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BENEFITS OF APPLYING MICRO X-RAY DIFFRACTION TO THE CHARACTERIZATION OF ARTWORK

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This work examines the analytical advantages of applying micro X-ray diffraction (μ-XRD) in the investigation of materials used in Cultural Heritage. This non-destructive technique (NDT) enables direct analysis of samples, thus allowing further studies with other techniques. To apply μ-XRD to our chosen samples, a single-crystal diffractometer equipped with an areal detector (Bruker SMART APEX) was used. Since such equipment is now commonly available in X-ray crystallography laboratories, μ-XRD is less costly and more accessible than other techniques recently applied to study artwork, such as synchrotron X-ray microdiffraction,. Altogether μ-XRD is a feasible, non-expensive and non-time consuming NDT that is facilitated by the use of the specialized software *XRD2Dscan*. This program transforms the Debye-Scherrer rings acquired from the selected irradiated spot into a linear 2θ scan similar to that obtained with a conventional powder X-ray diffractometer. The detailed mineralogical and microtextural information contained in the 2D diagram has been further analyzed using *XRD2Dscan* and the *XPowder* program.

The spatial resolution of the technique depends on the X-ray beam size employed to irradiate the sample. In our case, collimators of 50μm, 100μm and 500μm were used either directly on the samples with no preparation, or on cross-section paint stratigraphies. Mineralogical and microtextural characteristics of focal spots are acquired within a few dozen seconds. Original composition of the studied materials, newly formed minerals as alteration products (e.g. salts) or reaction minerals (e.g. high temperature silicates in bricks), mineral transition pathways, and the associated microtextural transformations in the analyzed samples can be investigated without difficulty.

To illustrate the benefits of applying μ-XRD in artwork research, we present the results obtained from: i) pigments used by the Nasrids (1232-1492) to polychrome the Alhambra palaces (Granada, Spain); ii) Islamic bricks and enamels used to decorate pottery, and iii) bronze from the hull of the French ship *Bucentaure*, sunk by the British navy in the Battle of Trafalgar in 1805.