'pock marks' might be taken as natural formations, but, as will be explained in Part II, they are in fact hand-made and possess special ritual significance.

To ensure adequate reproduction the stone was photographed first dry (Plate K*a*), then dry with the engraved lines chalked in (Plate L*a*), and finally wet (Plate L*b*). In his book Chief P. I. Marealle gives a diagram, to be reproduced in Part II, with certain points of significance lettered. Most of these can be discerned with photographs; for instance the two engraved kidney-shaped depressions appearing in all photos are the points marked *g* in the upper left-hand corner of the diagram, and the numerous 'pits' marked *f* can be clearly seen towards the bottom of Plate L*a*, *b*. The lines *xx* and *yy* are also conspicuous, whilst the points *a*, *b*, *c*, *d* and *e* can be clearly located by comparing the diagram with the photographs.

The second and third stones B and C are closely associated with A, the former being 17 yards distant on a bearing of 185° and the latter a further 9 yards away on the same bearing. Owing to the dense shade I failed to get a photograph of stone B suitable for publication, but it is the least interesting of the group. It protrudes from the ground, which is sloping, in the form of a step, about 2 feet 9 inches high and about 8 feet in length. It displays the characteristic lines of all the stones, though they are fewer in number, and also the pock marks also seen on stones A and C, but not on D.

Stone C is very similar to A, though somewhat smaller, being about 7 feet 6 inches long by 4 feet 6 inches broad with the long axis running north-east—south-west. As in the case of A it is closely covered with incised lines, but lacks the two kidney-like depressions of A. On the other hand the holes are much deeper, extending 5 or 6 inches into the rock. There is no evidence to show whether they are natural or man-made, but in the case of A one can assume the latter by virtue of the description to be given in Part II.

The last engraved rock, here referred to as stone D, is situated in the same Chiefdom of Marangu, about a mile to the north-west of the Chief's headquarters, at Kilaremo in the parish of Kyala. It can be approached by driving from the Kibo Hotel along the upper Moshi Road for exactly one mile, when the Marangu West Co-operative Society building is reached. Here one turns right (*i.e.* north) for a quarter of a mile up a side road and on reaching a fork either leaves the car and walks 70 yards past the stone and thatch house, the roof of which can be seen in the upper left-hand corner of Plate K*b*, or drives up the left fork (a steep climb) to the yard of the Kilarema R.C. School, and thence walks about 50 yards to the stone.

The engravings on the stone are 7 feet long and 5 feet 3 inches broad, with an unengraved margin at each side (Plate L*d*). In contrast to the other stone, the engraved surface is at an angle of about 30 degrees. The top of the stone is 4 feet above ground level when approached from the back, but owing to the slope of the ground its top is 5 feet 5 inches high when looked at from the front. It faces south. In the centre of the top there is a depression, seemingly natural, said to be used as a receptacle for libations, while at the base there is a small stone conveniently placed as a seat or stance for the officiating elder. Plates K*b* and L*d* illustrate the stone and its setting much more clearly than any description. The photographs also show that the whole engraving presents a much more symmetrical appearance than those on stones A, B and C, whilst the depressions and pock marks of the latter are entirely lacking. No description of the rites here practised is yet available.

As explained above, all these stones can be approached to within about 100 yards by car; that is, in dry weather. In the rains the village roads leading to them become impassable, but with either the Government Rest Camp or one of the two local hotels as a base, all these stones can be reached in under half an hour's walk.

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CASTING MOULDS MADE IN METAL*

by

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245 The six-piece bronze mould for casting arrowheads, now in the Department of Egyptian and Assyrian Antiquities of the British Museum, is perhaps not so well known to students of prehistoric metallurgy as its importance warrants, and has received only somewhat slight publication many years ago.[1] Through the kindness of the Keeper of the Department, and with the valued collaboration of Mr. Maryon of the British Museum Research Laboratory, I am now enabled to

*With two text figures

describe the mould in greater detail. I am also indebted to Mr. Maryon for the scale drawing reproduced as fig. 1. In fig. 2 are shown arrowheads cast in plaster from the mould in the Laboratory. Concerning the age of the mould, the keeper informs me that there is no external evidence for its date since it was bought from a private owner, but its origin is given as Mosul, and it may be regarded as Assyrian, probably of the eighth to seventh centuries B.C.

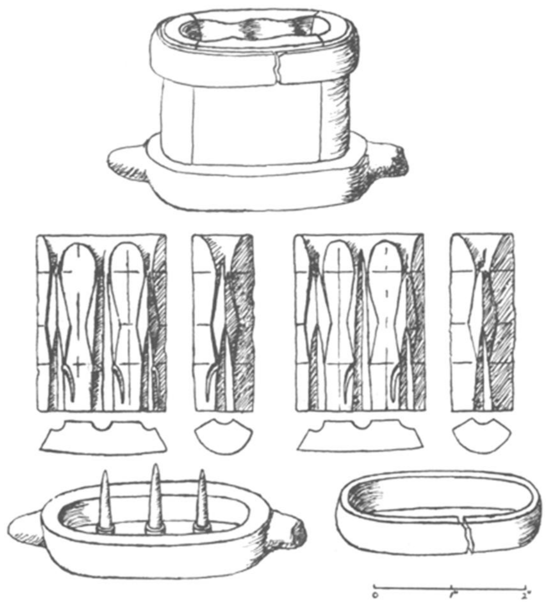

FIG. 1. BRONZE CASTING MOULD FROM MOSUL

The mould is shown assembled (above) and in six parts (below); drawn by Mr. Herbert Maryon. Scale: $\frac{2}{5}$

In construction, the mould consists of six pieces for casting three arrowheads at a time. As may be seen from the drawing, the base block is an elliptical casting, hollowed, and fitted with three tapering points of bronze which formed the cores for the hollow sockets of the arrows. The main body of the mould is formed by four moveable bronze blocks or dies in which the external contours of the arrows have been cut. These dies are very accurately fitted into the base block, and are also very carefully mated to each other. The four moveable sections are also held closely together at the top by means of a bronze ring which slips over the four dies when they are assembled in position in the base block. Mr. Maryon's drawing shows the various parts separately, and also as a complete assembly. Two lugs will be noticed, one at each end of the base block. Their purpose is unknown; it would seem unnecessary to provide means for holding down a small and relatively heavy mould of this nature while the metal was being poured, especially as the mould has a flat base and is therefore quite stable. As an example of tool-making the mould attains a very high standard and is quite the equal of similar work of today. Indeed, when we consider that the geometrical layout of the tool is far from simple, and that of course there were no machine tools which could be set automatically to generate the desired angles in the work as we should do today, the craftsman's skill of over two thousand years ago is amazing. The four main blocks or dies were finished to size and fitted with extreme accuracy. The accuracy of the work is such that we suspect the mating surfaces must have been scraped, and possibly also ground, so that the fit of the various sections appears to be true within a limit of about four thousandths of an inch. After the assembly of the dies, vertical and horizontal setting-out lines (seen in fig. 1) were scribed on adjacent faces; from the lines the contours of the three arrowheads were set out. The arrowhead cavities were next chiselled out using the lines as a guide. The recesses would then be scraped smooth and ground to produce a good finish. The taper socket cores were made separately and fitted into holes drilled in the base block. The fit of these core pins was assured by punching round the shoulder of the pins with a chasing tool.

It will be noted that the mould is not vented, but as the length of the arrowheads is small, and the passageways through the mould are direct, no difficulty need be expected in the production of sound castings of tin bronze. Spectrographic analysis of the mould in the British Museum Research Laboratory showed the metal to be a tin bronze containing small amounts of lead, iron, cobalt,

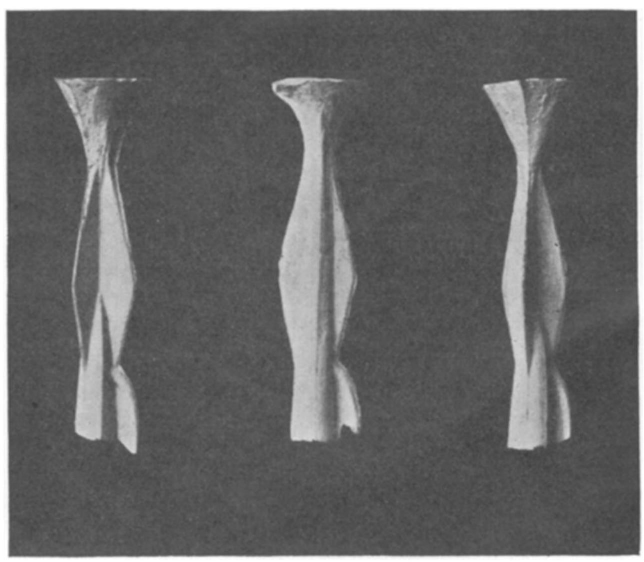

FIG. 2. CASTS FROM THE MOULD

These casts are of plaster and were made in the British Museum Research Laboratory. The flaring upper ends represent the casting jets and would be carved away in finishing the arrowheads.

and nickel, and a trace of silver. The tin content is about ten per cent. From this analysis it will be observed that no apparent attempt was made to give the metal used for the mould a higher melting point than that of the average tin bronze to be cast. It has recently been shown by practical experiment [2] that satisfactory castings of bronze may be made in a bronze mould without any damage occurring to the mould itself. Absence of burning or other damage to the mould may be ascribed to the rapid cooling ensured by the fact that the mass of metal comprising the mould is considerably greater than that of the casting. In the palstave mould used for the above mentioned experiments the mould weighed four pounds six ounces, while the casting made in the mould weighed one pound seven ounces. In the case of our Assyrian arrow mould the relative weight of the mould to that of the castings is even greater. A metal mould would therefore serve for a long period, and for the production of a large number of castings. Such is its role today when repetition castings of high quality are required. No doubt arrows would have been wanted in large quantity and therefore the difficult work of making a metal arrow mould would have been well repaid. It is interesting and remarkable to find a modern foundry technique anticipated in the eighth and seventh centuries B.C. The British Museum mould shows no visible evidence of use. However, this cannot be taken as proof that the mould has not been used, for it is quite possible that a mould dressing was applied before castings were made, and if the number of castings made were not large, cleaning would soon remove any visible sign of use.

It is interesting to find another metal mould for casting arrowheads in the British Museum collections. This is a bronze mould from Carchemish,[3] Museum No. 116254 *a* and *b*. The mould was in three segments, each with a long handle behind; these segments, when fitted together, would have been fixed by insertion in a circular base ring, which would have carried a spike to form a core for the hollow socket of the arrow to be cast. One segment and the base ring are missing. As in the Mosul mould, the molten metal was poured in through a hole at the top. The mould is dated to before 604 B.C., so that the Carchemish and Mosul moulds are well within the period during which iron tools would have been available. Indeed, it is not impossible that chisels, carburised to a semi-steel which would take a fair temper, were already known.

The Carchemish mould is clearly of the same family as the Mosul one. The type of arrow, socketed and with a side barb, is also similar; the mould, however, is of more simple design and casts but a single arrow at a time. The handles were provided for convenience in working and they would greatly facilitate handling the segments when hot. Also, they would serve to lever open the segments after a casting had been made. Experiments with a bronze palstave mould showed that some force was needed to separate the mould so as to release the solidified cast. The Carchemish mould is now somewhat corroded, but evidence remains to show that the fitting and general finish must have been of the same high order as that of the Mosul one.

Metal moulds, while not of common occurrence, are not rare. Evans in his classic work *Ancient Bronze Implements* (1881), pp. 439ff., has recorded some 40 examples, the most popular types being for casting palstaves and socketed celts. Of the moulds listed by Evans, 15 were for casting palstaves (three from Ireland, four from Britain, four from France, and a total of four from Germany and Switzerland) and 16 for socketed celts (12 from Britain, two from Germany, one from Sweden, and one from France). Metal moulds for other artifacts are much less frequent, Evans only mentioning one mould for a sword hilt, two for casting gouges, and two for spearheads. No doubt archæologists can cite more recent examples: for instance, Przeworski[4] illustrates a two-piece metal mould for casting a shaft-hole axe from Tagiloni, Georgia, U.S.S.R.; from Trans-Caucasia at least three examples have been recorded, which would point to the shaft-hole axe having been cast in metal moulds in this region at least by around 1000 B.C.

As the metal moulds which have been discovered can be but a small proportion of the total number made, it is clear that these interesting devices must have been by no means unimportant in the foundry industry of the Late Bronze Age.

Notes

1 *Proc. Soc. Bibl. Archæol.*, 1884, pp. 109–10 and plate. It is also mentioned, quoting the 1884 description, in Garland and Bannister, *Ancient Egyptian Metallurgy*, 1927, pp. 55–7.

2 Pitt Rivers Museum, Occ. Pap. on Technology, No. 4 (1951), pp. 112–15.

3 Woolley, *Carchemish*, Vol. II (1921), p. 130 and Plate 23*b* (excavations at Jerablus, House D).

4 Przeworski, *Metallindustrie Anatoliens* (1939), Plate XXII, 4, and p. 115.

OBITUARIES

George Davis Hornblower: 1864–1951. *With a portrait*

246 George Davis Hornblower, O.B.E., who was born on 19 September, 1864, came only late—in 1923—to the Fellowship of the Royal Anthropological Institute, yet there remained before him a period of service to the Institute which was as remarkable for duration as for unswerving devotion to its interests.

His career was, at least in its later stages, in the service of the Egyptian Government, where shortly before his retirement he was Director-General of Public Security in the Ministry of the Interior. He was awarded the O.B.E., as well as an Egyptian decoration.

After retirement (apparently about the time of his joining the Institute), he came to live at Golders Green, London, where I am informed that he had a considerable collection of art and antiquities. (I am much indebted to his friend Mr. Eric Davies, of the law firm of Bristows, Cooke and Carpmael, for information about his life apart from his association with the Institute.)

Five years after becoming a Fellow, he accepted the onerous charge of the Honorary Treasurership and held it from 1928 until 1935, except for one year (1930–1) in which he stepped into the breach as Honorary Secretary. He was thus an Officer at one of the most important periods of the Institute's history, as anyone will understand who reads Sir John Myres's three Presidential Addresses. He was then elected a Vice-President, and at the end of his three-year term, in 1938, a member of the Council. But almost on the eve of the Second World War Mr. Coote Lake, the Honorary Treasurer, died, and Hornblower was once more called upon at the age of 75 to manage the finances, this time at a crisis more cruel, for a treasurer, than any in the Institute's past; it had