

astonishingly complete picture of extinct rivers, not only the major channels but also the minor tributaries that reach to every part of the Fen. This conjures up a vivid picture of the conditions of the fens before the seventeenth century drainage.

An interesting comparison may be made between FIG. 1 and Hayward's map of 1604, perhaps the earliest surviving survey of the Fens showing any degree of detail (Hayward, 1604). The map shows the state of the Fens before the great drainage schemes, and readily enables many of the principal waterways to be identified on air photographs. The main river in the upper right-hand quadrant of FIG. 1 is a part of the natural course of the Ouse, the old 'West Water', to use the name adopted on Hayward's map and in Blaeu's survey (Blaeu, 1645). This meanders through the Fens from Earith, northwards eventually to Wisbech. The pattern even of the main channels is far from simple as will be appreciated from FIG. 1. Thus the arm that leads to the Forty Foot Drain seems to connect, as adjoining photographs show, with one of the outlets from Whittlesey Mere. Not all the channels may have been functioning at the same time: the rivers will have divided into distributaries, to unite again after the fashion of rivers crossing large areas of alluvium or of fenland.

Not only does the drawing suggest the remote nature of such marshland, impenetrable except

by boat, but it also raises interesting questions about human settlement. The only Roman settlement recorded within the area of FIG. 1 is at Worlick at the E edge of the Ramsey 'island' (Phillips, 1970, sheet K: general distribution map). Yet the old channel of the Little Ouse from Littleport to Welney has Roman settlement sites clustered along it. A tongue of silt, indeed, extends south-eastwards past Welney beside the Little Ouse channel, but the roddon of the West Water, approximately 300 m. broad towards the upper margin of FIG. 1, is wide enough to have attracted settlement, if the levee were sufficiently high above the marshland to have made firm ground. Field-walking along the line of these old river channels may have much to reveal.

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Probable trephination of five Early Saxon skulls

PLATE XXXIV

This note describes and discusses four skulls from Norfolk and one from Suffolk, each of which has a well healed perforation.

DESCRIPTION

1. *Swaffham, Inhumation 'A'*. (Wilson *et al.*, 1970; 1971). The skull of a man aged 30-40 years. It is rugged in build, of typical Anglo-Saxon type, it is a long ovoid in norma verticalis and has a Cranial Index of 69.3 (dolichocranial).

There is an elliptical groove in this skull, the long axis of which lies about 6 mm. to the left of the mid-sagittal plane in the obelionic region of the L. parietal bone (PL. XXXIVA). The floor of the groove is perforated and medially it

transgresses the sagittal suture to encroach very slightly on the R. parietal. Its overall dimensions are: anteroposterior, 42.8 mm.; transverse, 22.5 mm.—these being the measurements across the top of the bevelled edge. The orifice is 16.4 × 10.7 mm. in diameter and its margin is cleanly healed except for a few millimetres where it shows some post-inhumation damage. The bevel around this orifice is smooth, well healed and slightly steeper at each side than at its anterior and posterior ends. The sides descend at an angle of about 50°, the ends at about 30°, from the plane of the surrounding bone. The process of repair has led to a low (*c.* 1 mm.) heaping of the bone along that part of the margin of the groove

formed by the R. parietal. A large venous blood vessel, the superior longitudinal sinus, must have been opened when the cavity of the skull was entered. No trace of infection is present, and the wound appears to have healed rapidly.

2. *Swaffham, Inh. 7.* (Wilson *et al.*, 1970; 1971) Male. Age 40–55. This is a very incomplete specimen. A damaged frontal bone survives; a fragment comprising the posterior three-quarters of the parietals, with the occipital, most of the temporals and the sphenoid; also fragments of jaw and vertebrae. The skull is strongly built, with prominent muscle markings.

There is an elliptical opening in the R. parietal bone (PL. xxxivb). The long axis of the ellipse is close to the sagittal plane and the opening lies 20.0 mm. to the right of the sagittal suture, about 18 mm. anterior to the lambdoid. The diameters of the lesion across the top of the bevel are: anteroposterior, 41.2 mm.; transverse, 21.5 mm.; and the orifice measures 12.3 × 8.4 mm. The margin of the orifice is cleanly healed. The bevel is smooth, well healed and steeper at the sides than anteriorly or posteriorly. The sides descend at an angle of about 45°, the ends at about 30°, from the plane of the surrounding bone. A very low (*c.* 0.5 mm.) heaping of bone lies along the medial margin of the bevel. The opening into the skull was crossed by a large branch of one of the middle meningeal vessels. There is no trace of infection on either surface of the skull and the wound appears to have healed rapidly.

3. *Watton.* Male. Age 25–35. This is a fairly sturdy skull of ordinary Anglo-Saxon type. It is a long ovoid in norma verticalis, with a Cranial Index of 70.1 (dolichocephalic).

It has an elliptical opening in the L. side of the frontal bone, with its long axis almost exactly in the sagittal plane (PL. xxxivc). The edge of the lesion lies about 9.0 mm. from the mid-line. Its dimensions across the top of the bevel are: anteroposterior, 37.8 mm.; transverse, 21.7 mm. The orifice measures 14.8 × 6.1 mm. This wound is well healed. The edge of the orifice is cleanly repaired; the face of the bevel is smooth, even and with a somewhat steeper slope at its sides than at each end. The lateral faces of the bevel descend at an angle of about 40°, the anterior and posterior faces at about 25°, from the plane of the surrounding bone. No trace of infection is present externally or internally and the wound appears to have healed rapidly.

4. *Grimston Inh. 'B'.* (Webster *et al.*, 1972).

Male. Age 30–40. A fairly rugged skull of ordinary Anglo-Saxon type. It is ovoid in norma verticalis, with a Cranial Index of 74.4 (dolichocephalic).

It has an elliptical opening in the anterior third of the R. parietal bone (PL. xxxivd). The overall dimensions of the lesion across the bevel are: anteroposterior, 41.5 mm.; transverse, 20.8 mm.; and the orifice measures 9.5 × 4.1 mm. The long axis of this ellipse is very close to the sagittal plane. It lies about 32.3 mm. to the right of the sagittal and 5.0 mm. posterior to the coronal suture. The edge of the orifice is cleanly healed. The bevel is smooth, even and slopes rather more steeply at the sides than at each end. The slope of the bevel is about 45° laterally, and about 27° anteriorly and posteriorly. The orifice lies across a moderately large branch of a middle meningeal blood vessel. No trace of infection surrounds the lesion which appears to have healed rapidly.

A second shallow depression is present in this skull. It is elliptical in outline and lies on the left half of the frontal bone and the left parietal. Its dimensions across the bevel are: anteroposterior, 39.0 mm.; transverse, 23.8 mm. Its long axis is almost exactly in the sagittal plane, it lies about 15 mm. to the left of the bregma and the coronal suture bisects it into almost equal parts. There is no evidence that any opening penetrated the floor of the groove into the skull during life (there is now a small soil erosion orifice) but the smoothness and regularity of the bevel, as far as it goes, suggests that it healed rapidly without becoming infected.

5. *Eriswell, Inh. 13.* Male. Age 30–35. This was a powerfully built man. The skull was much warped and broken but fortunately the frontal bone survived in good condition. It contains an elliptical opening, the long axis of which lies in the mid-sagittal plane. Across the bevel it measures 38.5 mm. anteroposteriorly, 22.5 mm. transversely; and the orifice is 13.2 × 9.5 mm., with its centre 30 mm. in front of the bregma. The edge of the orifice is cleanly repaired. The face of the bevel is smooth, well healed and slightly steeper at the sides than at each end. The sides descend at an angle of about 45°, the ends at about 30°, from the plane of the surrounding bone. A very low (*c.* 0.5 mm.) heaping of the bone runs round the lip of the bevel. The superior longitudinal sinus (a large blood vessel) lay under the long axis of the orifice which must have encroached on it. There is no perceptible

ANTIQUITY

evidence of infection of the adjacent bone and the lesion appears to have healed rapidly. (Although I examined and measured this skull the day after it was excavated on an American Air Base, it was unfortunately stolen from there before it could be photographed.)

DISCUSSION

There is unequivocal evidence that the skulls from Swaffham, Grimston and Eriswell are of Pagan date. The Watton skull retains a soupçon of uncertainty because it was revealed by a mechanical excavator but strong presumptive evidence indicated that this, too, is Early Saxon: the excavator which brought it to the surface also unearthed sixth-century pottery a metre or two away from it. The other four all came from inhumation cemeteries which are primarily of sixth-century date. The parishes from which these specimens were recovered lie not far apart in Norfolk and Suffolk. Watton is the central site, with Swaffham about 12 km. to the NW, Grimston another 16 km. further still to the NW, whilst Eriswell, which is some 28 km. to the SW, is the only one in Suffolk. The Swaffham, Grimston and Eriswell cemeteries are, moreover, all representative of a type, found in west Norfolk and north-west Suffolk, which is becoming increasingly recognized as of a well-defined and distinctive character.

Because I am going to propose these skulls as examples of trephination, it is important to state that none of them shows undoubted evidence of this operation. The Watton calva was the first of them to be found (1950) and, in view of certain dogmatic statements in the local press, I at once pointed out that it had no indubitable feature indicating that it was, indeed, a trephined skull. It has no residual marks of sawing, drilling, cutting or scraping such as would be virtually conclusive evidence. The next one to be found was the Eriswell specimen and, again to cool hasty speculation, I recorded (Wells, 1966) that there was 'no special evidence to suggest that it was due to deliberate trephination'. In view of the sensational appeal which this operation has for the lay mind (and many archaeologists have succumbed to this) it should be emphasized that one should never be stampeded into making

this diagnosis without very good evidence. Holes in the skull can be due to many causes which may be broadly grouped into six categories: congenital lacunae, traumatic conditions, infections, neoplastic lesions, blood dyscrasias and certain intrinsic bone diseases. Before trephination can be asserted beyond doubt, every alternative possibility within each of these categories must be eliminated (Wells, 1964). Apart from the appearance of the hole, there may be extraneous factors which greatly affect the likelihood of the diagnosis. If the skull in question comes from a region which has produced large numbers of other trephined crania, such as the Seine-Oise-Marne or the Cevennes districts of France, and Peru or Ecuador in South America, there will be strong *a priori* grounds for suspecting that other similarly perforated skulls are also likely to be due to the same operation. If, on the other hand, the questioned skull comes from a region (and a period) in which trephination is recorded rarely, doubtfully or not at all, great caution is needed before accepting the diagnosis.

Trephination is attested only weakly among the British Anglo-Saxons. From the thousands of their skulls which have been exhumed, no more than a dozen or so can be thought to show the lesion with any plausibility. And perhaps each of these could be explained just as well, or even better, as being due to wounding or to one of the many other pathological conditions which may closely simulate this operation. It should also be remembered that there is an extensive Anglo-Saxon medical literature covering a wide range of topics, including accidental and malicious wounds of the head yet, surprisingly, there is no textual reference to this dramatic surgical achievement. It is difficult not to give considerable weight to this fact, especially as the Leech Books give detailed instructions for performing such delicate and ambitious operations as the plastic repair of hare lip or the amputation of a gangrenous limb. Despite these objections, however, I believe the balance of evidence does indicate that the Anglo-Saxons performed trephinations on rare occasions.

When the six lesions described earlier in this note are examined, the outstanding feature

about them is their uniformity. Trephinations may be round, irregularly circular, squarish, rectangular, ovoid, pentagonoid and various other shapes. These are all elliptical. The size of trephinations also varies greatly. Their orifices (disregarding the bevels leading down to them) may range from a few millimetres across to huge lacunae which have removed most of the vault of the skull, as at St-Urnel in Finistère (Giot, 1949). The East Anglian lesions are quite remarkably alike: both the length and breadth measurements of the largest opening (Swaffham 'A') are less than 7 mm. greater than those of the smallest (Grimston). Extensive differences (which, of course, largely depend on the technique and preference of the surgeon) are often found in the bevels or slopes leading from the surrounding normal bone down to the rim of the actual opening into the skull. Sometimes the bevel is no more than a millimetre wide, falling almost vertically to the opening below it. Sometimes a wide, gently sloping berm descends at an angle of only 10 or 15 degrees. Often there is much irregularity in the width and slope of the bevel at different places around the orifice, which occasionally gives a kind of corrugated or sinuous effect. In the present group great regularity is found: the angles of the bevels at each end of the grooves are all $27^{\circ} \pm 3^{\circ}$; at the sides of the grooves they are all $45^{\circ} \pm 5^{\circ}$. With elliptical trephinations, such as these, much variation may be found in the orientation of the long axis of the ellipse. It may lie transversely across the skull, in the coronal plane, or at any angle between this and the sagittal plane. All the present ones are orientated sagittally; four of the six grooves are almost exactly so, the other 2 deviate by no more than 6 or 7 degrees. A further similarity between these lesions is their closeness to the mid-line. Two of them actually intrude on the superior longitudinal sinus, three others approach to within 20 mm. of it and only the Grimston lesion is no nearer than 32 mm. The final uniformity of these lesions is that they have all healed, apparently without a trace of infection.

Perhaps each one of these lesions could, in isolation, be interpreted as due to a weapon

wound but that six, virtually identical, lesions should be so caused seems exceedingly unlikely. Moreover, Anglo-Saxon skull wounds are well known and show far less regularity than these. (Only the ultimate failure to open a second orifice in the Grimston skull makes that groove any different from the rest. The lesion could be explained as an abandoned attempt at trephining, perhaps from lack of endurance on the part of the patient.)

When confronted by examples of ancient surgery many people, even archaeologists, tend to overlook the fact that surgeons are craftsmen and individualists, no less than potters or carpenters are. Whatever 'the textbook' may prescribe, every surgeon (unless driven by special exigency) tends to follow his own regular routine and technique for each kind of operation, whether appendicectomy, hysterectomy, pinning a broken bone, amputating a finger or . . . opening a skull. To an ex-surgeon, such as myself, it is common knowledge that in a large hospital even such a small part of an operation as the placing and appearance of the incision may suffice to distinguish immediately between the work of different colleagues.

A corollary of this is that, if these skulls have been trephined, we must inevitably wonder whether they were all the work of a single surgeon. Apart from the uniform operating technique which they unquestionably display, they reveal something more about the man who performed the work. In those skulls where the venous sinus was opened, and possibly in the others also, profuse bleeding probably occurred. Evidently the operator was psychologically equipped to deal with such an alarming and potentially dangerous event. Furthermore, and this is a point which perhaps only other surgeons can fully appreciate, the fact that all these wounds healed without a trace of infection implies a standard of craftsmanship, with a deftness and delicacy of control, a neatness in handling the tissues, that betrays the highest level of manipulative skill. There seems at least a strong possibility that one of the rare Anglo-Saxon leeches to perform trephinations practised in the Watton area sometime during the sixth century.

One final point: how were these openings made? Clearly, they were not sawn or drilled and there are no stray cut marks to suggest that the bone was pared away with a free knife edge. Nothing is more remarkable about them, as a group, than the regularity of the grooves in which these openings lie. The transverse diameters of all six grooves, across the bevel, fall within the limits of 22.5 ± 1.5 mm., a quite astonishingly narrow range. As one who has done trephinations (albeit by a different technique) I am prepared to suggest that this not only indicates that each operation was done by the same surgeon but also that each was done *with the same instrument*. It is known that Anglo-Saxons had gouges and these would be excellent instruments for performing trephinations. After our anonymous surgeon had incised the scalp and exposed the periosteum he could use his gouge to remove slivers of bone, from an ever deepening channel, probably gliding it to and fro from alternate ends as the operation progressed, and controlling the final opening into the cranial cavity according to his assessment of the situation. I envisage a gouge about 18 mm. wide and having an arc of approximately a third of a circle. Allowing for some slight 'play' in use, this has been found, experimentally, to produce grooves and bevels of the pattern common to all these skulls.

When art historians identify a distinguished

but nameless early painter, from some particularity of his work, they have the gracious custom of rescuing him from total anonymity by devising a well-chosen sobriquet. It is thus that we have come to know the Master of the Mousetrap or the Master of the Female Half Length. Dare I, too, rescue an early colleague from oblivion and introduce a great Anglo-Saxon surgeon as the Master of the Gliding Gouge?

CALVIN WELLS

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Lapita pottery at Talasea, West New Britain, Papua New Guinea

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Lapita pottery, in its classic decorated form dated between 3200 and 2500 years BP, has acquired considerable importance through its apparent connexion with the ancestors of the Polynesian peoples (Poulsen, 1968; Golson, 1971; Groube, 1971; Green, 1973). This note

records the discovery of this pottery at one of the most important obsidian sources in the western Pacific, Talasea on the north coast of New Britain, Papua New Guinea. Several sites in island Melanesia have yielded flakes of obsidian identified, by trace element analysis, as originating from the Talasea source (Key, 1968; Ambrose and Green, 1972). At some of these sites, such as those on Watom and Ambitle Islands in the New Guinea region (Specht, 1967; 1968; White and Specht, 1971), this obsidian is the only material from which flaked stone tools were made. The widespread dispersal of Lapita sites across 4,000-plus km. of ocean, and the persistent occurrence of



PLATE XXXIV: PROBABLE TREPHINATION OF FIVE EARLY SAXON SKULLS
Skulls from (a) Swaffham, Inhumation. 'A'; (b) Swaffham, Inh. 7; (c) Watton; (d) Grimston, Inh. 'B'

See pp. 298-302