Going Beyond Appearance: Use of Imaging Technology for the Examination of Hidden Paint Layers in a *Gulistan* of Sa'di from the Freer Collection

Multispectral imaging technology is increasingly important for the investigation of artworks on paper. It is noninvasive and relatively easy to implement, and provides valuable information about the materials and working methods of artists. Its exploitation for curatorial and technical research in the field of Islamic art on paper is not as widely adopted, but it is believed to be particularly promising.

Islamic miniature paintings are complex objects with no set structure, which are often extensively modified throughout their history in response to changes in style and ownership. The *Gulistan* of Sa'di from the collection of the Freer Gallery of Art in Washington, DC, is an especially notable and illustrative example of these practices. The manuscript was copied between 1468–69 in Herat, capital of the Timurid Empire. It then traveled to Tabriz, where lavishly illuminated borders were added during the 1540s at the royal workshop of the Safavid ruler Shah Tahmasb (ruled 1524–76). Under the reign of the Mughal emperor Shah Jahan (ruled 1628–58), the original illustrations were completely repainted by some of the most respected artists of the court. Tantalizing traces of the earlier paintings can be seen on the opposite sides of the folios as discolored areas produced by copper-based pigments.

A thorough imaging campaign aimed at revealing as much as possible of these pre-existing paintings was performed as part of a fellowship funded by the Smithsonian Institution and hosted by the Freer Gallery of Art and Arthur M. Sackler Gallery. The main tool used for this purpose was the VSC 6000, a high-resolution multispectral imaging system manufactured by Foster and Freeman and designed for the forensic investigation of questioned documents. Examinations using reflected and transmitted visible light, UV light, and reflected and transmitted IR light were performed with this instrument. Additional pivotal information was acquired using X-ray computer-generated radiography and a targeted use of X-ray fluorescence spectroscopy undertaken in the Department of Conservation and Scientific Research at the Freer Gallery of Art.

From an art-historical perspective, the investigation successfully exposed sections of the underlying paintings, allowing comparisons between Persian and Indian depictions of the same subject. From a technical standpoint, it drew attention to the potential and limitations offered by the implemented equipment, and to the specific challenges involved in the investigation of Islamic miniature paintings. This research also offered an opportunity to devise a method that brings together the complementary information obtained in the different spectral regions.

ELISABETTA POLIDORI
Samuel H. Kress Paper Conservation Fellow
Northeast Document Conservation Center
Andover, Massachusetts
elisabetta.polidori@gmail.com

BLYTHE MCCARTHY
Andrew W. Mellon Senior Conservation Scientist
Freer Gallery of Art and Arthur M. Sackler Gallery
Smithsonian Institution
Washington, DC
mccarbl@si.edu

EMILY JACOBSON
Paper and Photograph Conservator
Freer Gallery of Art and Arthur M. Sackler Gallery
Smithsonian Institution
Washington, DC
jacobsone@si.edu

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