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Reviewed Article:

Replica of the Knife 2165 found in Flixborough a Late Anglo-Saxon Period Knife with an Inlay of Twisted Bronze and Silver Wires

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This work aims to show the reconstruction of a medieval era knife that was found in Flixborough, Lincolnshire (UK). Flixborough's Anglo-Saxon cemetery has returned a total of 11 knives that can be dated between the 8th and the 10th century AD. The specimen discussed

here is known as Knife 2165 and was found in context 3417 of the site. This knife is the smallest of the inlaid knives found in Flixborough...

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Knife 2165 belongs to the rare category of domestic knives that were decorated with inlays, along with Flixborough's knife 2046, knives 976 and 989 found in Mucking I necropolis and knife 2808 from Coppergate (Riley, 2015, pp.17-19).

When considering both knives 2165 and 2046, this decoration is even more interesting due to the fact that two metal wires instead of a single one have been used to create the inlay. These wires, of bronze and silver, were twisted together first and then hammered into grooves previously made on the blades.

A good description of Knife 2165 is provided by Ottaway (2009, p.393) in which it is described as inlaid with twisted silver and copper wires on both blade faces, with the wires on the right face being S-twisted and those on the left face being Z-twisted. Ottaway also reports the presence of a second groove on the right side of the blade. Lastly the authors affirm that the knife length is 56 mm, with a blade length of 42 mm, which is a discrepancy from the measurements provided by Riley.

It is important to note that the representation of 2165 provided in the same book (See Figure 9) is missing the second groove on the right side.

Since the graphic support is missing, it was decided to avoid reproducing this groove on the replica. Similarly, missing any information or hypothesis on the length of the full tang, it has been decided to reproduce it as it is depicted in the table, although incomplete.

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Similarily this knife has been published and carefully described, meaning that there is enough information to commence the reconstruction. Furthermore, the small size of the original have been considered a peculiarity worth investigating by actively using the reconstruction and then trying to understand whether its dimensions had a precise practical meaning or not (e.g. being so small it was best suited for working some materials instead of others, and other similar hypothesis).

This paper sets out to examine all the steps needed to obtain this kind of inlay, with two objectives. The first is to verify the feasibility of creating such a decoration using only manual tools, in order to hypothesize the use of such tools in the historical context, and to verify the hypothesis suggested by Panter (2009, pp.165-168) according to which the presence of tiny flecks of copper on the surface of an iron file may indicate the use of such tools during the fabrication of a number of objects, and the same tool may have produced some faint striations running across the blade of a knife. The second objective is to give the readers a step by step tutorial on how to decorate a knife with metal inlays.

This latter objective rises from the acknowledgment of how little is known about this technology. The author himself found notable difficulties in gathering detailed technical information on the correct way to use this technique before getting to work, therefore having to proceed through tentative steps and failures until beginning to obtain the first encouraging results (see video link below).

In his *I metalli nel mondo antico* the author describes this decoration as a kind of inlaying where a metal sheet is placed in the specific recesses of the basis. This means that metals of different colors are superimposed, which produces a particular chromatic effect (Giardino, 2010, pp.91-92).

Based on this kind of information, once a sufficient knowledge on how to inlay a metal blade was gained, the author decided to condense this knowledge in this article. This way the information will be available to all who could be interested in the matter and in applying this fascinated branch of metallurgy.

The reconstruction begins with choosing the metal for the blade. A rectangular mild steel plate with a thickness of 4 millimetres was chosen. This plate was shaped by removing the metal with a hand saw and a file. The final shape is that of a blade with a triangular section and a characteristic whittle tang.

Given the discrepancies between the knife size given by Ottaway (2009, p.393) (length 56mm, blade length 42mm) and that given by Riley (length 42mm) a decision was taken to follow Riley's description and make a blade that is 42mm long from the end of the tang to the tip of the blade.

All this work took two hours. It has to be noted that the author purposely avoided obtaining the blade by forging, mainly due to the small size of the finished object. Forging it would have meant a greater employment of time and resources, which on this occasion was judged to be a waste given the final objective of the reconstruction. On the other hand, a proper thermal treatment of the blade would have ended in a stronger metal.

Since this was not the objective of the reconstruction and taking into account the metallographic analysis related to the Flixborough finds (Starley, 2009) and those published by Tylecote (Tylecote and Gilmour, 1986) and Riley (Riley, 2015, pp.3-4), which all confirms the existence of Anglo-Saxon knives made out of bare iron, working by material removal was preferred over forging.

It is also important to note that at the Flixborough site, a knife blade has been found on which some “faint striations running across the blade” were noted, the cause of which was hypothesized to be the use of a file (Panter, 2009, p.166).

The next step was to create the grooves in which the twisted metal wires would be hammered.

When such a groove is prepared with this objective, it is important that the technical process of inlaying is clear. A wire of soft metal will be forced by hammering in the groove created on the surface of the object that will be decorated. Clearly, the latter has to be made out of a harder metal than the wire.

It is clear then that simply carving the groove would not be enough. This way the soft wire would be forced into it, but it would also slip out just as easily, should the groove keep a simple square section.

It is thus necessary to give the groove a trapezoidal section, its base wider than its entrance. This way the softer metal would spread into the base, therefore not being able to get out from the entrance. It would then be firmly stuck on the inside.

In order to obtain a trapezoidal section, it is important to use two different chisels. The first requires a stretched triangular section and is used to carve a groove that has to be as deep as the soft metal wire is thick.

The groove created will now have a vaguely triangular cross-section. Several passes with the chisel, directing it against the sides of the groove, are required to shape its section into a square.

At this point, the second chisel, with a flat cross-section, is used. By inserting the cutting edge in the groove and pressing it diagonally against the base it will now be possible to enlarge the base instead of the entrance, by hammering the chisel’s handle (See Figure 1).

This whole operation requires a still hand and the greatest care. It is important to carve a groove as linear as possible in order not to compromise the final aesthetic result. It is also important to use the second chisel firmly to make sure it will only work on the groove’s base and not on its entrance. This operation is vital to grant a strong grip of the metal wire that will be hammered into the groove.

A single badly-given hammer strike at this point of the work could compromise the solidity of the softer metal wire.

Once each groove has been prepared, the next step is to fabricate two twists of metal wires. As I did not have silver wire available for this reconstruction, a tin wire has been used instead (See Figure 2).

This material and the presence of the maker's mark MF on the replica are the main differences with the archaeological find. Other differences are the use of modern industrially made iron for the blade and the lack of the second groove on the right side of the blade.

Checking table 5.30 (See Figure 9) published in *Life and Economy at Early Medieval Flixborough* has been very important to have a visual idea on how to reproduce the twisted motif (Ottaway, 2009, p.384). The different metals used here are clearly shown in the table, where silver and bronze are represented with different colors. Thanks to this it has been possible to twist the tin and the bronze wires, trying to obtain a final decoration as similar as possible to that shown in the table, also taking into account its description (See Figure 3).

A first tentative decoration on the left side of the blade was an immediate success. Once the twisted wires were hammered into position and confirmed by touch to be firmly secured in the groove, hammering continued in order to make them as flat as possible. Once some fragments of bronze and tin began to detach and slip away from the blade, the biggest portion of both wires were already well inserted in the groove (See Figure 4).

The next step was then to remove the surplus wire by filing it with a triangular section file. At the end of this work, the result was very encouraging, with the twisted wires perfectly fitting the groove and almost totally adherent except for a tiny portion of circa 1mm (See Figure 8).

This imperfection is even more interesting when we consider the above-mentioned affirmation that is it is important to use the utmost care in carving the groove and widening its base with the chisels. The tiny void obtained in this otherwise perfect inlay attests that while using the flat cross-section chisel in that portion of the groove, its entrance was obviously damaged by either a badly given hammer blow or a lack of firmness in holding the chisel.

With regard to filing the blade it might be interesting to mention two more finds from Flixborough. These are two fragmentary iron files one of which still shows traces of copper in between its teeth. This is why Panter hypothesize that this file may have been used for non-ferrous metal-working and the present reconstruction may confirm this use (Panter, 2009, pp.166).

At this point, the whole groove carving was replicated on the right side of the blade. This time two pairs of twisted wires were prepared instead of a single one. The first was of the same dimensions as that used on the left side of the blade, while the second was resized with the file in order to remove that surplus of material that was lost while hammering the wires in the groove of the left side.

This latter pair of twisted wires was used on the right side groove and were hammered into it without losing the same quantity of material (See Figure 5). Removing that material early evidently weakened the grip between the two wires at the point and a small portion of the bronze wire detached and fell down before it could be hammered into the groove.

This loss, which this time is not due to an error during the making of the groove, is a further confirmation of the care that must be taken during every stage of a blade inlaying.

Once completed the second inlay, on the other hand, was much more similar than the first to the decoration shown in table 5.30, the different metals being more easily recognizable and spaced with more regularity. This characteristic is surely due to the fact that the second pair of wires were much more tightly twisted than the first pair, where the twist showed wider spirals (See Figures 8c, 8d, 8e and 8f).

In order to help better understanding all the sequences of metal inlay, a simple drawing is proposed where the knife is seen in frontal section (See Figure 10). The sequences can be resumed and explained as follows:

1. Using the triangular section chisel a groove is produced on the knife's surface. At the end of this phase the groove will have a rough square section and will therefore be unadequate to hold the softer metal wire hammered into it.
2. The square section chisel is now used to enlarge the groove's base on either side. This way a trapezoidal section will be created, and the softer metal can now be inserted into it since the entrance will be smaller than the base.
3. The softer metal wire (displayed in yellow in the drawing) is being hammered into the groove. Note that the groove's entrance width is matching the wire's diameter, which will enhance the grip once the wire is hammered in position.
4. Hammering the wire will cause it to expand into the groove filling its base, therefore making it impossible for the softer metal to slip out of the narrower entrance of the groove.
5. The last step is to refine the surface of the knife. As seen in this section, at this final phase of the inlaying the softer metal is filling the whole groove.

The final steps of the reconstruction consisted in creating a handle, for which ash wood was used, and in making a leather sheath (See Figures 6 and 7). It was decided to avoid decorating

these in order not to withdraw the viewers' attention from the blade inlays (See Figures 8a and 8b).

Lastly, I would like to thank the whole EXARC staff for reviewing and editing this paper. The biggest thank, however, goes to the Readers and Members of EXARC, for making all this possible.

Link(s)

Author's guide to metal inlay (Italian language)

Keywords (re)construction
knife
iron
silver
bronze

Country United Kingdom

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FIG 1. CARVING THE GROOVE ON THE LEFT SIDE. PHOTO BY MAURO FIORENTINI

FIG 2. THE GROOVE IS CARVED AND THE SOFTER METAL WIRES TWISTED. PHOTO BY MAURO FIORENTINI

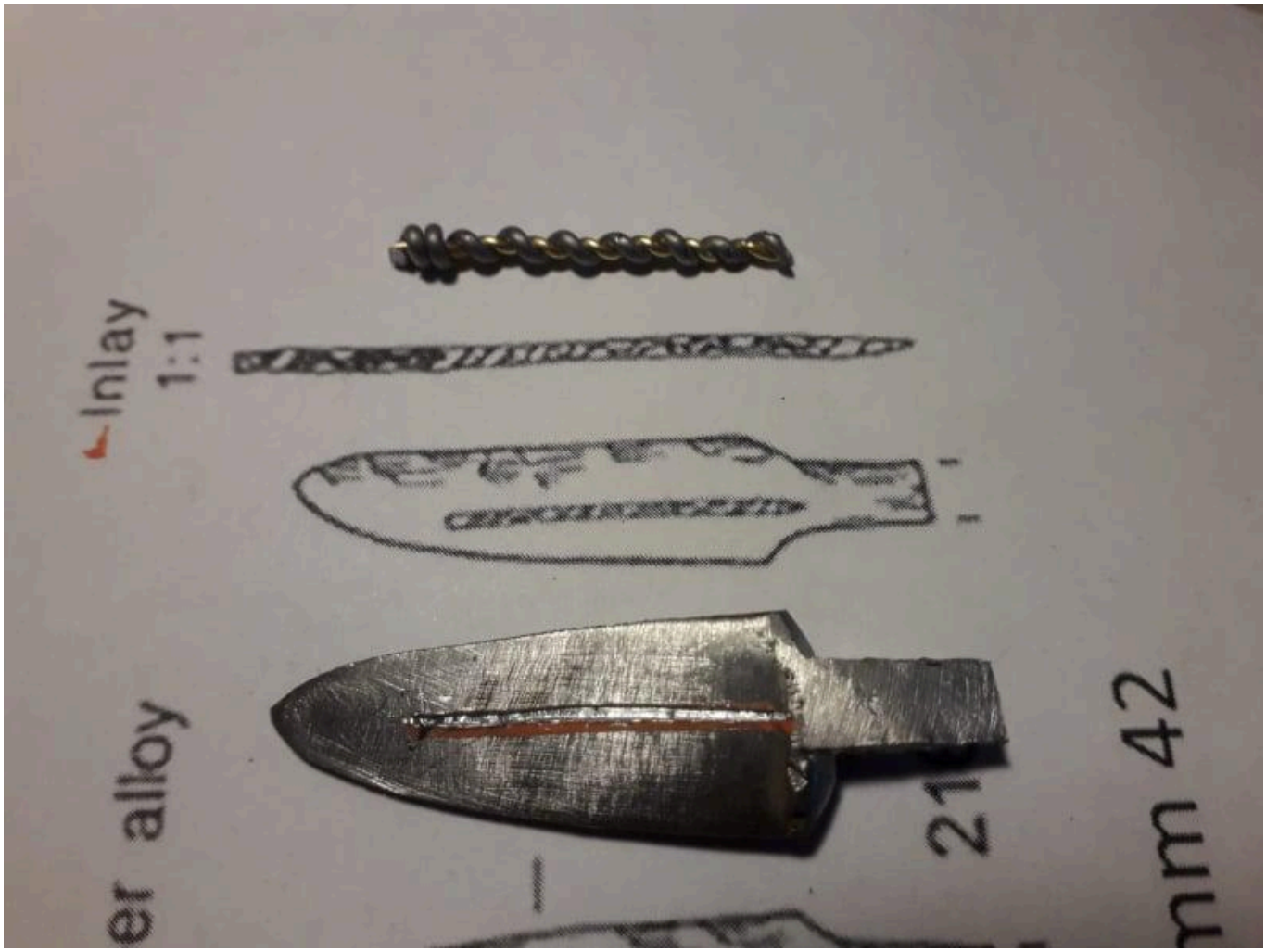

FIG 3. A COMPARISON BETWEEN THE PIECES FORMING THE REPLICA AND THEIR ORIGINAL COUNTERPARTS. PHOTO BY MAURO FIORENTINI

FIG 4. EARLY PHASES OF HAMMERING THE TWISTED WIRES ON THE LEFT SIDE GROOVE. PHOTO BY MAURO FIORENTINI

FIG 5. THE SECOND COUPLE OF TWISTED WIRES IS BEING HAMMERED ON THE BLADE'S RIGHT SIDE. PHOTO BY MAURO FIORENTINI

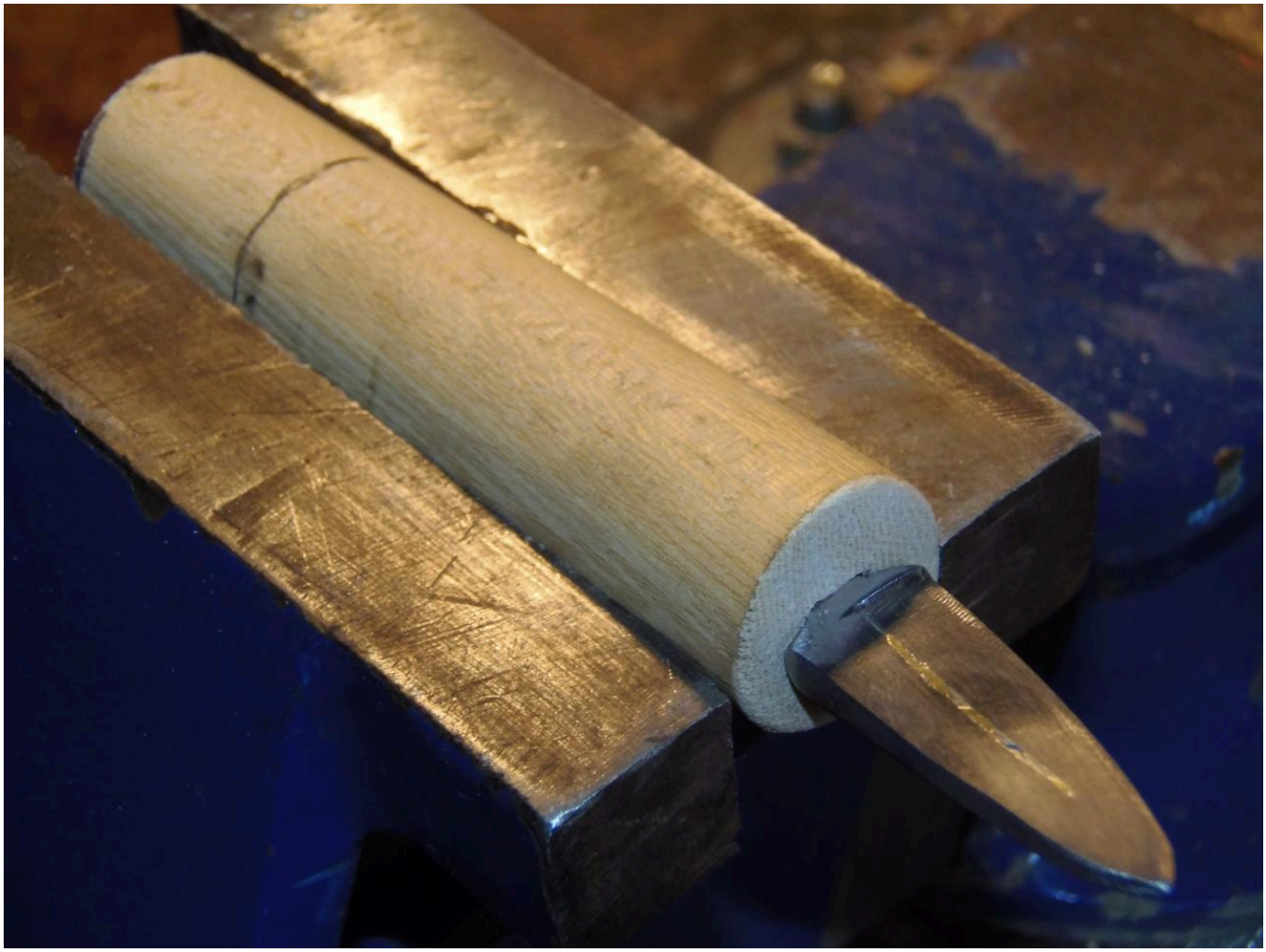

FIG 6. GROOVES HAVE BEEN FILLED WITH THE TWISTED WIRES, THE BLADE SURFACE HAS BEEN SMOOTHED AND IS NOT TIME TO WORK ON THE HANDLE. PHOTO BY MAURO FIORENTINI

FIG 7. THE HANDLE IS ALMOST FINISHED. PHOTO BY MAURO FIORENTINI

FIG 8A. FINISHED KNIFE, LEFT SIDE. PHOTO BY MAURO FIORENTINI

FIG 8B. FINISHED KNIFE, RIGHT SIDE. PHOTO BY MAURO FIORENTINI

FIG 8C. A CLOSE UP OF THE BLADE'S RIGHT SIDE SHOWS THE MAKER'S MARK AND LITTLE IMPERFECTION ON THE INLAY. PHOTO BY MAURO FIORENTINI

FIG 8D. ANOTHER VIEW OF THE FINISHED KNIFE. PHOTO BY MAURO FIORENTINI

FIG 8E. ZOOMING ON THE LEFT SIDE OF THE BLADE, WHERE THE INLAY IS CLEARLY VISIBLE. PHOTO BY MAURO FIORENTINI

FIG 8F. ANOTHER CLOSE UP OF THE BLADE'S RIGHT SIDE. IT CAN BE COMPARED WITH THE LEFT SIDE TO SEE THE DIFFERENCES IN THE INLAYS PATTERNS. PHOTO BY MAURO FIORENTINI

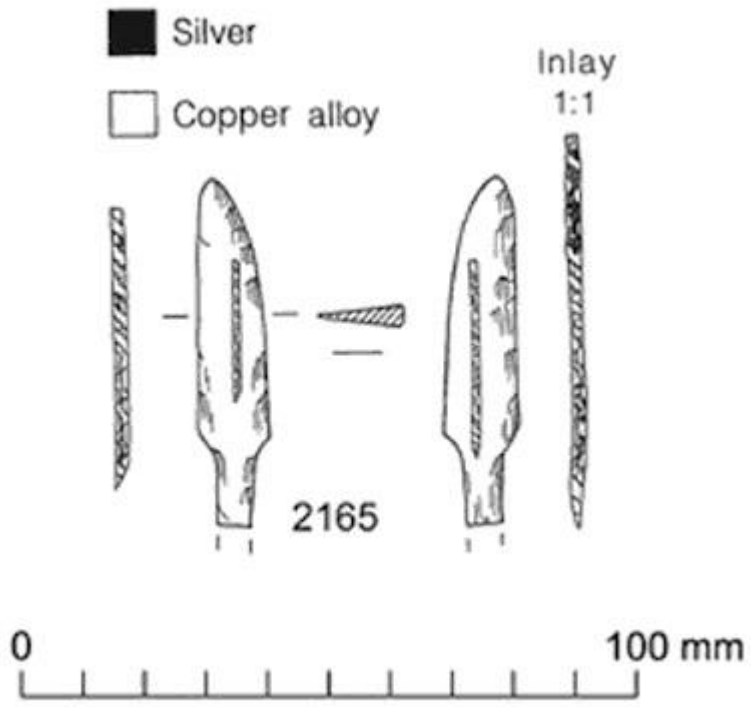

FIG 9. TABLE 5.30 FROM "LIFE AND ECONOMY AT EARLY MEDIEVAL FLIXBOROUGH"

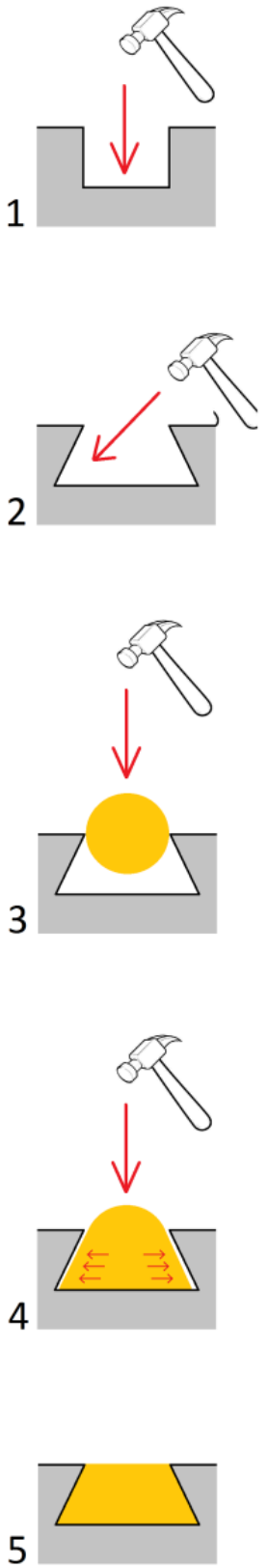

FIG 10. SEQUENCES OF INLAYING. IMAGE BY MAURO FIORENTINI