiles) was laid for 6 ft. 6 in. westward from the east wall (Plate IIb). Further west the floor was of chalk rubble on an irregular thickness of mortar.

Butted against the east wall of the chancel, 3 in. south of centre, was an altar of chalk clunch 5 ft. long and 2 ft. 9 in. wide, its top level with the walling and its western edges having lost any quoins they had (Figs. 5, 6; Plates II a, b). An irregular piece of antique green porphyry, found just above the floor in the south-east corner of the chancel, may have come from the altar (Fig. 14.6). This is probably one of the few surviving pre-Conquest altars in this country.

The filling above the floor was made up of chalk and mortar rubble, containing a few bird bones, a little charcoal and much fragmentary red coloured plaster, one piece showing black horizontal and red vertical painted lines imitating masonry joints. Three sherds of late Saxon Stamford ware (and one of Thetford ware) were found north of the altar, together with a rim fragment of a small bronze censer (Fig. 13.2).

Abutting against and projecting from the north wall of the chancel were the foot-wide foundations, in small concrete, of the east wall of a small vestry 7 ft. 7 in. long; only 18 in. remained of the north wall. A chalk clunch buttress had been set between the east wall of the vestry and the north-east corner block, and a mass of masonry partly overlay the junction. A possible reconstruction is shown on the inset to Fig. 5, a simplified version of the arrangement at Blakeney, where a room over the thirteenth-century vaulted chancel is reached by a newel stair from the vestry which is there placed behind the altar.

The remains of the church have now been covered again with soil, and a note of the date and circumstances of the excavation has been buried in a bottle beneath the south wall of the chancel, 9 ft. west of the inner face of the east wall.

## THE DEDICATION AND DATING OF THE CHURCH

By A. B. Whittingham, M.A., A.R.I.B.A.

*Dedication (Fig. 1)*

The conclusion that this is St. Martin's Church is reached by a process of elimination. The sites of the seven churches on the Norfolk side are known. Of the thirteen churches on the Suffolk side, twelve can be located: Great St. Mary's (in turn used as Cathedral, Priory 1104—7, and Blackfriars) incorporated in the Grammar School, with Holy Trinity at the south-east corner of the site and St. Sepulchre's (the Canons') further west next to Brandon Road. St. John's was south of the road and opposite the last. St. Margaret's was on the site of the cemetery south of the Elevedon Road. St. Mary the Less still exists between this and the Bury Road, with the site of St. Etheldred's in the lane east of the Bury Road and nearly opposite the footbridge. The foundations found on the Gas Works site are identified as St. Edmund's by a reference in the "Town Records" to the Canons having tithes of land "between St. Edmund's steeple and the water".<sup>9</sup> In 1912 the foundations of a church and graveyard were found in the field behind the Workhouse and near the semi-circular "Weaver's Close" (*ibid.*) This must have been St. Michael's because of a deed of land next to the church of St. Michael "part of which (land) bordereth on Livermere Way", now the Bury Road.<sup>10</sup> Also, in 1392 the Abbot of Bury gave licence to the Prior of Thetford to purchase the tenement called Playford in Barnham, near the rectory house of St. Michael's parish, held of the fee of St. Edmund.<sup>11</sup> This places St. Michael's close to the Bury Road, with its parish contiguous to Barnham Common.

Finally we come to the soke of St. Edmund outside the town defences. Blomefield places All Saints' inside the blocked Elizabethan brick gateway, which opens west from the Nunnery on to Barnham Common "on the right hand at the very entrance". This is confirmed by the existence of a foldcourse in 1338 "from Westwick field to the Church of All Saints" with the "chapel of St. Margaret and the London road" as the other boundaries.<sup>12</sup> All Saints' and St. Benedict's were both given by the Abbot of Bury to the Nunnery of St. George, part of whose church still survives. Here an enclosure south of the Nunnery and the track to Snarehill may be "Bennets Garden 1 acre, 3 R, 13 P" of the 1720 survey where "Red Castle Shift" is mentioned separately.<sup>13</sup> Brame (Bramis), the fifteenth-century monk of Thetford Priory, thought of St. Martin's as being early Saxon<sup>14</sup>, and it is first mentioned in 1086, whereas All Saints' and St. Benet's are not mentioned till *c.* 1175. They are more likely to be late twelfth-century churches, built in the Soke of St. Edmund, on land adjoining St. George's. The foundations of St. George's and the gift of this land and church are more likely to have taken place in the tenth century than in Canute's time as Blomefield supposed; because both are unrecorded, the church was served by Canons, and according to tradition commemorated St. Edmund's battle of 869, which is known to have been fought with the Danes near here. Three churches in a suburb sounds not impossible after two centuries growth.

This leaves St. Martin's as the only dedication available for Red Castle church. St. Martin's is mentioned in Domesday Book as a daughter church of St. Mary.<sup>15</sup> It does not occur in a 1368 inventory of church goods,<sup>16</sup> which suggests it may have been disused by then. There were no late medieval finds from the site.

#### *Dating*

Since the monastic churches of Bury St. Edmunds and of St. Benet's were of timber framing and clay construction respectively until Canute caused their rebuilding in stone, one would judge from the neatness, skilled foundation and sound construction of Red Castle church that it was very closely related to the new highly competent work at Bury or Thetford. The naïf way of forming the interior angle argues that the builder was perhaps using novel methods and the work may therefore be dated *c.* 1030. The Normans would certainly have retooled the corner blocks neatly and made them fit properly. There seems to be no parallel to the flint-capped plinth running into the side of the wide pilaster-strip at the angle, although a flint plinth occurs at North Elmham (*c.* 1030-40), where the preceding structures were of wood.<sup>17</sup> Pilaster-strips were practically unknown in Norfolk apart from in belfries (Weybourne, Great Yarmouth), but where they do occur (as at St. Benet's, Cambridge) it is normal for them to start from projecting blocks.

The date of the vestry is unlikely to be earlier than the thirteenth century, before which vestries hardly came in.

#### REPORT (CONTINUED)

##### *Burials near the church*

A number of burials occurred immediately south and south-east of the church (Figs. 5, 6 a, b), one skull being jammed right up against the south-east corner block. Several of these were in chalk sarcophagi; in some the body fitted so tightly that it was evident that the stones had been set round the body. This was certainly the case with R.C.B.46 (Plate IV) where the footstone actually rested on the feet of the burial. A few sarcophagi had curved headstones; that containing burial R.C.B.8 (Fig. 5) was partly mortared and had a boat-shaped section at the western end. See page 155 for Dr. Calvin Wells' report on the skeletons.

Associated with scattered bones south of the line of the nave was a small patch of chalk clunch flooring and a limestone slab (inset in Fig. 5), just below modern ground level. A flint road 15 in. below modern ground level ran across the north end of R.C.19A, perhaps an access path to the church (Figs. 2, 4).

##### *The town ditch*<sup>18</sup>

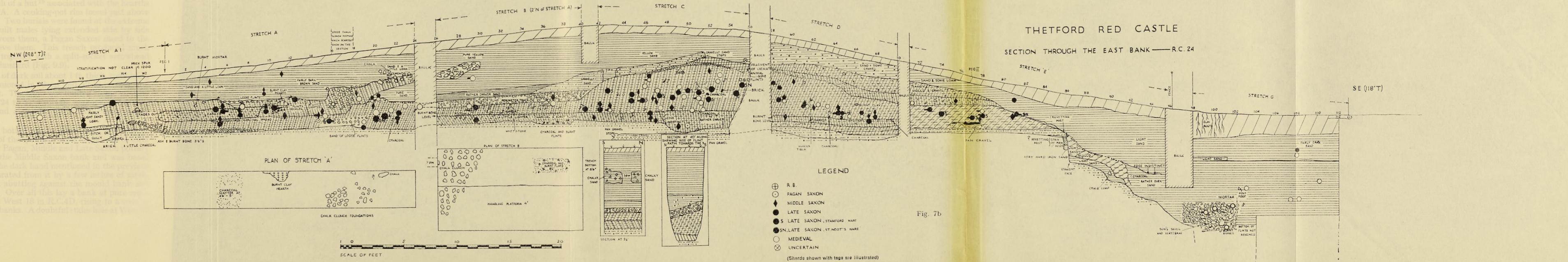
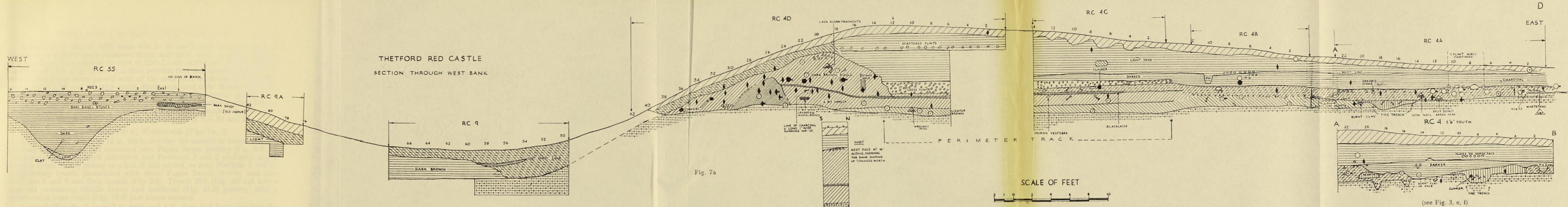
Excavation in 1952 showed that the defences of the Saxon town, consisting of a ditch 42 ft. wide by 11 ft. deep, ran north-west from the London Road at a point opposite St. Margaret's Cemetery. Further excavation to south and to north of Red Castle earthwork showed that the town ditch altered its alignment at a point some 300 ft. south of the earthwork, and that Red Castle itself had been thrown up astride the line of the ditch (Plate I).



Plate IVa. Burials RCB46 (in stone coffin) and RCB47.



Plate IVb. Rib from burial RCB6 with marks of textile.  
(Published by kind permission of Curator Norwich Castle Museum)



A test trench dug in 1952 some 400 ft. to north-west of this change in alignment revealed a much shallower ditch, only 20 ft. wide. A ditch of similar size was found immediately to west of Red Castle earthwork (R.C.61, 56, 55, 53, 60, 62, 59, 63), (Fig. 2) and it is thus possible that as originally laid-out, the ditch of the Saxon town passed west of the area later occupied by the earthwork. In R.C.56 and 61, this outer ditch contained only Middle and Late Saxon sherds, some embedded in a layer of flints at the bottom (possibly the remains of a former revetment). Other sections produced twelfth-century pottery from the bottom of the ditch. A number of Late Saxon sherds (Fig. 10, nos. 4, 8 and 9) were also found on the level stretch to east of R.C.59 and 63.

*The main earthwork: (i) Western side (Figs. 7a, 2)*

A band of light soil, 6 to 12 in. thick, overlay the natural in trench R.C.4D eastward from West 24 and contained only Pagan Saxon pottery (Fig. 8.6, 7). The eastern part was much disturbed, but Postholes 1 and 2 probably, and 3 possibly (Figs. 3f, 7a) belong to a hut of this period, as may Posthole 4 and its neighbouring hearth (associated with three Pagan Saxon sherds) and also Postholes 5 and 6 and their hearth (Fig. 3d). Trench 29A (Fig. 3a) cut into a large pit containing Middle Saxon and medieval (Fig. 12.2) pottery, with a double-sided bone comb (Fig. 15.8) just above natural.

A trench (Fig. 3e, f) some 2 ft. wide and 1 ft. deep had been dug into the natural. It contained a Middle Saxon base, burnt bones and black soil spilling over the sides, and may be the fire trench of a hut<sup>19</sup> associated with the hearths at the west end of trenches R.C.4 and 4A. A cooking-pot rim found just above the fire-trench is illustrated (Fig. 9.11). Two burials were found at the extreme eastern end of R.C.4A, both of well-built males lying extended side by side with a small whetstone (Fig. 14.4) between them, a Pagan Saxon sherd to the west and a Middle Saxon one just above them. This trench produced much Middle Saxon pottery (Fig. 9.8, 9, 14), together with a split-socket arrowhead (Fig. 13.7) closely associated with the rimsherd (Fig. 9.9).

Above the light soil layer was a band of dark soil about 1 ft. thick, containing (at West 22, R.C.4D) a circular depression 4 in. deep and 12 in. across, full of burnt animal bones (including sheep). The band was limited to the west by a 3 ft. high bank of darker soil (West 24 to 31, R.C.4D), perhaps a boundary bank, containing two Pagan Saxon and a number of Middle Saxon sherds (Fig. 9.10, 12, 15).

Trench R.C.9 was dug down to the bottom of the main ditch, some 16 ft. below the crest of the bank. The bulk of the spoil had been thrown up to form a bank of dark brown mould containing Pagan, Middle and Late Saxon pottery (Figs. 9.1, 10.6, 10). This enveloped the Middle Saxon bank and was based on a 4-in. layer of black soil overlying the dark band mentioned in the previous paragraph. Above this again, and separated from it by a few inches of sandy loam, was a band of flints 15 in. thick abutting against the mould bank and forming a perimeter track 14 feet wide. Over all this lay a bank of pure sand, from the eastern end of R.C.4 as far as West 18 in R.C.4D, rising to a crest at West 14, that, is east of the underlying banks. A doubtful stake-hole at West 17

in the mould bank suggests that there may have been a palisade retaining the sand at one time; another possible posthole was noted in the southern section (South 19).

Two small test holes were dug in the crest of the bank. In R.C.5, natural was covered by 2 ft. of sandy loam capped with 3 ft. of sterile sand. A surface find nearby was a short-cross penny of King John, minted at Canterbury about 1205. R.C.6, fifty feet to the north, had a layer of flints at least 2 ft. thick, probably part of the perimeter track.

Two parallel lines of loose flints ran diagonally across trenches R.C.4A and 29 (Fig. 3d, e). A fine half-quern of Mayen lava (Fig. 14.1) formed part of the eastern band of stones, beneath which were a number of medieval sherds (Fig. 11.14, 15, 17) in a layer of sandy loam below the sand overburden. R.C.29 and 29A-C contained no pure sand overburden. This and roofing and floor tiles, together with a considerable number of medieval sherds (Fig. 11.8, 9, 24; Fig. 12.1) suggest that a wooden building may have stood on the flint foundations.

(ii) *Eastern Side (Figs. 7b, c, 2)*

Trench R.C.24 was cut through the eastern side and revealed a somewhat similar pattern to that found on the west, but with significant differences. A sherd of pseudo-Samian and one of a Romano-British cooking-pot (Fig. 8.3) were found in the earliest occupation level, a band of light sandy soil 3 ft. thick at the west tapering to 9 in. eastward, and also Middle and Late Saxon pottery. A darker band containing mixed Saxon pottery (Fig. 10.1) ran out in the middle of the lighter band, covering a spread of charcoal. A fragment of a St. Neots' ware cooking-pot (Fig. 10.15) occurred below a hearth at East 10 and a Stamford ware pitcher (Fig. 10.16) underlay a Pagan or Middle Saxon lug handle (Fig. 9.17) in a disturbed level just above natural at East 16. Another hearth had been dug into natural between East 34 and 40, with charcoal, burnt flints and a fragment of siltstone (Fig. 14.2), perhaps for scouring wooden platters. A Pagan and a Middle Saxon sherd were found in a dip in the natural around East 46, and the base of the inner bank caused the disappearance of the Saxon level at about East 40; there were no Saxon levels east of the main ditch.

On top of these layers were two sherds of the eleventh/twelfth century (West 9, 12) and a dropped-arm prick-spur (Fig. 13.6). Two bands of flints crossed the trench between East 16 and 29. They may have been wall foundations, especially the western one (3 ft. thick, 2 ft. wide) and the upward slope may represent the angle of rest of fallen stones during the westward drift of the sand overburden. Late Saxon and medieval pottery (Fig. 11.13) was found down to natural below the flints.

As in R.C.4 on the opposite side of the earthwork, an inner bank of dark sandy mould rested upon the Saxon layer and contained pottery from Roman times to the twelfth century (Figs. 9.2; 10.2, 12, 14, 18, 19, 21, 22; 11.6, 7; 12.3, 4, 5). A grooved stone, perhaps natural (Fig. 14.3) came from near the top of the bank. A foot-thick band of flints lying on the tail of the bank (East 24 to 41) was similar to the track found in R.C.4D. The mould bank was capped

THETFORD RED CASTLE SECTION THROUGH EAST DITCH  
15' S. OF RC 24

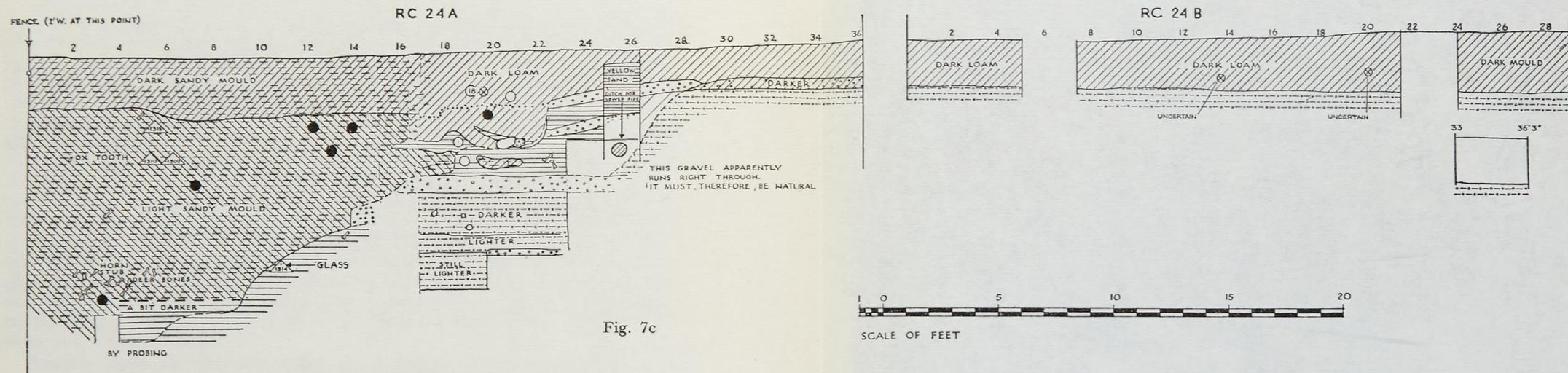


Fig. 7c

THETFORD RED CASTLE SECTION THROUGH SOUTH BANK

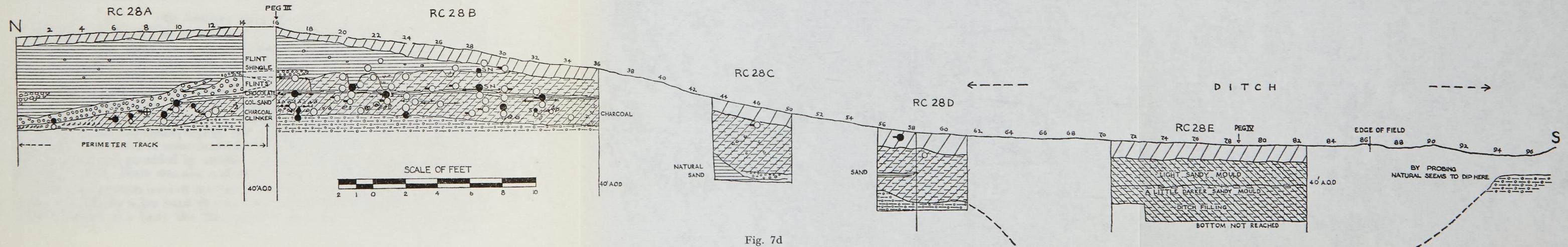


Fig. 7d

with a layer of gravelly sand overlapping the flint track and ending abruptly at East 52; a break at East 43 may indicate a posthole. In stretch D there were 2 ft. of gravelly sand overburden, whereas further east and west the overburden was pure yellow sand.

The main ditch was about 40 ft. wide. At East 86 the face was cut vertically for a depth of about 3 ft. and stained with "pan", perhaps the remains of some kind of revetment (Plate IIIB). The ditch filling contained a little medieval pottery and one Saxon sherd at a high level, together with some ironwork (Fig. 13.3, 4, 5). Between East 98 and 102 was a band of flints, animal bones and mortar at a depth of 8 ft. 6 in., extending downwards for over 3 ft. The similar band of flints at the bottom of the shallow ditch passing to west of the earthwork (trenches R.C.56, 61) will be recalled. Obstruction further east prevented the ditch bottom and outer lip being found, but, thanks to the kindness of Lt.-Col. E. C. Harrington (the owner of the adjoining house, Red Castle Furze), it was possible to cut trench R.C.24A, 15 ft. further south. Bottom here was reached by probing, giving a depth below the present crest of the bank of some 20 ft. A number of horn stubs and deer bones were found near the bottom of the ditch, and six Late Saxon sherds in the filling. At the edge of the ditch, just in the sand, was a moulded fragment of glass (Fig. 14.5). The subsoil east of the ditch was mainly gravelly sand, which would account for the presence of this in the outer envelope of the bank. There was no trace of an outer ditch beyond.

Further north, no sand overburden, nor anything else of note, was found in trench R.C.17. Trench R.C.8 showed the bank sloping downwards toward the north. It is thought that this marks the southern side of the entrance, now marked by a deep depression up which winds the path from the Brandon Road. The dark mould bank re-appeared in this trench, containing two Middle Saxon sherds, with a Romano-British and a Late Saxon one in the filling further north. There was a possible posthole in the crest of the mould bank with many flints to the north, in one place rising to a low pillar, perhaps once a flint wall.

(iii) *Southern side (Figs. 7d, 2)*

Trenches in the R.C.28 series were cut through the southern side of the earthwork. One sherd of a second-century Romano-British cooking-pot (Fig. 8.1) occurred below the flint track, but no Pagan Saxon and only one sherd of Middle Saxon pottery was found here.

A band of light sandy soil some 12 to 18 in. thick lay upon natural, with patches of midden refuse (South 0-4, 13-22, 30-34) including mussel, oyster and winkle shells, a cod vertebra and animal bones, together with Late Saxon (Fig. 10.3, 11, 20) and medieval (Fig. 11.2, 3, 4, 20, 21, 22, 23; Fig. 12.6) pottery. Iron nails were found in some quantity (Fig. 16.4, 5, 6, 7, 9) and evidence of metalworking was provided by clinker, charcoal and three crucible fragments (Fig. 12.7, 8, 9). There was also a charcoal scatter around South 36.

A 3-in. occupation level of chocolate-coloured sand overlay this light band, covered in turn by a low bank of dark sandy mould which appeared to be the eroded remains of a bank like that found in the other cuttings. A patch of

sand between South 19 and 20 may be another palisade stakehole like that found on the western side. (It does not appear in the section, being 2 ft. to the west; the depressions at South 21 and 22 are probably caused by roots). A considerable quantity of both Late Saxon and medieval pottery (Fig. 11.10, 11) was found in the inner bank.

A band of flints between 0 and South 16 was similar to the flint track found elsewhere. It appeared to butt against a patch of darker loam just north of the inner mould bank and was covered by a patch of smaller shingle. Sand overburden containing medieval sherds (Fig. 11.5) and iron nails (Fig. 16.8) extended as far as South 30 where it merged into topsoil, no doubt due to ploughing. Further south, natural dipped in R.C.28C and ran level to the lip of the ditch; the outer lip was found by probing, to give a width of 33 ft. A Late Saxon and a medieval sherd from the topsoil are shewn in Figs. 10.7, 11.1.

### THE DATE AND PURPOSE OF THE EARTHWORK

*By D. F. Renn, F.S.A.*

As the excavations have shewn, the surface contours are not a good guide to the original form of the Red Castle earthwork. Quarrying and road-making have altered the northern part of the site, and blown sand has masked the rest of the bank and ditch. What does survive indicates an embanked circular enclosure some 220 ft. across from crest to crest, perhaps with an entrance to the north-east. The bank is still up to 6 ft. high and was 40 ft. wide between revetments, the tail being covered by a wide flint band. Outside is a ditch of varying profile, up to 12 ft. deep and 40 ft. wide. Such a strong earthwork must have been defensive in purpose, despite the church and burial ground occupying part of the site, hitherto an open one.

It is tempting to deduce from the "perimeter track" a geometrically circular earthwork of Trelleborg type<sup>20</sup> or to see in the hut-sites evidence of Frankish or Saxon origin.<sup>21</sup> But the evidence is inconclusive, and many of the sherds excavated from the bank are regarded, in the present state of our knowledge, as post-Conquest rather than Late Saxon. In particular, the vertical-sided cooking-pot (p. 145, Fig. 12.5) is usually considered typical of the late eleventh-early twelfth century in the Oxford region, and persists into the thirteenth century further north and west,<sup>22</sup> though examples dating from the early eleventh century have been found at Sulgrave, Northants.

Ringworks have been excavated at a number of places in England and Wales, and there are several sites in Eastern England which, if unexcavated, may nevertheless be usefully compared with that at Red Castle. The very large oval at Belsar's Hill, Willingham (Type IC)<sup>23</sup> may be William I's siege-camp of "Alrehede" of 1070 and Picot's Castle at Bourn, also in Cambridgeshire, (ICb3) is mentioned in Domesday Book.<sup>24</sup> The earthworks at Framlingham, Suffolk (I/IICb2), inside the east angle of the town ditch, overlay a Middle Saxon cemetery and may date from the grant of 1100/01, if we discount the story of a stronghold of the time of St. Edmund.<sup>25</sup> At Castle Rising (I/IICd3), the siting of the early Norman chapel is best explained by its being contemporary with the ringwork cutting across the rectangular enclosure on the site. The

ringwork at New Buckenham (Cb3) stands at the west corner of the town enclosure, and is circumstantially dated by the gift of the *castellum diruendum* of Old Buckenham to the Augustine canons about 1146.<sup>26</sup> This reminds us of Blomefield's reference to the Earl "Warren" holding Red Castle and founding the priory of the Holy Sepulchre nearby (p. 121). In many ways, this last example may provide the closest parallel.

Thetford castle, nearly three-quarters of a mile away on the opposite bank of the Little Ouse, dates from the late eleventh century.<sup>27</sup> Red Castle is too far away to be an effective siegework, and it guards the other ford. Being in different fees, there is no reason why both castles should not have been in use together. There seem to be four likely times for Red Castle to have been built, within the limits laid down by the finds:

- (i) Some time after the Danish settlement of 869, perhaps in the eleventh century but before the Norman Conquest, or
- (ii) Shortly after 1066, either during the operations against Hereward (1070) or Ralph Guader (1075):<sup>28</sup> or
- (iii) During the Anarchy (1135-54), or
- (iv) At the time of the "Young King's" rebellion (1173), just after Thetford Castle had been dismantled.<sup>29</sup>

While the evidence is admittedly slender, the writer inclines to date (ii) on balance, but the reader may well disagree.

#### THE FINDS

All records and finds of the excavation have been deposited in the Castle Museum, Norwich.

#### THE POTTERY

A considerable quantity of pottery was found throughout the site, mainly in single sherds. Most of these are shown on the various sections under their respective symbols. Sherds shown with tags are illustrated.

##### *Romano-British pottery* (Fig. 8, 1-4)

Twenty-three sherds were found; Miss S. A. Butcher has kindly examined them and reports that the types are not sufficiently distinctive to enable firm dating to be applied. Most of the sherds not illustrated were body sherds, including a Samian fragment from R.C.50, a Castor ware sherd from R.C.54 and 57, and a pseudo-Samian sherd from R.C.24 (at 6 ft. 6 in., 65 ft. east) (Fig. 7b).

##### Fig. 8

1. Cooking-pot, reddish-brown, sandy ware. R.C.28B, 8 ft. south at 4 ft. 9 in., just in dark soil below perimeter track (Fig. 7d).
2. Cooking-pot, light red, sandy ware. East end of church at 3 ft. 3 in. below chalk cobbles.
3. Cooking-pot, dark brown, micaceous ware. R.C.24, 29 ft. east at 6 ft. 10 in. (Fig. 7b).
4. Storage jar, buff-gray sandy ware. R.C.57 at 4 ft. 3 in. in dark brown sand, associated with Late Saxon ware.

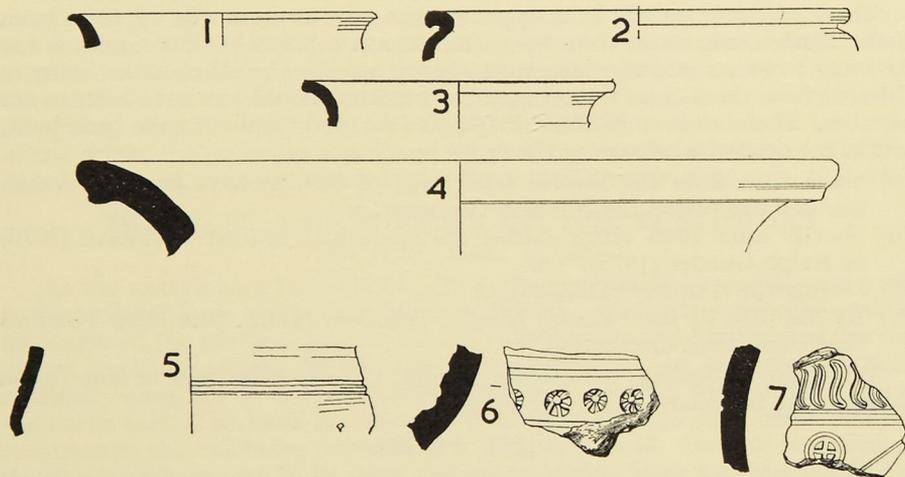


Fig. 8

1-4, Romano-British ; 5-7, Pagan Saxon (6, 7, four-sevenths ; remainder two-sevenths)

*Pagan Saxon Pottery* (Fig. 8, 5-7)

Fifty-eight sherds were found, mostly undecorated body sherds. The decorated sherds shown below have been examined by Dr. J. N. L. Myres, who has kindly reported on them.

Fig. 8 (cont'd).

5. Body sherd of jar, dark brown, smooth ware with flint grits and two girth grooves. R.C.19A, 6 ft. from northern end at 3 ft. 6 in. below flint road, in light sandy loam (Fig. 4).
6. Neck sherd of jar or urn, dark brown, smooth ware, with girth grooves and band of rosettes. R.C.4, 22 ft. west at 4 ft. 6 in. in dark sand to the west of and level with the top of hearth 1 (Fig. 7a).

The scheme on Illington Urn 33 is similar and could be from the same workshop, but the rosette has eight petals.

7. Body sherd, dark brown, smooth ware; two girth grooves between a band of S worms and an incised, pendant triangle of cruciform stamps. Five other Pagan Saxon sherds were found in association with this sherd in R.C.4B, 9 ft. west at 5 ft. 6 in. in light brown occupation soil, between a layer of pebbles and natural (Fig. 7a).

This scheme is exactly the combination on Urn 229 from Illington; Urn 28 has two similar stamps but the scheme is different.<sup>30</sup>

*Middle Saxon Pottery* (Fig. 9)

Nearly 200 sherds were found, mainly at the western side and in the burial ground. All four types of fabric mentioned by Mr. J. G. Hurst under Ipswich ware<sup>31</sup> occurred. A number of simple rim forms similar to those illustrated in his paper on Saxo-Norman pottery were noted,<sup>32</sup> as well as some much more developed ones. There were no spouts or handles, but one example of a pierced, upright lug. Mr. Hurst advances the theory that Ipswich ware is the result of trade contacts with the Rhineland, greatly expanded by Frisian merchants, after the conversion of East Anglia to Christianity.<sup>33</sup> This is of particular interest in view of Dr. Wells' suggestion that Frisia may have been the homeland of the round-headed people buried at Red Castle.

## SIMPLE RIMS

Fig. 9

1. Cooking-pot, dark brown, smooth sandy ware; rim almost vertical. R.C.4D, 14 ft. west at 5 ft. 6 in., just in dark soil (Fig. 7a).
2. Cooking-pot, dark brown, sandy ware, light reddish-brown core; rim almost vertical and squarer than 1. R.C.24, 46 ft. 6 in. east at 7 ft. (Fig. 7c).
3. Cooking-pot, dark brown, smooth ware, sooted. Tapered rim, almost vertical. R.C.18, 2 ft. north at 2 ft. 6 in., as also
4. Cooking-pot, dark brown, pimpled ware, charged with small grits; rim almost vertical, bevelled and slightly splayed.

5. Cooking-pot, dark brown, rough-textured ware, charged with flint grit, sooted; rim almost vertical, with slight internal beading. R.C.18, 2 ft. north at 3 ft. 2 in.
6. Cooking-pot, gray, pimpled ware, charged with small grits; rim slightly everted. R.C.7, 8 ft. east, in burial ground associated with the pelvis of R.C.B.22 (Fig. 4) (see note below RC.7 Section heading on Fig. 4).
7. Cooking-pot, dark brown, rather smooth ware; rim slightly everted and squared, girth ribs on body. R.C.13, 5 ft. west at 1 ft. 3 in.

## RIMS WITH EXTERNAL BEADING

8. Cooking-pot, dark brown, rough gritty ware; rim slightly everted, with slight shoulder below neck. R.C.4A, 9 ft. west at 3 ft. 5 in. below flint wall footings (Fig. 7a).
9. Cooking-pot, dark brown, gritty ware; rim everted and squarer than 8; angular tuck-in of external beading. R.C.4A, 12 ft. west at 3 ft. 9 in. below wall foundations and closely associated with split-socket arrowhead (see Fig. 13.7) (Fig. 7a).
10. Cooking-pot, dark brown, pimpled ware, charged with small grits; rim slightly everted. R.C.4D, 25 ft. west at 5 ft. (Fig. 7a).

## DEVELOPED RIMS

11. Cooking-pot, buff-brown ware, almost black inside, with pimpled surface; rim almost vertical, splayed and bevelled with groove on top. The body widens out sharply below the neck and the walls are ridged. R.C.X, 3 ft. west at 4 ft. 6 in., above fire trench, adjacent to R.C.4A and part of the same hut complex (Fig. 3g).
12. Cooking-pot, dark gray-brown, sandy ware; rim everted and rounded, with inner surface bevelled and walls rilled. R.C.4D, 24 ft. west at 4 ft. 9 in. (Fig. 7a).
13. Cooking-pot, dark buff-brown, sandy ware, with a little flint grit, pimpled and pitted in places; rim bulged below top edge, with inner face bevelled and rounded. R.C.24, 3 ft. east in sand overburden (Fig. 7b).

## ROUNDED BASES

14. Iron-gray, smooth ware, wiped on inside; little definition at angle. R.C.4A 20 ft. 6 in. west at 4 ft. 10 in. above fire trench (Fig. 3e, 7d).
15. Gray-brown, pimpled ware, with defined base angle. R.C.4D 26 ft. west at 4 ft. 10 in. just above natural (Fig. 7d).
16. Greenish-brown, smooth ware, with slight sag to base, walls pitted. R.C.7 in burial ground at 1 ft. 9 in. (Fig. 4).

## LUG

17. Fragment of vertical-pierced lug from large cooking-pot or bowl, coarse, reddish-brown ware; hand-made. The body seems to have bulged out below the lug. R.C.24, 15 ft. east at 5 ft. 10 in. (Fig. 7b).<sup>34</sup> Perhaps Pagan Saxon.

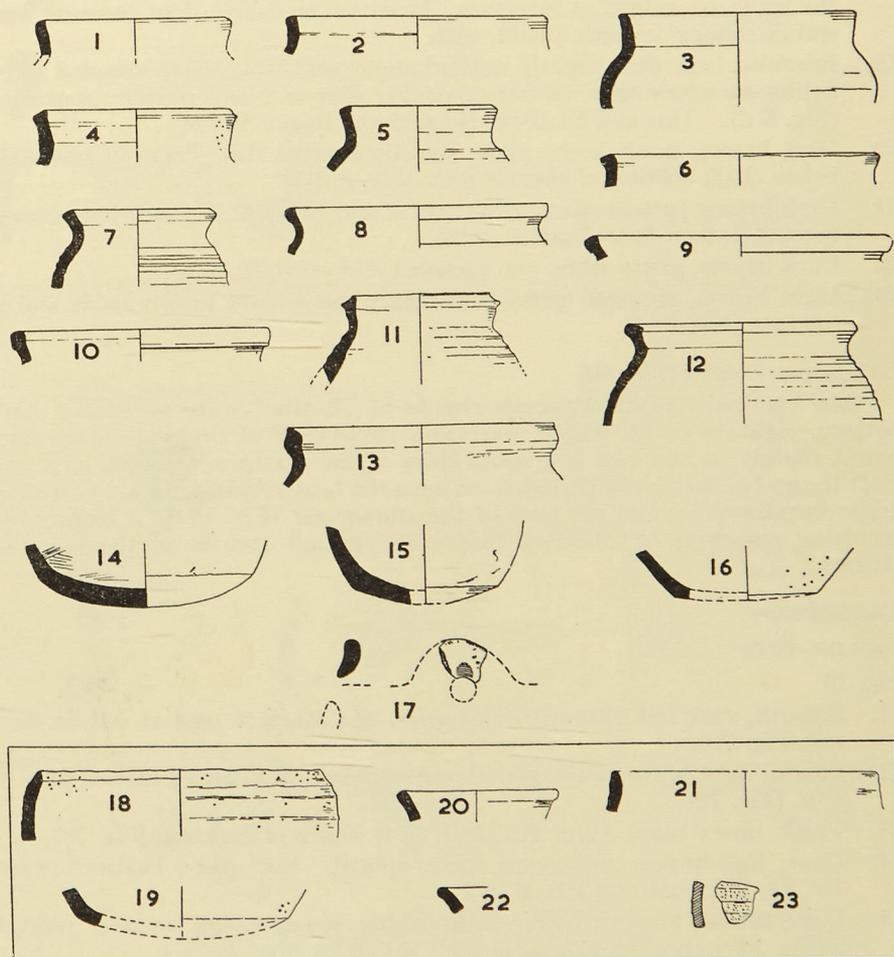


Fig. 9. Middle Saxon Pottery  
(18-23 from Church)

## COOKING-POTS FROM BELOW CHANCEL FLOOR

18. Bowl or cooking-pot, soft, coarse, dark brown ware, much pitted and abraded. The rim slopes inward and the inner surface is sharply bevelled; the walls are ridged at intervals. From below rubble floor towards west end of chancel in dark mould, with
19. Rounded base with slightly defined angle, soft hand-made abraded ware, lighter in colour than 18 but of similar diameter and possibly matching (Fig. 6 d). This and 18 above are perhaps Pagan Saxon.
20. Dark brown, sandy ware; plain, slightly everted rim. From immediately below chalk cobbles of chancel floor (Fig. 6 d).
21. Dark brown, smooth ware; rim vertical and tapered. From below chancel floor, 3 ft. 3 in. below datum, with
22. Dark brown, gritty ware; rim rounded and everted, and
23. Light brown, pimpled, gritty ware; body sherd, dark brown inside and at fracture (Fig. 6 b).

*Late Saxon Pottery* (Fig. 10)

One hundred and thirty-seven sherds of Thetford ware or similar hard pottery, eighteen of St. Neots' ware and twenty-six of Stamford ware were found, mainly on the east and south sides of the earthwork. Some of it was from the end of the Saxon period, as witness the heavy, raised cordon with deep finger impressions round the base of the storage jar (Fig. 10.8), a feature not occurring elsewhere at Thetford before the second quarter of the eleventh century.

*Thetford ware*

## COOKING-POTS

## Fig. 10

1. Smooth, dark red ware with flint grits. R.C.24, 6 ft. east at 4 ft. in dark soil (Fig. 7b).
2. Coarse, light brown ware, pitted and abraded. R.C.24, 73 ft. east at 4 ft. 1 in. (Fig. 7b).
3. Thick, heavy black ware. R.C.28B, 32 ft. south in dark soil (Fig. 7d).
4. Close, buff-brown, micaceous ware, sooted. Not quite Thetford ware. R.C.63, 2 ft. east and 1 ft. 6 in.
5. Dark brown, smooth ware, with wiping striations on outside, reddish inside, grey core. R.C.7, level with R.C.B.25 (Fig. 4).

## BOWL

6. Dark brown, gritty ware. R.C.4D, 24 ft. west at 3 ft. 2 in. in inner bank (Fig. 7a).

## DISH

7. Dark brown, harsh gritty ware. R.C.28D in topsoil (Fig. 7d).

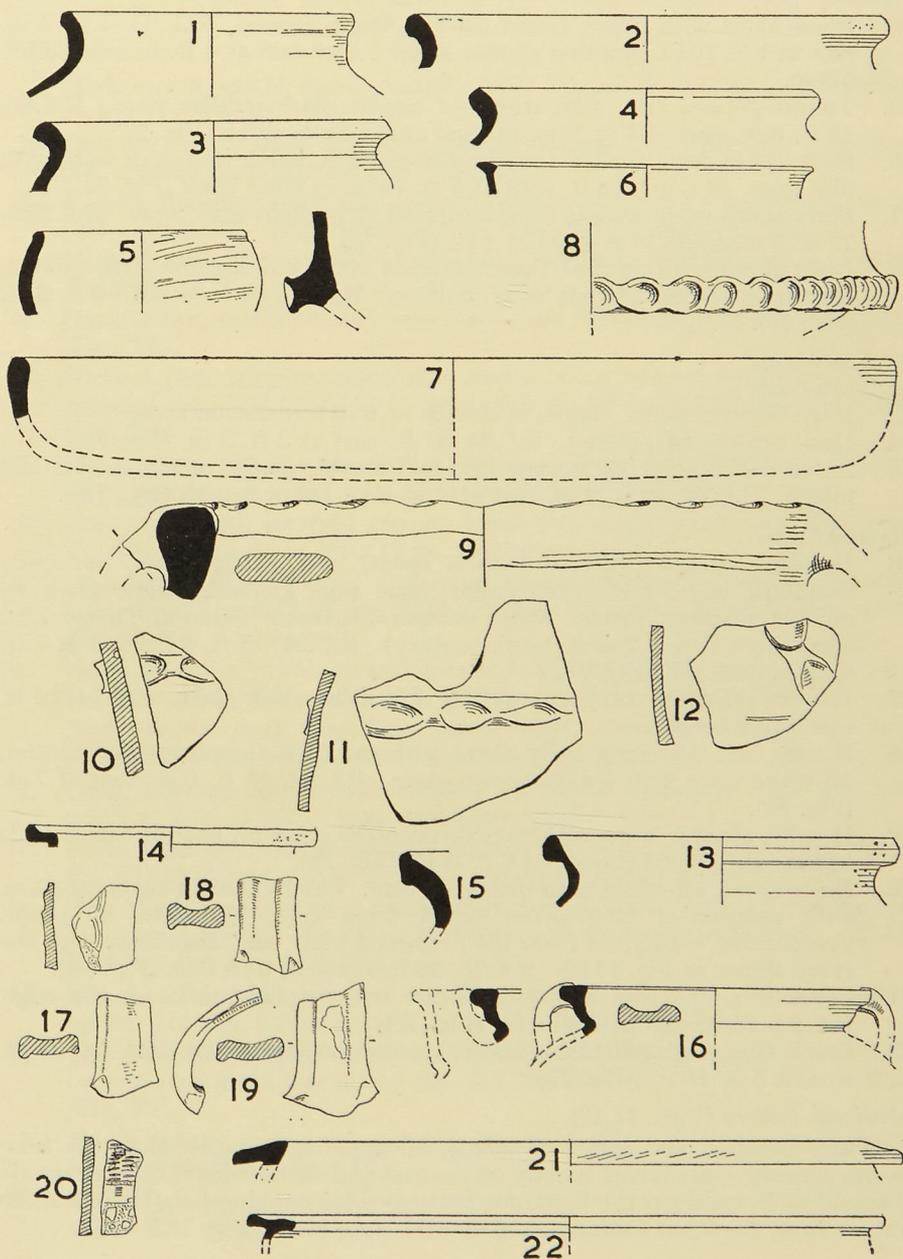


Fig. 10. Late Saxon Pottery

1-11 Group I Ware; 12-14 St. Neot's Ware; 15-21 Stamford Ware (all quarter)

## STORAGE JARS

8. Basal angle with heavy raised cordon, finger-pressed. R.C.63, 4 ft. 4 in. east at 1 ft. 10 in.; another similar sherd 1 foot east at 4 ft. in outer ditch filling.
9. Thumb-pressed rim, with stump of handle, dark reddish ware. R.C.63, 12 ft. 8 in. east at 1 ft. 3 in. in sand above outer ditch (Fig. 2).
10. Body sherd with applied thumb-pressed strip, harsh iron-gray ware with flint grits. R.C.4D, 18 ft. west at 4 ft. 10 in. in inner bank (Fig. 7a).
11. Body sherd with applied thumb-pressed strip, light grey ware. R.C.28B, 17 ft. 6 in. south in midden at 4 ft. (Fig. 7d).
12. Body sherd with applied thumb-pressed strip and shallow girth groove; light brown, coarse, sandy ware, flaking. R.C.24, 64 ft. east at 6 ft. 3 in. (Fig. 7c).

*St. Neots' ware*

## COOKING-POTS

13. Dark brown, shelly. South of church at wall foundation level<sup>35</sup>.
14. Dark brown, soft, pitted. R.C.24, 81 ft. east at 2 ft. 9 in. (Fig. 7b).
15. Large cooking-pot or storage jar, buff-brown, shelly, much eroded and pitted. R.C.24, 10 ft. 6 in. east at 4 ft. 6 in. below hearth (Fig. 7b).

*Stamford ware*

16. Handled pitcher (restored with a spout), red, sandy paste, not quite Stamford ware, but very similar; pale sage greenish-yellow glaze on outside; unglazed inside. Shape comparable to one found at Thetford St. Mary from Period 2 or 3 (tenth century). R.C.24, 15 ft. 6 in. east at 6 ft. 6 in. in dark soil (Fig. 7b).
17. Handle, off-white ware with patchy, greenish-yellow glaze. R.C.24, 22 ft. east (spoil heap).
18. Handle and matching body sherd with moulded thumb-pressed cordon; off-white ware with orange-brown glaze. R.C.24, 45 ft. 6 in. east at 7 ft. (Fig. 7b).
19. Handle, pinkish ware with patchy primrose glaze on outside and a little inside. R.C.24, 64 ft. east at 6 ft. 3 in. (Fig. 7b).
20. Body sherd, off-white with blue-grey core. Patchy, cream-coloured glaze, with patches of bluey-green colour from core; horizontal striations. Comparable with glaze from the Stamford kilns, and associated with the sherd shown in Fig. 11.23. R.C.28, 23 ft. south at 3 ft. 6 in. (Fig. 7d).
21. Crock rim, unglazed yellow-buff ware with wiping marks on rim edge. R.C.24, 78 ft. east at 3 ft. 6 in. (Fig. 7b).
22. Crock rim, unglazed pinkish ware, sooted on lower side. R.C.24, 77 ft. east at 3 ft. 10 in. (Fig. 7b).

*Medieval Pottery* (Figs. 11,12)

Three hundred and fifty-two sherds, all apparently earlier than the fourteenth century, were found, mainly on the east and south sides of the earthwork. Unusual finds included the base of a vertical-sided cooking-pot (Fig. 12.5), an import from the West Country, and crucible fragments (Fig. 12.7-9).

## LATE ELEVENTH- EARLY THIRTEENTH-CENTURY COOKING-POTS

Fig. 11

1. Dark brown, sandy ware, probably early medieval. R.C.28C, 46 ft. south at 1 ft., in light soil (Fig. 7d).
2. Dull red, sandy ware, grey core, sooted outside. R.C.28B, 20 ft. south at 3 ft. 7 in. in dark midden soil (Fig. 7d).
3. Lightly thumb-pressed rim, almost black, sandy ware (diameter approximate). R.C.28B, 19 ft. south at 3 ft. 4 in. in dark soil (Fig. 7d).
4. Necked pot with moulded, upstanding rim, dull red, sandy ware, sooted. R.C.28B, 17 ft. south at 4 ft. 4 in., in dark midden soil (Fig. 7d).
5. Dark brown, smooth sandy ware. R.C.28B, 30 ft. south at 8 in. in topsoil. (Fig. 7d).
6. Necked pot, with moulded rim similar to 4 above, bright red, hard pimpled ware. R.C.24, 42 ft. east at 8 ft. 4 in., at base of inner bank (Fig. 7b).
7. Dirty brown, sandy ware, darker inside, probably early medieval. R.C.24, 46 ft. east at 4 ft. 8 in., near top of inner bank (Fig. 7b).
8. Nosed rim with internal groove, harsh red sandy ware with flint grits. R.C.29, 24 ft. east at 3 ft. 10 in., just above natural.
9. Moulded rim, with deep under-rim groove like a mid-twelfth century series from Therfield, Herts.<sup>36</sup> Red, sandy ware. R.C.29 south face, 14 ft. east at 3 ft., in dark soil.
10. Body sherd with comb-incised lines and chevrons, light brown, sandy ware. R.C.28B, 25 ft. 6 in. south at 2 ft. 8 in., in dark soil (Fig. 7d).
11. Body sherd, dark chocolate-brown ware, sooted, with incised lines. R.C.28B, 30 ft. south in dark bank soil (Fig. 7d).
12. Large cooking-pot, brown pimpled ware with flint grits. R.C.18, 3 ft. north at 2 ft. in sandy loam just above darker layer.
13. Neck sherd with thumb-pressed cordon, red, sandy ware, buff-grey inside. R.C.24, 29 ft. east at 3 ft. 9 in., in sand below chalky patch (Fig. 7b).
14. Rim sherd, perhaps of a crock, dark brown ware, pimpled outside and buff-brown inside. The flat on the rim edge is probably fortuitous. R.C.4A, 12 ft. west at 3 ft. 4 in. (Fig. 7a).
15. Moulded rim with internal beading, dark brown ware, sooted, lighter inside. R.C.4A, 9 ft. west at 3 ft. in large stones (Fig. 7a).
16. Jug neck, grey, sandy ware, with yellowish-buff glaze mottled chocolate-brown; stab mark just above rib. R.C.24, 99 ft. east at 9 ft. 6 in. in flints (Fig. 7b).
17. Harsh, gritty ware, red outside, brown inside. R.C.4A, above burial R.C.B.51 at 2 ft. (Fig. 7a).
18. Dished spade rim, colour not noted; knife slashing below rim; buff, sandy ware. R.C.15, 14 ft. west at 1 ft. (Fig. 4).

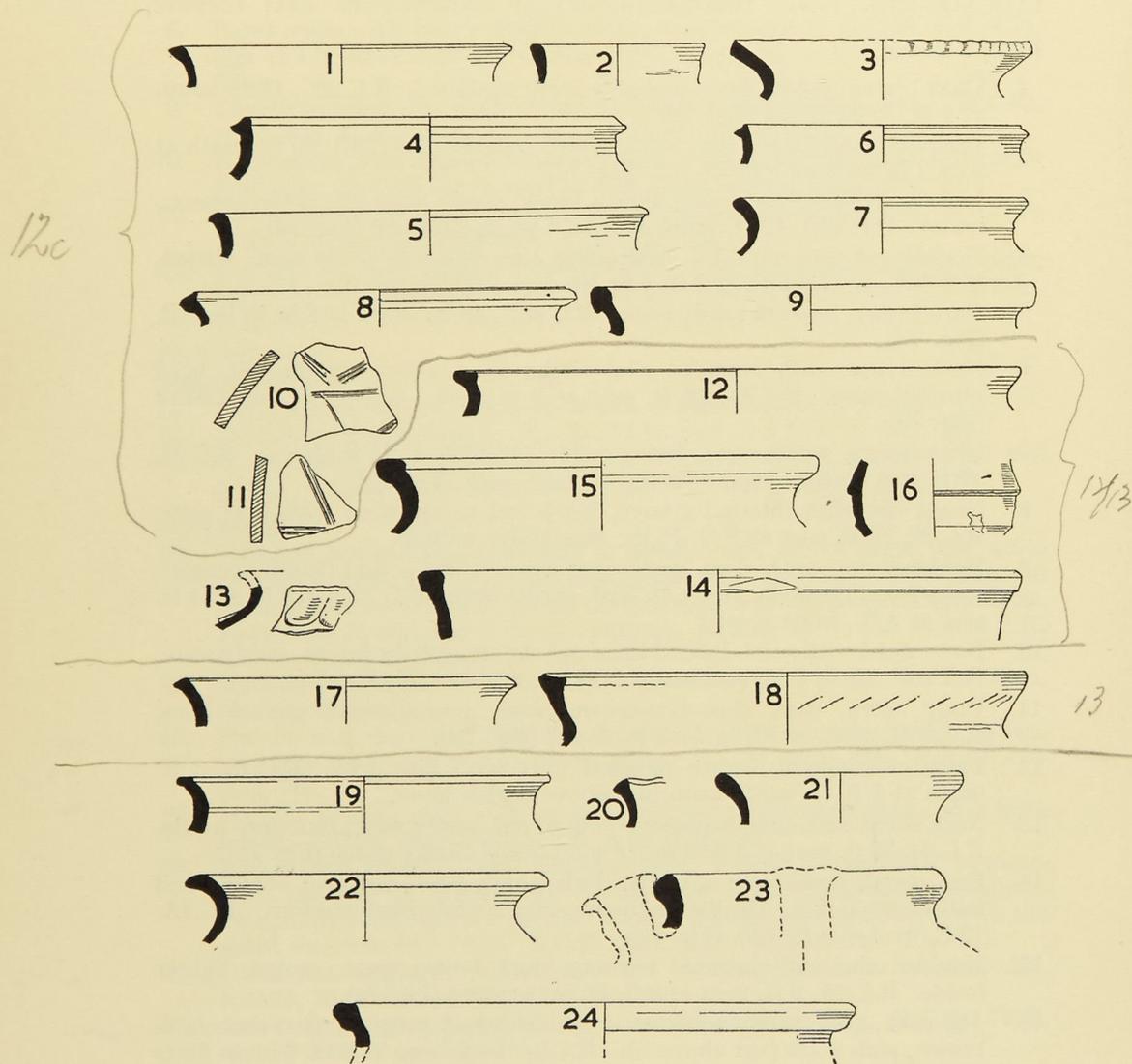


Fig. 11. Medieval Cooking Pots

1-11, 12th century or early medieval; 12-16, 12th/13th century;  
 17-18, 13th century; 19-24, undated (all quarter)

19. Harsh, gritty ware, buff-brown inside, reddish outside, sooted. R.C.28B, 21 ft. south at 3 ft. 10 in. in dark soil (Fig. 7d).
20. Thumb-pressed rim in dark brown, sooted ware. R.C. 28B, 23 ft. south at 3 ft. 6 in., with crucible (Fig. 12.7) (Fig. 7d).
21. Dark brown sandy ware, sooted. R.C. 28B, 28 ft. south at 3 ft. 10 in. (Fig. 7d).
22. Dark brown ware, charged with a little grit, sooted. R.C.28A, 10 ft. south at 4 ft. 7 in. below the perimeter track (Fig. 7d).
23. Part of a spouted and probably handled pitcher in coarse, light red ware, flaky and pitted. R.C. 28B, 20 ft. south at 3 ft. 9 in., associated with the glazed sherd (Fig. 10.20) (Fig. 7d).
24. Brown ware, pimples, with small flint grits. R.C.29, north face, 8 ft. east at 2 ft.

## BOWLS, DISHES, STORAGE JAR AND CRUCIBLES

## Fig. 12

1. Bowl, dark brown, smooth, sandy ware. R.C.29, south face, 10 ft. east at 3 ft. 4 in.
2. Dish, dark brown, gritty ware with small flints, reddish inside with micaceous flecks. R.C.29B, on top of Pit 2 at 2 ft. 11 in. (Fig. 3a).
3. Dish, reddish-brown, sandy ware; R.C.24, 78 ft. east at 3 ft. 6 in. (Fig. 7b).
4. Bowl, harsh red, sandy ware, lighter inside. R.C.24, 51 ft. east at 6 ft. 9 in. (Fig. 7b).
5. Base, chocolate-brown, smooth soapy ware, pitted; the walls slope inwards from the base and it appears to be one of Professor E. M. Jope's West Country type of the late eleventh-early twelfth centuries.<sup>37</sup> R.C.24, 78 ft. west at 3 ft. (Fig. 7b).
6. Storage jar with thumb-pressed rim, harsh, light red sandy ware.<sup>38</sup> R.C.28B, 27 ft. south at 2 ft. 4 in. in bank (Fig. 7d).
7. Crucible, hard, close, cream-coloured ware with unusually upstanding, pinched-lip spout (dimensions approximate). R.C.28B, 23 ft. south at 3 ft. 6 inches in midden, associated with cooking-pot (Fig. 11.20) (Fig. 7d).
8. Crucible, close, off-white ware (dimensions approximate). R.C.28A, 6 ft. south at 5 ft. 6 in. (Fig. 7d).
9. Crucible, off-white ware, fired or smoked nearly black. R.C.28A, 12 ft. south at 5 ft. 5 in., just above natural (Fig. 7d).

For similar crucibles deposited in the 1070's at London, Oxford and York, see the references cited by Professor Jope.<sup>39</sup>

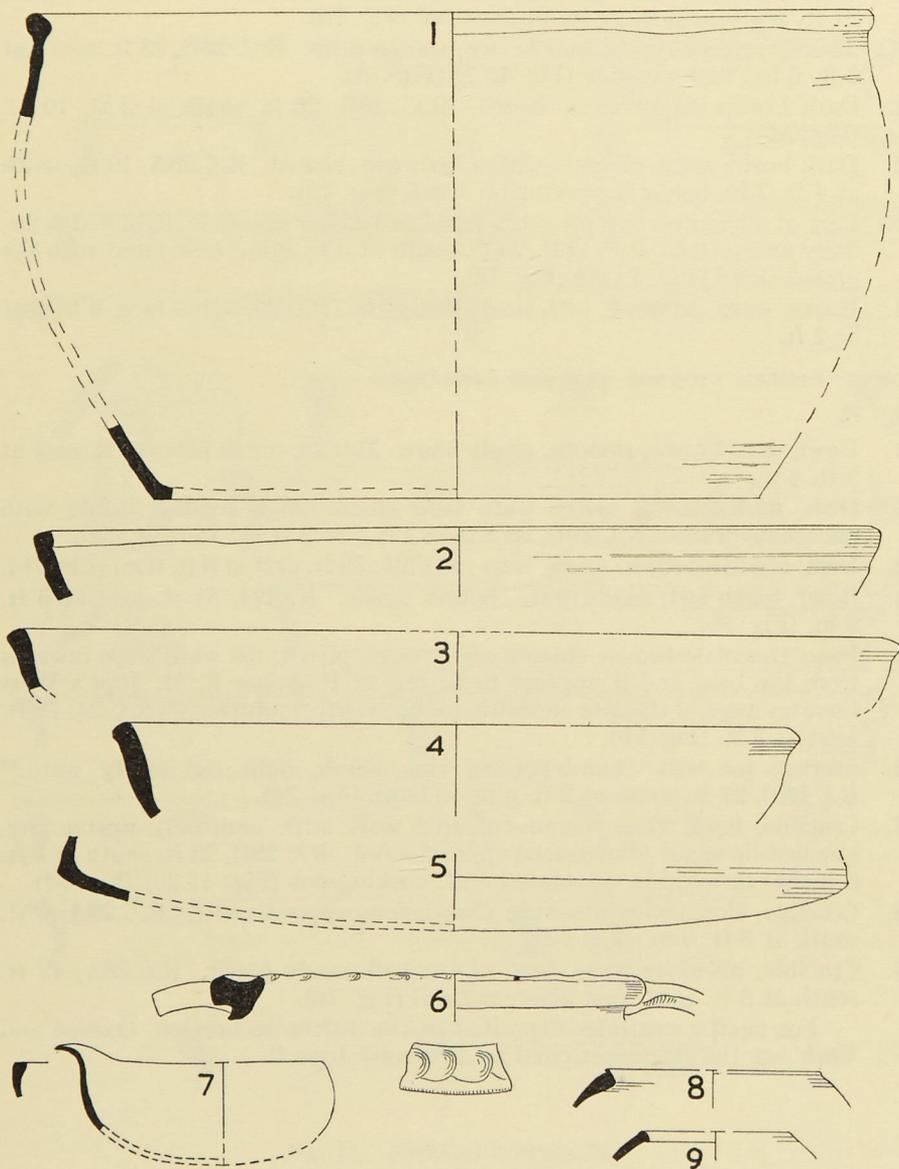


Fig. 12. Medieval bowls, dishes, storage jars and crucibles (quarter)

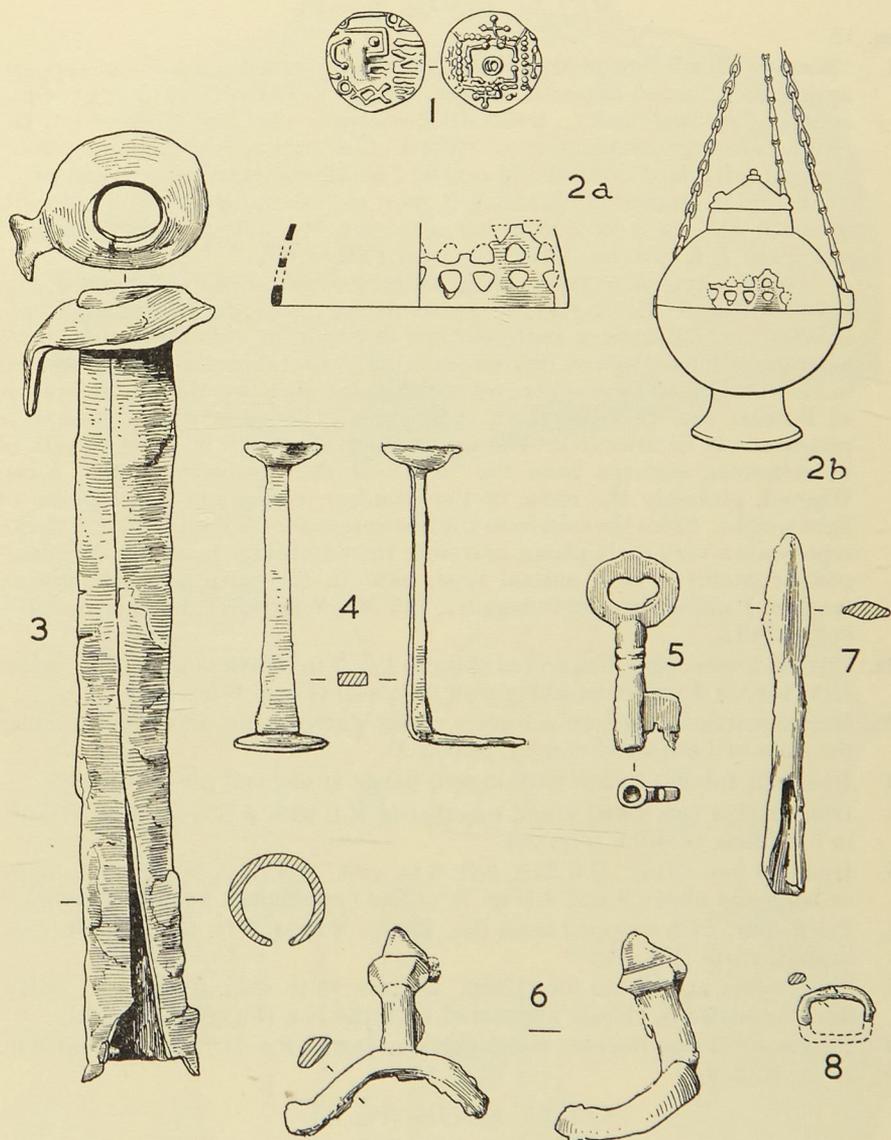


Fig. 13. Metal Finds  
(1, to scale; 2(b) quarter; remainder half)

## METAL FINDS (Fig. 13)

## Fig. 13

1. "Sceatta" (small-flan penny) of base silver (in cleaned condition of coppery appearance); mean diameter 13 mm., weight 0.744 gm. (11.5 gr.). Obv. squarish, stylised head r., trellis design (*not* rune for "ng") below, l.  $\Lambda$  between two large annulets, r. o. "wigrd" (for "wigræd"), in runes. Rev. stylised "standard", annulet in centre,  $\Gamma$  in all angles, cross on all sides.

Found in chancel of church, 4 ft. west of east wall and 4 ft. 6 in. north of south wall, at 3 ft. 2 in. below altar top, just above natural, in dark soil (Figs. 5, 6 b, d, no. 1328, miscalled 1382 in 6d).

This is a typical example of the class of coins called "secondary Runic *sceattas*" by S. E. Rigold<sup>40</sup>. These derive from the "primary Runic *sceattas*", which have a south-eastern distribution, but themselves have a strongly East Anglian distribution, and were almost certainly minted in East Anglia. At the other end of the series, they are allied to the pieces of Beonna also probably East Anglian, *c.* 758. The weight and style progressively deteriorates. The usual runes are "epa" or some version of it, stemming perhaps from the "æpa" of the "primary Runic" coins. Wigræd, probably the name of the moneyer, represents a late phase of light weight. Since the coin from the Garton-on-the-Wolds hoard, *c.* 725-30, represents a very early phase, and since the Cambridge hoard of "Wigræd" coins contains a local animal type, akin to the earliest Northumbrian *sceats* of Eadbald (probably begun *c.* 745-50), Wigræd's coinage is probably in the 740's.

- 2a. Pierced bronze rim. Chancel of church, 1 ft. 7 in. north of altar, 2 ft. below altar top, in destruction filling near east wall (Fig. 6 b no. 1324).
- 2b. Reconstruction based on a bronze censer dated about 1200, found under the floor of Limpsfield church, Surrey.<sup>41</sup>
3. Iron split tubular socket with tagged flange at one end (no. 1310) and
4. Iron bracket (no. 1309) found together in R.C.24A, 5 ft. east at 4 ft. 6 in., in top filling of ditch (Fig. 7c).
5. Iron key (no. 1315). R.C.24A, 5 ft. 5 in. east, at 3 ft. in upper ditch filling or bank slip above 3 and 4 (Fig. 7c). The type cannot be closely dated.<sup>42</sup>
6. Prick spur, with dropped arms (no. 1300). R.C.24, 3 ft. west at 3 ft. 2 in. in darker soil (Fig. 7b).<sup>43</sup>
7. Split-socket arrowhead (no. 1289). R.C.4A, 12 ft. west at 3 ft. 9 in. below flint foundations, closely associated with the rim (Fig. 9.9) (Fig. 7a).
8. Fragment of iron buckle. From pelvis of burial R.C.B.12 in R.C.7 at 3 ft. 10 in. (Fig. 4).

## STONE FINDS (Fig. 14)

By S. E. Ellis, B.Sc.

## Fig. 14

1. Part of a quern of Mayen lava. R.C.4A, 10 ft. east at 3 ft. in wall footings (Fig. 7a).

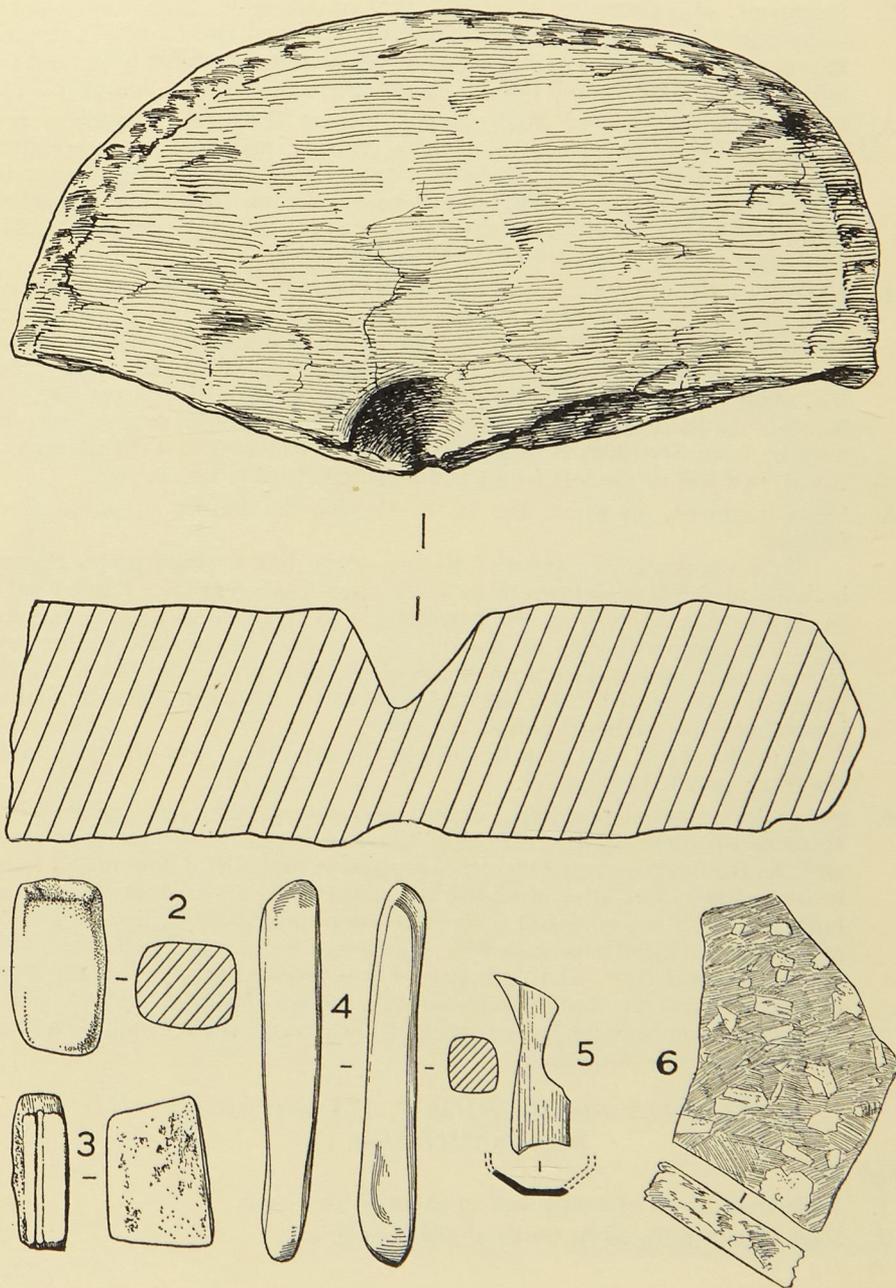


Fig. 14. Stone and Glass  
(1, quarter; remainder half)

2. Fragment of calcareous siltstone, indistinguishable from the Upper Greensand "Hearthstone" of Surrey, with smoothed and rounded corners. It is too friable to have been used as a hone and it may have been used to scour wooden platters and bowls. R.C.24, 33 ft. east at 7 ft. 3 in. (Fig. 7b).
3. Flat rhomboidal grooved stone, of spongy chert, the most probable source being the Lower Greensand of Kent or Surrey, although other possible sources in the Jurassic or Cretaceous rocks of the Midlands or North cannot be completely ruled out. The groove marks a plane of weakness parallel to the bedding and is probably natural, as may be the whole object. R.C.24, 49 ft. east at 4 ft. 2 in. in inner bank soil (Fig. 7b).
4. Hone (D.1287) of greywacke-stiltstone of common Lower Palaeozoic type, with angular to sub-angular quartz grains  $\cdot 01$ — $\cdot 05$  mm. in diameter, and some plagioclase feldspar, mica flakes, and chloritised volcanic glass, in a matrix corresponding to partially recrystallized argillaceous mud (i.e. mainly of quartz, chlorite, some calcite sericite and iron oxides). It has no distinctive characteristic suggesting a limited provenance; it may be from Southern Scotland, North-west England or Central Wales. R.C.4, just left of the left femur of burial R.C.B.52 (Figs. 7a, 3).
5. Glass fragment, on which Dr. D. B. Harden has kindly commented as follows:

"It is conceivably a piece of Roman glass, but I would prefer to put it down to the late eighteenth or early nineteenth century. I think that the inside of it is too shiny and bright for it to be as old as Roman, having regard to the weathering on the outside. It does not remind me of any Roman piece and it does remind me of the flat, hexagonal bottle which druggists have used for the last 150 years or so. I am quite certain that it is not from the medieval period".

R.C.24A, 11 ft. east at 9 ft., just in the sand edge near the bottom of the ditch (no. 1314, Fig. 7c).

6. Fragment of green porphyry, almost certainly *porfido verde antico* from Marathonisi (near Sparta), Laconia, Greece. Both the antique porphyry, and the Dublin porphyrites which are often so difficult to distinguish from it are variable, but after studying the range of available thin sections of both, Mr. Ellis has no doubt where this specimen belongs. The rock is an altered lava (chloritized andesite). South-east corner of the chancel, just above the sand floor. If this fragment was indeed deposited at the time of destruction of the church, as its position seems to indicate, and was not a Victorian curio brought back from Italy or Greece, it may well be a chip off the altar slab or quoins.

IRON NAILS FROM CHURCH, LOOM-WEIGHT AND  
BONE COMB (Fig. 15)

Fig. 15

1. Nails from south of south wall of chancel, and from
2. East of east wall, 10 ft. north of south wall, and

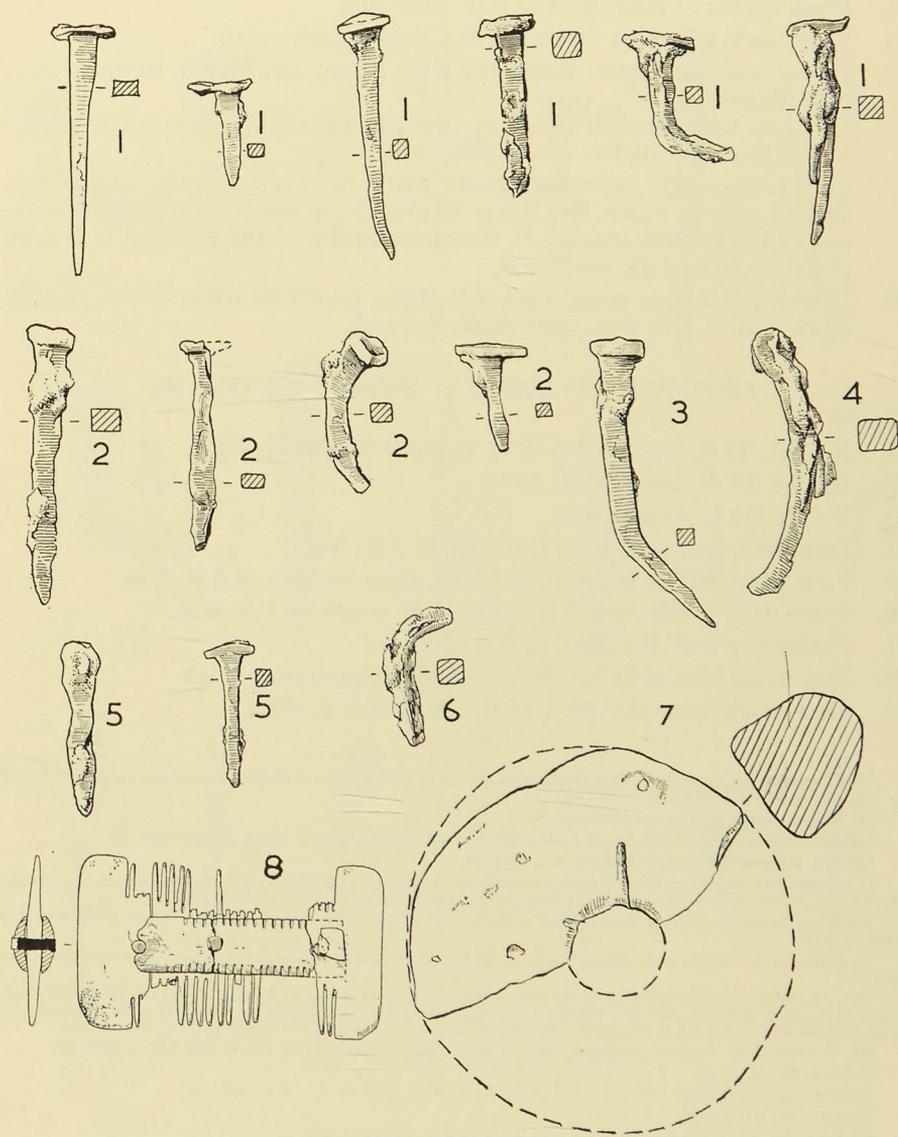


Fig. 15

1-6 Iron nails from church ; 7 Clay loom weight ; 8 medieval bone comb (all half)

3. From north-east of north-east corner stone, and
4. From rubble of floor, west of 6 ft. west, and
5. From dark soil chalk below cobbles in sanctuary, with
6. Below sanctuary floor, associated with Pagan and Middle Saxon pottery (not illustrated).

These nails, most of which are probably pre-Conquest, are rather better forged than the medieval ones (Fig. 16).

7. Clay loom-weight, showing groove made by warp threads, of the bun-shaped variety which Mr. Hurst thinks was in use from the ninth to the end of the twelfth century.<sup>44</sup> From spoil-heap at the east end of R.C.29, probably from dark sandy soil.
8. Double-sided bone comb with side-plates joined by three rivets. R.C.29, 30 ft. east at 2 ft. 8 in., just above natural.

#### IRON NAILS, MOSTLY MEDIEVAL (Fig. 16)

Fig. 16

1. R.C.4A, 13 ft. west at 3 ft. 3 in. in stone floor (Fig. 7a).
2. R.C.24, 19 ft. east at 6 ft. 10 in.
3. R.C.24, 59 ft. east at 6 ft.
4. Four nails (out of 9) from R.C.28B, at 5 ft. 3 in.
5. Four nails (out of 10) from R.C.28B, from midden at 4 ft. 8 in.
6. Spike with "cocks spur" R.C.28A, 7 ft. south at 4 ft. 6 in.
7. Fiddle-key nail, R.C.28A, at 2 ft. 3 in.
8. Four nails (out of 7) R.C.28A, just above perimeter track.
9. Three nails from R.C.28A, 13 ft. south at 5 ft. 6 in.

<sup>1</sup>F. Blomefield, *An Essay Towards a Topographical History of the County of Norfolk*, second edition (1805), Vol. II, pp. 7-9. He spells the crossing as *Ditcheuford*.

<sup>2</sup>T. Martin, *History of Thetford* (1779), pp. 9-10.

<sup>3</sup>*Flores Historiarum*, in *Corolla Sancti Eadmundi* (ed. Lord Francis Hervey, 1907), pp. 179, 185.

<sup>4</sup>Burrell, *Thetford Corporation Archives*, Vol. II, f. 50.

<sup>5</sup>Although the Saxon Town Ditch was later found to run beneath the earthwork, to east of the church, no trace was found in the present excavations, probably owing to the difficult character of the subsoil at this point.

<sup>6</sup>Compare the human teeth in the left hand of Burial S.22 at Snell's Corner, Hants.; *Proc. Hants. F.C.*, Vol. XIX (1958), p. 132.

<sup>7</sup>Compare the sarcophagi of the Saxon burials under the *bergfried* at Bad Godesberg: *Bonner Jahrbucher* 160 (1960), tafel 57.

<sup>8</sup>The relationship of these buildings to the town defences is hard to assess. If the ditch found to west of Red Castle is part of the early defences, then the church at this stage would have lain within the town. At some later stage the town defences were re-aligned to pass east of the church, which thus became, for a time at least, extra-mural.

<sup>9</sup>W. G. Clarke MS. *Thetford, prehistory*, etc., Norwich Public Library, THE, 942.61, MS. 124, L. 7321 (a).

<sup>10</sup>Martin op. cit., p. 70.

<sup>11</sup>Martin op. cit., p. 177.

<sup>12</sup>Martin, op. cit., p. 183.

<sup>13</sup>Leigh Hunt, *The Capital of the Ancient Kingdom of East Anglia*, p. 337.

<sup>14</sup>Leigh Hunt, op. cit., p. 404.

<sup>15</sup>V.C.H., Norfolk II 47.

<sup>16</sup>Dom Aelred Watkin, *Norfolk Record Soc.*, Vol. XIX, Pt. 11 (1948), pp. 141-6.

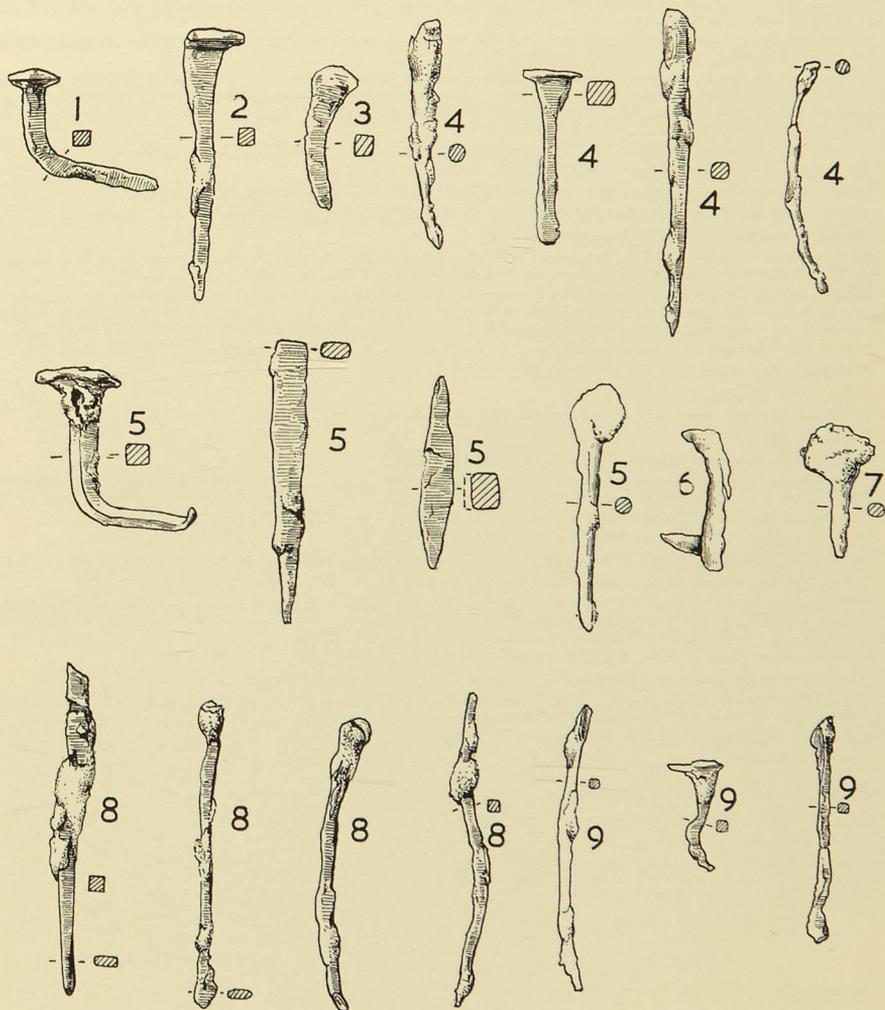


Fig. 16. Iron nails and spikes  
 1, RC 4A; 2 and 3, RC 24; 4-9, RC 28 (all half)

- <sup>17</sup>*Medieval Archaeology*, Vol. VI/VII (1962-3), pp. 65 ff., particularly pp. 103-108.
- <sup>18</sup>For detailed drawings, see forthcoming H.M.S.O. report on excavations on the site of the Saxon town.
- <sup>19</sup>Compare the fire-trench in the medieval Norse hall at Hvalsey, East Settelement, Greenland: Aage Roussell, *Farms and Churches in the Norse Settlements of Greenland, Meddelelser om Grønland*, 89.1, Figs. 87, 88, building IX and p. 191 and Fig. 118, building X.
- <sup>20</sup>Paul Nørlund, *Nordiske Fortidsminder*, Vol. IV (1948); Johannes Brøndsted, *The Vikings* (Penguin, 1960), pp. 162 ff. and *Danmarks Oldtid*, Vol. III (1960), p. 363.
- <sup>21</sup>For examples, see W. C. Braat's papers in *Oudheidkundige Mededelingen*, Vol. XXII (1941), Vol. XXIII (1942) and Vol. XXXV (1954), and C. Schuchardt, *Die Burg im Wandel der Weltgeschichte* (Potsdam, 1931), pp. 189 ff. Smaller works are discussed by L. Alcock, *Dinas Powis* (Cardiff, 1963) and M. de Bouard in *Chateau Gaillard*, Vol. I (Caen, 1964), pp. 23 ff.
- <sup>22</sup>*Antiquaries Journal*, Vol. XXXIX (1959), pp. 240 ff.; *Medieval Archaeology*, Vol. VI/VII (1962/3), p. 150.
- <sup>23</sup>For this typology, see *Antiquity*, Vol. XXXIII (1959), pp. 106 ff.
- <sup>24</sup>*Victoria County History of Cambridgeshire and the Isle of Ely*, Vol. II (1948), pp. 45-46, 16-17.
- <sup>25</sup>*Proceedings of the Suffolk Institute of Archaeology*, Vol. XXVII (1956), pp. 66 ff.
- <sup>26</sup>*Norfolk Archaeology*, Vol. XXXII (1960), pp. 232 ff.
- <sup>27</sup>Interim report to the Norfolk Research Committee dated 5 October 1962 by R. R. Clarke and Miss Barbara Green. For similar dated mottes, see *Chateau Gaillard*, Vol. I (Caen, 1964), pp. 127 ff.
- <sup>28</sup>The siting of the earthwork of Red Castle astride the Town Ditch suggests that the garrison was concerned either to protect or to control a population living within the Town Defences (cp. the siting of the earliest fortifications on the site of the Tower of London). Excavation of the town itself suggests that it was abandoned by about 1100.
- <sup>29</sup>*Pipe Roll 19 Henry II*, r.8m.1 (p. 117).
- <sup>30</sup>*Medieval Archaeology*, Vol. III (1959), p. 13.
- <sup>31</sup>*Ibid.*, Vol. III (1959), p. 14.
- <sup>32</sup>*Proceedings of the Cambridge Antiquarian Society*, Vol. L (1957), Figs. 1 and 2.
- <sup>33</sup>*Ibid.*, p. 30.
- <sup>34</sup>Compare *Medieval Archaeology*, Vol. III (1959), p. 17, Fig. 3,4.
- <sup>35</sup>Compare an eleventh-century example from Thetford, Herts.: *Journal of the British Archaeological Association*, Third series, Vol. XXVII (1964), p. 73, Fig. 19,1.
- <sup>36</sup>*Journal of the British Archaeological Association*, Third series, Vol. XXVII (1964), p. 77, Fig. 21,4-9.
- <sup>37</sup>*Trans. Bristol and Glos. Arch. Soc.* Vol. 71 (1952) 88 ff, Fig. 1.4.
- <sup>38</sup>Compare others from Thetford: *Proceedings of the Cambridge Antiquarian Society*, Vol. L (1957), p. 57, Fig. 8,47.
- <sup>39</sup>*Dark-Age Britain* (ed. D. B. Harden) (London, 1956), p. 244, note 47.
- <sup>40</sup>*British Numismatic Journal*, Vol. XXX (1962), pp. 6 ff. For similar coins of Wigraed, see *Numismatic Chronicle*, Third series, Vol. XIV, p. 18, Nos. 8 & 9; *Sylloge of Coins of the British Isles: Hunterian and Coates Collections, University of Glasgow*, No. 17 and ditto, *Fitzwilliam Museum, Cambridge*, Nos. 235, 236.
- <sup>41</sup>*Archæological Journal*, Vol. LXXXIX (1932), plate XII A opposite p. 13.
- <sup>42</sup>London Museum *Medieval Catalogue*, Fig. 42, type III.
- <sup>43</sup>*Ibid.*, Fig. 31.6 and p. 101 A 4987, dated c. 1200 but the type is known fifty years earlier: B. Hope-Taylor, *Report on the excavations at Lowe Hill, Wakefield, Yorkshire* (Wakefield, n.d.), p. 10, 2.
- <sup>44</sup>*Medieval Archaeology*, Vol. III (1959), pp. 23-5, Fig. 6.3.

REPORT ON THE HUMAN SKELETONS FROM  
RED CASTLE, THETFORD

By CALVIN WELLS, Ph.D., M.R.C.S., M.R.C.P., F.R.A.I.

INTRODUCTION

It will be clear from the main archaeological report on this site that the inhumations in the burial ground were tightly packed and much disturbed. As a result it is uncertain how many people were buried here but it seems possible to identify about eighty-five individuals. Of these less than twenty were approximately complete and only twenty-eight skulls survived in good measurable condition. This small number does not justify an elaborate statistical analysis but the group is, nevertheless, an interesting one and a few simple measurements and statistics will be given. A few hints about the pattern of life and general circumstances of these people can be obtained from non-metrical observations and details of their pathology.

*Age*

Of the eighty-five burials sixty-one are adults, twenty-four children.

Not all adults can be confidently aged but the mean age at death of the individuals listed in Appendices 1 and 2 is shown in Table 1.

TABLE 1. Age at death

<i>Combined males and females</i>	<i>Males</i>	<i>Females</i>
33.9 years (28)	38.1 years (13)	30.4 years (15)

As in most prehistoric, early historic or primitive groups the Red Castle females die at a younger age than the males. The somewhat high difference of 7.7 years may merely be due to the small number on which the estimate is based. This disparity between the sexes is usually explained as the result of the women being exposed to the hazards of childbearing. I believe, however, that this is at best an incomplete explanation in the present case. There is some slight evidence here that childhood malnutrition was commoner among the girls than the boys and this may have left them more vulnerable in later life. If the childbirth explanation is considered it will be seen that three principal classes of obstetric abnormality are likely to lead to maternal deaths:

- (1) Difficult or obstructed labour due to pelvic deformities;
- (2) Puerperal infection due to unskilled interference during labour or the puerperium;
- (3) Haemorrhage (caused by a variety of conditions, none of which would be identifiable in skeletal material).

It is interesting to find that Class 1—pelvic anatomical abnormalities—can be wholly excluded at Red Castle. No malformations likely to have an adverse effect on parturition were found.

The estimated age at death of the children is shown in Table 2.

TABLE 2. Distribution of ages at death of children

<i>Age in years</i>	<i>Number</i>	<i>%</i>
0—2	14	58·3
2—4	4	16·7
4—6	3	12·5
6—8	2	8·3
8—10	0	0·0
10—12	1	4·2
12—18	0	0·0

The mean age of all children's burials is 2·6 years. If these children are added to the twenty-eight adults of Table 1 the mean age for the group becomes 19·5 years but if allowance is made for undetected infant burials it is probable that the expectation of life (from birth) for these people was no more than about ten years.

The scarcity of individuals between the ages of 12 and 25 years might suggest that many teenagers and young adults were given to travel and, if they died, were buried away from home. What is more likely is that this period represents the decade of greatest vitality for the group. The hazardous years of infancy and early childhood having been safely passed, some degree of immunity from infectious diseases may have been acquired and the next ten or dozen years saw a vigour and resistance not equalled at any other time of life. There is evidence that this is so and that after the middle or late twenties a fairly rapid deterioration began which would account for the early age at death even amongst those who had successfully reached maturity.

#### *Sex*

Of the sixty-one adults identified at Red Castle it seemed justifiable to diagnose twenty-two as males and thirty-two as females—a somewhat unusual sex ratio. The failure to sex the remaining seven burials was due to their incomplete and fragmentary condition. It need only be said that sexual dimorphism in this group was well developed and seemed to be rather more pronounced than that found in other East Anglian populations of Anglo-Saxons, such as those from Caister-on-Sea and Thornham, Norfolk, or Burgh Castle and Eriswell, Suffolk. The preponderance of females cannot be explained in skeletal terms and must remain an archæological problem. But disregarding the seven unsexable burials it will be seen that there are only twenty-two adult males to fifty-six women and children.

#### *Physical type*

It is unfortunate that the archæological evidence for dating these burials is inconclusive because their interest depends in part on the age that can be assigned to them. Morphologically they are quite sharply distinguished from almost all Saxon groups in this country and they resemble much more closely some of the post-Conquest Medieval populations.

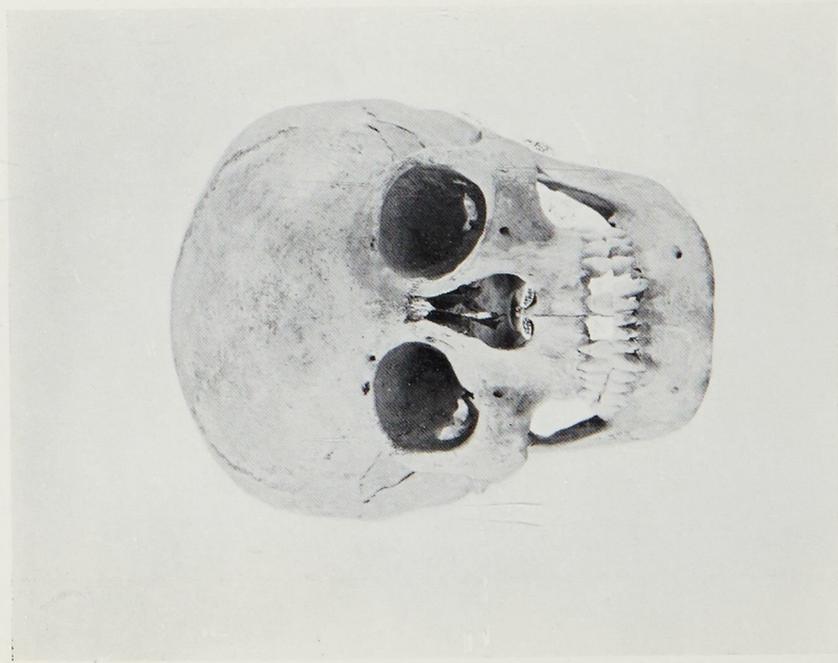


Fig. 1. Inhumation 24. Female.

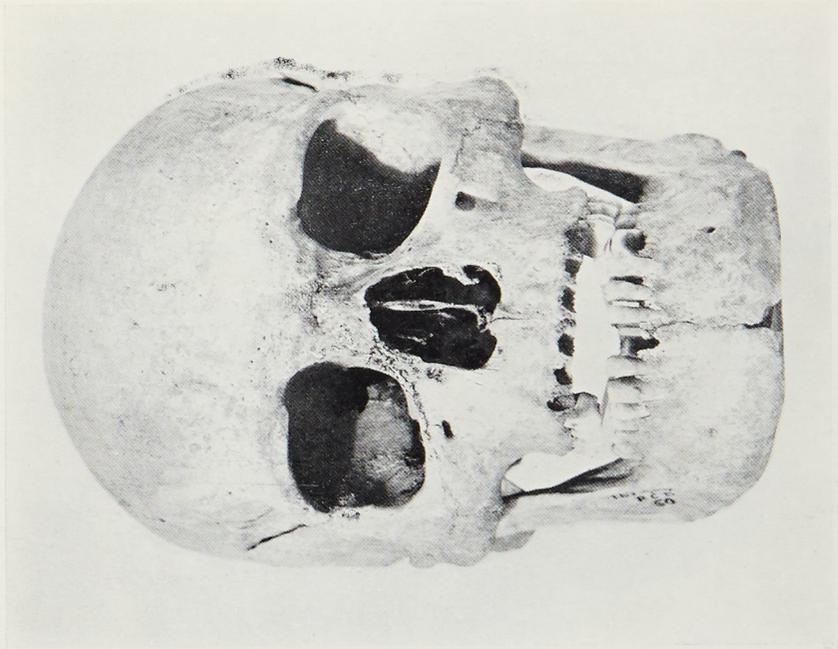


Fig. 2. Inhumation 50. Male.

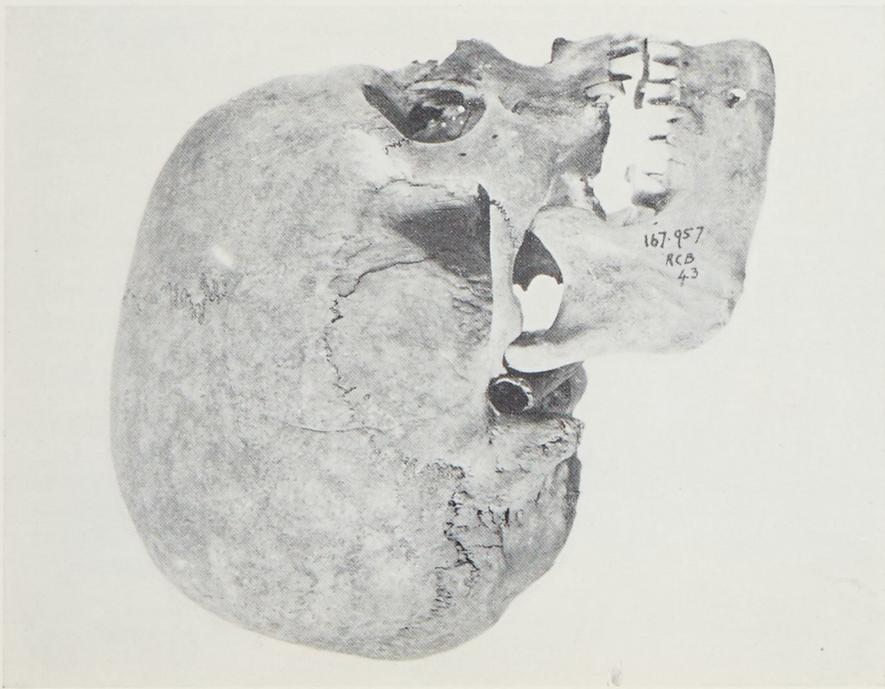


Fig. 3. Inhumation 43. Male.

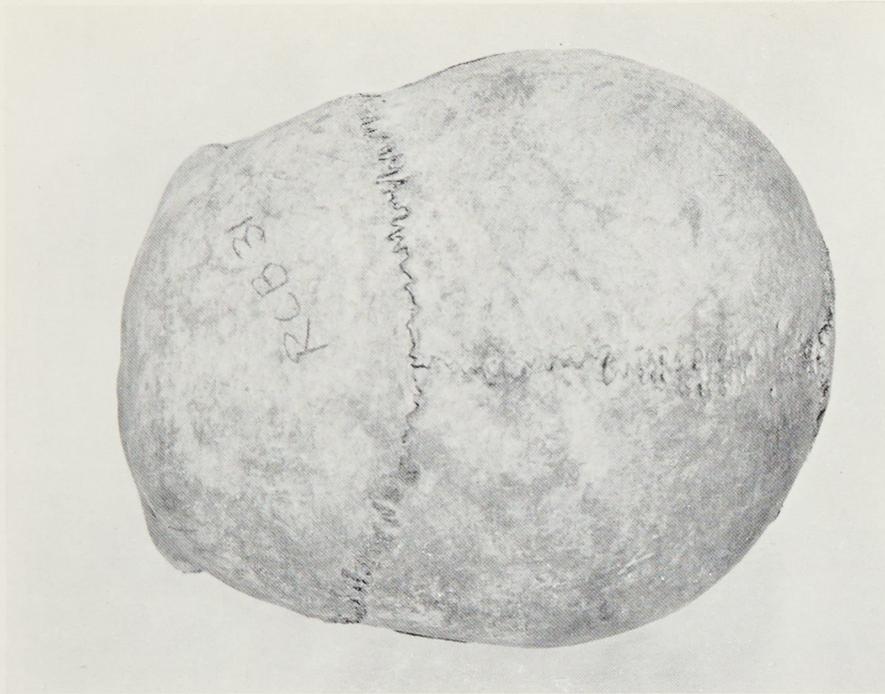


Fig. 4. Inhumation 31, Female. The asymmetry of this skull is probably the result of cradling habits.

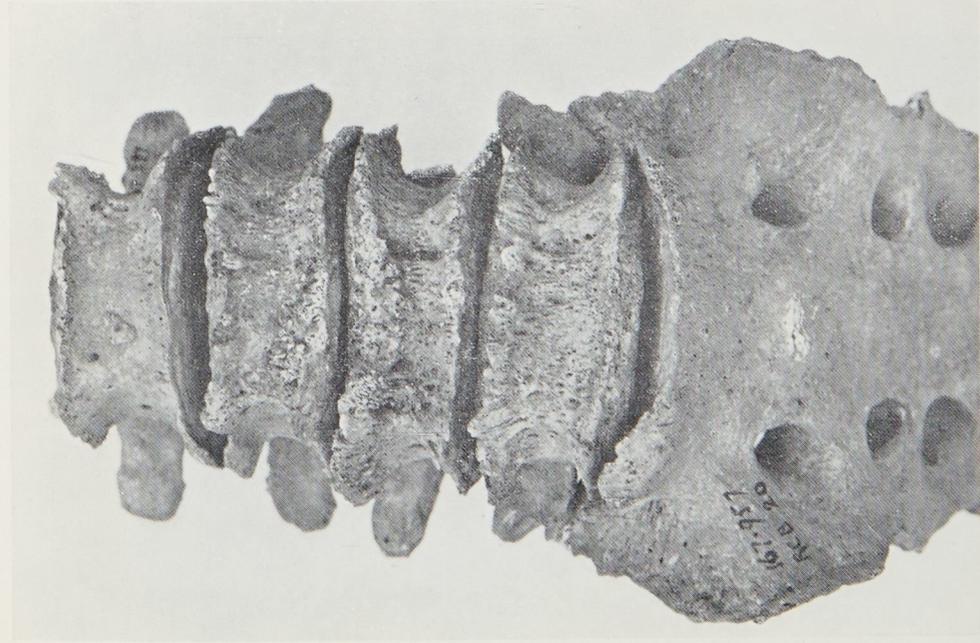


Fig. 5. Inhumation 20. Male. Osteophytosis and distortion of the lumbar vertebrae and sacrum.

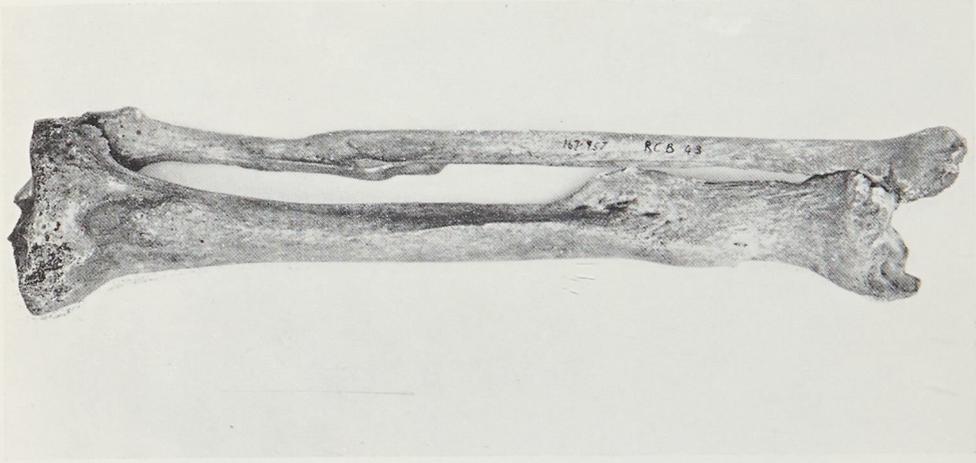


Fig. 6. Inhumation 43. Male. Fracture of the left tibia and fibula. Healing is sound but there is gross deformity of the bones.



Fig. 7. Inhumation 31. Female. Chronic infection of the right mastoid. Pus in the mastoid air cells has destroyed the bone and discharged through a fistula into the auditory canal.

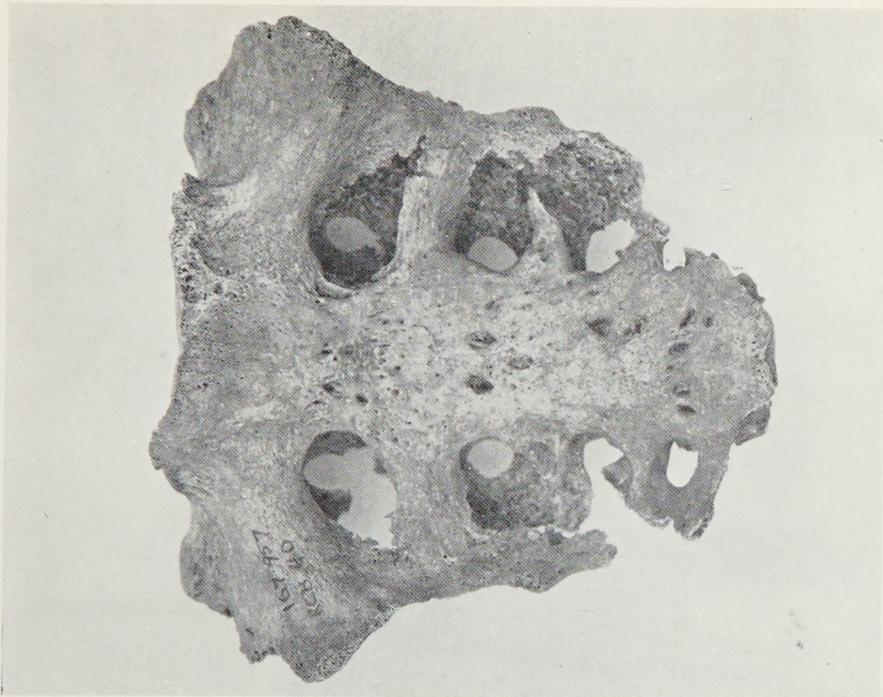


Fig. 8. Inhumation 40. Female. There is irregular osteitis of this sacrum with multiple small sinuses extending into the bone. It may be the result of a puerperal pelvic infection.

Individual cranial measurements are given in Appendixes 1, 2, 3 and 4; the means of measurements and indices in Appendixes 5, 6, 7, 8, 9 and 10. A simple statistical comparison with the well-known Anglo-Saxon group from Burwell, Cambridgeshire is given in Appendix 11.

Tables 3 to 7 briefly summarize a few proportions of the cranial architecture of the measured skulls.

TABLE 3. 100 B/L (Cranial Index)

<i>Class</i>	<i>Range</i>	<i>Number</i>	<i>%</i>
Dolichocranial	x—74·9	5	17·8
Mesocranial	75—79·9	7	25·0
Brachycranial	80—x	16	57·1

TABLE 4. 100 H'/L (Height—Length Index)

<i>Class</i>	<i>Range</i>	<i>Number</i>	<i>%</i>
Chamaecranial	x—69·9	6	24·0
Orthocranial	70—74·9	17	68·0
Hypsocranial	75—x	2	8·0

TABLE 5. 100 H'/B (Height—Breadth Index)

<i>Class</i>	<i>Range</i>	<i>Number</i>	<i>%</i>
Tapeinocranial	x—91·9	17	68·0
Metriocranial	92—97·9	7	28·0
Akrocranial	98—x	1	4·0

TABLE 6. 100 NB/NH (Nasal Index)

<i>Class</i>	<i>Range</i>	<i>Number</i>	<i>%</i>
Leptorrhine	x—46·9	6	27·2
Mesorrhine	47—50·9	9	40·9
Chamaerhine	51—x	7	31·8

TABLE 7. 100 O<sub>2</sub>/O<sub>1</sub> (Orbital Index)

<i>Class</i>	<i>Range</i>	<i>Number</i>	<i>%</i>
Chamaeconch	x—75·9	8	30·7
Mesoconch	76—84·9	15	57·7
Hypsiconch	85—x	3	11·5

It can be seen, therefore, that the Red Castle people were predominantly a round- or broad-headed group of moderate head height and with noses and eye-sockets of medium proportions. (Figs. 1, 2, 3 and 4). It is this high cranial index

that would be especially difficult to explain if they were to be dated two or three centuries pre-Conquest. It might then suggest that they had an affinity with some of the Frisian brachycranials from terp burials at Westergo and elsewhere. With the increasing brachycranialization of post-Conquest times this Red Castle head pattern would be much less remarkable.

An outstanding feature of these skulls is their lack of symmetry. In general it can be said that most well preserved British Anglo-Saxon skulls are strongly symmetrical and of a long ovoid or ellipsoid outline in *norma verticalis*. By contrast, one of the most obtrusive features of the Red Castle series is the frequency and extent of asymmetry that is found. This is primarily a plagio-cranial flattening of the occipital region, usually with some compensatory deformation across the frontal bone (Fig. 4). Of the measured crania eleven are plagio-cranial to varying degrees and to these may be added the adolescent Interment 8A. This gives a frequency of 41.3 per cent. Of these skulls five are males, seven females. They are all well preserved and the deformity is not due to post-inhumation warping.

Together they give a strong impression that it was produced artificially and if so it can be confidently asserted that it was accidental, not deliberate. The most likely cause would be some cradling or head-binding habit in infancy. Almost always when a baby is bound to a cradleboard it develops the habit of twisting its head slightly to one or other preferred side and thus acquires an oblique flattening of the occiput similar to that found at Red Castle. It is highly probable that cradle-binding was a regular custom with these people.

#### *Stature*

This has been calculated from the formulae of Trotter and Gleser (1952, for females; 1958, for males). The results are shown in Table 8.

TABLE 8. Stature: means and range

<i>Sex</i>	<i>No.</i>	<i>Mean</i>	<i>Range</i>
M	16	1697.1 mm. (5' 6 $\frac{3}{4}$ " )	1613.4 mm. (5' 3 $\frac{1}{2}$ " )—1753.8 (5' 9" )
F	17	1581.0 mm. (5' 2 $\frac{1}{4}$ " )	1518.7 mm. (4' 11 $\frac{3}{4}$ " )—1669.5 mm. (5' 5 $\frac{1}{2}$ " )

It will be seen that they were a people of medium height. The difference between the sexes is a little above that of an Early to Middle Anglo-Saxon group from Burgh Castle, Suffolk. This may be another expression of the relative malnutrition in the Red Castle females which has been suggested above.

#### *Pathology*

It cannot be too strongly emphasized that the pathology of a group is never randomly produced. It is invariably an expression of the stresses and strains to which the people were subjected, a response to their total environment both external and internal. It reflects the climatic conditions under which they lived, their habits of diet, their daily occupations, their choice of clothing or weapons, their social customs and their genetic inheritance.

The morbid conditions recovered from any excavation are, therefore, always of major importance. Unfortunately this subject has been much neglected in the earlier literature. Many excellent reports on skeletal material give little or no attention to pathology and with a few notable exceptions little has been published which deals methodically with this aspect of anthropology. Recently there have been attempts to remedy this but these efforts have often largely failed because their authors have had no clinical training and were unable to relate a post-mortem appearance to what really produced it during life. Just as adult anatomy is the end result of a long period of growth and must remain basically incomprehensible to anyone who has no exact and detailed knowledge of embryology, so the post-mortem pathological findings are the result of diseases occurring during life and can only be properly interpreted by someone familiar with what has led up to them. It is the task of the clinician to observe disease in living subjects, to study the minutiae of its development, the subtlety of its progress, and to construe the final picture in terms of what he knows about the vital processes preceding it.

That the importance of an adequate training in anatomy, physiology, clinical medicine and pathology is still insufficiently recognized by some anthropologists must be the justification for giving prominence to it here. It is precisely because we cannot ask the patient for the history of his case that a profound clinical knowledge is essential in solving the problems of palaeopathology.

By far the commonest disease at Red Castle is osteoarthritis. (This is not the same as rheumatoid arthritis.) Although much about its cause still remains obscure it is safe to say that osteoarthritis is partly traumatic in origin, due to a single severe injury or more commonly to the long continued repetition of lesser damage. The joints most often affected vary with differences of occupation. In agricultural communities the spine is often the main focus of attack and at Red Castle the vertebrae are, indeed, the site of election for the condition. This has a direct bearing on the rapid deterioration of physical well-being which, as suggested above, probably occurred in most individuals after the age of thirty, or even earlier. For in no part of the body is osteoarthritis likely to be so crippling and to have such generalized and far flung effects as when it attacks the vertebral column.

Twenty-eight (46 per cent) of the sixty-one adults show moderate or severe osteoarthritis. But many of these sixty-one individuals are represented by only a few bones and no more than seventeen bodies are even approximately complete. Yet, of these, fifteen (88 per cent) have well marked osteoarthritis. In individuals surviving to the fourth decade it was universal and only relatively early death explains its absence in reasonably complete bodies.

Although its site of election is the vertebral column its frequency is not the same at all levels. It is most common in the lumbar region, somewhat less so in the cervical and least frequent in the thoracic. In saying this it is important

to be quite clear about what is discussed. There is a common condition in which outgrowths of bone, or bony "lipping", arise from the margins of the vertebral bodies and may form bridges across the intervertebral disc spaces leading to fusion of adjacent bones. In another less common condition vertebral fusion follows ossification of the longitudinal ligaments. Neither of these is properly termed osteoarthritis. The first is osteophytosis, the second ankylosing spondylitis and both are excluded from the present discussion. By vertebral osteoarthritis I now intend only that form of the disease which affects the posterior intervertebral joints between the inferior articular processes of one bone and the superior processes of the bone below it. With this in mind the frequency of the condition at each spinal segment is shown in Table 9:—

TABLE 9. Frequency of osteoarthritis (O-A) and osteophytosis (O-P) in the spinal column

<i>Segment</i>	<i>O-A</i>	<i>O-P</i>	<i>Segment</i>	<i>O-A</i>	<i>O-P</i>	<i>Segment</i>	<i>O-A</i>	<i>O-P</i>
C1	4	0	D1	4	9	L1	10	8
C2	5	0	D2	0	7	L2	13	8
C3	11	6	D3	0	7	L3	21	14
C4	17	11	D4	2	8	L4	29	12
C5	14	11	D5	4	9	L5	27	13
C6	16	13	D6	2	11			
C7	6	7	D7	4	13			
			D8	4	13			
			D9	5	12			
			D10	8	11			
			D11	6	8			
			D12	8	6			

*Note:* For each segment the figures are based on the inferior pair of joints (O-A) or the corresponding margins of the adjacent vertebral bodies (O-P).

The differences are striking. The relative freedom of the dorsal or thoracic column is especially interesting even though its significance may be open to several interpretations. It may basically be connected with the normal pattern of movement possible at different levels: apart from the atlanto-axial joint, rotation can hardly occur at cervical or lumbar levels and is limited to the thoracic region.

Like osteoarthritis, osteophytosis is also partly traumatic in origin but its frequency in thoracic segments is much higher than arthritis.

A further point of significance can be found in the thoracic column at the joints for the heads of ribs on the vertebral bodies and at those for their tubercle articulations on the transverse processes. Osteoarthritis of these joints occurs in most adult burials at Red Castle and several segments are usually affected, especially of the costal facets on the bodies. In some instances fusion of rib and vertebra has occurred.

The total impression given by these costo-vertebral conditions is one of gross disability in the group as a whole, with rapidly increasing rigidity and limitation of movement amongst most of the older members. Males and females are about equally affected, as must be the case if its incidence approaches 100 per cent. Some of the worst examples of osteophytosis, associated with partial collapse of the vertebral bodies, occur in the cervical vertebrae (usually  $C_3$  to  $C_6$ ) of females. This might mean that the women of this group were accustomed to carry burdens on their heads. No other evidence exists to support this suggestion but the average shape of their heads would most admirably suit such a practice.

The next commonest sites of arthritis at Red Castle are the sacroiliac joints, the elbows and the feet. Lipping of the auricular surfaces of the sacrum and the ilia is present in fifty-six out of sixty-eight joints (82 per cent). To some extent this joint is affected by the same stresses which produce vertebral arthritis and the high incidence is not surprising. The elbow consists of three joints any one of which can be affected independently of the others. Ten of the adults (8 ♂, 2 ♀) have some osteoarthritis, usually at the humero-ulnar and proximal radio-ulnar joints. The condition is somewhat more common and distinctly more severe on the right side than the left. In the feet it may occur anywhere in the tarsus or metatarsus but four main foci are found. In descending order of frequency these are (a) the 1st metatarsophalangeal joint, (b) the talocalcaneonavicular joint, (c) the ankle joint and (d) the cubometatarsal joints. The incidence of arthritis in the foot is about equal for the sexes.

In the skull the temporo-mandibular joint was arthritic in seven individuals (4 ♂, 3 ♀). In at least one of these there was evidence that it may have been associated with recurrent dislocation—a condition which is not infrequently seen in modern jaws.

In seven individuals (5 ♂, 2 ♀) sixteen clavicular joints were affected: eight medial and eight lateral. Again there was a tendency for the lateral end of right clavicles to be more severely affected than the left but sternal ends were attacked equally.

Shoulder joints were affected in six males (5 right, 4 left). The milder cases were more readily detectable on the glenoid face of the joint than on the humerus. A few carpal, metacarpal and phalangeal joints showed mild signs of the disease.

In many early populations the knee joint is frequently attacked. A few are found at Red Castle. Interment 20 has moderate bilateral lipping of the femoral condyles; four other single specimens show slight or doubtful changes out of forty-six available. Interment 22 lacks the femora but the tibial heads are deformed by extensive lipping. Interment 46 has both acetabula and femoral heads grossly deformed. Apart from this only one other femoral head shows doubtful changes out of forty-six specimens.

The total distribution of osteoarthritis and osteophytosis permits a few tentative conclusions. There is little doubt that these people suffered from

extensive spinal strains of some kind or another. Their basic economy was presumably agricultural and a combination of working heavy, perhaps largely unbroken, land and the carrying of substantial burdens over rough, uneven surfaces would have produced sufficient vertebral injury to induce the profound pathological changes which are found. It has been noted above that partial collapse of some vertebrae is present in several inhumations (Fig. 5). This is sometimes associated with a "splaying" of the vertebrae at the levels of the metaphyses and with some exaggeration of the normal spinal curves. This is the picture produced by Scheuermann's disease, a condition developing in early adolescence. It is aggravated if not positively caused by weight bearing, straining the spine and repeated slight injury and may be associated with a condition known as Schmorl's nodes. These are extrusions of cartilage from the intervertebral discs which erode into the body of the bone. Slight irregularities of the disc surfaces of several vertebrae in the Red Castle series do occur and the overall picture makes it almost certain that Scheuermann's disease can be diagnosed here.

The extensive osteoarthritis which is found in the feet of the burials could similarly be caused by constant walking and working over rough ground. Unfortunately we know little about the foot-wear of these people. In a few cases the fifth metatarsal seems to be unusually bowed—perhaps due to the use of tight straps or sandal thongs. The frequent involvement of the cuboid may have some bearing on this. Although arthritis is common at the first metatarsophalangeal joint there is no suggestion here that hallux valgus occurred—that is the lateral deviation of the great toe which so often indicates cramping foot-wear.

The arthritic condition present in the knees presumably stems also from similar causes. The extreme mildness of the condition in this joint is, perhaps, surprising as is the relative absence of the disease at the hip joints. Severe arthritis of the acetabulum and the head of the femur is very common in both early and modern populations and the presence of only one really clear example, at Red Castle is remarkable.

The changes present in the clavicular, shoulder and elbow joints, as well as in the hand, reflect the vigorous use of the arms. Abrupt, jerky movements such as hammering, digging and hoeing hard soil, metal working and many other occupations would be likely to produce it. In most of these joints the right side is affected more severely—though hardly more often—than the left. This would accord with the greater trauma sustained by that side in normal conditions of predominant right handedness. In contrast to the lower limbs, arthritis of the arms is much more common in the men than in the women.

The presence of temporo-mandibular arthritis reinforces the dental evidence that considerable strain was imposed on the jaws. Food was almost certainly coarse and tough and a lifetime of hard chewing, even perhaps bone-gnawing, could reasonably be expected to leave its effects on this relatively delicate and complicated joint.

Nine individuals have fractures.

Int. 3 (♂) has a fracture of the left nasal bone and of the left orbital margin. This seems to be the result of a blow with some sharp weapon or tool. The frontal bone close to the fronto-nasal suture has been wounded and in line with it on the inferior margin of the orbit the maxilla has been shallowly incised. All wounds are firmly healed and it is unlikely that permanent disability was produced although damage to the soft tissues might have resulted in troublesome after effects. It is possible that the left lachrymal ducts were severed in which case overflow of the tears would have followed.

Int. 17A (♂). The right 6th rib has a fracture of the angle: it is well healed with little displacement. The left 5th rib is similarly broken and healed. Both could have occurred from a single antero-posterior crushing injury.

Int. 18 (♂). The right nasal bone has been fractured.

Int. 20 (♂). Both nasal bones have been fractured. Three surviving rib fragments, probably the left 6th and 7th and the right 5th have been fractured in the anterior half of the body. These breaks were probably due to direct violence at the site of fracture. The left tibia had a fractured malleolus.

Int. 31 (♀). There is a fracture in the distal third of the right fibula. It has healed well but there is extensive osteitis of the shaft. The right 3rd metatarsal has a mid-shaft fracture. Although it is possible that these injuries resulted from a single accident, it is likely that they derive from separate episodes. The metatarsal break probably followed direct injury from a blow on the foot but a spontaneous origin of the "march" fracture type cannot be excluded. The fibular fracture is characteristically due to indirect injury from a fall—typically one producing excessive twisting of the foot on the leg—but other causes are possible.

Int. 39 (♂). The left 4th rib is fractured at its angle but is well healed. It resembles the specimen from Int. 17A and contrasts with those from Int. 20 probably being due to indirect violence, perhaps caused by antero-posterior compression of the thorax.

The left humerus has a Y-shaped epicondylar fracture. It is well healed and has none of the severe deformity which commonly follows this type of injury although some slight arthritis of the elbow resulted. The bone is no shorter than its fellow on the right side. It was almost certainly produced by falling forward on an outstretched forearm.

Int. 43 (♂). The left tibia and fibula have been fractured (Fig. 6). Both bones were broken as a result of the same episode: the tibia obliquely through the lower third, the fibula through the upper third. The tibia is severely deformed as a result of this break. The distal fragment shows forward angulation through about 25 degrees and it has been drawn proximally by spasm of the calf muscles so that the bone is now 18 mm. shorter than its fellow. Superfluous

callus is present and arthritis has developed at the ankle joint. The fibula has about 25 degrees of posterior angulation at the site of fracture, a similar shortening and a similar excess of callus. Both bones are firmly healed and although the shortening of the limb must have made this man walk with a pronounced limp and the arthritic ankle would have left a stiff and painful joint the overall result of this severe fracture would be a tolerably efficient limb for most purposes of everyday life. Of the various ways in which this injury could be caused a likely one would be by catching the foot in a rut or pocket in the ground and snapping the bones by the weight of the body as the man fell. We cannot exclude, however, the possibility that it was produced by falling from a height. The positions of the tibial and the fibular fractures reduce the likelihood of this being a direct injury from a blow.

Int. 46 (♂). There is a Colles' fracture of the distal end of the left radius: it has healed with such perfect alignment and lack of surplus callus that only close inspection reveals its presence. This type of fracture is commonly associated with a crack through the styloid process of the ulna and on turning to that bone in the present case we can, indeed, see a very slight deviation of the tip of the bone which must have been part of the total injury. Also a tiny flange on the lateral side of the head of the ulna shows where a few fibres of the articular capsule were torn as a result of the springing of the bones; the tissues bled and subsequent organization of the clot left a ridge. A Colles' fracture is classically produced by falling on to an outstretched hand palm downwards. This man also has a fracture in the distal third of his left fibula. It is soundly healed with negligible deformity.

Int. 52 (♂). This shows a mid-shaft fracture of the right humerus just below the insertion of the deltoid muscle. This is one of the commonest of all fractures to result from *muscular action*. It may follow a movement such as throwing a cricket ball or be due to biceps-brachialis compression stress when lifting a heavy weight. The present example is well healed but there is an axial deviation of a few degrees in the line of the bone.

Several points of interest emerge from a consideration of all these fractures.

Firstly, eight of the nine individuals concerned are males. This implies that the Red Castle men led lives which were more active and exposed to greater trauma than the women. From the point of view of our own society this occasions no surprise, but taking an anthropological view it must be remembered that in some societies it is the women rather than the men who are exposed to the greater risk of injury. We may also wonder whether there was a basic difference, at Red Castle, between the osseous physiology of the two sexes. Although this cannot be proved it is, perhaps, just possible that dietary—especially calcium—deficiency was a factor in making the women's bones less brittle than those of the men. There is some slight evidence from the teeth and also from the internal architecture of the bones as shown by radiography that a difference in diet did exist between the sexes.

Secondly, the kind of violence which produced these fractures needs consideration. It would be a facile assumption to see these folk as a turbulent, bickering people whose frequent quarrels and fights led to the injuries which have been enumerated. Little evidence can be found to support such a view. When these fractures are examined with a full appreciation of their usual clinical background the majority of them are found to be those which result from ordinary domestic and occupational accidents. It is true that three individuals have broken nasal bones and that this is typically the injury produced by a punch on the nose. But it is almost equally typical of running into a tree in the dark or colliding with a door-post when drunk. For Int. 3 some explanation other than a simple blow is needed because it is evident that an instrument of some kind was the cause. This could just as well have been an accidental injury with a tool as a deliberate assault with a weapon but of all the fractures present this one is probably the most likely to be the result of aggression. The broken noses of Ints. 18 and 20 remain quite ambiguous.

The rib fractures are equally equivocal. A total of six fractures in five sides of three individuals is found. It is impossible to determine the precise way in which these breaks arose. Any of them could have been caused in a brawl but it is a fact that they are all of types which recur constantly either as a result of accidental falls on to a projecting object or as a consequence of front-to-back compression of the thorax. Some such pressure injury—from a slipping building timber or a refractory horse, for example—could easily have damaged the two ribs of Int. 17A and that of Int. 39. In addition to external violence fractured ribs are quite commonly caused by nothing more exotic than a paroxysm of sneezing or coughing—another example of fracture by muscular action.

All the other fractures which have been described are much more likely to be the result of accidents than of assault, so it must be accepted that the pathological findings at Red Castle give no justification for supposing these people to be unduly truculent. One other hall-mark of pugnacity is also lacking here: punched out incisor teeth. Three individuals have ante-mortem loss of one or more incisors but in each case this is associated with gross attrition of all surviving teeth and is evidently the result of disease.

Thirdly, the anatomical distribution of the lesions is interesting. Although Int. 43 has two fractures it is certain that they represent a single injury: the fibular fracture would normally accompany the grossly deformed tibial break. The radial and ulnar fractures of Int. 46 must also be viewed as a single episode. It is also quite possible that the humerus and rib of Int. 39 were injured simultaneously, though this is less certain.

From the three arm fractures no common aetiology obtrudes, each was caused by a different type of event though all were due to indirect violence. By

contrast, the four leg injuries show a very clear pattern: each could have been the result of a fall with severe twisting of the foot when traversing rough, uneven ground. In the case of Int. 46 the Colles' fracture may have followed a fall of precisely this kind: the left foot became inverted as the victim stumbled, he fell to the left, the fibula snapped and he extended his left arm in an attempt to save himself but broke it as he fell on it.

Fourthly, something must be said about the medical treatment of these conditions. And here it can be stated at once that no fracture shows anything but "natural" repair. Common sense suggests that the double leg fracture of Int. 43 would have been splinted to support the bones and give some comfort to the victim but the deformity remains just what it would have been if this had not been done. No reduction of the bones to their normal position has been achieved. Similarly for all the rest. In those instances such as the Colles' or the fibula of Int. 46 where the final anatomical result is nearly perfect we must assume that the original displacement of the broken surfaces was negligible. This cannot be proved. It is possible that the Colles' fracture was originally much more displaced and was reduced to its present position by traction and manipulation soon after it occurred but the balance of evidence makes this extremely unlikely.

Even today, unless the lung was torn, simple rib fractures such as we find at Red Castle would probably be treated by nothing more than rest. The nasal bones, too, could safely be left to repair themselves unless cosmetic considerations dictated plastic intervention. It is the limb fractures that might be expected to need surgical correction so it is especially interesting to see how well unaided nature has coped with these injuries apart from the gross lesion of Int. 43—and even that is solidly healed.

As far as the fibular fractures are concerned it is interesting that this bone survives (not always bilaterally) in twenty-one of the Red Castle adults and our three cases of fracture represent an incidence of 14 per cent of individuals with this injury. With this frequency the leeches of the time must have been thoroughly familiar with the condition and it is likely that more or less standard or traditional ways of dealing with it would have been practised. The relatively rare epicondylar fracture of Int. 39 would, by contrast, have to be dealt with on an *ad hoc* experimental basis.

We can summarize the evidence of these fractures as follows: there are twenty-two injured bones in nine individuals (this includes the damaged frontal and maxilla of the orbit of Int. 3). Most of these appear to be occupational injuries of the type sustained by men employed in heavy, vigorous work on a rough terrain. Firm evidence of assault as opposed to accident is lacking and it is also interesting to see that hand and finger injuries are absent from the group although it must be remembered that only a small percentage of the total metacarpals and phalanges has survived and further that many hair-line phalangeal fractures would be unrecognizable even if present.

The predominance of fractures amongst the males, with its implication of their exposure to severe physical hazards, has another aspect of interest. Taken by itself it might lead us to suppose that the women led sheltered and protected lives. That this was not the case is clearly shown by the equal sex incidence of osteoarthritis. A consideration of the total pattern presented by arthritis, osteophytosis and fracture leads us to infer that although both men and women worked hard physically there were distinct differences between the tasks allotted to the two sexes.

### Teeth

Dental decay is rare in this group. Omitting deciduous teeth, which show no trace of it, there are ten carious teeth amongst a surviving 638 (0.15 per cent). They are distributed among six individuals and consist of: Maxilla—two 1st premolars and two molars; Mandible—six molars. But the dental pathology was considerably higher than this because 136 teeth out of a total of 856 identifiable tooth positions had been lost during life.

Table 10 shows the distribution of the lost teeth.

TABLE 10

Tooth	MAXILLA			MANDIBLE		
	<i>Identifiable Positions</i>	<i>No. Lost</i>	<i>%</i>	<i>Identifiable Positions</i>	<i>No. Lost</i>	<i>%</i>
I <sub>1</sub>	52	1	1.9	57	3	5.3
I <sub>2</sub>	52	1	1.9	57	3	5.3
C	52	0	0.0	57	1	1.8
PM <sub>1</sub>	52	4	7.7	57	2	3.5
PM <sub>2</sub>	52	8	15.4	57	3	5.3
M <sub>1</sub>	51	23	45.1	57	17	29.8
M <sub>2</sub>	51	22	43.1	56	12	21.4
M <sub>3</sub>	48	25	52.0	48	11	22.9
Total	410	84	20.5	446	52	11.7

The combined tooth loss for upper and lower jaws is 15.9 per cent. This total loss of 136 teeth is spread over twenty-two individuals. In twenty-four instances both jaws are available for examination, in two individuals only the maxilla, in five only the mandible. Only seven combined dentitions can be recognized which have not lost any teeth during life.

Throughout the group attrition of the occlusal surface is very heavy. Deciduous teeth are often severely eroded before being shed and in quite young adults the second and even the third molars may have their crowns almost completely removed by this excessive wear. It is evident that the diet of these people must have been extremely coarse and abrasive. Probably their querns shed abundant grit into their flour. In view of the low caries rate, the high

antemortem tooth loss amongst this relatively short-lived population was presumably due to erosion of the occlusal surface of the teeth—especially the molars. In many instances it is likely that the roots were shed only after the crown had been completely eroded. Fracture of the teeth by bone gnawing or nut cracking may also have contributed to this process (Fig. 3).

Occasionally loss of a relatively unworn tooth may have resulted from the development of a paradontal abscess around it. These are one of the commonest pathological findings in most Anglo-Saxon and Medieval populations. Red Castle is no exception. Table 11 shows the number of paradontal abscess cavities identifiable in males and females:—

TABLE 11

<i>No. of individuals</i>	<i>Abscess cavities</i>		
	<i>Maxilla</i>	<i>Mandible</i>	<i>Total</i>
Males (6)	7	5	12
Females (8)	5	5	10
Total 14	12	10	22

A tentative estimate is that about one-third of the population suffered from this disease which in some instances was clearly a chronic condition associated with sinus formation and persistent discharge of pus from infected cavities. A chronic oral infection of this kind leads easily to acute or chronic respiratory infection and other more generalized septic conditions. The toxæmia produced by these abscesses and their sequelæ must have been another potent factor in bringing about the rapid physical deterioration that has been postulated for these people.

Many of these paradontal abscesses no doubt also arose as a direct result of their diet. Husks of grain, fish bones, spicules of chicken bone, etc. may readily set up this condition if they become lodged between the neck of a tooth and the bony alveolus (Fig. 3).

A few miscellaneous conditions deserve special comment.

Cribra orbitalia occurs in four of the skulls. This is of uncertain origin (Møller-Christensen and Sandison, 1963) but may perhaps be a deficiency disease. It may or may not be associated with a similar appearance in the bones of the cranial vault—a condition which is not found at Red Castle.

Moderately severe osteitis is present on a few long bones other than those with fractures. It is present in Ints. 22 (R. fibula) and 43 (R. tibia).

The surviving (distal third) fragment of a right tibia from Int. 31A is peculiar. It shows a condition suggestive of early Paget's disease, with uneven

thickening of the cortex. A small osteoma is present on the R. maxilla of Int. 4B close to the piriform opening; another occurs on the L. tibial shaft of Int. 34; another on the L. mandibular condyle of Int. 38. All are small and of the "ivory" or "button" osteoma type.

Int. 9A is remarkable for the lightness and gracility of all the surviving bones. Muscle markings are extremely feeble and the impression given by this body is one of extreme under-development due to chronic malnutrition or chronic constitutional disease of some kind.

Int. 47 has a small organized haematoma on a proximal phalange of one finger—probably a simple occupational injury.

Int. 43 is interesting because it shows clear evidence of sinusitis in the form of an osteitic reaction inside the left maxillary antrum. (It is visible owing to a post-mortem defect in the bone.) The condition seems to be due to the erosion of a paradontal abscess round the root of M<sub>2</sub> into the antrum.

#### *Causes of Death*

So far no cause of death has been noted. In two of the inhumations, however, there is a high probability that we can see the lethal process. Int. 31 has extensive disease of the right mastoid region in which spontaneous drainage occurred into the auditory meatus (Fig. 7). This by itself would hardly justify the assumption that it was a fatal condition but on examining the interior of the skull a minute opening into the sulcus sigmoideus can be seen. This is the mastoid foramen and there appears to be some roughening of the bone around it which may represent a spread of infection into the venous sinus with subsequent fatal thrombosis.

The other possible case is Int. 40. Here the anterior surface of the sacrum shows evidence of severe infection. Osteitis of the bone has led to irregular proliferation in an attempt to repair and seal off the infection. Multiple sinuses extend into the bone, however, and it is impossible to look at this without visualizing a most serious clinical condition of some kind (Fig. 8). To permit this bony reaction the victim must have lived for at least a week or two but the associated pelvic cellulitis or abscesses probably proved fatal. This is a female and it is possible that it represents the catastrophic results of a difficult labour. The rest of the pelvis is too deficient to reveal its obstetric potential. No obvious defect can be seen in the surviving fragments of the innominate bones, but many obstetric complications (impacted twins, hydrocephaly, etc.) could produce obstructed delivery needing dangerous interference even with a normally developed pelvis.

#### *Estimation of Illnesses*

A method of estimating the amount of illness, especially infections and protein starvation, during the growing period of childhood and adolescence has been evolved (Wells 1961; 1964). It depends on the radiographical identification

of lines of arrested growth—Harris's Lines—in long bones. This can be used to compare the amount of juvenile morbidity between different populations and to elicit information about the age and sex incidence of disease.

From Red Castle the tibiae of thirty-five adults were X-rayed and it was found that individuals ranged from none to twelve lines per bone, with an average for the group of 1·8. Some perspective is given to this by noting that a group of Bronze Age pastoralists from Crichel Down averaged only 0·8 lines per bone whereas the Early Saxons from Caister-by-Yarmouth averaged 5·1. At Red Castle 43 per cent of the individuals had no Harris's lines at all, which implies that throughout their childhood no illness was severe enough to arrest growth.

A few negative details may be noted. The absence of *cribra frontalis* or *parietalis* has already been commented on, as has the absence of pelvic deformity. No trace of rickets was present in any of the bodies. Syphilis, *as we know it in later periods*, is absent, though whether some of the examples of osteitis are thought of as being possible examples of this condition presumably depends on whether one is prepared to accept the possibility of pre-Columbian syphilis or not. My own view about these cases is that it would be unwise to reject them as potential examples of treponemal infection although other explanations are undoubtedly feasible. Some of the Red Castle radiographs strongly suggest syphilis. Neither leprosy nor tuberculosis has been identified at Red Castle. Congenital dislocation of the hip and Perthes' disease are also absent. On the surgical side no evidence was found of amputation of limb or digit, and finally, no hint of trephination.

#### *Decapitations*

Two skulls are especially interesting because they had been decapitated.

Int. 9 consists of a cranium, two fragments of atlas and the dens of the axis. It was found in a hollowed-out basin of earth which had been carefully lined with flints and chalk blocks. No other body was in any degree intermingled with this inhumation and it is clear that it must have been decapitated. The plane of decapitation was close below the skull for both mastoid processes have been truncated and the occipital squama behind and to the left of the foramen magnum has been damaged. Yet about two-thirds of the anterior half of the atlas survives, including the fovea, and the amputated dens of the axis is perfectly preserved.

The skull is heavily built with strong muscle markings and prominent supra-orbital ridges. It is a long ovoid in *norma verticalis*, very different in general architecture from the mean pattern of this group, but closely resembling the typical Anglo-Saxon skull as found in many East Anglian burial grounds. The mandible is sturdily built and in perfect condition except for damage to the lower half of the posterior border of the ramus. This was presumably caused by

the follow through of the decapitating weapon. This skull is very considerably darker and greyer than any other from Red Castle except Int. 35. The difference must be entirely due to soil staining and strongly suggests that it had been interred previously in another place where the soil was darker.

Int. 35 consists of a cranium and a fragment of atlas. It was found in a hollowed-out basin of earth which had been lined with flints and small blocks of chalk. The way in which it was placed was almost identical with Int. 9 and clearly this, too, had been decapitated. This skull, like Int. 9, is a distinctly different colour from the rest of the skulls in this series—presumably from previous burial elsewhere. The facial skeleton broke away and disintegrated at the time of excavation but the mandible survives, although with damaged posterior borders similar again to those of Int. 9. Both mastoid processes have been truncated at their bases and also, apparently, the left occipital condyle. The pattern of this skull is very close to that of Int. 9.

The Red Castle group as a whole is a brachycranial population made up of two distinct elements, (a) a low to medium brachycranial stock with a moderately steep frontal region, a plano-occipital rear and a tendency to plagiocrany; (b) a dolichocranial or low mesocranial strain, with symmetrical long ovoid skulls, a tuber occipitale and rather sharply quadrangular orbits.

Both Int. 9 and Int. 35 are morphologically clearly set apart from the brachycranial group and fit quite well into the much smaller dolichocranial moiety. What the social relationship between the two groups may have been it is impossible to conjecture. As far as these decapitated skulls are concerned we might see them as beheaded enemies or "headhunter's" trophies. If this were the case their interment in carefully lined basins amidst their presumed captors does not seem easy to accept. A more likely explanation would be that these skulls were especially revered as being those of distinguished members of the community and possibly, in view of their divergence from the general cranial shape, members of an elite ruling aristocracy. This view is reinforced by the very strong suggestion offered by their distinctive colour that this man and woman have been brought to Red Castle after having been buried for a time elsewhere.

### *Method*

The measurements, method of measurement, and coding follow those of Morant (1922) except for a few minor modifications. These are the following: in the appendices recording individual measurements and indices Morant's two categories of doubt "?" and "??" have been merged in one and recorded as "?". His category of presumed inaccuracy "[ ]" has been omitted. In determining the Frankfort plane if both orbitalia are absent the vertex has been arbitrarily assumed to be 12.4 mm. behind bregma for male skulls and 14.1 mm. for females, these figures being the respective mean distances on intact skulls. Where the nasion cannot be determined as the point of junction of the inter-nasal and the fronto-nasal sutures, owing to loss of the nasal bones, it has been

taken as the highest point on the fronto-nasal suture. This may or may not lie in the median sagittal plane. Nasal and orbital heights and orbital breadth are taken on the right side if available whenever they cannot be taken on the left. For mandibles Morant's techniques have been exactly followed.

### *Summary*

The group of bodies excavated at Red Castle, Thetford is one of great interest. The total number of individuals represented is probably about eighty-five but of these only thirteen males and fifteen females are suitable for anthropometric analysis. A further two dozen bodies are moderately satisfactory as far as identification of sex and age is concerned.

The chief point of interest about this community is its divergence in physical type from most other East Anglian groups of roughly similar date. From the end of the Roman Period until well into Medieval times—at least until the thirteenth century—a cranial pattern is found which, despite a wide range of variation, is basically either long-headed or verging on it. It is a type which we have come to think of as "Anglo-Saxon" and bears a general similarity to the well-known series of that date from Burwell, Cambridgeshire. The Red Castle population is quite distinct from this. Although it has a high variability it is predominantly a round-headed series bearing a considerable likeness to later round-headed groups of fourteenth—fifteenth century date from Hythe, Kent and Rothwell, Northamptonshire.

The origins of these Red Castle folk remain obscure. The archæological evidence is too meagre to provide the answer and this places a heavy burden on the anthropologist. Unfortunately insufficient comparable material of known date and provenance is available and again the solution is left open to doubt. Possibly a Frisian source has contributed to this unusual group and it is highly probable that further continental discoveries will eventually throw a clearer light on its affinities.

In general the bones are well preserved so that it has been possible to gather substantial evidence about the skeletal proportions, anatomical characteristics and pathology of the group.

Osteoarthritis was the commonest disease found: probably most adults suffered from it. Paradental abscesses round the roots of teeth were also extremely frequent, affecting about a third of the population, together with severe dental erosion which was no doubt due to the coarse diet.

A somewhat unusual feature is the fact that females outnumber males in this burial ground. No certain explanation of this is possible. By contrast, the age distribution of the group is similar to that of many populations from early cemeteries. The mean age at death is very low and men outlive women by several years.

A curious and unsolved puzzle is the occurrence of two decapitated heads of the long-headed Anglo-Saxon type. One is a male, one female. Both seemed to have been re-interred at Red Castle after previous burial elsewhere.

The skeletal remains from this site are now preserved in the Castle Museum, Norwich (Accession Number: 167.957).

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## APPENDIX 1. Individual measurements of male crania

Skull	Age	L	B	B'	B''	H'	OH
3	55	183.0	146.4	95.0	121.2	135.2	115.1
4E	33	178.6	147.8	95.4	120.0	130.2	113.2
6	30	179.1	154.2	102.1	126.7	135.6	117.8
9	40	186.7	138.8	93.6	119.1	129.7	110.7
13	42	185.2	140.2	95.7	120.6	128.0	107.7
18	38	172.1	150.3	96.1	124.2	126.6	114.7
20	42	189.0	163.6	111.2	141.6	133.2	118.8
39	28	179.5	154.5	97.3	129.7	129.6	115.4
43	34	181.5	150.0	101.1	124.1	136.0	116.8
46	38	191.1	140.1	93.5	113.4	137.6	110.6
47	35	180.5?	149.2	105.3?	128.6	134.3	117.2
48	40	192.7?	137.5?	97.5?	112.0?	133.2	107.9?
50	40	195.0	142.1	101.1	118.6	137.2	111.7

## APPENDIX 2. Individual measurements of female crania

Skull	Age	L	B	B'	B''	H'	OH
4A	28	175.0	133.3	97.1	117.1	123.2	106.6
4B	35	171.3	145.1	95.6	120.2	123.5	110.9
4D	30	176.3	142.8	94.0	116.3	126.3	106.6
5	30	174.1	139.7	89.2	113.0	128.9	111.4
8	34	179.2	141.3	89.5	113.3	127.8	110.3
17	28	181.4	145.2?	97.1	125.1	—	116.1
24	29	163.0	151.8	91.3	120.4	124.1	112.2
25	30	168.2	140.0	92.8	115.5	120.7	110.3
31	28	176.1	141.1	93.7	121.7	126.8	110.6
33	27	180.6	140.1	94.5	120.2	—	99.6
34	33	181.5?	156.2?	104.7	123.4	—	108.0
35	31	182.1	138.6	91.1	115.5	120.0?	107.6
37	23	178.3	132.0?	86.5	120.2	123.5	109.2
41	42	176.2	134.1	89.1	109.7	120.0	100.2
42	28	176.1	137.2	95.0	121.3	124.1	103.6

Q	S	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S' <sub>1</sub>	S' <sub>2</sub>	S' <sub>3</sub>
320.1	364.5	128.0	117.9	118.6	114.0	106.2	98.4
312.1	365.2	120.9	121.0	123.3	108.7	109.7	98.0
333.4	372.4	132.1	122.5	117.8	116.4	109.1	93.2
307.2	362.7	122.8	127.9	112.0	108.2	117.9	90.1
301.7	369.1	123.2	121.3	124.6	108.9	105.0	99.4
326.4	361.8	126.3	122.2	113.3	111.9	105.6	92.5
343.7	377.5	131.6	125.3	120.6	114.9	108.6	95.3
324.6	367.1	125.5	121.2	120.4	111.4	109.3	95.7
316.8	374.8	122.3	128.6	123.9	107.3	112.8	102.2
303.8	384.0	132.5	128.3	123.2	113.0	117.4	99.8
323.2	368.5	128.4?	121.5	118.6	109.4	109.5	97.6
297.6	371.6?	129.7?	128.5	113.4	115.3?	118.3	90.0
310.5	380.6	135.6	130.3	114.7	118.0	116.8	89.1

*continued overleaf*

Q	S	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S' <sub>1</sub>	S' <sub>2</sub>	S' <sub>3</sub>
294.8	340.8	115.7	118.6	106.5	103.8	108.7	94.1
312.3	351.0	117.2	113.1	120.7	105.8	101.3	96.7
300.3	350.6	114.7	124.6	111.3	102.0	111.2	93.2
305.5	357.8	121.0	125.4	111.4	108.2	113.0	94.6
302.8	357.0	117.8	117.8	121.7	104.1	108.2	99.3
316.5	373.3?	132.0?	123.8	117.5	112.3	110.9	100.6
326.5	343.1	126.2	109.4	107.3	110.3	95.7	89.9
306.4	348.8	125.2	112.2	111.4	110.5	100.0	88.3
306.5	361.6	122.0	123.9	115.7	103.0	109.6	94.1
283.5	348.3	114.1	119.0	115.2	99.4	107.8	93.1
308.5	368.4?	114.5?	123.7	130.2	103.9?	109.5	105.1
301.5	372.1	129.5	127.7	114.9	112.1	113.2	94.3
297.3	367.7	124.2	128.2	115.3	107.4	114.9	91.2
281.6	351.7	118.3	112.6	120.8	102.8	102.9	94.7
293.4	360.1	128.8	115.5	115.8	108.1	105.0	93.2

*continued overleaf*

APPENDIX 1. Individual measurements of male crania—*continued*

Skull	Age	fml	fmh	PH	GL	G'H	LB	NH
3	55	39.1	29.0	20.9	91.3	73.6	105.2	53.5
4E	33	29.3	28.0	19.8	88.0	64.4	96.3	48.9
6	30	31.0	—	20.9	96.6	73.0	106.2	53.3
9	40	31.9	—	23.6	96.0	70.8	103.5	49.4
13	42	37.4	29.8	19.7	95.1	73.0	100.2	56.0
18	38	27.5	28.6	25.0	92.0	72.8	97.3	48.3
20	42	37.6	31.3	21.2	100.8	73.1	109.2	53.2
39	28	34.3	30.0	23.0	91.8	68.2	97.1	48.7
43	34	34.8	34.3	21.7	100.0	71.8	104.4	50.1
46	38	32.8	28.1	19.0	102.3	65.7	105.0	47.0?
47	35	40.1	36.8	23.2	92.4	73.9	97.3?	55.4?
48	40	35.4	31.8	—	—	—	109.0?	—
50	40	37.6	34.5	22.0	115.8	69.5	113.1	49.1

APPENDIX 2. Individual measurements of female crania—*continued*

Skull	Age	fml	fmh	PH	GL	G'H	LB	NH
4A	28	36.4	29.4	23.5	98.1	71.2	98.1	50.1
4B	35	31.1	28.4	20.5	92.0	71.1	97.1	53.4
4D	30	38.8	30.0	20.3	90.2	64.9	95.4	47.1
5	30	33.5	29.3	19.1	89.1	63.0	95.2	45.0
8	34	36.8	29.1	22.0	88.9	69.0	97.2	49.9
17	28	—	—	15.0?	—	70.5?	—	51.3?(R)
24	29	32.8	28.7	20.8	89.8	62.1	89.1	45.8
25	30	30.0	25.2	21.8	93.5	68.2	92.1	48.0
31	28	32.3	30.9	18.9	86.1	67.8	95.6	48.6
33	27	—	—	21.7	—	70.3	—	50.5
34	33	—	—	16.6?	—	69.0?	—	52.0?
35	31	33.6?	29.0	—	—	—	96.1?	—
37	23	37.4	29.9	—	—	—	86.5	—
41	42	34.8	29.2	17.0	85.2	64.0	93.7	50.0
42	28	34.1	28.9	12.9	94.2	61.3	90.0	48.8

NB	G <sub>1</sub>	G' <sub>1</sub>	G <sub>2</sub>	EH	EOW	IOW	GB	J
23.3	47.9	42.0	—	—	105.5	99.9	98.5	139.8
23.8	44.1	41.3	40.2	12.1	103.5	93.5	91.2	127.0?
27.1	48.0	40.2	43.0?	12.5?	111.9	102.3	97.4	143.0
27.6	50.0	44.9	—	—	109.0	102.9	98.7	141.2
25.2	57.3	49.4	44.1	11.1	106.7	99.5	98.8	136.2
26.4	51.1	49.2	38.0?	—	105.3	99.0?	91.2	132.3
26.1	50.0	44.6	46.0?	—	118.1	108.0	105.6	152.8
23.0	51.1	49.3	40.6	10.8	105.6	99.2	95.5	—
—	56.3	50.8	—	—	108.3	103.2	87.5?	137.2
—	53.0	48.1	42.1	11.5	104.7	94.1	95.6?	—
28.2	52.7	46.9	39.0?	10.2?	111.4	103.0	101.5	—
—	—	—	—	—	108.3	102.7	—	137.8
26.4	59.2	54.3	46.0	18.1	114.1	108.5	101.0?	—

*continued overleaf*

NB	G <sub>1</sub>	G' <sub>1</sub>	G <sub>2</sub>	EH	EOW	IOW'	GB	J
25.9	52.7	47.4	—	—	105.1	98.2	93.1	131.6
24.0	50.1	45.7	—	—	106.3	100.9	88.3	131.0
24.3	51.9	45.0	37.5?	12.1?	102.3	96.6	94.5	—
22.5	49.0	43.9	37.8	12.1?	97.1	92.0	84.0?	—
22.3	49.8	45.0	34.8	12.3	97.8	93.6	90.5	121.3
—	49.9?	44.8?	—	—	104.7	97.1	—	—
24.1	43.2	40.9	37.4	12.9	98.2	93.0	86.5	127.6
25.0	53.2	48.3	39.2?	13.6?	101.8	98.3	96.7	131.3
23.2	43.1	39.8	—	—	102.7	97.0	96.4	127.0?
24.9	50.5?	43.3	—	—	99.2	93.8	91.9	133.0?
24.0	—	—	—	—	110.6	103.5	96.4?	136.3?
—	—	—	—	—	101.8	96.2	—	—
—	—	—	—	—	90.2?	83.3?	—	—
22.3	44.0	41.1	—	—	98.2	90.3	87.1	125.4
24.2	43.8	38.9	42.0?	—	103.4	94.1	97.1	125.4

*continued overleaf*

APPENDIX 1. Individual measurements of male crania—*continued*

Skull	Age	O <sub>1</sub>	O <sub>2</sub>	U	< N	< A	< B	OcI	100B/L
3	55	42.2	38.0	519.8	58.3	78.5	48.2	59.63	80.00
4E	33	39.2	28.1	516.2	63.0	76.3	40.7	56.70	82.75
6	30	42.4	37.2	535.1	62.1	75.9	42.0	56.46	86.10
9	40	44.0	35.0	517.0	63.8	74.8	41.4	57.38	74.34
13	42	41.5	32.1	516.8	63.0	69.8	47.2	56.88	75.70
18	38	44.0?	32.1	516.1	63.7	71.1	45.2	58.35	87.33
20	42	42.3	34.4	567.0	64.3	75.1	40.6	56.42	86.56
39	28	44.5(R)	31.8(R)	529.8	64.2	73.7	42.1	56.58	86.07
43	34	47.0(R)	36.0(R)	531.2	66.7	71.8	41.5	59.15	82.65
46	38	41.8(R)	27.3(R)	526.3	65.1	77.3	37.6	57.84	73.31
47	35	43.2?	37.1	533.4	63.7?	70.6?	45.7?	58.96	82.66
48	40	42.5?	32.5?	528.0?	—	—	—	56.62	71.35
50	40	48.8	35.0	540.9	74.3	70.2	35.5	55.64	72.87

APPENDIX 2. Individual measurements of female crania—*continued*

Skull	Age	O <sub>1</sub>	O <sub>2</sub>	U	< N	< A	< B	OcI	100B/L
4A	28	43.5	29.9	493.5	68.3	68.9	42.8	67.67	76.17
4B	35	43.5	33.5	503.7	64.3	71.5	44.2	57.15	84.71
4D	30	42.5	32.2	505.6	65.0	74.1	40.9	60.46	81.00
5	30	42.0	31.6	493.0	65.4	74.8	39.8	61.86	80.24
8	34	41.0	31.8	508.3	62.1	74.4	43.5	58.29	78.85
17	28	43.7?(R)	36.0?(R)	532.0?	—	—	—	62.86	80.04
24	29	41.6	34.9	498.8	70.5	68.8	40.7	60.31	93.13
25	30	44.1	33.7	492.2	69.4	67.3	43.3	56.54	83.23
31	28	40.6	33.4	506.4	60.6	75.9	43.5	58.06	80.12
33	27	40.5	31.4	506.0?	—	—	—	57.69	77.57
34	33	41.6?	32.5?	535.0?	—	—	—	57.58	86.06
35	31	—	—	515.3	—	—	—	58.77	76.11
37	23	—	—	502.0?	—	—	—	56.46	74.03
41	42	39.4	32.3	499.1	62.3	76.0	41.7	56.00	76.11
42	28	39.1	30.3	507.1	74.5	66.6	38.9	57.43	77.91

100H'/L	100H'/B	100NB/NH	100O <sub>2</sub> /O <sub>1</sub>	100G'H/GB	100G'H/J	100GB/J	100fmb/fml
73.88	92.35	43.55	90.05	74.72	52.63	70.46	74.17
72.90	88.09	48.67	71.68	70.61	50.70	71.81	95.56
75.71	87.94	50.84	87.74	74.95	51.05	68.11	—
69.47	93.44	55.87	79.55	71.73	50.14	69.90	—
69.11	91.30	45.00	77.35	73.89	53.59	72.54	79.68
73.56	84.23	54.66	72.95	79.82	55.02	68.93	104.00
70.48	81.42	49.06	81.32	69.22	47.84	69.11	83.24
72.20	83.88	47.23	71.46(R)	71.41	—	—	87.46
74.93	90.67	—	76.60(R)	82.06	52.33	63.78	98.56
72.00	98.22	—	65.31(R)	68.72	—	—	85.67
74.40	90.01	50.90	85.88	72.81	—	—	91.77
69.12	96.87	—	76.47	—	—	—	89.83
70.36	96.55	53.78	71.72	68.81	—	—	91.76

100H'/L	100H'/B	100NB/NH	100O <sub>2</sub> /O <sub>1</sub>	100G'H/GB	100G'H/J	100GB/J	100fmb/fml
70.40	92.42	51.70	68.74	76.48	54.10	70.74	80.77
72.10	85.11	44.94	77.01	80.52	54.27	67.40	91.32
71.64	88.45	51.59	75.76	68.68	—	—	77.32
74.04	92.27	50.00	75.24	75.06	—	—	87.46
71.31	90.45	44.69	77.56	76.42	56.88	74.61	79.08
—	—	—	82.38(R)	—	—	—	—
76.13	81.75	52.62	83.89	71.79	48.67	67.79	87.50
71.76	86.21	52.08	76.42	70.53	51.94	73.65	84.00
72.00	89.87	47.74	82.27	70.33	53.38	75.91	95.67
—	—	49.31	77.53	76.50	52.86	69.10	—
—	—	46.15	78.12	71.58	50.62	70.73	—
65.90	86.58	—	—	—	—	—	86.31
69.27	93.56	—	—	—	—	—	79.95
68.10	89.49	44.60	81.98	73.48	51.04	69.46	83.91
70.47	90.45	49.59	77.49	63.13	48.88	77.43	84.75

## MANDIBULAR

## APPENDIX 3. Males

Inhumation	w <sub>1</sub>	goGo	rb'	zz	h <sub>1</sub>	CrCr	gnGo (l)	gnGo (r)	cyl
4E	115.9	—	32.3	45.3	30.0	88.3	—	71.0	18.9
6	131.4	97.2	34.0	42.4	32.8	99.2	85.5	85.7	25.9
9	123.6	—	—	46.9	31.4	99.0	—	—	21.2
13	123.1	97.1?	35.9(R)	48.5	36.1	—	85.0	85.3	21.3
17A	—	110.8	36.1	43.6	35.3	104.1	88.2	87.0	—
20	143.8	94.8	41.6	49.5	36.0	106.4	91.5	91.1	23.2
29	133.3	109.1	34.1	48.0	38.9	110.0	90.9	88.9	20.3
38	125.0	102.3	27.2	48.3	29.3?	103.2	80.7	82.6	22.0
39	119.8	104.7	33.1	45.9	32.2	110.1	94.1	91.7	19.3
43	—	95.0?	37.0(R)	46.1	32.4	98.0	88.7	89.5	22.3(R)
45A	122.0	98.8	35.7	50.3	31.0?	94.9	89.5	89.4	25.2
46	119.9	101.4	34.0	47.9	32.2	94.6	86.2	83.0	24.0
47	128.0	109.6	32.9	48.1	29.9	104.6	82.0	79.1	21.1
49	128.9	95.0	37.1	49.8	35.9	106.9	84.1	87.0	24.3(R)
50	122.3?	98.1	38.7	50.2	36.5?	100.0	88.2?	88.1?	22.9

## APPENDIX 4. Females

Inhumation	w <sub>1</sub>	goGo	rb'	zz	h <sub>1</sub>	CrCr	gnGo (l)	gnGo (r)	cyl
4A	115.9	92.3	30.0(R)	44.9	36.0	—	76.0	78.2	19.4(R)
4B	—	92.6	32.9	40.8	29.8	95.6	74.7	72.6	20.0
4D	116.0	87.2	31.0	43.2	32.9	89.8	77.4	80.0	17.9
5	100.0?	89.1	32.0	39.5	27.8	82.0	80.4	82.1	19.7
8	106.9	81.9	29.8	38.9	32.1	83.1	79.3	76.1	18.9
17	120.8	93.5	29.2	43.3	26.1?	97.9	77.0	78.9	20.0
20A	122.3	93.6	31.3	45.0	29.1	95.6	73.8	72.0	21.3
24	112.6	87.5	31.9	42.2	22.6	91.2	77.9	77.8	19.1
25	110.0	76.6	35.4	43.4	30.0	93.2	78.3	77.9	21.0(R)
31	116.5	82.1	29.0	41.0	26.2	95.0	69.3	68.7	21.9
33	119.0	87.9	29.1	44.3	31.0	97.3	74.8	74.9	18.7
34	124.0	95.0	27.9	42.0	24.7	107.5	77.6	78.6	20.1(R)
35	—	—	—	42.9	25.6?	—	—	—	—
44	118.3	95.2	30.0	45.6	26.9	99.8	77.5	78.6	20.7
42	117.9	87.9	31.0	46.9	30.0	87.4	76.8	78.1	19.1

## MEASUREMENTS

m <sub>2</sub> p <sub>1</sub>	ih	c <sub>rh</sub>	c <sub>yh</sub>	m <sub>2</sub> h	ml	c <sub>pl</sub>	rl	< M	< R
28.6	47.9	60.0	57.5	27.3	88.1	66.7	63.9	114.6	70.8
27.6	51.2	72.3	61.3	28.6	104.1	79.8	67.3	117.7	79.2
33.1?	49.2?	63.5	61.3?	24.3	109.7	—	—	—	—
30.1	48.1	70.0(R)	55.7	27.2	105.0	80.3	66.2	119.6	77.1?
29.1	43.8	60.6	52.5(R)	23.5	—	76.3?	60.2	129.5?	—
28.2(R)	53.1	65.6	67.0	33.8(R)	111.2	91.0	73.4	108.7	69.1
30.0	51.3	66.8	59.8(R)	29.7	112.4	79.7?	69.3?	125.3?	72.4
—	41.0	60.3	44.0	—	102.3	67.4	60.1	133.6	70.0
27.9	45.0	62.1	57.9	24.1	106.1	81.8	64.6	117.4	71.8
29.2(R)	52.8(R)	70.6(R)	67.2(R)	29.0(R)	—	90.7?	70.1(R)?	111.8?	—
—	50.5	59.9	66.5	—	114.1	86.1	74.9	118.7	57.3
27.0	46.5	64.6	59.2	26.8	110.6	77.3	73.8	125.0	61.6
26.3	50.5	64.4	61.1	25.9	103.7	70.2	69.9	122.2	63.1
32.3	—	73.2	72.5	28.1	110.8	83.1	81.4	115.6	64.2
25.3	70.1	85.7	85.5	34.3	111.6	84.1	87.1	112.8	68.0

m <sub>2</sub> p <sub>1</sub>	ih	c <sub>rh</sub>	c <sub>yh</sub>	m <sub>2</sub> h	ml	c <sub>pl</sub>	rl	< M	< R
25.8	46.0(R)	62.2(R)	56.3(R)	27.6	105.4	70.8	64.2	127.2	63.6
25.3	47.1	67.9	56.7	29.2	—	68.5?	59.6?	114.2	87.3?
27.3?	42.9	57.2	52.4	24.5?	98.7	72.1	58.8	121.3	65.6
23.8	44.3	55.4	55.3	25.1	96.8	75.3	59.4	116.5	62.3
—	40.1	55.4	47.8	—	101.1	71.8	54.8	123.6	66.4
28.6	44.9	63.1	56.7	25.0	101.0	67.8	65.0	126.8	65.3
25.6	41.2	53.2	49.0	23.2	99.0	66.7	58.6	128.9	59.0
27.4	41.2	51.9	52.9	26.1	96.3	73.7	61.4	116.7	58.3
26.3	53.0	64.8	68.4	28.9	97.2	77.4	71.0	108.6	65.0
—	54.5	68.9	65.1	27.0?	89.7	64.4	67.5	113.0	78.7
26.2	43.7	60.5	53.7	30.2	91.1	68.0	59.3	117.8	71.2
28.9	32.4	52.6	42.9(R)	17.2	107.8	70.7	56.5	132.6	67.6
26.1(R)	—	—	—	22.1?	—	—	—	—	—
—	44.0	60.9	51.7	—	95.9	69.3	59.3	121.3	73.6
24.4	47.2	61.4	59.0	27.3	96.1	73.0	64.9	114.6	69.8

APPENDIX 5. Means of measurements and indices of male crania

Character	n	$\bar{x}$ and m	Var.	v	$\sigma$ and e
L	13	184.15 ± 1.84	44.45	3.62	6.67 ± 1.30
B	13	147.28 ± 2.11	58.44	5.18	7.64 ± 1.49
B'	13	98.83 ± 1.40	25.84	5.14	5.08 ± 0.99
B''	13	123.06 ± 2.13	59.09	6.24	7.68 ± 1.50
H'	13	132.80 ± 1.00	13.07	2.71	3.61 ± 0.74
OH	13	113.66 ± 1.05	14.42	3.34	3.79 ± 2.49
Q	13	317.01 ± 3.67	175.33	4.11	13.24 ± 2.59
S	13	368.68 ± 3.07	123.05	3.00	11.09 ± 2.16
S <sub>1</sub>	13	127.60 ± 1.50	29.43	4.24	5.42 ± 1.06
S <sub>2</sub>	13	124.34 ± 1.09	15.70	3.18	3.96 ± 0.78
S <sub>3</sub>	13	118.80 ± 1.20	19.05	3.67	4.36 ± 0.85
S' <sub>1</sub>	13	112.10 ± 0.93	11.41	3.01	3.38 ± 0.66
S' <sub>2</sub>	13	111.24 ± 1.38	25.01	4.49	5.00 ± 0.98
S' <sub>3</sub>	13	95.48 ± 1.17	17.82	4.42	4.22 ± 0.82
fml	13	34.52 ± 1.07	14.92	11.18	3.86 ± 0.76
fmb	11	31.10 ± 0.89	8.70	9.51	2.96 ± 0.63
PH	12	21.66 ± 0.49	3.20	7.89	1.71 ± 0.34
GL	12	96.84 ± 2.13	54.33	7.60	7.37 ± 1.40
G'H	12	70.81 ± 0.92	10.36	4.54	3.22 ± 0.65
LB	13	103.40 ± 1.50	29.42	5.24	5.42 ± 1.06
NH	12	51.07 ± 0.87	9.15	5.91	3.02 ± 0.61
NB	10	25.71 ± 0.57	3.31	7.08	1.82 ± 0.40
G <sub>1</sub>	12	51.72 ± 1.24	18.53	8.35	4.30 ± 0.87
G' <sub>1</sub>	12	46.79 ± 1.23	18.26	9.12	4.27 ± 0.87
G <sub>2</sub>	9	42.11 ± 0.97	8.43	6.88	2.90 ± 0.68
EOW	13	108.64 ± 1.17	17.85	3.88	4.22 ± 0.82
IOW	13	101.21 ± 1.22	19.55	4.36	4.42 ± 0.86
GB	12	96.87 ± 1.43	25.48	5.21	5.05 ± 1.03
J	9	138.58 ± 2.39	51.75	5.18	7.19 ± 1.69
O <sub>1</sub>	13	43.33 ± 0.68	6.06	5.67	2.46 ± 0.48
O <sub>2</sub>	13	33.58 ± 0.92	11.14	9.91	3.33 ± 0.65
U	13	529.04 ± 3.96	204.02	2.69	14.28 ± 2.80
< N	12	64.35 ± 1.07	13.77	5.76	3.71 ± 0.75
< A	12	73.75 ± 0.86	8.97	4.05	2.99 ± 0.61
< B	12	41.89 ± 0.94	10.80	7.83	3.28 ± 0.67
100B/L	13	80.13 ± 1.63	34.43	7.32	5.87 ± 1.15
100H'/L	13	72.16 ± 0.63	5.23	3.16	2.28 ± 0.44
100H'/B	13	90.38 ± 1.45	27.35	5.78	5.23 ± 1.02
100G'H/GB	12	73.22 ± 1.21	17.80	5.90	4.22 ± 0.86
100G'H/J	8	51.66 ± 0.78	4.98	4.24	2.21 ± 0.55
100GB/J	8	69.33 ± 0.93	7.22	3.93	2.68 ± 0.67
100fmb/fml	11	89.24 ± 2.57	72.90	9.55	8.53 ± 1.81
100NB/NH	10	49.95 ± 1.28	16.54	8.12	4.06 ± 0.90
100O <sub>2</sub> /O <sub>1</sub>	13	77.54 ± 2.00	52.29	9.33	7.24 ± 1.42
Oc I	13	57.43 ± 0.36	1.61	2.20	1.26 ± 0.25

## APPENDIX 6. Means of measurements and indices of female crania

Character	n	$\bar{x}$ and m	Var.	v	$\sigma$ and e
L	15	175.96 $\pm$ 1.36	27.85	2.99	5.27 $\pm$ 0.96
B	15	141.23 $\pm$ 1.68	42.69	4.62	6.53 $\pm$ 1.19
B'	15	93.41 $\pm$ 1.14	19.57	4.73	4.42 $\pm$ 0.80
B''	15	118.19 $\pm$ 1.10	18.37	3.53	4.28 $\pm$ 0.78
H'	15	124.07 $\pm$ 0.67	6.82	2.11	2.61 $\pm$ 0.47
OH	15	108.21 $\pm$ 2.01	17.48	3.86	4.18 $\pm$ 0.76
Q	15	302.49 $\pm$ 3.04	139.09	3.89	11.78 $\pm$ 2.15
S	15	358.15 $\pm$ 2.72	111.58	2.94	10.56 $\pm$ 1.93
S <sub>1</sub>	15	121.39 $\pm$ 1.54	35.75	4.92	5.97 $\pm$ 1.09
S <sub>2</sub>	15	119.70 $\pm$ 1.57	37.31	5.09	6.10 $\pm$ 1.11
S <sub>3</sub>	15	115.66 $\pm$ 1.56	36.57	5.22	6.04 $\pm$ 1.10
S' <sub>1</sub>	15	106.24 $\pm$ 1.02	15.69	3.73	3.96 $\pm$ 0.72
S' <sub>2</sub>	15	107.46 $\pm$ 1.40	29.60	5.06	5.44 $\pm$ 0.99
S' <sub>3</sub>	15	94.82 $\pm$ 1.10	18.35	4.51	4.28 $\pm$ 0.78
fml	12	34.30 $\pm$ 0.76	6.99	7.69	2.64 $\pm$ 0.54
fmb	12	29.00 $\pm$ 0.39	1.87	4.69	1.36 $\pm$ 0.27
PH	13	19.23 $\pm$ 0.87	9.79	16.27	3.13 $\pm$ 0.61
GL	10	90.73 $\pm$ 1.22	14.91	4.25	3.86 $\pm$ 0.86
G'H	13	67.10 $\pm$ 0.94	12.74	5.30	3.56 $\pm$ 0.70
LB	12	93.84 $\pm$ 1.06	13.47	3.91	3.67 $\pm$ 0.75
NH	13	49.26 $\pm$ 0.66	5.77	4.87	2.40 $\pm$ 0.47
NB	12	23.89 $\pm$ 0.32	1.26	5.27	1.12 $\pm$ 0.23
G <sub>1</sub>	12	48.43 $\pm$ 1.10	14.69	7.90	3.83 $\pm$ 0.78
G' <sub>1</sub>	12	43.67 $\pm$ 0.74	8.77	5.83	2.55 $\pm$ 0.52
G <sub>2</sub>	6	38.11 $\pm$ 0.97	5.71	6.23	2.38 $\pm$ 0.68
EOW	15	101.29 $\pm$ 1.24	23.07	4.74	4.80 $\pm$ 0.87
IOW	15	95.52 $\pm$ 1.02	15.97	4.17	3.99 $\pm$ 0.73
GB	12	91.87 $\pm$ 1.26	19.02	4.74	4.36 $\pm$ 0.89
J	10	128.99 $\pm$ 1.40	19.61	3.42	4.42 $\pm$ 0.98
O <sub>1</sub>	13	41.77 $\pm$ 0.45	2.66	3.90	1.63 $\pm$ 0.32
O <sub>2</sub>	13	32.57 $\pm$ 0.54	3.77	5.92	1.94 $\pm$ 0.38
U	15	506.52 $\pm$ 3.34	167.42	2.55	12.93 $\pm$ 2.36
< N	10	66.24 $\pm$ 1.37	19.99	6.58	4.36 $\pm$ 0.97
< A	10	71.83 $\pm$ 1.15	13.36	5.08	3.65 $\pm$ 0.81
< B	10	41.93 $\pm$ 0.56	3.22	4.26	1.79 $\pm$ 0.40
100B/L	15	80.35 $\pm$ 1.26	23.79	6.06	4.87 $\pm$ 0.89
100H'/L	12	71.09 $\pm$ 0.76	7.03	3.72	2.65 $\pm$ 0.54
100H'/B	12	88.88 $\pm$ 0.93	11.83	3.87	3.44 $\pm$ 0.70
100G'H/GB	12	72.85 $\pm$ 1.31	20.74	6.24	4.55 $\pm$ 0.93
100G'H/J	10	52.26 $\pm$ 1.15	18.23	6.94	3.63 $\pm$ 0.80
100GB/J	10	71.68 $\pm$ 1.10	12.24	4.87	3.49 $\pm$ 0.78
100fmb/fml	12	84.83 $\pm$ 1.53	28.04	6.23	5.29 $\pm$ 1.07
100NB/NH	12	48.75 $\pm$ 0.87	9.09	6.17	3.01 $\pm$ 0.61
100O <sub>2</sub> /O <sub>1</sub>	13	78.03 $\pm$ 1.10	15.87	5.10	3.98 $\pm$ 0.78
Oc I	15	59.14 $\pm$ 0.79	9.59	5.22	3.09 $\pm$ 0.56

## APPENDIX 7. Means of indices of combined male and female crania

Character	n	$\bar{x}$ and m	Var.	v	$\sigma$ and e
100B/L	28	80.24 $\pm$ 0.99	27.64	6.54	5.25 $\pm$ 0.70
100H'/L	25	71.64 $\pm$ 0.24	6.19	1.73	1.24 $\pm$ 0.17
100H'/B	25	89.66 $\pm$ 0.88	19.67	4.94	4.43 $\pm$ 0.62
100G'H/GB	24	73.04 $\pm$ 0.87	18.47	5.87	4.29 $\pm$ 0.62
100G'H/J	18	51.99 $\pm$ 0.71	9.17	5.80	3.02 $\pm$ 0.50
100GB/J	18	70.07 $\pm$ 0.66	11.00	4.32	3.03 $\pm$ 0.50
100fmb/fml	23	86.94 $\pm$ 1.49	51.71	8.27	7.19 $\pm$ 1.06
100NB/NH	22	49.29 $\pm$ 0.74	12.25	7.10	3.50 $\pm$ 0.53
100O <sub>2</sub> /O <sub>1</sub>	26	77.78 $\pm$ 1.12	32.78	7.35	5.72 $\pm$ 0.70
Oc I	28	58.35 $\pm$ 0.50	7.13	4.57	2.67 $\pm$ 0.35

## APPENDIX 8. Means of measurements and indices of male mandibles

Character	n	$\bar{x}$ and m	Var.	$\sigma$ and e
w <sub>1</sub>	13	125.92 $\pm$ 2.09	52.87	7.27 $\pm$ 1.48
goGo	13	101.06 $\pm$ 1.67	33.75	5.81 $\pm$ 1.18
rb'	14	34.97 $\pm$ 0.93	11.32	3.36 $\pm$ 0.66
zz	15	47.39 $\pm$ 0.63	5.54	2.35 $\pm$ 0.44
h <sub>1</sub>	15	33.33 $\pm$ 0.78	8.45	2.91 $\pm$ 0.55
crCr	14	101.38 $\pm$ 1.74	39.35	6.27 $\pm$ 1.23
gnGo (l)	13	87.28 $\pm$ 1.11	14.74	3.84 $\pm$ 0.78
gnGo (r)	14	85.67 $\pm$ 1.52	29.94	5.47 $\pm$ 1.07
cyl	14	22.28 $\pm$ 0.53	4.44	2.11 $\pm$ 0.41
m <sub>2</sub> P <sub>1</sub>	13	28.82 $\pm$ 0.64	4.88	2.21 $\pm$ 0.45
ih	14	50.07 $\pm$ 1.87	45.41	6.74 $\pm$ 1.32
crh	15	66.64 $\pm$ 1.85	48.02	6.93 $\pm$ 1.31
cyh	15	61.95 $\pm$ 2.51	88.54	9.41 $\pm$ 1.78
m <sub>2</sub> h	13	27.89 $\pm$ 0.96	11.12	3.33 $\pm$ 0.68
ml	13	106.90 $\pm$ 1.96	46.36	6.81 $\pm$ 1.39
cpl	14	79.60 $\pm$ 2.10	57.37	7.59 $\pm$ 1.49
rl	14	70.16 $\pm$ 2.11	58.07	7.62 $\pm$ 1.49
< M	14	119.46 $\pm$ 1.94	48.92	6.99 $\pm$ 1.37
< R	12	68.72 $\pm$ 1.91	40.21	6.34 $\pm$ 1.35
100crh/ml	13	62.60 $\pm$ 1.87	41.88	6.47 $\pm$ 1.32
100crCr/ml	12	94.97 $\pm$ 1.96	42.32	6.51 $\pm$ 1.38
100goGo/cpl	13	126.67 $\pm$ 4.86	283.85	16.85 $\pm$ 3.44
100goGo/crCr	12	99.70 $\pm$ 1.85	37.62	6.14 $\pm$ 1.30
100rb'/rl	14	50.09 $\pm$ 1.23	21.14	4.59 $\pm$ 0.90

## APPENDIX 9. Means of measurements and indices of female mandibles

Character	n	$\bar{x}$ and m	Var.	$\sigma$ and e
w <sub>1</sub>	13	115.40 ± 1.91	43.88	6.36 ± 1.35
gogo	14	88.74 ± 1.53	30.62	5.53 ± 1.08
rb'	14	30.75 ± 0.53	3.68	1.92 ± 0.38
zz	15	42.93 ± 0.59	5.04	2.24 ± 0.42
h <sub>1</sub>	15	28.72 ± 0.76	8.03	2.82 ± 0.53
crCr	13	93.49 ± 1.99	47.96	6.93 ± 1.41
gnGo (l)	14	76.49 ± 0.76	7.59	2.75 ± 0.54
gnGo (r)	14	76.75 ± 0.99	12.73	3.57 ± 0.69
cyl	14	19.84 ± 0.30	1.21	1.10 ± 0.21
m <sub>2</sub> P <sub>1</sub>	12	26.31 ± 0.46	2.35	1.53 ± 0.33
ih	14	44.46 ± 1.49	29.19	5.40 ± 1.06
c <sub>r</sub> h	14	59.67 ± 1.53	30.49	5.52 ± 1.08
c <sub>y</sub> h	14	54.85 ± 1.82	43.37	6.58 ± 1.29
m <sub>2</sub> h	13	25.65 ± 1.07	13.69	3.69 ± 0.75
ml	13	98.16 ± 1.44	24.91	4.99 ± 1.02
cp <sub>l</sub>	14	70.68 ± 0.97	12.37	3.52 ± 0.69
rl	14	61.45 ± 3.65	173.89	13.19 ± 2.58
< M	14	120.22 ± 1.73	39.11	6.23 ± 1.22
< R	14	68.12 ± 2.15	60.17	7.76 ± 1.52
100c <sub>r</sub> h/ml	13	60.39 ± 2.11	53.49	7.31 ± 1.49
100c <sub>r</sub> Cr/ml	12	95.78 ± 2.34	60.48	7.78 ± 1.66
100gogo/cP <sub>l</sub>	14	125.98 ± 3.06	131.25	11.46 ± 2.34
100gogo/c <sub>r</sub> Cr	13	94.91 ± 1.96	45.94	6.78 ± 1.38
100rb'/rl	14	49.97 ± 0.94	12.47	3.53 ± 0.69

## APPENDIX 10. Means of indices of combined male and female mandibles.

Character	n	$\bar{x}$ and m	Var.	$\sigma$ and e
100c <sub>r</sub> h/ml	26	61.15 ± 1.87	91.19	9.55 ± 1.32
100c <sub>r</sub> Cr/ml	24	95.38 ± 1.43	49.34	7.02 ± 1.01
100gogo/cP <sub>l</sub>	27	126.31 ± 2.69	196.82	14.03 ± 1.91
100gogo/c <sub>r</sub> Cr	25	97.21 ± 1.36	46.19	6.79 ± 0.96
100rb'/rl	28	50.03 ± 0.76	16.19	4.02 ± 0.54

## APPENDIX 11

Another comparison of the Red Castle male skulls with those of the Burwell series is shown in Appendix 11. In calculating the values of this table the Burwell means and standard deviations are postulated as being those of the total Anglo-Saxon population. Then if  $\bar{x}$  and n are the means and number of measurements available for the cranial characters of the Red Castle series, and  $\mu$  and  $\sigma$  are the respective means and standard deviations for corresponding characters of the Burwell series, and d is the difference between  $\bar{x}$  and  $\mu$  irrespective of sign, then  $\sigma \sqrt{(1/n-1)}$  gives e<sub>d</sub> the standard error of that difference.

From this the value of the critical ratio d/e<sub>d</sub> may be obtained and is considered to be statistically significant at the 5 per cent probability level when d/e<sub>d</sub> is 2.0 or more.

APPENDIX 11. Comparison of Red Castle, Thetford, and Burwell, Cambridgeshire, male crania.

Character	Red Castle		Burwell		d	ed	d/ed
	Mean $\bar{x}$	n	Mean $\mu$	N			
L	184.15	13	189.62	45	5.47	1.61	3.3
B	147.28	13	141.68	45	5.60	1.58	3.5
B'	100.93	13	95.22	44	5.71	0.98	5.8
H'	132.80	13	136.29	40	3.49	1.65	2.1
OH	113.66	13	114.09	37	0.43	1.42	0.3
Q	317.01	13	312.86	37	4.15	3.26	1.2
S	368.68	13	381.64	42	12.96	2.95	4.3
S <sub>1</sub>	127.60	13	128.38	42	0.78	1.74	0.4
S <sub>2</sub>	124.34	13	130.86	42	6.52	2.11	3.0
S <sub>3</sub>	118.80	13	122.55	42	3.75	2.14	1.7
S' <sub>1</sub>	112.10	13	112.69	42	0.59	1.37	0.4
S' <sub>2</sub>	111.24	13	117.36	42	6.12	1.65	3.7
S' <sub>3</sub>	95.48	13	99.79	42	4.31	1.59	2.7
fml	34.52	13	37.32	37	2.80	1.04	2.6
fmb	31.10	11	31.11	37	0.01	0.75	0.0
GL	96.84	12	94.11	33	2.73	1.74	1.5
G'H	70.81	12	69.02	31	1.79	1.51	1.1
LB	103.40	13	102.38	40	1.02	1.51	0.6
NH	51.07	12	50.04	34	1.03	1.09	0.9
NB	25.71	10	24.12	34	1.59	0.59	2.6
G <sub>1</sub>	51.72	12	48.50	11	3.22	1.05	3.0
G' <sub>1</sub>	46.79	12	44.57	14	2.22	0.98	2.2
G <sub>2</sub>	42.11	9	40.41	29	1.70	1.15	1.4
GB	96.87	12	94.71	31	2.16	1.71	1.2
J	138.58	9	134.02	24	4.56	2.26	2.0
O <sub>1</sub>	43.33	13	41.85	33	1.48	0.49	3.0
O <sub>2</sub>	33.58	13	32.77	33	0.81	0.58	1.3
U	529.04	13	527.76	42	1.28	3.76	0.3
< N	64.35°	12	63.30°	32	1.05	1.04	1.0
< A	73.75°	12	75.80°	32	2.05	1.01	2.0
< B	41.89°	12	40.91°	32	0.98	0.83	1.1
100B/L	80.13	13	74.76	45	5.37	0.91	5.9
100H'/L	72.16	13	71.87	40	0.29	0.92	0.3
100B/H'	112.13	13	104.43	40	7.70	1.49	5.1
100G'H/GB	73.22	12	72.46	30	0.76	1.77	0.4
100G'H/J	51.66	8	51.85	21	0.19	1.51	0.1
100fmb/fml	89.24	11	83.84	37	5.40	2.45	2.1
100NB/NH	49.95	10	48.39	34	0.56	1.47	0.3
100O <sub>2</sub> /O <sub>1</sub>	77.54	13	78.34	33	0.80	1.17	0.6
Oc.I	57.43	13	58.94	42	1.51	0.81	1.8