VIII Congresso Nazionale di Archeometria
Scienze e Beni Culturali: stato dell'arte e prospettive
Bologna 5 - 7 Febbraio 2014

# OPUS LEMOVICENSE: SPECTROSCOPIC CARACTERIZATION OF VITREOUS GEMS

**L. Bonizzoni[1*], A. Galli[2], G. Giubertoni[1], N. Ludwig[1], C. Maggioni[3]**

[1] Università degli Studi di Milano, Dipartimento di Fisica, via Celoria, 16 – 20133 Milano
letizia.bonizzoni@unimi.it
[2] CNR-IFN and Università degli Studi di Milano-Bicocca, Dipartimento di Scienza dei Materiali, via R. Cozzi, 53 – 20125 Milano
[3] Università Cattolica del Sacro Cuore di Milano, Scuola di Specializzazione in Beni Storico-Artistici, via Lanzone, 29 – 20123 Milano

The Poldi Pezzoli Museum was originated by the decision of the Milanese nobleman Gian Giacomo Poldi Pezzoli (1822-79) who wanted to make his art collections available for public use and benefit: they were gathered throughout all his life and housed in his private apartment in a family palace's wing, at 12 Corsia del Giardino (now via Manzoni).
Goldsmith's art very soon became one of his first objects of interest, so much that to house these pieces he furnished a *Cabinet* (1853-56), a highly sophisticated casket created with the most precious techniques that was to be his personal study too. Its arrangement is portrayed in the topographic inventory drawn up at his death in the presence of Giuseppe Bertini, curator of Poldi Pezzoli House, and Giuseppe Speluzzi, bronze smith and wood-carver, who had also taken part in its decoration.
The same group of collaborators -Speluzzi for goldsmith's works in particular- examined the new acquisitions joining the collection in order to value their conditions and the possibility of a restoration. However, the very concise hints in the documentation don't let us understand to what kind of maintenance/integration each object was submitted [1].
An interesting case is given by a processional Cross (n.1453, fig. 1), that can be referred to the later phase of limousine production (end 13$^{th}$ cent.) [2]. On the recto, figures of cast copper are fixed, brighten up with an enamel coat and surrounded by gems: the Crucified, in the archaic version of *Christus triumphans* -alive and crowned-, the Virgin, St. John and two saints. Many gems reveal tamperings in the pave.

Fig. 1. The processional Cross (later phase of limousine production, end 13$^{th}$ cent.)

Material characterization of the gems was carried out through XRF (X Ray Fluorescence) and FORS (Fiber Optics Reflectance Spectroscopy) analyses. These analytical techniques have been chosen because of their complete non-invasivity towards the art object and because they can be performed "in situ".
We used two XRF portable spectrometers showing different features: the Lithos 3000 (Assing) spectrometer and the Bruker's Tracer III SD spectrometer. XRF analyses allowed to detect medium-heavy elements in the vitreous gems, with particular attention to chromophore and opacifiers. In fact, low Z elements such as Si and Na cannot be revealed in our working conditions; nonetheless, information about the glassy matrix can be inferred by the relative presence of Ca and K, together with the evaluation of Pb [3]. Moreover, the possible presence of As as opacifier is a clear index of modern production.
Achievable information from reflectance spectra are linked to properties of light reflection, which results in a chemical and chromatic characterization of the gems. This kind of analysis, not so much used on amorphous transparent materials, gives indeed a huge amount of information about both chromophore and glassy matrix constituent [4, 5, 6].
Comparison between data from both analyses allowed to verify that all the gems, opaque turquoise ones included, are vitreous decorations, some congruent with the production of Limoges, some other surely substituted in the 19$^{th}$ cent.
More in detail, we have four types of gems: blue, red and green transparent ones and turquoise opaque gems. These last are particularly intriguing as they were supposed to be modern turquoise paste [2]. Experimental results indicates that they all are vitreous gems and that only one of them is compatible with medieval production, with Cu acting as chromophore. All the others were instead replaced during 19$^{th}$ cent. restorations and they show As as opacifier in addition to Cu. They were thus compared with the decoration gems of the Poldi Pezzoli *Cabinet*, contemporary to attested restorations: in this case, beside As as opacifier detected by XRF, Co bands were recognized in FORS spectra.
Red and blue glass gems show different behaviour, testifying ancient substitutions.
Green gems are quite peculiar, very transparent with reflectance near to zero, and a high Pb concentration. This result could be the statement of a recipe content in a cyclopaedic 14$^{th}$ cent. manuscript (British Museum, ms. Sloane 1754) for "false emerald" production: "*Who wishes to make a precious green, clear and bright stone from the crystal here composed, must take calcined, and grind it very fine. ...*".

## Acknowledgments

The authors thank sincerely Annalisa Zanni, Curator in Chief and Director, and the whole Poldi Pezzoli Museum staff for giving us the opportunity of carry out this research. A. Galli and L. Bonizzoni are grateful to Bruker Italy for placing Tracer spectrometer at disposal.

## References

[1] Zanni A., 1985. *Giuseppe Speluzzi: un artigiano restauratore*, in *Fatti come nuovi. Restauri di oggetti d'arte applicata nel Museo Poldi Pezzoli*, catalogo della mostra (Milano 1985-86), a cura di M. T. Balboni Brizza et al., Firenze 1985, 14-16.

[2] Galli P., 2004. Scheda n. 21, in *Restituzioni 2004. Tesori d'arte restaurati - XII edizione*, catalogo della mostra, a c. di C. Bertelli, Vicenza, 128-132.

[3] Schalm O., Janssens K., Wouters H., Caluwé D., 2007. Composition of 12-18$^{th}$ century window glass in Belgium: Non-figurative windows in secular buildings and stained-glass windows in religious buildings. Spectrochimica Act Part B, 62:663-668.

[4] Mirti P., Davit P., Gulmini M., 2002. Colurant and opicifiers in seventh and eight century glass investigated by spectroscopic techniques. Anal. Bioanal. Chem., 372:221-229.

[5] Ceglia A., Meulebroeck W., Baert K., Wouters H., Nys K., Thienpont H., Terryn H., 2012. Cobalt absorption bands for the differentiation of historical Na and Ca/K rich glass. Surf. Interface Anal., 44:219-226.

[6] Galli, A., Poldi, G., Martini, M., Sibilia, E., Montanari C., Panzeri, L., 2006. Study of blue coulor in ancient mosaic tesserae by means thermoluminescence and reflectance measurements. Appl. Phys. A 83, 675–679.