

Boolybrien

The Personal Hoard of a Bronze Age Musician

Simon O'Dwyer

Zusammenfassung

1929 wurde in einem Moor in Boolybrien, Co. Clare, Irland, von einem Bauern beim Ausheben eines Entwässerungsgrabens ein Hort aus Bronzegegenständen entdeckt. Im Jahr 2000 übergab das National Museum of Ireland dem Clare County Museum die Kollektion zur dortigen Ausstellung. Der Hort besteht aus elf Objekten, die in eine Tierhaut eingewickelt waren, und enthält eine Kette mit elf mehrteiligen Gliedern, zwei größere Ringe, drei kleinere Ringe mit seitlichen Löchern, einen Schwertgriff (Klasse 4^e), zwei Tüllenbeile, eine große verzierte Gewandnadel mit scheibenförmigem Kopf und das Schallstück eines endgeblasenen Bronzehorns (Klasse 2^e).

Wir interpretieren die Kollektion als persönlichen dekorativen und funktionellen Bestandteil einer Ausrüstung, die ein Bronzehornspieler in Westeuropa während der Späten Bronzezeit getragen hat. Der vorliegende Beitrag beinhaltet Auszüge aus bereits früher erschienenen Beschreibungen des Hortes und eine neue detaillierte Untersuchung der Artefakte mit dem Ziel, deren möglichen Gebrauch nachzuweisen. Alle Gegenstände wurden exakt reproduziert, so dass Experimente durchgeführt werden können, die dabei helfen, die praktische Handhabung und die Beziehungen der Stücke des Hortes zueinander zu erschließen. Auf diese Weise ist es uns möglich, einen neuen Blick auf einen seltenen persönlichen Bronzehort zu werfen. Wir gewinnen dadurch ein tieferes Verständnis für das Erscheinungsbild, den Platz und den sozialen Status, den ein bronzezeitlicher Musiker in Irland um 1000 bis 700 vor Christus hatte.

1 Introduction

In 1929, Pat Joe Greene and his son Dan Greene were digging a drain in a small field or 'kitchen garden' near their house at Boolybrien, Co. Clare. They uncovered a leather skin which was wrapped

around the bell of a bronze horn and inside the bell were the remaining items of a hoard. Not realising what it was, they put the skin and its contents on top of the kitchen dresser where it remained for almost a year. In 1930 Pat Joe Greene's brother identified the artefacts as being very old and brought them to the National Museum of Ireland in Dublin. His name was Raymond Greene and he was training to be a priest at the time. The animal skin was not included and is now lost. According to Dan Greene, they were not able to identify the animal from which the skin came though they thought it might have been a goat skin. This information is sourced from Edel Greene, daughter of Dan Greene, 20 January 2013.

The hoard was described by George Eogan as being located at a mud level that contained tree stumps, below the peat and above the gravel.¹ The artefacts were kept in the National Museum of Ireland until the year 2000 when they were given over for display to the Clare County Museum. In 2008, whilst giving a presentation at the Clare County Museum, Maria Cullen O'Dwyer of Ancient Music Ireland observed that the collection may be interconnected parts of an outfit or costume originally worn by a bronze horn player. Having established that this possibility had not been previously explored, it was decided by Ancient Music Ireland to undertake an in-depth study of the hoard.

Permission was granted by the National Museum of Ireland to conduct a detailed study of all the pieces to look for evidence of their original uses and to facilitate the accurate reproduction of the complete hoard. Holger Lönze,² a PhD sculptor

¹ Eogan 1983, 65–67.

² Lönze 2007–2012. Observations and results of the new castings of items from the hoard are described by Holger Lönze in *Notes on the Methods Used in the Reproduction of the Boolybrien Hoard* as appendix to this paper. Lönze is specialising in the reproduction of ancient bronze artefacts from Europe (<<http://www.holgerlonze.com/lbahorns.shtml>>).

and bronze casting expert, was approached to undertake the casting of new reproductions of the hoard.

2 Boolybrien Hoard as Described by Eogan³

2.1 Tang of Sword. Possibly 'Class 4'

"This is flanged; it has two rivet holes and terminates in a straight-ended projection to each side. The mould joint is visible on the side. It appears that this is a tang that was cast on but subsequently became detached."⁴ (Fig. 1).

2.2 Looped Socketed Axe Head, Bag Shaped

"The mouth is roughly oval. The walls average 3 mm in thickness. There are two shallow grooves underneath and there is a longitudinal crack running down one face for a length of 15 mm internally at about mid-point, on the long axis, two low casting ridges occur. The edge is sharp and on the sides evidence for a mould joint is clearly visible. The external diameter of mouth is 32 by 22 mm. Maximum width at cutting edge is 41 mm."⁵ (Fig. 2).

2.3 Looped Socketed Axe Head, Bag Shaped

"The mouth is to some extent oval; it is 30 mm in maximum length and 23 mm in maximum width. The walls average 3 mm in thickness. Underneath the mouth, the axe is encircled by three shallow incisions. Internally there are two casting ridges at about mid-point on the long axis. On the side, the mould joint is visible. Indeed the two pieces did not fit evenly and this caused a slight step on the outside. The lower portion of the axe is missing."⁶

2.4 Disc-Headed Pin with Bent Stem (Sunflower Pin). 'Class 2'

"There is a slight ridge at the edge of the disc and in from this there is a series of hatched triangles. This is executed in very light incised lines. Between this and the central boss fifteen concentric circles occur. The boss is 12 mm in diameter at the base and 9 mm in height. The back of the head is also ornamented. Here the decoration consists of straight lines extending in from the edge for a distance of 5 mm. For part of the way, on the inside, they are bounded by an incised thin line. The stem is round in cross-section and tapers from a maximum diam-

eter of 6 mm to a point. It has been broken 140 mm from the tip. Diameter of the head is 62 mm, length of pin is 220 mm."⁷ (Fig. 3).

2.5 Horn 'Group B', Mac White,⁸ 'Class 2' End Blow of Coles⁹

"This appears to have been cast in one piece but it has now been broken across at about mid-point. The mouth is circular and is 42 mm in external diameter by 37 mm in internal diameter. Underneath there are four spikes evenly placed. These average 18 mm in height and 10 mm in diameter at the base. Towards the bell end which is also circular, the walls widen a little. There is a slight internal ridge. Here the object is 100 mm in external diameter and 92 mm in internal diameter. Immediately below the lip a small perforation was filled in antiquity. There are again four spikes underneath. These average 19 mm in height and 12 mm in diameter at the base."¹⁰ (Fig. 4).

2.6 Plain Ring

"Bronze plain ring 44 mm in external diameter and 35 mm in internal diameter. The ring is solid and circular in section."¹¹ (Fig. 5).

2.7 Second Plain Ring

"Bronze plain ring similar to previous."¹² (Fig. 5).

2.8 Ring with Proliferations

"Bronze ring with two unprotected transverse perforations through the body. This is a flat oval in section with an internal bevel. The perforations are at two points opposite each other. They are roughly oval and average about 8 mm in maximum length by 5 mm in maximum breadth. The ring is 30 mm in external diameter, 9 mm internally and 8 mm thick. It appears to be solid."¹³ (Fig. 6).

³ Eogan 1983, 65–67.

⁴ Eogan 1983, 66.

⁵ Eogan 1983, 66.

⁶ Eogan 1983, 66.

⁷ Eogan 1983, 66.

⁸ MacWhite 1945, 85.

⁹ Coles 1963, 326–356.

¹⁰ Eogan 1983, 66.

¹¹ Eogan 1983, 66.

¹² Eogan 1983, 66.

¹³ Eogan 1983, 66.

2.9 Second Ring with Proliferations

“Bronze ring with two unprotected transverse perforations through the body. Similar to previous example.”¹⁴ (Fig. 7).

2.10 Third Ring with Proliferations

“Bronze ring with two unprotected transverse perforations through the body. Somewhat similar to the previous example except that it is smaller and lacks the pronounced internal bevel. The two transverse perforations are not exactly opposite each other. The ring is roughly circular in section and as far as can be determined is solid. Its external diameter is 28 mm and internal is 16 mm.”¹⁵ (Fig. 7).

2.11 and 2.12 Links of Chain

“Chain consisting of seven triple links, two double links of the same dimensions and two larger double links making a total of twenty-nine rings. The smaller rings are flat, approximately 2 mm in maximum height. They are roughly circular and average 19 mm in external and 11 mm in internal diameter. The two pairs of double rings are of the same dimensions, 18 mm in external diameter. The larger rings may have been attached to the ends of the chain. One of each pair is slightly thicker than the other. All are 23 mm in external diameter but the larger is 15 mm in internal diameter and the smaller is 17 mm in diameter. At five places the links are joined by pieces of a thin wire like bronze. In another instance a flat band of bronze is used. These are not satisfactory methods of attachment as the ends were only pushed together and no attempt was made to secure them, a fact that suggests the chain was not used for any strenuous purpose. The chain is 657 mm in total length.”¹⁶ (Fig. 8).

3 Boolybrien Hoard as Described by O’Dwyer

3.1 Sword Tang

The sword tang comprises approximately two thirds of the handle. It appears to have been broken away from the rest of the sword as a result of some violent action rather than through natural decay. A good idea of what it originally was like can be gained by looking at another surviving complete example which is very similar in design and comes from a nearby area. Eogan describes it as *Killaloe*, the town land where it was recovered.¹⁷

3.2 Looped Socketed Axe Head

This is one of a pair of axe heads which are almost identical. An important feature is the crack in the side wall, which could have been caused to the axe when it was originally fitted with a handle and used to strike something with force. Such an impact would cause the cup head to be pushed up onto the fitted cone-shaped receiver on the handle, which would tend to widen the bronze at the open end, thus causing a crack to be created at a weak point in the casting. Yet, there is no visible damage or blunting to the axe edge, indicating that it did not impact on a hard surface such as stone or metal but rather on something softer than the bronze, like wood or bone. The expanded crack undoubtedly indicates a possibility that the axe head was fitted at some stage with a handle perhaps made of wood, bone or antler.

3.3 Looped Socketed Axe Head

The severe damage on this axe head indicates that it was probably subjected to extreme force. Only a very violent blow would result in the clean break where most of the blade is missing.

3.4 Disc-Headed Pin

The disc head of the pin is decorated with a very definite pattern. Great care was taken in its design. It is interpreted as representing a sunflower because of the triangles with internal diagonal lines that surround the outside of the disc. They might appear as flower petals, yet to be interpreted in this way they would need to have the pointed ends of the triangles facing outward, whereas the opposite is the case. The filled triangle motif occurs in Irish antiquity from the Neolithic on burial pots to the Early Medieval as part of a decoration design on the River Erne horn and is thought to represent¹⁸ femininity or reproduction.¹⁹ Inside them is a definite number and arrangement of concentric circles from the outer raised edge of the disc in to the centre boss. They all appear to be part of the original casting except for the inner two circles, which are hand worked, indicating that the

¹⁴ Eogan 1983, 67.

¹⁵ Eogan 1983, 67.

¹⁶ Eogan 1983, 67.

¹⁷ Eogan 1983, 65–67.

¹⁸ Blackledge 2003, 53–56.

¹⁹ Holmes 1978, 165–188.

overall number and positioning are of importance. Curiously, if the circles are projected as vertical lines onto a horizontal with the groups and spacing as portrayed, a mathematical interpretation may be achieved; it begins at the outer raised ring at 1 (Fig. 9).

If a single extra beat is added to three of the spacings, an exact 8 bars of 4 beats may be achieved. If this sequence is repeated, a continuous dance rhythm may be played (Fig. 10).

Therefore, is it possible that the design on the front of the circular plate of the pin is a visual representation of a tune? However, decoration of concentric rings represents a common type within the Middle and Later European Bronze Age.²⁰ In connection with the deposition of a musical instrument and the interpretation as a musician's equipment, we may speculate whether there could be a musical symbolical meaning to this decoration (such as for instance a musical rhythm). This, however, should not be overemphasized. The fine lines around the outer edge of the back of the disc may have had some meaning that is now obscure, yet the mere presence of any decoration is remarkable bearing in mind that it would never be seen while the pin was being worn. As with the sword and axes, the shaft of the cloak pin is broken. The edges of the two parts are sharp, suggesting that the damage may have been caused by brute force. The whole surface of the pin, particularly the front of the disc, is very worn and smooth. Parts of the detail of the design are almost obliterated, indicating that it was repeatedly polished over a long period of time (Figs. 11–12).

3.5 Bronze Horn

Eogan's description of the horn as a 'Class 2' instrument is derived from John Coles' classification of cast bronze horns from the southern part of Ireland.²¹ The larger end-blown instruments were made in three parts that were fitted together. None of the originals survive in a complete state. In all cases the mouthpiece ends are missing. There are several examples where the centre tube and bell are present. In this instance only the bell survives. Though broken into two halves when recovered, the horn pieces were re-connected using what appears to be paper on the inside and some form of filler. Though there is no record of a repair it is likely that this work was carried out by the National Museum of Ireland shortly after recovery. It is not possible to establish whether the break was caused by some violent action in antiquity or is the result of degradation of the bronze over time.

3.6 and 3.7 Bronze Rings

Both of these rings are of particular interest in that they both have approximately the same metal thickness and shape, yet one is roughly three quarters the size of the other. There is also a lot of wear present, particularly on the inside curves of both. The very fine finish suggests that continuous polishing may account for much of this smoothness but it is also probable that such obvious wear may indicate the possibility of another source, e.g., abrasion resulting from repeated moving contact with a rough material.

3.8 and 3.9 Bronze Rings

These rings are unusual in that great care that was taken to achieve the accuracy and complexity of their design. As is the case with the disc pin and rings 6 and 7, they appear to have been repeatedly polished. The metal finish is very smooth with very little noticeable deterioration. The design of the centre holes, with their distinctive shape and the further incorporation of the transverse holes, is very complex. Clearly this was done to fulfil an important specific function.

3.10 Bronze Ring

In this instance the centre hole of the ring is not as defined as in the case of rings 8 and 9. It is also lighter, though the transverse holes are very similar. It is possible that it was a less successful casting but still good enough to be of use.

3.11 and 3.12 Bronze Chain

The chain is a very fine example of bronze casting and finishing. The multiple links are even and uniform. Great care was taken to give them a smooth, regular finish. There is evidence of repeated polishing. It is not possible to establish if all the original links are present. However, they can be connected in such a way as to form a balance over the whole length (Fig. 13).

One large double, a double and four triple links are still connected by a small strip of sheet bronze at the end and five cast circular pieces, each with a gap at one point. Thus, one link was attached to another by fitting an end of each into a circular piece

²⁰ E.g., Eogan 1974.

²¹ Coles 1963.

at the opening and then squeezing the piece closed. If all the surviving links are to be joined together a total of ten connecting pieces would be required. The small strip of sheet bronze may have been a part of the chain when it was originally made, though it is more likely that this was a replacement for a ring that was lost, i.e., a repair made in antiquity. To join all the surviving links another five circular pieces would be required. The fact that so many connections are missing may be explained by the chain's having been yanked or pulled very hard so that when subject to pressure the circular pieces were spread and the openings widened enough so that the chain links could fit through and become separated and the pieces lost.

4 Interpretation of Interconnection and Function

4.1 Sword

It may be deduced from the surviving part of the sword handle by comparison with a similar complete example that it was approximately 486 mm long in its original state. There is also a strong possibility that it was accompanied by a scabbard and belt that would have been fastened around the waist of the wearer. Swords from the Later Bronze Age can vary in length from 480 mm to 680 mm, so this is one of the shortest in the collection.²²

4.2 and 4.3 Socketed Axe Heads

In examining the axe heads, the presence of the crack in the side wall of axe head 'number 2' indicates that the head was at one time fitted with a handle. It therefore follows that the same applies to axe head 'number 3'. Thus, there are two axes of the same size and weight. Each could be wielded by the right and left hand of the bearer. This raises the possibility that they may have been used to practice a martial art similar to the double stick fighting disciplines or *kalli escrima* which are part of Philippian traditions today. It is also the case that provision would have to be made to allow for the pair to be carried on the person. This may have been achieved by attaching two loops on the belt through which the handles of the axes could be inserted and held close to the body.

4.4 Disc-Headed Pin

In proposing a practical costume or outfit for a person it is important to note that the hoard is described as being recovered in a leather skin. As this is now lost it is impossible to establish whether its

purpose was in any way related to the hoard, e.g., as a shirt, jerkin or jacket, yet the artefacts are associated with leather. Thus, it may be suggested that a leather shirt or jerkin was worn with a belt supporting the sword and axes around the waist. Therefore, a large pin would not be required unless there was a further outer garment such as a cloak or cape which was wrapped around the upper body and secured on the right or left at the front. There can be no doubt that great care, expertise and intricate workmanship was employed to ensure that the pin was decorated to have an impressive appearance. It was clearly made to fulfil an important visual role. Evidence of polishing suggests that the wearer wanted the metal to shine. An important aspect of bronze is that when highly polished it resembles gold in appearance, but unlike gold the lustre will fade with time and may only be maintained by repeatedly renewing the shine.

4.5 Bronze Horn Bell

Though only the bell-end of the original horn is present, there are other more complete examples with which we can make a comparison. One of these has two of the original three parts surviving and was recovered in 1875 at Clogherclemin, Co. Kerry.²³ There were five other horns included in this find. A common feature of the large end-blown horns is the presence of a ring attached to the centre of the long parallel centre tube at the back. Its likely use was as an attachment for a strap which was passed around the neck of the player and acted as a support taking some of the weight whilst the horn was being played. It would also facilitate performance in a parade. A similar arrangement is used for large saxophones in modern times.²⁴

4.6 and 4.7 Two Bronze Plain Rings

These bronze rings could be used for many purposes but there are features which may be clues to their original use.

- a) One bronze ring has a wider diameter than the other, yet they have both the same metal thickness and shape.
- b) Both rings are well worn, particularly on the insides of the curves.

²² Eogan 1965, 48–49.

²³ Eogan 1983, 91, 318.

²⁴ O'Dwyer 2004, 46–47.

Knowing that a belt would be required for the sword and scabbard, it is then possible to suggest that the rings will work as a buckle. An average belt for an adult needs to be approximately 120 cm long and 25 mm wide. One end of a leather strap of these dimensions is passed through both rings, with the smaller on the outside, and then looped back and secured to the strap behind it so that it can then be brought around the waist of the wearer. The other end may be fed from the back through, around and in-between the smaller and larger rings. The strap may then be pulled tight and the leather will lock between them. This buckle system may be found in use today. By making a leather strap fitted with two reproduction bronze rings it has been established that they do indeed work perfectly as a strong, practical and, easy-to-use belt buckle (Fig. 14).

4.8, 4.9 and 4.10 Three Bronze Rings

These three bronze rings have two unprotected transverse perforations through the body. The clue to their use lies in the transverse perforations or holes. They allow for thread or string to be sown through each side onto leather or cloth. Thus the ring is attached to the material from behind so that no tie is visible from the front. If a hole is then cut in the cloth corresponding with the keyhole-shaped bevelled one in the ring, a peg may be pushed through from behind. The distinctive 'key-hole' shape of the centre means that if there is a corresponding similarly raised ridge on the end of the peg, it may be inserted and twisted through 90°, whereupon it will lock in the ring. A small transverse hole drilled through the other end of the peg will allow for it to be sown onto another piece of cloth or leather. Thus, the peg on one side of a shirt or coat may be fastened onto the ring on the other side. The result is a very efficient and attractive button. This has been successfully tested by removing the sleeves, collar and original buttons from a simple leather coat and fitting three reproduction bronze rings and pegs. The result is surprisingly modern in its concept and functions as effectively as any other button system (Figs. 15–16).

4.11 and 4.12 Linked Bronze Chain

There is no way of knowing if all the original links are present in the chain. It may well have been longer. However, the length at 657 mm is enough to allow for its use as a strap passed around the neck of a person in a standing position. A leather thong tied to each of the end rings and then to the ring on the back of the horn presents the mouth-

piece to the lips of the player whilst the weight of the instrument is taken by the shoulders. The horn hangs from the chain or strap in a balanced way and is much easier to play. This arrangement also makes it possible for music to be played in a parade whilst walking. Eogan²⁵ points to the smaller connections on the original as being not strong enough to be used for any strenuous purpose as their ends are not joined. It has been established that the new reproduction, though it is made with the same arrangement, is perfectly able to take the weight of the horn without causing any stretching or damage.

5 The Making of the Reproductions

The horn and sword were made by Ancient Music Ireland with bronze casting by the Dublin Art Foundry in 1998. The method used was 'lost wax' and ceramic shell. A new mouthpiece was designed for the horn by Ancient Music Ireland. Note: Peter Holmes states that the horns were cast in antiquity using a two part dry clay mould with a centre core held in position by chaplets.²⁶ The other reproduced items including axe heads, chain links and rings, which were made by Lönze in 2012 from drawings and photos of the originals (Fig. 17).²⁷

6 Conclusion

In establishing an inter-relationship of uses for the artefacts of the Boobybrien hoard, known facts may be combined with suggested functions to gain a likely overall interpretation. The sword and axes are undoubtedly weaponry and could have been used as such. They may also have been worn for show or ceremony. Yet it would not be possible to wear them without a belt and thus a possible purpose is given for the pair of solid rings. Whilst it is not known if the skin in which the hoard was found fulfilled any function, yet leather is associated with the items and may well have been used as the material for part of a costume. Woven wool was also commonly employed in the Late Bronze Age as a material for clothing. For this project it was decided to use a simple leather coat with the collar and sleeves removed as an under shirt or jerkin. It was fitted with the 'button rings' and a length of herring bone woven wool was used as an outer cape held closed by the disc-headed

²⁵ Eogan 1983, 65–67.

²⁶ Holmes 1978, 165–188.

²⁷ Lönze 2007–2012.

bronze pin. It must be noted that these clothes are not made to reflect an original costume from the Bronze Age. They are designed merely to allow for the reproduction bronze artefacts to be displayed in a fashion that demonstrates the possible way in which the originals were employed. The horn is presented held in front of the player and supported by a linked chain strap. There is no record of music in the Bronze Age, but studies²⁸ have shown that the bronze horns of Ireland and Britain are acoustically complex and a variety of musical sounds may be played on them.²⁹ Many of the items that would be particularly visible when worn as part of a costume display evidence of repeated polishing. It would be natural for a performer to want to have the outfit to look as bright and as important as possible for special occasions such as royal or religious concerts. The amount of bronze used and the very fine workmanship of the hoard indicate that its owner was a person of considerable wealth and importance in the community. It may have been the case that all horn players were held in high regard, but as this is the only surviving known example of a hoard of this kind perhaps this player was a particularly famous or accomplished musician. Most of the artefacts are damaged or incomplete as if an effort was made to put them beyond use before being deposited. There is an ongoing discussion about the interpretation of depositions, basically

between a profane (hidden treasures, merchant's depots) and ritual (offerings) interpretation. The variety of interpretations for the growing number of deposited single objects and larger ensembles in the Bronze Age is immense.³⁰

The reproduction of the items allows us to demonstrate that they all may be combined in a practical and logical way to achieve a visibly attractive costume or outfit which would undoubtedly have enhanced the status of a horn player and impressed an audience in the Irish Bronze Age (Fig. 18).

7 Acknowledgements

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²⁸ O'Dwyer 2004, 39–44.

²⁹ O'Dwyer 1998, 337–339.

³⁰ Cf. Bradley 1990; Hansen 1994; Hänsel – Hänsel 1997; Fontijn 2002; Maraszek 2006.

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Fig. 1 Original bronze sword tang (photo by Maria Cullen O'Dwyer, AMI). ©National Museum of Ireland.



Fig. 2 Original bronze cup axe head (photo by Maria Cullen O'Dwyer, AMI). ©National Museum of Ireland.



Fig. 3 Original bronze disc-headed pin (photo by Maria Cullen O'Dwyer, AMI). ©National Museum of Ireland.



Fig. 4 Complete original Boolybrien hoard (photo by Maria Cullen O'Dwyer, AMI). ©National Museum of Ireland.



Fig. 5 Original belt buckle rings (photo by Maria Cullen O'Dwyer, AMI). ©National Museum of Ireland.



Fig. 10 Disc-headed pin mathematical interpretation part 2 (drawing by Simon O'Dwyer, AMI).
©Ancient Music Ireland.



Fig. 11 Triangle design on original disc-headed pin (photo by Maria Cullen O'Dwyer, AMI).
©National Museum of Ireland.

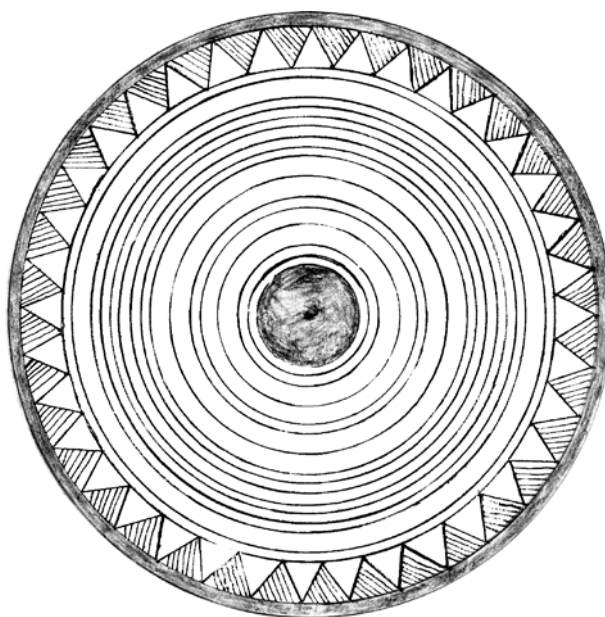


Fig. 12 Drawing of disc-head bronze pin (photo by Maria Cullen O'Dwyer, AMI).
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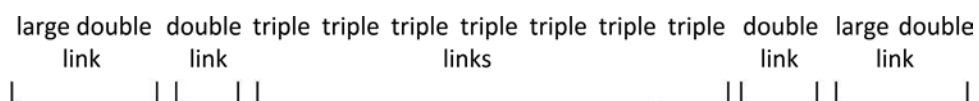


Fig. 13 Number of links chart (drawing by Simon O'Dwyer, AMI). ©Ancient Music Ireland.



Fig. 14 Reproduction of bronze belt buckle rings (photo by Simon O'Dwyer, AMI). ©Ancient Music Ireland.



Fig. 15 Reproduction of bronze button ring (photo by Simon O'Dwyer, AMI). ©Ancient Music Ireland.



Fig. 16 Reproduction of wooden peg (photo by Simon O'Dwyer, AMI). ©Ancient Music Ireland.



Fig. 17 Complete reproduction of bronze sword with wooden handle (photo by Simon O'Dwyer, AMI).
©Ancient Music Ireland.



Fig. 18 Complete reproduction of outfit with bronze horn, bronze chain, bronze sword and scabbard, bronze axes, leather jerkin with bronze 'buttons' and leather belt with bronze 'buckle', and woollen cloak with bronze disc-headed pin (photo by Simon O'Dwyer, AMI). ©Ancient Music Ireland.

Appendix

Notes on the Methods Used in the Reproduction of the Boolybrien Hoard

Holger C. Lönze

Zusammenfassung

Der Text erläutert die Wahl der Methode für die Reproduktion kleinerer Bronzeobjekte im Boolybrien Fund in Co. Clare, Irland. Weiterhin beschreibt der Text Einzelheiten des Reproduktionsprozesses und dessen Ergebnisse und Funde.

1 Reconstruction Methodology

The reconstruction of items for the presented display focussed on the smaller bronze objects contained in the hoard: chain links, rings, buttons, two axe fragments and the sunflower pin/dress fastener. Drawings with measurements, tracings and close-up photographs taken from the original artifacts by O'Dwyer contained sufficient data and detail to serve as a starting point for producing patterns for the reproductions. The aim was to fabricate the majority of the objects using materials and processes that were as authentic as possible to the Late Bronze Age (LBA) originals. Modern fabrication methods (green sand casting) were, however, employed where sufficient results could not be produced in time with authentic methods, i. e., in case of the sunflower pin and 50 % of the chain links.

Careful examination of the originals, their close similarity in dimensions and proportions, as well as the efficiency of the chosen process led to the decision to favor timber patterns in combination with press moulds (bivalve ceramic moulds) over the 'lost wax process' for the reconstruction of chain links and rings. The lost wax process, however, was employed to make the two socketed axe heads. Both techniques have been re-developed by the Ireland-based experimental archaeology group Umha Aois¹ since 1995 and have provided repeatable and reliable results.² Ceramic mould fragments of previous sword casting experiments of the group showed close similarity to fragments found in LBA contexts at Lough Eskragh, Co. Tyrone³ in texture, composition and size.⁴ The stages of the reconstruction process included:

1. Examination of drawings, photographs and tracings by O'Dwyer.
2. Fabrication of wood patterns in ash wood.
3. Production of multiple press moulds (clay/sand/dung mix).
4. Drying and firing of moulds in bonfires.
5. Casting using charcoal-fired pit furnaces and 'horseshoe furnaces' with hand bellows.
6. Surface finishing using stones, sand and ash in combination with leather rags.
7. Completing remainder of the artifacts with alternative contemporary methods.

2 Reconstruction Processes

2.1 Chain Links, Rings and Buttons

Ashwood patterns were carved and finished as close to the provided drawings and photographs as possible using modern tools (saw, files, auger drills) and then finished with beeswax. Two batches of mould mix were then carefully prepared to provide an inner and outer layer of the moulds: a) a fine mix consisting of equal parts grey clay, fine beach sand, crushed mould fragments and horse dung and b) a coarser mix of equal parts grey clay, coarse sand, coarse mould fragments and grass cuttings. A sandwiched slab of these two mixes was then rolled out to a thickness of 8 mm and cut into small rectangles of equal dimensions (approx. 40 mm x 70 mm), two of which subsequently formed one bivalve mould into which the wooden

¹ An informal group of 10–20 sculptors, crafts people, archaeologists and researchers, both Irish and international, who meet once a year to experiment with Bronze Age (BA) metal casting methods, <<http://www.umha-aois.com>> (2008).

² Hansen 2008, 69–80.

³ Tylecote 1986, 89.

⁴ The similarity in consistency of the moulds was further confirmed by comparison of mould fragments found at Loughgall and reconstruction mould fragments from Umha Aois symposia during a research meeting with Barry Raftery, University College Dublin, in 2005.

pattern was pressed. After removal of the pattern, the ingate and airvent were added using a wooden stick and the two halves were finally joined using a clay slip as a binder. To prevent warping and splitting, the moulds were dried slowly and evenly under cover over a period of seven days and then bisque-fired in a bonfire (to approx. 500 °C). Low temperature firing in combination with a high organic fibre content results in a very fragile and crumbly texture that makes the moulds temperature-shock resistant and easy to remove after casting. For the casting, the bronze was pre-alloyed from 99 % pure copper and 99 % pure tin (tin content 10 %) and cast as small ingots. These were then melted a second time in charcoal-fired pit-furnaces using hand bag bellows. The crucibles held as much as 900 g of alloy and the moulds were consistently cast in a cold state with a metal temperature of 1,150–1,200 °C. To prevent splitting, the moulds were packed into a damp sand bed, dug into the ground. The mould was removed when the metal was still very hot in order to break off the sprue and air vent, thus avoiding further tooling of the casts. The surface was then finished and polished using a piece of wet leather with fine silt and ash as polishing compounds.

2.2 Axe Heads

As the axe heads were reproduced using the lost wax process, their patterns were first modeled using a mix of beeswax, ash and amber rosin. After spruing with two in-gates and one air vent at the rim of the socket, these were encased in the same mould mixes as described in 2.1, followed by the same stages of drying, firing, casting and subsequent finishing. The core was secured with two chaplets.

2.3 Sunflower Pin

The fabrication of the sunflower pin required a more complex system to achieve the precision in detail and exact circularity of the original artifact. The following pattern-making processes were identified as possible options:

- a) Creating a wooden press pattern with a treadle-operated pole lathe or bow lathe.
- b) Using a thin timber ‘compass’ in a circular motion, thus directly inscribing the negative space in the bivalve clay mould.
- c) Preparing a precise wax pattern and using the lost wax process.

Only process b) has been explored at this stage and only with limited success due to failure of the moulds during the firing process. The process involves making a profile ‘jig’ from wood that contains a central pivot. This pivot locates in a hole in a wooden base plate on which a 10 mm thick flat slab of clay is placed. The jig is then continuously turned and slowly lowered into the clay, thus inscribing a perfect circular space in the clay mould material (same composition as described in 2.2). A backing slab is then placed onto the first slab, forming a bivalve mould.

3 Outcomes and Findings

The fine and elongated form of the chain links and the relatively small pouring cups dictated by the process required the metal being poured at a relatively high temperature of c. 1,200 °C. Despite these precautions the failure rate was around 50 % (a total of 22 moulds produced 10 complete and 2 almost complete links). Increased venting in the moulds marginally improved the casting quality. These casting problems were not encountered with any of the larger rings or buttons, all of which were cast without difficulty. Equally, all four axe head moulds were cast without any failures or surface pitting. All gates, vents and sprues were removed in a hot state and subsequently no further time-consuming tooling was required. The process allowed insight into the high skill and effort required to reproduce artifacts that require only a small volume of molten metal and contain intricate detail. It was also found that the reproduction of the sunflower pin will require considerably more experimentation and research using a variety of possible reproduction methods and no definite method can be identified at this stage.

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