STONE MOULD FROM THE DERWENT VALLEY, DERBYSHIRE

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INTRODUCTION

The construction in 1905 of the Derwent Masonry Dam on Howden Reservoir led to the discovery of a primitive stone mould (Winder 1918, 103). The mould was recovered 'on the hillside near the Derwent Dam at a depth of five to six feet' (Sandeman 1910, 74). At the time of discovery opinion differed as to the date of the artefact according to several experts. Professor Boyd Dawkins believed it likely to have been of the Iron Age, while C. H. Read of the British Museum stated it was evidently an open mould for casting bronze ingots and rings and probably of the Bronze Age (Sandeman 1910, 75). The stone mould was subsequently stored at Bamford filter plant until January 1989 when it was kindly loaned to Sheffield Museums Department by the North Derbyshire District of Severn Trent Water.

DESCRIPTION

The mould is made from a lozenge-shaped block of sandstone (Figs. 1, 2) which is flat on both faces except for a 6mm high step on the upper face, probably the result of a thin slice of stone breaking away from the main block. The sides of the block suggest signs of working, although erosion of the friable surface makes it difficult to be certain of this supposition. The sandstone is of a locally occurring type which is readily available on the gritstone edges west of Sheffield.

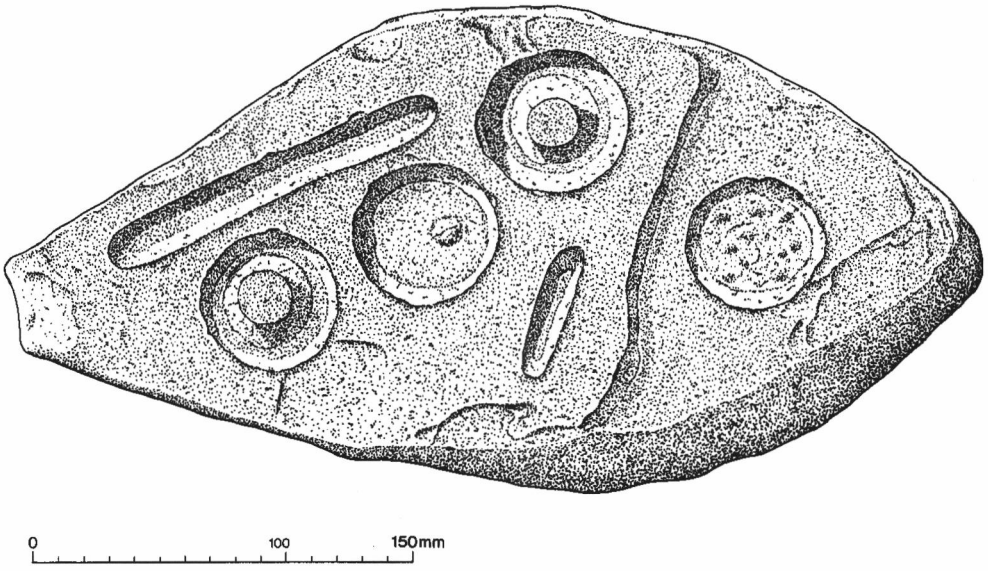

Fig. 1 Stone mould from Derwent: upper face.

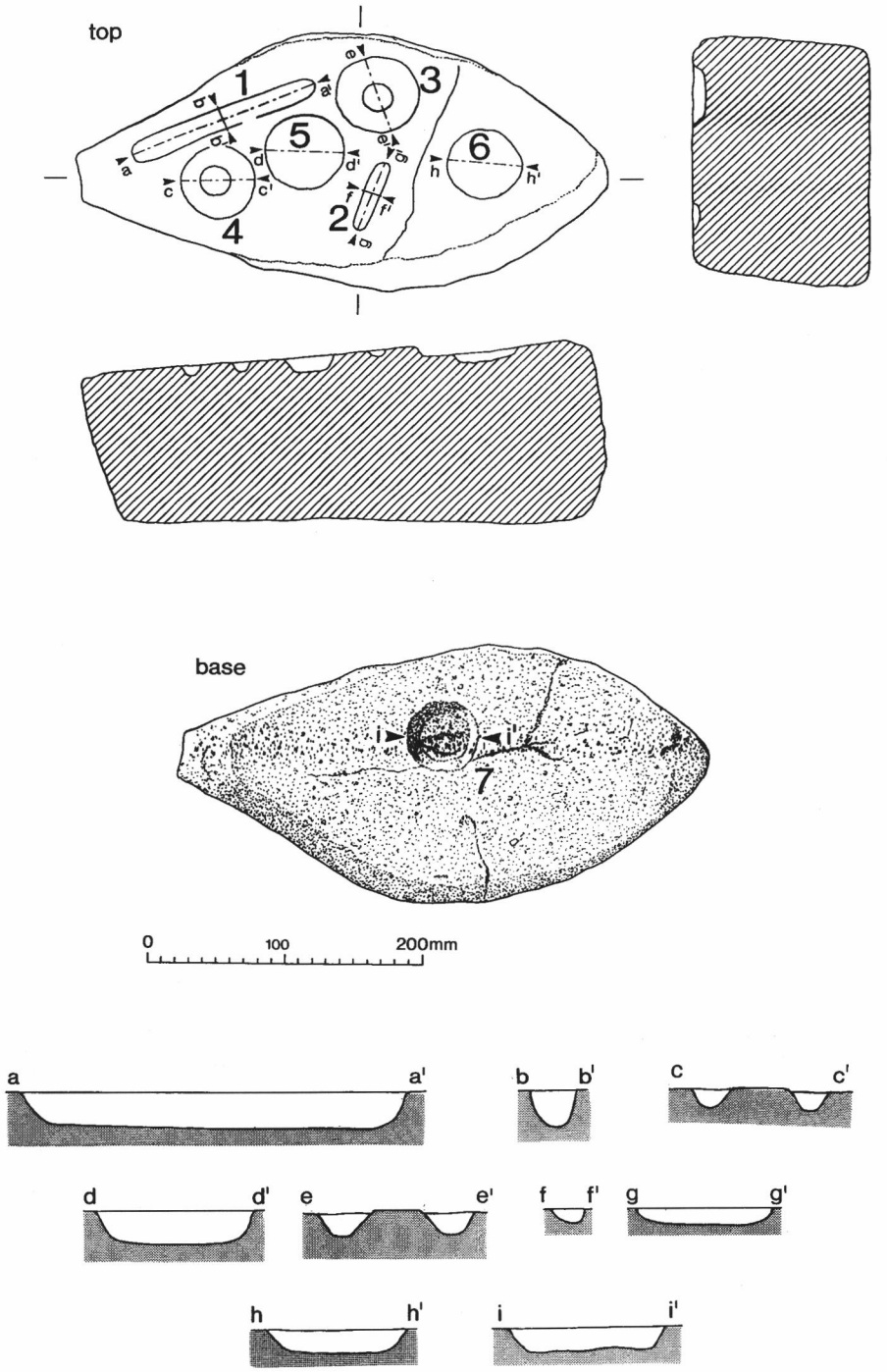

Fig. 2 Stone mould from Derwent: lower face and cross-sections *(not to scale)*.

The block is 382mm long, 190mm wide and 64mm thick. Cut into the upper and lower faces is a series of matrices for the casting of bars, rings and disks.

Matrix 1 (see Fig. 2 for numbering) is a bar, 139mm long, 18mm wide and a maximum of 12mm deep. It is parallel-sided with rounded ends. The cross-section is D-shaped although towards the middle there is a slight flattening of the matrix floor accompanied by an area of pinkish discoloration.

Matrix 2, the second bar, is 52mm long, 18mm wide and 6mm at its deepest point. The internal faces are roughly parallel, although one is poorly cut. This is reflected in the cross-section of the matrix (Fig. 2:f-f^{1}), The straighter side is cut steeply into the stone while the opposite side is less steeply cut and possibly unfinished. Thus the bar cast from Matrix 2 would have an asymmetrical, rounded cross-section. There is no sign of discoloration in this matrix.

Matrix 3 is a ring of 58mm external diameter, 19mm internal diameter and a maximum depth of 9mm. The centre is in the form of a truncated cone, the ring itself being of trapezoidal cross-section. The matrix is crudely formed with a V-shaped scar running at a tangent to the ring and penetrating one edge of the matrix. This fault would have caused the molten metal to flow out of the matrix if filled above a certain level. Matrix 3 has a clean incised edge, in contrast to Matrices 1, 4 and 5 which have slightly rounded edges and eroded surfaces. Matrix 3 shows considerable darkening, a characteristic which Bayley (1992, 767) notes on other stone moulds and suggests is a sign of use.

Matrix 4, the second annular mould, has an external diameter of 55mm, an internal diameter of 21mm and a depth which varies between 5-7mm. This differential is due to the centre rising slightly above the surface of the stone around the matrix. The cross-section of the ring varies between D-shaped and trapezoidal.

Matrix 5, one of the three disk matrices, is 57mm in diameter and 12mm deep. The matrix has inward sloping sides and a flat internal floor with a sub-circular depression of some 15mm in diameter where a flake of stone has become detached. This would undoubtedly have left a scar on any casting, but such imperfections would be unimportant if the metal blanks were for subsequent re-melting or cold working into another form.

Matrix 6, a disk matrix, is 51mm in diameter and 7mm deep. This matrix is separated from Matrices 1-5 by the stepped edge running transversely across the full width of the block. Matrix 6 is crudely circular in plan; the half lying nearer the step has been carefully formed while the other is shallow and stepped with part of the edge broken away. The matrix floor is uneven, suggesting it was abandoned unfinished. The matrix may well have been cut prior to formation of the step and consequently has lost part of its original depth. Indeed the cutting of Matrix 6 may have caused the fracture which is evident at this end of the mould.

Matrix 7, cut from the underside of the block (Fig. 2), is 57mm in diameter and 8mm at its maximum depth. The floor of the matrix is very uneven and a crack runs almost the whole length of the underside of the block which is considerably pitted with areas of pinkish discoloration.

The seven matrices are easily divisible into three groups: bars, rings and disks. The bar Matrix 1 is complete; Matrix 2 is much smaller and appears unfinished. The two ring matrices, 3 and 4, are similar both in shape and dimensions. It is worth noting that Matrices 1 and 3, despite being of different shape, have very similar volumes, raising the possibility that the casts produced may be of standard weights for trading purposes or as exchange media. Clearly any of the simple shapes produced from the Derwent mould could be subsequently worked into finished items or re-cast in more complex moulds. In either case the finished objects would be far removed from the original 'as cast' versions.

DISCUSSION

The lack of an archaeological context for the mould means any attempts to date it are based on purely comparative, and therefore obviously subjective, methods. The largest bodies of evidence for extant stone moulds in Britain are dated either to the Earlier Bronze Age, or the tenth and eleventh centuries AD in those areas of the country associated with Scandinavian settlement.

Earlier Bronze Age moulds

The use of 'open' stone moulds to cast copper alloys is normally associated with metalworkers of the Earlier Bronze Age. The term 'open' has been disputed by Tylecote (1962, 112) and Hodges (1959, 130) who suggest such one-piece moulds would have had flat, moveable covers to prevent over-rapid cooling and hence oxidation during the casting process. Hodges (1959) and Britton (1963) provide extensive lists of Bronze Age moulds. Their distribution is almost exclusively limited to northern Britain, and more particularly to the Highland and Grampian regions of Scotland with outliers in Northumbria, Suffolk, Cornwall and Gwynedd. All of these moulds, which Britton calls the Marnoch group (1963, 319-24), have matrices to cast flat axes. Indeed the flat axe matrix is the common characteristic used to date the group. The majority have matrices cut into at least two faces; some, like the New Deer (Grampian) example, have matrices on both faces and on one long side (Callander 1904, 492; Hodges 1959, 135; Britton 1963, 322).

BAR MATRIX	DIMENSIONS (mm)	CROSS-SECTION
The Fens, Suffolk	90 x 9 x 5	square
Burreldales, Grampian	110 x 11 x 6	trapezoidal
	79 x 8 x 5	trapezoidal
Foudland, Grampian	145 x 16 x 12	sub-trapezoidal
	155 x 17 x 12	sub-trapezoidal
Kintore, Grampian	183 x ? x 11	trapezoidal
	145 x ? x 9	trapezoidal
New Deer, Grampian	83 x 12 x 5	sub-trapezoidal
	152 x 15 x 5	sub-trapezoidal
Turiff, Grampian	140 x 13 x 6	?
	80 x 10 x 5	?
Dufftown, Grampian	140 x ? x 12	damaged
	85 x 9 x 6	trapezoidal
Marnoch, Grampian	203 x 10 x 5	sub-trapezoidal
Derwent, Derbyshire	139 x 18 x 12	D-shaped
	52 x 12 x 6	D-shaped

Table 1 Stone mould from Derwent: a comparison of bar matrices of the the Marnoch group (summary of Britton 1963 and Hodges 1959) with those of the Derwent mould.

In addition to flat axes the Marnoch group also has matrices for casting bars and rings. Because of this fact the Derwent mould has been included in a sub-group of possible Marnoch examples (Britton 1963, 324). The Derwent mould does share some characteristics of the Marnoch group, but there are a number of significant differences. The greatest of these is the lack of a flat axe matrix. Since the axe certainly seems to have been the most important metal object in Earlier Bronze Age society, it seems surprising that metalworkers, going to the effort of cutting a stone mould, should fail to produce a rudimentary axe shape.

The bars produced from the Derwent mould also seem at odds with those cast from the Marnoch group (Table 1). The Marnoch moulds would have produced bars of angular, often trapezoidal, cross-section, as the plaster casts taken from the Foudland mould prove (Callander 1904, fig. 5). Britton characterises bars of the Marnoch group as being oblong or trapezoidal in section (1963, 265). The Derwent mould, in contrast, would produce finger-shaped bars of D-shaped cross-section with rounded ends.

It is also perhaps important to note that even in the comparatively large group of nineteen Marnoch moulds listed by Britton (1963, 319-24) not a single example has a matrix for casting disks. In contrast the Derwent mould has three. It can be stated with some degree of conviction that the mould found near the Derwent Dam does not belong to the Marnoch group, nor to that particular metalworking tradition. Consequently an Earlier Bronze Age date for the object is doubtful.

Medieval stone moulds

Stone mould use is also prevalent in the Early Medieval period, and the bar or ingot is especially characteristic of the time. The areas of Scandinavian settlement or incursion into Britain have produced a number of examples, the most notable being a stone mould for casting ingots and Thor's hammers from Whitby, North Yorkshire (Graham-Campbell 1980, 8, pl. 2). Wilson has suggested the Whitby mould was used for making ingots from melted-down church plate, after Vikings had raided monasteries near the coast (1976, 395).

A number of stone moulds was discovered at the Anglo-Scandinavian Coppergate site in York. These are generally sub-rectangular blocks fashioned from steatite or talc schist, probably quarried in Scandinavia, with matrices cut out of each flat face (Bayley 1992, 768-70, figs. 330-1). The moulds were solely for the production of ingots, usually silver, which are common in Viking age hoards (Graham-Campbell 1980, pl. 301; Edwards 1985). The size and shape of the matrices in the Coppergate examples are not at odds with the Derwent mould. They range in size from 20mm to over 150mm (Bayley 1992, 772, fig. 333) with a range of cross-section shapes and a mean width of 10mm. The Coppergate site, however, has not produced any comparable ring and disk matrices. Indeed cast discoidal or annular forms are certainly very uncommon amongst Viking period hoards.

Examples of stone moulds from later Medieval sites do exist. A notable example from London (Egan and Pritchard 1991, 239-41, no. 154) has a form similar to the Derwent mould, but in fact is only half of a two-piece mould for use with lead or tin. It dates to the fourteenth century. Examples of ornate stone moulds, described by Ramsay for use with pewter or silver, are dated to the Medieval period and seem to have been used exclusively to produce thin decorative mounts (1987, 394-6).

Iron Age and Romano-British moulds

The characteristics of the Derwent mould fail convincingly to match the Earlier Bronze Age or Medieval examples, but one further group of open stone moulds exists which perhaps more than any other shows similarities. Frustratingly most of this group is not easy to date because of a lack

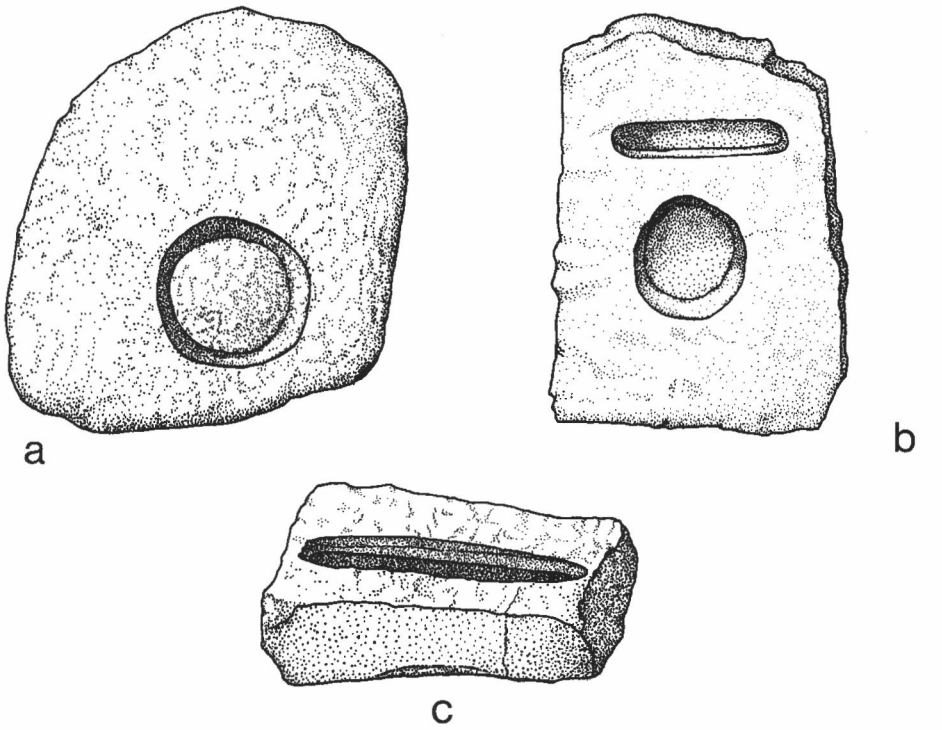

Fig. 3 Stone mould from Derwent: moulds from a) Kilmalie, b) Buston and c) Lochlee *(scale 1:4).*

of archaeological context. A stone from Kilmalie in Scotland (Highland) is one such example (Fig. 3:a). It is described as a water-worn slab of micaceous sandstone measuring 254 x 210 x 90mm. It has a ring matrix with an external diameter of 74mm and a second possible disk or ring matrix (Anon. 1874, 248; Hodges 1959, pl. Y2; Britton 1963, 325). Two further crude stone moulds recovered from the crannog sites in Scotland also bear a resemblance to the Derbyshire mould. One, from the site of Buston, was described by Munro as 'used for polishing small objects such as jet rings' (1882, 211), but is undoubtedly an open mould (Fig. 3:b). This example is also made from sandstone with a crudely shaped disk matrix of 63mm and a bar matrix 77mm long. Lochlee produced a stone block with a single bar matrix, 150mm long, cut out of one face (Fig. 3:c). Munro believed this stone to have been used as a hone (1882, 105). The dating of these crannog sites is somewhat vague, stretching from around 500BC right through to the Romano-British period (Ritchie and Ritchie 1981, 111).

Further evidence of open stone moulds, once more from Scotland, comes in the form of a series of six from the hillfort of Traprain Law (Lothian). All are cut from sandstone and have bar and disk matrices (Curle 1915, 191-3). The moulds were recovered from the second and upper levels which are characterised by native pottery with some Roman imports, tentatively dating the moulds to the later first century AD at the earliest.

Far and away the most convincing local parallel for the Derwent mould comes from Navio, the Roman fort at Brough-on-Noe, Derbyshire. Excavations in 1983 revealed a gritstone fragment with a bar matrix cut into one face (Drage 1993, 90, no. 102). Unfortunately the mould

is broken, but what survives of the matrix in form, cross-section and size (width 19mm, depth 13mm) is very similar to the bar matrices of the Derwent mould. The Navio fragment also shows blackening around the matrix and even pinkish discoloration from scorching on the underside, suggesting that methods of usage of the two moulds were similar. Certainly there is a striking resemblance between the Navio matrix and the Derwent mould Matrix 1.

The Navio example is also important in being well dated by association with pottery to the late second to mid-third century AD (Drage 1993, 66). Analysis of the Navio stone at the Ancient Monument Laboratory detected traces of copper and lead, but the exact metallic composition could not be determined (Drage 1993, 90).

CONCLUSION

A comparison of mould types breaks down into at least four chronological or typological groups: the fairly uniform Earlier Bronze Age Marnoch group; the ingot moulds of the Early Medieval period; the later Medieval stone moulds for producing decorative dress items; and a miscellaneous group of crudely cut sandstone moulds of the Later Iron Age or Romano-British period, mostly from Scotland. The example from near Howden Reservoir seems to have most in common with this final grouping. The Derwent mould was certainly used to cast metal blanks, not however functional casts such as axes or awls as with the Marnoch group, but rather bars, rings and disks. These were presumably for re-casting and trading.

Surface analytical techniques such as scanning electron microscopy and X-ray fluorescence may be able to determine the metal being cast, though the weathered condition of the block may have reduced the potential for successful analysis—as already noted in the case of the excavated example from Navio, analysis was of little help in determining the nature of the casting process.

It is clear that the matrices are very crudely fashioned and the cast objects would have been rude and unsuitable for use in their unmodified form. The block, though heavy, is portable enough to have been carried to a particular source of raw material for use. The lack of castings from the mould, however, really prevents any useful discussion of their possible use.

The casting of crude metal blanks in stone moulds could be seen better perhaps as a reaction to particular changes in the conditions under which a community existed rather than as a strictly cultural trait characteristic of a specific period of time. Thus the distribution of moulds in the final miscellaneous group above may be a reflection of how some communities reacted to similar stimuli, rather than necessarily implying that all the moulds must date to the same period in time or archaeological culture. Times of change, for example reorientation of trading systems or changes in ideology, can cause certain objects to become less influential and even obsolete. Destruction and recasting of metal objects may be indicative of fundamental changes in social organisation.

The lack of close parallels has limited what can be said usefully about the Derwent mould. It cannot be slotted neatly into a known typological grouping. The poor archaeological context of the find only adds to the problem. Similarity with the Navio example makes it tempting to suggest that the two examples from Derbyshire were used to cast lead ingots as part of a small scale trade outside official Roman channels. Unfortunately the Derwent Valley is somewhat to the north of traditional lead-mining areas, throwing doubt on this otherwise appealing hypothesis.

A suspicion remains that more of these stone moulds exist in museums and collections around the country, but have not been recognised as such. It is hoped that the above discussion will act as a stimulus for further examples to be presented. The ideas and tentative dating proposed above

can then be either reinforced or replaced with more confident suggestions of exact date and usage.

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