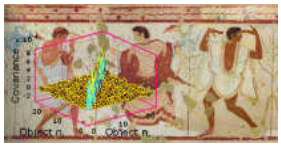

Cluster Analysis: a Precious Tool for Study Antique and Etruscan Jewellery from Castellani Collection

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Abstract

A new approach of elaboration of the compositional data carried out by using X ray energy dispersion system (EDS) trough cluster analysis method, has been applied to the study of two pairs of earrings "a bauletto" from Castellani Collection in exposition at the Museo Nazionale Etrusco di Villa Giulia of Roma. The study allowed to identify the differences between the Etruscan original parts and the Castellani goldsmiths reworking.

Introduction

The first pair of earrings N. Inv. 85019 (Fig. 1), is included in the part of collection called "modern jewellery", while the other one, N. Inv. 53580 e 53582 (Fig. 2) come from the group of "archaeological jewellery" [1].
The uniqueness of the items and their intrinsic value, owing either to the precious material either to the historical and artistic content, constrains the choice of an archaeometric investigation necessarily projected with not destructive methods. The exceptional importance of he jewels, induces to arrange new inedited methodological approaches connected to the possibility to individuate reshuffle of Castellani goldsmiths on the Etruscan objects. For the above reasons the study takes into account the dialectic ratio at the base of the goldsmith production Castellani.

Fig.1 - N. Inv. 85019 "modern jewellery"

Fig.2 - N. Inv. 53580 "archaeological jewellery", Cerveteri del VI sec. b.C.

To visualize the structural differences on micro/nano scale between the "hand" of Castellani goldsmith and that of the Etruscan craftsman, an innovative imaging approaches has been experimented. Different granulation reference samples realized in experimental archaeology by changing the soldering procedures, have been virtually reconstructed in 3D vision. With this method also he smallest variation of the metal structure can been evidenced allowing to distinguish the original parts from the restored ones.

Materials & Methods

The first part of the experimental has been carried out on the earrings pair produced in the 800' years. This has been realized trough superficial morphological analysis with the Scanning Electronic Microscopy and the elemental analysis of the micro areas trough Energy Dispersion system (EDS) [2]. The possibility to analyze earrings either really realized in the 800' years either of

certain Etruscan provenance, allowed to individuate the characteristics of the Castellani *officina* in the modern jewel and the to recognize the same in the restored earrings so to distinguish the original Etruscan working process. The modest composition variation and the not perfect localization of the Castellani's interventions, on micrometric scale, induced us to test an elaboration of the numerous data carried out by EDS microanalysis, by using the statistical method of the Cluster Analysis, that consents to establish areas of elements correlation [3].

The data statistical elaboration has been performed on 74 spectra acquired on different areas previously selected on the base of their technical content. Before any classification analysis, a correlation matrix is realized with he aim to evidence eventual connections among the precious alloy components and other added elements.

Results

In the earrings realised by Castellani in the 1800, the correlation analysis made us to suppose that the soldering alloy is a brazing alloy realized with an higher silver content. The copper seem to not participate, while the cadmium presence is lightly connected to the silver one. This led us to suppose its use as a cadmium mineral, CdS, thanks to its yellow colour that could mimetize the gold soldering. The cluster analysis (Tab. 1) allowed of identify the elemental composition of the lamina and the soldering.

Tab. 1 Cluster analysis – "modern jewellery"

Cluster	**N. Elements**	**Cu**	**Ag**	**Cd**	**Au**	
1	53	0.2	0.8	0.2	98.7	**Lamina**
2	21	0.5	3.1	0.6	95.8	**Soldering**

N. Inv. 53580. The most significant evidence revealed by the variables correlation analysis is that the decrement of the Au concentration in the jewel, depends from the presence of Cu e Cd (his means the presence of soldering areas by copper salts with some modern interventions by using cadmium). Beside no direct proportionality relation is detected between Ag e Cu. This means that in the analyzed areas the two elements are not correlated and this yields to the exclusion of any utilization of Ag-Cu alloy.

N. Inv. 53582. The decrement of the Au is correlated to presence of Ag (silver joining) and Cu (copper soldering). The correlation Ag-Cd is relevant because lead us to consider that the cadmium has been utilized in addition to silver soldering.

Conclusions

The study on the Castellani collection has been particularly complex, giving reason to the numerous papers and documents on this noble family. In fact the big amount of interpretations reported induce to hypothesize that no only an unique procedure has been adopted in their *officina,* but new experimentation have been applied either for the realization of the modern jewels either for the restoration of the ancient Etruscan manufact.

References

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