Soft Clouds: Analytical Pigment Identification for Historical Paste Papers
from Harvard's Rosamond B. Loring Collection

Mitchel Gundrum (UCLA Library)[1]

Debora Mayer (Weissman Preservation Center, Harvard Library)[2]

Kelli Piotrowski (Weissman Preservation Center, Harvard Library)[3]

Paste paper (German: *Kleisterpapier*) is a style of surface-decorated paper characterized by colored starch paste modified with various tools and techniques to render an array of designs. The technique originated in southern Germany around 1600 and was popularly used across Europe for book papers, wallpapers, and furniture linings through the 1830s. This pilot project focused on the analysis of blue colorants on papers produced ca. 1670–1830, with the goals of assessing analytical techniques and developing a framework for future surveys of historical decorated papers.

ANALYSIS

Visual Analysis

255 paste papers examined: 229 from the Rosamond B. Loring Collection of Decorated Papers (*52L-1000), Houghton Library, Harvard University; 26 from private collections. Color, pattern, and publication data recorded in a spreadsheet.

Macrophotography

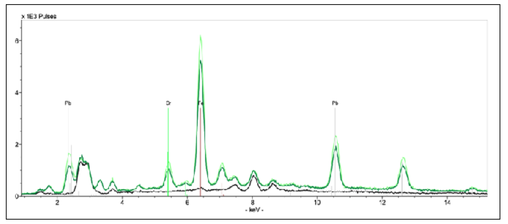
Leica MZ16 stereomicroscope (.63 objective, 10× binocular eyepieces, adjustable Ergo tube 10°–50°) at ~15–60× magnifications, Leica IC90 E camera, Leica KL 1500 LCD fiber optics system, and Leica LAS X imaging software.

Prussian blue, a synthetic iron colloid with a <1 µm particle size, rendered a uniform color layer which was slightly shimmery in a paste binder.

Indigoids (chemically identical compounds derived from various organic sources) have larger, irregular particles which appeared clumpy and opaque in paste.

X-Ray Fluorescence Spectroscopy

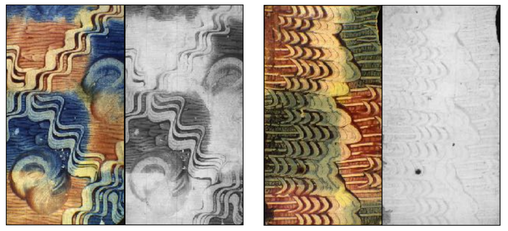
Bruker TRACeR III-V pXRF analyzer with a rhodium X-ray tube, silicon drift detector, and 3 mm × 4 mm oval spot size. Spectra collected at 40 kV, 10 µA, without filters or vacuum, for 120 seconds live time per measurement.



Prussian blue (ferric ferrocyanide), chrome yellow (lead chromate), and orpiment (arsenic trisulfide, not shown) were identified by their mineral constituents. Organic indigoids are undetectable with XRF.

Spectral Examination and Imaging

Foster and Freeman, Ltd. Video Spectral Comparator (VSC 8000). IR imaging between 780 nm and 925 nm. Reflectance spectra from 400–1000 nm at 15× with a 122 nm spot size. Composite false-color imaged at R: 555 nm, G: 996 nm, and B: 405 nm.

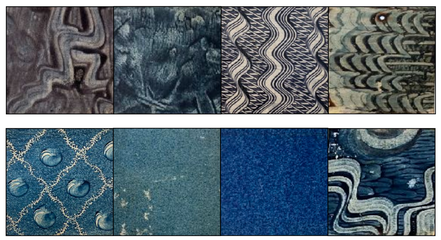


Infrared imaging distinguished the absorption behavior of Prussian blue (left) from the reflection behavior of indigoid colorants (right), providing a rapid screening technique.

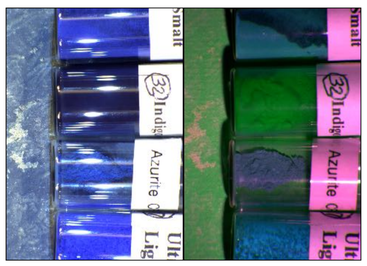
RESULTS

Pigment Identification

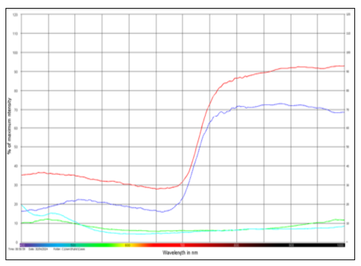
16 blue paste papers from the Loring collection were analyzed using one or more of the above complementary techniques. **The major blue colorant was identified as an organic indigoid in 8 instances, Prussian blue in 7, and remained inconclusive in 1.**



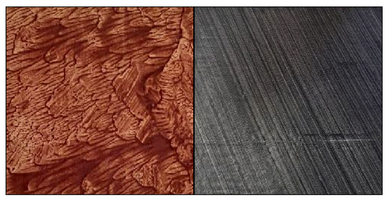
Perceived hue was shown to be an unreliable method of pigment identification; similarities between and variations within indigoid (top row) and Prussian blue (bottom row) subsets attributable to production methods, colorant mixtures, and degradation.



A type of false-color composite imaging helped to reveal similarities between paste paper samples and visually comparable blue pigment reference vials.



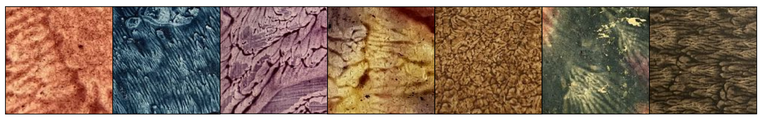
This spectrum plots reflectance from 400 nm to 1000 nm, showing characteristic lines for examples of indigo (paste paper sample: blue; reference: red) and Prussian blue (paste paper sample: green; reference: turquoise).



While many papers combine multiple application techniques, the most prevalent base layer techniques were veined (149) and brushed (56).

Color and Pattern Organization

Descriptive cataloging, categorization of colors and patterns, and statistical analysis of survey data have suggested some preliminary trends in pigment and pattern usage across temporal, geographic, and cultural contexts.



The most prevalent hue families from this survey by number of examples were red (109), blue (81), violet (41), yellow (34), brown (33), green (27), and black (17).

Statistical analysis revealed temporal trends for single- and multi-color papers (left), distinctions between directly and indirectly impressed secondary designs (center), and an early 19th-century prevalence of extra-fine vein-patterned papers (right).

Conclusions

- This first analytical identification of historical paste paper colorants helps establish a basis for authenticity and rarity.
- Complementary analyses proved more effective than any individual technique. Spectral analysis and XRF in tandem were particularly effective with a range of historical colorants.
- Collection surveys offer the opportunity for more holistic characterization of a family of artifacts in context than any comprehensive investigation of a single item.
- Decisive provenance trends are only possible through an expanded dataset, including additional hue families, organic colorants, broader time periods, other analysis techniques.
- Replication of historical recipes might provide context for when, where, and how these objects were made and used.
- Collaborative art-historical databases, such as the University of Delaware's *Poison Book Project* and Penn Libraries' *BASIRA*, might serve as models for a public access platform crowdsourcing analytical data on decorated book papers.

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Contributions

1) MG: Kress Fellow for Conservation
2) DM: Conservator for Analytical Services and Technical Imaging
3) KP: Special Collections Conservator

- Survey, statistical analysis, and poster presentation: MG
- Macrophotography: DM and MG
- VSC analyses and imaging: DM
- XRF analyses and spectra: KP

- Corresponding Author: MG: mitchelgundrum@gmail.com