Proc. Univ. Bristol Spelaeol. Soc., 1978, 15 (1), 7-22.

A PIERCED REINDEER PHALANX FROM BANWELL BONE CAVE AND SOME EXPERIMENTAL WORK ON PHALANGEAL WHISTLES

by
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ABSTRACT

This paper describes a pierced reindeer phalanx which was found in Banwell Cave and contains an account of the practical and experimental work undertaken in an attempt to ascertain whether or not this bone is an artifact. This work included a study of the gross structure of a series of Pleistocene reindeer phalanges, the demonstration experimentally of a mechanism by which some of these objects could have been formed 'naturally', the manufacture of whistles from modern reindeer phalanges and the determination of their effective ranges and their frequencies.

Besides showing that the pierced phalanx from Banwell is not an artifact, the results provide guide lines for the study of other pierced phalanges, using as examples specimens from Upper Palaeolithic sites in France.

The experimental work also produced circumstantial evidence to support and to extend ideas put forward by other workers on the development and use of whistles in Upper Palaeolithic times.

INTRODUCTION

The phalangeal whistle is a commonly found object on Upper Palaeolithic sites from Central Europe to the Dordogne. It consists of the first phalanx of a reindeer (*Rangifer tarandus*), which is pierced, usually at the proximal end of the posterior surface by a single hole.

Such a phalanx was found in May 1977 in Banwell Cave (plate 1a) but unfortunately no stratigraphic evidence is available since at some time in the past the phalanx had been removed from the deposit and cast onto one of the small, random piles of bones which lie against the southern wall of the *East Branch* of the *Bone Cave* (terminology-Chapman, 1955). Although the bone still had the cave earth adhering to it, the hole was clearly visible and it was this which attracted attention. Since evidence of Palaeolithic man having visited Banwell Cave is limited to just a few flint implements, and even their attribution to this cave has been questioned (Davies, 1926 and Balch, 1948), the object had at least potential importance and for this reason it was removed from the cave for examination.

Although pierced reindeer phalanges from Upper Palaeolithic deposits have traditionally been regarded as whistles and were, according to Sollas (1924), still in use by North American Indians during the early part of this century, the possibility that at least one museum specimen was not man-made had been raised by R. A. Smith (1911) who thought it possible that the hole in a whistle from Laugerie Basse (Brit. Mus.) had been made by Hyaena (fig. 1b).

When considering a pierced reindeer phalanx, there are several possibilities:

(1) The object is a whistle.

(2) The object is an artifact but is not a whistle.

(3) The object is man-made but is the result of some 'natural' process.

The Banwell bone was capable of producing a loud clear note and although it showed no definite signs of being man-made in the form of cut-marks or tool-marks, the chamfered appearance of the edges of the holes (see below) was at least suggestive of this possibility. The questions raised by this bone were therefore, of more than just local interest and suggested several lines of practical and experimental work, an account and the results of which are set out below.

DESCRIPTION

The Banwell bone is a reindeer first phalanx and closely resembles a modern specimen which is known to be from the hind foot of a large male (plate 1.a and plate 1.e).

Before a thorough examination of the bone was possible, it was necessary to clean it and to conserve it and, in order to preserve any possible tool-marks which might still be present, this cleaning was undertaken with great care. A few hours after its removal from the cave the phalanx which was still wet was immersed in water in a shallow dish and most of the sandy cave earth fell away. The little which remained was easily removed by the gentle use of a fine sable watercolour brush and a pipette with a rubber bulb, whilst the bone remained immersed in the waterbath. The medullary cavity of the bone was found to contain a small amount of cave earth but no fragments of bone were noted (cf. Sun Hole phalanx p.9). After cleaning the phalanx was removed from the water-bath and allowed to dry slowly. A preliminary examination of the bone was made before giving it a single application of a 10% solution of P.V.A. in toluene.

The surface of the bone was found to be weathered, mostly on its posterior aspect, which has at its proximal end a hole, 9mm. long by 7mm. wide (fig. 1.a). The lower margin of the hole and its two sides are curved and smooth and when the hole was examined originally gave the impression that the hole could have been man-made with a carefully cut edge which had been chamfered on the inside (fig. 3.3). No cut-marks or tool-marks however were found on any part of the bone but this was perhaps hardly surprising in the presence of the weathering mentioned above.

Examination of Pleistocene Reindeer Phalanges

Before commencing experimental work designed to investigate the possibility that some 'whistles' are not artifacts but were formed 'naturally', it was decided to examine a sample of reindeer phalanges from Pleistocene deposits. The main object was to determine whether their gross structure is such that, either during or after their incorporation into a deposit, they are predisposed to damage which could be mistaken for a man-made hole. Pleistocene reindeer phalanges from the U.B.S.S. Museum collections were examined from the sites of King Arthur's Cave (U.B.S.S. W2), Sun Hole (U.B.S.S. M5), Banwell Bone Cave (U.B.S.S. M15) and from Picken's Hole (U.B.S.S. M30). Reindeer phalanges were most numerous from Picken's Hole (report in prep.) and from this series twelve were picked out at random and radiographs were made of them in order to ascertain the relative thickness of the compact bone at various points on their shafts. The X-rays showed that in every case, the bone at the relevant point (i.e. the upper end of the posterior surface) was significantly thinner than at any other point on the shaft and measurement confirmed objectively that the bone at this point is, on average, only half the thickness of the compact bone elsewhere.

Plate (1.c) is a photograph of one of the specimens from Picken's Hole (M30.2/44) which was divided longitudinally using a jeweller's saw, whilst plate (1.b) illustrates the variation in thickness as shown on a typical X-ray (M30.2/37). The likelihood of damage at this point is also increased by the shape of the bone, for whilst at its distal end the posterior surface is convex from side to side, at its proximal end it is flattened and is consequently more likely to collapse under pressure. The structure of the reindeer phalanx therefore is such that there is an inherent weakness at that point where the holes most often occur in phalangeal 'whistles'. A heavily weathered example from the Picken's Hole material (M30.2/202) whose shaft has given way at this point is shown in fig. (1.e).

An interesting unstratified find (M5.2/43) from the Pleistocene levels at Sun Hole, Cheddar, was found in September 1977 whilst the standing section-face of the U.B.S.S. 1950's excavation (Tratman, 1955) was being cleaned. One superior condyle of this phalanx is largely missing and there is a small hole at the proximal end of the posterior surface (fig. 1.i). The hole, which is lateral to the midline, is irregular in outline and has roughened crumbly edges.

The bone was cleaned by the method described above and its particular interest lies in the fact that, mixed with the small amount of cave earth which was found inside the marrow cavity, there were small fragments of bone which had obviously been pushed inside as the bone was damaged. The general state of the bone together with the shape of the hole make it unlikely that it would ever have been mistaken for an artifact, but even if the shape of the hole had been such that it suggested this, it could have been discounted because of the bone fragments found inside the cavity. This is a specific point to be kept in mind when new finds of this sort are examined but it also emphasises the general point that great care and attention are required when *'possible'* bone artifacts are being cleaned and examined. This phalanx functioned weakly as a whistle. (table 1).

The above phalanx is reminiscent of one from Abri Blanchard, Castel Merle. Dordogne (plate 1.h). This is also weathered and fragile, has the same degree of damage and shows the same crumbly appearance at the edges of the holes.

EXPERIMENTAL PRODUCTION OF WHISTLES BY A 'NATURAL' MECHANISM

Having shown that in theory it was not only possible but probable, that reindeer phalanges subjected to pressure or impact in a stoney deposit could become pierced at the relevant point, it was decided to examine this possibility experimentally.

Modern reindeer phalanges were used for this and the following experiments. In a garden path which consisted of hard, well-trodden and compacted earth, a rectangular hole was cut 100mm. × 100mm. × 40mm. deep and the base was covered with a layer of small angular limestone chippings. A phalanx (RHRP 1) was placed upon this layer with its posterior surface uppermost and more chippings heaped over it until they stood just above the level of the path (fig.3.1). No attempt was made to position individual chippings relative to the phalanx. A rectangular cast iron weight of 7lbs. (3.2kg.) was dropped onto this from a height of 0.25m. The chippings were then carefully removed piece by piece, in order to inspect the bone. The whole procedure was repeated several times because on the first three occasions there was no such obvious damage to the phalanx. On the fourth attempt it was found that a hole had been punched in the upper end of the posterior surface of the shaft (plate 1.e).

The form of the resulting hole was unexpected for it was found that the lower margin and the side of the hole formed a smooth curve with sharp edges very similar to that on the Banwell bone. It is important to note that this smooth curved outline was not due to the shape of the stone responsible for the hole but was due to the way in which the bone was fractured, as was the sharp edge which gave the chamfered appearance. The mechanism of this is shown in fig. (3.2) and illustrates how the upper part of the detatched piece of bone was pulled away from the spongey bone of the epiphysis.

The experiment was repeated using another reindeer phalanx (RHRP 2) and this gave similar results. This time however the smooth curved border accounted for approximately seven-eighths of the circumference of the hole. Once again the sharp edge described above was produced and the interruption of the smooth border again occurred at the proximal end (plate 1.d). Another phalanx (RHRP 3) was prepared in the same way but this time, instead of dropping an iron weight onto the chippings, they were crushed slowly under the heel in a deliberate walking step (body weight — 70kg.). On the fourth attempt it was found that pressure had produced a hole with the same characteristics as the other two. It seems therefore, to make no difference to the shape of the hole whether the force is applied suddenly by impact or slowly as a steadily applied pressure.

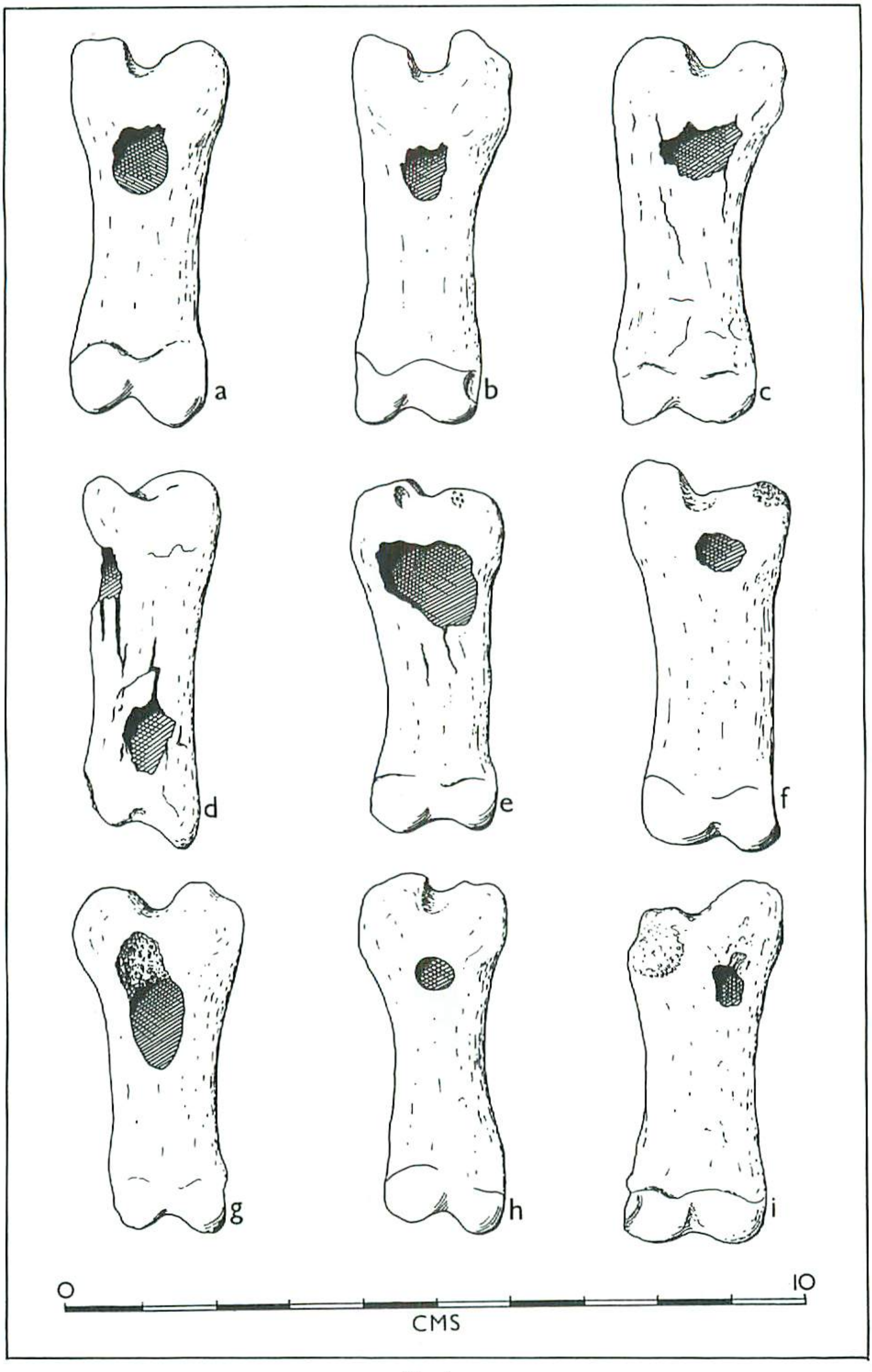

Fig. 1.

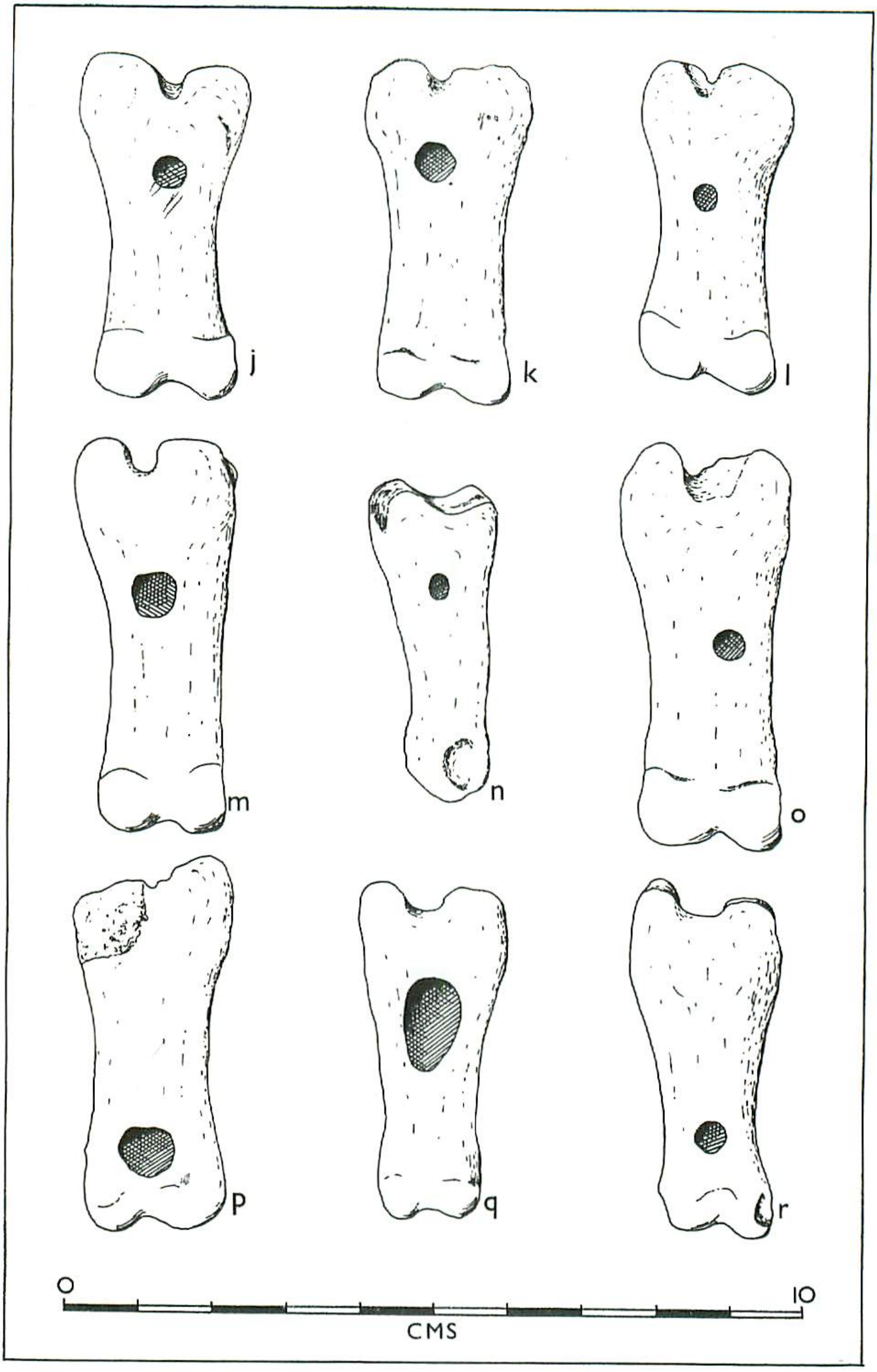

Fig. 2.

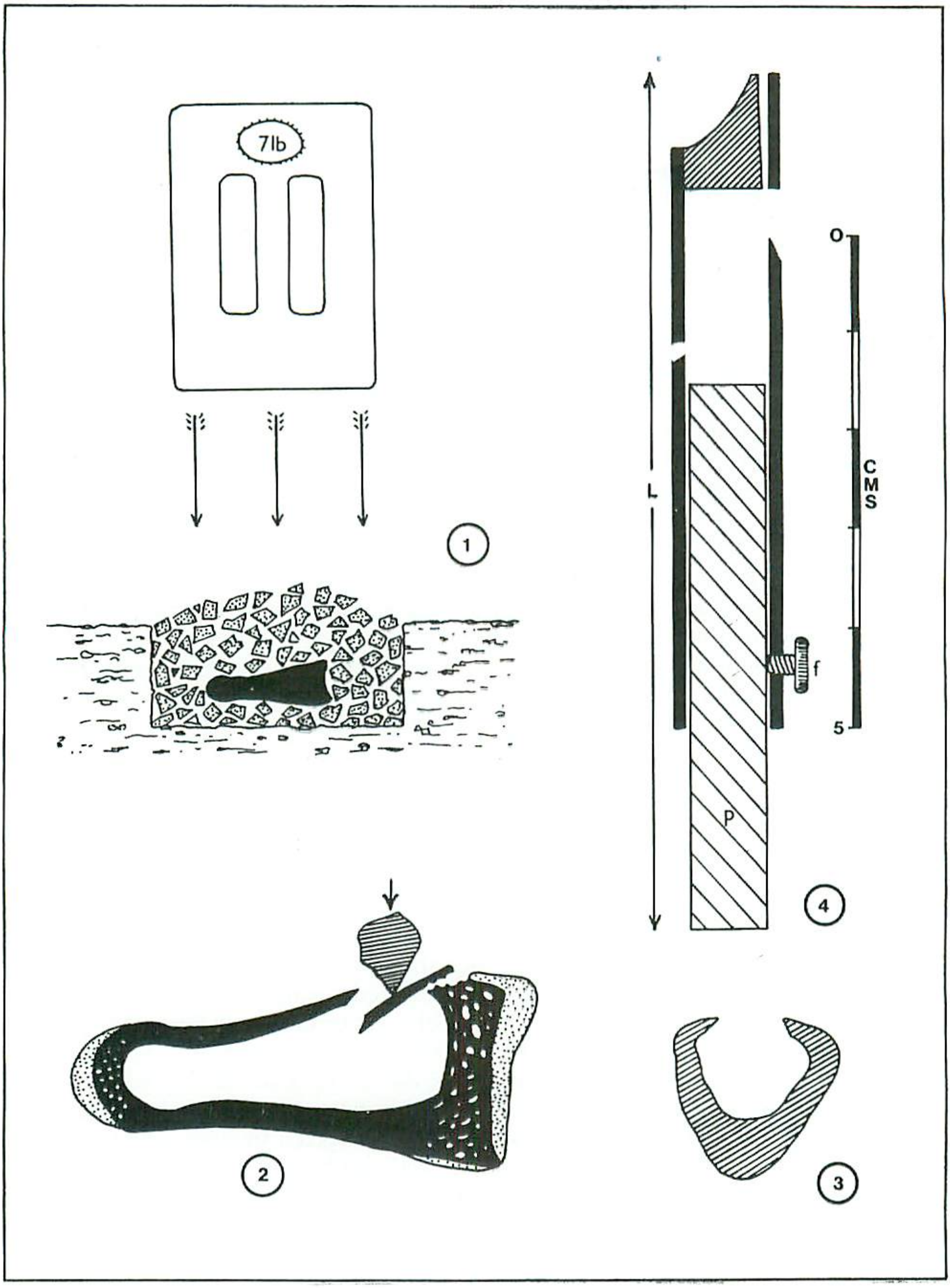

Fig. 3.

EXPERIMENTAL PHALANGEAL WHISTLES

In order to do some of the practical work described below, it was necessary to manufacture several phalangeal whistles. Fresh reindeer material was available for this purpose and a flint burin made by the author was used to make the holes in two stages. The production of holes in two stages when a non-mechanical method of boring is used on a hollow object, is a technique known to have been used by Palaeolithic man (Semenov, 1970). During the first stage a short-stroke gouging movement is used and by gradually deepening the short furrow this makes, the burin soon cuts through to the medullary cavity. The burin is then held in a 'key grip' and a rotary motion used to enlarge the hole. During this second stage the cutting is done not by the tip of the burin but by the edges of the burin facets and thus produces a tapered hole, the obliquity of which depends upon the angle of the burin point.

Two phalanges in the Pitt Rivers Museum, Oxford, one from La Madelaine (1938.34.271) and one from Laugerie Basse (1938.34.272) both have rather uneven, though obviously man-made holes, which both show this 'taper'. An extremely well preserved phalanx, also from Laugerie Basse (Pitt Rivers Mus. 1909.4.1) has no taper to the hole, the edges having been cut at right angles to the surface of the bone.

Phalanges with tapered and with untapered holes were made but there was no difference in performance although those with tapered holes were slightly more difficult to 'play'. The full process of making a hole, from the beginning to the production of a functional whistle, takes on average between three and four minutes.

DETERMINATION OF THE RANGE OF AUDIBILITY OF PHALANGEAL WHISTLES

Examination of a number of pierced reindeer phalanges from French Upper Palaeolithic sites showed that amongst those which could confidently be classed as artifacts, there existed a considerable variation in the sizes of the holes. It was desirable, therefore, to determine by suitable experiment how much the performance of a whistle might be related to this variation in hole size, since the distance at which a whistle can be heard must have implications concerning its possible original use. The 'whistles' were all tested over the same stretch of open country, which consisted of grassland with occasional shrubs and trees. It was not possible to test all the whistles on the same occasion but as far as possible, days with similar weather conditions were chosen. These were fine, dry days with little or no breeze (i.e. less than 2 on the Beaufort Scale).

The method of testing which required two people was as follows. One person acted as the 'transmitter' i.e. blew the whistle and also recorded the results, the other person acted as a receiver for the signals.

The 'transmitter' was stationary and the 'receiver' moved slowly away in a straight line towards a previously agreed land mark. The 'receiver' carried a flag which was waved immediately a signal was heard. Obviously as the distance increased, a slight time lag was noted and allowed for, since sound travels relatively slowly at about 340m./sec. The signals were made at irregular intervals and at the same time the receiver's responses were observed and noted down as necessary. The transmitter also had a flag and was thus able, by means of pre-arranged signals to tell the receiver when to stop, return, etc.

Early in the trials it became necessary to differentiate between what I have called the *'reliability limit'* which is the distance at which the receiver was able to distinguish ten out of ten signals, and the *'absolute limit'* which is the greatest distance at which that particular whistle was heard. Between these two is a range over which use of the phalangeal whistle as a signal would be unreliable. The results of these field trials are set out in table (1). The areas of the holes in the phalanges were measured by tracing their outlines on cellophane using a .1mm drawing pen and counting millimetre squares with the tracing placed on graph paper.

DETERMINATION OF THE FREQUENCIES OF PHALANGEAL WHISTLES

In order to determine the frequencies of the notes emitted by reindeer phalangeal whistles, a simple tubular metal whistle was made (fig. 3.4), the pitch of which was tuned by ear to the same note as the phalanx being tested by means of a plunger (p). The plunger was then 'locked' into position using the fingerscrew (f) and the overall length of the whistle (L) was measured with a Vernier caliper. By subtracting from this measurement the length of the whistle with the plunger pushed in fully, one is left with relevant internal length of the tube and from this frequency of the note may be calculated. When tested against notes of known frequency, this method was found to give frequency values which were accurate to within 0.5% and this was considered to be accurate enough for the purposes of this study. Using this method the Banwell 'whistle' was found to have a fundamental frequency of 3586±18Hz. A note of this frequency would have second and third harmonics of about 10,759Hz. and 17,900Hz. respectively.

The first phalanges of reindeer vary in size from animal to animal, male to female and from front to hind limb, but working from measurements taken both from Pleistocene and from modern specimens, it seems unlikely that the pitch of any two of these whistles could differ more than a few semitones, i.e. with a possible variation in fundamental frequency range of approximately 2,700Hz. — 4,000Hz. The frequency range which can be heard by a young present day West-European is 30Hz. — 20,000Hz. (Guyton, 1967). The frequency of the fundamental note and also any possible second and third harmonics of the average reindeer phalangeal whistle are thus within the range of normal human hearing.

The phalanges mentioned so far all have holes at the same place on the bone surface i.e. at the proximal end of their posterior aspect but phalanges are known which are perforated at other points. On display in the Musée Nationale de Prehistoire, Les Eyzies, is a small phalanx from a 'Perigordian' level which has a neatly made, circular hole in the *distal* end of its *anterior* surface (fig. 2.r). A phalanx from La Madelaine (British Museum) has large hole in the *distal* end of its posterior surface (fig. 2.p). Another from La Madelaine (fig. 2.o) has a small circular hole in a mid-shaft position as does one from Peterfels, Germany, (Coles and Higgs, 1969) illustrated in Fig. (2.l). Yet another variation is to be seen in a phalanx from a Solutrean level at the *abri* of Le Mazerat, Dordogne, (fig. 2.n) which has a small hole in the lateral aspect of its shaft.

All five of these phalanges are almost certainly arifacts. The example from La Madelaine (fig. 2.p) with an aperture area of 38.5 sq.mm. would, to judge from the results of the field trials, make an effective outdoor signal whistle. The other four would however, would be of rather limited use as signal whistles since their holes are comparatively small.

PHALANGES WITH TWO HOLES

Buchner (n.d) shows a photograph of a reindeer phalanx found at the Magdelenian site of Pekarna, Moravia, and Jelinek (1975) shows a photograph of the same object taken from a slightly different angle. This phalanx has two holes, one of which is in the usual place but the other is on the lateral surface towards the distal end. Both of these photographs and particularly Buchner's show this phalanx to be heavily weathered and eroded with several cracks and fissures and that both holes are irregular in outline and have rough and splintered edges (fig. 1.d). Jelinek describes the holes as 'crudely cut' but the edges of the holes could hardly have escaped the damage which has obviously taken place to the rest of the bone surface, so that even if the edges of the holes were originally cleanly cut, one would not have expected them to have remained so in this case. It seems more likely therefore, that the roughened edges of these particular holes are due to 'natural damage'.

Buchner (n.d) does not differentiate between phalanges with one man-made hole and those with two but labels both as signal whistles. As Megaw (1968) pointed out however, phalanges with two holes could only function as whistles if one of the two holes were covered over and does not consider them further. Nevertheless. it was decided, using the Pekarna phalanx as a model, to make a two-holed phalanx and to test its potential as a whistle.

A fresh reindeer phalanx (RHRP 4) and flint tools were used to make this whistle. First of all, a hole was made in the usual place and the edges of the hole were trimmed until it produced a good note. Then a second hole was cut on the lateral side (plate 1.f). When this second hole was covered by a finger-tip, the whistle could be blown in the normal way but when the second hole was not covered no clear note was possible. If however the second hole is covered and uncovered rapidly whilst a continuous note is blown, then an interrupted trill-like note is produced. Thus the addition of a second hole to the pierced reindeer phalanx, whilst not adding a new note, could have been utilized to add a distinctive sound to a repertoire limited to varying length notes of the same pitch.

RESULTS OF THE EXPERIMENTAL WORK

Experimental work has shown that some of the pierced reindeer phalanges in museum collections which have been labelled as whistles, are in fact almost certainly the result of 'natural damage' which occurred either during or after their incorporation into the archaeological deposit in which they were found. Such phalanges will have holes whose characteristics will be one of two basic types, depending upon whether the damage occurred whilst the bone was fresh or after it had largely lost its organic content.

A bone which was still fresh when the damage occurred will have a hole, the outline of which is smooth and curved except for a greater or lesser part of the circumference nearest to the superior epiphysis. At this transition point from spongey to compact bone the fractured edge of the hole is usually irregular. This is the type of hole which was noted on the phalanx from Banwell (fig. 1.a and plate 1.a). Another phalanx (fig. 1.b) which shows the same characteristics was found by Lartet and Christy at Laugerie Basse (British Museum) and this phalanx has the added interest that it contains material cemented to the inside of the lumen by stalagmitic concretion. (It will be recalled that Smith (1911) had suggested the possibility that this particular phalanx had been damaged by hyaena. In fact none of the phalanges examined during this work had damage attributable to carnivore activity but this is hardly surprising since the small size and the structure of these bones make it unlikely that they could withstand the serious attentions of a carnivore such as hyaena.)

Sometimes the irregular proximal border of this type of hole may extend as a scar onto the spongey bone of the epiphysis. The hole with it adjacent area of exposed spongey bone on the experimental phalanx (RHRP 1) (plate 1.e) is precisely similar to that observed on a perforated phalanx (fig. 1.g) from an 'Upper Perigordian' level at Petit Puyrousseau, Dordogne (Musée du Perigord, Perigueux, F534.).

The smooth border of this type of hole with the 'undercut' edge seems to be characteristic and is due to the manner in which the bone fractures and not to the shape of the stone which makes the hole. The experimental phalanx RHRP 2. (plate 1.d) emphasises the closeness with which this type of damage may mimic a man-made hole.

Holes made after the bones have lost most of their organic content tend to have asymmetrical irregular outlines with roughened edges, due to the fact that bones in this condition crumble rather than break cleanly, especially when they are damp.

Examples with this type of damage are a phalanx from Castel-Merle, Dordogne (Musée du Périgord, Périgueux. Inv. 4713.), shown in plate (1.h) and another from Sun Hole, Somerset (fig. 1.i) referred to earlier (p. 9). The holes may be large or small, the small ones often being lateral to the midline. Holes made during or since excavation will probably be easily distinguished by the difference in colour between the edges of the hole and the rest of the bone suface. With careful examination these phalanges should not be mistaken for artifacts.

There is of course, the possibility that some of these bones have, since their original perforation, received further damage by weathering, movement within the deposit or even by injudicious cleaning or careless handling. (The latter is made the more likely by the fact that it is a hundred years or more since many of these pierced phalanges were first found and they have obviously been subjected to much handling. Of the eight phalanges in British collections five were found by Lartet and Christy before 1863.)

This secondary damage may be slight as in the case of a phalanx from La Madelaine (British Museum) which by the shape and position of its hole (fig. 2.o), must be an artifact but has edges to its hole which when examined under a ×12 magnification are seen to be roughened due to a small amount of weathering. On this type of artifact however even a small amount of damage may make it difficult to recognise a man-made hole and if the secondary damage is extensive it could be impossible. A phalanx which has this type of damage is one of those from Pekarna (fig. 1.c) which Buchner calls a whistle but which has secondary damage which is such that one could doubt that it is in fact an artifact (cf figs. 1.c & 1.e).

DISCUSSION

In spite of the fact that some of the phalanges, which have until now been called whistles, have been shown to be more satisfactorily explained as the result of 'natural processes' and the case for others remains 'not proven' there are still some pierced reindeer phalanges which are obviously artifacts. Among those who consider that these phalanges with man-made holes to be whistles, two general explanations of their use have been put forward. On the one hand it has been suggested that they could have been used as signal whistles possibly to aid group hunting and on the other hand is their possible use in shamanistic ritual. Both of these suggestions could be supported in a general way by ethnographic parallels and some circumstantial evidence could be produced to give weight to either view.

Also in the hunting context is the possibility that pierced phalanges were used as decoy whistles. Simple tubular, home-made whistles are still used to lure game birds by poachers which at least shows this to be a possibility (Niall, 1962). It was noted at an early stage of the field trials that these whistles disturbed feeding rooks before they could otherwise have been aware of our presence in the vicinity. There is no doubt that the results of experimental work, designed to test the reactions of such elements of the late Pleistocene fauna as still exist to the sound of phalangeal whistles, would provide interesting reading.

Experimental work has shown that although some of these phalanges, (e.g. the example from La Madelaine, fig. 2.p, with its relatively large circular hole) could be made to produce a sound which would be heard with 100% reliability at distances up to 1.25km., others would produce only relatively feeble sounds due to the small area of their 'sound holes'. Thus if we visualise their use as signal whistles to help cooperation in, for example, the sort of caribou hunting practised by the Kutchin Indians (Coon, 1972), it must be admitted that some of these whistles would be ineffective over the distances at which they would be required to function. This does not of course, rule out their possible ritual or decoy use or even their use as toys or as casual playthings.

The discussion so far has been based upon the assumption that those phalanges shown to be artifacts were made to produce sounds. Rudolf Maier (teste Megaw, 1968) has put forward a theory that these objects were 'schematic bone idols'.

Another though rather unlikely possibility is that these objects, if provided with a suitable plug for the hole, could have been used as containers. It is difficult to imagine what could have been kept in them however, since their average capacity is less than 2.5ccs. Practical work to examine the marrow cavities for traces of foreign substances has not been possible to date. It is certain that, in deciding the answer to this question of function, the ability of a 'whistle' to produce a note is irrelevant, since it has been shown that purely 'accidental' damage to a reindeer phalanx may produce an excellent functional whistle. Even given a phalanx with a demonstrably man-made hole which is also capable of producing a good note, one still cannot be sure that the maker intended it to be used as a whistle. As any schoolboy knows there are numerous contemporary man-made objects, ranging from ball-pen tops to cartridge cases which without any modification will make excellent whistles.

It has been suggested (Megaw, 1960) that bones with 'naturally weathered holes' could have been the starting point for the development of the whistle. In the light of the experimental work described above, it is certainly possible for the first phalangeal whistle to have been a naturally pierced bone. Not only has it been proved, that a reindeer phalanx is particularly susceptible to the sort of damage required to produce a 'whistle' and a possible mechanism for this demonstrated, but the existence of such 'naturally' pierced phalanges in Pleistocene deposits has been shown. It has also been demonstrated that some of these phalanges (e.g. the Banwell bone) are excellent functional whistles and there is thus the very best circumstantial evidence to support the hypothesis that the first whistle was a 'naturally' pierced reindeer phalanx.

On the other hand, Palaeolithic man was often employed in the working of bone and it is possible that a craftsman engaged in piercing a phalanx for other reasons could have discovered, whilst blowing away chippings or shavings of bone, that it would produce a sound. Megaw (1960) has also suggested that the pierced reindeer phalanx could have been the precursor of the multitonal whistle but did not suggest how the evolution from one to the other might have occurred. Now that it has been shown that the second hole present on some phalangeal artifacts could have been functionally useful, a fact not previously commented upon, the mechanism of *cross-mutation* (Harrison, 1954) provides a possible explanation of this development. If a Palaeolithic craftsman who was familiar with the two-holed phalanx, had transferred the idea of a second hole from the phalangeal whistle to the single-holed open-ended whistle, this would have been produced not an interrupted note but a second note of a different pitch. Thus the simplest form of multitonal whistle would have been invented. That simple open-ended whistles were known to Palaeolithic man is shown by the example from Pekarna (Buchner, n.d.) a deposit which also contained reindeer phalanges with two holes.

Whatever the original use or uses of these objects and wherever their place in the evolutionary development of musical pipes, their most intriguing feature must be the fact that they are represented at every cultural level of the Upper Palaeolithic in Europe. If, as seems likely, they really represent evidence of a single cultural trait which persisted from the 'Perigordian' to the 'Magdalenian', then the pierced reindeer first phalanx would seem to have been a basic item in Upper Palaeolithic man's equipment.

ACKNOWLEDGEMENTS

The author would like to thank the authorities of The British Museum, The Pitt Rivers Museum, Oxford and the Musée du Périgord, Périgueux. In particular I would like to thank Mr. C. Bonsall (British Museum), Miss H. La Rue (Pitt Rivers Museum) and Monsieur M. Soubeyran, Le Conservateur, Musée du Périgord. My thanks are also due to Dr. E. K. Tratman who read the draught of this paper and made helpful suggestions.

The experimental work could not have been undertaken without the help of Dr. E. J. Lindgren, Hon. Sec. of the Reindeer Council of the

United Kingdom and Mr. Mikel Utsi of the Reindeer Company Ltd., Aviemore, who kindly arranged for the supply of reindeer bones. That the field trials were completed sucessfully is due to the patient assistance of my daughter for which I thank her. The photographs used in plate (1.g.h.i.) were taken by Monsieur R. Gautier, official photographer to the Musée du Perigord.

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Table 1.

	Reliability Limit	*Absolute Limit*	*Area of hole (sq.mm.)*	*Frequency (Hz.)*
Banwell phalanx	1,250m.	2000m.	55	3469
Exp. phalanx RHRP 5	600m.	880m.	35	2743
Picken's Hole phalanx M30.2/43	450m.	650m.	26	2361
Sun Hole phalanx M5.2/43	250m.	400m.	16	2253

Plate 1.

a. Banwell, Somerset.
b. Picken's Hole, Somerset. Radiograph of M30.2/37.
c. Picken's Hole, Somerset. Longitudinal section of M30.2/44.
d. Experimental phalanx RHRP 2.
e. Experimental phalanx RHRP 1.
f. Experimental phalanx RHRP 4.
g. Laugerie Basse, Dordogne. Musée du Périgord, A1662.
h. Castel Merle, Dordogne. Musée du Périgord, Inv. 4713.
i. Laugerie Basse, Dordogne. Musée du Périgord, F353.

Fig. 1.

a. Banwell Bone Cave, Somerset.
b. Laugérie Basse, Dordogne. (British Museum, not numbered).
c. Pekárna Cave. Moravia. (after Buchner).
d. Pekárna Cave, Moravia. (after Buchner).
e. Picken's Hole, Somerset. (U.B.S.S. Museum. M30.2/202).
f. Picken's Hole, Somerset. (U.B.S.S. Museum. M30.2/43).
g. Petit-Puyrousseau, Dordogne. (Musée du Périgord. F354).
h. Bruniquel, Dordogne. (after Sollas).
i. Sun Hole, Somerset. (U.B.S.S. Museum. M5.2/43).

Fig. 2.

j. Laugérie Basse, Dordogne. (Pitt Rivers Museum, Oxford. 1901.4.1)
k. La Madelaine, Dordogne. (British Museum, not numbered).
l. Peterfels, Germany. (after Coles and Higgs, 1969).
m. "Aurignacian", (Musée Nationale, Les Eyzies. C133).
n. Le Mazerat, Dordogne, (Musée du Périgord, Périgueux. no. 10632).
o. La Madelaine, Dordogne. (British Museum, not numbered).
p. La Madelaine, Dordogne. (British Museum, not numbered).
q. La Madelaine, Dordogne. (Musée Nationale, Les Eyzies. J338).
r. "Perigordian", (Musée Nationale, Les Eyzies.).

Fig. 3.

1. Diagram of experiment on phalanx RHRP 1 (p. 10).
2. Diagram to illustrate mechanism of damage to phalanx RHRP 1 (p. 10).
3. Cross-section of phalanx RHRP 1 to show apparent chamfer (p. 10).
4. Tuning whistle (p. 15).

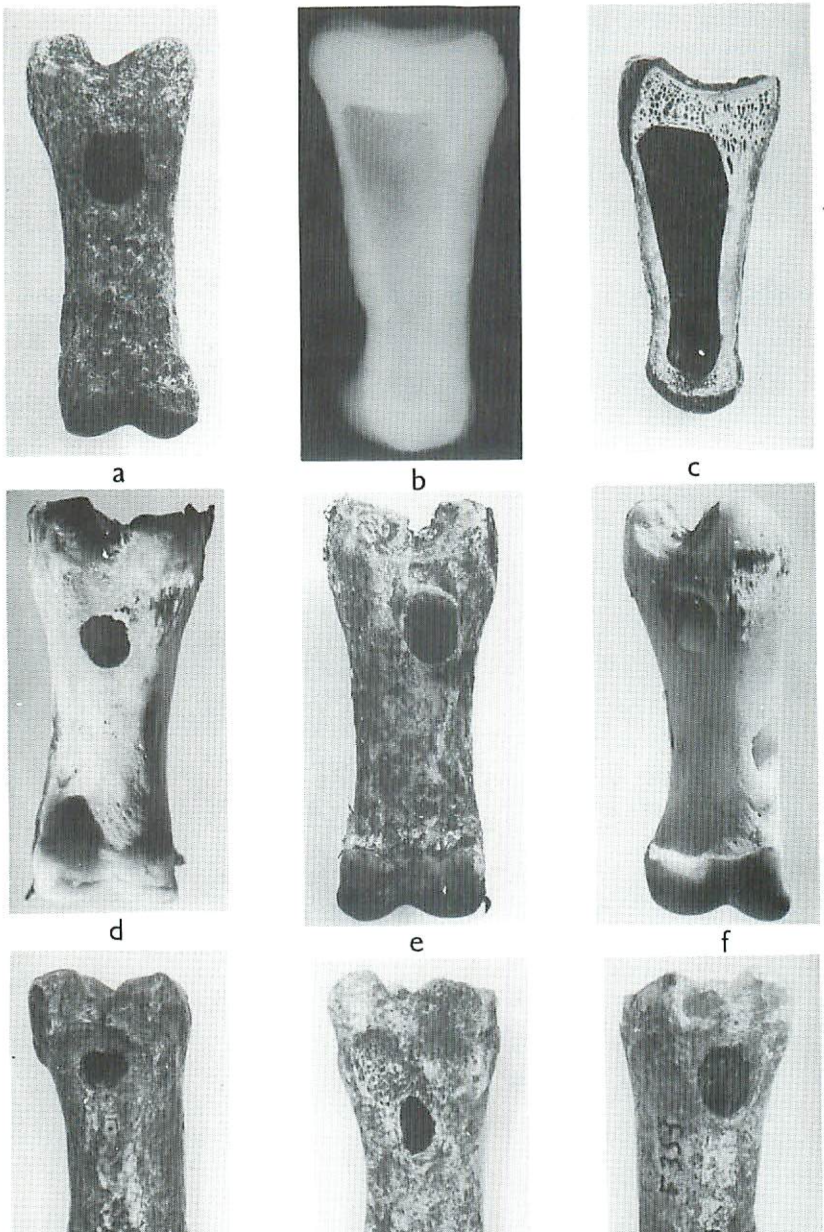

Plate 1 **Phalangeal whistles.**