

## **Investigations of Pigments and Papers of some Historical Postage Stamps by Multiple Analytical Techniques**

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Stamps, which are considered a cultural heritage, serve as a recording source for information that illustrates the cultural, historical, social and artistic aspects of a society in their own unique style. They constitute a sort of artwork which could be very rare and precious. Many chemical pigments and dyes are used as colorant for the colored inks of this artwork. Mineral-based or inorganic pigments and dyes, particularly those containing heavy metals, were widely used in past, but due to their toxic effect, environmental concerns have reduced the application of heavy metal containing pigments at the present time.

The first postage stamps of Ottomans, known as Duloz series, were printed in 1865-1876. These first stamps showed the Tughra (signature) of Ottoman Empire Abdulaziz, over a crescent in which Devleti Aliye Osmaniye, or "The Sublime Ottoman Empire" was written. After being a member of Universal Postal Union, founded in 1875, Ottomans issued a new set of stamps known as Crescent series which was first issued in September 1876. The Crescent series stamps bore the name of the country and the values in western characters as well as Arabic. The design consists of a crescent, with ends pointing upward. For this reason they are known as "Crescent Stamps".

In this study Duloz and Crescent series of Ottoman postage stamps, the first postage stamps of Ottomans, printed in 1876-1890 have been analyzed non-destructively using Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR), Raman and Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometry methods. Lead chromate, Prussian blue, vermilion, calcium carbonate, gypsum, cellulose and degradation products of cellulose were identified. The merging of data coming from ATR-IR and Raman spectroscopy, and EDXRF techniques has allowed the characterization of the pigments used on the surface of each stamp and dispersed between the paper fibers. Moreover the adhesive on the rear side of the stamps was also investigated.