MEDIA PROBLEMS

3. Media Problems (May 1985)

Characteristics inherent in graphic media which create problems: in the media or in the relationship between media and support; at time of application or as the object ages; or pose special problems during conservation treatment.

3.1. Purpose: To identify potential problems so that treatment and storage and exhibition conditions can be limited or modified so that media are not altered. To identify problems to help determine treatment methods.

3.2. Factors to Consider

3.2.1. Inherent physical characteristics of media:

A. Color
B. Surface: glossy or matte, compacted or fluffy
C. Topography: raised or flat, thick or thin
D. Integrity: fixed or loose, flexible or brittle (tented, flaking, etc.)

3.2.2. Relation of media to support:

A. Media may discolor or degrade paper (e.g. oil paint, iron gall ink, printing ink, titanium dioxide, copper greens, zinc white).

B. Media may protect paper: lead and calcium whites; opaque pigments

C. Is media well adhered to paper support? (or to ground or underlying layers)

3.2.3. Alteration of media upon aging

A. Desiccation of binders: watercolor, gouache, tempera, distemper, printers inks

B. Oxidation of oils, waxes

C. Color changes, fading and other alterations may occur without the influence of an outside agent, e.g. fading of iron gall ink; felt tip pen inks.

D. Materials in combination with each other may cause changes over time, e.g. lead and arsenic containing pigments in Islamic miniatures. (M.C.)

3.2.4. Sensitivity of media to environment:

A. Light: e.g. natural organic pigments, gamboge, cochineal lakes, indigo, carmine, vermillion; some pastels. Inorganic pigments are much less susceptible.

B. Humidity

C. Pollution: e.g. red lead, white lead, naples yellow, smalt

D. Heat: e.g. wax

3.2.5. Chemical sensitivity to

A. pH

1. Acidity: (calcium carbonate, red lead, ultramarine). "Litmus" reactions seen in watercolors which have been in contact with acidic mats.

2. Alkalinity: In most cases it is organic pigments that change colour on deacidification due to changes in their molecular and electronic structure (logwood, carthamine, gamboge, litmus, tumeric, cochineal) (Daniels). (Also, Prussian blue, madder, chrome green, Hookers green, yellow lake, van dyke brown, gamboge, some pigments in Currier and Ives prints).

B. Oxidation/reduction: indigo, Prussian blue (develops irridescence)

C. Heavy metal ions (some transition metals in particular, e.g. Co, Cu, Fe, Mn, Zn) which may catalyze degradation of cellulose in presence of oxygen and moisture (Mairinger et. al.-p.181) Specific pigments: e.g. TiO_2, ZnS, ZnO, copper greens.

3.2.6. Potential alteration of media during handling: flexing support, brushing, touching or covering surface.

Note: a uniform surface "abrasion" or polishing may be a positive sign of the good condition and normal aging of old master prints and drawings kept historically in albums. (M.C.)

3.2.7. Potential alteration of media during conservation treatment:
Effect of moisture, solvents, consolidants, buffers, weight and pressure, heat, air currents, static charge, lining.

Treatment may affect the chemical structure of the media without causing visible alteration at the time of treatment.

3.3. Materials and equipment for treatment of media problems.

See specific catalogue categories as referenced below.

Consolidation/Fixing/Facing (#23)
Treating friable or soluble media

Matting and Framing (#40)
Special considerations for friable materials

Materials/Tools/Equipment (#47)
Suction table (47.3.1)
Electrostatic plate

3.4. Media Problems

Media problems will be discussed in terms of general problems, specific problems, suggested or ill-advised treatments, and/or traditional and contemporary formulations and applications.

3.4.1. Drawing media

Some potential friability with most drawing media. Range from slight to marked friability, with sensitivity to abrasion or to any material capable of generating or holding static charge, e.g. plexiglas/ polyester film.

Dusting of soft pencil or other friable drawing media over the surface of a drawing often creates a grimey or smudged appearance and poses the problem of whether or not to dry clean. Careful consideration should be given to possible creation of "halo" effects around drawing lines before undertaking such treatment. (See: 17. Dry Cleaning)

A. Metal Point (See: Ellis; Harding)

1. Medium: An anticipated and desirable tarnishing of the metal media to their characteristic colors.

2. Ground:

   a. Friable and easily abraded (surface should be carefully protected)

   b. Absorbs oils and fingerprints

   c. Softens and stains readily with moisture

   d. Susceptible to cracking (See: 3.4.3. watercolor - friability, flaking, etc.)

3. Treatment
   Caution with oxidative bleaches - can cause discoloration of the media.

   Reductive bleaches may cuase changes in tarnished (naturally oxidized) media.

B. Pencil

1. Graphite
   Pronounced reflectivity of natural graphite could be adversely affected by wet treatment (?) (M.C.)

2. Indelible pencil

   a. Visually is virtually identical to graphite pencil. Purple component bleeds out with slight moisture application and may also be solvent (acetone) sensitive.

   b. Seen in German and Central European works, often in signatures. Some suggestion that it was used during WWII when graphite was in short supply. Also appears in some Picasso signatures, so caution with pencil signatures on contemporary prints.

   c. Treatment: Test pencil drawings and signatures separately. Will not necessarily bleed with brief testing with water.

      Colored dye may be pH sensitive and conservator can possibly minimize disfiguring aspect of bleeding dye by locally applying buffered solution.

      Encountered in a sketch by Dufy. In treatment it turned purple but did not bleed in acetone. Conservator continued wash with a stronger solvent; rinsed with acetone. Purple was removed except in four heaviest downstrokes. These lessened with local application of methanol.

   d. "Mephisto" is one current brand name.

3. Carbon pencil

4. Colored pencil

   a. May be fugitive

   b. May be water soluble (e.g. prismcolor). If watercolor pencils have been blended into a design by applying water, care must be taken not to soften hard edges of lines not treated with water. E.g. Many Jackson Pollack drawings were only partially treated with water by the artist to make washes. (M.E.)

   c. Often sensitive to or soluble in organic solvents.

5. Watercolor pencil

   Looks like regular colored pencil, but feathers even in slight vapor as would be used for flattening. Used dry by Jackson Pollack along with regular colored pencils. Each color must be checked prior to treatment. (M.E.)

C. Charcoal

1. Extreme friability makes any treatment problematic. In addition, a drawing may be only partially fixed, the lower layer being fixed before the last application of charcoal. Must test for fixing throughout the drawing.

2. Resinous or sooty charcoals may be soluble in solvents.

3. Homemade/manufactured charcoals may have dye additives.

D. Chalks

1. Natural chalks

   a. White: calcium carbonate (see watercolor below), lead carbonate, calcium sulphate, etc.

   b. Black

   c. Red: (iron oxide) Not susceptible to fading. May darken and/or dissolve upon wetting.

   Water and some organic solvents will disperse smallest particles, move out binder yielding darker, cooler hue. (D.D.M.)

   Turns yellowish orange on abrasion.

2. Fabricated chalks and pastels

   a. Friability: Greatest natural media friability is encountered in pastels and charcoal. While pastels may be fixed by the artist, fixing is not generally recommended as a conservation treatment as it can alter the appearance of the media. (See cautions for drawing media below).

   b. Binder: Gum tragacanth, the traditional binder, is attractive to insects and promotes mold growth. Cellulose ethers are now used instead.

   c. Sensitivity to light: e.g. Degas used a bright red violet; red component is a lake (morphology under crossed polars); this fades leaving deep cobalt blue on surface. (P.D.)

3. Oil Pastels
   Can be damaging to paper due to oil content. Can be sensitive to organic solvents for the same reason.

E. Waxy Crayons
("Crayon" also an early term for chalk and pastel).

Likely solubility or softening of waxy binders in organic solvents. See: 19. Solvent Treatments.

F. Litho Crayon
May be solvent sensitive.

G. China Marker
Red, black, white.
May be solvent sensitive, soluble.

H. Cautions for drawing media during Conservation Treatment

See Paper Conservation Catalogue categories referenced below:

Washing (#18):
-float washing: potential compaction, movement of loose particles.
-solubility of one component of a mixed pigment undetected during testing (e.g. gamboge in a green)

Consolidation/ Fixing/Facing(#23):

Fixatives applied to reduce natural friablity of media, especially pastels and charcoal. Generally not recommended conservation treatment for drawing media, expecially pastels, as application will alter the artist's aesthetic. Can cause compaction/ saturation of media and blending of colors, possibly altering color value and characteristic "fluffy" surface.

Fixatives may be absorbed into the paper and cause (J.K.):
-discoloration and degradation products to be held in sheet
-haloing
-uneven aging of paper.

Backing Removal (#24):
Potential transfer if object placed face against surface (particularly pastel). If such treatment is necessary with friable drawing media place recto against smooth relatively frictionless (glass, glassine, silicone release) and weight to prevent movement. Repeated testing essential in treatment, as pressure, steam or moisture applied to verso may cause unanticipated transfer of media.

If possible treat vertically as with a Dutch strainer (J.K.)

Environment (#43)

Exhibition/Storage (#44)

Matting and Framing (#40)
Considerations for friable materials

Transportation/Packing (#45)

Materials/Tools/Equipment (#47)

Suction table (47.3.1):
Some conservators are wary of possible compaction of media or pulling of media into the paper, particularly fluffy pastel. Possible problem of pulling soluble media to the back of the artwork.

Electrostatic plate: (Blythe)
Creates an electrostatic attraction between the pastel particles and their support through the use of an electrostatic stabilizing plate (elaborate....)
Presented as an alternative to several methods of fixing which potentially alter the appearance of pastels.

3.4.2. Ink

A. Black carbon inks

1. India ink:
Shellac binder soluble in alcohol.

2. Sumi or Indian black carbon inks:
Very water soluble.

B. Brown inks
Some brown inks are affected by hydrogen peroxide or other oxidizing agents. Necessitates particular caution when converting darkened lead whites on brown ink drawings.

1. Iron gall
Can also be categorized as a "black" ink, the color after initial application and atmospheric oxidation. Generally fades to reddish brown, often eventually to pale yellowish brown due to decomposition products of carboxyphenolic acids which can no longer complex with the traces of metallic oxides remaining on the support (Talbot et. al.-p.1)

Note: Some inks are pale from the start depending upon the recipe (J.K.)

a. May penetrate, deteriorate, corrode paper support due to its acidity. No certain method for stopping or reversing its effect on paper. Weakest areas should be reinforced on verso with Japanese tissue. Extensive deterioration may warrant lining.

b. May fade (Talbot, et.al.-p.2)

1) Factors affecting fading

a) external factors: oxygen, humidity, light, pollution

b) internal factors: composition of the ink, nature of the support

c) high pH in aqueous deacidification can lighten lines, whether by fading or by increasing solubility is unclear. (M.C.)

2) Methods of making faded iron gall ink visible:

a) U.V. or I.R.

b) Regeneration: various solutions to reintroduce color.

2. Bistre

3. Sepia

C. Colored Inks and Washes

Red inks are frequently extremely soluble and difficult to consolidate sufficiently for wet treatment.

D. Writing inks (fountain pen inks)

May have solvent sensitive/ soluble somponents.

Blue/black writing inks (especially those used by Elie Nadelman) have often faded to brown. Original color can be detected under magnification where the edges of the black line are blue, as wicked out by paper fibers. Very water soluble. (M.E.)

E. Ballpoint pen inks

Extremely variable in makeup and reaction to treatment. The lubricant in the pen ink is an oil base material.

May have solvent soluble/ sensitive components.

Often soluble in alcohols. This factor may be useful for removing or diminishing accession numbers written on artworks in ball point pen.

Some formulations are quite fugitive.

F. Felt tip pen inks

Most formulations are extremely fugitive even when stored in the dark. Some recent formulations may be more stable.

May have solvent sensitive/ soluble components.

G. Cautions for drawing inks during conservation treatment.

See Paper Conservation Catalogue categories referenced below:

Washing (#18)

Solvent Treatments (#19)

3.4.3. Paints

A. Watercolor and gouache

May be fugitive, either fading or changing color, in the presence of light (also, oxygen and water vapor) because of thinness of application, minimum of binder, and/or inclusion of dyes and other natural organic materials.

Often one component of a mixed pigment (e.g. gamboge in a green) will be more fugitive than the other, shifting the tonal balance of the pigment as it fades.

1. Pigments: See "D" below.

2. Binders (gum arabic, vegetable gums, dextrin, tragacanth)
   "An understanding of specific pigment usage and pigment/binder relationships will aid the conservator in deciding whether a watercolor can be washed and in what solution." (Cohn-AIC-p. 39)

   a. Continued solubility or sensitivity to water:

      1) Continued solubility has a great deal to do with whether watercolors were drycake, moist cake or tube. Therefore, pre-nineteenth century watercolors are generally a lot less soluble, assuming the washes are thin. Thicker accents will be soluble. Later watercolors may be very safe too, but each color must be tested at its point of thickest application. pH changes can adversely affect solubility. (M.C.)

         Rule of thumb: watecolors over 60 years old tend to be less water soluble.

      2) "Folk art, such as Pa. Dutch Fraktur, where the home made paint was pigments ground in cherry gum, remain so soluble (esp. red and yellow) it is a risk to even spray the painting with water." (Weidner)

Primary documents also list other binders used in Frakturs and folk art. Extreme solubility of these pigments is not necessarily the rule, and moisture can often be used after careful testing. (J.K.)

3) Treatment: Might humidify prior to aqueous treatment for more even and complete wetting of watercolors, and to ease the shock to the media.

b. <u>Sensitivity to or solubility in organic solvents</u>:

1) Watercolor pigments which are truly soluble in water (as compared to "sensitive") may be highly soluble in other polar solvents as well.

2) Thanka paintings: Yak fat is used as binder can be sensitive to naptha and toluene.

c. <u>Friability, flaking, tenting</u>.

Integrity and permanence of the paint layer depend on the adhesiveness of the binding gum, characteristics of the paper support, thickness of the paint layer, and environmental influences.

1) "The most common cause of flaking paint is dehydration of the binding vehicle used in the original mixing of the paint. Binders such as egg, glue or gum can gradually lose their ability to hold the pigment particles together or to their support" (e.g. Islamic miniatures, medieval manuscript illuminations, grounds of metal point drawings, tempera, gouache). (Ellis-p.31)

2) If paper surface is not sufficiently absorbent, paint adhesion may be incomplete or insecure. Also, the thinner the paper support, the more it moves (e.g. paper with short woodpulp fibers), the smoother its surface, the greater the possiblity of flaking.

3) If the paint layer is thick as in gouache, it will be brittle and inflexible and will tend to crack with movement of the paper support.

4) Treatment: Even a stable watercolor can have friable elements which are not evident until aqueous treatment is begun. Surface tension of the water bath can pull off friable material. Suggestion that this can be alleviated with the addition of alcohol to the bath (approximately 10% solution). Caution: the alcohol may make float washing a bit more difficult.

3. Masking agents

"Masking agents that establish areas of reserved highlights through the principle of water repellency (as opposed to water resistance, the principle of other masking agents) are other substances that are affected by organic solvents. Often their presence can be detected only through a careful examination in strong raking light, yet they should always be of concern, as their removal could take with it residues of fragmented color films." (Cohn-AIC-p.40)

B. Tempera

1. Often problems with cracking and flaking.

2. Specific artists: Andrew Wyeth often did not follow a recipe - problems with cracking and flaking in his works. Paul Cadmus followed medieval recipe, and no such problems seem to occur. (M.E.)

C. Oil

1. Incompatible with paper support. Causes oxidation of the paper: degrading, discoloring, embrittling. A halo of discoloration appears around the pigments, caused by oil which has bled out and oxidized the fibers. A heavily sized paper may be somewhat more resistant to the degrading effects of oil.

Note: Some artists have sought the halo effect, e.g. Picasso (C.B.)

2. Can become hard and brittle with age. As paper contracts and expands with temperature and humidity fluctuations "if the paint is applied to the paper too thickly there is a good chance the paint will become crackled and flake off. It is for this reason that it is often recommended that a thick oil painting on paper be mounted on a rigid support." (Weidner)

3. Specific artists: Degas successfully used oil paints which had been leached of much of their oil, "Peinture a l'essence," ground pigments in spirits. These works are often mistaken for gouache because of their matte surface and "dry" look.

4. Paper can become sensitive to alkali. (J.K.)

5. Thymol softens oil binder.

6. Treatments for drawings severely weakened by oil medium: (Advisable to consult a painting conservator or, better yet, a Painting Conservation Catalogue).

   a. Solid mounting

   b. Lining with Japanese tissue. (Haner et.al.)

   See: 23. Consolidation/Fixing/Facing;
   29. Lining and Mounting

D. Synthetics

1. Acrylics

   a. Magna color: solvent based media (xylene)

   b. Liquitex: water based media, but does not remain so when dry.

2. Alkyd resins
3. Casein
4. Synthetic laquers
5. Nitrocellulose based products
   a. Laquer (Agateen)
   b. Paint
6. Metallic paints and Phosphorescent paints

E. Pigments

(Information on causes of pigment discoloration taken in large part from paper by D. Evans. See bibliography).

1. Whites

a. Chalk (whiting)(lime white)(calcium carbonate):
Acids released from paper support when it is humidified or wetted by float washing may consume, diminish or discolor the white pigment.
Tends to soften with water.

b. Lead white (flake white)(basic lead carbonate):
Generally darkens to gray, brown or black lead sulphide when in contact with sulphide pigments (e.g. vermillion) or when exposed to hydrogen sulphide in a polluted atmosphere. This discoloration occurs more readily in the presence of moisture and is favored by darkness.

May be oxidized back to a white pigment, lead sulphate, with dilute, slightly alkaline hydrogen peroxide (aqueous or ethereal).

Hydrogen peroxide for converting lead whites should not be used in acidic solution because remaining lead carbonate may be consumed by the acid.

Occasionally it is observed that converted lead whites "appear" to revert to a gray state. It is likely that initially only a thin film of the pigment had darkened to the sulphide and had been converted to the sulphate during treatment, and that it is the remaining lead carbonate which has reacted with hydrogen sulphide to form more of the darkened pigment.

Darkened lead whites cannot always be successfully converted to a white pigment. Lead which which has gone "completely" black seems most resistant. Application of hydrogen peroxide as an oxidizing agent may only turn such pigment pale gray, and at worst may make it disappear.

Occasionally a yellow or salmon-colored phase is seen. Such pigment seems readily converted to white with hydrogen peroxide application.

c. Lithopone (combination of barium and zinc whites). Can darken in the presence of iron. (E. Sayer)

d. Zinc white (Chinese white)(zinc oxide): Photosensitizer - reacts photochemically with paper. Loses covering power due to hydrolysis by alkalis.

e. Titanium dioxide: Photosensitzer.

2. Reds

a. Natural Alizarin (madder lake) (organic): Purpurin component is quite fugitive.

b. Synthetic alizarin (from aluminum hydrate treated with alkali): Alkali sensitive.

c. Carmine: (cochineal) (organic): Discolors to a greenish grey or a faint sepia-like brown in sunlight.

d. Cadmium red (inorganic): Poisonous if ingested. Blackens in chemical reactions similar to those of cadmium yellow.

e. Red lead (minium) (inorganic): Darkens to black or deep brown, sometimes with a silvery sheen, when light causes formation of brown PbO_2; can use hydrogen peroxide to convert darkened surface pigment to thin translucent film of white sulphate which allows red beneath to show through. (see white lead, above).

e. Vermillion (red mercuric sulphide)(red cinnabar) (inorganic):
"...its easy redissolution, must be approached with great circumspection if washing in water is contemplated as treatment." (Cohn-AIC-p.39-40)

May darken toward black with sun exposure, which promotes conversion to the black enantimorph (meta- cinnabar). Darkening occurs more with artificial pigment. Some say that this discoloration is reversible to a certain extent in the dark.

3. Yellows

a. Gamboge (organic):

1) A gum resin so is partially soluble in alcohol and some other organic solvents.

2) Is alkali sensitive. Discolors to red with alkali. Darkens with ammonia fumes.

3) Fades in sunlight.

4) Its use in a watercolor may be revealed only after the closest examination, for it was recommended not only as a pigment but as a local varnish, to intensify the tones of deep green and brown foliage areas, where its coloring effect would be inconsequential." (Cohn-AIC-p.40)

5) In 19th c. is often mixed with Prussian blue to produce a green. It may pass unnoticed in testing prior to treatment but may solubilize in solvent treatment, changing green to blue.

b. Yellow Lake (Quercitron Lake, Brown Pink) (organic):
Fades to bluish gray or yellowish brown on contact with alkalis.

c. Indian Yellow (organic):
Discolors to brown on decompositon by oxidation, hydrolysis.

d. Lead-tin yellow (inorganic):
Discolors to grey, i.e. may revert to white lead on long exposure to damp air.

Blackens to lead sulphide in presence of hydrogen sulphide.

e. Orpiment (inorganic):
Blackens when placed with copper containing pigments, forming black copper sulphide.

f. Naples Yellow (inorganic):
Blackens or darkens in the presence of sulphur compounds (in air or in other pigments), or when in contact with metallic iron, tin, pewter, zinc.

g. Turner's Patent Yellow (inorganic):
Blackened by water and sunlight.

h. Chrome Yellow (inorganic):
Turns green when mixed with colors of organic origin: tendency towards reduction, the loss of oxygen by its chromic constituent, by which the green oxide of chromium is formed.

Darkens to dark brown or grey on reaction with hydrogen sulphate in polluted air.

i. Barium Yellow (inorganic):
Turns green on exposure to light due to formation of chromic oxide.

j. Cadmium Yellow (inorganic):
Bleached by water and oxygen from atmosphere due to formation of white cadmium hydroxide.

Darkens when mixed with copper piments or when mixed with flake white, the lead of the latter takes a sulphur ion from the cadmium yellow, transforming it to black lead sulphide.

k. Cobalt Yellow (aureolin) (inorganic): Discolors to brown or black when mixed with indigo in presence of hydrogen sulphide.

4. Greens

a. Copper greens
Malachite (basic copper carbonate)
Green verditer (manufactured basic copper carbonate)
Verdigris (copper acetate)
Copper resinate (copper acetate or other copper salt in resinous solution)

1) Degradative effects on paper ("Kupferfrass")(verdigris, copper resinate)

a) Appearance: "During the first stage pigments seem to migrate to the reverse of the paper support giving it a green appearance. In the following stage the paper becomes brownish, first locally at those places bearing the green pigment; afterwards the destruction spreads over wider areas. As the browning increases, the green color disappears gradually and in extreme cases cannot be detected anywhere. Finally the perforation of the paper takes place on account of its increase embrittlement." (Mairinger et. al.-p.181)

b) Causes: "IRS studies concerning degradative properties of some copper compounds with cellulose gave indications for combined influence of S02 and sunlight with wavelengths above 330-340 nm." (Banik and Ponahol-p.1)

c) Specific pigments: "Different types of copper acetate showed no uniform behaviour but gave stronger effects than copper chloride, whereas malachite, schweinfurt green and calcium-copper acetate were proved to be inert, as far as the present research work could be carried out." (Banik and Ponahol - p.1)

2) Alteration in pigment hue: Discolorations ranging from small shifts of hue to a complete change from green to brown or even to black..." (Mairinger et. al.-p.180. See article for discussion of chemical reactions).

3) Treatments

a) The literature mentions that soluble magnesium, calcium, cadmium salts inhibit decomposition of cellulose by heavy metal ions. Tests by Mairinger et. al indicate that "Magnesium seems to inhibit strongly the degradation of the paper carrier." Chelating and complexing agents might be used for the same purpose. (Mairinger et.al.-p.181)

-Question remains as to how much magnesium is needed.
-Caution must be taken if the area is very acidic, as alkali may be injurious. (J.K.)

b) Locally treating degraded area with alkaline solutions (See: 20. Alkalization and Neutralization).

c) Buffered Japanese tissues placed behind sensitive areas. (See: 20. Alkalization and Neutralization).

b. Scheele's Green:
Rapid fading, blackening due to decompostion by acids, presence of lead; also, blackening due to formation of copper sulphide in presence of sulphur containing air.

c. Emerald Green:
Turns brown or black in strong light, in presence of sulphur containing air or pigments, or when decomposed by acids or warm alkalis.

d. Sap Green:
Fades.

e. Hooker's Green (Prussian Blue and Gamboge):
Turns blue due to fading of gamboge.

f. Chrome Green (Prussian Blue and Chrome Yellow):
Turns blue in strong light, due to darkening of chrome yellow or because of acids which dissolve lead chromate.

Turns dark orange in alkalis which effect the decomposition of the Prussian Blue component.

5. Blues

a. Indigo (organic):
Vegetable coloring matter. May undergo discoloration by reduction reactions. i.e. turns white when reduced by any of several reducing agents to soluble indigo white, which is oxidized by air to insoluble indigo blue. Also, bleached by hypochlorite solutions.

Fading or browning when decomposed by photooxidation; fading increased by presence of alum in the paper.

b. Logwood (organic):
Used in 17th and early 18th c. to color prints.
Discolors to red.

c. Prussian blue (organic):
Alkali sensitive may turn brown.
Fades in strong light. Literature mentions that depth of blue will return after brief storage in the dark.

Treatment: some suggestion that unanticipated browning of Prussian blue exposed to alkaline material during treatment might be reversed by exposure to mild acid, i.e. carbonic acid formed by carbon dioxide reacting with moisture. In practice the material might be humidified/moistened and exposed to the air. (A.O.)

d. Ultramarine (natural and synthetic)(inorganic):
Turns pale greyish blue when decomposed by very weak acids and the presence of sulphur dioxide.
"Acid sensitive." Will permanently decolorize, e.g. if a picture with a slat burn is treated with water, making the acid liquid. (M.C.)

e. Azurite (inorganic):
Turns green by hydration.
Blackened by warm alkalis or exposure to sulphur fumes.

f. Blue Verditer (inorganic):
Turns green through loss of ammonia component.

g. Smalt (inorganic):
Turns pale greyish from exposure to moisture and carbonic acid in air.

E. Cautions for paints during conservation treatment.

See Paper Conservation Catalogue Categories referenced below:

3.4.5. Miscellaneous media encountered in drawings and paintings on paper.

A. Wax

Can be applied to paper in the form of drips (Jackson Pollack) or brushed on as resist (Victor Brauner). In both cases, it was observed that the paper below the wax darkened and became brittle. The same guidelines for painting in oil on paper apply to the use of wax. (M.E.)

Sargent used white wax resist pencil in some watercolors. (M.C.)

B. Distemper

On early wallpaper may be insoluble but friable. Particles may physically be moved by touch or water. (J.K.)

Vuillard used dry pigments and warm glue, "detrempe," on paper. One such painting was seen to have severe flaking problems. Literature mentions that Vuillard had flaking problems even while he was working. (M.E.)

C. Enamel

Jackson Pollack used enamel for some of his drip paintings on paper. The paper below these enamel lines is severly degraded - brown, brittle, and in several cases, cracked. Suspicion that this early type of enamel was nitrocellulose. Pollock preferred it because it dried quickly. (M.E.)

D. Mixed media

1. Acrylic mixed with gouache, e.g. Altoon

2. Foodstuffs combined with traditional media, e.g. Rusche, Rauschenberg

3.4.6. Prints and Printing Inks

A. General considerations about stability and permanence:

1. Solubility: printing inks are generally insoluble in water and most organic solvents. There are, however, exceptions. Inks which appear safely insoluble in a given solvent during preliminary testing may soften or begin to bleed during actual treatment, prolonged treatment or reimmersion. One soluble component of an ink may be released onto the paper or into a bath, or in rare cases the entire ink may soften or solublize. See: 19: Solvent Treatments. 18. Washing.

2. Contemporary and modified formulations: from the mid nineteenth century on printing ink formulations become more experimental and brief spot tests become less reliable in predicting the stability of these inks towards immersion in water, alkaline baths, or solvents.

3. Breakdown of binder: "In some black and white prints, esp. 19th [c.] prints where the blacks are heavily applied, the oil medium appears to have disintegrated and the black pigment lies like chalk on the surface. Obviously these should not be placed in a water bath." (Weidner)

4. Alkaline reactions: Some fear that very alkaline solutions may saponify the oil in printing inks, causing the binder to break down.

   Have seen oil paint stains on the verso of a drawing which had been stable for 100 years saponify after deacidification and stain through the sheet. (M.C.)

   Consideration might be given to introducing the print first into a neutral water bath and gradually increasing the alkalinity of subsequent baths, thus avoiding possible damage to the oil binder. (L.K.)

5. <u>If a component of a printing ink is softened or solubilized during treatment</u> the conservator can be faced with a split second decision:

   a. Is it safest to allow the soluble component to bleed out into the bath, hopefully resulting in little apparent visual alteration of the ink and lessening the likelihood that the solubilized component will be set permanently, remaining as a disfigurement on the paper support, or

   b. is it safer to immediately remove the object from the bath and treat the bleeding component locally, possibly on the suction table, or blot and blow dry?

   c. When the softening/solubility is overall, clearly immediate removal from the bath is dictated.

6. <u>Storage Problems</u>:

   a. Reported softening of lithograph and engraving inks on prints stored for several years in fresh cedar shelving.

   b. Urea formaldehyde adhesive in plywood may effect media. Air circulation important in storage areas constructed of plywood.

B. <u>Intaglio</u>

1. <u>Engraving</u> (line, stipple, copperplate, steel)

2. <u>Mezzotint</u>: more friable ink surface than other intaglio techniques. Especially fragile as soap was added to enhance impression quality.

3. <u>Drypoint</u>

4. <u>Etching</u> (regular, crayon, soft-ground, sugar-lift, relief, aquatint)

C. Planographic

1. Lithograph (crayon, chalk, pen, wash, litho-engraving, litho-etching, litho-mezzotint, chromo-litho)

   Red inks on chromolithographs can split and bleed. Deacidification can make the problem worse. Length of time in a bath can be critical (Calder, Toulouse Lautrec, movie posters: 1930s and 1940s).

2. Offset lithograph

D. Relief: (woodcut, metalcut, chiaroscuro woodcut, wood engraving, linoleum print, letter press, zinc etching (relief etching), white engraving on stippled background.

1. 20th century woodcuts: reported pale tinted material bleeding out from inks in early 20th century woodcuts in water baths (Provincetown School, Russian Constructivist). The green ink on a Heckel woodcut split and bled yellow to the verso of the print, so caution with German Expressionists as well.

2. Some late 19th early 20th c. woodcuts are printed with paste binder ink "a la Japonnaise."

E. Stencil

1. Screenprint
   (formerly silkscreen)
   Soft, matte surface is extremely vulnerable to burnishing, even by cover tissue dragged casually across the face.

   Silkscreen prints by Robert Motherwell, framed with plexiglas, developed white powdery accretions both on the surface of the print and on the plexiglas where the two came into contact. It is assumed that this was a reaction between the plexiglas and the silkscreen inks.

2. Pochoir
   Teriade used Linel paints for Matisse's Jazz series: very water soluble and very susceptible to abrasion. Some colors also solvent soluble (e.g. acetone).

F. Hand colored prints

Hand coloring may remain soluble

G. Varnished or glazed prints

"On some prints, in order to heighten a dark color, a thin transparent, varnish like coating is applied to a print, often in a haphazard fashion. This appears to be either a gum resin or gelatin. It is easily water soluble and sometimes becomes crackled, like a varnish on an oil painting and starts flaking off, taking the ink and color beneath with it. This has been noted particularly on Currier and Ives, racing prints and Daumier prints." (Weidner)

The varnish or glaze is often an important part of the history of the print.

H. Japanese woodcuts
Colors are derived largely from vegetable sources and are highly impermanent.

1. Fugitive: e.g. aigami blue, beni pink, yukon yellow
2. Soluble
3. Mica
4. Metallic "inks" (brass, tin, silver) often tarnish.

I. Photomechanical prints

1. Planographic (collotype, Albertype, heliotype, photolithography/photchrome, offset)

2. Relief (wood engraving and zinc relief, swell gelatin or levytype, line cut photo engraving: half tone, fourcolor process, Woodburytype or gravure, photomezzotint, stannotype).

J. Photoelectric (photocopy)(copy art) (transfer photocopy, direct photocopy, color photocopy, color and color photocopy)

K. Other

1. Thermography (pseudo embossing): powdered resinous material is blown across the wet printing ink and fused with heat. This gives it a raised character which imitates engraving; often in letterheads. Reportedly, the resinous binder in some formulations may soften and dissolve in solvents (e.g. acetone), leaving behind only the loose raised ink deposit on the surface.

2. Computer art

3. Monotype

4. Collagraph

L. Cautions for printing media during conservation treatment.

See Paper Conservation Catalogue categories referenced below:

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