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"Not Always for Ornament:" Transparent Liquid Colors for Maps, Plans, and Prints

INTRODUCTION

Today, transparent effects for graphics are achieved with just a click of the mouse. To color a map or print with transparent color in the 18th century, in accordance with guidelines set forth in various English craft manuals, artists needed a solution of very finely ground pigment suspended in a clear aqueous medium. For this, a class of colorant was specifically formulated for coloring maps, plans, and prints, and they were the transparent liquid colors, commercially available or made by the colorist (cartographer, surveyor, artist). These transparent liquids were very different from the water-based media used for other types of objects, such as miniatures and even other types of popular prints, where body color and opacity were permissible. With greater specialization in the 18th century, with technical drawing in architecture, surveying, and engineering, and with the rising profession of the colormen, this new class of artists' materials was developed to meet specific needs. In 1755, Henry Wilson stated in his treatise on the manufacture of maps that colors must be made to be "so transparent as not to obliterate or deface the Lines, Trees, Houses, or whatsoever is necessary or ornamental to the Map" (263).

What are these liquid colors and how are they different from other watercolors? Who used them? Can you tell if a map or print was colored with the liquids? This paper will explore these questions against the backdrop of the history of watercolor and the rise of the professional colorman. Conservators can rely on a number of excellent resources on the history and development of watercolor; however, the commercially prepared liquid colors are little mentioned. In the 17th century and before, precursors to the liquid colors could be prepared as aqueous or oil-based solutions called tinctures, used particularly for washing or coloring maps (Purinton 2001). Pigments could also be purchased as powders in vials and mixed or "tempered" with gum arabic or purchased solidified in shells.

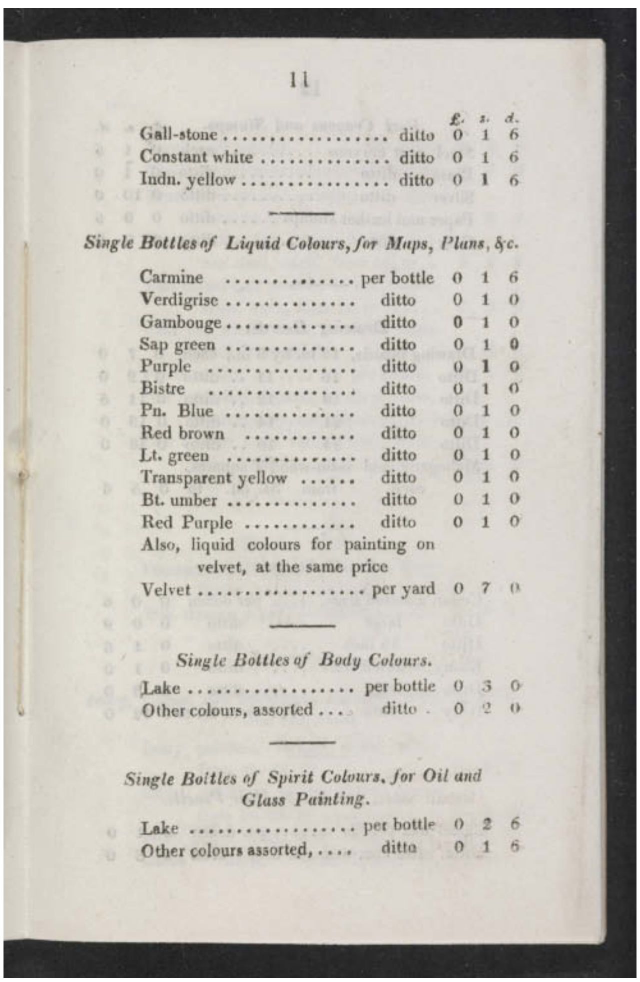
Papers presented at the Book and Paper Group Session, AIC's 46th Annual Meeting, May 29-June 2, 2018, Houston, Texas

Watercolor painting as an independent art form did not exist until the end of the 18th century, when it became a fashionable pastime in England—especially associated with scenic touring and capturing the landscape. Before that time, artists used watercolor as a subsidiary medium to heighten color in monochromatic drawings or to tint prints. By the last quarter of the 18th century, artists, gentlemen, and ladies could purchase solid watercolors in cakes more or less as we know them today.

HISTORY OF THE LIQUIDS

Interestingly, the liquid colors first arose in the building trades and created rising fortunes for the colormen, and sometimes colorwomen. That liquid colors may have some roots in the home trades makes considerable sense, since a particular formulation was needed to create broad, even washes of color for large swaths of wall or wallpaper. The Emertons of London initially traded more as color manufacturers than artists' colormen, promoting their wares to house builders and shipwrights. In this context, a very early commercial reference to the liquid colors appears in a trade card for Alexander Emerton. He established his business in London advertising in 1728 as a house painter and referred to "all Sorts of Water-Colours, prepared in Shells; and Liquid Colours, for Maps and Plans, &c" (National Portrait Gallery 2018). Another early reference also appears in a most unusual advertisement by a colorwoman, his wife Elizabeth Emerton, who took the reins of the family business following the death of Alexander in 1737. Elizabeth's trade card advertises "fine liquid colors for staining silks, linen, and paper" (Emerton 1741). Noteworthy, the Emertons also boasted of England's only horse mill for grinding fine pigments, which they touted as superior and less expensive than those ground by hand. The Emertons trade in house paints could well explain the trade card that appeared later in the century, where descendants seem to have made the upward social transition from color manufacturers to artists' colormen. Joseph Emerton's trade card prominently displays an artist at the easel painting the portrait of a lady sitter. However, his familial roots in industrial color remain evident, in the iconography of galley pots, wallpaper strainers' brushes—even the horse mill (Emerton 1744). The liquid colors eventually diverge from the building trades and also appear to diverge from general use by the public. William Reeves' trade card advertised "chemical colours for maps and plans" (Reeves 1782–1783). The term *chemical colors* suggests a technical rather than public vocabulary. Eighteenth-century experimentation led to the introduction of several chemical colors such as Prussian blue, Scheele's green, and others, which were the result of separation and combination techniques more common to the laboratory than the home studio.

As the 18th century drew to a close, the liquid colors were clearly a distinct commodity, arriving in American port cities in the early 1790s as "Reeves transparent liquid colors in bottles for illuminating maps and plans" (*New York Daily Gazette* 1793, 4). Whether in America or Britain, the liquids reigned supreme in the opening decades of the 19th century for the technical market (fig. 1). In "Treatise on the Construction of Maps," Alexander Jamieson (1814) directs his reader to "Mr. Newman, artist's colourman, 24 Soho square, has liquids in the following colors: gamboge, verdigris, carmine, purple, bistre, Prussian blue, light green, dark green…" (157). Jamieson mentions that Newman also sells cakes but cautions the draftsman in their use—advising to mix well and not add an excess of pigment because it is "liable to settle in particular places" (157). Though convenient cakes and tubes were widely available, it is significant that 19th-century manuals for surveyors and architects continue to provide instructions for grinding pigments and for steeping bits of bark and berries to create liquid colors because the particular properties of these colors were so useful for specialists. The palette remained remarkably unchanged until the introduction of aniline dyes. Transparent liquid colors persisted well into the 20th century, to be supplanted only by the most intangible of transparent media—CAD, computer assisted design.



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		£.	s.	d.
Gall-stone	ditto	0	1	6
Constant white	ditto	0	1	6
Indn. yellow	ditto	0	1	6
Single Bottles of Liquid Colours, for Maps, Plans, &c.				
Carmine	per bottle	0	1	6
Verdigrise	ditto	0	1	0
Gambouge	ditto	0	1	0
Sap green	ditto	0	1	0
Purple	ditto	0	1	0
Bistre	ditto	0	1	0
Pn. Blue	ditto	0	1	0
Red brown	ditto	0	1	0
Lt. green	ditto	0	1	0
Transparent yellow	ditto	0	1	0
Bt. umber	ditto	0	1	0
Red Purple	ditto	0	1	0
Also, liquid colours for painting on velvet, at the same price				
Velvet	per yard	0	7	0
Single Bottles of Body Colours.				
Lake	per bottle	0	3	0
Other colours, assorted	ditto	0	2	0
Single Bottles of Spirit Colours, for Oil and Glass Painting.				
Lake	per bottle	0	2	6
Other colours assorted,	ditto	0	1	6

Fig. 1. Liquid colors remain a commodity throughout the 19th century (Driver and Shaw 1824, 11).

MANUFACTURE AND USE

Other than the obvious fact that these are fluid media, what technical features distinguish the liquid colors and why did they have such lasting power, particularly for specialists? Clues about their technical qualities, especially transparency, are embedded in techniques of production. The trade cards don't reveal the secrets of their success, but the craft manuals of the 17th and 18th centuries provide some details. Craft-oriented manuals by English authors such as John Smith, William Salmon, and later Robert Dossie, offer guides for ladies and gentlemen in the arts—including the "washing" or coloring of maps and prints. These manuals encouraged the use of a variety of colorants, which we today would classify as organic and inorganic pigments. Many manuals praise the transparent effects of organic pigments such as madder or sap green while warning against some mineral pigments such as vermillion, which was said to "hide the mark of the graver" or obscure the printed design (fig. 2). These craft manuals for generalists and amateurs advised that the pigments for washing maps and prints could occasionally be the same as those used with oil, but only with thorough grinding and chemical additives. In other words, a good wash of inorganic vermillion, sometimes referred to as semitransparent, could be nearly as transparent as a wash of the organic pigment madder, but only with proper care and preparation.

Specialist manuals, however, told a different story. Edward Laurence, author of *The Young Surveyor's Guide* of 1716, unequivocally asserts that surveyors' colors are not the same as those used by painters in oil. "But for our purpose the transparent colours are principal…. Brazil and Logwood Water, Carmine, Indian-Cakes, Turnsoil, Ultramarine, Gamboge, Yellow-Berries, Saffron, Litmose, Sap-Green, French Verdigrease, Wood Soot, and Walnut Husks" (227). Here Laurence has listed primarily vegetable colors such

Fig. 2. (a) Opacity of vermillion (16x) versus (b) transparency of organic red (16x), which allows engraved details to be visible through the wash.

as Brazilwood and also a few inorganic exceptions of relatively small particle size—ultramarine and French verdigris. Consistent blues and greens were difficult to achieve with some of the plant-based sources such as litmus and turnsole for blue or sap green and buckthorn berries for green. Hence, the manuals commonly provided mineral-based alternatives for these colors, often ultramarine before the commercial availability of Prussian blue, and verdigris, which remained a standard green until aniline dyes became available. Laurence also advised the surveyor to be very careful about sourcing pigments and contracting with colorists, stating that "it is not convenient to repair to a painter to finish his work […] a painter is not to be found in every county, or is every painter furnished with colours fitting for such a purpose, they for the most part using more gross and ordinary colours" (216).

What was gross and ordinary was particle size and weight—key physical properties linked to transparency and opacity. Hiding power or opacity is the ability of a pigmented coating to obliterate the surface of the substrate. Naturally, the thickness of the coating and the concentration of the pigment play a role; however, the specific pigment and its particle size is important. Mineral pigments are generally more opaque because they are larger and heavier than organic pigments. Another key factor in opacity is refractive index, a pigment's ability to bend or scatter light in relation to the binder. Mineral pigments have a higher refractive index than organic pigments, again contributing to their relative opacity in water and gum arabic. Yet, in the generalist manuals by Dossie and others, the mineral pigments were not dismissed out of hand. Some of the minerals of smaller particle size could be mixed in a vehicle or aqueous solution with a suspension agent or additive that could reduce a tendency to agglomerate or clump and settle, creating an uneven, dappled wash. According to many, the preferred suspension agent or surfactant was alum while others recommended ox gall. Dossie specified "isinglass size prepared with sugar or honey, which makes the colours of this sort [semitransparent] work so freely, that they may be diffused almost as easily as the transparent kinds and with nearly good effect" (1758, 327).

These physical properties are what ultimately divided the users of the transparent liquid colors and the watercolor cakes. For professionals, the preference wasn't only for vegetable colorants but also for the vehicle—a liquid. Before the invention of the cakes in 1780, specialists and amateurs alike used the liquid colors for painting on velvet, flower painting, and for tinting prints, maps, and plans (Alston 1804).[1] For coloring prints, numerous craft manuals for amateurs and artists extolled the virtues of transparent effects or "leaving the lights" of the paper to appear through the wash, often for aesthetic rather than technical purposes. It was in poor taste to indiscriminately daub on very thick color, similarly covering the lights and shades, "like a penny print" (Jackson 1749, 49). Rather, colorists of prints were encouraged to let the light of the paper shine through and to be careful of colors that are too opaque, "sad," or deep. The liquids were considered ideal for these purposes.

After 1780, however, the new and exciting cakes appear to be the preference for most consumers, except for the professional or technical specialist. Though the manuals for generalists persisted in regurgitating the same recipes for making the liquids for a decade or so—as was customary with the popular craft manuals—the genteel reader of the "manual of elegant recreations" was advised to leave the liquids behind for the more convenient cakes: "The old treatises on water colours which contain directions for grinding them may be considered as obsolete colours being now manufactured...in cakes which are both brilliant and permanent" (Young Lady 1829, 355).

For professionals such as surveyors and architects, however, the issue of permanence was not a major concern and transparency was much more than an aesthetic issue. Legibility of the drawn or printed design and text, as seen through a transparent wash, was crucial to the function, which was informational. In addition, these professionals needed a large wash of consistent color, not one that might vary depending on the manufacture of the cake or techniques of dilution in a small saucer, as was the case with the cakes. This is not to say that cake or shell colors were never used by professionals. Surveyors may well have occasionally used solid cake or shell color for reasons of portability or for rendering border color or illuminating the cartouche, where more saturated color and precise lines were desirable. *The Practical Surveyor* of 1765 lists "Bottles and Shells of Water-Colours" in its list of necessary supplies for drawing and geometry (Hammond, 198), but it provides instructions only for preparing the liquids for washing or coloring plans (130). Much attention, therefore, is given in *The Practical Surveyor* and similar manuals to tools and techniques of grinding and processing pigments in preparation of a transparent liquid color.

A colorant owes its relative transparency not only to the chemical and physical properties of the pigment, but also to its processing. After extraction, mineral pigments such as ultramarine and red lead—and a few organic ones such as indigo—were ground. Artists' colormen commonly hand ground the mineral pigments into the first decades of the 19th century, however, the Emerton company boasted the superiority of horse grinding. Specifics for hand grinding unprocessed pigments are given in several of the surveyor's manuals. Some coarser pigments such as red lead and iron oxides were not well suited for a water-based medium and required further processing to create liquid solutions—if they were to be used at all as liquids. This laborious process was called, unfortunately, washing. "Washing" in this context does not mean coloring but means refining pigment by separating the coarser, larger particles from the smaller. This was accomplished by allowing the larger particles to settle in water or cling to the sides of the glass vessel, and collecting only the finest particles for use. In one manual, the reader is instructed to "put the colour in some clean Water into a Bason, often stirring it together; then let the Colour settle… and what at last sticks to the Sides will be the better colour" (Wilson 1755, 265).

No matter how well processed, ground by hand or by horse, or suspended in a variety of liquid vehicles, the opaque or even semitransparent pigments such as Prussian Blue or vermilion could not compete with the transparent pigments for effect or for ease of preparation. The transparent colors such as Brazilwood or gamboge were preferred because of their visual effects and because they required little preparation. These pigments were not ground, tempered, or washed but were simply diffused or steeped cold or hot, in a variety of liquids. These include water, stale beer, wine, or vinegar with the addition of various suspension agents (ox gall, gums, honey). Of gamboge, Salmon instructed: "dissolve it in fair spring water, and it will make a beautiful and transparent yellow: if you would have it stronger, dissolve some Alom therein" (Salmon 1672, 204–205). Alum was added not only to heighten color, but as a mordant and was thought to protect the color from fading. Color intensity was also adjusted by raising the pH with "sope lees," the dregs of the soap-making process, or lowering it with vinegar or citric acid. The liquors of these aqueous solutions were to be poured off "free of their settlings" and stored in glass bottles without further preparation. The "settlings" could also be strained through linen, brown paper, or both, which some manuals recommend.

HISTORIC RE-CREATIONS

To understand how the liquid colors handled, how they compared to cakes, and to answer the question of whether or not one can tell if a map or print was colored with the liquids versus cakes, test specimens were created in accordance with historic recipes. For these experimental reconstructions, it was understood from the beginning that organic pigments sourced from contemporary manufacturers would not be identical to those of the 17th and 18th centuries, but the goal was to make several liquids as close as possible, according to the recipes of the time. These selected colors, common for washing maps and prints, are Brazilwood, cochineal, gamboge, madder, and verdigris. Rather than use the formulations given by any one particular author, such as Boyle, Salmon, or Hoofnail, preference was given to the author who provided more quantitative details in their formulations such as drams, ounces, and quarts versus more informal instructions such as "boil it till it taste strong on the tongue" (Salmon 1672, 203). Pigments used in the preparation of the recreations were made from Kremer's line of historic pigments. The papers used for test washes are 18th-century English printing papers taken from a damaged book used for student experiments at Winterthur. The test pages were additionally sized with gelatin and alum as recommended in the manuals. Specific formulations for the liquid reconstructions appear in the Appendix.

Do washes of liquid colors look different than those from cake colors? Sometimes, depending on which cakes. To the naked eye, washes made with the liquids appear very even and dense, fully saturating the fibers. The liquids appear to have higher tinctorial strength than the cakes, making it challenging to create a pale wash with only one spare application of liquid medium. In order to compare the liquid washes to early watercolor cake washes of similar composition, that is, before organic synthetic dyes, watercolor manuals from the first decades of the 19th century were surveyed to select ones that included specimen washes of single colorants versus popular color mixes, such as "lake" and indigo. Two such pre-1830s manuals were found in Winterthur's library (Hassell 1825; Smith 1827).

In comparing washes made from the liquid laboratory reconstructions to watercolor cake washes of similar composition and color density, the 19th-century cake washes were found generally to have deposits of finely divided pigment visible in the specimens of medium to dark tonality, with a few exceptions, such as gamboge. Comparisons between organic liquids and inorganic cakes, such as Brazilwood liquid to red lead cake, were generally quite obvious, with the inorganic pigment having clear deposits of granular material. Interestingly, pigment particles were even visible in many of the organic lake watercolor cakes, which have a relatively small particle size. By contrast, the comparable organic liquids have minimal deposits of visible pigment. To hone in on these differences, potentially visible with simple optical microscopy available to the bench conservator, the red lakes were closely examined since they were often manufactured as liquids and as cakes. Comparisons between liquids of madder and cochineal-carmine lake were compared to numerous historic watercolor washes of madder, carmine, and "lake" (the latter often historically described as a mixture of cochineal-carmine, cochineal mixed with Brazilwood, or either of these with a small amount of vermilion). Among these red lakes, pigment particles were again visible in the cake washes of medium to dark tonality whereas the liquid washes had minimal visible pigment (fig. 3). However, the visible differences were negligible when comparing very pale washes of either historic cake or liquid, or when comparing liquids to some modern cakes, such as carmine, which is synthetic-dye based. It should also be noted that there would be differences in manufacture among the cakes and the liquids from varying sources. For instance, the historic manuals suggest that the liquids could be filtered through brown paper or linen, or levigated by simply allowing the solution to settle over time while pouring off the clear fluid. All of these techniques would impact the amount and size of particles visible in the final medium. The liquid recreations in this study were purified by levigation, with the exception of madder, which was strained as recommended in the manuals.

Another difference between the liquid recreations and the cakes is the presence of dark bits of detritus, possibly small pieces of root or bark, that do not appear highly colored as in pigment. These are not present in the cake washes from any of the manuals examined but were almost always visible in the liquid washes, even in the palest shades. One can imagine that such debris would have been difficult to control in the liquids and could be the product of manufacture or happenstance collection in open vessels. This debris proved useful when comparing the liquid reconstructions to two historical objects that were good prospects for "knowns" of liquid colors. A large 1775 pocket map (Scull) almost certainly had professional early color and was a good prospect for a liquid color due to its large size and its date—before the invention of watercolor cakes. A second object, a small 1762

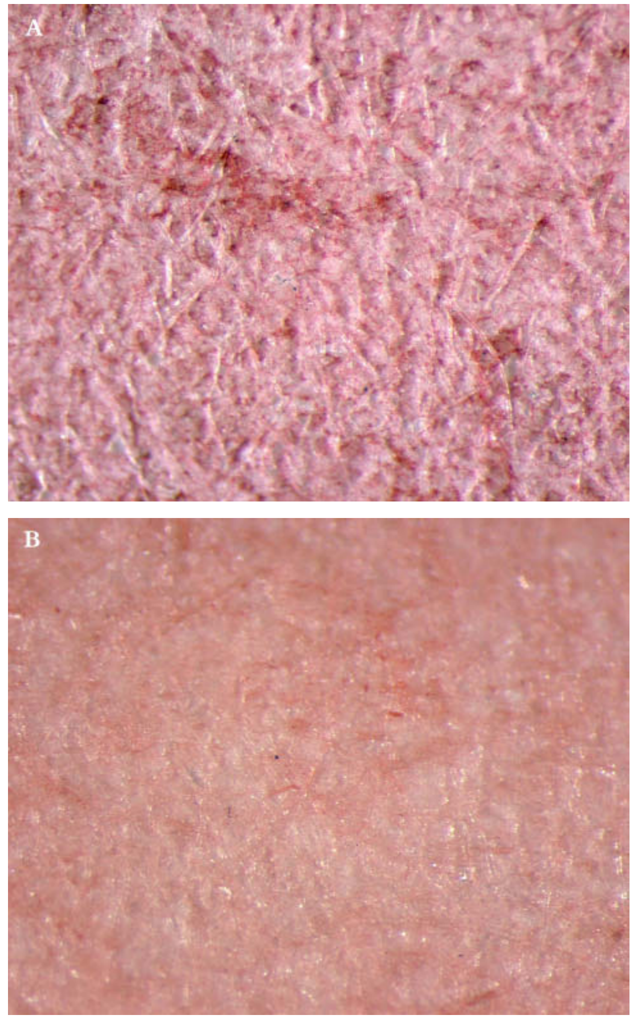

Fig. 3. (a) Agglomeration of pigment visible in madder (40x) specimen from Smith's Art of Drawing (1827) versus (b) little visible pigment in liquid madder (40x) reconstruction.

atlas (Bonne), was also identified as a "known" for liquids by assessing application technique and by comparing to other volumes of the same atlas, which were similarly colored, suggesting a professional workshop. Under magnification there was little particulate pigment visible in the washes of organic yellow, organic pink, and verdigris in either object with only random, very scattered pigment solids occasionally discernable. However, small bits of dark debris, of varying size and shape, were also present—not as surface dirt—but bound in with the medium, much like the liquid laboratory recreations (fig. 4). The appearance of this debris may be another useful indicator of the presence of historic transparent liquids in hand-colored objects.

Another aspect of looking closely at the liquid colors is identification through analytical methods. Many conservators are very familiar with the various analytical techniques

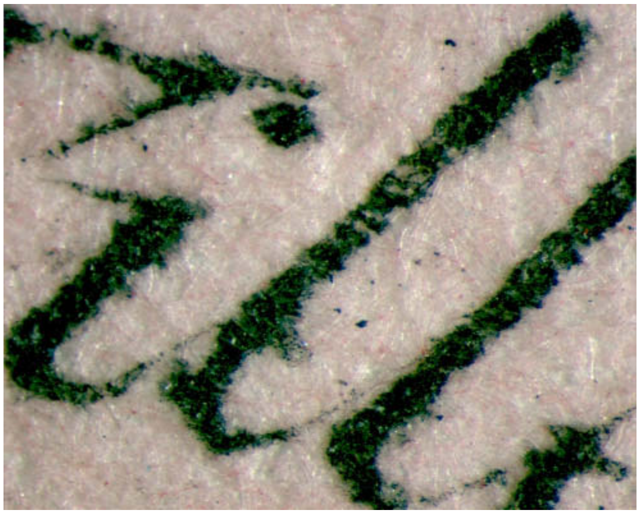

Fig. 4. Small bits of detritus bound in with liquid medium (40x) present in historical objects such as this 1762 French atlas colored with transparent liquids.

for identifying organic and inorganic pigments. What complicates analytical methods for the liquids is what makes the liquids so unique—homogenous washes of color deeply stained in the paper and therefore nearly impossible to sample. Extracting even minute fibers would mar a delicate, even wash. Preliminary work at Winterthur looks promising in terms of introducing a minimally invasive method of sampling for high-performance liquid chromatography (HPLC). Small 1-4 mm discs of agarose, 5 wt% and 10 wt%, were made using dermal punches. These were applied to watercolor washes to extract just enough pigment to achieve a successful HPLC separation—without visual effect on the sampled area in visible and ultraviolet light. This work is ongoing and results will be shared in the future, along with the use of nondestructive fiber optic reflectance spectroscopy (FORS), which has shown promise with organic materials.

CONCLUSION

For the conservator, the relevance of the liquid watercolors lies in connoisseurship and collections care. The liquids were preferred for transparent effects in some tinted prints, botanicals, and all maps, plans, and architectural drawings. Determining whether or not an object has early color has vexed conservators and curators alike; perhaps the presence of the liquids can, at least, provide some qualitative information. The appearance of the liquids on a print could suggest early color. Such an assessment must also take into consideration other qualities that conservators typically look to when analyzing color such as scientific analysis, palette, condition, application technique, and workshop practice, to name a few. The presence of the liquid colors, especially on an object that postdates the invention of watercolor cakes, also suggests a professional or technical hand. One suspects that even before the cakes, shell colors, the precursors of the cakes, would have been a more convenient and tidier option for the amateur than the messy liquids or tinctures in bottles.

While permanence may have been a concern for artists and amateurs, it was less prized than transparency by jobbing professionals and technicians. The fugitive nature of organic watercolors, made famous by Russell and Abney in 1888, was well known long before their time. As stated in the *Young Surveyor's Guide* of 1716, "N.B. Colours made from vegetables fade the soonest" (Laurence, 218). The small particle size and thinly applied washes that lend the beautiful transparency to the liquid color washes also make them most vulnerable to light, oxidation, acids, alkali, and, ultimately, fading. The latter we can observe empirically and has remained an area of continued scientific inquiry with microfading and with studies of photo-oxidation under anoxic conditions. Transparent beauty, though, is as seductive today as it was centuries ago, especially for the professional. On their website, Winsor & Newton advertise professional-grade watercolors as having "unrivalled transparency." Professionals today know what they knew in 1755, that "colouring… is not always for ornament only" (Wilson, 269).

AKNOWLEDGMENTS

Many thanks to Winterthur and the University of Delaware for supporting this research and the following for their contributions: Jocelyn Alcántara-García, Assistant Professor, Conservation Scientist, for high-performance liquid chromatography; Betty Fiske, for generously allowing me to share the history of the liquids with members and friends of Historic Odessa Foundation; John Krill, for sharing thoughts and research on the history of watercolors; Catherine Matsen, Scientist, Winterthur, and Rosie Grayburn, Associate Scientist, Winterthur, for x-ray fluorescence spectroscopy.

APPENDIX

Alum (alum water)

Definition: Alum (or Roche alum, rock alum, Roman alum) generally refers to aluminum potassium sulfate. It is a colorless, crystalline material used in the tawing of skins and as a mordant for many natural dyes.

Historic recipe: "To make alum water dissolve 4 ounces of alum in a pint of fair water boiling them till the alum is dissolv d or thus to 2 quarts of spring or well water put half a pound of Roch alum poudered dissolve it well by boiling filtre it through brown paper and keep it for use" (Barrow 1735, 1 recto Hh).

Laboratory reconstruction: 113 g of potash alum in 473 mL of Winterthur filtered tap water, boiled until solids dissolved.

Gum arabic (gum water)

Definition: a gum exuded from the stem of several species of Acacia tree, typically found in subtropical regions of the world.

Historic recipe: "Put a quart of pure spring water into a jar glass and hang in it ty d up in a fine woollen rag a sufficient quantity of pure white gum arabick bruised. Let it hang till the gum is dissolved put your fingers into the water and if you find them to stick together as if they were glued your water is too strong or full of the gum and therefore you must put more fair water to it and if you find it too weak you must put in more gum" (Barrow 1735).

Size

Definition: A material added to a porous substrate such as paper or textile to diminish absorbency. Common sizing agents for paper are starches, animal glues, gelatin, and cellulose ethers.

Historic recipe: "Take glew which steep all night in water then melt it over the fire to see that it be neither too strong nor too weak then let a little of it cool; if it be too stiff When it is cold put more water to it if too weak more glew using it lukewarm" (Salmon 1672, 202).

Laboratory reconstruction: .5% powdered gelatin dissolved in Winterthur filtered tap water, heated until all solids dissolved.

Brazilwood

Definition: Brazilwood is derived from various tropical trees of the senna genus native to South America, the East Indies, and parts of Asia. Brazilwood was an important wood and dye export from South America beginning in the 17th century.

Historic recipe: "To some ground Brazil put small [weak or stale] Beer and Vinegar of each a sufficient quantity let it boil gently a good while then put therein Alom in powder to heighten the Colour and some gum Arabick to bind it boil it till it taste stronge on the tongue and make a good red" (Salmon 1672, 203).

Laboratory reconstruction: 28 g of Brazilwood in 473 mL of liquid composed of equal parts stale IPA beer and white vinegar, boiled; 4 mL alum water and 4 mL gum water were added.

Cochineal-Carmine

Definition. Cochineal is derived from dried insect bodies of *Dactylopius coccus* Costa (formerly *Coccus cacti*) from Central and South America. The lake pigment carmine is formed when precipitated with alum.

Historic recipe: "Cochenele, Steeped as Brazil was boiled makes a fair transparent purple as thus take Cochenele and put it into the strongest Sope lees to steep and it will be a fair purple which you may lighten or deepen at pleasure" (Salmon 204). For proportion, Hoofnail cites a dram of solid cochineal powder in a pint of Thames water—or approximately 1.77 g in 473 mL (Hoofnail 1738, 27). There are numerous variations in vinegar, Rhenish wine, and "alkaly."

Laboratory reconstruction: 2 g of cochineal in 473 mL of liquid composed of equal parts stale IPA beer and white vinegar, not boiled; 4 mL alum water and 4 mL gum water were added. The solution was made alkaline with potassium hydroxide, to approximate "Sope lees" (or the dregs of soap making) to a pH of 14.

Gamboge

Definition: a yellow resinous plant gum produced by several species of the Garcinia tree. Gamboge was imported into Europe in the 17th century and possibly earlier.

Historic recipe: "Cambogia Dissolve it in fair spring water and it will make a beautiful and transparent yellow: if you would have it stronger, dissolve some Alom therein" (Salmon 1672, 204–205).

Laboratory reconstruction: 28 g of gamboge in 473 mL of Winterthur filtered tap water.

Madder

Definition: A natural red dye extracted from the roots of various species of the genus *Rubia*.

Historic recipe: "Take Madder four Drachms, ground Brazil one ounce, Rainwater a quart; boil away a third part: then add Alom half an ounce, boil it to a pint; then gum; Arabick one ounce, which boil till it is dissolved, cool it stirring it often, and strain it for use" (Salmon 1672, 202).

Laboratory reconstruction: 7 g of madder and 28 g Brazilwood ground in mortar and pestle, 946 mL of Winterthur filtered tap boiled and reduced in volume by one third, 14 g alum added and reduced to 473 mL; 28 g ground gum arabic added and heated until dissolved; solution cooled and strained through cheesecloth.

Verdigris

Definition: Verdigris or basic copper acetate is a bluish-green corrosion product formed when copper is put into acetic acid (vinegar). It is cheap and easy to obtain; the powder simply is scraped off copper and used as a pigment.

Historic recipe: "verdigrise boiled in vinegar makes a very good green but as it dries deep the wash must of course be very pale" (Jamieson 1814, 156). Hoofnail recommends adding a dram of gum water, or roughly 4 mL.

Laboratory reconstruction: 28 g of verdigris in 473 mL of white vinegar, with 4 mL of gum water or liquid gum arabic.

NOTE

1. The liquids colors are widely noted for painting on velvet and were advertised by Ackermann, Newman, Reeves, and others for this purpose. Manuals seem to suggest that the binder for liquids for painting on velvet was gum tragacanth, rather than gum arabic (Alston 1804, 69). Gum tragacanth was also used as a food thickener and may have yielded a more viscous solution, a more suitable consistency for painting on velvet rather than on a well-sized paper.

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SOURCES OF MATERIALS

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Daniel Smith

Potash alum; pigments
Kremer Pigments

Gelatin (200 Bloom, Type B)
Polistini Conservation Material LLC

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