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Proposal for the application of neutron activation analysis of micro-samples of pigments in archaeological ceramics from the Argentine Northwest

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The general objective of this project is to make comparisons between archaeological ceramics of different styles, locations of discovery and chronologies, from the Argentine Northwest. The observation of similarities and differences in the chemical composition of ceramic materials has been useful to investigate the standardization in ceramic production, the identification of sources of raw materials, and the circulation of vessels and materials in space in past times.

Given their status as cultural heritage objects, the characterization of archaeological ceramics requires non-destructive and minimally invasive experimental approaches. Our group has experience in the use of micro-destructive techniques on flakes or powders obtained from fragments of non-museumable archaeological ceramics: SEM coupled with EDS, Raman micro-spectroscopy and micro-XRD. These techniques showed great potential for characterizing slips and paints in red, black and cream tones, formed by heterogeneous compounds, generally with low crystallinity, and the presence of solid solutions. However, it is necessary to use other analythical techniques, such as neutron activation analysis (NAA), to quantify the presence of traces and reliably determine the chemical composition of the paints.

The advantages of this nuclear characterization technique are the use of small amounts of material, the short time necessary to prepare the sample, the possibility of analyzing multiple samples simultaneously and determining, in a single measurement, major and minor elements and traces. Since NAA is a multielemental technique that requires processing a very small mass for its implementation, it has been applied to the study of archaeological ceramic fragments considered non-museumable. In previous works, this technique was used to study archaeological ceramic pastes and clay sources from the Argentine Northwest. However, its utilization to evaluate slips and paints, applied in thin layers (a few microns) on ceramic surfaces, still needs to be developed, since the minimum sample size (usually 2 to 3 g) according to standard sample preparation protocols is not suitable for these cases. Micro-sampling techniques was used and irradiation with high neutron flux was applied to small samples (10 mg), belonging to objects declared as cultural heritage (Landsberger and Yellin, 2018); micrograms of meteorites were also evaluated with this technique (Sekimoto et al., 2016). These antecedents provide an interesting perspective for the study of slips and paintings in the archaeological ceramics of the Argentine Northwest, whose analysis, combining different analytical techniques, we are looking to develop according to a multidisciplinary and collaborative approach (Palamarczuk et al., 2020; Tomasini et al., 2020).

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