The Effect of Aged Varnish on Paper Objects

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Varnish was applied to utilitarian paper objects, both for protection and aesthetics, and is most often found on 19th century maps and globes. As varnish ages, it becomes brittle and discolored, necessitating removal with organic solvents. Aged, deteriorating varnish is known to have negative effects on the paper below; this research seeks to explore and quantify the damage, and to isolate the effects of varnish from related factors such as sizing, solvents, and the inherent vice of some papers.

Experiment: Sizing with gelatin or dammar
- Varnishing with dammar or shellac
- Artificial aging
- Removal of the varnish with solvent baths

Aging Parameters:
- Despatch LEA 469 aging oven
- 28 days at 80% RH and 65 degrees Celcius, in dark conditions

Fold Endurance:
- In most cases, the aged varnish significantly decreased fold endurance, but the gelatin sized samples did retain a relatively high degree of strength.
- Sizing remained stable during aging.
- No extreme brittleness manifested.
- There are several unexplained anomalies.

Tensile Strength:
- Aging and varnishes do not have dramatic effect on breaking strength or elongation.
- Gelatin sized samples have the best strength retention.

Cold Extraction pH:
- Aged and unaged varnish samples have pH lowered by 1-2 pH units compared to untreated controls.
- Full results pending.

Colorimetry:
- Aged varnished samples exhibited dramatic color change from white to yellow brown.
- Unaged varnished samples exhibited no more color change than did unvarnished control groups.

Cross Sections:
- Thin sections were stained with Rhodamine B to stain varnish layer red and show penetration.
- Historical sample shows a more discrete varnish layer while prepared samples are more evenly colored pink.
- Whatman paper is less dense than historical samples.

FTIR:
- Spectra illustrate the complete removal of varnish from washed samples.

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