

## II.

NOTICE OF A STONE MOULD FOR CASTING FLAT BRONZE AXES AND BARS FOUND IN THE PARISH OF INSCH, ABERDEENSHIRE; WITH NOTES ON THE OCCURRENCE OF FLAT AXE MOULDS IN EUROPE. BY J. GRAHAM CALLANDER, F.S.A. Scot.

## SUMMARY.

Description of the Foudland mould. Remains of a black coating in the matrices. Shape of the casts as they came from the mould. All recorded flat axe moulds are of stone, none of clay. Table of flat axe moulds found in Europe. Slabs bearing axe-like hollows found associated with interments—The Kilmartin slab—The Shapwick slab. Objects found associated with flat axe moulds. All the British flat axe moulds apparently open moulds, but some Spanish and French examples used with covers. Sandstone the favourite material for these moulds. The number of moulds from Scotland and Ireland compared with the number of flat axes from these countries. Statistics of finds contradictory. All the recorded Scottish flat axe moulds have been found in the north-east part of the country. Suggestions regarding the smaller matrices on the Foudland mould—Probably for the smaller sizes of flat axes—Examples of this shape and size in *copper* common in Ireland—Also found in Swiss lake-dwellings. The matrices on the Foudland mould compared with the “Maidens” hoard of flat axes. Moulds for bars found in Scotland. The Marnoch mould now in Banff Museum. Probable purposes of the bars—Ingots, chisels, rings, or armlets—Most probably for armlets—Similar moulds from Spain and France supposed to have been for armlets. Chronology.

The stone mould for casting flat bronze axes and bar-like objects which is the subject of this paper, was found two years ago on a small farm on the south face of the Hill of Foudland, in the parish of Inch, Aberdeenshire. It had been turned up by the plough, and no other objects were observed associated with it. It is here shown (figs. 1, 2) to a scale of  $\frac{1}{4}$ , and for comparison a similar mould from Culbin Sands is shown along with it (figs. 3, 4) to a scale of  $\frac{1}{3}$ .

The stone is a rather thin, flat block of reddish brown quartzose sandstone. It somewhat resembles a voussoir, or a keystone of an arch, being slightly broader at one end than at the other. It measures  $8\frac{5}{8}$  inches at its greatest length, 7 inches at its greatest breadth, 6 inches at its narrowest breadth, and 2 to  $2\frac{1}{2}$  inches in thickness. The mould

is in a wonderfully good state of preservation, and the matrices show the precise shape and size of the objects which could have been cast in all of them except one, which is so much damaged as not to admit of the exact measurements being determined. Other two of the matrices are slightly broken at one side, but they are sufficiently preserved to exhibit their perfect shapes and sizes. The stone has incised upon its matrices for no fewer than nine different objects: four are for flat bronze axes, three are for flat axe-like tools of a smaller size, and two are for bars or ingots. The obverse of the stone bears three matrices, the reverse four, and on each of two sides there is one matrix, each of the four faces being thus fully utilised. Two of the matrices on the obverse (fig. 1), for flat bronze axes, are placed alongside each other, but reversed, the butt of the one being in juxtaposition to the face of the other. The third matrix on this side is for one of the flat axe-like implements, and it is placed across the narrow end of the stone, at right angles to the two axes. It is so much damaged that the only dimension obtainable is its greatest breadth. The matrices on the reverse (fig. 2) are for the smallest of the axes, the smallest of the axe-like tools, and for two bars or ingots, all of which are placed alongside each other on the stone. The axe and the axe-like object are laid down reversed, like the two axes on the obverse. The axes are of the ordinary flat bronze type, with the top and bottom edges expanding trumpet-like towards the cutting face; the axe-like objects have the top and bottom edges straight from the butt to the cutting face; and the bars are straight and of quadrilateral section the top being rather broader than the bottom.

The sides and bottoms of all the matrices on the obverse and the reverse have been covered with a coating of a black substance which reflects light at certain angles. This coating is specially noticeable in the matrices for the two largest axes, and traces of it are quite distinct in the four matrices on the reverse. It has not been detected on the two matrices on the sides of the stone, or on any part of the surface of the stone outside the matrices. Sir John Evans, in referring to

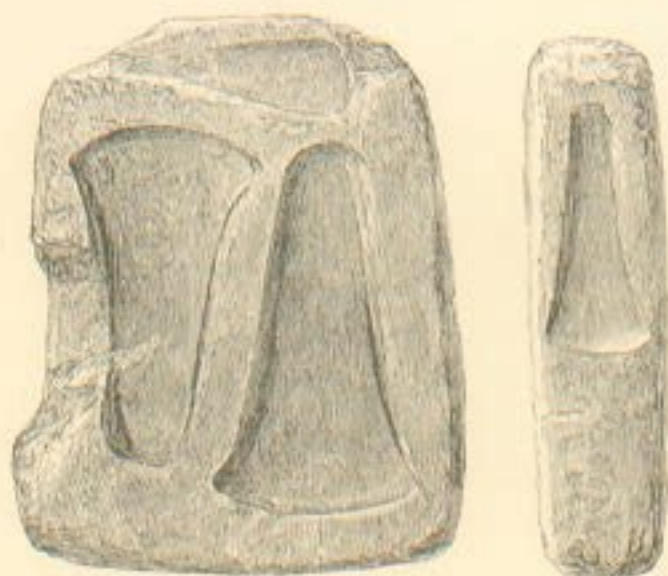


Fig. 1. Obverse and right side of Stone Mould found at Hill of Foudland, Insch, Aberdeenshire. ( $\frac{1}{2}$ .)

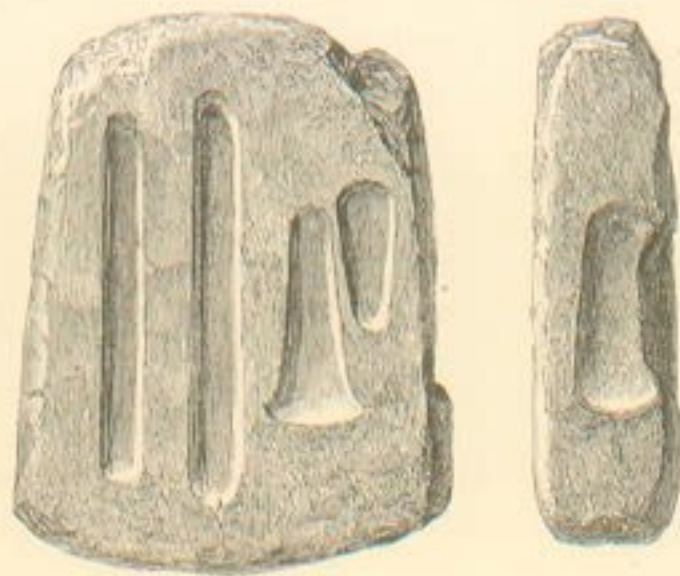


Fig. 2. Reverse and left side of Stone Mould found at Hill of Foudland, Insch, Aberdeenshire. ( $\frac{1}{2}$ .)

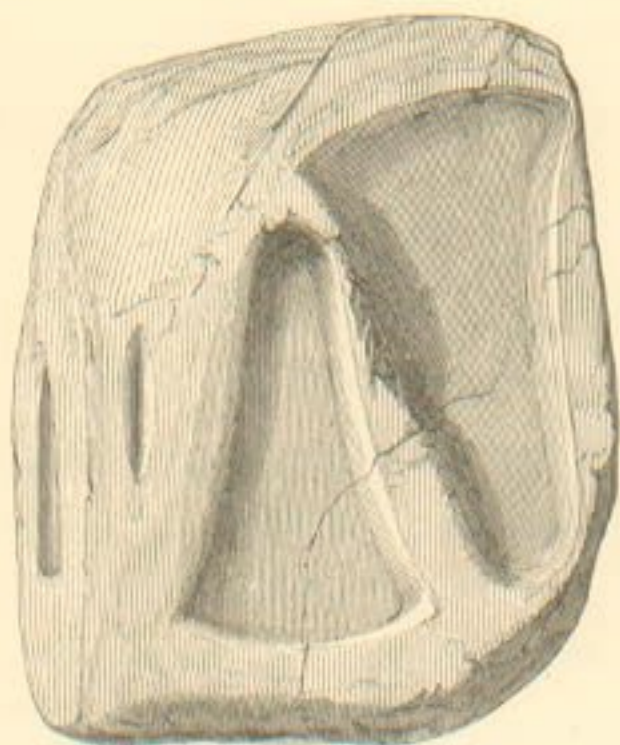


FIG. 3. Obverse of Stone Mould found on Culbin Sands. ( $\frac{1}{2}$ .)

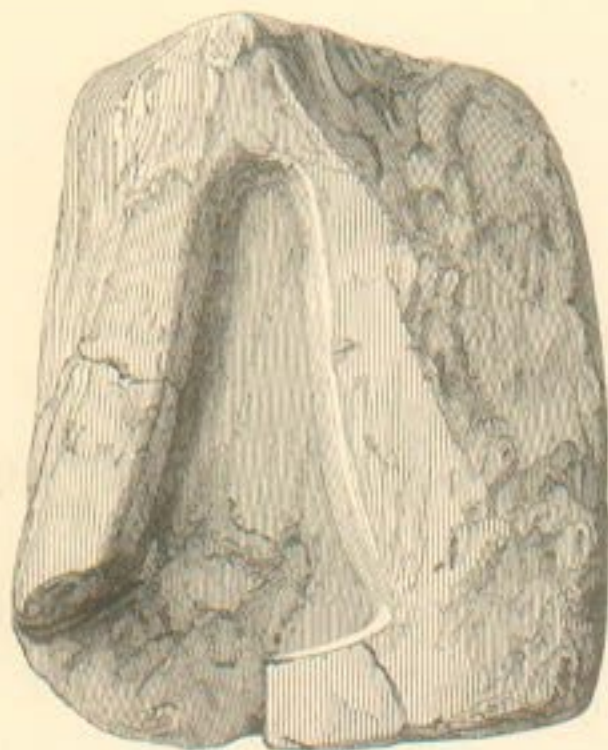


FIG. 4. Reverse of Stone Mould found on Culbin Sands. ( $\frac{1}{2}$ .)

moulds made of bronze, mentions that "in order to prevent the molten bronze from adhering to the bronze mould, the latter must have been smeared with something by way of protection, so as to form a thin film between the metal of the mould and that of the castings."<sup>1</sup> In the case of a stone mould there would be no danger of the metal adhering to the stone, and so making it difficult to extract the cast. The contraction of the metal as it cooled would counteract this. At the present day iron-moulders paint the insides of their moulds with charcoal or plumbago blacking, so that the casts may have a finer skin or surface. The ancient bronze-founder may have discovered that by giving his mould a coating of some substance, as his modern successor does, he was able to produce a finer casting, and it may be that this black substance is still the remains of it. Some moulds found at El Argar, Spain, including the two for flat axes referred to later, show that the sandstone of which they are made has been reddened by the action of the molten metal (*là où le métal a coulé ils sont colorés en rouge*).<sup>2</sup>

The matrices for six of the cutting tools are cut almost perpendicularly into the stone at the cutting faces, and so would produce an object which would require to be hammered out, or ground, to give it a sharp edge. The seventh matrix, No. 4 in the photograph (fig. 5), for the smallest of the four axes, is cut slantingly into the stone at the cutting face, and would produce a cast with a fairly sharp edge, requiring little hammering or grinding beyond what was necessary to bring the cutting edge to the centre of the face of the tool. As the casts left the mould they were flat on the top and curved on the under side, so a certain amount of working was necessary to make the sides symmetrical and balanced. This point is referred to by Sir Arthur Mitchell in describing the Strathconan mould. He also states that no genuine ancient bronze implements show signs of having been ground or rubbed down after they had left the mould; that all subsequent fashioning had been

<sup>1</sup> *Ancient Bronze Implements*, p. 444.

<sup>2</sup> H. and L. Siret, *Les premiers Ages du Métal dans le Sud-Est de l'Espagne*, texte, p. 127.

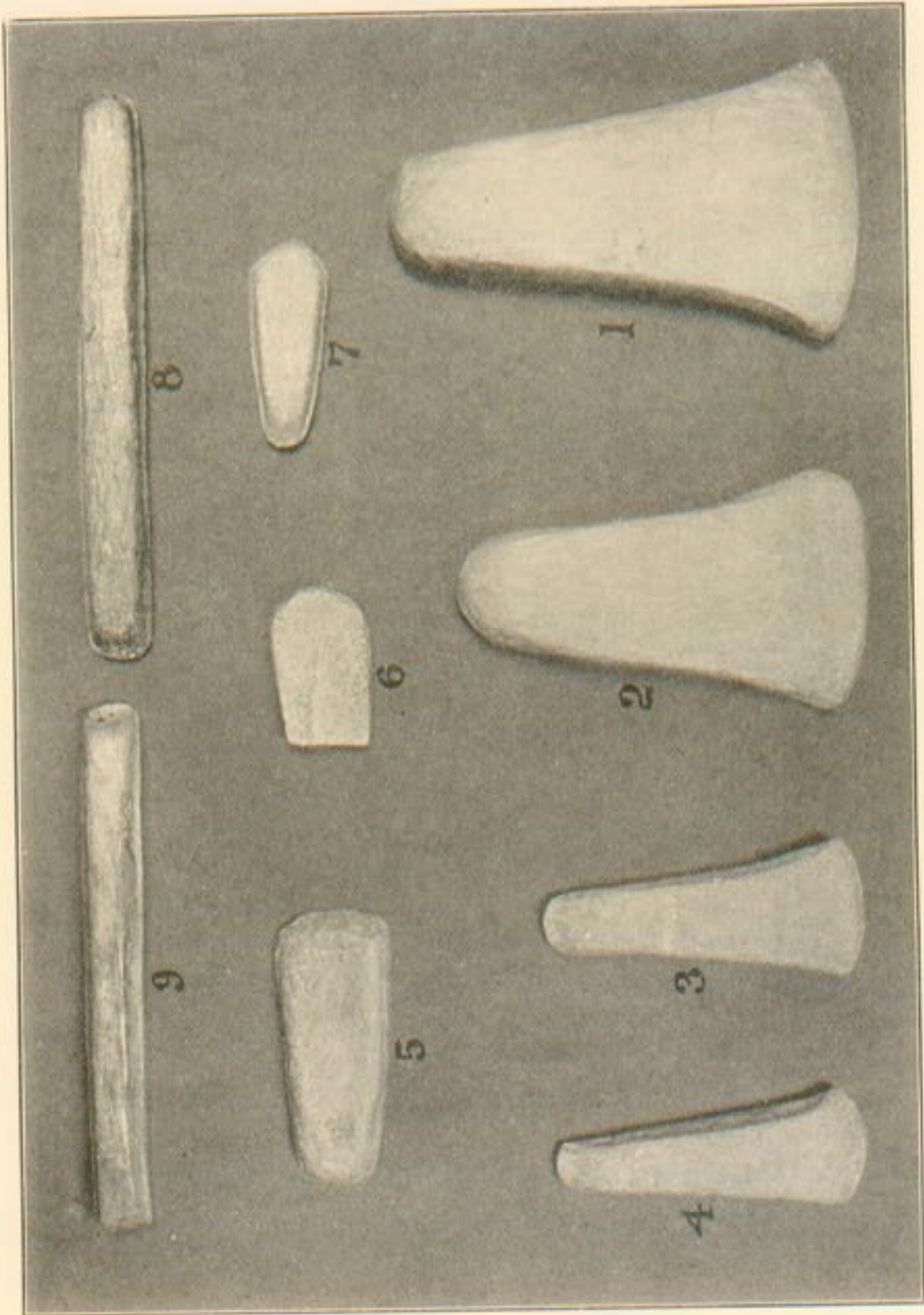


Fig. 5. Photograph of Plaster Casts taken from each of the Matrices of the Fouldland Mould.



## STONE MOULDS BEARING MATRICES FOR CASTING FLAT AXES OF BRONZE OR OF COPPER.

Where Found.	Description and Number of Matrices.	Where now Located.	Source of Information.
SCOTLAND. I. Strathconan, Ross-shire	One flat axe . . . . . 1	In the possession of the Right Hon. A. J. Balfour of Whittingehame Nat. Mus. of Antiq. of Scotland	<i>Proc. Soc. Ant. Scot.</i> , vol. xxxii. p. 39.
II. Culbin Sands, Morayshire	Two flat axes and small groove on obverse, one flat axe on reverse, and one small flat axe-like object on one side . . . . . 5	" "	<i>Proc. Soc. Ant. Scot.</i> , vol. xxv. p. 495.
III. " "	A fragment. One flat axe on each face . . . . . 2	" "	" "
IV. Kintore, Aber- deenshire	Two flat axes on obverse . . . . . 2	" "	<i>Proc. S. A. S.</i> , vol. ii. p. 33; vol. vi. p. 209; Evans, <i>Anc. Bronze Imp.</i> , p. 430.
V. Fondland, Insch, Aberdeenshire	Seven flat axes and two bars . . . . . 9	...	Described in Notice.
VI. New Deer, Aber- deenshire	One flat axe on obverse, one flat axe and one bar on reverse, and one bar on the side . . . . . 4	In the Collection of Mr Alex. Gray, New Deer	Described in present Volume.
VII. Marnoch, Banff- shire	One flat axe on obverse, one ring and one bar on reverse . . . . . 3	Banff Museum	<i>Proc. Soc. Ant. Scot.</i> , vol. xvii. p. 369.
ENGLAND. I. Wallington, Nor- thumberland	Two flat axes on obverse, one flat axe and one flat ring on reverse . . . . . 4	British Museum	Evans, <i>Anc. Bronze Imp.</i> , p. 430; <i>Arch.Æliana</i> , vol. iv. p. 107.
II. Hurbuck, near Lancaster, Durham.	One flat axe on obverse, two flat axes on reverse . . . . . 3	Canon Greenwell's Collection	Canon Greenwell, and Mr E. W. E. Ballyen.
III. Same district as No. II.	One flat axe on obverse, two flat axes on reverse . . . . . 3	In the possession of Mr E. W. E. Bal- lenty, Cousett.	" "
IRELAND. I. Ireland	Two flat axes on obverse, one flat axe and one knife on reverse . . . . . 4	Nat. Mus. of Antiq. of Scotland	<i>Museum Catalogue</i> , p. 124; <i>Proc.</i> <i>Soc. Ant. Scot.</i> , vol. ii. p. 34.
II. Lough-Sear-Craun- nog, Leitrim	One flat axe and one looped palstave on obverse, one flat axe on reverse . . . . . 3	Royal Irish Acad- emy's Collection	Wilde, <i>Cata. of Royal Irish Acad.</i> <i>Coll.</i> , p. 91, fig. 72; Evans, p. 430.
III. Carrickfergus, Antrim	Three flat axes . . . . . 3	Bateman Collection	Evans, <i>Anc. Bronze Imp.</i> , p. 430; <i>Bateman Coll. Cata.</i> , p. 78.
IV. Ireland	Four flat axes . . . . . 4	Belfast Museum	Evans, <i>Anc. Bronze Imp.</i> , p. 430; <i>Arch. Journal</i> , vol. iv. p. 335.
V. Ballymena	One flat axe . . . . . 1	Sir John Evans' Coll.	Evans, <i>Anc. Bronze Imp.</i> , p. 428.

<p>BELGIUM. I. Filée, Province de Namur</p>	<p>Flat axe mould</p>	<p>Museum at Namur</p>	<p>M. George Macoir, Brussels, and <i>Annales de la Soc. Arch. de Namur</i>, T. viii. p. 451.</p>
<p>FRANCE. I. Plouharnel, canton de Quiberon, arrondissement de Lorient (Morbihan)</p>	<p>Flat axe (<i>hache plate</i>) mould of red granite</p>	<p>Lebail Collection at Plouharnel</p>	<p>Claudre, <i>Age du Bronze</i>, Ire partie, p. 33, No. 62 in table, quotes M. Parenteau, <i>Bulletin de la Soc. Arch. de Nantes</i>, 1868, T. viii. pl. 1, fig. 1.</p>
<p>II. Moltig-les-Bains, Pyrénées-Orientales</p>	<p>One face has a matrix for a flat axe (<i>hache plate à bords droits</i>), the other face has a matrix for a similar axe and a long and deep cavity tapering towards the ends</p>	<p>In the possession of M. de Massia, Moltig-les-Bains</p>	<p>M. Salomon Reinach and <i>Matériaux pour l'Histoire primitive et naturelle de l'Homme</i>, 1888, vol. xxiii. p. 158.</p>
<p>SPAIN. I. El Argar, Almería.</p>	<p>Flat axe mould of micaceous sandstone with one matrix</p>	<p>British Museum</p>	<p>Siret, <i>Les Premiers Ages du Métaux dans le Sud-Est de l'Espagne</i>, Texte, p. 127; Album, pl. xxvii.</p>
<p>II. and III. "</p>	<p>Two flat axe moulds of micaceous sandstone with one matrix</p>	<p>Royal Museum at Brussels</p>	<p>Don Francisco Alvarez Ossorio, Madrid.</p>
<p>IV. and V. Cerro de los Santos, Montealegre, Tecla, Murcia</p>	<p>Two flat axe moulds</p>	<p>National Archaeological Museum at Madrid</p>	<p>" "</p>
<p>SWITZERLAND. I. Greng, Insel, Lake of Morat</p>	<p>Mould for flat celt, with the casting still in its case.</p>	<p>Museum at Bern</p>	<p>Munro, <i>Lake Decidings of Europe</i>, p. 70.</p>
<p>II. Ueberlingensee, Lake of Constance</p>	<p>Resembles preceding example</p>	<p>Museum at Stuttgart</p>	<p><i>Ibid.</i>, p. 70.</p>
<p>ITALY. I. and II. Bodio in the Lago di Varese</p>	<p>Two moulds, apparently for flat or slightly flanged celts</p>	<p>...</p>	<p>Evans, <i>Anc. Bronze Imp.</i>, p. 430, quotes Pegazzoni, <i>L'anno presé. nella Prov. di Como</i>, 1878, pl. vi. 18-20.</p>
<p>BAVARIA. I. Roseninsel, Starnbergersee (Würmsee), near Munich.</p>	<p>Broken flat axe mould</p>	<p>Ethnographic Museum at Munich</p>	<p>Professor D. J. Ranke, Munich.</p>

done with the hammer.<sup>1</sup> Mr George Coffey, however, says that some Irish *copper* axes have been ground.<sup>2</sup>

Stone moulds for flat bronze axes are by no means common in the British Isles, and are less so on the Continent. I have been able to tabulate 28 European examples:—7 from Scotland, 3 from England, 5 from Ireland, 1 from Belgium, 2 from France, 5 from Spain, 2 from Switzerland, 2 from Italy, and 1 from Bavaria. They are, indeed, less numerous than might have been expected from the large number of flat bronze axes that have been found. That clay moulds were more often used might be suggested as a possible reason for this, but no clay moulds for flat bronze axes have been recorded; besides, it is not to be expected that an itinerant bronze-founder, as probably was the proprietor of this mould, would carry about a heavy stone mould if he could secure the less heavy one of clay.

One of the end slabs of a cist found at Kilmartin, Argyllshire, bears a series of flat axe-shaped depressions, which seem too shallow to have been used as matrices for casting flat bronze axes. The number of depressions is variously given as seven,<sup>3</sup> eight,<sup>4</sup> and nine,<sup>5</sup> but the cast of the slab in the National Museum seems to have eight depressions on it. Another slab from the opposite end of the cist "is marked with a long groove picked out with a sharp-pointed instrument, and having ten shorter grooves at right angles to it."<sup>6</sup> One of the side slabs adjoining the stone with the axe-like markings has "9 or 10, or 11 small 'pits' or hollows, as large as a fourpenny piece, most clearly artificial."<sup>7</sup> In the British Museum there is a fragment of a slab about 20 inches long and about 17 inches broad, from the Durden Collection at Blandford, which was found in the centre of a barrow at Shapwick, Dorsetshire.<sup>8</sup>

<sup>1</sup> *Proc. Soc. Antiq. Scot.*, vol. xxxii p. 39.

<sup>2</sup> *Journal of the Anthropological Institute*, vol. xxxi. p. 274.

<sup>3</sup> Evans, *Ancient Bronze Implements*; see note to one of the references, p. 430.

<sup>4</sup> *Proc. Soc. Antiq. Scot.*, vol. viii. p. 379, fig. 3.

<sup>5</sup> Evans, *Ancient Bronze Implements*, p. 430.

<sup>6</sup> Dr Joseph Anderson, *Scotland in Pagan Times*,—*Bronze and Stone Ages*, p. 88.

<sup>7</sup> *Proc. Soc. Antiq. Scot.*, vol. viii. p. 380.

<sup>8</sup> *Catalogue of the Durden Collection*, No. 41, p. 19.



Several urns were found in the barrow, but unfortunately they were destroyed. The slab originally measured  $6\frac{1}{2}$  feet by 4 feet by 15 inches, but all that is now preserved is a part bearing incised figures. The objects incised upon it are all on one side of the stone, and comprise three, or perhaps four, axe-shaped hollows, and six small cup-like markings, two of which appear to be joined by a duct. The two largest axe-shaped depressions, which measure 12 inches and  $8\frac{1}{2}$  inches in length, and  $5\frac{1}{2}$  inches and  $3\frac{1}{2}$  inches at their greatest breadth, have each a protuberance springing from the top and bottom edges just behind the cutting face. The third axe-like hollow is about  $3\frac{1}{2}$  inches in length, and is of the shape of the ordinary flat axe. As for the fourth axe-like incision, it is doubtful if it were meant to represent a flat axe. It is triangular in plan, with an acute angle at the apex, and has straight sides. The cups vary in size from  $1\frac{1}{4}$  inches to  $1\frac{3}{4}$  inches in diameter, and some of them are  $\frac{3}{8}$  of an inch deep. The axe-shaped hollows vary from  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch in depth; on the Kilmartin slab the hollows are much shallower.

None of the flat axe moulds from the British Isles appears to have been found associated with any other remains. No objects seem to have been recorded as found directly associated with the mould from the Lough Scour Crannog,<sup>1</sup> or the example from Kintore, which is said to have been found in a cairn. As for Continental examples, the mould from Plouharnel, Brittany, is recorded as an isolated find;<sup>2</sup> the other French example, from Molitg, Pyrénées-Orientales, is stated to have been found at the foot of a large block of granite in a field along with some fragments of pottery scattered in earth mixed with bits of charcoal (*une terre charbonneuse*);<sup>3</sup> and the two moulds from El Argar were found with crucibles and other moulds, including one with three matrices for bars, in a small round space, roughly vaulted by means of stone and earth.<sup>4</sup>

All but one of the British and some of the Continental flat axe moulds

<sup>1</sup> Munro, *Lake Dwellings of Europe*, p. 370.

<sup>2</sup> E. Chantre, *Age du Bronze*, 1<sup>re</sup> ptie., p. 33.

<sup>3</sup> *Matériaux pour l'Histoire primitive et naturelle de l'Homme*, 1888, vol. xxii. p. 158.

<sup>4</sup> Siret, *Les premiers Ages du Métal*, texte, p. 127.

seem to have been used as open moulds without a cover; at least, it has not been recorded that cover-stones have been found with them, or that they showed any signs of having been so used. No. II. of the Irish examples probably had been furnished with a cover for the face bearing the matrix for the looped palstave, though such an arrangement was not found with it. The French specimen found near the Spanish border had apparently been used with a cover,<sup>1</sup> and one of the axe moulds and the mould with the three bar matrices from El Argar were found with their cover-stones complete, while there were also fragments of what had been the cover-stone of the other axe mould.<sup>2</sup>

Sandstone seems to have been the favourite material for making these flat axe moulds. All except No. I. from Scotland, the three examples from England, several of the Irish specimens, No. II. from France, and Nos. I., II. and III. from Spain, are of this material. No. I. from France is of red granite.

It is seen that 7 moulds for flat axes have been found in Scotland, 3 in England, and 5 in Ireland. Judging from the number of flat bronze axes in the National Scottish and Irish Collections, this is not what might have been expected. The Irish National Collection contains 85 copper and nearly 200 bronze flat axes, all found in Ireland, and our own National Museum contains 74 Scottish flat bronze axes.<sup>3</sup> In view of there being only 74 Scottish against nearly 300 Irish flat axes in the respective National Collections, it is surprising to find that more flat axe moulds have been found in Scotland than in Ireland. From the number of flat axes found, Ireland should have furnished several times the number of moulds found in Scotland. It will also be noticed, that, with the exception of the cist slab from Kilmartin, which probably was not a mould, all the Scottish specimens come from the north-east part of the country. Four of them have

<sup>1</sup> *Matériaux pour l'Histoire primitive et naturelle de l'Homme*, 1888, vol. xxii. p. 158.

<sup>2</sup> Siret, *Les premiers Ages du Métal*, texte p. 127, album pl. 27.

<sup>3</sup> Four of these are said to be of copper. *Journal Anthropological Institute*, vol. xxxi. p. 278.

been found within a radius of fifteen miles in the counties of Aberdeen and Banff. Considering that so large a proportion of flat axe moulds has been found in that portion of Scotland, it is a striking fact that of the 74 Scottish examples of flat axes in the National Collection, only 5 come from Aberdeenshire and 9 from Banffshire, which includes the hoard of 7 axes from Colleonard, in all only 14 specimens from the two counties, a very small proportion considering also the wealth of prehistoric remains in this part of the country. These apparent contradictions, applying not only to the two different countries but to different parts of Scotland, show how untrustworthy are mere statistics of finds in the formulating of theories.

The mould under consideration shows that no two of the implements cast from it were of the same dimensions. The four axes are finely graded in size, and the smallest of them is slightly larger than the largest of the axe-like objects, which again are each of a different size. None of the 74 Scottish flat axes in our Museum is so small as the smallest of these tools, and none of them is shaped like any of the three axe-like objects. The top and bottom edges of the whole 74 curve out trumpet-like as they approach the cutting face; not a single one has its edges running in straight lines from the butt to the face. It is rather unlikely that the cutting faces of the tools from this mould were lengthened to any appreciable extent by hammering after they were cast, because it is seen from the mould that the founder was careful to have the matrices cut very accurately to correspond to the shape of the finished article. This is specially noticeable in the case of No. 4, which so attenuates as it approaches the cutting face that it is evident that the ultimate shape of the tool differed very little from its shape when it left the matrix. This, I think, is borne out also by the Wallingford mould, on which the smallest of the three axe matrices is of this straight-edged type. This matrix is  $3\frac{3}{16}$  inches long. The probabilities are that these three matrices on the Fouldland mould and the one on the Wallingford example show the form of the smaller sizes of the flat bronze axe, and that in the first-mentioned mould

there is exhibited a fairly complete set of the various sizes of flat bronze axes in use in the Scottish area at some stage of the Early Bronze Period. The peculiar contour of the smaller type of axes may be accounted for by the fact, that if their edges had curved in from the cutting face to the butt, they would have been too light for use as axes, but by having the edges straight they absorbed a greater quantity of metal, which gave them a little more necessary weight. When the axe was made larger it was seen that the cutting face could be lengthened, or, to put it another way, that a certain amount of metal could be taken away from the edges of the tool without affecting its efficiency. The smallest specimen looks rather small and light to have made an effective axe, and it may have been used as a chisel, but, so far as I am aware, chisels of this shape have not been recorded. Mr W. J. Knowles, of Ballymena, has a stone mould with matrices for a socketed and looped spear-head and for what he considers a small chisel. However, the latter matrix differs from the small matrices on the Foudland mould by being straighter at the cutting face, and by tapering more towards the other end. Some Spanish chisels of copper which have been figured are shorter and more rectangular in shape.<sup>1</sup>

This type of small straight-edged axe seems to be very rare in bronze, although it is found to be not uncommon in copper. Specimens have been found in Ireland and in the Swiss lake-dwellings.<sup>2</sup> So much do some of them resemble the shapes and sizes of the smaller matrices on this mould that they might have been cast in them. Straight-edged flat axes of copper of larger sizes, simulating thin stone axes, have been found from the Levant to the Atlantic. They have been found in Cyprus, Italy, Switzerland, Spain, and Ireland. MM. Henri and Louis Siret have figured a series of Spanish flat axes of copper, showing a complete record of the various developments from the straight-edged imitation in copper of the stone axe to the perfected flat axe of bronze, with its elongated cutting face and curved sides. Mr George Coffey

<sup>1</sup> Siret, *Les premiers Ages du Métal*, album pl. 10, figs. 6-9.

<sup>2</sup> Munro, *Lake Dwellings of Europe*, p. 140.

has illustrated this most elaborately in a series of flat axes of copper found in Ireland.<sup>1</sup> Although several parts of the Continent and Ireland have furnished many flat copper axes of the shape of a thin stone axe, none appear to have been found in Scotland. All the recorded specimens seem to be of the fully-developed bronze flat axe type, with its diverging trumpet-like sides. However, the employment in Scotland of a small axe-like tool with straight edges is demonstrated by this mould. The discovery of any actual specimen has not yet been recorded, but it may now be inferred that not only did such a type exist, but that it was contemporary with the larger flat axe, with its curved edges.

From the list of flat axe moulds which I have been able to compile, it will be noticed that all have been found in the south and west of Europe. I have been informed by Dr Oscar Montelius and Dr Sophus Müller that no flat axe moulds have been found in Scandinavia or Denmark, and by Dr Götze, Berlin, that there are none from Germany in the King's Museum, Berlin.

Attention has been directed to the striking gradation in the sizes of the five flat bronze axes found at the "Maidens," Ayrshire;<sup>2</sup> but that fine hoard is even surpassed by the set of axes that could have been cast in the Foudland mould, both as regards regularity of gradation and the completeness of the set of tools. Though some of the axes from the "Maidens" are much worn, and though the finished tools from the Foudland mould might differ a little in size from the matrices, it may be of interest to compare the dimensions of them. The following tables give the respective measurements of the axe matrices on the mould and of the axes of the hoard.

It will be noticed that the smallest of the axes in the "Maidens" hoard is  $3\frac{3}{4}$  inches in length and  $1\frac{1}{2}$  inches in breadth, and that the smallest of the four typical flat axe matrices on the Foudland mould is about  $3\frac{7}{16}$  inches in length and about  $1\frac{5}{16}$  inches in breadth. The

<sup>1</sup> *Journal Anthropological Institute*, vol. xxxi., pls. xxi.-xxxiv.

<sup>2</sup> *Proc. Soc. Antiq. Scot.*, vol. xvii. p. 433. *Arch. and Hist. Collection of Ayr and Wigton*, vol. iv. p. 1.

The Foudland Mould.				The "Maidens" Hoard.			
No.	Length.	Greatest Breadth.	Thickness.	No.	Length.	Greatest Breadth.	Thickness.
	Inches.	Inches.	Inch.		Inches.	Inches.	Inch.
1	$5\frac{1}{2}$	$3\frac{5}{16}$	$\frac{1}{2}$	1	$5\frac{1}{2}$	$4\frac{1}{2}$	$\frac{2}{8}$
2	$4\frac{7}{8}$	$2\frac{7}{8}$	$\frac{7}{16}$	2	$4\frac{3}{4}$	$2\frac{5}{8}$	$\frac{2}{8}$
3	$3\frac{3}{8}$	$1\frac{1}{2}$	$\frac{5}{16}$	3	$4\frac{3}{8}$	$2\frac{3}{4}$	$\frac{3}{16}$
4	$3\frac{7}{16}$	$1\frac{5}{16}$	$\frac{5}{16}$	4	4	$1\frac{3}{4}$	$\frac{1}{4}$
5	$3\frac{1}{8}$	$1\frac{5}{16}$	$\frac{1}{4}$	5	$3\frac{3}{4}$	$1\frac{1}{2}$	$\frac{1}{4}$
6	...	$1\frac{1}{2}$	...				
7	$2\frac{5}{16}$	1	$\frac{7}{32}$				
The Bars.							
8	$6\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{8}$				
9	$5\frac{3}{8}$	$\frac{9}{16}$	$\frac{1}{32}$				

All the measurements from the mould are taken at the lips of the matrices, except in the case of the breadth of No. 6, which is taken at the bottom of the matrix.

largest of the three axe-like tools, being about  $3\frac{1}{8}$  inches in length and about  $1\frac{5}{16}$  inches in breadth, is smaller than the smallest of the "Maidens" axes both in length and breadth. These measurements are quite in keeping with the idea already expressed, that in this country axes of the smaller sizes may have differed from the larger ones in having the sides straight instead of curved.

Several stone moulds for casting bar-like objects have been found in Scotland. The mould found at Marnoch, and now in the Banff Museum, which is made out of a flattened oval piece of sandstone, measuring  $9\frac{1}{8}$  inches in length,  $6\frac{3}{4}$  inches in breadth, and from 2 to 3 inches in thickness, bears on the obverse a matrix for a flat axe, and on the reverse matrices for a bar and for a circular ring of the type displayed by the mould from Kilmailie, Inverness-shire, which has an annular matrix on both the obverse and the reverse. The outside and inside diameters of the ring on the Marnoch mould measure about  $3\frac{7}{16}$  inches and  $2\frac{9}{16}$  inches respectively; the ring produced would be about  $\frac{5}{16}$  of an inch in depth, and roughly semicircular in section. The bar is 8 inches long.

$\frac{9}{16}$  of an inch deep, and  $\frac{1}{4}$  of an inch broad at the bottom of the matrix. The New Deer mould has matrices for a flat axe on the obverse, for a flat axe and a bar on the reverse, and for a bar on one side. A mould from Benachie, Aberdeenshire, has matrices for two bars,  $6\frac{1}{2}$  by  $\frac{11}{16}$  by  $\frac{7}{16}$  of an inch and  $2\frac{1}{4}$  by  $\frac{5}{16}$  by  $\frac{1}{4}$  of an inch respectively, on the one side of the stone. One from Alford, in the same county, has on the top side of the stone matrices for two bars 10 by 1 by 1 inch and 4 by  $\frac{3}{8}$  by  $\frac{5}{16}$  of an inch respectively, for a flat crescent-shaped object, and for an object shaped like an elongated oval drawn in waist-like at the sides. On the under side of the stone there is a shallow groove,  $7\frac{3}{4}$  inches by  $1\frac{1}{4}$  inches by about  $\frac{1}{4}$  of an inch, which broadens out at one end to form a circular depression of about  $1\frac{1}{4}$  inches diameter. Another mould, from Orkney, is incomplete, but shows matrices for two straight bars on the obverse, for one curved bar on the reverse, for a small Latin cross on one side, and for a straight bar on the opposite side. The last specimen probably belongs to a later period than those bearing matrices for flat axes, the cross indicating perhaps an Early Christian or mediæval date. Those last three moulds are in the Scottish National Museum, and the first two of them, it will be seen, come from the same part of the country as the flat axe moulds.

It is impossible to say whether the two bar-like matrices on the mould under review were simply for casting ingots, or bars which were afterwards fashioned into some other object. As they stand, they do not resemble any known type of implement or ornament of the Bronze Age. They could easily have been made into chisels, but to have done so would have been a very great waste of what at that period must have been a very scarce and valuable metal. Still, a blunt chisel or punch, approximating in size to the largest bar on the mould, has been recorded and described by Dr Joseph Anderson.<sup>1</sup> It was found at Dumfries, and was of cylindrical shape, tapering from near the middle to a blunt point. It measured  $6\frac{1}{4}$  inches in length, and  $\frac{3}{4}$  of an inch in thickness. The large size of the bars cast in the Alford mould seems to preclude of their being anything else but ingots. If the two bar-like

<sup>1</sup> *Proc. Soc. Antiq. Scot.*, vol. xxviii. p. 207.



matrices on the Foudland mould were for ingots, a more handy and suitable shape could not have been devised, whether for convenience in transport or for remelting.

That both the Marnoch and the English specimens bear matrices for a large circular ring as well as for flat axes, is evidence that armlets of cast bronze of the completely annular form were contemporary with the earliest type of bronze axe in Britain, but it is found that the ring with the break is more common than the complete ring that would have been produced by each of these two moulds. It is reasonable to suppose that the first bronze rings made by man would be fashioned by the bending of a straight rod or bar, the circular matrix for casting the complete ring being a later development. It is also reasonable to believe that the earlier types of such bars may have been of quadrangular section, rounded bars (if ever such were cast) belonging probably to a later period. Thus, the two bar-like matrices on the Foudland mould may have been intended for casting bars of gold or bronze which afterwards were beaten and bent into the shape of a ring, which was quadrangular, semi-circular, or circular in section. If penannular rings with expanding ends are excluded, it is found that there still remains a not uncommon type of bronze ring or armlet which is semicircular in section, or perhaps better described as circular in section but flattened on the inside. The fabrication of armlets of this shape from bars cast in this mould would involve very little working, owing to the depth of the bars being less than their breadth. All that would be required would be the rounding of the corners. The longest bar from the mould would be  $6\frac{1}{4}$  inches in length. A bar of this length would allow of the manufacture of a ring with an inside diameter of almost 2 inches, without reckoning any lengthening of the bar by hammering. The quantity of metal in such a bar would easily allow of its being beaten out 2 or 3 inches more in length, and so would permit of the production of a ring almost identical in shape and size to the three fine Scottish examples figured in *Scotland in Pagan Times*, pp. 58, 59, and 60. Dr Anderson there mentions four different finds of this type of ring:—from Stobo, Peebles-

shire, from Crawford, Lanarkshire, from Kinneff, Kincardineshire, and from Ratho, Midlothian. Some of the relics said to have been found associated with them point to their having belonged to a later phase of the Bronze Age, but Dr Anderson points out that the data are not quite trustworthy. However, Scotland has produced two well-authenticated cases of such rings having been found associated with flat bronze axes. A penannular ring of bronze was found along with the hoard of five flat axes at the "Maidens," Ayrshire, which has already been referred to. The Migdale hoard, described by Dr Anderson, contained three pairs of plain and one pair of ornamented bronze armlets, besides many other bronze and jet objects.<sup>1</sup> None of the rings from the "Maidens" or from Migdale appears to have been a circular casting. They all have a break, which shows that apparently they were made by bending straight rods or bars. In Spain, rings of the same shape but of copper were often associated with the flat axe. Quite a number of men's graves explored at El Argar contained a flat axe, a knife dagger (*poignard*), and a bracelet, all of copper.<sup>2</sup> Some of them also contained other ornaments, and one had a silver bracelet as well as one of copper. Several of the bracelets were found still encircling the bones of the arm of the skeleton.

While the two matrices may have been used merely for the casting of ingot bars, they might have been meant for the reception of superfluous molten metal, that is, for the metal left over after the filling of the matrix for the axe in the course of manufacture. The bars could also have been used for the manufacture of chisels. It is, however, far more probable that these matrices were for fashioning bars intended for the manufacture of rings or armlets of the type of the Stobo and plain Migdale specimens. The mould from Molitg-les-Bains, France, besides the two matrices for flat axes had one for a bar-like object which was supposed to have been used in the manufacture of armlets. One of the moulds from El Argar, Spain, bore matrices for three bars which

<sup>1</sup> *Proc. Soc. Antiq. Scot.*, vol. xxxv. p. 266.

<sup>2</sup> Siret, *Les premiers Ages du M $\acute{e}$ tal*, texte, pp. 145, 146, 147, album pls. 29, 30.

were considered suitable for being made into chisels, arrow-heads, bracelets, or awls.

As flat axes have been assigned to the early part of the Bronze Age, and as there is no evidence of the bars belonging specially to a later period, this mould may safely be considered to have been made and used during the Scottish Early Bronze Age. It is to be expected that the bronze merchant or founder at that time would find it necessary to travel over the country for purposes of his craft. It would be much more suitable for him to go to his customers than for his customers to come to him from great distances. The mould itself suggests that it belonged to an itinerant bronze-founder. The stone of which it is made is not found in the district. Slate and whinstone are the underlying rocks. Sandstone is found some ten miles distant, but its colour is a darker red than the sandstone of this mould. This perhaps can hardly be considered an argument in favour of its owner being a travelling merchant, but it is of interest to note that the material of which the mould is made is foreign to the immediate neighbourhood of where it was found. The reason that the surface of the stone, even the sides, is so fully occupied by matrices, may be that this particular piece of stone was specially suitable for casting purposes, but it seems more probable that the shape and size of the mould was dictated more by reason of the necessity of having it in a light, handy, compact, and portable form. If the founder had had his place of manufacture fixed in one locality, it is to be expected that he would have had his various moulds all on the top surface of several moulding stones, and not on four sides of the same stone, as in this case. There is scarcely any doubt that this mould was once the property of a travelling bronze-founder, who, on the spot, could produce an armlet, or one or more of a variety of axes, which the customer desired or could afford to buy; it is unlikely that such a merchant would carry many axes in stock, bronze being too scarce and valuable a commodity in Scotland during the early part of her Early Bronze Period. If the customer possessed a broken or worn axe, the founder could there and then remelt and recast it.

From a survey of the fifteen flat axe moulds recorded from the British Isles, it is seen that the only other objects associated with them on the moulds are bars in three Scottish cases, rings on one Scottish and on an English specimen, and a knife and looped palstave each on an Irish example, all of which, with the exception of the looped palstave, are recognised as quite typical of the Early Bronze Age. As for the Irish specimen with the palstave, one of the two flat axes on it is of an uncommon flat-faced type, which may belong to a somewhat later period, and so become reconciled with the looped palstave. Regarding the Continental examples, it is found that what applies to the British flat axe moulds applies to them. Only matrices for bars and for knives or daggers are found associated with flat axe matrices.

The district in which this mould was found has produced large numbers of stone implements, but I have been unable to learn that any of bronze have been found there. The scarcity of bronze objects may be accounted for by their being easily noticed, and so readily picked up early in the history of the tilling of the ground. A bronze object would catch the eye at once, and being of some apparent value it would be removed. I have heard of a bronze axe having been secured by a local blacksmith, who said he would try and make it into a "southerin' bolt." Besides this mould I have a small whetstone of reddish quartzite, of the type that is usually attributed to the Bronze Age, which was found a couple of miles to the north-west, on the other side of the hill.

Though bronze implements and weapons are very scarce in this district, still we see that Bronze-Age man has left behind him some typical utensils, as well as numerous graves which have from time to time been turned up, all which is clear testimony to his once having dwelt in the glens of Foudland.