CHARACTERIZATION OF SILVER GELATIN FIBER BASED PHOTOGRAPHIC PAPERS USING X-RAY FLUORESCENCE SPECTROSCOPY

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Abstract

X-ray fluorescence spectroscopy (XRF) is commonly used in the field of Heritage Science and Conservation for the *in situ* and non destructive elemental analysis of a broad range of art and archaeological artifacts. In studies of fine art photography, both modern and historical, XRF is used primarily to identify the photographic processing chemistry and the nuances associated with chemical toning of the image layer. It can also be used to characterize the white reflective baryta (barium sulfate) layer between the image layer and the paper support in gelatin silver prints. Based on that information, Stulik has developed the concept of Individual Database Segment (IDS) analysis for barium and strontium in the baryta layer to support attribution and dating of gelatin silver prints[1]. XRF results have not been used to collect information from the paper support, even though it has the potential to contribute another dimension of data pertaining to the nature and abundance of inorganic fillers, pigments or sizing agents used in the paper support.

In this communication, we report on the XRF examination of more than 80 reference samples of silver-gelatin fiber based photographic papers commercialized during the 20th century, mostly by American manufacturers. This data was collected from the paper side, or verso, of the photograph. In addition to Ba and Sr from the baryta layer, XRF analysis reveals that papers contain elements Al, Si, S, K, Ti, and Fe, some of which appear helpful at determining a paper's provenance. The presence of these elements can be traced to the use of clay as filler for the paper and baryta coating; the titanium may be indicative of post WWII efforts to make images brighter than baryta. The relative abundance of these elements when examined by classification tree regression analysis allows the distinction of several different classes of papers. Considering that this regression analysis also assigns a specific production period to each of the reference paper categories, a methodology was derived and successfully cross validated and tested using some of these elements as chemical markers for the characterization of unknown papers and establishes their approximate production date.

Reference:

[1] D. Stulik and A. Kaplan, Proceedings of the 9th International Conference on NDT of Art, Jerusalem Israel, 2008, pages 1-11.