

OBJECT RESEARCH



Alfred Stieglitz (American, 1864–1946)

## Georgia O'Keeffe—Hand

1918

Palladium print

Alfred Stieglitz Collection

**AIC accession number:** 1949.743

**Stieglitz Estate number:** OK 515D

**Inscriptions:** Unmarked recto; inscribed verso, on mount, lower left, in graphite: "OK 515 D"; verso, on mount, lower right, in graphite: "treated by Steichen"

**Dimensions:** 11.2 x 9.2 cm (image/paper); 35 x 27.5 cm (mount)

**Print thickness:** N/A

**Mount:** Original

**X-ray fluorescence (XRF) spectrometry:**  
See below

**Fourier transform infrared (FTIR) spectroscopy:**  
See below

**X-RAY FLUORESCENCE (XRF) SPECTROMETRY**

XRF spectral readings were taken from the recto of the work and from the mount when available. The elements listed below have been positively identified in the work; elements in bold have been attributed to the processing of the print.

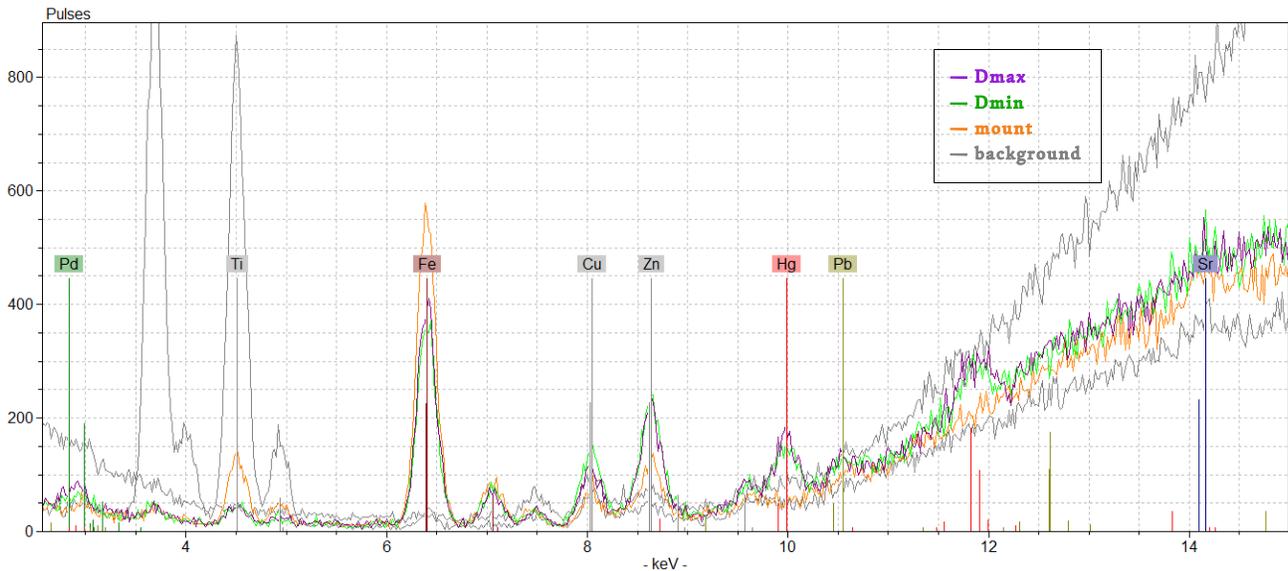
Print: **Fe, Pd**, Hg, Pb

Mount: Ti, Fe, Cu, Zn, Sr

The graph below shows XRF spectra for three distinct measurement areas on the print: the darkest, maximum-density image area (Dmax, purple); the lightest, minimum-density image area (Dmin, green); and the mount, when available (orange). The background spectrum (gray) represents the characteristic contribution of the instrument itself as measured on a Teflon reference and is included in order to discount irrelevant elements from the print's signature. Elements were identified based on the presence of their characteristic peaks. Analysis was performed with a Bruker ARTAX air-path portable micro-XRF system equipped with a laser pointer, an integrated camera system, a Mo 12.5µm filter, and a Mo tube. Measurements were taken for 250 LT at 50 kV and 800 µA. The spectrum below illustrates the significant peaks for this print in the energy range from 3 to 15 keV.

Figure 1. (right)  
Locations of XRF measurements

Figure 2. (below)  
XRF spectra from the Dmax, Dmin, mount,  
and background signal produced by the  
analyzer.



**FOURIER TRANSFORM INFRARED (FTIR) AND FT-RAMAN SPECTROSCOPY**

Analysis was conducted using Attenuated Total Reflectance spectroscopy (FTIR-ATR). A thin layer of wax coating was identified. The presence of gum arabic can be hypothesized based on the FT-IR-ATR spectrum and was confirmed with FT-Raman analysis.

Analysis was performed using a Bruker tensor 27 FTIR spectrophotometer with mid-IR glowbar source coupled to Hyperion 2000 Automated FTIR microscope with nitrogen cooled MCT detector (covering the range 4,000- 450  $\text{cm}^{-1}$ ). Samples were analyzed using a germanium ATR attachment for the microscope, collecting 512 scans at a resolution of 4  $\text{cm}^{-1}$ . FT-Raman spectroscopy was conducted in-situ using a Bruker Ramscope III FT-Raman Microscope and open architecture external arm adapted for the study of art objects (ArtArm). The instrument is equipped with a (D418-T/R) high-sensitivity Ge detector and  $\text{Nd}^{3+}$ /YAG laser, with excitation wavelength at 1064 nm. 1000 scans were accumulated three times and averaged, at 4  $\text{cm}^{-1}$  resolution, using a 10x microscope objective with a nominal laser power of 100mW.

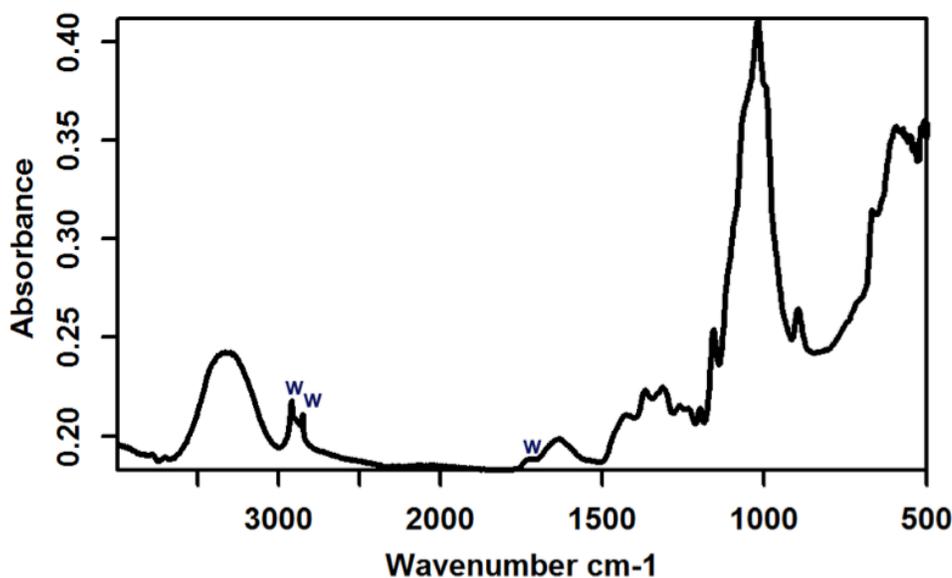
Figure 1. (right)

Location of two spots analyzed with FTIR-ATR and FT-Raman spectroscopy



Figure 2. (below)

FTIR-ATR spectra taken in the hand: Sharp peaks for wax are visible (labeled 'w' in the image). While the spectrum is dominated by the bands of the cellulose substrate, it is possible that contributions of gum Arabic also give rise to the particular shape of the carbohydrate bands.



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Figure 3. (below)

FT-Raman spectrum recorded on the print: after subtraction of the spectrum of paper (black curve); compared to a reference FT-Raman spectrum of gum arabic coating over a photographic paper reference (gray curve)

