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Technology Geometric Decoration with Silver and/or Bronze Wires on Magnetite Patinas in the Armament of the Preroman Peoples of the Iberian Peninsula

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Abstract

In this paper we studied weapons had found in archaeological finds in the Iberian Peninsula pre-Roman times, in which have been observed the presence of magnetite patinas. The novelty of the study is the presence of silver wires with these magnetite patinas and what technology was used to it.

Keywords: Patinas; Decoration; Armament; Archaeological; Pre-Roman

Introduction

The archaeological materials studied in the research belong to the prehistory of the Iberian Peninsula, more specifically, pre-Roman cultures of centuries V-II B.C. In these centuries the Peninsula was inhabited by the Iberians, Celts and Celtiberians [1-4]. The weapons of these villages are very characteristic and specific. Something striking is that the weaponry generally has a layer of artificial magnetite with a geometric decoration of silver or bronze wire inserted in it, and also, widely practiced the rite of incineration [5-11]. This incineration has made many of the pieces that have been studied show modifications of importance [12]. Research has been carried out with pieces from the Necropolis de la Hoya (Laguardia, Álava (Spain)) (Figure 1), cemetery of incineration mid-fourth century BC, with the presence of funerary pieces corresponding to tombs of warriors. Has been examined a large samples of such weapons; have been extracting samples for study of the most representative pieces [1].

The samples studied represent the two types of patinas of magnetite used in weapons studied in the Second Iron Age in the Iberian Peninsula: direct magnetite on steel and magnetite on an intermediate layer of bronze or silver deposited directly on steel [11] (Figure 2). The aim of study is to show the patina of magnetite can have, or not, an intermediate layer of silver or bronze patina and how to set magnetite geometric decoration with silver or bronze. As an initial image we present reconstructions of Celtic weapons made by Encarnación Cabré [12] (Figures 3 and 4).

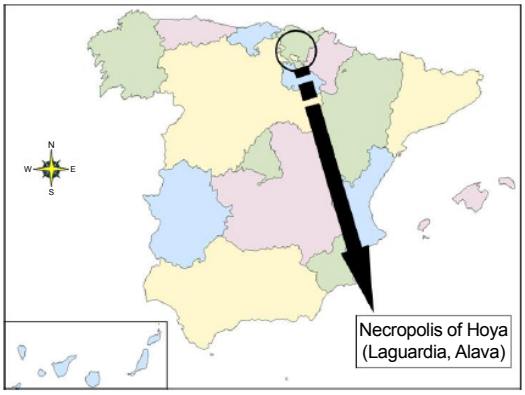

Figure 1: Location on the map of the Iberian Peninsula of the Necropolis de la Hoya (Laguardia, Álava).

Experimental Technique

The samples studied are representative of these pre-Roman techniques of the Iberian Peninsula to get on weapons and other fixtures, a layer of matt black magnetite in which profuse geometric decorations were made with silver or bronze wires. The two varieties of patina, simple magnetite or bronze-magnetite, depended on the piece to be treated. If the piece was complex, was used bronze or silver to brazing its entirety and, on this layer, he appeared magnetite patina, for example, in handles or pods. If the piece was simple, the patina of magnetite was produced directly on steel; Examples of this are the steel sheets of daggers, swords and spearheads, etc. [10,11].

On the magnetite patina, in both cases, the decoration appears

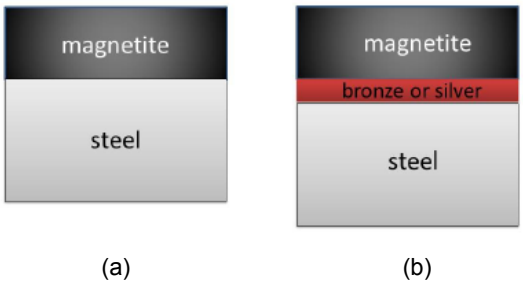

Figure 2: (a) The patina of magnetite is formed directly on steel. (b) The patina magnetite is formed on a film deposited on the steel bronze.

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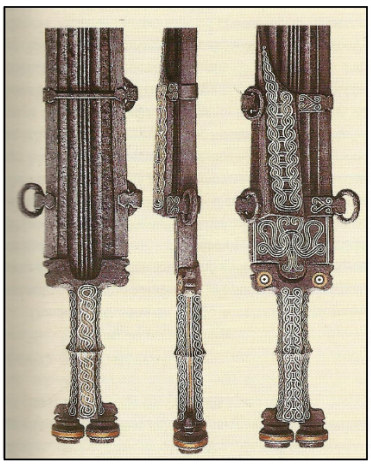


Figure 3: Celtic weapons from the Necropolis of the Osera (Chamartin de la Sierra, Ávila (Spain)) of the fourth century B.C. They are deposited in the National Archaeological Museum in Madrid (Spain).

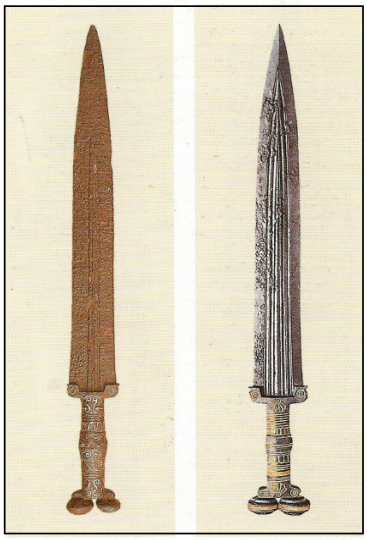


Figure 4: Celtic weapons from the Necropolis of the Osera (Chamartin de la Sierra, Ávila (Spain)) of the fourth century B.C. They are deposited in the National Archaeological Museum in Madrid (Spain).

on silver and/or bronze. The event subsequent to incineration of the corpse with their weapons, as was the custom in pre-Roman Spain, deteriorates in some cases a lot, and others less, the magnetite layer, so that the pieces found in the necropolis have significant degree impairment. Counting on this fact, we have extracted samples of pieces that we think could provide us with the information we seek about the way to make the decoration with silver and/or bronze on the patina of magnetite.

There are two parts examined for this research:

A. The front half of one of the leaflets that make up the pommel of a sword (Necropolis de la Hoya. Archaeological Museum of Álava) (Figure 5).

B. The scabbard of sword Monte Bernorio type [12-14] (Necropolis de la Hoya. Archaeological Museum of Álava) (Figure 6). Samples taken from the pieces were embedded in resin Mecaprex KM-U. Roughed by abrasive discs of Buehler grain 240, 320, 600 and 2000 in water; and subsequent polishing α alumina (0.3 microns) and alumina γ (0.03 microns) in Buehler polishing cloth. Chemical etching for metallographic observation by FEG should be very careful and free from residues of attack deposited on the target surface. The high quality of the microscopic observation of this instrument may be affected with a defective metallographic preparation and chemical attack.

The etching was performed with 4% Nital, and washed with distilled water in an ultrasonic bath. Samples were observed by conventional light microscopy (M.O.) and scanning electron microscopy (M.E.B.). For the observation of the samples in scanning electron microscopy, after preparation roughing, polishing and chemical etching, they were metalized with gold for 30 seconds with a current of 20 mA, and thickness of 3 nm gold. The scanning electron microscope with thermionic cathode of tungsten filament (FEG) used is JEOL model JSM 6400 that provides images and physic-chemical data of the sample surface. It has three sensors: secondary electron detector, the image resolution is 35 KV, detector to work at 8 mm distance with an image resolution of 3.5 nm and detector to work to 39 mm with an image resolution 10 nm. It provides backscattered electron images with an image resolution of 10 nm, an 8 mm working distance. In addition, you can perform qualitative elemental analysis (EDS) with a resolution of 133 eV.

Results and Discussion

The extracted sample of the part A, shows inlaid yarns silver artificial magnetite patina. It is an axial section; the images have been obtained by M.E.B., using backscattered electrons (Figures 7 and 8). We observed clearly the remains of the primitive patina of magnetite,

Figure 5: Image Part A: pommel of a sword presented magnetite black patina and geometric decoration with silver wires.

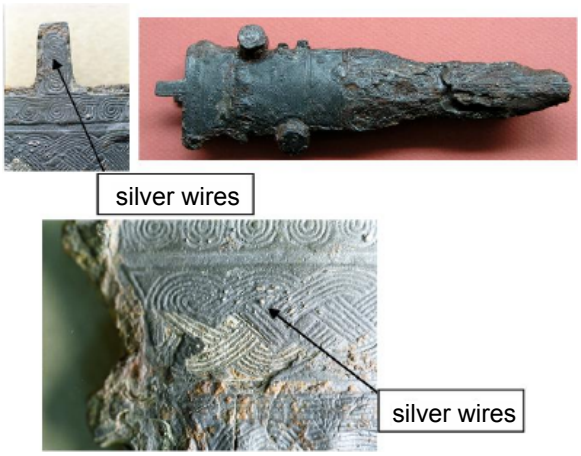


Figure 6: Image Part B: sword scabbard Monte Bernorio typology, with patina silver-magnetite and geometric decoration with silver wires.

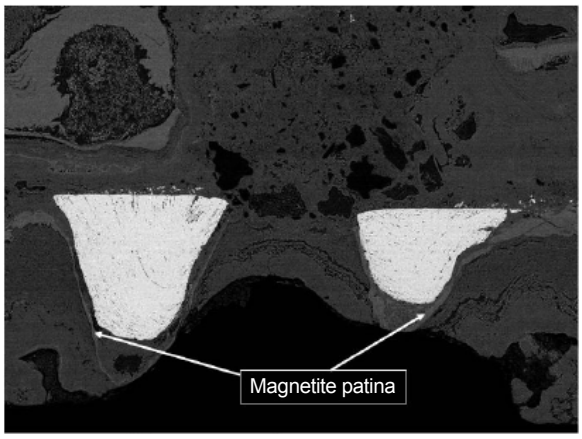


Figure 7: Image obtained by SEM with backscattered electrons of the axial section of silver wires on the remains of the patina of magnetite.

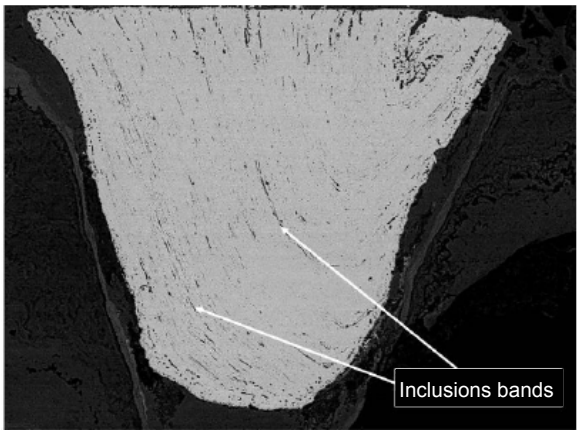
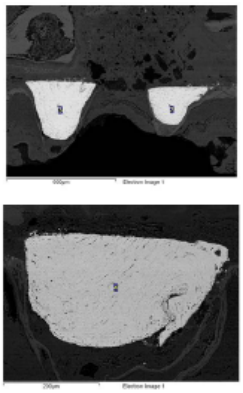


Figure 8: Bands inclusions outlining the hole in the patina of magnetite.



Spectrum	Cu	Ag	Total
2	2.94	97.06	100.00
3	2.99	97.01	100.00
4	5.79	94.22	100.00

All results in weight%

Figure 9: Results of the analysis performed by EDS-EDX.

badly damaged by the incineration process produced (Figure 8). In detail, at higher magnification, of silver wires observed, in addition to the remains of magnetite patina, the internal structure of these silver wires (Figure 8). These bands of inclusions and impurities form the profile inlay yarn patina by cold stamping. Surely, they were beaten by a useful and hammer (Figure 8). The wires, analysis by EDS-EDX, confirm that the wires are of a very rich silver alloy (Figure 9).

It is evident that the silver wire decoration was applied after the patina of magnetite is created by cold drawing in the furrows of it. The grooves drawn in magnetite were carved on the base metal with a fine awl, before the creating process of it; following this order of operation (Figure 10).

A useful analogy of cold pressed, the silver wires in the furrows of the patina of magnetite, is that of a piece of metal by stamping. In Figures 11 and 12 a screw aluminum (DIN AlMgSi0.5, IN AW6063), cold stamping. Can be seen clearly bands or striations, inclusions adapted to the die (Figures 11 and 12). The extracted sample of part B, shows two silver wires on artificial silver magnetite patina (Figure 13). The sample has a very advanced corrosion state. The silver patina and the wires are visibly deformed by effects of incineration. In the Figure 14,

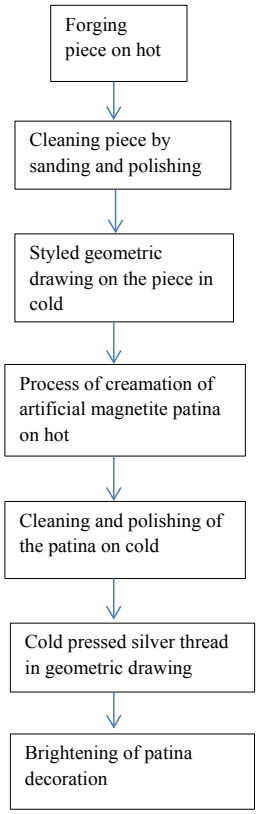


Figure 10: Order of operation before creating process.

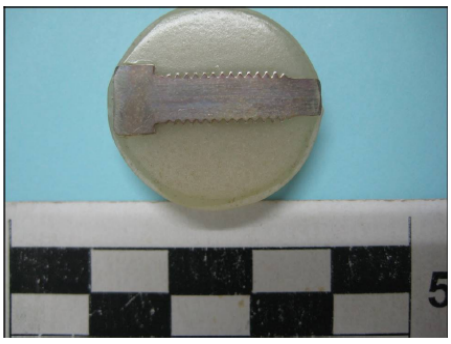


Figure 11: Image obtained by MO screw aluminium manufactured by cold stamping.

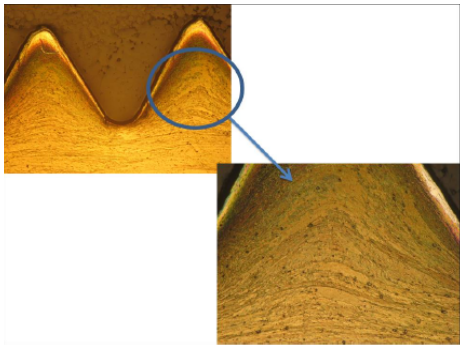


Figure 12: Image obtained by M.O. the structure of the screw stamping cold; bands showing inclusions adapted and aligned with the die walls.

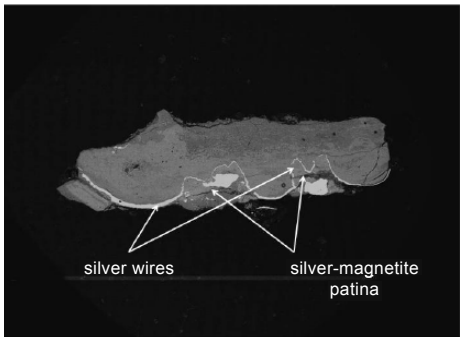


Figure 13: Image obtained by M.E.B. with backscattered electrons of axial section of silver wires on the remains of the patina silver-magnetite.

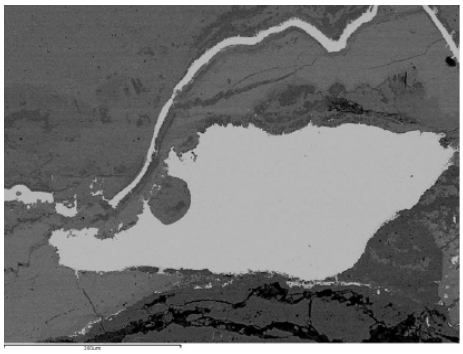
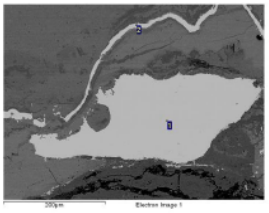


Figure 14: Image obtained by MEB with backscattered electrons. It is observed a very thin patina off silver-magnetite, and section silver wire decoration.

seen clearly, a fine patina of silver-magnetite, also the silver wire of the decoration, very deformed. What is very interesting about the piece B is that the patina is composed of bronzemagnetite, observed in numerous other pieces studied in this necropolis Hoya, which has been replaced by a silver-magnetite (Figure 15). We believe that it is a qualitative leap in the study of weapons of the Second Iron Age in the Iberian Peninsula, the existence of patinas silver-magnetite, which involves the use of brazing with silver, for the manufacture of parts composite, replacing the brazing. It is, at least, a curious detail, the use of silver, a more noble, scarce and expensive to manufacture bronzemagnetite metal patinas. Our proposal on the order of operations to perform geometric decoration with silver wires is as follows (Figure 16).

Conclusion

It has been demonstrated that silver wires of geometric decoration in pre-Roman weapons of the Second Iron Age (fifth to s.II BC) in the Iberian Peninsula were inlayed by pummel cold in the grooves made on the artificial matte black magnetite patina. The section of these yarns shows inclusions of bands aligned with the grooves in the magnetite, this is indicating they have been introduced by cold pressure. It has



Spectrum	Ag	Total
1	100.00	100.00
2	100.00	100.00

All results in weight%

Figure 15: Results of the analysis performed by EDSEDX silver-magnetite patina and wire of decoration.

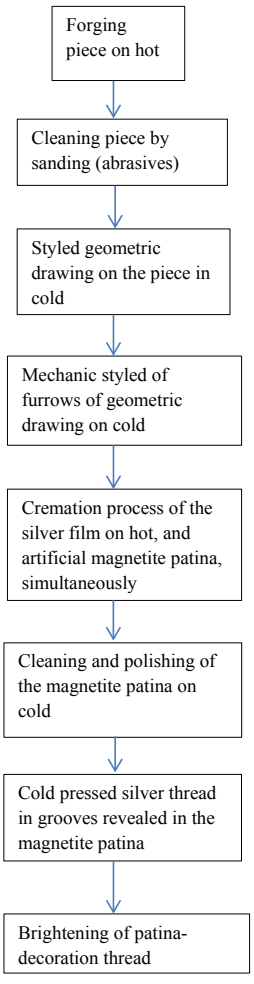


Figure 16: The order of operations to perform geometric decoration with silver wires.

also been shown that the decorative grooves in which silver wires are embedded are made in the clean metal part. The back and warm patina formation of magnetite or silver magnetite reproduces these grooves which is where the wires are inserted of the decoration.

A surprising fact of this research is to have shown that bronze-magnetite patina, in complex pieces of weaponry examined, can be silver magnetite. Silver is used instead of bronze as welding element in these composite parts.

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