Proceedings

of the

PREHISTORIC SOCIETY

for 1963

(New Series, Vol. XXIX)

Edited by Prof. J. G. D. CLARK, Sc.D., F.B.A., F.S.A.
University Museum of Archaeology and Ethnology, Downing Street, Cambridge
assisted by
JOHN COLES, Ph.D., F.S.A. and Prof. S. PIGGOTT, D.Litt.Hum., F.B.A., F.S.A.

December, 1963

Price—Fifty Shillings

The Annual Subscription for Membership of the Society, entitling members to the Proceedings as well as to attendance at meetings, is Two Guineas. Associate membership at a reduced subscription is available to persons under 21. Application forms for Membership, and back numbers of the Proceedings can be obtained from the Assistant Secretary, Miss J. M. Bull, 16 Pembridge Gardens, London, W.2. For any further particulars, apply to the Honorary Secretary, N. de L'E. W. Thomas, M.A., F.S.A., Department of Antiquities, City Museum and Art Gallery, Birmingham.

London Agents: H. K. Lewis & Co., Ltd., 136 Gower Street, London, W.C.1.

Neolithic Bows from Somerset, England, and the Prehistory of Archery in North-western Europe

By J. G. D. Clark

Department of Archaeology and Anthropology, Cambridge

THE object of this paper is first to describe and reconstruct the halves of two Neolithic bows found in the course of peat-digging in the Somerset Levels during 1961[1] and second to put these in historical perspective in relation to the development of archery in north-western Europe. The outcome of comparative studies has been to show that the Somerset bows fall into the last quarter of the first major cycle in the history of the bow in this part of the world, one that lasted from the 9th to the 2nd millennium B.C., during which the bow was by far the most important weapon for both hunting and fighting. So soon as metallurgical industry had made swords and socketed spears available these weapons became predominant and indeed bows and arrowheads fade almost, if not in some areas wholly, from the archaeological record of this part of Europe. It was not until around A.D. 200–400 and, then only among the Teutonic peoples centred on Schleswig-Holstein and Denmark, that there is evidence for a revival in archery. So far as Britain is concerned, the use of the bow was reintroduced by the Anglo-Saxon invaders, probably reinforced by Danes. If the traditional source of the English Long Bow in Gwenth is correct, the weapon must be thought of as developing in the immediate wake of the Anglo-Norman invasion of the closing years of the 11th century. As a major weapon in English armies it lasted from the end of the 13th until the second half of the 16th century when it was effectively replaced by firearms.[2]

The weapons dealt with in this paper belong to the group of self-bows made from single pieces of wood, man-sized weapons for the most part, used by archers on foot, the prototype of all bows and one that successfully maintained itself in this part of the world against the predominantly Asiatic composite bow, built of different elements, most commonly of wood stiffened by antler or horn and backed by sinew. As General Pitt-Rivers and Henry Balfour long ago maintained,[3] the composite bow had no inherent superiority over the wooden self-bow, so long as the latter was made from the most favourable kinds of timber and expertly used. The composite bow was developed in the first place to meet the deficiencies of an

[1] First reported by Professors Grahame Clark and Harry Godwin, 'Prehistoric Ancestors of the Weapons which brought England victory at Crécy, Poitiers and Agincourt: Neolithic Long-bows of 4,500 years ago, found in the Somersetshire Peat', *Illustrated London News*, Feb. 10 (1962), pp. 214–15.

[2] For a useful survey, see Viscount Dillon's chapter VIII in 'The Badminton Library volume on *Archery*, edited by C. J. Longman and Col. H. Walrond and published in 1894. The classic work on the English Long Bow, R. Ascham's *Toxophilus*, originally published in 1545, appeared in an English Reprint edition of 1868.

[3] *J. Roy. Anthrop. Inst.*, xx (1890), pp. 230–50. See especially pp. 242 and 248–50.

environment in which no timber with the toughness and resiliency needed for a good self-bow was available. Recent discoveries by Soviet prehistorians, notably by A. P. Okladnikov, have shown that bows stiffened by antler splinters, and presumably given resilience by sinew backing, were already in use during the 3rd millennium B.C. among the Serovo hunters of the Lena Valley.[1] These weapons made in a territory far beyond the range of deciduous forest were intended for use on foot and, to judge from the traces in graves (fig. 1), were approximately of man size. The composite bows best known to history in the west were of course those carried in by steppe peoples like the Cimmerians and Scyths, short, strongly recurved weapons capable of being fired rapidly from horseback.

Fig. 1

Traces of composite bow, marked by broken antler stiffeners, with burial of a stone age hunter of the Serovo stage in the Lena Valley, Siberia. *After Okladnikov.*

The prehistoric bow of prehistoric Europe, like the English Long Bow of the Middle Ages, was normally made of Yew (*Taxus baccata* L.), a long-lived and slow-growing tree that produced tough and resilient wood. The indications are that the yew did not spread over the north-west German plain and the British Isles until well into the Post-glacial warm period,[2] but charcoals from Long Barrows and 'camps' from southern England show that it was already common there during the Neolithic occupation.[3] It seems that other woods were used for bows only in territories in which the climate was too cold for the yew to make substantial growth; for instance in Schleswig-Holstein and Denmark Elm (*Ulmus*) was generally used; and a single bow, dating from the close of the northern Bronze Age, found in the marginal zone of the deciduous forest in Östergötland was made of Pine (*Pinus*).

Morphologically bows offer scope for variation in length, profile, nature of grip, width and section of limbs and method of attaching the string. A sufficient number of complete specimens is available from the prehistoric period to give a useful idea of the range of size. In the case of incomplete specimens only estimates can be made, though it is sometimes possible, where not more than part of one limb is missing, to reach a close approximation by taking account

[1] A. P. Okladnikov, *Materialy po Arxeologii SSR*, no. 18, fig. 63 *et passim*.
[2] F. Firbas, *Spät- und nacheiszeitliche Waldgeschichte Mitteleuropas nordlich der Alpen*, p. 270 (Jena, 1949).
[3] H. Godwin, *History of the British Flora*, p. 274 (Cambridge, 1956).

of the degree of taper. On the other hand, where only half the stave survives, as happens when it snapped at the grip, there is likely to be a larger margin of error, since bows are likely to be slightly asymmetrical on account of the arrow having to be released from above the hand that held the grip. Unfortunately most of the complete bows have no well-defined grip, so that it is rarely possible to check whether or not they are symmetrical. However, a specimen from Rolenhausen with a pronounced grip was *c.* 2.5 centimetres longer in one limb than in another; and, exceptionally, one from Edington Burtle, which had markedly different nock-ends, showed much more pronounced asymmetry.

Most of the long bows represented in the rock-paintings of eastern Spain, now generally assigned to Mesolithic hunters, are of the simple arc form,[1] but there are several having a wavy profile;[2] and another such example is found engraved on a stone slab (pl. IX) from the long cist or gallery-grave of Göhlitzsch near Merseberg, Germany. As the late Dr K. H. Jacob-Friesen pointed out,[3] this wavy arc can only have been achieved in the case of a self-bow by artificially warping the wood by such means as boiling in water. The degree of waviness, it should be noted, is far less than that of the strongly reflex composite bow and may be compared almost precisely with that displayed by a roughly man-sized wooden self-bow made by the Masai displayed in the University Museum of Archaeology and Ethnology, Cambridge. No surviving bow from prehistoric Europe shows any trace of such a profile, but it should be remembered that wooden objects are only likely to have been preserved under temperate conditions through having been incorporated in water-logged deposits; and in such deposits they would in many cases have been subject to the pressure of overlying beds. A further difficulty lies in the fact that many of the earlier finds, not having been adequately treated, have become more or less severely warped: for purposes of illustration those latter have been drawn as if they had been straight.

Like the Long Bow of Mediaeval England, the examples considered in this paper were normally made from billets split from large timbers, though occasional examples were made by working down a smaller stem. Although care was no doubt taken to select wood as free as possible from knots, such were inevitably present if only where small side-branches had sprouted from the main stem; at such points the prehistoric bowyers, like their recent successors,[4] were careful to leave extra wood in the form of protuberances to counter the local weaknesses. The limbs of the prehistoric bows were almost invariably D-sectioned and the question arises whether the convex face of the stave was held away from or directly fronting the bowman. Among modern 'primitives' the practice was by no means unanimous and the Andaman Islanders, for example,[5] held the flat face of the bow towards them. On the other hand in the case of the English Long Bow

[1] e.g. the well-known scene in the Cueva de la Araña, Bicorp, Valencia. M. Almagro Basch, *Manual de Historia Universal*, v. I, fig. 228 (Madrid, 1960), and Luis Pericot, *El Arte Rupestre Español*, plate opp. p. 48 (Barcelona, 1950).

[2] e.g. at the Cueva Remigia, Castellón de la Plana. See Pericot, op. cit., plate opp. p. 32.

[3] K. H. Jacob-Friesen, 'Die ältesten deutschen Pfeilbogen aus Dauerfrost gefunden', *Heimatblätter für die Grafschaft Diepholz*, N.F. 4/8 Folge, 1960.

[4] An instructive work on modern bows in the Long Bow tradition is Saxton Pope's *Hunting with the bow and arrow* (New York, 1925). For the method of coping with grip, see p. 62.

[5] A. R. Brown, *The Andaman Islanders*, pp. 419–32 (Cambridge, 1922).

and its modern descendants, that presumably derive ultimately from the prehistoric bows of Europe, there is no question that the convex face formed the belly directly fronting the archer and the flat one the back that faced away from him. Occasionally, as with the specimen from Ashcott (no. 4), it is possible to determine from signs of wear on the nock that the stave was in fact held with the flat face away from the archer. There is no apparent sign that the Ashcott and Meare or, indeed, any of the Stone Age bows from Europe retained sapwood on the back as do 19th-century long bows still used in competitions in England.

As to the means of grasping the weapon, many of the prehistoric bows have clearly defined hand-grips. The degree to which the grip is defined depends in part on the relative width of the limbs, which range from *c.* 2.5 centimetres to as much as 6.85 centimetres, and in part on the degree to which the grip is shaped to project when viewed from the side. In section the hand-grips range from circular (class A) to elliptical (class B) and quadrangular (class C). On the other hand some prehistoric bows, like the historical Long Bow itself, show no shaped grip; but this feature seems to have appeared relatively late in the north-west European sequence, first appearing in the 3rd millennium B.C.

In the more sophisticated Long Bow the string was secured to separate horn nock-pieces fixed to either end of the stave, a device that seems to have made its first appearance in northern Europe during the Late Roman Iron Age[1] (A.D. 200–400); but in the prehistoric bows the nock was formed from the tip of the wooden stave. There was wide scope for variation in the precise form of nock and the following classes may be noted:

Class A. In this the tip of the stave has merely been tapered to a point.

Class B. Here the projection for holding the string has been more or less sharply defined from the stave by cutting a shoulder. The projection itself may be broad and spatulate (B1), narrow (B2) or knobbed (B3).

Class C. In this class notches have been cut on either side to isolate the tip, which could be short (up to 1.5 centimetres) and blunt (C1) or up to 3 centimetres in length and more or less pointed (C2).

Class D. The tip is spoon-shaped, being only gently defined by shallow concavities on either side.

Class E. The tip tapers but is squared at the end. No notch or shoulder. Only one specimen and possibly incomplete.

As a rule where both ends of a bow are preserved the two belong to the same class (*e.g.* nos. 14, 24, 31); the only certain exception (no. 6) is also outstanding by reason of its pronounced asymmetry.

One of the most marked ways in which self-bows differ from one another lies in the thickness and width of their limbs and in particular in the ratio of thickness to width, which, as we shall see, ranged in the prehistoric series from 1:1.1 to as low as 1:3.9 (fig. 2).

[1] e.g. At least two of the 36 bows from the Nydam ship had separate nocks secured to the tips of the stave, one being of horn, the other of antler.

A final matter that needs consideration is the extent to which the prehistoric bows were backed by the addition of animal sinew or other material. In so far as almost all the prehistoric bows were made of the same wood as the historic Long Bow, which required no backing of any kind[1], there is no *a priori* reason for supposing that they had either. Careful examination of prehistoric staves has failed to reveal any trace of backing with the single exception of the bow from Meare described in detail in this paper. This example was furthermore the only

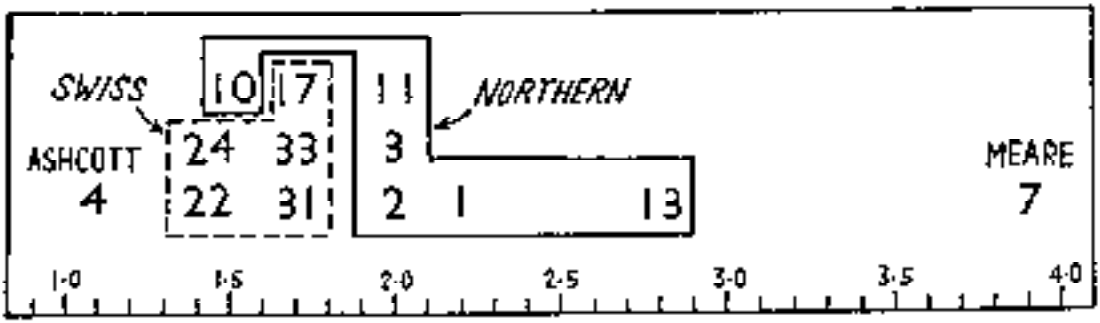


Fig. 2

Diagram illustrating ratio of thickness into width of limb in prehistoric bows from north-west and central Europe. The numbers refer to the list of bows (pp. 85–95).

one to reveal definite traces of the binding at the extremities of the limbs which we know from contemporary illustrations[1] to have been used to fortify this part of the historic Long Bow. In parenthesis it should be noted that although many of the older finds have deteriorated since they were found, a number of new finds have been very carefully preserved (*e.g.* nos. 3, 4, 7, 16–20, 33) or alternatively have been examined by the present author while still wet (*e.g.* nos. 17–20, 33). The webbing on the limbs of the Meare bow was presumably needed because they were cut exceptionally wide in relation to their thickness (see fig. 2).

PART I. THE BOWS FROM ASHCOTT AND MEARE, SOMERSET

The conditions under which the halves of two bows were recovered during 1961 from the Somerset Levels are fully described in the preceding article in this volume (pp. 17–49) by Professor H. Godwin, F.R.S. and Mr H. S. L. Dewar.[2] It will be sufficient to note here that the bows owe their survival to the fact that they had been discarded by their former owners in peat bogs and to the further circumstance that employees of the Eclipse Peat Company were sufficiently observant and interested not only to notice them but to remove them in such a way as to make it possible to fix their precise stratigraphic context. One may believe that this interest was a direct outcome of the researches and watchfulness of

[1] e.g. on an illuminated MS. of c. 1300 illustrated on fig. 97 of Longman & Green's *Archery*.

[2] H. S. L. Dewar and H. Godwin, 'Archaeological Discoveries in the Raised Bogs of the Somerset Levels', *PPS*, xxix (1963), 17 ff.

Professor Godwin and Mr Dewar over a long period of years.[1] Certainly it is solely due to their work and that of the staff of the Cambridge University Sub-department of Quaternary Research that it has been possible to fix the chronological context of the two bows.

Stratigraphically the two bows occurred near the base of dark humified peat previously known to have yielded a polished axe of Craig Llywd stone and sherds of a Neolithic bowl of the Peterborough class, as well as a number of wooden trackways of Neolithic age.[2] Analysis of peat samples from the surface of each of the bows revealed the presence of a number of plants, such as rib-wort, plantain, docks, dandelion and mugwort, characteristic of the clearance phase associated with the spread of Neolithic farming. And, thirdly, radio-carbon analyses by Dr Eric Willis gave results fully consistent with these findings, viz.

Ashcott bow:	Q 598	2665 B.C. ± 120
Meare bow:	Q 646	2690 B.C. ± 120

Dr Willis has since given great assistance to the research on prehistoric bows by dating samples cut from the two other specimens known from England, those from Edington Burtle, Somerset, and from the neighbourhood of Cambridge, found respectively in 1842 and 1885.

The Ashcott and Meare bows were each brought direct to Cambridge as soon as they were found in a wet condition and were subjected to carbowax treatment by Mr C. E. Lilley in the workshop of the Cambridge University Museums of Archaeology and Ethnology. As a result they are both in a remarkable state of preservation so that the finest cuts and marks can be observed on their surfaces. Tentative examination was made and records taken before treatment, but no complete study could be undertaken until they could be handled freely. All drawings of these and of comparable bows from England and continental Europe were made by the author. The Ashcott and Meare bows were photographed by Mr J. P. Morley of the Museum staff. Life-size reconstructions were made by Mr Lilley and these proved of great value in elucidating details. The author is greatly indebted to the Curator for making these facilities available and for his wise counsel. Finally, it deserves to be recorded with special gratitude that the Eclipse Peat Company followed up their highly commendable initiative in rescuing the bows by presenting them to the Cambridge University Museum of Archaeology and Ethnology where they are available for study and inspection.

Description

The two half bows which provide the immediate occasion of this paper, although found within a mile of one another and dating from the same period, differ markedly one from the other. The Ashcott bow was not only a shorter weapon by something of the order of 30 centimetres, but also a slenderer and at

[1] Prof. Godwin published a preliminary account of the stratigraphy of the Somerset Levels more than twenty years ago in the *New Phytologist*, vol. 40, 1941. Since then he has issued a number of papers on this topic.
[2] H. Godwin, 'Prehistoric wooden trackways of the Somerset Levels: their construction, age and relation to climatic change', *PPS*, xxvi (1960), pp. 1–36, especially pp. 17–24.

the same time proportionately much thicker one. Indeed, whereas in the Ashcott bow the ratio of thickness to width of limb is one of the highest, the Meare one is by far the thinnest of the whole prehistoric series (fig. 2), the ratio (1: 3.9) of thickness to width being easily the lowest; again the absolute width of the Meare bow is more than 3½ times that of the Ashcott one. The two agree in having well-defined grips, each somewhat flattened in side view, but different in that the Ashcott one is only very slightly and the Meare one very markedly constricted viewed from front and back. In the form of nock there is also some difference, that of the Ashcott bow being made of class B2 and that of the Meare one, so far as can be told from the surviving fragment, of class B3.

Coming down to greater detail, the Ashcott specimen (fig. 3; pl. II), like that from Meare, has apparently been cut from a billet of yew wood split from a mature trunk or stem. The limbs have been shaped to a D-section by cutting away wood along the whole length of one face on either side of the grip, the central part of which is oval in section (class B). The bow has evidently been finished to a high state of smoothness. The limbs taper towards their extremities and the surviving nock has been vigorously shaped: although falling broadly into class B3, the precise form is in fact unique, the shoulders being slightly everted and the notch obliquely rather than transversely cut. A feature of particular interest is the transverse groove on one face of the nock, clearly visible in side view: whether intentionally cut to receive the bowstring or the result of wear from this, this feature shows clearly enough that the bow in question was held with the flatter face forming the back away from the archer, who, as in the case of the historic Long Bowman, fronted onto the convex belly.

The Meare bow (fig. 3; pls. III, IV), like the one from Ashcott, has been snapped at the grip, the result perhaps of a broken string or of too much force having being applied to the stave. This makes it difficult to estimate precisely the form of the handle or even the length of the bow. In arriving at some notion of the handle great assistance was obtained from Mr C. E. Lilley, who working from drawings of natural size and following the beautifully cut contours of the original, made the reconstruction shown on pl. V. Assuming that the reconstruction of the handle is approximately correct and accepting that the bow was symmetrical about the grip, its total length would have been *c.* 199.5 centimetres; on the other hand, if we allow for the degree of asymmetry shown for example by the complete specimen from Robenhausen (nn. 24), one must conclude that its length may have been either 188 or around 193 centimetres. The limbs have been finely cut and finished and are unique in the European series, not only for their width and relative thinness, but also for the keel that runs down from the handle, a feature that may well have been designed to compensate for the weakness imparted by the inward curvature of the handle on the opposite face. Although towards the end the surviving limb assumes the normal, though very shallow, plano-convex section, nearer the middle it is convex on both faces, even if rather more so on one, and towards the handle becomes markedly keeled on the face opposed to the regularly convex one. The fact that only a small part of the nock is preserved in this case makes it difficult to decide which face formed the belly fronting the bowman; on the other hand the transverse groove visible on the remaining part

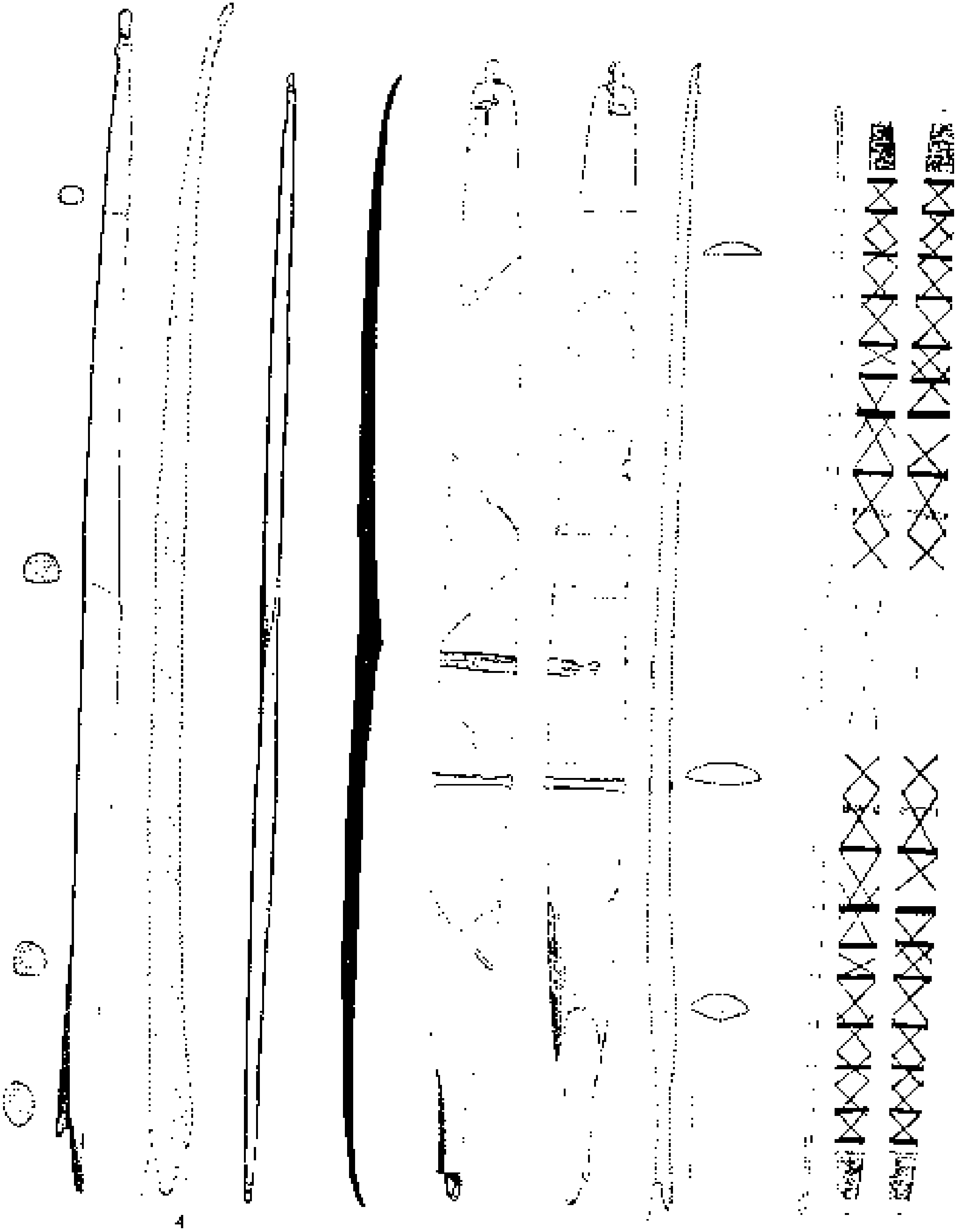


Fig. 5

Drawings of the Ashcott (Q 598, 2005 B.C. ± 120) and Meare (Q 646, 2690 B.C. ± 120) bows, showing the surviving half staves at 1/5 and the reconstructions at [illegible] to natural size.

suggests that the bow may have been held as shown on pl. v, that is with the more convex face outermost.

A feature of the Meare bow for which no parallel has yet been found on any other prehistoric bow, either in this country or on the continent of Europe, is the elaborate binding and webbing on the limbs. None of the actual binding has survived, but impressions of this are visible over a zone of about 8 centimetres below the nock and again over a width of *c.* 1.3 centimetres below the transverse webbing. The evidence is clearest where the binding cut into the sharp edges of the bow and enlarged photographs (pl. III) have shown that faint traces can even be seen traversing the convex face of the stave. To judge from the markings where these are most sharply defined, the thread must have been a very fine one—something of the order of 25 to the centimetre. The function of the binding at the end of the bow was doubtless to strengthen it at its whippiest part and at the same time to prevent splitting along the natural grain of the wood where the limb began its most pronounced taper.

More clearly visible in some cases (pl. IV) are signs of what appears to have been a complex system of webbing, comprising two main elements, transverse and criss-cross. Two members of the transverse elements survive in the form of raw-hide or leather bands, one complete, the other not quite so. According to Dr Ryder's expert determination (Appendix III), the material comprised ox skin, which may or may not have been tanned. The complete band was a plain strip about 1 centimetre in width joined on the convex face by scarfing and presumably by sticking the overlapping ends. The less complete band was half as broad again and was decorated on the outer face by six parallel lines, apparently incised by a sharp flint flake or blade, a method of decoration for which there is a good analogy in the chevrons incised on the leather scabbard of the well-known flint dagger from Wiepenkathen, kr. Stade, in north-west Germany.[1] Examination of the flatter face of the bow shows that originally there must have been as many as eight of the transverse bands on each limb; the positions of these are indicated by dots on fig. 3 and in some cases are visible in the form of transverse markings on the photograph of the inner face of the surviving limb (pl. II). The final trimming of the webbing seems to have been carried out after these had been fixed on the wooden stave: as Professor Harry Godwin, F.R.S., first noticed, irregularities seem to have been cut away by a sharp-edged flint comparable with that used to decorate one of the surviving bands, a fine cut-mark being clearly visible running parallel to the plain band on its nock-ward side. Other cut-marks are visible on the convex face of the limb and provide evidence for criss-cross webbing. The existence of parallel cuts shows that this criss-cross webbing was made of thongs ranging from $\frac{1}{3}$ to $\frac{1}{2}$ of a centimetre in width. Only one slight trace (pl. IV) of this narrower webbing survives in the form of a thin portion of translucent material, presumably some kind of animal gut or sinew. The criss-cross markings and Mr Lilley's experiments suggest that two threads were used and that the finished result, which accounts for all the traces, would have been much as shown on the reconstruction (pl. V and fig. 3).

[1] A. Cassau, 'Ein Feuersteindolch mit Holzgriff und Lederscheide aus Wiepenkathen, Kreis Stade', *Stader Archiv*, (1937), pp. 3–15. See also *PPS*, II (1936), pl. XII.

What was the purpose of this webbing? It can hardly be without significance that this apparently unique feature occurs on a bow which stands out from the whole prehistoric sequence in the relative thinness and width of its limbs. The webbing, one would think, was designed to compensate in some way for the breadth and thinness of the stave, but this only poses the question why a weapon should have been designed that needed this rather complex compensation? Why not simply have made the limbs narrower and thicker? Quite clearly the bow was something of a *tour de force*, being outstanding in size and finish as well as in respect of this webbing. In Neolithic Britain it is not difficult to imagine that the bow was symbolic of a man's standing and very personality. In prehistory we cannot identify distinguished individuals by name, but we can sometimes recognize their existence. The effectiveness of the Meare bow was demonstrated at the Grand Western Archery Society's Meeting held at Dunster in May, 1963, when an experienced bowman, using a reproduction made by Mr Lilley, hit the target at the third draw from a range of 60 yards.

PART II. ARCHERY IN NORTH-WESTERN EUROPE FROM THE 9TH TO THE 2ND MILLENNIUM B.C.

Although recourse has been made in certain sections to published sources, almost all the bows tabulated in Appendix I, as well as the later ones discussed in the final section (pp. 86–9), have been studied in the original and drawn by the author.

Grateful acknowledgment is made to all who made it possible and indeed easy to study the bows. The author would like in particular to thank the Council of the British Academy for help towards the cost of travel; and the authorities of the Pitt-Rivers Museum, Oxford, of the Castle Museum, Taunton, and of the Provincial Museum of Drenthe at Assen for permitting samples to be taken from the bows found near Cambridge (no. 5), at Edington Burtle, Somerset (no. 6) and at Oostwedde, Groningen (no. 14) for the purpose of radiocarbon dating. Among the many individuals he would wish to thank are: Dr J. Troels-Smith of the National Museum and Professor C.-J. Becker of the University, Copenhagen; MM. J. D. van der Waals and H. H. van Regteren Altena of Groningen and Assen and M. W. A. van der Wal of Hoornstede, owner of the Noordwijkerhout bow; Professor H. Schwabedissen of the University of Cologne; Dr W.-D. Asmus of the Landesmuseum, Hanover; Professor M. Jahn, Director of Landesmuseum, Halle Saale; Professor E. Vogt, Director of the Landesmuseum, Zürich; and Dr W. U. Guyan, Director of the Allerheiligen Museum, Schaffhausen.

The Beginnings of Archery

Precisely when early man hit upon the idea of utilizing the resilience of a wooden stave to propel darts is still uncertain, but the claim sometimes made that the bow is man's oldest weapon is certainly incorrect since there is no evidence in the archaeological record for any kind of projectile head until a comparatively late

stage of the Old Stone Age. The only definite weapon identified from the Lower Palaeolithic is the stout wooden spear with point; specimens from Clacton, Essex,[1] and from Lehringen, near Verden in Lower Saxony,[2] were each made of yew wood and the latter was actually found between the ribs of an extinct straight-tusked elephant (*Hesperoloxodon antiquus* Falc.) in an interglacial marl. Spears of this simple type would have been useful for holding wild animals at bay, but to judge from the experience of the pygmies of the Cameroons their main purpose was probably to wound enough to draw the blood needed to provide a trail. At what stage wooden shafts were first made more effective by the attachment of stone heads is still not certainly determined, but bifacially flaked points found in certain Mousterian industries of Central and Eastern Europe would have been well adapted to this purpose.

The first undoubted projectile heads to appear in the archaeological record were those made in antler, bone and ivory, as well as flint, by the several groups of the Advanced Palaeolithic hunters who began to appear in Europe around 35,000 years ago. The bases of the various forms of split-base, lozenge and biconical points made of bone and similar materials by the Aurignacians and the bevelled points favoured by the Early and Middle Magdalenians were all adapted to mounting on wooden shafts either as tips or barbs. That some at least of the spears or lances so formed were propelled is suggested by the often beautifully carved rigid spear-throwers of reindeer antler from Middle Magdalenian cave-deposits,[3] as well as by the representation of what appears to be a thrower and a single-barbed spear on the famous painted scene at Lascaux[4] featuring a wounded bison and a recumbent man. Further it must be remembered that effective spear-throwers could have been made from wood or leather thongs, neither of which would survive in cave deposits; and in this connection it may be noted that rigid throwers of reindeer antler die out of the record at the very moment that the barbed points of the Late Magdalenian appear, points which from the swelling and or perforation at the base have been assumed to have served as harpoon-heads attached to lines, weapons that must surely have been propelled.

What evidence is there that any of the Advanced Palaeolithic hunters of Europe practised archery? To be sure of this, it may first be emphasized, one needs traces of actual bows or undoubted representations of these; only less decisive are arrowshafts with the lower ends sufficiently intact for the nock to be present. Nothing definite can be inferred from projectile-heads, or even from representations of projectiles, concerning the methods by which they were projected. Projectiles are indeed represented quite commonly in the cave art of the Franco-Cantabric area, notably the 'arrow' signs engraved on the flanks of horses and bison at Lascaux,[5] in one case pointing to cup-shaped hollows presumably indicating wounds, or again on bison at Niaux[6] and the fletched or

[1] K. P. Oakley, *Man the Tool-Maker*, p. 14, fig. 5 (London, 1952 edn.).
[2] Hallam L. Movius, 'A Wooden Spear of Third Interglacial Age from Lower Saxony', *Southwestern Journal of Anthropology*, vol. 6 (1950), pp. 139–42.
[3] D. A. E. Garrod, 'Palaeolithic Spear-Throwers', *PPS*, xxi (1955), pp. 21–35.
[4] F. Windels, *Lascaux*, pl. 53 (Montignac-sur-Vézère, 1948).
[5] *Ibid.*, pp. 50–1 and 78.
[6] P. Graziosi, *L'Arte dell' Antica Età della Pietra*, Tav. 200b, pp. 201 and 272 (Florence).

feathered shafts depicted for example in dark paint on or close to horses from Lascaux,[1] but there is in fact nothing to show that such were propelled by bows rather than spear-throwers and they are probably best designated as darts.

What is potentially the earliest evidence for archery, takes the form of delicately flaked barbed and tanged points of flint (fig. 4) from Late Solutrean deposits underlying Early Magdalenian ones in the cave of Parpalló in Eastern

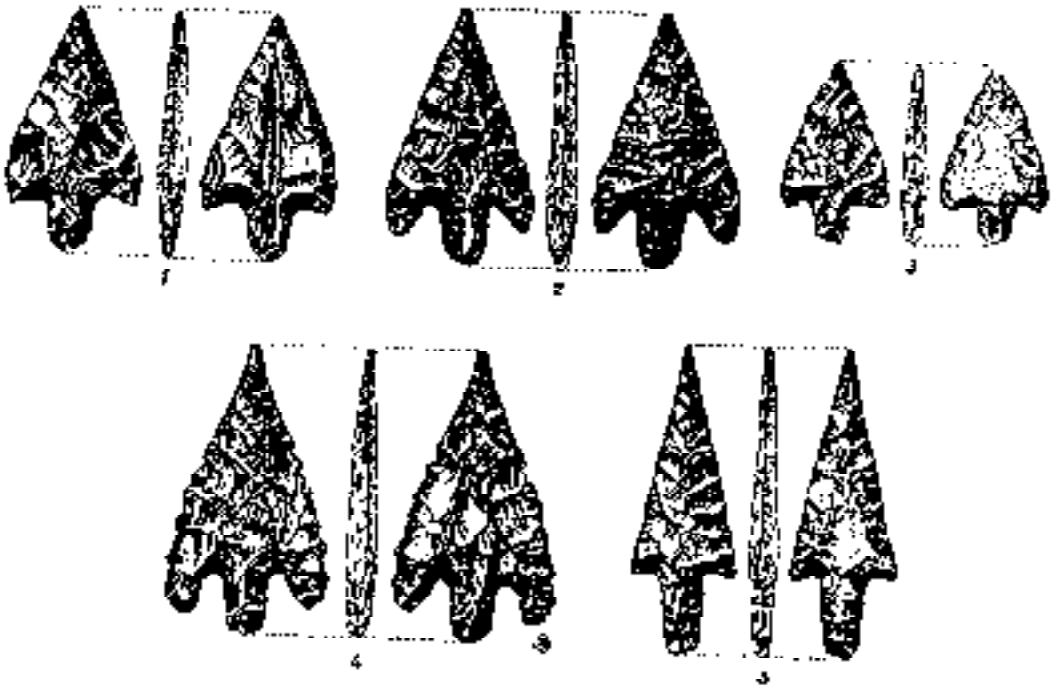


Fig. 4

Flint projectile points from Late Solutrean deposits underlying Magdalenian levels in the cave of Parpalló, eastern Spain. Nat. size. *After Pericot.*

Spain,[2] a territory notably different ecologically from that in which the Franco-Cantabric art was executed: these points, which have clear affinities with those of the Aterian of North Africa, would, if discovered, for instance, in an Early Bronze Age context in Britain, be accepted beyond any doubt as arrowheads; yet one can hardly infer the use of the bow from these alone, since there is always the possibility that they may have been propelled by some other means.

More conclusive evidence for archery dates from the final or Younger Dryas phase of the Late Glacial period (*c.* 8800–8300 B.C.) and comes from waterlogged sediments at Stellmoor, the open station in Schleswig-Holstein occupied by Ahrensburgian reindeer-hunters. Remains of what appear to be over 100 wooden

[1] Windels, *op. cit.*, pp. 53 and 78.
[2] L. Pericot, *La Cueva del Parpalló*, fig. 21, pl. IX (Madrid, 1942).

arrow-shafts (fig. 5), including a number with their lower ends intact and several upper ends, two with the tangs of flint arrow-heads still in place, as well as a complete tanged point found with two fragments of the shaft in the breast of a reindeer,[1] are highly suggestive; indeed, the only gap in the evidence is an actual bow.[2] The exceptional conditions for the preservation of wood in these glacial tunnel-valleys leads one to examine with some attention material from the earlier Hamburgian levels (*c.* 13,000 B.C.) in the same area. Clues from the Hamburgian horizon at Stellmoor comprised splinters of shouldered flint points embedded in reindeer bones,[3] but there was no decisive evidence as to the means of projection. Rather more definite, though still inconclusive, evidence can be cited from the site of Meiendorf, where the Hamburgian culture was first recognized, in the form of holes in the bones of Crane and White Grouse that seem to match reindeer antler points of a kind found on the site;[4] but here again, though one can be reasonably sure that projectiles were used, the actual mechanism must remain in doubt.

Fig. 5
Reconstruction of Ahrensburgian arrow. (½)

To sum up, one must conclude that, in relation to the million years or so of man's prehistory, the bow is a comparatively recent invention; that it may have appeared in southern Europe and northern Africa around 15,000 B.C.; and that in northern Europe it had almost certainly begun to come into use during the final (Younger Dryas) phase of the Late-glacial period, that is during the 9th millennium B.C.

Archery during the Mesolithic, Neolithic and Early Bronze Age Phases in North-western Europe

There are many indications that archery played a role of great importance whether in hunting or fighting, both among the hunter-fishers who established themselves at a time when forests were consolidating during Post-glacial times and among early peasant populations, down to the time when metallurgy had developed far enough to make alternative forms of armament effective. As a matter of convenience the evidence for bows and arrows will be reviewed separately before consideration is given to the purposes for which this armament was used. Details of the bows and arrows referred to will be found in Appendices I and II and their positions are shown on fig. 6.

[1] A. Rust, *Die Alt- und Mittelsteinzeitlichen Funde von Stellmoor*, pp. 189–92, pls. 91–6 (Neumünster, 1943).
[2] The two pieces of pine wood put forward as bow-ends by Rust (*op. cit.* pls. 93–8) fail to carry complete conviction.
[3] A. Rust, *op. cit.*, p. 133, pls. 34, 35, fig. 1.
[4] A. Rust, *Das altsteinzeitliche Rentierjägerlager Meiendorf*, pp. 116–7, pl. 53 (Neumünster, 1937).

Bows

Mesolithic. Although microlithic arrow-armatures are among the most characteristic artifacts of the Mesolithic phase of European prehistory, the only certain traces of Mesolithic bows are two specimens (nos. 1–2) from Holmegaard IV (pl. VI) on the Danish island of Zealand, a site which seems to have been occupied

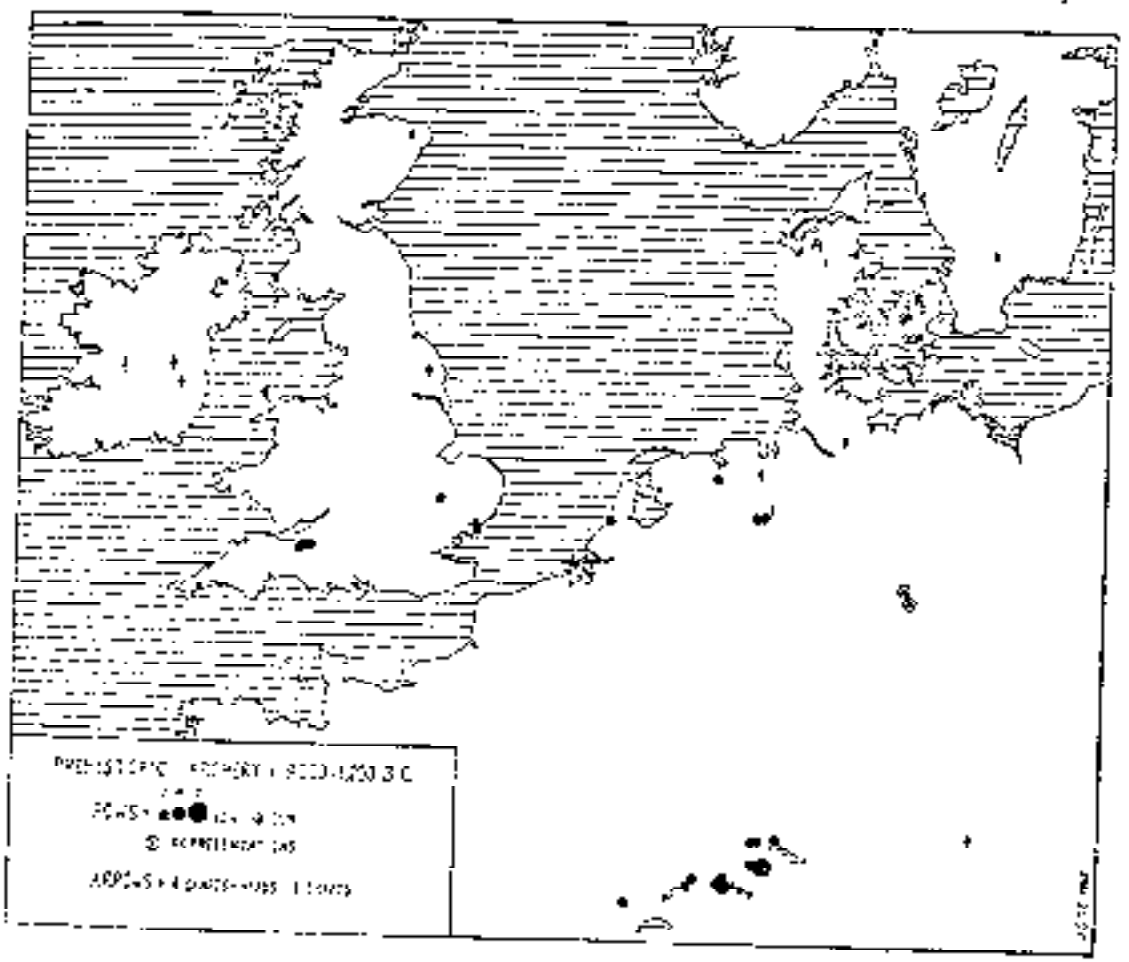


Fig. 6. Map of bows and arrows described in text.

during Late Boreal times (from *c.* 6000 B.C.). Although varying in length (154 centimetres and *c.* 180 centimetres), it is important to note that both are man-sized bows; the only man of the Boreal period from Denmark whose stature can be calculated, namely the one from Koelbjerg, near Odense, Fyen,[1] was *c.* 155 centimetres tall, though there are signs in the remains from Stangenäs in Bohuslän[2] that taller men, up to *c.* 182 centimetres, existed in west Sweden at about this time. The Holmegaard bows can be seen to belong to the same type, even if the ends of the larger one are missing. The limbs are plano-convex and

[1] K. Brøste, *et al*, *Prehistoric Man in Denmark*, vol. 1, p. 28 ff., 54 ff., pl. 19 ff. (Copenhagen, 1956).
[2] C. M. Fürst, *Fornvännen* (1925), 269 ff.

notably broad and the ratio of thickness to width is low (fig. 2); the grip is well-defined from both aspects and roughly quadrangular in section (class C); and the extremities are pointed (class A; fig. 8).

Neolithic. Bows are much more numerous from Neolithic contexts, even though they have only survived on old bog or lake sites, where alone conditions prevailed that inhibited or at least slowed down the decay of wooden objects. In addition to those already described from England, they fall into two main groups, one centred on the North European Plain and the other on the Alpine zone, where lakeside settlement was strongly developed.

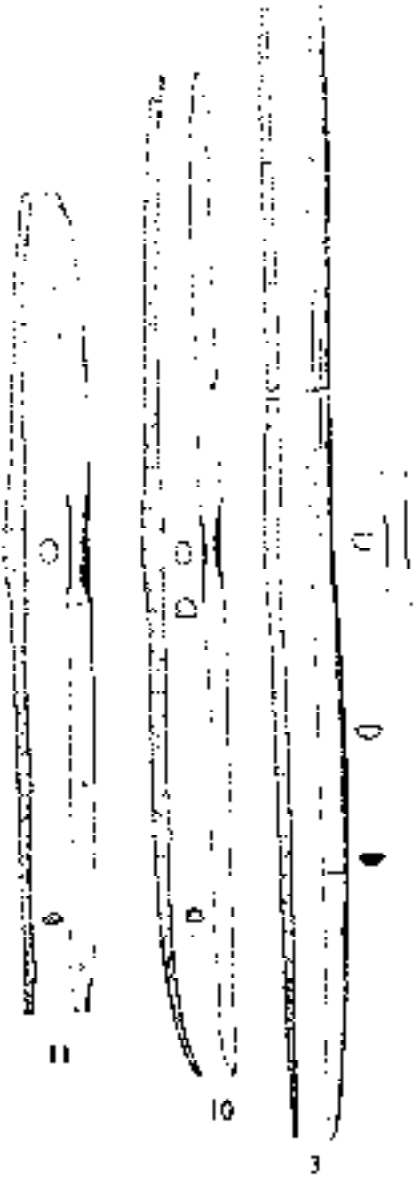


Fig. 7. Neolithic bows from northern Europe. (1–10)

The northern bows (fig. 7) are disappointingly small in number and for the most part poor in quality. The only certainly man-size specimen, indeed, is that from the well-known Funnel-neck Beaker A site of Muldbjerg on Zealand, a bow (no. 3) that must originally have been around 160 centimetres long. The remaining examples were all rather small, comprising a broken one (no. 12) from a site of comparable age from the Satrup bog in Schleswig-Holstein and a pair of older finds (nos. 10–11) from the Ochsenmoor, Diimmer, Lower Saxony, one *c.* 134 centimetres, the other probably substantially longer. The most interesting feature of these bows as a group is their general resemblance to the ones from Holmegaard, which could well have been their prototype; thus, all six have constricted grips, the Holmegaard ones differing only in having quadrangular sections (class C); the limbs are plano-convex in section and the ratio of thickness to width is relatively low, mostly bunching into the zone 1:2.6 to 1:2.2 (fig. 2); and the nocks (fig. 8) in the three bows, where these have been preserved, are all of the pointed type (class A).

The bows from the Alpine region are more numerous and on the whole better preserved (fig. 9); and they show a wider variety of forms. Bows with well-defined grips occur from Robenhausen (no. 24) and Sutz (no. 31), but each of these has well-defined shoulders and projecting nocks (class B2). More numerous, on the other hand, were bows having no defined grip, more or less

4

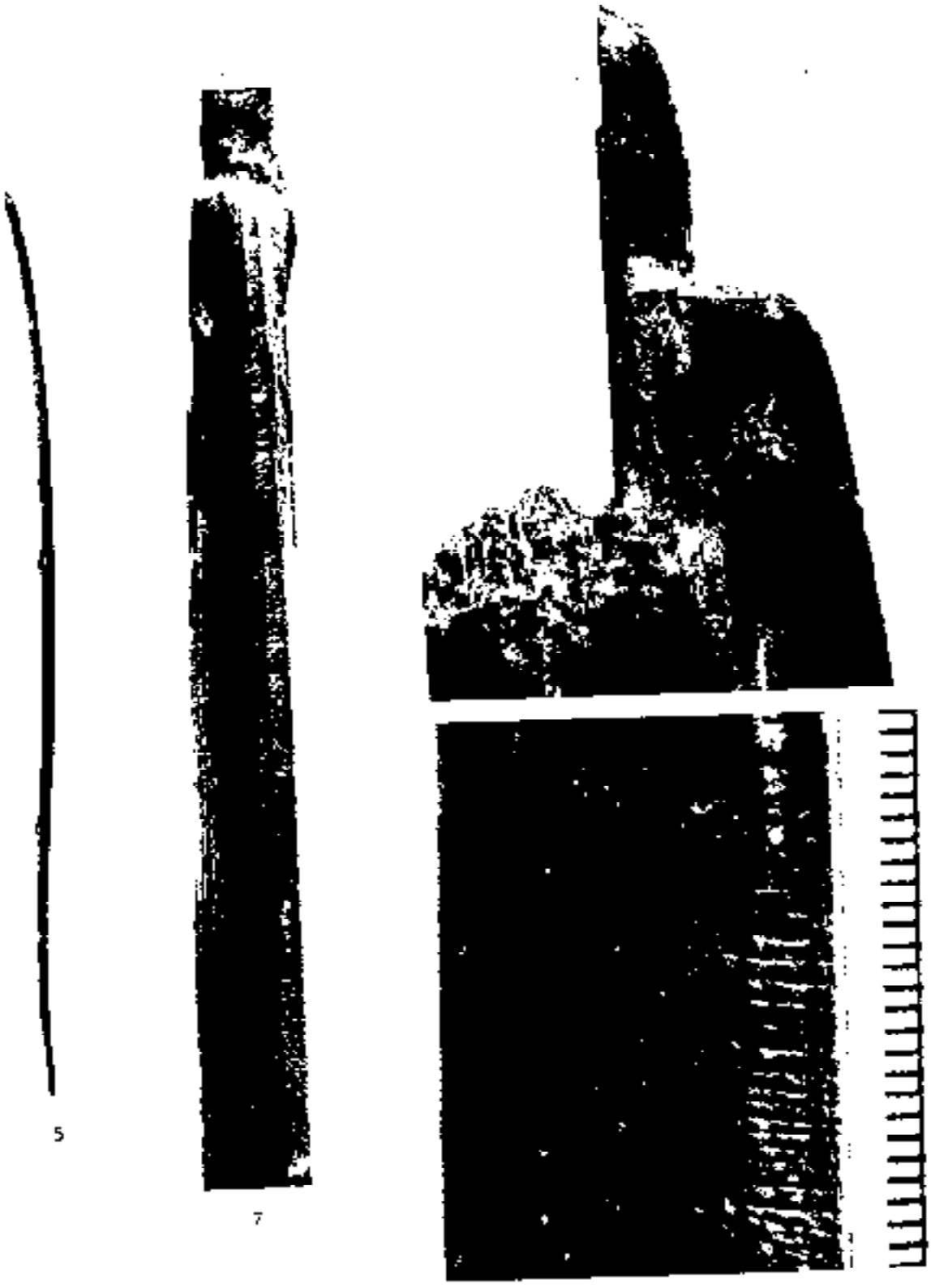
7

The Ludford Neolithic yew bows from Ashcott (no. 4) and Meare (no. 7), Somerset ($\frac{1}{2}$).

Note. Side view of the back of no. 4, showing the bow-string groove ($\frac{1}{2}$).

Photos, Cambridge Univ. Mus. Archaeology and Ethnology.

PLATE III



(Left) Side view of Cambridgeshire Beaker bow (no. 5) (c)
(Middle) Detail of the surviving end of the Meare bow (no. 5). Side view (2·1)
(Right, upper) Meare. Remaining part of the nock with bow-string groove (2·1)
(Right, lower) Meare. Marks made by the bending thread (scale in half-centimetres)

Photos: Camb. Univ. Mus. Archaeology and Ethnology.

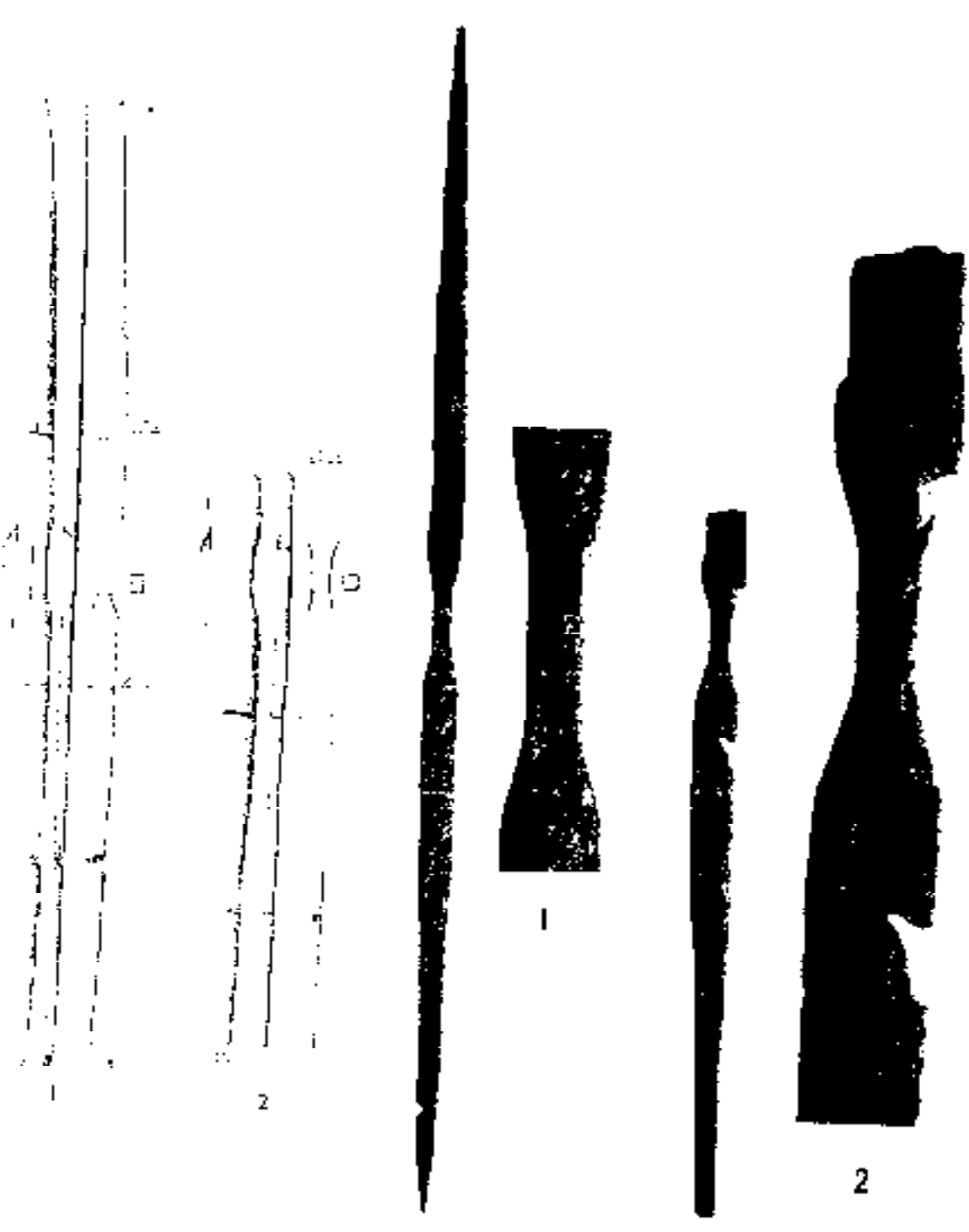
PLATE IV

Detail of the webbing on the Moore Bow, showing transverse feather bands and a trace (top left of right-hand photograph) of the narrow oblique webbing. (cf. 23)

Photos, Cambr. Univ. Mus. Archaeology and Ethnology.

Reconstruction of the Meare bow in the initial phases of being drawn by Mr E. C. Talley.

Photo. Comb. Univ. Mus. Archaeology and Ethnology.



Mesolithic elm bows from Holmegaard IV, Zealand, Denmark (nos. 1, 2). ½.

Photos: Nationalmuseet, Copenhagen.

Middle portion of Early Bronze Age yew bow from De Zilk, Noordwijkerhout, Zuid Holland, Netherlands (no. 131 (1))

Photo, Archaeological-Biological Inst., Groningen.

Stone Age arrows and shafts from northwest Europe. [illegible]

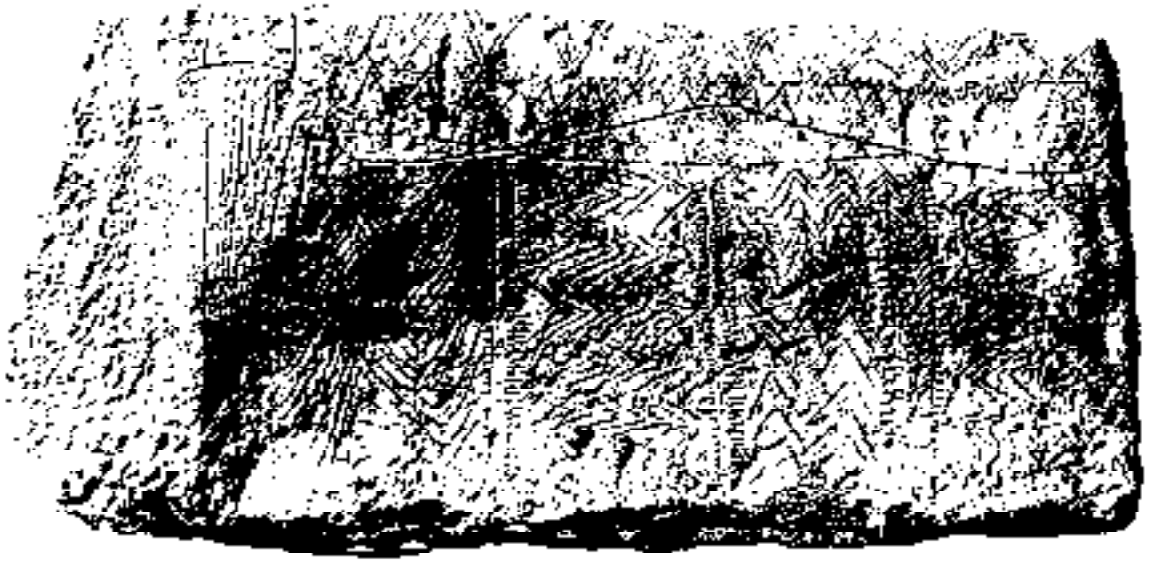
A Forepart of arrow from Burgäschisee, Berne, Switzerland, the [illegible] split to reveal the flint head, the tip of the shaft and the binding. *Photo: Landesmuseum, Zürich.*

B Leaf-shaped arrowhead from the [illegible] surface at Walton-on-the-Naze, Essex, showing profile of [illegible] defined by differential patination.

C Chisel-ended or transverse flint arrowhead mounted on wooden shaft with sinew binding from [illegible], Jutland.

D Mesolithic arrowshafts from Vinkel Mose, Zealand, Denmark. *Photo: Nationalmuseet, Copenhagen.* i–iii. Tip with slot for microlith. [illegible] iv. Traces of the binding that secured the upper end of the feathering. v–vi. Nock-end with lower sinew binding.

E Nock-end of yew bow from Niederwil, Thurgau, Switzerland (½).



(*Upper*) Boarman and Animals engraved on a Late Neolithic sandstone slab from Salzmünde, nr. Halle, Saxony. (c. ⅓)

(*Lower*) Engraving on the Gönnebeck slab showing a bow of wavy profile suspended below the waters next to an axe and a quiver with six arrows. *Photos: Landesmuseum, Halle, Saale.*

complete examples occurring at Egolzwil 4 (no. 17) and at the Michelsberg sites of Niederwil (no. 22) and Weiher (no. 33); these bows have plano-convex limb-sections of slightly concave D-form with a width-breath ratio of between *c.* 1 : 1.4 to 1 : 1.7, that is to say substantially higher than those of the Northern group; and they have nocks of classes C and D, which are apparently peculiar to the region at this period (fig. 10).

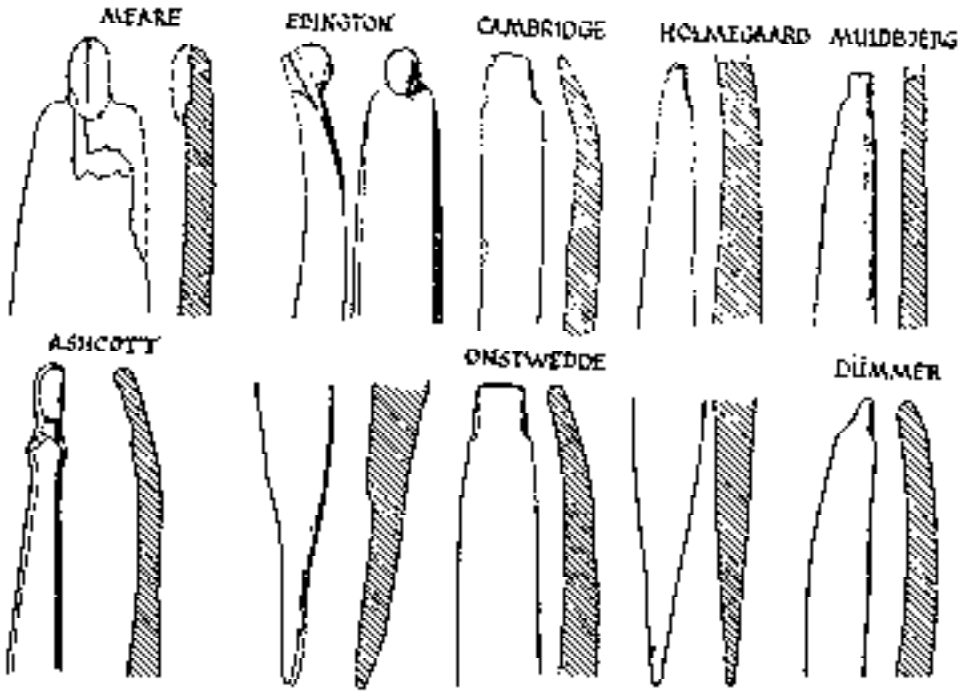


Fig. 8. Nock-ends of bows from north-west Europe. (½)

In comparing the English Neolithic bows, their well-defined grips could be matched in either the Northern or Alpine group. The limb-proportions of the two stand at almost the extreme range. Their nocks (fig. 8) are to a large extent unique, even if that of the Ashcott bow falls broadly into class Ba. The fact that our three neolithic groups differ from one another is not surprising when it is recalled that the bow had already a long history before the spread of agriculture; and indeed as we have shown the indications are that the Northern group stemmed from the Holmegaard type already long established in the area. Although some of the Northern bows were admittedly of smaller scale, the early bows were in general of man-size, a fact which, despite the small numbers of more or less complete bows, is well brought out when comparison is made (fig. 11) with the heights of contemporary men: even if the English bows are too few to make a comparison of averages meaningful, it is suggestive that their presumed lengths are respectively slightly above the minimum and maximum statures of males from recently excavated Long Barrows;[1] in the case of the Swiss bows the five more or

[1] The English material used for fig. 11 comprised nineteen males from recently excavated Long Barrows, viz. Giant's Hills, Skendleby (post), A. J. E. Cave in *Archaeologia*, LXXXV, 93 ff.; Lochill (four), A. J. E. Cave in *PPS*, IV, 131 ff.; Nutbane (three), G. H. Bushnell, D. K. Verity and I. W. Cornwall in *PPS*, XXV, 46 f.; West Kennet (eleven), Prof. R. J. Wells in S. Piggott's *The West Kennet Long Barrow Excavations, 1955–56*, pp. 82 and 86.

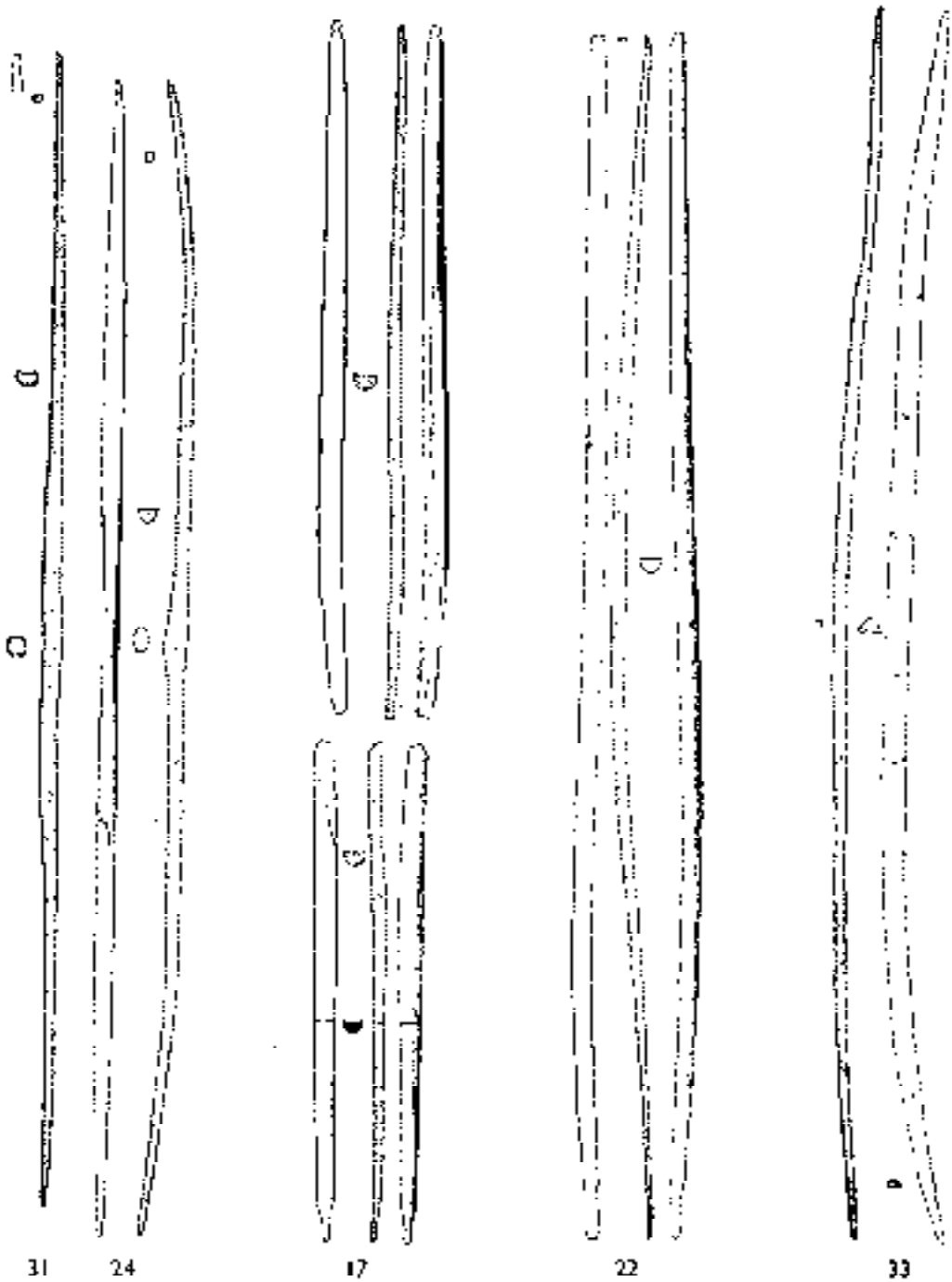


Fig. 9

Neolithic bows from Switzerland. (1, 10)

less intact ones convincingly out-top the mean average stature of Neolithic males from the region.[1]

Beaker and Bronze Age. Two bows can be attributed on the basis of radiocarbon analysis to the Beaker people. Of the English specimen (fig. 12, no. 5) our only record is that it was 'found deep down in the peat near Cambridgeshire in 1885'. Vague as this record was, it suggested the likelihood that the bow would prove

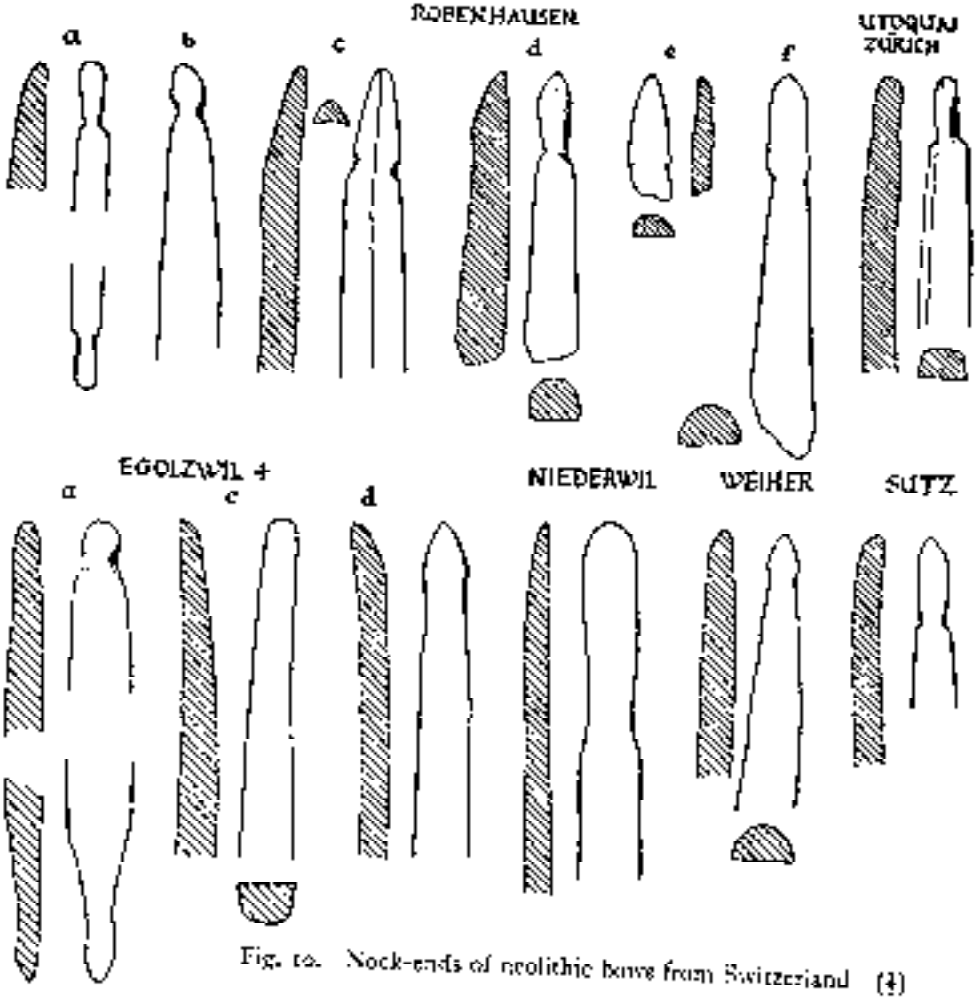


Fig. 12. Neck-ends of neolithic bows from Switzerland (½)

to be comparable in age with the horizon established in the base of the upper peat in the south-western fens and marked by Necked Beakers and associated pottery together with such flint types as plano-convex knives and numerous barbed and tanged arrowheads.[2] This is in general agreement with the radiocarbon age (Q 684, 1730 B.C. ± 110) determined from a sample of the bow by Dr Eric Willis of

[1] I am greatly indebted to Professor Marc Sauter of the Institute of Anthropology of the University of Geneva for detailed information. Of the 37 males on which the average of 1680 centimetres is based, 14 came from the cemetery of Chamblandes, 13 from that of Collombey and the rest from a variety of sites. A striking fact is that from the point of view of stature the Neolithic skeletal material from different Swiss sources proved to be remarkably homogeneous.

[2] *Arch. J.*, xcii (1935), pp. 286–96; xv (1935), pp. 284–319.

the Radiocarbon Dating Laboratory at Cambridge. The Cambridge bow is important not merely as the earliest one of the class without a defined grip so far known from England, but also because, apart from being a little shorter, it compares so closely with one from the Stadskanaal, Onstwedde, north-east Holland (fig. 12, no. 14), as to suggest some historical link: they agree in lacking a defined grip, both have exceptionally high ratios of thickness to width of limb (0.9 and 1.0 respectively) and they have almost identical nocks, the only ones of

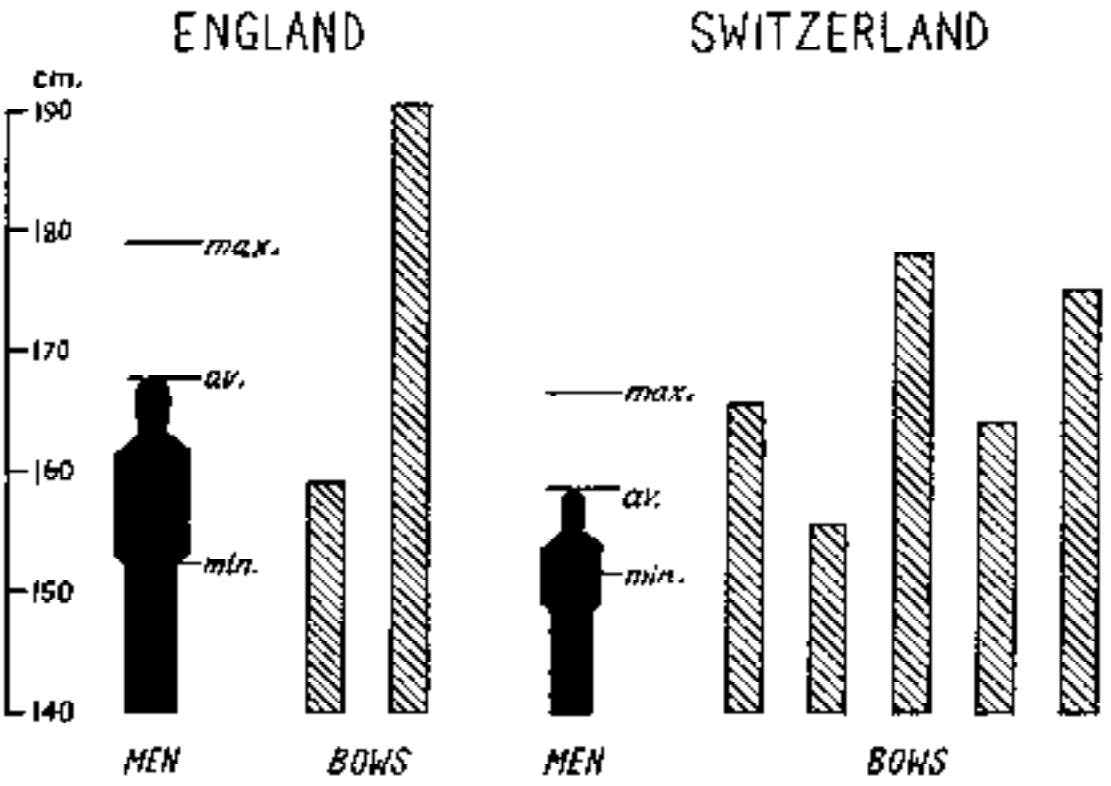


Fig. 11. Lengths of English and Swiss neolithic bows compared with statures of English and Swiss Neolithic men.

their class (B1) to survive. It is all the more interesting that when Dr J. C. Vogel of the Radiocarbon Laboratory at Groningen kindly measured the residual radiocarbon activity of a sample from the core of the Onstwedde bow he obtained a date (GrN 4069) of 2020 B.C.±65, which falls well within the range of the Beaker occupation of Holland[1] (*c.* 2200–1500 B.C.).

From the earlier part of the full Bronze Age one may cite a Dutch bow from the locality De Zilk, Noordwijkerhout, Zuid Holland, from the collection of M. W. A. van der Wal of Heemstede. This specimen, which continues the old northern tradition of a markedly constricted hand-grip and broad limbs, has been dated by Dr Vogel to 1550 B.C.±100 (GrN 4070). Slightly younger is the bow

[1] D. van der Waals, 'Beaker types and their distribution in the Netherlands', *Palaeohistoria* IV: 5 46, pp. 33–45.

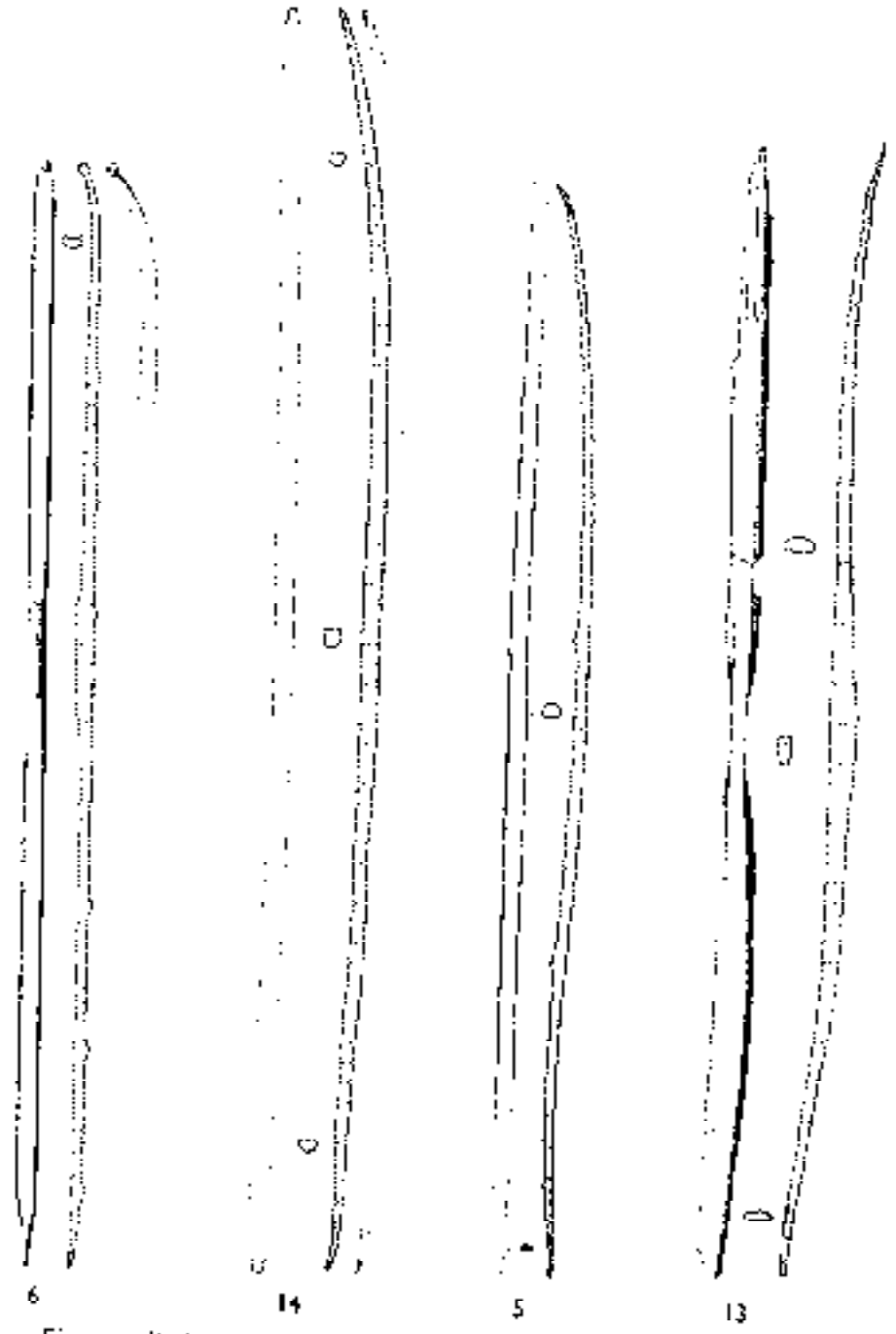


Fig. 12. Beaker and Bronze Age Bows from England and Holland (1 : 10)
No. 6, Edington Burtle, Somerset, England (Q 669 . 1320 B.C. ± 110); No. 14, Stadskanaal, Onstwedde, Holland (GrN 4089 . 2020 B.C. ± 65); No. 5, Nr. Cambridge, England (Q 684 . 1730 B.C. ± 110); No. 13, Noordwijkerhout, Holland (GrN 4070 . 1550 B.C. ± 100).

found in 1845 at Edington Burtle, Somerset, the radiocarbon age of which has been determined by Dr Willis, again from a sample taken from the bow itself, at 1320 B.C. ± 110 (Q. 669). At present this bow (fig. 12) is unique in its asymmetry, one limb being *c.* 17 centimetres longer than the other and the nocks varying from a button-like protuberance to a 'rat-tail' point.

Arrowheads

Research on prehistoric arrows—and for that matter on prehistoric archery—has in the past concentrated too exclusively on arrowheads and even these have been studied mainly from a traditional typological point of view as a means of defining chronological and cultural groupings.[1] In this paper arrowheads will be dealt with summarily and more attention will be given to aspects of arrows previously neglected.

Fig. 13
Maglemosian arrow set with microliths, from Loshult, Scania, south Sweden. (½)

The first and most obvious thing about arrowheads is their immense abundance during the phases when archery played a key rôle in hunting and fighting, an abundance which throws into relief the vestigial character of the surviving evidence bearing on bows and on the shafts of the arrows themselves.

The Mesolithic peoples of Europe employed microliths to tip and barb their arrows,[2] even if by no means all microliths were used for this purpose. From a study of the foreparts of mesolithic arrowshafts (for references, see Appendix II) it is evident that they were armed in different ways: shafts from Holmegaard IV show that microliths were sometimes fitted into grooves in the sides of the foreparts of arrowshafts; alternatively, they might, as suggested by a shaft from Vinkelmose in Jutland (pl. VIII, d), be fixed in oblique slots at the tip; or, again, they might be set, as in specimens from Loshult in south Sweden (fig. 13), both at the tip and also at the side of the forepart, in the latter case being held in resin. The Loshult find is particularly important because it brings out the fact that microliths could serve two distinct purposes when mounted on an arrowshaft, the function of the one mounted at the tip being to penetrate and that of the side one, set with its retouched edge embedded in the resin and its sharp one outermost and at an oblique angle, to cut. Another way of combining penetration and cutting was to make oblique arrowheads from rhombic sections of regular blades, two opposite sides being retouched and two sharp, a type (fig. 14) especially popular among the Cartesminde or Kongemose culture of

Fig. 14
Oblique arrowhead of the Danish Early Coastal culture, showing method of mounting (1)

[1] e.g. the famous paper by R. A. Smith on 'Flint Arrow-heads in Britain', *Archaeologia*, LXVII (1917), pp. 81–148.
[2] *cf. Excavations at Star Carr*, p. 163 (Cambridge, 1954).

Denmark.[1] During the final phase of the Stone Age coastal culture of Denmark a type of chisel-shaped arrowhead came into fashion,[2] made from sections of regular blades steeply retouched on each of two sides and mounted with the cutting-edge transverse to the shaft.

This type of transverse or chisel-ended arrowhead (pl. VIII, C) was the standard type in use among the earliest farmers of the Northern area, the Funnel-neck Beaker people. It was also popular in Brittany and in the late Neolithic culture of the Seine-Oise-Marne area, as well as among the collective tomb-builders of Iberia; and it enjoyed a powerful revival, albeit modified by flat flaking, during the closing phases of the British Neolithic. In other territories of Neolithic Europe pointed arrowheads were preferred. These were generally shaped by shallow flaking applied to both faces, a technique, it may be recalled, first found on delicate projectile points in Europe many thousands of years previously. The shapes of the arrowheads worked by the bifacial technique were by no means uniform, the Alpine peoples preferring triangular forms (pl. VIII, A), sometimes with the narrow side concave, whereas leaf (pl. VIII, B) and lozenge shaped ones were favoured by the Chassey people of France and the Primary Neolithic ones of Britain.

During the closing phase of the bow's long period of dominance as the leading weapon of the prehistoric peoples of north-western Europe arrowheads with projecting wings came strongly into fashion. The effect could be produced either by chipping a deep concavity in a fairly wide-based triangular point or alternatively a couple of small indentations isolating the barbs from a central tang. In Iberia both hollow-based and barbed and tanged types were liable to occur with Beaker pottery, as well as lozenge forms; on the other hand Bohemia and Moravia and N. Italy were centres of the hollow-based form; and Great Britain of the barbed and tanged. Although the barbed and tanged arrowheads flourished in the same context as the beginnings of metallurgy, the immense antiquity of the form (see p. 61) disposes of any notion that it was inspired by metal prototypes; indeed, it seems likely that barbed and tanged forms made of metal, like those from the Swiss Early Bronze Age site of Bleiche-Arbon[3] were on the contrary based on flint prototypes. What is certain is that metal was rarely used at this time for arrowheads. This was partly no doubt due to its cost and the risk of loss; but partly also to the fact, demonstrated by modern experiments,[4] that flint arrowheads were as and even more effective for some purposes than metal ones. Archery continued to play an important role during the full Early Bronze Age in Britain, exemplified by the Wessex burials and in this context flint arrowheads reached their perfection in this country: they were not only larger but more regular in outline with more angular barbs and tangs than those of the preceding Beaker phase.

[1] *Danske Oldsager:* I. *Aeldre Stenalder*, nos. 94–7.
[2] *Ibid.*, I, nos. 98–105; II. *Yngre Stenalder*, nos. 263–5.
[3] *Thurgauische Beiträge zur Vaterländischen Geschichte*, hft. 85, p. 57, abb. 6.
[4] Saxton Pope (*op. cit.*, pp. 47–8) found that obsidian arrowheads fired into a target of animal tissue at a distance of 20 yards penetrated 30 inches as opposed to the 22 inches achieved by a steel head.

Arrowshafts

According to modern authorities the material from which arrowshafts can be made allows of more latitude than that for bow-staves: whereas Saxton Pope[2] prefers birch for hunting arrows and pine for target shooting, Colonel Walrond[3] opts for ash; and E. G. Heath[4] in his recent discussion on mediaeval arrows concludes that ash or birch were most usually employed together with pine where this was available. In the case of the prehistoric arrowshafts it so happens that the only area from which raw materials have been systematically identified is northern Europe (for details see Appendix II). Shafts (no. 10) dating from the Younger Dryas and Boreal phases of Late-glacial and early Post-glacial times were in nearly every instance made of Pine (*Pinus*). In later Boreal and Atlantic times, as temperatures rose and deciduous trees began to feature more and more prominently until they became dominant in the forests, the range of choice widened and already we find the late Maglemosians of Holmegaard (no. 3) using the Guelder Rose (*Viburnum opulus* L.); Guelder Rose was also used by the Neolithic inhabitants of Aberdeenshire (no. 16); and among other woods used in early times were Ash (*Fraxinus excelsior* L.) (nos. 5 and 14) and Yew (*Taxus baccata* L.) (no. 11), both of which spread into north-western Europe during the warm Atlantic phase of climate, possibly together with Alder (*Alnus*) tentatively identified from Ireland (nos. 13 and 15).

In the two instances for which detailed information is available, namely the large assemblage from the Ahrensburgian level at Stellmoor and the two shafts from the Neolithic site of Muldbjerg, the wood seems to have been taken from larger timbers respectively of pine and ash and in the latter instance Dr J. Troels-Smith has been careful to note[5] that the fork or cleft for holding the base of the head was cut at approximately 45 degrees to the medullary rays of the wood.

There was some variation in the way arrowheads were secured to their shafts. As we have seen microliths were mounted in slots cut into the sides of shafts or in clefts cut obliquely or transversely to the tip. The latter method was that normally employed by the makers of Neolithic or Early Bronze Age arrows, whether the heads were pointed or transverse. As a rule the tip of the shaft was left rather blunt so that the nock was comparatively shallow with thick walls, but in two examples from Britain, Fyvie (fig. 15) and Walton-on-the-Naze (pl. VIII, B), the tip was tapered to a fine point. The lower part of the cleft was tightly bound by lashing, most often animal sinew, and in some cases, notably from Ireland (nos. 11–14), the material itself has survived. Already in Mesolithic times resin, most probably birch-pitch, had been used to keep arrow tips and barbs in position, but apparently it was only in the Alpine area that this material was used to help

[2] *Op. cit.*, p. 82.
[3] C. J. Longman and H. Walrond, *op. cit.*, p. 366.
[4] E. G. Heath, 'The English Mediaeval War Arrow,' *J. of the Society of Archer Antiquaries*, vol. 4 (1961), pp. 17–19.
[5] *Aarbøger* (1959), pp. 92–105.

fix Neolithic arrowheads (fig. 15). Professor Vogt's dissection of a specimen from the Swiss site of Burgäschisee shows that the resin was applied after lashing the cleft in which the arrowhead was set and in such a quantity that it obscured all but the tip and leading edges (pl. VIII, A).

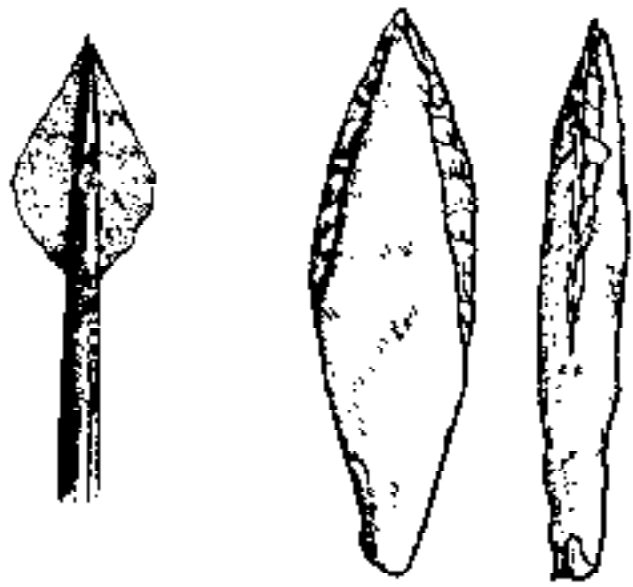


Fig. 15

Neolithic arrow mountings from (*left*) Fyvie, Scotland, and (*right*) Zugelburg-Gasboden, Switzerland.

The length of the prehistoric arrows is difficult to estimate because they are generally found in highly fragmentary condition. A further complication is that the earliest arrows known to us, those from the Late-glacial site of Stellmoor, were in many cases at least made up from two parts with detachable foreshaft, a fact first pointed out by C. J. Becker;[1] thus, the very short specimens, 15.5, 16.5 and 20 centimetres long, illustrated and described by Rust[2] were in fact foreshafts and the forks at the lower end, much too acute and deep to serve as mere nocks for engaging the bow-string, were well designed to fit onto the wedge-shaped tips of the lower parts of shafts. Even so, the existing evidence suggests that the Ahrensburgian reindeer-hunters and the Maglemosian hunters of elk, aurochs and stag in Denmark and south Sweden used arrows considerably longer than those advocated by most modern authorities on archery. Saxton Pope[3] maintained that 28¼ inches (*c.* 72 centimetres) was the proper length for an arrow plus or minus 1 inch (*c.* 2.5 centimetres) according to the length of the bowman's arm. This agrees closely with the opinion of Colonel Walrond[4] who considered 28

[1] *Fra Nationalmuseets Arbejdsmark* (1945), pp. 70–1.
[2] A. Rust, *Stellmoor*, pp. 189–92; pl. 92, 1 and 2; pl. 95, 4.
[3] *Op. cit.*, p. 82. [4] *Op. cit.*, p. 306.

inches (*c.* 71 centimetres) a normal length for a man's arrow. On the other hand it seems to be agreed that the war arrows of the English mediaeval bowmen were substantially longer than this. In his classic chapter in the Badminton volume on *Archery* a former Viscount Dillon[1] accepted the widely held opinion that they were a yard (91 centimetres) long and this view has recently been confirmed in Mr E. G. Heath's recent article.[2] When we turn to the earliest prehistoric arrows from northern Europe we find that the longest fragment from Stellmoor was 75 centimetres, even though lacking both the tip and the nock end; an incomplete arrow from Holmegaard was 86 centimetres long and one from Loshult, also incomplete, was 88 centimetres: and, finally, the most conclusively, a complete arrow from the Danish locality of Vinkelmose, dating from early in the Boreal period (zone V), measures no less than 102 centimetres (pl. VIII, d).

It was highly important for accurate markmanship that there should be no unnecessary friction as the arrow sped through the air. Where they are well preserved the prehistoric arrowshafts, which range in diameter from 0.7 to 1.0 centimetres and taper towards the tip, were finished so smoothly that no traces of cut-marks can be seen except at the nock and the fork for holding the head. An obvious way of achieving this was to use a sandstone rubber with a longitudinal groove and it is significant that this was already devised by the Late-glacial hunters—good examples occurred for instance in the Ahrensburgian level at Stellmoor in Schleswig-Holstein[3]—and were still in use well into the Bronze Age. A significant fact about their later occurrences, generally in the form of grave-goods in association with flint arrowheads, is that they have been found in pairs—one such occurred in a cist under barrow 6 at Roundway, Wilts., with Beaker equipment[4] and another in the context of the Wessex culture in the Breach Farm barrow, Llanbleddian, Glamorgan (fig. 16)[5]: this suggests that they were used together being held in one hand either side of the shaft which was rotated in the other. An example from the Danish Stone Cist period has the interesting feature of transverse grooving on the main runnel of the rubber.[6]

Although not absolutely essential, most bow-using peoples have found it useful to steady their arrows by fletching them. The device of attaching sections of split feathers to the lower part of the shaft of projectiles—darts and harpoons as well as arrows—is widely spread in time and space. The high antiquity of the idea is shown by its representation in Advanced Palaeolithic art, whether represented on a calcareous pebble from La Colombière[7] or on the wall of the Lascaux caves.[8] The numerous hunting scenes featuring archers depicted in the rock-paintings of eastern Spain show that it was standard practice among the mesolithic peoples, at any rate of that region, to fletch their arrows and there are indications that this practice was in fact widespread. The fact that no traces of the feathering attached to arrowshafts have survived, or could be expected to survive in

[1] In Longman and Walrond, *op. cit.*, pp. 287–8. [2] *Op. cit.* [3] A. Rust, *Stellmoor*, pl. 86.
[4] *Catalogue Antiquities Devizes Museum*, pp. 2, pp. 19–20.
[5] W. F. Grimes, *PPS*, IV (1938), pl. xii, no. 11. [6] *Danske Oldsager*: II *Yngre Stenalder*, no. 539.
[7] L. Mayet and J. Pissot, *Abri-sous-roche préhistorique de la Colombière*, figs. 47, 56 and pl. xx, no. 5 and xxii, no. 5 (Lyon, 1915).
[8] Windels, *op. cit.*, p. 53 (no. 43) and p. 78 (no. 42).

north-west Europe,[1] means that many details are missing. For instance we have no means of telling whether three feathers, the standard European practice in historic times, were used, as opposed to two or four, for each of which recent ethnographic parallels could be quoted. From surviving traces it can, however, be seen that the prehistoric fletchers followed the standard practice of splitting sections of comparatively straight feathers, preferably pinion feathers, removing

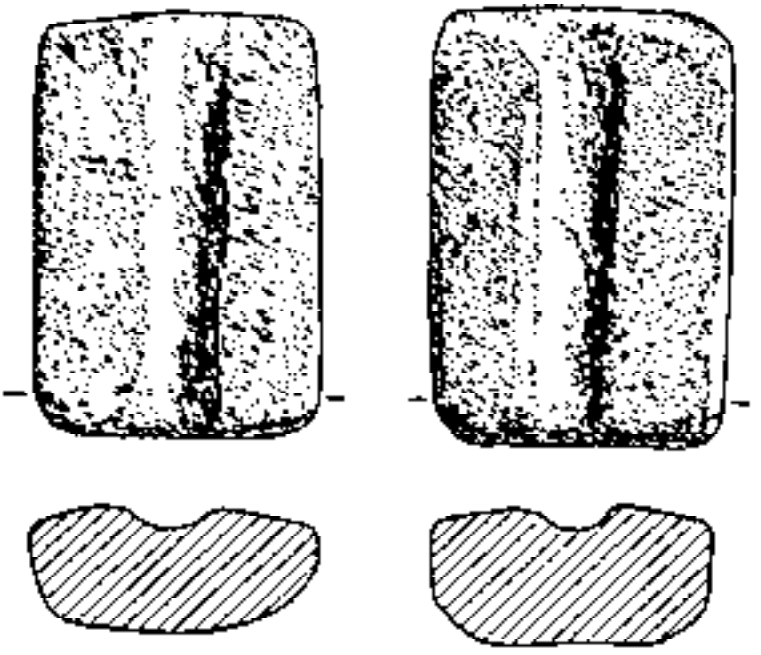


Fig. 16

Pair of arrowshaft smoothers from a burial of the Early Bronze Age at Breach Farm, Llanfleddian, Glam. (½) *After Grimes.*

the feathering for a certain distance from either end, and binding the projecting ends of the spine with sinew threads. Such binding is to be seen intact immediately above the nock end of the complete arrow of early Boreal age from Vinkelmose, Denmark, and impressions of the upper binding are visible on the shaft (pl. VIII, D): the gap between them gives an accurate idea of the length of the feathering, c. 16 centimetres, used on this arrow, just as do similar thread-marks on arrowshafts of the Younger Roman Iron Age of Denmark from Vimose[2] and Thorsbjerg.[3]

[1] Notched arrows with intact feathers are only likely to survive under exceptional conditions, such for example as those prevailing in Tut-ankh-amen's tomb. See Howard Carter, *The Tomb of Tut-ankh-amen*, III, p. 139 and pl. xlv (London, 1933).

[2] C. Engelhardt, *Vimose Fundet*, 23 and pl. 14, no. 21 (Copenhagen, 1869).

[3] C. Engelhardt, *Denmark in the Early Iron Age*, 58 and p. 62, no. 11 (London, 1866).

The kind of feathers used in prehistoric times is more open to conjecture. Some of those most favoured during the historic period, the peacock's feathers alluded to by Chaucer[1] or the turkey ones favoured by Saxton Pope,[2] were not available to the prehistoric Europeans. A source favoured traditionally since the times of Hesiod was the eagle, whose pinion feathers were supposed to have directed the arrows of Hercules himself,[3] and whose shooting by an arrow fletched with eagle feathers provided the subject of one of Aesop's fables.[4] There can hardly be a doubt that the zoologist Magnus Degerbøl[5] was right to explain the abundance of remains of the White-tailed Eagle on Danish Stone Age sites in terms of specialized hunting for the provision of fletching feathers. Down to the late 19th century the Chinese exacted tribute of eagle feathers for this purpose and an 18th-century traveller reported that there was hardly a yurt in the Kuriles without its eagle, fed to provide feathers for trading to the Japanese for their bows.[6] Only less effective were goose feathers, recommended by Ascham[7] as the 'best feather for the best shooter,' and when neither of these could be had duck was no doubt made to serve.

Whereas a pikeman or swordsman could get along with a single weapon the bowman's arrows were expendable and he required a number of them. To judge from the eastern Spanish rock-paintings[8] the mesolithic hunters of that region were accustomed to carry spare ones in the hand alongside the bow, even when in the act of releasing an arrow; as a rule the bowmen are shown with four arrows in hand or with three in reserve and one in the air or about to be released. An alternative was to stuff the spare arrows in one's belt as did one of the characters in the Prologue to the *Canterbury Tales* of whom Chaucer wrote:[9]

> 'A shafe of peacock arwes, bright and keen,
> under his belt he bare ful thriftily.'

A method less liable to ruffle the feathers, though slightly more expensive, was to carry them in a quiver, that might be made of leather, basket work, wood or a combination of such. A splendid example is depicted on the already-mentioned Göhlitsch slab (pl. IX, lower) hanging close to a great bow, that was evidently resting on pegs just below the eaves, with in between an adze. It is interesting to count six arrows in this Neolithic quiver, rather more than the east Spanish hunter-fishers were accustomed to carry. The circumstance of collective burial makes it difficult to gain information about the number usually carried by a Neolithic archer in our area, but the objects found under a flat stone beneath a stone cairn in a Long Barrow on Seamer Moor in the North Riding of Yorkshire[10] may be taken as the equipment of an individual and it may be significant that in

[1] Prologue to *The Canterbury Tales*. [2] *Op. cit.*, p. 86.
[3] *The Shield of Hercules*, v. 135 (Bohn. edtn., 1959), p. 57.
[4] 'The Eagle and the Arrow'. This notion was used by many later poets, including Byron.
[5] In Th. Mathiassen *et al.* *Stenalderbopladser i Aamosen*, p. 192 (Copenhagen, 1943).
[6] For references and fuller account see G. Clark, 'Fowling in prehistoric Europe', *Antiquity*, XXII (1948), p. 128.
[7] R. Ascham, *Toxophilus*, p. 132 (English Reprint edtn., 1868).
[8] M. Almagro Basch, *op. cit.*, figs. 386, 393, 396, 400, 418, 425; Luis Pericot, *op. cit.*, pl. opp. p. 55.
[9] *Op. cit.* [10] R. A. Smith, *op. cit.*, fig. 14

addition to four celts, two knives and some boars' tusks this included five lozenge-shaped arrowheads. Much more information is available from the period of individual burial; the Beaker people in Britain sometimes only deposited three barbed and tanged arrowheads (*e.g.* Green Lowe, Derby, and Thwing, E.R.), but more commonly four (*e.g.* Fovant, Wilts.; Mouse Lowe, Derby; Dairsie, Fife; Clinterty, Aberdeen) and sometimes as many as seven as at Stanton Harcourt, Oxon.[1] and Sutton, Glam.[2] Burials dating from the period of the rich Wessex graves of the full Bronze Age frequently yielded six barbed and tanged arrowheads *e.g.* Conegar Hill, Dorset; Lambourn Down, Berks.; and Winterbourne Came, Dorset); and it is interesting to note that the thirteen arrowheads found packed into a small hole under the famous barrow on Breach Farm, Llanbleddian, Glam., fall into two groups, six being of yellow and seven of grey to black flint,[3] evidently the contents of two quivers.

Other accessories: wrist-guards and girdle-fasteners (fig. 17)

Although some form of bracer to protect the arm holding the bow from the rebound of the string and prevent fouling with the sleeve is regarded as a normal part of an archer's equipment, there is no evidence that it was a necessity in the sense that a bowman could not operate without it. Conversely, many of the materials used for protecting the forearm today,[4] such as leather, plaited fibre or wood, are not such as could be relied upon to survive in the archaeological record of temperate Europe. The first bracers recognizable from prehistoric Europe date from the close of the 3rd and the beginning of the 2nd millennium B.C., a time when the use of metal was spreading widely over temperate Europe. They took the form of oblong plaques of stone or occasionally bone, perforated in each corner or at either end; at first they were usually moulded in a gentle curve to the forearm, but later ones were often flat. The main agents in spreading this device[5] rapidly over a territory extending from Iberia and the East Balkans to Scotland, Central Europe and Denmark were undoubtedly the Bell Beaker people whose prowess as archers was advertised by their practice of burying arrowheads with male corpses.

Another object found with burials at this time over much the same territory and extending north to Sweden is the bone girdle-fastener, often described by English authors as ring-pendants,[6] but which probably served the more useful function of keeping the archer's garment free of his weapon. In the form known from Britain and which occurred as far afield as the Middle Danube area and

[1] Unless otherwise noted the information in this and the following paragraph is taken from R. A. Smith, *op. cit.*

[2] W. F. Grimes, *Excavations on Defence Sites, 1939–1945* I, pp. 162–170 (London, 1960).

[3] Sir Cyril Fox, *Life and Death in the Bronze Age*, p. 67, pl. xx, a.

[4] *PPS*, xv (1949), p. 215.

[5] See *Journal Soc. of Archer-Antiquaries*, vol. 4 (1961), pp. 33–41. The Bronze forearm ornaments from Denmark and Germany ought surely to be excluded, especially since nos. 1–3 belong to a period in which the bow seems to no longer to have played a significant role as a weapon in Denmark.

[6] See V. G. Childe, *The Dawn of European Civilization*, pp. 90, 162, 165, 225, 304, 328, 330 (1957 edition).

[7] The most useful reference is W. F. Grimes, *Excavations on Defence Sites*, I, pp. 166–7; also Childe, *The Dawn*, pp. 57 and *passim*.

even further east, the object comprises a ring about 1.5 centimetres in internal diameter, a size well-adapted to taking a toggle, with a handle-like projection having a much smaller perforation to which a girdle end might have been secured. One reason for advancing this explanation is that the specimen found with the carefully excavated archer from Stanton Harcourt, Oxon., occurred in the area of

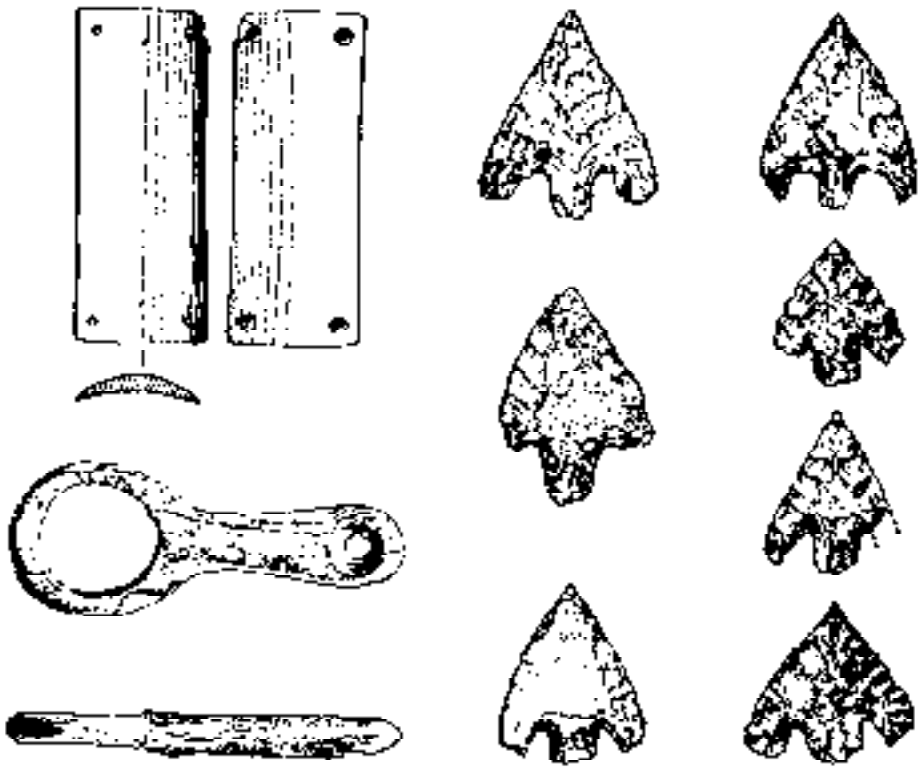


Fig. 17

Archers' equipment from Beaker burials in Oxfordshire.

No. 1. Wrist-guard, Dorchester. (½). *After Case.*

No. 2. Girdle-fastener and heads of a quiver of arrows, Stanton Harcourt. (½). *After Grimes.*

the stomach[3] precisely where one might expect to find a belt-fastener. Another is that analogous objects made from subtriangular bone plates, but having more complex openings, have been found on several occasions, often in pairs, immediately by the pelvis of an inhumation burial, over an area extending from Gotland and East Germany to Czechoslovakia and dating from around the same period; although the fastening arrangements seem to have been more complex, these

[3] W. F. Grimes, *op. cit.*, fig. 66

objects, firmly classified by Professor Stenberger as girdle-plates,[1] evidently performed basically the same function as the fastener from Stanton Harcourt.

Evidence for the uses of early bows and arrows

The evidence of iconography and of arrowheads embedded in the skeletons of animals and men alike shows that the bow, during its 7,000 years or so as the dominant weapon in temperate Europe, served impartially for hunting and fighting. The most prolific and explicit representations of prehistoric archery lie outside our immediate area of reference in the rock-paintings of eastern Spain,

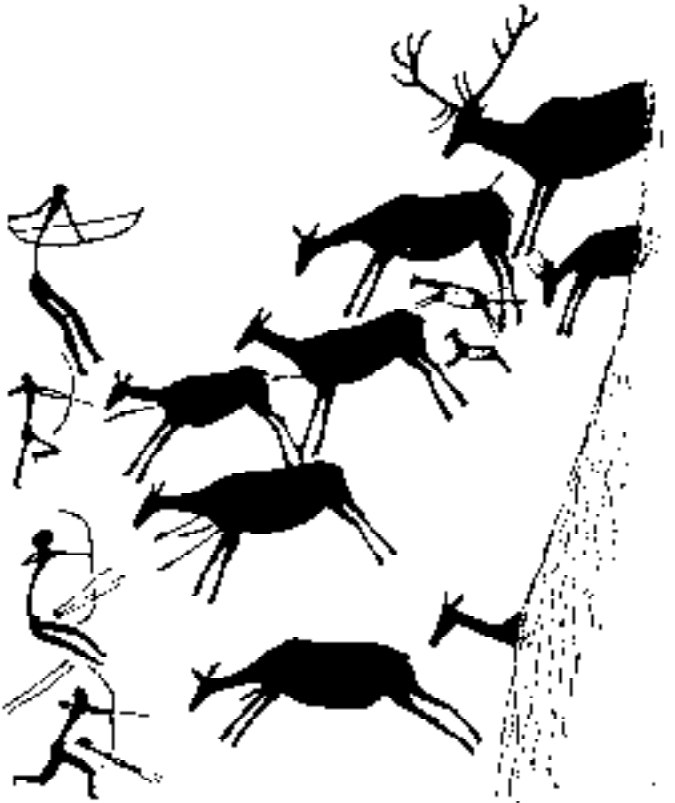


Fig. 18

Rock-painting from the Cueva de los Caballos, Castellón, east Spain, showing deer driven into a line of bowmen.

but these predominantly mesolithic sources are so close at hand that it would be pedantic to ignore their testimony. There is plenty of evidence from earlier times that certain types of hunting were organized on a large scale, or at least on as large a scale as the restricted communities of the time made possible. From certain of the eastern Spanish paintings we get a vivid impression of game being driven into a line and ultimately a ring of bowmen: the well-known scene (fig. 18) from the

[1] M. Stenberger, *Det Gravfält von Vasterhjers auf Gotland*, pp. 56 and 92–4; Abb. 33 and Taf. 24, 1 (Stockholm, 1943). Stenberger gives a full discussion and references to the German and central European finds.

Cueva de los Caballos, Castellón,[1] shows red deer, including a stag and a number of hinds and young, being driven into a line of bowmen some of whom are in the act of releasing their arrows; and in another (fig. 19) from the Cueva de la Araña, Valencia,[2] the bowmen have closed in for the final battue. Other representations, notably in the Cueva Remigia, Castellón,[3] suggest that at times the archers had to

Fig. 19

Rock-painting from the Cueva de la Araña, Valencia, east Spain, showing bowmen closing in on deer.

pursue their quarry running as hard as they could go, carrying the bow and a cluster of arrows horizontally to the ground in one hand. From northern Europe there are indications that single bowmen might hunt with the aid of a pack of dogs. The only certain evidence for this dates, it is true, from the latter part of the Northern Bronze Age, from which time we have the pecked engraving from

[1] H. Obermaier, *Fossil Man in Spain*, pl. xiv (New Haven, 1925).
[2] E. Hernández Pacheco, *Las pinturas prehistóricas de las Cuevas de la Araña (Valencia)* (Madrid, 1924).
[3] J. Pericot, H. Obermaier and H. Breuil, *Excavaciones en la Cueva Remigia (Castellón)* (Madrid, 1935).

Kvilic in northern Bohuslän, West Sweden,[1] depicting a hunter with a bow reaching down to the knee running down a wild pig with the aid of dogs. On the other hand what appears to be part of a similar scene is engraved (pl. IX, upper) on an unhappily incomplete pottery amphora from Salzmünde, near Halle, Saxony,[2] which belongs to an assemblage broadly similar in date to the Jordansmühl cemetery and so must date from the closing phase of the Neolithic of the area; the bow, which appears to have reached down to about the knees, was of simple type with an elongated arc profile and it is notable that the arrow is shown being released from a point well above the middle of the stave. Despite the use of dogs or the organized drive, the prehistoric archer seems fairly often to have lost his victim, which sometimes even escaped for a second time. The skeleton of an Aurochs (*Bos primigenius*) from Vig in Jutland[3] is particularly instructive on this point: small splinters of flint embedded in the seventh rib and partly covered by boney tissue testify to an earlier escape; and, although a second encounter, marked by a fresh wound in the ninth rib and by three micro-flakes, two with steep retouch on part of one edge, was destined to prove fatal, the animal evidently still managed to elude its pursuers until he sank down in the swamp to die, since there are no marks of butchery and only a few bones are missing from the lower part of one front leg. A rib-bone of a Red Deer recently discovered from the Maglelyng settlement (MXL), Aamosen, Sjælland,[4] confirms that animals might survive shooting long enough for marked deformation of the bone to set in round the projectile head, although in this case, as the cut-marks clearly show, the animal must have been killed and butchered on a later occasion. The Aamosen rib-bone is also interesting for another reason because the projectile head in this case was a transverse flint arrowhead.

The eastern Spanish paintings also depict scenes of combat in which quite large groups of archers confront one another; a scene in the rock-shelter of Las Dogues, Castellón de la Plaña,[5] shows about ten individuals on one side and seventeen on the other (fig. 20). Again, confirmation is afforded by finding arrowheads embedded in human skeletons, especially when more than one is found in a single individual, seeming to rule out or at least render improbable the explanation of a hunting accident. Examination for instance of an adult male, the first of six individuals to be buried in one grave at the mesolithic site of Téviec, Morbihan,[6] disclosed the existence of a splinter of flint in the eleventh and of a complete triangular microlith deeply embedded in the sixth dorsal vertebra: the presumed trajectory of the latter shows that it would have penetrated the upper part of the lung and brought about death by haemorrhage and the depth of penetration shows that the triangular microlith must have been mounted at the tip of the shaft. The discovery of a transverse flint arrowhead embedded in a human vertebra

[1] Nils Niklasson, *Göteborgs och Bohusläns Fornminnesförenings Tidskr.* (1946–7), pp. 45–71. fig. 1.
[2] Ibid., pp. 59–60, fig. 5.
[3] N. Hatt and H. Winge, *Aarbøger*, bd. 32, 226 ff.
[4] Information kindly supplied by Dr J. Troels-Smith of the National Museum, Copenhagen.
[5] Martin Almagro, *Historia de España* (Ed. R. M. Pidal), vol. 1, fig. 307 (Madrid, 1947). Compare also fig. 183.
[6] M. et S.-J. Péquart, M. Boule and H. Vallois, *Téviec, Station nécropole mésolithique du Morbihan*. pp. 52–3 (Paris, 1937).

from an individual of the French Seine-Oise-Marne culture[1] confirms the effectiveness of this type of arrowhead and suggests that it was used for fighting as well as hunting. A third example, which like that from Téviec involves two shootings, is provided by a skeleton from Porsmose, dating from the Danish

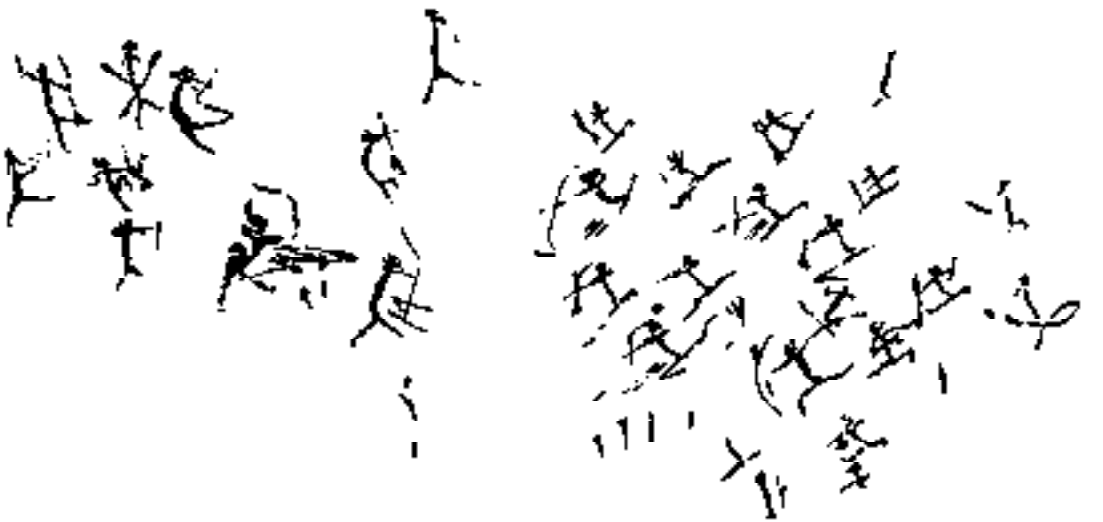


Fig. 20

Rock-painting in the rock-shelter of Las Dogues, Castellón de la Plana, east Spain, showing two groups of bowmen in combat.

Middle Neolithic,[2] which has one bone arrowhead penetrating the nasal aperture and the roof of the mouth and another similar one embedded some 5.5 centimetres in the breast bone, the tip projecting into the chest: the angle of the arrow in the nose suggests that it was shot on a lofty trajectory; and the fact that both arrows were of bone reminds us that flint and metal were by no means the only materials available for arrowheads.

PART III. THE DECLINE AND REAPPEARANCE OF THE SELF-BOW IN NORTH-WESTERN EUROPE

If we are to judge from the archaeological traces, it must be accepted that after a period of predominance that lasted in north-western Europe from the 9th till the middle of the 2nd millennium B.C. the bow entered on a period of decline during which it was only one of a number of effective weapons, including the swords and metal-headed lances that came in with a well-developed metallurgy. This is not to say that the bow did not play an important role at certain times

[1] J. de Baye, *Revue archéologique*, 1, p. 403 (Paris, 1874).

[2] C. J. Becker, *Fra Nationalmuseet Arbejdsmark* (1952), pp. 25–50; J. Brøndsted, *Danmarks Oldtid*, 1, p. 248 (1957 edn.).

among certain peoples during the last 3,000 years or so, but even the Long Bow of later Medieval England was after all the weapon only of a certain element in the army, decisive as it often proved to be in trained hands.

Considering first the full Bronze Age, one may say that evidence for the use of the bow after the initial phase is at best exiguous over the territory from Britain to Denmark. One might have been prepared to discount the absence of bows by supposing that conditions for the conservation of wood might have grown less favourable, were it not well-known that timber trackways dating from the Late Bronze Age,[1] as well from Neolithic times,[2] have been found quite commonly in Britain and north-west Germany and that it is precisely from this period that we have the wooden tread-traps[3] extending over a territory from Ireland to Denmark and Poland. Moreover the lack of bows is matched by an excessive rarity of arrowheads. One can hardly ascribe the extreme scarcity of bronze ones in Great Britain[4] and Denmark[5] respectively to the high cost of metal, because flint ones, which after all have been shown[6] to have an even better capacity for penetrating tissue, are of the same order of rarity. In the case of Britain this can be tested by examining the flint assemblages from the south of England: not a single arrowhead occurred for instance at Itford Hill, Sussex;[7] Minnis Bay, Birchington, Kent;[8] Thorny Down, Wilts.;[9] or Shearplace Hill, Sydling St. Nicholas, Dorset.[10] The only apparent exception, the leaf-arrowhead from Plumpton Plain, Sussex,[11] really proves the rule, since the flints from this site include other elements, such as a part of a polished flint axe and a denticulated flake with a narrow zone of gloss, that point to the existence of a neolithic 'scatter' on the site. Even in territories where indigenous traditions might be expected to have been stronger, flint arrowheads are extremely rare at a time when bronze swords and socketed spearheads were plentiful: thus at Mildenhall, Suffolk,[12] there were only two barbed and tanged arrowheads from a very rich assemblage of worked flints and, to judge from its condition, one of these can be referred to the earlier phase of occupation denoted by the reworking of certain flints and the presence of a handful of worn cord-impressed sherds; and the well-known assemblage from the Heathery Burn cave[13] yielded only one barbed and tanged arrowhead.

In Denmark the situation was much the same. Flint arrowheads, which abounded in a variety of forms during the Stone Cist phase, continued to be represented, though now exclusively by hollow-based forms,[14] in burials of period I of the Northern Bronze Age, after which they disappear from the record. The only evidence for the continued use of the bow in Denmark during the greater part of the Bronze Age is comprised, as we have seen, by a single socketed

[1] J. G. D. Clark, *Prehistoric Europe: The Economic Basis*, pp. 312–15 (London, 1952).
[2] H. Godwin, *PPS*, XXVI (1960), pp. 1–36. [3] Clark, *op. cit.*, pp. 311–4.
[4] The few rare specimens include ones from the Langrove hoard from Penard, Gower (R. E. M. Wheeler, *Prehistoric and Roman Wales*, fig. 56) and Water Dean Bottom, Salisbury Plain (*Ant. J.*, VI, p. 182).
[5] Thus H. C. Broholm notes the socketed and barbed example from Per. V of the Northern Bronze Age as a unique specimen (*Danske Oldsager: Yngre Bronzealder*, no. 165).
[6] Saxton Pope, *op. cit.*, pp. 47–8. [7] *PPS*, XXIII, p. 202. [8] *Ibid.*, IX, p. 39.
[9] *Wilts. Arch. Mag.*, XLVII, p. 634; *PPS*, V.I, pp. 131–2.
[10] *PPS*, XXVIII, p. 323. [11] *Ibid.*, I, pp. 33–6. [12] *Ant. J.*, XII, pp. 49–50.
[13] *B.M. Guide . . . Bronze Age* (1920 edn.), p. 50.
[14] H. C. Broholm, *Danske Oldsager: Aldre Bronzealder*, nos. 53–4 (Copenhagen, 1952).

bronze arrowhead dating from period IV.[1] In view of this it is significant that, though weapons are shown plentifully on the engraved slabs of the Kivik cist and on the natural rock-surfaces of Scania,[2] no trace of the bow appears in the representations. It is only on the northern margin of the territories that supported the Northern Bronze Age that any considerable traces of archery appear and then only from the later stages of the local Bronze Age; for example, though the weapons most strongly represented on the rock-art of the west Swedish province of Bohuslän comprised spears, heavy axes and swords, they included in at least two parishes, namely Kville[3] and Tanum,[4] unmistakable pictures of knee-length bows of more or less wavy profile; and, most conclusively, we have the grip of a pine-wood bow from the parish of Ljung in Ostergötland,[5] dated by pollen analysis to the same period.

Further south there is evidence that the bow continued to play a significant role in certain Middle and even Late Bronze Age cultures. This is notably the case with the Tumulus Bronze Age culture of Oberpfalz,[6] the warriors of which relied on swords (cf. Reinecke, C.) for close combat and on arrows tipped with socketed bronze heads for projectiles. It is likely that the use of the bow spread from here to south Thuringia[7] where similar bronze arrowheads were buried with warriors, one being found embedded in a vertebra. Again, socketed arrowheads, some with a spur at the base of the socket, and in addition tanged ones, occur in Urnfield contexts, for example, in Bavaria, Franconia and Steiermark.[8] Yet this hardly alters the conclusion that the bow declined markedly in importance as a weapon with the time of advanced bronze metallurgy and there seems no reason to doubt that this change in armament was closely linked with the potentialities of the new material; so long as only flint, stone and copper were available the bow had only to compete in warfare with daggers, halberds and axes; but bronze made practicable rapiers, swords and spears, whether for thrusting or casting. To look beyond our immediate area to Greece, the earliest centre of bronze production in Europe, it seems that the bow had been relegated to hunting already by the beginning of the Mycenaean age:[9] positive evidence for the use of the bow is concentrated in Shaft-Grave IB, the only one to yield arrowheads and it is significant that both the works of art showing the bow, the gold signet-ring and the dagger, depict it in use for hunting stag and lion respectively; whereas in scenes of combat like that on one of the stone stelae from the Grave Circle the chariot-born warrior is armed with a powerful thrusting lance with a sword at his side. At a later stage of the Mycenaean culture it appears that slashing swords

[1] See fn. 3, page previous.

[2] e.g. C.-A. Althin, *Bronzezeitlichen Felszeichnungen von Skåne* (Lund, 1945).

[3] Nils Niklasson, *Göteborgs och Bohusläns Fornminnesförenings Tidskr.* (1946–7), pp. 45–71 (Göteborg, 1948).

[4] For the Aspeberget engraving see Brøndsted, *Danmarks Oldtid*, bd. II, pp. 136–7 (1958 edn.); for Fossum, see Althin, op. cit. pl. 110.

[5] A. Oldeberg, *Fornvännen* (1959), 4.

[6] W. Torbrügge, *Die Bronzezeit in der Oberpfalz*, p. 65 (1959).

[7] R. Feustel, *Bronzezeitliche Hügelgräberkultur im Gebiet von Schwarza (Südthüringen)*, 8, taf. xvii, 7; xxxvi, xxx 4, 6 (Weimar, 1958).

[8] H. Müller-Karpe, *Beiträge zur Chronologie der Urnenfelderzeit Nördlich und Südlich der Alpen*, taf. 124 D, 13; 186 C, 9, 10; 202 B, 13, 14; 208, 7, 9, 11, 13 (Berlin, 1959); *Die Vollgriffschwerter der Urnenfelderzeit aus Bayern*, 31, 91 (Munich, 1961).

[9] H. L. Lorimer, *Homer and the Monuments*, pp. 276–305 (London, 1950).

(Naue type II) came into use in Greece, together with defensive armour, including metal helmets, corselets and greaves, of types like those found in the Middle Danube area.[1] Throughout the whole period during which the Mycenaean culture prevailed in Greece the spear seems to have been used for thrusting as a lance, but in Proto-Geometric and Geometric times it became common to use a pair of casting spears or javelins, a weapon much favoured in both the *Iliad* and the *Odyssey*[2] and which at the opposite end of the Mediterranean was frequently depicted in Iberian vase-painting.[3]

It was not until Late Geometric times that archers regained any substantial importance in Greek warfare.[4] To judge from the vase-paintings, bows were then of the composite Asiatic type combining elements of wood, horn and sinew and the bronze arrowheads of the period were of the three-winged type introduced to Asia Minor by the Cimmerians. Arrowheads of this type have been found as far west as the Lower Loire, the Seine Valley and Flanders and it seems likely that they spread from Greek workshops in southern Italy by way of the Alpine passes.[5]

The dispersal of three-winged arrowheads over northern France probably around 600 B.C. only stands out from the archaeological record because of the general rarity of indications of archery in north-western Europe at this time. By comparison with the sword and the spear the bow was of insignificant importance in north-western Europe during the Pre-Roman Iron Age, both in the central areas of the Hallstatt[6] and La Tène cultures[7] and in the outlying provinces of the Celtic world. The relative unimportance of the bow can be illustrated from the site of La Tène itself,[8] which yielded only 12 examples or (allowing six a quiver) two sets of arrowheads as against 166 swords and 264 spearheads. Arrowheads of the type discharged from hand-bows are extremely rare in Britain from the pre-Roman Iron Age. To test the military status of the bow we may turn to two of the most important hill-forts of southern England: at Maiden Castle, Dorset, for instance, there was not a single iron arrowhead from any level antecedent to Vespasian's bombardment and the numerous arrowheads dating from this phase in the history of the site were of types 'common on Roman military sites where ballistae, but not hand-bows are to be inferred';[9] and at Hod Hill all but two of the large number of iron projectile heads other than spearheads are interpreted by Mr Brailsford[10] as catapult armament. The complete absence of bow fragments, arrowshafts or arrowheads from the Glastonbury and Meare lake-villages, which still provide the most complete picture we have of the equipment of the pre-Roman Iron Age in Britain, argues that archery can hardly have been of much importance even for hunting, an activity in which the villagers seem certainly to have engaged.

[1] H. Müller-Karpe, 'Zur spätbronzezeitlichen Bewaffnung in Mitteleuropa und Griechenland', *Germania* (1961), pp. 255–86. [2] G. S. Kirk, *The Songs of Homer*, pp. 140 and 183 (Cambridge, 1962).
[3] J. Maluquer de Motes, 'Pueblos Ibericos', *Historia de España*, I. 1, pp. 34, f. 238, figs. 223, 105, 224 (Madrid, 1954). [4] H. L. Lorimer, *Homer and the Monuments*, pp. 295–300.
[5] O. Klemm, *Die drahtförmigen Pfeilspitzen in Frankreich* (Mainz, 1962).
[6] Déchelette, *Manuel*, II, p. 233 (1927) makes the point strongly, while quoting some of the far exceptional finds from central Europe. [7] Déchelette, *Manuel*, III, II, pp. 1196 and 1253–4 (1914).
[8] P. Vouga, *La Tène*, table on pp. 29–30; p. 55 (Leipzig, 1923).
[9] R. E. M. Wheeler, *Maiden Castle, Dorset*, pp. 62–3.
[10] J. W. Brailsford, *Hod Hill*, I, pp. 5–6 (B.M., 1962).

was with war-like equipment, a find moreover in which wood was exceptional well preserved; yet amid a plenitude of spears, swords and shields not a sing trace of bow or arrow was found.

On the other hand it was in this part of Europe that we find the emergence splendid long bows during the latter part of the Roman Iron Age, that is betwe A.D. 200-400. This is all the more striking in that, as Professor Brondsted point out,[2] arrowheads had continued to be conspicuously absent from the weap finds of the first part of this period (A.D. 0–200). To seek an explanation for th apparently sudden appearance would involve consideration of the history of th bow in territories outside our immediate frame of reference. It is sufficient he to note that bows reappeared, not only in burial finds such as the Vallet cemetery,[3] but above all in the great votive finds (fig. 21) of Denmark an Schleswig-Holstein, notably Thorsbjerg, Vimose and Nydam;[4] and no doubt th closely comparable example from the Heechterp near Leeuwarden in Dut Friesland[5] is connected with this group. The Nydam ship alone yielded som thirty-six bows, as well as several hundred arrow-shafts and many heads of bon and iron. Careful examination of bow staves from Nydam in the National Museu at Copenhagen showed that some of them had been bound with zones of fi thread and these have been restored in the drawings of the specimens in questio One of the Vimose staves has three parallel grooves cut longitudinally into on face. The bowstrings were held in notches cut towards either ends of the stave some of which were tipped with antler or iron. As our table shows these bow

	Length	*Thickness*	*Width*	*Thickness: Width*	*Museum*
Nydam	197·5	2·60	2·75	1 : 1·1	Copenhagen
	175	2·60	2·80	1 : 1·1	— —
——	182·5	2·05	2·75	1 : 1·3	——
Vimose	176·5	2·50	3·25	1 : 1·3	——
——	169·5	2·50	2·50	1 : 1·1	
Heechterp	151· (originally c. 168)	2·45	2·45	1 : 1·0	Leeuwarden
Mary Rose (1545)	187	3·20	3·50	1 : 1·1	Tower Armoury
——	190	3·25	3·50	1 : 1·1	—
——	188	3·00	3·25	1 : 1·1	Roy. United Services Inst.
Ballinderry, I	185	2·86	3·80	1 : 1·3	Dublin

Table giving dimensions of bows from the Younger Roman Iron Age (A.D. 200–400) as compared with those of the English Long Bow and of a Viking specimen from Ireland.

[1] G. Rosenberg, *Hjortspringfundet*, pp. 40-41 (Copenhagen, 1937).
[2] *Danmarks Oldtid*, II (1939 edn.), p. 160. [3] Ibid., p. 190. [4] Ibid., p. 221.
[5] Preserved in the Leeuwarden Museum. Mr J. D. van der Waals informs me that the occupation o Heechterp began during the currency of *streekband* pottery, that is from c. 200 B.C. until early in the Roman Iro Age. Since wooden objects were not preserved in the upper levels, it is likely that the bow belongs to the Roma Iron Age.

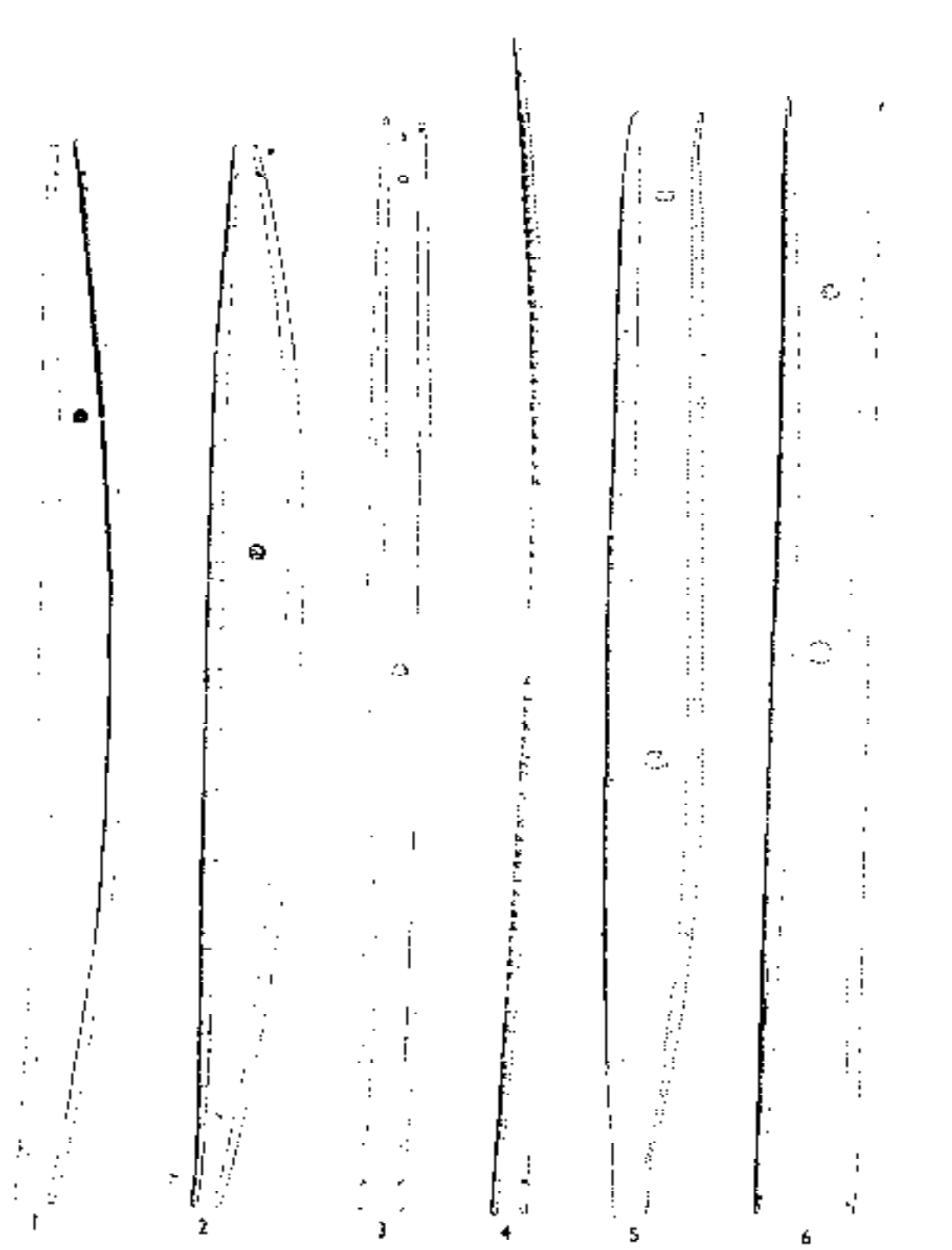


Fig. 21. Long bows ranging from the Roman Iron Age to the 16th century A.D.
No. 1 from Vimose (A.D. 200–400).
Nos. 2–4 from the Nydam ship (A.D. 200–400).
No. 5 from Ballinderry, crannog no. 1 (10th century, A.D.).
No. 6 from the wreck of the *Mary Rose* (1545).

compare closely in length, ratio of thickness to width of limb and general form with surviving specimens of the English Long Bow salvaged from the wreck of the *Mary Rose* (1545);[1] none of the three surviving specimens retains a nock, but discolourations at either extremity indicates that separate pieces, presumably of horn, had once been fitted.

In approaching the immediate origin of the English Long Bow one enters a terrain with little firm ground. The source of the weapon first used by English troops as a principal arm at the battle of Falkirk (1298) is traditionally set, largely on the authority of Giraldus Cambrensis, in South Wales. It seems important to define the focal area in more detail. Reference to Giraldus himself[2] shows that the men he claimed to be 'more accustomed to war . . ., and more expert in archery, than those of any other part of Wales' were in fact the men of Gwenth, the district enclosed within the triangle Newport–Chepstow–Abergavenny; it was at the siege of Abergavenny that the famous feat of shooting an arrow through an oak door four fingers thick is supposed to have been performed;[3] and it was from his castles of Chepstow and Striguil that Richard de Clare set forth on the campaigns in Ireland (1170–6) that earned him the soubriquet of 'Strongbow'.[4]

The significance of this will soon appear. First we must eliminate the possibility of an indigenous Celtic source for the Long Bow. As we have already emphasized, evidence for archery is conspicuously lacking for the Pre-Roman Iron Age in Britain. During the Roman occupation archers were introduced, but these were auxiliaries of Syrian origin who used the Asiatic composite bow[5] and it is exceedingly unlikely that they influenced the natives who lacked a bow-tradition of their own. Admittedly very little is known of the equipment of the Welsh during the 1st millennium or so after the birth of Christ, but here it is surely permissible to look across the Irish Sea where the crannogs have preserved a remarkably full picture even of the more perishable aspects of the Celtic material equipment of the period. Dr Hencken's exemplary excavation of the Lagore crannog in County Meath[6] is revealing in this respect: as might be expected this royal residence of the 7th to the 10th centuries produced a wealth of weapons, but among numerous swords, scramasaxes and spears, and a few throwing axes, not a single arrowhead and, despite the excellent preservation of wood, not a trace of bow-stave or arrowshaft came to light.

The only bow-stave from an Irish crannog of this period, that from Ballinderry I (10th century), came from the floor of the same hut as yielded the well-known Viking sword.[7] The Vikings are known to have used bows especially for hunting,[8] even though relying mainly on various kinds of sword and spear for fighting, and the Ballinderry stave of over 185 centimetres is certainly a worthy successor of those of the Roman Iron Age just described. Yet we can hardly

[1] Viscount Dillon in C. J. Longman and H. Walrond, *op. cit.*, p. 124. I am greatly indebted to Mr William Reid of the Tower Armouries for his help in studying the originals.

[2] *The Historical Works of Giraldus Cambrensis* (ed. Thomas Wright), p. 370 (London, 1863). [3] *Op. cit.*, p. 111.

[4] I. A. Richmond, *Papers of the British School at Rome*, XIII (1935), pp. 1–40.

[5] H. O'N. Hencken, *Proc. R.I.A.*, LIII, sect. C, pp. 1–40. *Arch. Cambr.*, LXXXVII, pp. 65–66.

[6] H. O'N. Hencken, *Proc. R.I.A.*, LIII, sect. C, pp. 1–247. See especially pp. 25–98.

[7] H. O'N. Hencken, *Proc. R.I.A.*, XLIII, sect. C, pp. 103–240. See especially pp. 138–9.

[8] J. Brøndsted, *The Vikings*, pp. 124–5 (Penguin Book, 1960); P. Norlund, *Trelleborg*, pp. 137–9 (Copenhagen, 1948); H. Shetelig and H. Falk, *Scandinavian Archaeology*, p. 392 (Oxford, 1937).

attribute the rise of archery in Gwenth to the Viking settlement in South Wales, since this barely extended so far east.[1] Since on the other hand of course Gwenth lay well to the west of the Anglo-Saxon settlement, the only possibility that remains is that the bow was introduced there in the wake of the Anglo-Normans during the last decade of the 11th century.

The bow was certainly in use within the area of Pagan Anglo-Saxon settlement and it is likely that the Saxons even reintroduced the weapon to England. The archaeological evidence is by no means plentiful from the early period and we have nothing like the great series of bows from the cemetery of Oberflacht in Suabia (*c.* A.D. 600), bows by the way, which, to judge from the example illustrated in *Archaeologia*,[2] differed both from the Nydam and Medieval Long Bows in having pronounced shaped grips; nevertheless the archer buried in the cemetery at Chessell in the Isle of Wight was not only accompanied by about two dozen arrowheads, but also by the decomposed traces of a 5-foot bow.[3] Iconographic indications are that the bow began to play a more important part in the later Saxon period, perhaps in part as a consequence of the Danish invasions, even though to judge from the representation on the top panel of the Franks casket[4] (*c.* A.D. 700) onwards the weapon reached only to about the archer's knees. If we may judge from the Bayeux tapestry the Normans used bows of about the same length at the Battle of Hastings.[5] Thus all the main elements of the Anglo-Norman invaders must have been acquainted with the bow, even if they were accustomed to a medium sized weapon, and three generations would not have been too short a time for the development of the Medieval Long Bow, a weapon which had after all been anticipated by nearly a 1000 years in the splendid weapons of the Nydam ship.

APPENDIX I: LIST OF BOWS SHOWN ON MAP (Fig. 6)

DENMARK

1, 2. *Holmegaard mose, Sjaelland.* Pl. VI

(1) Elm. Complete, but broken, bow with well-defined grip (class C) and broad, tapered limbs. Both extremities are pointed (class A), one fairly abruptly, the other finely tapered. 154 centimetres long. Width 4.4 centimetres (limb), 2.5 centimetres (grip). Thickness 2.0 centimetres (limb), 2.9 centimetres (grip).

(2) Elm. Only about half complete, including the well-defined grip (class C). This was evidently of the same type, but larger than no. 1, being probably *c.* 180 centimetres long when intact. Length of surviving piece 90 centimetres. Width 5.7 centimetres (limb), 2.1 centimetres (grip). Thickness 2.8 centimetres (limb and grip).
Bog finds. Mesolithic. Pollen analysis: Jessen, Zone VI.

National Museum, Copenhagen. C. J. Becker, 1945.

[1] See Map 6 in P. Hunter Blair's, *An Introduction to Anglo-Saxon England* (Cambridge, 1956).
[2] W. M. Wylie, *Archaeologia*, xxxvi (1955), pp. 129–60, pl. xiii, fig. 5.
[3] G. Hillier, *The History and Antiquities of the Isle of Wight*, p. 30.
[4] *B.M. Guide to Anglo-Saxon Antiquities*, pl. viii (1923).
[5] *The Bayeux Tapestry*, no. 70 (Phaidon Press, New York, 1957).

3. *Muldbjerg, Aamosen, Sjaelland.* Fig. 7

Elm. Complete, though broken, except for one end. Constricted grip (class B) with broad tapered limbs, one of which shows three grooves near the grip. The more or less complete end has been nocked (class A) to receive the string.
At present 153 centimetres long, but estimated to have been *c.* 160 centimetres when intact. Width 3.55 centimetres (limb), 2.8 centimetres (grip). Thickness 1.8 centimetres (limb), 2.2 centimetres (grip).
Excavated from settlement of Danish TRB 'A' culture.

National Museum, Copenhagen. J. Troels-Smith, 1959.

ENGLAND

4. *Ashcott Heath, Somerset.* Pl. II, fig. 3

Yew. About half the bow survives, the stave having snapped at the grip (class B). The latter is well-defined laterally, though not in face view. The limbs taper and the surviving nock, which is intact and particularly well preserved, belongs to Class B2, though showing some unique features.
Surviving length 83 centimetres; if symmetrical about the grip, the bow would have been *c.* 159 centimetres in length. Width 2.5 centimetres (limb), 2.3 centimetres (grip). Thickness 2.25 centimetres (limb), *c.* 3.2 centimetres (grip).
Bog find. Neolithic. Pollen-analysis: lower half of Godwin's Zone VIIb.
Radio-carbon analysis: Q 598 . 2665 B.C. ± 120.

Cambridge University Museum of Archaeology and Ethnology.

5. *Cambridge, nr.* Pl. III; fig. 12

Yew. The bow, described as having been 'found deep down in the peat near Cambridge in 1885', was complete when it came into the late Mr C. J. Longman's possession, except for a small portion 'probably an inch or less' broken off one end. When Longman described it the other end was intact and had well-defined shoulders (class B2). This end has since received some damage and has apparently at some time been repaired: in the illustration prepared for this paper the shouldered extremity has been rectified to accord with the photograph published by Longman. There is no well-defined grip, the limbs merely being thinned down and slightly tapered towards either end. Prominences at intervals on the convex face mark the position of knots or pins in the wood.
At present 148 centimetres long; originally *c.* 153 centimetres. Width 2.7 centimetres. Thickness 2.9 centimetres.

Bog find. Chalcolithic. Radio-carbon analysis: Q 684 . 1730 B.C. ± 110.

Pitt-Rivers Museum, Oxford. C. J. Longman, 1894, pp. 19 ff.

6. *Edington Burtle, Somerset* Fig. 12

Yew. This bow appears to be intact, though severely warped at the present time. The grip has a rounded section (class A) and the limbs, which taper slightly towards either end, have been thinned by cutting away wood on either side. Prominences which appear at intervals along the convex face of the bow mark the positions of knots or pins. This bow is noteworthy for its asymmetry: the ends are treated differently and the limbs are of markedly unequal length, that with the pointed or rat-tail end being some 6¾ inches (17 centimetres) longer than that which terminates in a knob or button (class B3).
The bow is inscribed:

> 'Bow, perhaps ancient British, found in 1842, in the peat at Edington Burtle, Somerset. Strutting Coll. Purchased 1902. A.429'.

The published reference records the following:

'Ancient British Bow, 4 foot 11 inches long, with groove running along inner side, found in peat in Edington Burtle. 1842'.

Width 2.9 centimetres (limb), 2.3–2.5 centimetres (grip). Thickness 1.8 centimetres (limb), 2.4–2.6 centimetres (grip).

In its present condition it is difficult to measure, but about 148 centimetres (4 feet 10½ inches). Presumably it has shrunk since 1902 by ½ inch, when it was 150 centimetres. As it is likely that the initial shrinkage on drying occurred fairly rapidly, the probability is that the bow was originally a few centimetres longer.

Bog find. Middle Bronze Age. Radio-carbon analysis: Q 1169, 1320 B.C. +- 120.

Taunton Castle Museum. *Proc. Som. Arch. and Nat. Hist. Soc.*, XLVIII, 1902, 85.

7. *Meare Heath, Somerset.* Pls. III–V; fig. 3

Yew. Only about half the stave survives, the bow having snapped across the grip (class B). The nock is of class B3. A full description of the webbing on this outstanding specimen is given on p. 58–9.

The surviving portion measures 100 centimetres. Assuming the bow to have been symmetrical, the total length would have been *c.* 190.5 centimetres. Width 6.55 centimetres (limb), 2.75 centimetres (grip). Thickness 1.75 centimetres (limb), 2.25 centimetres (grip).

Bog find. Neolithic. Pollen-analysis: middle to upper part of Godwin's Zone VIIb.
Radio-carbon analysis: Q 1140, 2850 B.C. +- 120.

Cambridge University Museum of Archaeology and Ethnology.

8. *Lac de Chalain.*

Regrettably it has not yet been possible to obtain details.

Lons-le-Saunier and Dôle Museums. J. Déchelette, *Manuel*, 1924 edtn., I, 367.

GERMANY

9. *Budman.*

Yew. Closely similar in form to the complete example (no. 24) from Robenhausen. The grip (class B) is well-defined, particularly in lateral view. The limbs of D-Section taper gradually and are shaped to engage the string in similar fashion at either end (class B2). 155 centimetres long.

From a Neolithic pile-settlement.

Rosgarten Museum, Constance. H. Reinerth, 1926, 36, abb. 1.

10, 11. *Dummer (Oehsenmoor), Lower Saxony.* Fig. 7

(10) Yew. Complete except for one end, though broken in places. Well-defined grip (class B). Limbs of D-Section taper towards the ends. The surviving end is pointed (class A). Width 3 centimetres (limb), 2.05 centimetres (grip). Thickness 2.2 centimetres (limb), 2.8 centimetres (grip). At present 134 centimetres long; originally probably *c.* 144 centimetres.

(11) Yew. Similar in type, though the limbs are rather broader. Width 3.3 centimetres (limb), 2.5 centimetres (grip). Thickness 1.65 centimetres (limb), 3.6 centimetres (grip). Both ends are missing. At present 130 centimetres: if the limbs were proportionate in length to their width, the bow would have been substantially longer than no. 10.

Both these bows were found when cutting a trench in the bog. They were taken from a deposit of calcareous mud (*Mergelgyttja*) overlaid by 50 centimetres of *Bruchwaldtorf* and 40 centimetres of *Bleichmoostorf*. From what is known of the local stratigraphy

it is considered that these bows can hardly be later than the end of the Stone Age in north-west Germany.

Landesmuseum, Hannover. K. H. Jacob-Friesen, 1950.

12. *Satrup (Försternmoor), Schleswig-Holstein.*

Elm. Both ends are missing. The grip (class B) is slightly constricted viewed from belly or back, and thickened laterally. The limbs of D-section taper towards either end.
At present 110 centimetres long, but originally perhaps 150/5 centimetres.

Funnel-neck Beaker culture.

Schleswig-Holstein Museum, Schloss Gottorp. H. Schwabedissen, 1957-8, abb. 12, 1.

NETHERLANDS

13. *Noordwijkerhout, prov. Zuid Holland.* Pl. VII; fig. 12

Yew. The intact middle portion shows a markedly well-defined grip (class C) constricted in front view and flattened laterally. The limbs are broad and relatively flat. One of the surviving detached portions tapers markedly towards the extremity.
The estimated length of the complete bow is 180 centimetres. Width 5.2 centimetres (limb), 1.85 centimetres (grip). Thickness 1.85 centimetres (limb), 3.9 centimetres (grip). No precise information survives about the conditions of discovery.

Found at the locality De Zilk. Radio-carbon analysis: GrN. 4070. 1550 B.C. ± 100.

Private collection of W. A. van der Wal, Heemsteede.

14. *Ommeedde (Stadskanaal), Groningen.* Fig. 12

Yew. Complete. The limbs of D-section are narrow and taper slightly towards the ends which are shouldered to engage the string (class B1). There is no defined grip. 172 centimetres long. Width 2.55 centimetres. Thickness 2.55 centimetres. A stray find from peat, only 15 centimetres above sand which projects to the surface nearby.

Found in peat in 1887. Radio-carbon analysis: GrN. 4089. 2020 B.C. ± 65.

Provincial Museum of Drenthe, Assen. 1887. ix. 3.

SWEDEN

*15. *Visimosen, Ljung, Östergötland.*

Pine. Central part of bow including constricted grip and adjacent portions of limbs, which taper from a maximum width of 6 centimetres.
Length of fragment 30.5 centimetres.
A stray bog find dated to the youngest Bronze Age by pollen-analysis.

Östergötlands Museum, Linköping. A. Oldebjerg, 1959.

SWITZERLAND

16. *Egolzwil 3, Wauwil, Luzern.*

Yew. Part of a stave, apparently including the middle portion, but showing no trace of constricted or thickened grip. The limbs is of D-section and tapers from 3 to 2.5 centimetres in width and from 1.8 to 1.3 centimetres in thickness.
Length of fragment 69 centimetres.

Excavated from Neolithic (Early Cortaillod) settlement.

Landesmuseum, Zürich.

*Not shown on map.

17–19. *Egolzwil 4, Wauwil, Lucern.* Figs. 9, 10

(17) Yew. Two lengths of stave (71.3 and 99 centimetres respectively), each with D-section and maximum width of 3.3 centimetres and thickness of 2.0 centimetres. There is no trace of a shaped grip on either piece. The two were found in close proximity and Professor E. Vogt, the excavator, is of the opinion that they formed part of the same bow. If so, it provides an example of a bow having distinct classes of nock at either end, one having a termination of class C1, the other of class D.

The two fragments together total 170.3 centimetres in length, but the complete bow (assuming the two in fact belong, as they have every appearance of doing) may have been several centimetres longer.

(18) Yew. Part of stave of D-section and maximum width of 2.9 centimetres. One end has evidently been burnt. No signs of grip or termination.

Length of fragment 36 centimetres.

(19) Yew. The end of a bow, tapered and carefully shaped (class E). The stave is a deep D in section, the sides being flattened and slightly oblique.

Length of fragment 35.5 centimetres

Excavated from Neolithic (Younger Cortaillod) settlement.

Landesmuseum, Zürich.

20. *Luscherz (Bielersee), Erlach, Bern.*

Yew. Incomplete. One end was seen to be notched when examined by Reinerth, but is at present missing. The stave has a D-section.

At present 116.5 centimetres.

From a pile settlement, mainly Neolithic, but persisting until the beginning of the Bronze Age.

Historisches Museum, Bern. No. 2797. B. Adler, 1915, 190 f.; H. Reinerth, 1926, 36.

21–22. *Niederwil (Egelsee), Thurgau.* Pl. VIII, E; figs. 9, 10

(21) Yew. Nock-end (class D) only. What appears to be a 'ghost' of the bow-string is visible immediately below the nock.

Total surviving length 37.5 centimetres.

From Professor Waterbolk's excavations (1962) at the Neolithic settlement.

Historisches Museum, Bern.

(22) Yew. Almost complete, but one end broken short. The stave is 3 centimetres wide at the maximum tapering towards either end and is D-sectioned, the flatter face slightly concave. No defined grip. The surviving end is of class D and the stump of the missing one is comparable.

At present 170.5 centimetres long, but, if symmetrically tapered, the total length would have been about 177 centimetres. Width 2.9 centimetres. Thickness 2.1 centimetres. From early excavations at the Neolithic settlement.

Landesmuseum, Zürich. Niederwil 340. B. Adler, 1915, fig. 4; H. Reinerth, 1926, abb. 1.

23 *Riedspitz, Fällanden, Zürich.*

Yew (?). Two pieces, probably joining.

Total length 60 centimetres.

Landesmuseum, Zurich.

24–30. *Robenhausen, Wetzikon, Zürich.* Figs. 9, 10

(24) Yew. Complete bow-stave with identical knockends of class B2. The limbs are D-sectioned and tapered from a maximum width of *c.* 2.9 centimetres; one is *c.* 2.5 centimetres longer than the other. The grip (class B) is only slightly constricted when viewed from the belly, but from the lateral aspect it is thickened, being more or less oval in section.

162.5 centimetres long. Width 2.8 centimetres (limb), 2.1 centimetres (grip). Thickness 2.0 centimetres (limb), 3.5 centimetres (grip).

Landesmuseum, Zurich. No. 422. B. Adler, 1915, fig. 2; H. Reinerth, 1926, abb. 1.

(25) Yew. This specimen is much warped. The limbs are D-sectioned and taper from a maximum width of 2.6 centimetres. There is no shaped grip. One end is missing, the other being notched (class C1). At present 143 centimetres long, but, assuming that the limbs tapered identically, the missing part would have been about 12.5 centimetres, making a total length of c. 155.5 centimetres.

Landesmuseum, Zürich. No. 413.

(26) Yew. Nock-end (class C2) of D-sectioned bow-stave, the convex face of which is keeled for the final 10 centimetres or so, giving a sub-triangular section.
Length of fragment 17.5 centimetres.

Landesmuseum, Zürich. No. 431–7.

(27) Yew. Nock-end (class B2) of D-sectioned bow-stave.
Length of fragment 9.8 centimetres.

Landesmuseum, Zürich. No. 431 8.

(28) Yew. Nock-end (class C2) of D-sectioned bow-stave.
Length of fragment 4.2 centimetres.

Landesmuseum, Zürich. No. 13712.

(29) Yew. Nock-end (class C2) of D-sectioned bow-stave. Although not identical, this nock resembles no. 28 and may have come from the same bow.
Length of fragment 12.7 centimetres.

Landesmuseum, Zürich. No. 28346.

(30) Yew. Part of bow-stave of slightly concave D-section. Nock of class C1.
Length of fragment 66.7 centimetres.

Historisches Museum, Bern. No. 1064. B. Adler, 1915, 190 f.; H. Reinerth, 1926, 36.

Note: Nos. 24–30 came from the original excavations at the Neolithic site of Robenhausen. J. Messikommer, 1882.

31. *Suze (Bourrette), Bern.* Figs. 9, 10

Yew. A complete bow apparently cut from small timber. Well-defined nocks (class B2) at either end were apparently once identical, but one has been reduced a little in thickness, probably in modern times. The limbs are D-sectioned, the flatter side being slightly concave, and taper towards either end. The grip has a sub-rectangular section (class C).

Length 164 centimetres. Width 3.0 centimetres (limb), 2.6 centimetres (grip). Thickness 1.8 centimetres (limb), 2.6 centimetres (grip).
From a pile-dwelling.

Landesmuseum, Zürich. No. 6425. B. Adler, 1915, fig. 1; H. Reinerth, 1926, abb 1.

32. *Utoquai, Zurich.* Fig. 10

Yew. One end of a bow with D-sectioned limb and well-shaped nock (class B2).
Length of fragment 30 centimetres.

Landesmuseum, Zürich. No. 37863.

33–34. *Weiher, Schaffhausen.* Fig. 9

(33) Yew. A well-preserved bow intact apart from c. 1 centimetre at one end. There is no shaped grip. The maximum width is 3.3 centimetres. The convex face is slightly keeled

in its middle portions, but as it tapers towards either end it becomes D-sectioned. The fully surviving nock-end is of class D; the broken one could be of the same class or possibly of C1.
Present length 1·75 centimetres. Width 3·3 centimetres. Thickness 2·0 centimetres.

(34) Yew. A small, presumably toy bow. One end has a nock of class C1; the other has been pointed apparently secondarily. The present length is 80·7 centimetres, and if originally symmetrical about the grip it would have been c. 91 centimetres.
The limbs are D-sectioned, the very slightly constricted grip being sub-rectangular in section.

These two bows were excavated by Dr Guyan from the Neolithic settlement of Weiher. The large bow (no. 33) came from the gyttja outside the three enclosures together with sherds and other debris discarded from one or other of the settlements. Phases 1 and 2 were of the Michelsberg and phase 3 of the Pfyn culture.

Museum zu Allerheiligen, Schaffhausen.

APPENDIX II: LIST OF ARROWSHAFTS SHOWN ON MAP (Fig. 6)

AUSTRIA

1. *Mondsee.*

Flint arrowhead mounted at head of shaft and secured by resin, presumed to be birch-pitch.
R. Pittioni, *Urgeschichte des Österreichischen Raumes*, abb. 154, no. 14.

DENMARK

2. *Elsnæ, Ringkøbing, Jutland.* P. VIII, C

Chisel-ended flint arrowheads mounted on wooden shaft (diam. 0·85 centimetres) and secured by a sinew lashing.

National Museum, Copenhagen.

Dansk Oldsager, 1, 104; J. Brondsted, *Danmarks Oldtid*, 1, rev. 1957 edn.

3. *Holmegaard IV, Sjælland.*

Several broken arrowshafts (one 88 centimetres long, with the tip missing), including ones slotted in the forepart and another with thickened bolt-like head. Made from wood of the Guelder Rose (*Viburnum opulus*).

National Museum, Copenhagen. C. J. Becker, *Fra Nationalmuseets Arbejdsmark*, 1945, 66–8.

4. *Magleby Long, Magleby, Zealand.*

Two bunches of broken arrowshafts, including some with bolt-heads and one slotted at the tip. Traces of spiral lashing visible near the nock-end of one shaft.

C. J. Becker, *Acta Archaeologica*, XVI, 1945, 161, fig. 8.

5. *Muldbjerg, Aamosen, Sjælland.*

Two arrowshafts (diam. c. 0·7 centimetre) made from ash (*Fraxinus*) and split from large straight-grained wood. The slot for the chisel-ended flint arrowhead still in position has been cut at 45° to the medullary rays of the wood. The shafts have been broken short; at present only 35 centimetres long. Early Neolithic TRB A.

National Museum, Copenhagen. J. Troels-Smith, *Aarboger*, 1959, 92–163.

6. *Vinkel Mose, nr. Viborg, Jutland.*

Pl. VIII, D

Complete arrowshaft (diam. up to 1 centimetre) of pine (*Pinus sylvestris*) 104 centimetres long. Notched at one end for the bow-string and obliquely slotted at the tapered tip, presumably to carry a microlithic arrow-head. Sinew thread binding still in place immediately above the notch and impressions 16 centimetres up the shaft of similar binding, presumably to secure the fletching. Dated to Early Boreal period (Zone V) by pollen-analysis.

Stiftsmuseum, Viborg. Examined at the National Museum, Copenhagen.

J. Troels-Smith, *Aarbøger*, 1961, 122–46.

ENGLAND

7. *Aldro, barr. 88, Yorkshire (East Riding).*

A leaf-shaped flint arrowhead, found under the thigh-bone of a dismembered inhumation lying on the old ground surface under a round barrow, is reported by the excavator to have had close underneath it 'the remains of the decayed wooden shaft'. There were indications that 'the arrowhead had been secured in a slit in the end of the shaft'.

J. R. Mortimer, *Forty Years' Researches . . .*, 59; fig. 117.

8. *Walton-on-the-Naze, Essex.*

Pl. VIII, B

A leaf-shaped arrowhead, one of over 900 collected by the late Mr John Hassall from the old land-surface exposed at low water on the foreshore, gives clear evidence of the mounting, long since disappeared, in the form of localized unpatinated zones on either face: these taper from the base of the arrowhead to a point about two-thirds of the way up either face and contrast by colour, surface lustre and to a very slight extent by thickness with the whitish, dull and slightly thinner patinated zone. Evidently the hafting, of the same type as that from Fyvie (no. 16), protected part of the head at a time when the rest was exposed to patination; this difference has been preserved since the old surface was soon after covered by peat and mud.

C. I. Fell, *Proc. Camb. Ant. Soc.*, XLVII, 38 and Pl. VIII, a.

GERMANY

9. *Petersfehn, Oldenburg, Lower Saxony.*

The foreshaft of a wooden shaft (diam. c.9 centimetre) with a chisel-ended flint arrowhead secured by binding.

Found in peat-digging.

K. H. Jacob-Friesen, 1930, *Abb.* 4.

10. *Stellmoor, Ahrensburg, Schleswig-Holstein.*

Fig. 5

Parts of over a hundred arrow-shafts and foreshafts of pinewood were recovered during the systematic excavation of the Ahrensburg level in deposits of Younger Dryas age. Two of the foreshafts still retain the bases of tanged points of flint in the clefts.

A. Rust, *Die Alt- und Mittelsteingeitlichen Funde von Stellmoor*, pp. 189–92. Pls. 91–6. Neumünster, 1943.

11. *Wietingsmoor, gem. Wehrbleck, Diepholz, Lower Saxony.*

The upper portion 47 centimetres long of a shaft (diam. c. 0.9 centimetre) of yew (*Taxus baccata*). The tip is forked for holding the arrowhead and marked by threads used to tighten the hold on the base of the arrow.

Found in 1952 during peat-digging at a depth of 2 metres from the surface and 1 metre below the *Grenzhorizont*.

K. Pfaffenberg, *Die Kunde. Mitt. d. Niedersächsischen Landesvereins f. Urgeschichte*, N.F. 6, heft. 1–2, pp. 3–4. Hannover, 1955.

IRELAND

12. *Ballykilleen, Co. Offaly.*

A barbed and tanged arrowhead with sinew binding still partly in position. When found it was mounted on its wooden shaft, but this was discarded.

University Museum of Archaeology and Ethnology, Cambridge.

Sir William Wilde, *Catalogue of the Museum of the Royal Hist. Academy*, p. 254. Dublin, 1861.

13.* *Gortrea, Kilmalinoge, Longford, Co. Galway.*

Barbed and tanged flint arrowhead set in forepart (c. 2.75 centimetres) of wooden shaft (probably *Alnus*)* and secured by binding identified by Dr D. Baynes-Cope of the British Museum Research Laboratory as of animal sinew or gut.

National Museum of Ireland. 1943 : 322 B26.8.

14. *Knowlton bog, Carnalbanagh, Glenarm, Co. Antrim.*

Top 5.9 centimetres of wooden shaft with base of cleft (probably *Fraxinus*)* to receive the arrow and having binding identified by Dr Baynes-Cope as of animal sinew or gut. The flint arrowhead originally found in this, but since lost, was hollow-based.

National Museum of Ireland. S.A., 1927 : 964 C16.18.

W. J. Knowles, *JRSAI*, xvii, 1885–6. 126–8.

15. *Tatharligarden, Newbridge, Co. Kildare.*

Barbed and tanged flint arrowhead mounted on the top 42 centimetres of the wooden shaft (*Corylus*)*; binding of fine threads, probably of animal sinew or gut.

National Museum of Ireland. 1942 : 1535–B11.

J. Raftery, *Prehistoric Ireland*, pp. 164–5, fig. 121, no. 8. London, 1951.

SCOTLAND

16. *Fyvie, Aberdeenshire.* Fig. 15

A lozenge-shaped arrowhead mounted on a wooden shaft (from Blackhillock bog). According to Anderson 'when found, the shaft was entire to the length of about 9 inches (23 centimetres). The workmen who found it unfortunately reduced its length to 3 inches by breaking pieces off it'. If the shaft was in fact complete it can be assumed to have been a foreshaft. The shaft has been tapered to a sharp point and at present extends to the extreme tip of the arrowhead; but Anderson considered that the arrowhead had been pushed deeper into the slot through rough handling. No trace of any binding survived. The wood has been identified as *Viburnum* sp.

National Museum of Antiquities, Edinburgh.

J. Anderson, *Scotland in Pagan Times, The Bronze and Stone Ages*, fig. 375, pp. 361–2, 1886; Sir John Evans, *The Ancient Stone Implements . . . of Great Britain*, fig. 342a, p. 405. London, 1897; *Proc. Camb. Antiq. Soc.*, xl.vii, 8.

SWEDEN

17. *Loshult, Scania.* Fig. 13

A number of broken arrowshafts (0.85 to 1 centimetre diam.) of pine wood. One shaft almost complete, in two sections totalling 88 centimetres, but with an intervening piece missing; one end of this shaft is notched; the other has a microlithic point fixed in the head and secured with resin which extends down one side and carries inset a second microlith with the untouched edge outermost. Two microliths were also found with fragments of another shaft.

Lund University Historical Museum.

Mats Peterson, *Medd. Lunds Univ. Hist. Mus.*, 1951, 123–37.

*Identifications by Mrs M. J. P. Scannell of the Natural History Division, National Museum of Ireland.

SWITZERLAND

18. *Burgäschisee S.W., Bern.*

Pl. VIII, A

Triangular flint arrowhead mounted on a slotted wooden shaft, bound by lashing and enveloped in resin.

Historical Museum, Bern.

19. *Egolzwil 4, Lucern.*

(a) Two triangular flint arrowheads heavily mounted in resin and with casts of the forked tips of wooden shafts. Closely resembling the Burgaschisee specimen, though lacking the wooden shaft.

(b) Two wooden bolt heads one with total surviving length of 2·5 centimetres, the other only 7·5 centimetres.

Excavated from Neolithic (Younger Cortaillod) settlement.

Landesmuseum, Zürich.

20. *Zugerberg-Gaisboden.*

Triangular flint arrowhead set in the slotted tip of a wooden shaft and secured by lashing.

Evans, *Ancient Stone Implements* . . ., fig. 343, p. 409.

APPENDIX III: REPORT ON THE MEARE SKIN

By M. L. Ryder, M.Sc., Ph.D., M.I. Biol.

A.R.C. Animal Breeding Research Organization, Edinburgh, 9

The specimen of skin from the bow was dark brown in colour, but the grain side could be distinguished from the flesh side by its darker colour and rougher texture. It was brittle, and lacked the traces of fibrous structure common at the cut edges of modern as well as some ancient leather. The skin was much thinner than leather known to have been made from cattle skin.

The specimen was softened, sectioned and stained by the methods described by Ryder.* The sections stained maroon, i.e. the skin was very basophilic. Increased basophilia (affinity for basic dyes) occurs in recent vegetable-tanned leather, and it was further increased in medieval leather that had been buried. It is therefore possible that the Meare skin had been tanned in another way, or was raw-hide, and that the increased basophilia was entirely due to the burial, particularly as the peaty soil would have been acid.

The sections contained follicle remains and some well-preserved, non-medullated hairs like those of cattle. The hairs had a fine to medium diameter (mean 33 microns) and unlike sheep showed no evidence of grouping in the skin, or division into more than one diameter range. The relative fineness of the hairs, and the thinness of the skin make this skin different from that of modern domestic cattle.

There were some heavily pigmented follicle bulbs, and most of the hairs had a little pigment. This relatively low density of pigment in the hairs plus the presence of some completely non-pigmented hairs suggests a pale brown or grey animal (or area on an animal).

*Ryder, M. L., 'Keratin derived from skin' in Blackwell, H. R. and Hugo, E. S. (Eds.) *Science in Archaeology* (1963). London: Thames and Hudson, p. 332–334.