Reviewed Article:

The Arrowheads of the Squared-Mouthed-Pottery Culture: Reconstruction and Shooting Experiment

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This international experimental project focused on the production of replicas of different models of flat-retouched flint arrowheads (stemmed, with flat base, and ogives -with rounded base-) in use within the Neolithic Squared-Mouthed-Pottery Culture (SMP) of Northern Italy. The aim was to test their efficiency in order to understand if different morphologies of points produce different effects on the target. During the experimentation, an average penetration rate between 5 and 10 cm was registered. Both the models with a stem ("Italian type") and

those with flat base (used north of the Alps) are efficient, so it is supposed that their adoption could be due to cultural factors. On the other hand, none of the "ogives" remained stuck in the target, suggesting their interpretation should be considered as a preformrather than an arrowhead. The impact fractures registered on the replicas mostly have an oblique morphology that does not affect the re-use of the arrowhead.

> All the copies of the same replica were shot multiple times in a series, and a protocol was recorded. The variables that were taken into account were the distance from the target (5 m and 10 m) and the weight of the bow (23/28 lb. and 40 lb.).

Introduction

This experimental project is the result of an international collaboration between the Centro di Alti Studi Umanistici, Laboratorio Bagolini Archeologia, Archeometria, Fotografia (CeASUm LaBAAF) of the University of Trento (IT) and the Archäotechnisches Zentrum Welzow (DE). During the first phase of the project, a database was created in order to reconstruct the development of the arrowheads in northern Italy.

The flat-retouched flint arrowheads appear in Northern Italy within the Middle Neolithic Squared-Mouthed-Pottery Culture (SMP) around 4800/4700 cal BC. The first archaeological evidence was found in the regions of Lombardy and northern Emilia within Vhò (or Vhò-likely) contexts. Within a short time, around the beginning of the 5th millennium BC, the stemmed flat-retouched flint arrowheads are found across Northern Italy (with regional differences). This kind of arrowhead could then be defined as the "northern-Italian model" (Italian "Modello Padano"). This is a point realized with flat retouch, convergent stem, horizontal wings and triangular body. Occurring during the first phase of the SMP Culture (SMP I), they were likely to be produced out of blades, mostly of big dimensions and pretty standardized. The raw materials used came mostly from the mines located around the Lessini-Monte Baldo platform.

In the north-eastern part of the diffusion of the SMP I (in a territory that corresponds to the present regions of Trentino South Tirol, Veneto and eastern Lombardy), at the beginning of the 5th millennium cal BC the use of flat-based arrowheads had already occurred, attesting to intercultural contacts or intercultural communication across the Alpine region.

Around the middle of the 5th millennium BC, the second phase of the SMP Culture develops which covers an area slightly smaller compared to the previous phase. What characterizes this phase is the increased mobility of the human groups and more innovation. Evidence from the archaeological record shows that the sites were strongly inter-connected and exchanged raw materials on long-distance routes (obsidian from Southern Italy, green stones from Piedmont, quartz from the Central Alps, etc.). The Triveneto and eastern Lombardy show more regionalized traits. Here the arrowheads are more likely to be produced from

flakes (progressive change in the chaîne operatoire) rather than from blades and therefore are smaller. Moreover, a new type of arrowhead appears for the first time: the ogives.

This regionalized asset improves towards the third phase of the SMP, which develops contemporary with the SMP II but on a smaller area in the eastern part of the original area. Within the SMP III groups, the mobility increases and the production completely loses the standardization shown up to this moment. The supply of raw materials as well underlies new systems, showing clear evidence of a preferential exploitation of local mines. During these phases, the ogives not only increase massively in size but are available in the area in large amounts. The flat-based arrowhead type and the north Italian type are still found but without the standardization found in the first two phases.

From 4300 BC on in western Italy, the human groups' production of the arrowheads was clearly influenced by the French Chassey. In particular, it was noticed that the introduction of new raw materials in the archaeological record (es: Bédoulien flint) and new types of arrowheads (transversal blades and lozenge with concave basal sides). The models from the Chassey enter the SMP III area (in eastern Italy) in a late phase (SMP IIIb).

Aim

The objective of this experimental project was the reconstruction and shooting of replicas of flat-retouched flint arrowheads of the Squared-Mouthed-Pottery Culture (SMP) from selected archaeological contexts. In particular, the interest was to understand the technological aspects of the production and the use of the arrowheads: if there are differences in the effectiveness of the different morphologies (Italian type, north-alpine type, ogive) or if their adoption should be interpreted as cultural choices within each human group.

Materials

For the experimental phase of the project, three archaeological sites were selected, one for each SMP cultural phase: Fimon-Molino Casarotto (SMP I), La Vela (SMP II), Isera-La Torretta (SMP III and Late Neolithic).

Fimon-Molino Casarotto (Bagolini, et al., 1979; Bagolini, et al., 1973; Guerreschi, 1986) is a settlement in a wet area in the Vicenza province, where occupation has been recorded from the Neolithic to the Bronze Age. The lithic assemblage is mainly based on blades (82.5%). The flint arrowheads are highly standardized, mainly representing the typical north-Italian model with stem, but flat-based north-alpine types were recorded as well.

La Vela (Bagolini, et al., 1975; Cavulli, et al., 2002; Pedrotti, 1990) is an open-air site on an alluvial cone deposit of the homonymous river, north of the city of Trento where both anthropic levels of occupation and a funeral area have been found. The occupation of this site started presumably during the Mesolithic, and it developed throughout the Neolithic in many

phases (La Vela I-VIII). The flint arrowheads were produced on blades, and again the types are mainly north-Italian (stemmed) with the presence of flat-based north-alpine types.

Isera-La Torretta (Cavulli, et al., 2002; Degasperi and Pedrotti, 2002; Mottes, 2013; Mottes, et al., 2009), located just a few kilometers south of La Vela, is a settlement that developed on a natural hill and wherein 1990 three structures' rests were identified.

La Vela VIII and Isera-La Torretta have a similar chronology. At Isera: 4460-4248 cal BC (Mottes, 2013, p.94) and La Vela 4450-4350 cal BC and 4345-4265 cal BC (Mottes, et al., 2009, p.106). Although they belong to different stages of the development of the SMP Culture: La Vela to the SMP II and Isera to the SMP III, they clearly show evidence of a mosaic pattern of distribution of the human groups in the same area. In Isera, both of the previous models of arrowheads are known but whose morphology is no more standardized. Whereas the blade industry still prefers the north-Italian types. From this stage on in Northern Italy the ogives appear in large numbers. They are produced on flakes, and in many cases they show a very fast and irregular production.

Methods

For each of the three sites, some arrowheads were selected for reproduction and shooting. We produced three copies of each replica at 1:1 scale (named A, B, C).
The arrows have been assembled and constructed based on the archaeological evidence from Fimon-Molino Casarotto and other experimental data from the literature (Cavulli et al., 2002; Fischer, 1985; Grimaldi, 2008; Kelterborn, 2000). For an easier interchange of the points during the shooting experiment, we decided to mount the arrowheads on foreshafts and then mount them on the proper arrows.

Since it was not possible to reconstruct which material (binder/adhesive) the points were mounted on the arrows with, we decided to mount each copy following different protocols and variables: copies (A) with tar and vegetal string; copies (B) only with a sinew made from red deer Achille's tendon; copies (C) with tar and red deer Achille's tendon. The arrowheads were mounted on foreshafts made of Viburnum sp. With a length of about 10 cm each was properly cut so that the length of the point and the foreshaft were the best fit for the stability and dimensions of the whole arrow. A "U" slit had been carved with the purpose of holding the point in place. The shafts had a diameter of 8 mm and were produced out of coniferous wood by Wulf Hain.

The shooting test was carried out in December 2018 using a target - the carcass of a dead sheep on the third day after death, right after the rigor mortis has been concluded. Heart, lungs and liver were still in situ, but the intestine had been removed.

All the copies of the same replica were shot multiple times in a series, and a protocol was recorded. The variables that were taken into account were the distance from the target (5 m and 10 m) and the weight of the bow (23/28 lb. and 40 lb.).

Results

In total 60 arrows were shot, but only 42 hit the target and/or stayed embedded. The rib cage and the shoulders of the target were the most frequent hit areas. The head and the hind limbs were not hit at all.

The best conditions (good relationship between the arrow's weight, the bow's energy, and the possibility of stabilization during the flight) were recorded when the arrows were shot at a distance of 10 m with the 40 lb. bow. The average penetration was 8.37 cm deep and both the stemmed model and the flat basis registered peaks above 20 cm deep. On the contrary, the ogive did not penetrate the target at all, suggesting that maybe their function as arrowheads should be reconsidered.

Type (A) and (C) shafting yielded similar results in terms of penetration and durability; in fact it was possible to shoot them multiple times before they broke. There were frequent losses of the arrowhead from the shaft in Type (B) (attached with only deer's sinew) due to contact between the tendon and the organic substance.

The analysis of the macrotraces highlighted organic material (hair, blood and grease) on almost all of the arrowheads. Most of the macrofractures have an oblique development in the distal and/or proximal area that did not impede the re-use of the arrows. In only 3 cases there was a transverse fracture located at the point of contact with the shaft, but the proximal fragment remained inserted.

The dissection of the carcass showed that the vital organs (both lungs and liver) and some bones, especially the ribs, had been penetrated, confirming the efficiency of the arrowheads.

Conclusions

The results of the experimental project have shown that the best shooting conditions were recorded when the arrows were shot from 10 m of distance from the target, with the 40 lb. bow: the arrows penetrated deeper and had better stability during the flight.

The north-Italian arrowheads seemed to be extremely lethal, having an average of penetration of 18 cm (reaching in one case to 37 cm deep). The north-alpine type also reached satisfying results (penetration average of more than 8 cm). Since the efficiency of both the models appeared to be similar, we suggest that their adoption within each human group could be related to cultural choices and intercultural connections.

Importantly, the results of the shooting experimentation clearly illustrate that the ogives did not penetrate the target on any attempt. Their function as arrowheads should be revisited. The current interpretation could, therefore, be as a preform that could be easily carried around or stored/hidden and manufactured into tools at a later time.

Keywords bow and arrow
weapon
hunting

Country Italy

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Gallery Image

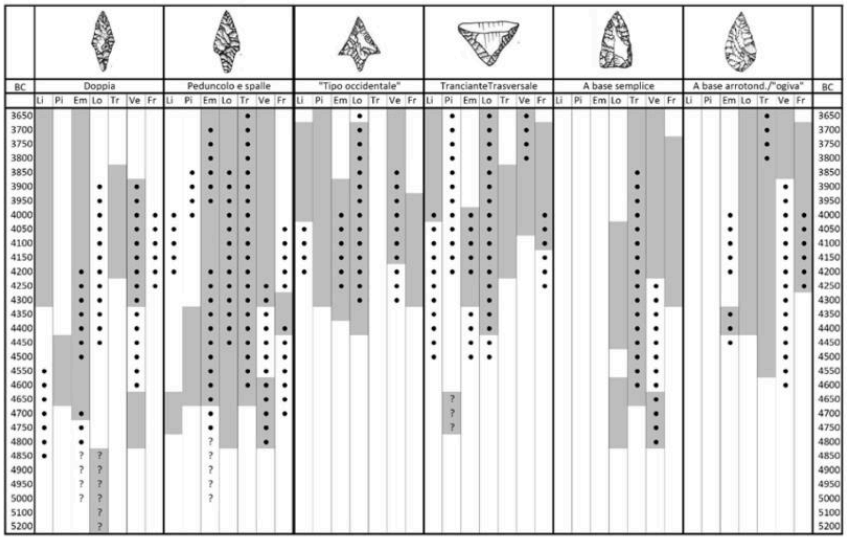
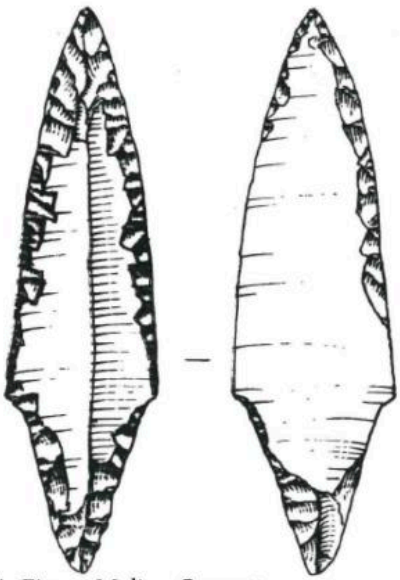
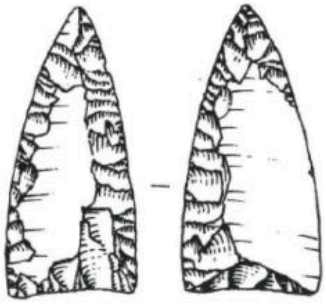


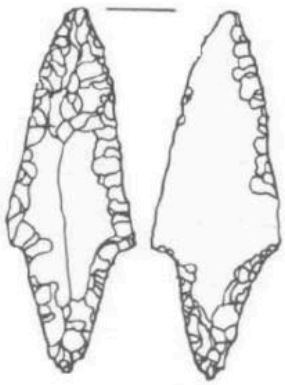
FIG 1. EVOLUTION OF THE FLAT-RETOUCHED ARROWHEADS IN NORTHERN ITALY DURING THE V MILLENNIUM BC. GRAPHIC BY M. SARTORI



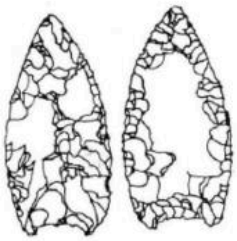
A. Fimon Molino Casarotto
(GUERRESCHI A., 1986: 86 fig 33)



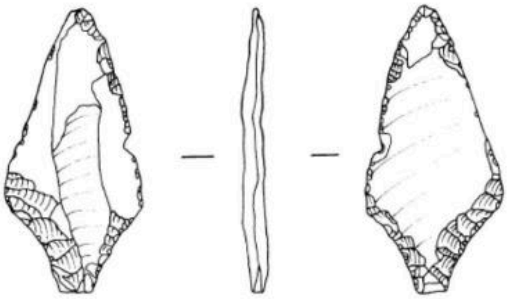
B. Fimon Molino Casarotto
(GUERRESCHI A., 1986: 86 fig 32)



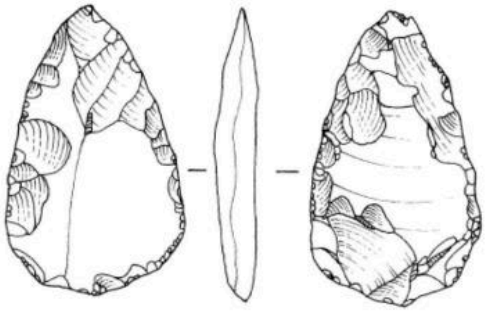
C. La Vela
(PEDROTTI A., 1990: 223 fig 6)



D. La Vela
(BAGOLINI B., BIAGI P., 1976: 4 fig 4)



E. Isera-La Torretta
(CAVULLI F., GRIMALDI S.,
PEDROTTI A., 2002 p 151 fig 9



F. Isera-La Torretta
(CAVULLI F., GRIMALDI S.,
PEDROTTI A., 2002 p 152 fig 11

FIG 2. SOME EXAMPLES OF ARROWHEADS FROM THE THREE SITES TAKEN INTO ACCOUNT WITHIN THE EXPERIMENTAL PROJECT: NORTH-ITALIAN ARROWHEADS (A, C, E); NORTH-ALPINE TYPES (B, D) AND OGIVES (F)

FIG 3. PRODUCTION OF THE ARROWHEADS' REPLICAS. PHOTO BY MADDALENA SARTORI

FIG 4. PRODUCTION OF THE ARROWHEADS' REPLICAS. PHOTO BY MADDALENA SARTORI

FIG 5. SHAFTING OF TYPE A ARROWS. PHOTO BY PHILLIP FEISTAUER

FIG 6. SHAFTING OF TYPE B ARROWS. PHOTO BY PHILLIP FEISTAUER

FIG 7. SHAFTING OF TYPE C ARROWS. PHOTO BY PHILLIP FEISTAUER

FIG 8. EXAMPLE OF A FORESHAFT READY TO BE USED. PHOTO BYPAOLO CHISTÈ

FIG 9. SHOOTING SESSION. PHOTO BY MADDALENA SARTORI

FIG 10. SHOOTING SESSION. PHOTO BY MADDALENA SARTORI

FIG 11. SHOOTING SESSION. PHOTO BY MADDALENA SARTORI

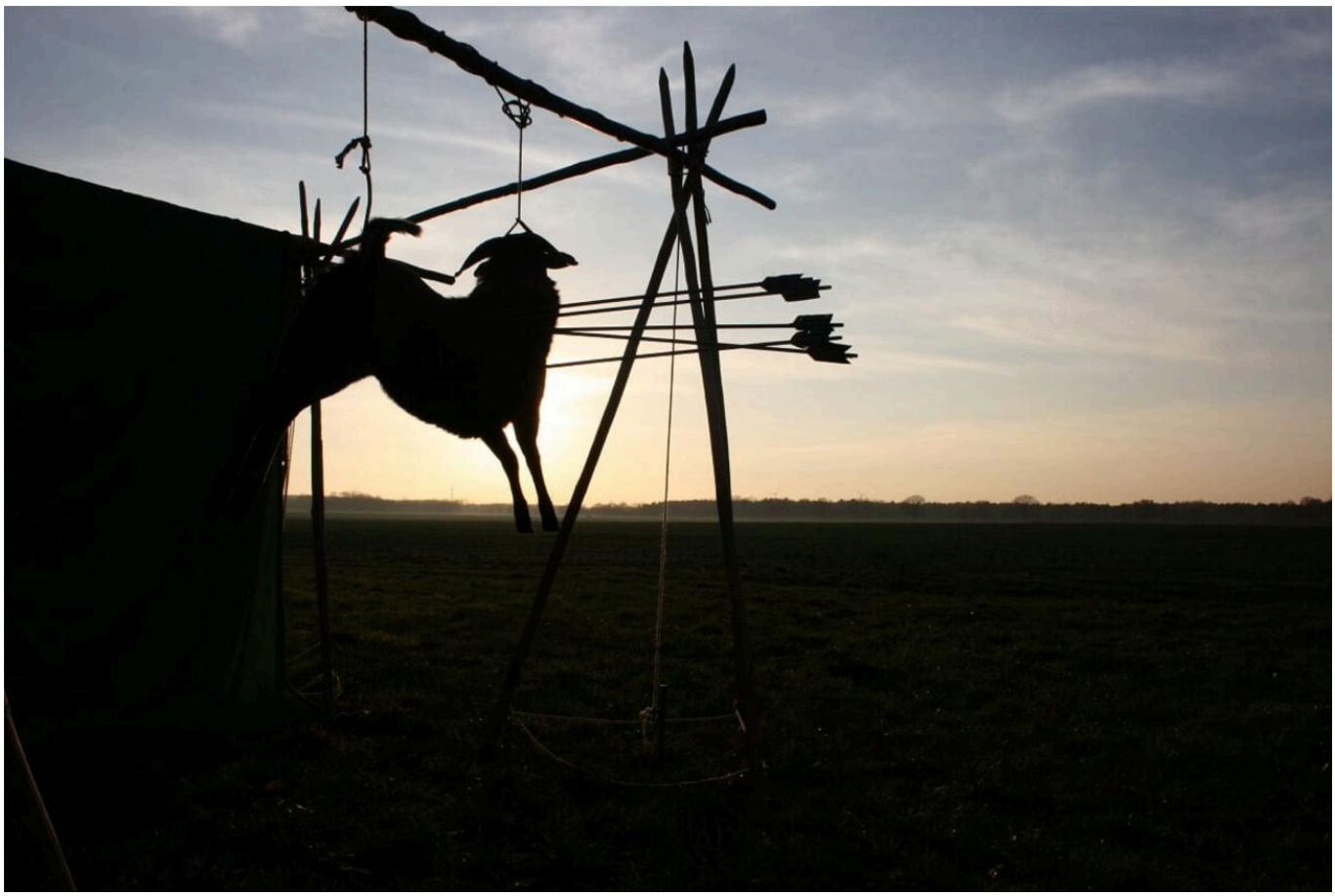


FIG 12. SHOOTING SESSION: ARROWHEADS THAT HIT THE TARGET. PHOTO BY MADDALENA SARTORI

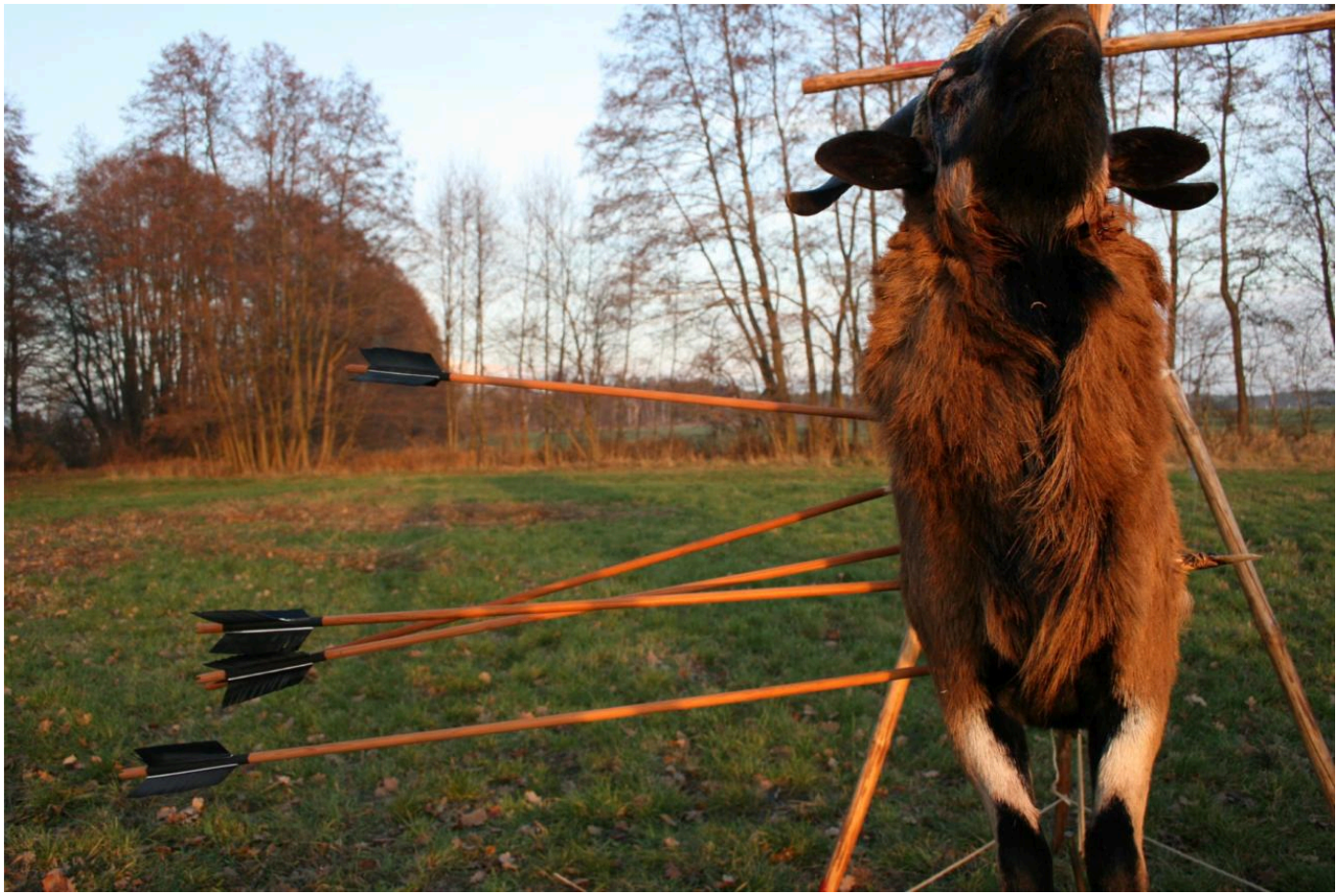


FIG 13. SHOOTING SESSION: ARROWHEADS THAT HIT THE TARGET. PHOTO BY MADDALENA SARTORI

FIG 14. SHOOTING SESSION: SOME OF THE ARROWHEADS THAT WENT ALL THE WAY THROUGH THE TARGET. PHOTO BY MADDALENA SARTORI

FIG 15. BUTCHERING: ARROWHEAD REMAINED STUCK BETWEEN THE RIBS. PHOTO BY MADDALENA SARTORI

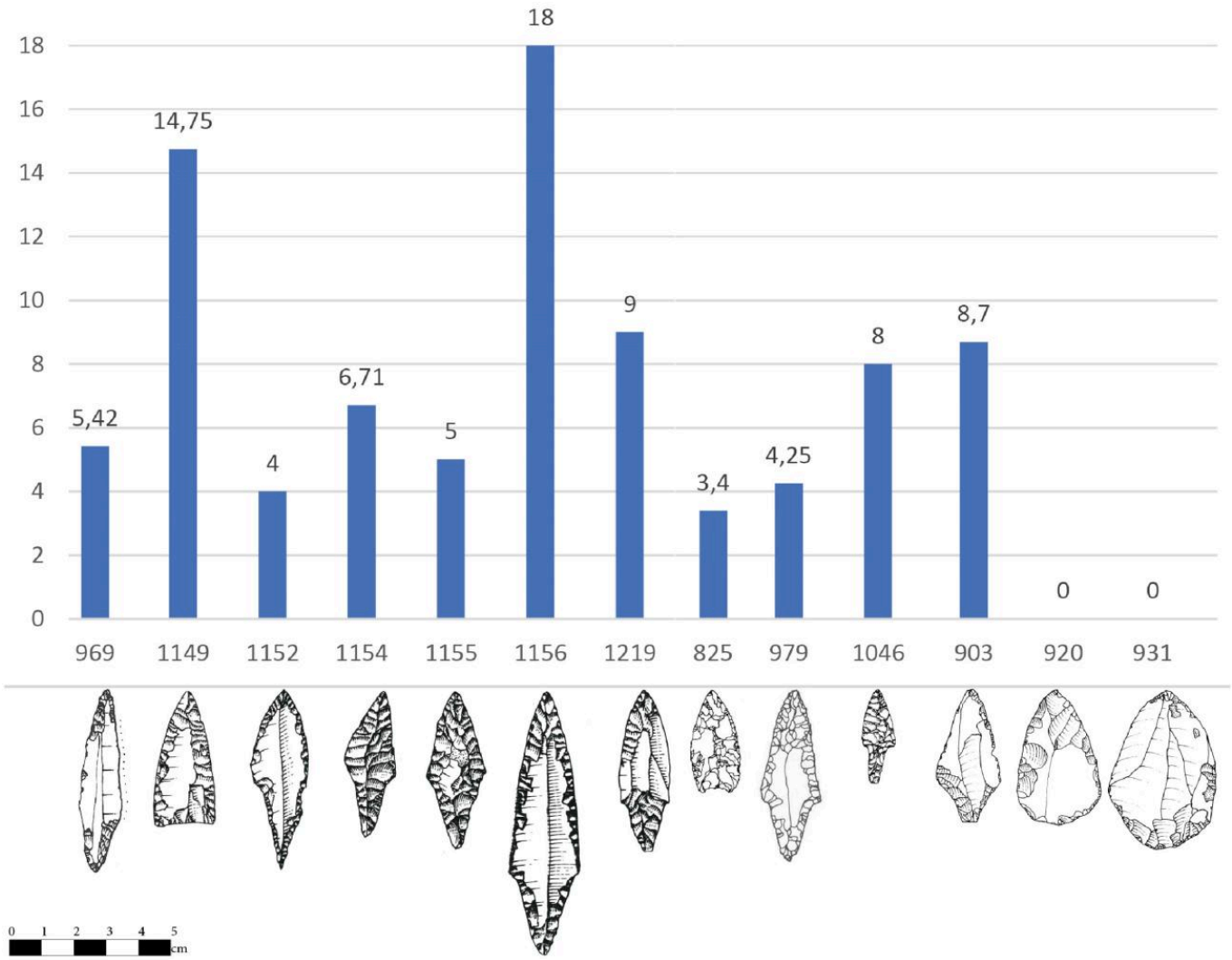


FIG 16. PENETRATION AVERAGE (IN CM) OF EACH MODEL OF ARROWHEADS. PHOTO BY MADDALENA SARTORI

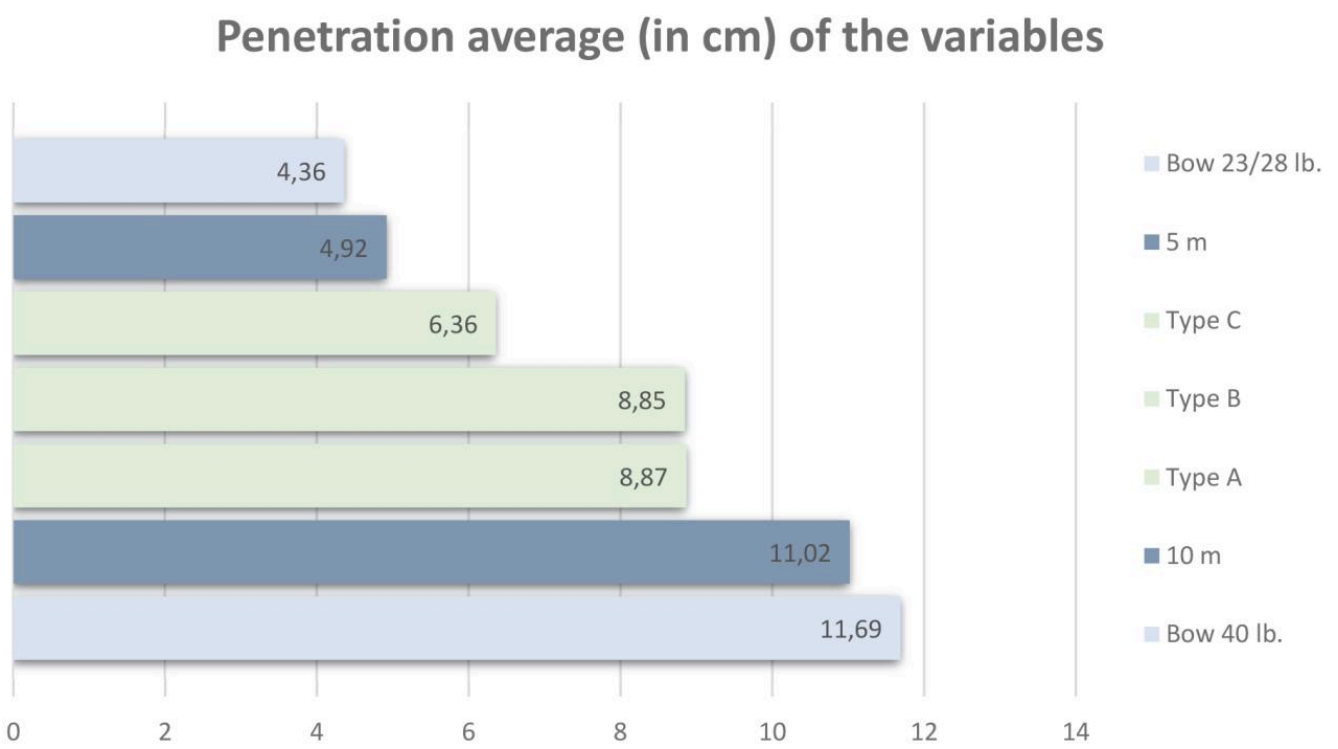


FIG 17. PENETRATION AVERAGE (IN CM) OF THE VARIABLES TAKEN INTO ACCOUNT DURING THE EXPERIMENT.

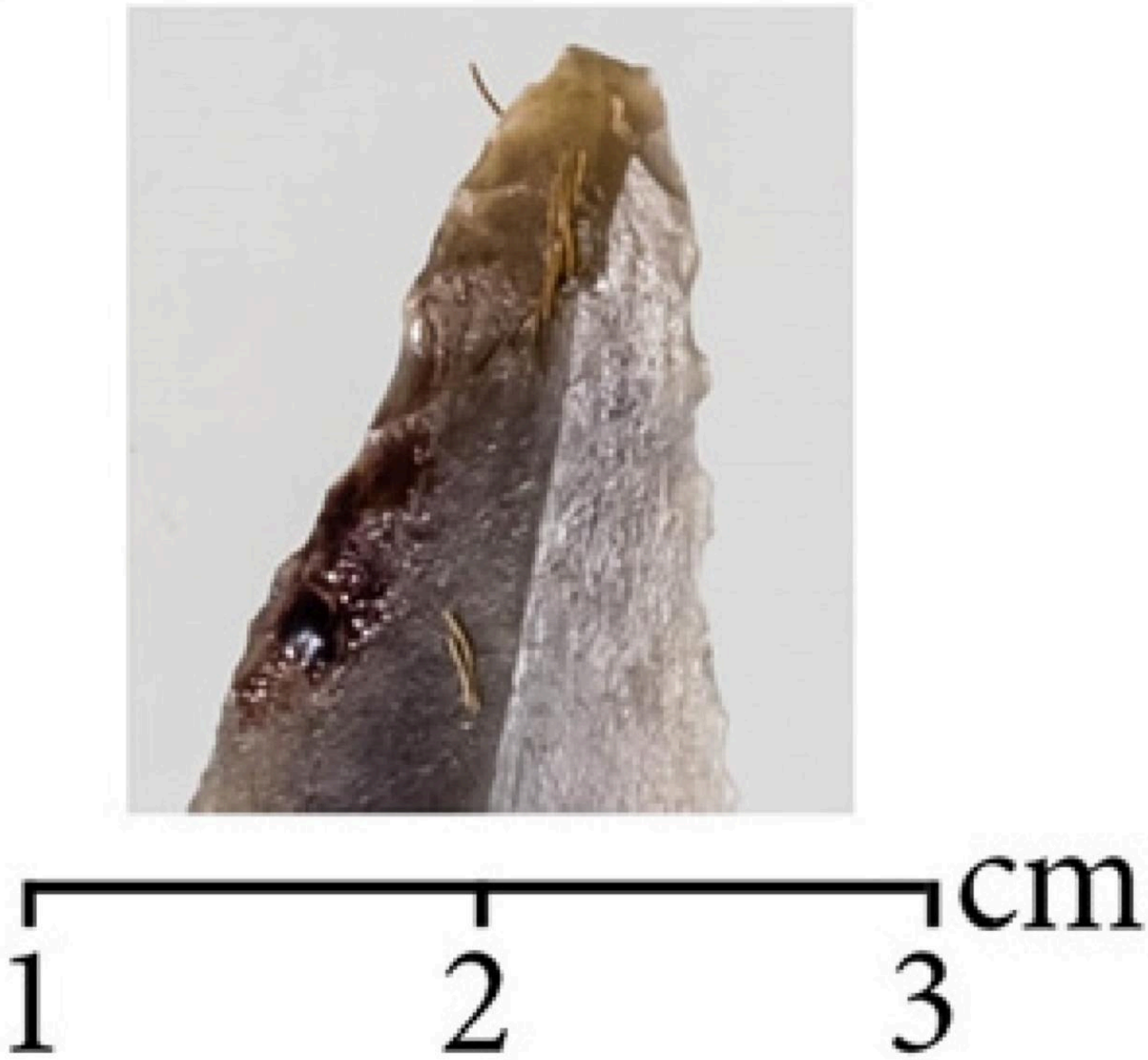


FIG 18. OBLIQUE MACROFRACTURE. PHOTO BY MADDALENA SARTORI

FIG 19. TRANSVERSE MACROFRACTURE. PHOTO BY PAOLO CHISTÈ

FIG 20. TRANSVERSE MACROFRACTURE. PHOTO BY PAOLO CHISTÈ