Type of presentation: Poster

ID-6-P-2299 Scanning Electron Microscopy with X-Ray Spectroscopy and Focused Ion Beam (FIB-SEM-EDX), an innovative tool for non-destructive analysis of Gold jewellery

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The marketing of counterfeit jewellery is a problem that affects at all societies in the world. Traditionally, the instrumental analysis of Gold jewellery is made by techniques such as Atomic bsorption or Inductively Coupled Plasma Mass Spectrometry, however, these studies involve sampling methods that removing portions of the specimen. The purpose of this study was to develop a methodology that would enable the elemental chemical composition of jewels composed of a Gold alloy, without affect their integrity and monetary value.

Because the penetration depth of the primary electron beam is limited in relation to the total volume of each specimen, cross section analysis was made by FIB. The material used in this study consisted of jewellery pieces presumably composed of Gold alloys. Each specimen was subjected to a gentle cleaning process. The samples were subsequently inspected using a stereomicroscope, to verify the effectiveness of the cleaning process and the presence of singularities in their surface continuity.

Analysis by SEM-EDX-FIB, was conducted in a Dual Beam Workstation FEI QUANTA 3D 200i, equipped with a X-ray Spectrometer EDAX APOLLO XL. A section the surface of each sample was analysed by EDS. Subsequently, a portion of the sample surface was subjected to a cross section process, by FIB. and an image was obtained using the Ion Beam (SIM). Finally samples were viewed at backscattered electron and if was necessary, an EDS analysis of their layers was done and supplemented with a Bidimensional mapping.

The analytical procedure described above proved to be adequate. In several cases the observation by light microscopy, was sufficient to detect regions of samples that had different coloration on their surface, which was presumed that different layers of material were present. Further analysis of these regions, confirmed the differences in chemical composition by EDS studies. The cross-section images obtained by SIM, facilitate their interpretation, even by non-experts in the methodology (judges, prosecutors, among others), situation which is supplemented by Bidimensional mapping. These facts, together with others obtained during the criminal investigation may be useful to allow the association of various species of jewellery, which have in common the same elaboration process.

In conclusion, the implemented methodology proved to be a useful tool in the study of Gold jewellery . Being a procedure that minimally alters the evidence, allow to get a lot of information on this, without depreciating its possible economic value. Additionally, the results can be easily understood by non-experts, which facilitates submission to the court during the course of judgments.

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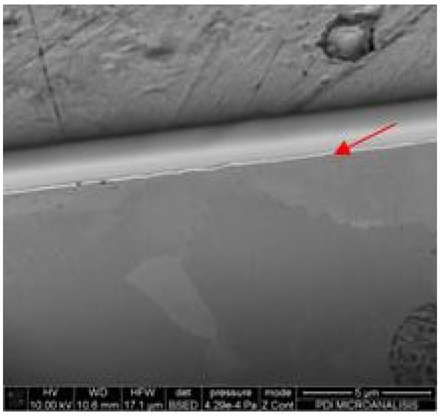

Fig. 1: SIM image of the cross section of a sample analyzed. The red arrow show a thin film of material, coating the solid mass of specimen.

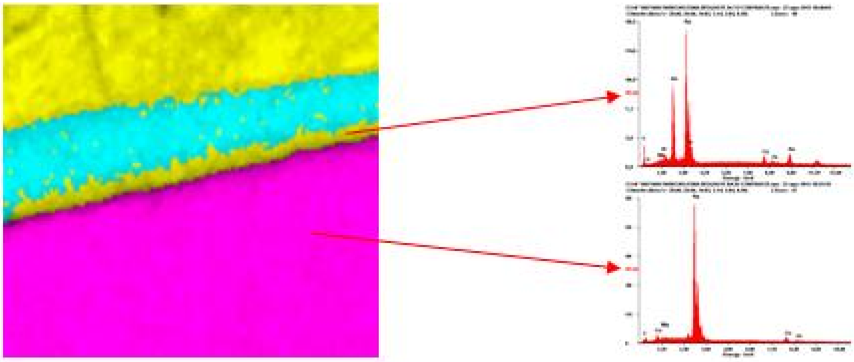

Fig. 2: Bidimensional mapping of a sample cross section. Pseudocolor representing the major chemical elements detected in the sample (gold and silver), as indicated by the corresponding X-ray spectrum. The blue area corresponds to the Platinum deposit made before cutting the sample.