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Combining SEM-EDS, PIXE and XRF Techniques for Complex Analytical Problems: Depth Profile Characterization of Prehispanic Gold

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Technological characterization of Pre-hispanic gold metallurgy has a wide deficit of analytical data upon which to build a synthesis, comparable to that made for ancient Europe. This contribution tries to fill the gap between the well established stylistic classifications and the scientific identification of the production processes. Our concern is mainly with gold and tumbaga alloys, lost wax technological processes, and depletion gilding.
The *Museo de América* (Madrid) keeps an important collection of pre-hispanic gold, the main part of which comes from Costa Rica and Colombia. The so called Quimbaya's treasure [1, 2] is a funerary set made up of 123 gold objects (originally near 200) dated to between 500-600 AC. It was found in two tombs in La Soledad, near the municipality of Finlandia (Department of Quindio, Colombia) and after its exhibition in Madrid during the 4th Centenary of the Discovery of America in 1892, it was offered as a present to the Queen Regent of Spain by the president of the Colombia Republic.

Some 50 objects from Costa Rica come from the South Pacific valley and the Diquís delta, although there is no information whatsoever about its archaeological context.
In the frame of a three years research project funded by the Spanish Ministry of Science and Innovation (Ref.: HAR2009-09298) we have designed a strategy for the study of the gold alloys, manufacturing techniques and surface treatments of these two groups of objects. Due to our previous experience [3, 4] and to the wide morphological differences, we thought in combining three analytical methods: SEM, PIXE-RBS and XRF, in order to measure the thickness of the gold enriched surface layer, and to allow access to high resolution, high magnification topographic images when possible. We have completed the first of a three stage program, which means the characterization of one third of the whole collection. Problems came from the abrasive cleaning methods used during the long history of the collection that have eroded the gilded layer almost to its disappearance in more than one case.

Preliminary conclusions point to depletion gilding as a standard finishing process in the Costa Rica production, while the Quimbaya objects show a variety of raw materials and technologies, from almost pure gold to tumbaga alloys, in masterly lost wax castings of big size, complex objects.

SEM-EDS analysis were performed at the *MicroLab* (CCHS, CSIC) in a Hitachi 3400 N provided with a Quantax 4010 energy dispersive X ray spectrometer from Bruker. For PIXE-RBS we used the Tandetron accelerator of 5 MV with an external microbeamline at the *Centro de Microanálisis de Materiales* (UAM). Finally, XRF measures were performed *in situ* with portable equipment.

References:
[1] C. Plazas, *Boletín Museo del Oro*, 1 (1978) 21-28.
[2] M. Cuesta and S. Rovira, *Los trabajos en metal en el área andina*, Ministerio de Cultura, Madrid 1982.
[3] J. Contreras, J.L. Ruvalcaba Sil and J. Arenas Alatorre, *Proceedings of the XI Int. Conf. on PIXE and its Analytical Applications* (2007).
[4] J.L. Ruvalcaba-Sil et al., *Tecnología del Oro Antiguo: Europa y América*, eds.: A. Perea et al. CSIC, Madrid (2004) 41-47.

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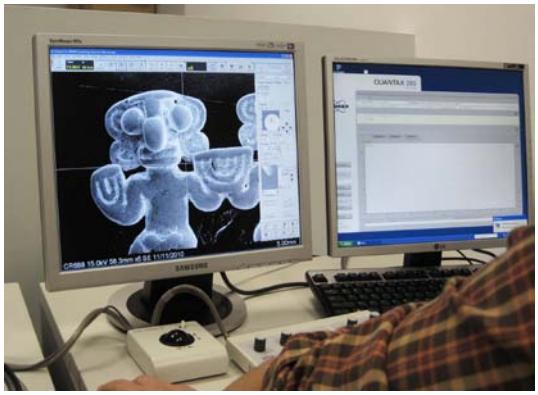

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1: Diquís style pendant from Costa Rica. Lost wax cast in a high gold ternary alloy. Coll. Museo de América, Madrid.

2: SEM-EDS equipment at the *MicroLab* (CCHS, CSIC).

3: "Poporo" used as a funerary urn from the Quimbaya treasure (Colombia). Lost wax cast in a tumbaga alloy. Coll. Museo de América, Madrid.

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