XRF LINE AND AREA SCANS IN THE EXAMINATION OF WORKS OF ART

Karen Trentelman, Getty Conservation Institute
1200 Getty Center Drive, Suite 700, Los Angeles, CA 90049; ktrentelman@getty.edu

XRF is widely employed in the study of works of art, in large part due to the fact that it is non-destructive, and, with the development of portable devices, can be applied *in situ*. While spot analyses have proven invaluable in the examination of many types of works of art, in many cases the spatial distribution of the elements present is as important as their identities.

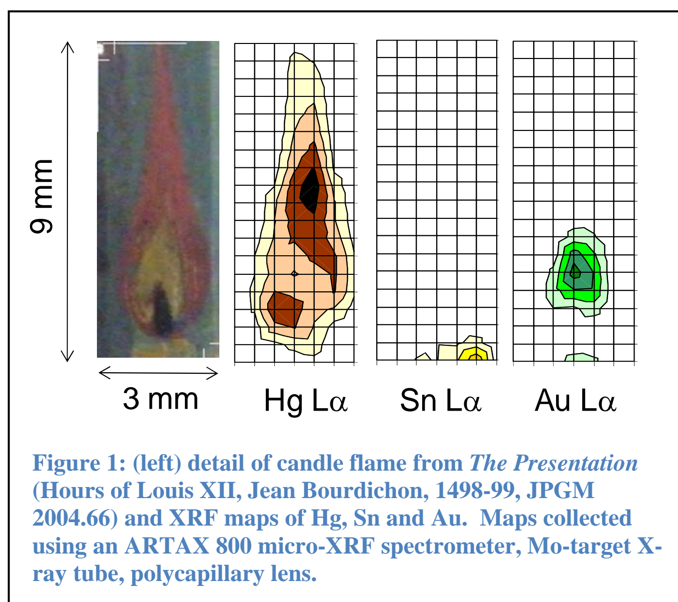

Figure 1: (left) detail of candle flame from *The Presentation* (Hours of Louis XII, Jean Bourdichon, 1498-99, JPGM 2004.66) and XRF maps of Hg, Sn and Au. Maps collected using an ARTAX 800 micro-XRF spectrometer, Mo-target X-ray tube, polycapillary lens.

Use of a micro-XRF spectrometer equipped with a motorized xyz stage provides the ability to generate element distribution maps and line profiles with sub-millimeter resolution. This resolution allows fine features in works of art to be probed directly, and their relationship to surrounding – or underlying – features evaluated.[1]

One particularly useful application of XRF mapping is in the study of manuscript illuminations. These paintings often contain extremely finely painted details, such as the candle flame shown in Figure 1. Though measuring only 3 × 9 mm, the pigments comprising the individual red and yellow components were identified with the help of XRF element maps. The red outer portion of the flame, containing mercury, is painted with the pigment vermilion (HgS). The candle, containing tin, is assumed to be painted with the pigment lead-tin yellow (Pb_2SnO_4). Interestingly, the artist chose to paint bright yellow core of the candle flame, measuring approximately 2 × 2 mm, in a different pigment – gold.

A number of examples of line and area XRF scans from a variety of works of art will be presented, including illuminated manuscripts, paintings, sculpture and ceramics. The potential for extracting information regarding the composition and relative position of hidden layers through a consideration of absorption effects and Compton scattering will also be discussed.

---

[1] Trentelman, K., Bouchard, M., Ganio, M., Namowicz, C., Schmidt Patterson, C., and M. Walton, *The examination of works of art using in situ XRF line and area scans,* X-Ray Spectrometry, published online, 2010 (DOI 10.1002/xrs.1242).