Gold application on gilded and enamelled glass objects from Southern Italy

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A group of gilded and enamelled glass, dating back to 13th - 14th century, was recently found in Melfi's Castle, a Frederick II fortress in Southern Italy. This production is comparable both with more recent Mamluk Syrian and Egyptian objects and with much more ancient Roman enamelled glass.
As far as the gildings are concerned, several different ways to apply gold on a glass/ceramic substrate are documented but they can be summarized in gold foil or "liquid" gold with or without heating. Special attention is given to the adhesion agents that allowed a certain resistance of the decoration for which different mechanisms were suggested.
The general objective of this study is to draw conclusions on possible commercial and cultural exchanges, while its specific aims can be summarized as such:
1) investigating the technological processes employed to apply gilding and understanding adhesion agents;
2) detecting the presence of tracing elements to hypothesize the provenance of gold.
Up to now, Raman spectroscopy, SEM-EDS analyses and OM observations were carried out on the enamels, whose pigments/opacifiers compositions were determined, and on the gildings. Gildings observations highlighted an irregular particle-like morphology that did not resemble that of a foil. As far as a possible medium or sub-layer working as a gluing agent is concerned, in our samples the experimental evidences are complex and diversified: 1) a frequent presence of manganese under and over the gildings, as well as an occasional presence of lead associated to the underlying manganese, was detected; 2) in few cases a red iron- and lead-rich enamel basis was observed directly below the gilding without a manganese intermediate layer; 3) in two samples gold was observed immersed into the red enamel, or into a green, lead based enamel; 4) in all samples Raman spectroscopy highlighted the occurrence of either amorphous carbon or an organic substance among the gold particles, occasionally found also in the manganese layer associated to gold.
For the elemental analyses, nowadays, the most accepted techniques are (LA)ICP-MS and IBA. However, (LA)ICP-is (micro)destructive and IBA techniques, despite being totally non-invasive, have inadequate detection limits for certain elements. In literature, as well as on ancient glass objects [1], SR-XRF studies on metallic objects are reported, aimed to the determination of the provenance of metals [2,3].
We believe that micro-analyses through SR-XRF associated to elemental mappings of the cross sections would be the optimal methodology to accomplish both our goals, thanks to the micronic spot and the high sensitivity fundamental to the resolution of the exposed problems.

References

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