A comparative analysis of the elemental composition of micro-samples of historical manuscripts with varying degrees of ink corrosion

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Inks found in historical documents present a unique challenge for conservators and researchers due to their diverse compositions and mechanisms of degradation. The most popular iron-gall inks have been used since ancient times until they were replaced by synthetically produced inks. Chemical composition this inks were fairly simple. The main ingredients are gall extract, vitriol (soluble salts) and binder (gum arabic). [1] Ink's additives were optional and depended on the availability of raw materials. The diversity of the chemical composition was the result of mixing different ingredients. This could result in chemical instability of the inks and then lead to degradation of the paper. Historical manuscripts may degrade over time. Apart from natural paper aging processes may result damage caused by the presence of free transition metal ions in the inks. Such we describe the mechanisms as ink corrosion. For the dominant mechanisms of this the process is considered to be hydrolysis or oxidation of cellulose. Acid hydrolysis induced is caused by the formed sulfuric acid (VI) and oxidation is a process catalyzed by Fe^{2+} ions leading to depolymerization. Due to corrosion ink printing is the loss of the mechanical properities of the paper. For corrosion of inks, gallic acid and gum arabic may also be responsible. [2] Neevel indicators are papers soaked in bathophenantroline. This relationship looks like as follows and has a characteristic red colour when it forms a complex with iron in the secod oxidation state. The procedure for performing such a test is simple: wet paper should be applied to the recorded part of the object for a time that allows the migration of ions iron (II) on the indicator and the creation of a complex with bathophenantroline. [3] Original manuscripts can be examined using non-destructive methods. In archaeometry, the most popular method is XRF, which intervenes at the molecular level in the object. Nevela indicators allow for more detailed studies using destructive techniques without damaging the original artifacts. The method used to determine the elemental composition of inks is LA-ICP-MS. By utilizing both methods, one can obtain a comprehensive understanding of archival or library collections, thus delving deeper into the history they contain.

The research is devoted to a comparative analysis of the total elemental composition and an attempt to correlate the proportions of detected elements with the intensity of destruction of manuscripts by ink corrosion processes

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