



MATERIALS

Flash in the Pan: A History of Manufacturing Watercolor Paint in America

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The mid-nineteenth to early twentieth century was an exciting time in the development of artists' materials in Europe and the United States. A new generation of colorants, papers, and other materials offered artists, illustrators, and designers innovative ways to express their vision. An understanding of these materials deepens our appreciation of their work, pulling us into the moment of creation and the technology of the time. The developments that took place during this period in the medium of watercolor—typically defined as a dispersion of finely ground pigment in gum arabic—resulted from both artistic mastery and industrial ingenuity.

Materials that had previously been obtained and prepared solely by the formally trained artist were made available to the masses for the first time through specialized manufacturers and sellers, called "color-men." By the mid-eighteenth century in Europe, where landscape painting in watercolor had a long history, these purveyors of artists' paints were already well established.¹ However, a formal system for supplying artists with paint and other art materials did not exist in colonial America. It was not until the Revolutionary War (1775–83) and the Napoleonic Wars (1799–1815) restricted the availability of imported products that the fledgling commercial paint industry began domestic production of fine artist paints.

Americans did not, at first, regard watercolor as a fine-art medium. Early in the history of watercolor practice in America, the primary practitioners were amateurs (frequently women) or military officers, who were trained to use watercolor in topographical documentation.² Neither would have known how to prepare their own paints, and so they depended on commercial suppliers, especially while traveling.

The establishment of colormen in the United States allowed these amateur artists to proliferate because technical knowledge was no longer needed in order to have a reliable and affordable source of paint. The expanding market in turn drove innovation in how watercolor paint was made, packaged, supplied, and used by both amateur and professional painters. An examination of the materials, manufacture, and supply of these paints in late eighteenth- and nineteenth-century America, within the context of the larger domestic paint industry, reveals the swift evolution of watercolor paints during this period.³

From Shipping Docks to Storefronts

In 1767 the painter John Singleton Copley lamented the puritanical American culture that regarded the creation of fine art as "no more than any usefull trade, as they sometimes term it, like that of a Carpenter tailor or shew maker."⁴ Just as the professional artist was a rarity in America before 1750, so too was the profession of colorman as a distinct endeavor. Rather, the artist, forced by necessity to import his pigments, resins, and other materials for paint making, typically sold a portion of the goods he received as a source of additional income. Often the artist-seller would simply set up "shop" at or near docks as the materials were unloaded from English ships, thus precluding the need for domestic suppliers of these goods.⁵

The earliest brick-and-mortar color shops, selling only imported artist materials, were located in Boston, New York, and Philadelphia in the mid- to late eighteenth century. Even after the Revolutionary War, these shops continued to import nearly all of their colors and other supplies from England through an agent or manufacturer. A few early shops served

John H. B. Latrobe (1803–1891)
Detail of *Trompe-l'oeil*, c. 1827
Watercolor, graphite, pen and black ink,
with scraping, on wove paper
6½ x 8¾ inches (16.8 x 22.5 cm)
Philadelphia Museum of Art. Gift of the
McNeil Americana Collection, 2009-218-3



FIG. 318
Paint and Varnish Manufacture as Conducted by F. W. Devoe & Company, New York
 Illustration on the cover of *Scientific American*, May 17, 1884

(Top row) grinding and mixing of colors, with separate facilities for making artists' tube colors, milled on a circular glass table with a revolving granite block; (second row) brushes made in-house and gums broken down into smaller pieces and sorted by hand; (third row) pulverizing of dry colors, the main store and showroom at the corner of Fulton and William Streets, and the cooling room; (bottom row) manufacture and/or processing of lower-grade and toxic pigments such as white lead and vermillion.

the additional function of art academies, providing a gathering place for learning and discourse.⁶ The colonial portraitist John Smibert ran a color shop out of his house in Boston that also gave artists access to his collection of imported prints, plaster casts, and copies he had made of works by the old masters.⁷

In the nineteenth century, the close physical proximity of industrial and artistic activity in increasingly populous American cities allowed colormen to formally establish themselves as middlemen between the artist and the manufacturer of his supplies. Artists in neighboring studios would patronize these firms,

which subsequently adapted and refined paints, stretchers, and other tools in response to their needs. As the symbiotic relationship between artists and their suppliers developed, the firms expanded, diversified, and often specialized. Some found success as distributors or dealers—forerunners of the art-supply houses and galleries such as M. Knoedler & Company that formed around midcentury. To support an emerging middle-class art market, these firms commissioned American artists to make copies of popular paintings and sculpture from Europe, or arranged for the reproduction and publication of selected artists' works, which introduced them to an international audience.

Early Domestic Color Makers

Until the twentieth century, all types of paints were made from the same essential materials: dry pigments, oils, resins, and gums. What distinguished artists' paints from industrial or "house" paints was how finely the pigments were ground and the quality and treatment of the vehicles used to disperse them. Before 1867, when ready-mixed paint in cans was patented,⁸ the terms *color* and *paint* might refer either to pigment or to paint prepared as needed by painters or druggists according to client specifications. The manufacturer Samuel Wetherill of Philadelphia wrote to his supplier in London in 1789 that in America, "We are Druggists as well as Oil and Colour Men."⁹ Because pharmacies already imported colors to use in medicines, and were familiar with grinding and mixing, the combining of the trades was natural.¹⁰

In the early years of the republic, commercial paint production was driven by the need for large quantities of protective coating for ships and houses, as well as for metal carriages, an early American export.¹¹ The deterioration of international commerce during the War of 1812 caused such a scarcity of chemicals that there was a desperate need for domestic pigment manufacturing, a task taken up primarily by immigrants who had learned the chemical processes in German, French, or English factories.¹² This industry also encouraged the mining of native red and yellow ochers and ores,¹³ and the large-scale domestic pro-

duction of inexpensive pigments such as lead white, minium (red lead), zinc white,¹⁴ Prussian blue, and lampblack.¹⁵ The discovery of chromium-containing mineral deposits in the United States, Britain, and France in the 1820s bolstered the widespread use of chrome colors.¹⁶ A survey by the American government in 1832 indicates that by this time 75 percent of all industries using paints employed domestic materials.¹⁷ The demand for paint soared again during railroad-building booms in the 1830s through 1860s, as railways replaced canals as the primary means of moving goods and people. The United States continued to import many mineral colors and organic dyestuffs—from regional organic or mineral sources or patented synthesized pigments—to manufacture such domestic goods as playing cards or wallpaper, but on a much smaller scale.¹⁸

By the 1880s paint factories were springing up in industrial centers across the nation. Since the weight of prepared paint made it expensive to transport, small domestic manufacturers in regional markets dominated until the mid-nineteenth century. These firms usually sold both local and imported pigments, made from natural plant, animal, or mineral sources as well as those synthesized by American chemists. As was the case in other American industries at this time, most of the colormen companies started with one or two employees and slowly grew as family businesses. The New York firm of Raynolds & Devoe (later F. W. Devoe & Company), for example, remained a family concern but expanded rapidly in the mid-nineteenth century, and in 1882–83 constructed large-scale facilities in Greenwich Village, where pigment and paint manufacture was spread across six floors (fig. 318).

As manufacturing sites gradually relocated from homes and small workshops to such factories, pigment production relied less on individual artisans involved in every step of product creation and sale, and more on a division of labor between specialized and unskilled workers. Authors of eighteenth- and nineteenth-century artists' manuals frequently advised their readers on the detection of fraudulent materials,¹⁹ for there was ample evidence of widespread

adulteration or substitution of many goods, including pigments, oil, and resins.²⁰ The apparent decrease in product quality resulted from the fact that the workmen involved at different stages of manufacturing might have little idea about the nature of a material or its end use. Painters now had to trust not only that the overseas agents had reputable suppliers, but also that the American importers, manufacturers, and sellers were trustworthy. One 1869 report describes possible adulterants of powdered madder root, at the time widely used as a dyestuff and pigment, as including brick dust, red ocher, clay, mahogany dust, logwood, japan wood, and bran. French madders apparently contained “half their weight of gum, sugar, salts, and other soluble substances.”²¹ More alarming was an instance in which vermillion (mercuric sulfide) adulterated by red lead was sold by a druggist for house paint, and subsequently used by a merchant to enhance his annatto food coloring.²²

Commercial Watercolor Paint

While early references to the sale or use of watercolors in America are sparse, those that exist perfectly describe the progress of the art-supplies trade, first documenting the importing and selling of raw materials to artists, then the sale of premade or made-to-order paints prepared by local artisans, and finally the availability of commercially prepared products

FIG. 319
Raw materials for watercolor
(Clockwise from left) Cherry almond gum (sometimes used in eighteenth-century watercolor formulations), gum arabic, a glass muller (used to disperse the pigment), synthetic ultramarine blue pigment, and gum water (gum arabic dissolved in water and strained through a sieve).



FIG. 320

Hand-ground watercolor paint in shells

Vermilion and yellow ocher pigments were dispersed in a solution of gum arabic and water using a muller. The paint paste was poured and pressed into the shells and left to dry.



FIG. 321

(Top) Watercolor cake manufactured by Reeves & Sons, c. 1830–1890

28 x 17 x 8 mm

Courtesy of Winterthur Museum, Winterthur, Delaware. Bequest of Henry Francis du Pont, 1967.1828

(Bottom) Watercolor cake in foil packaging manufactured by Reeves & Sons Ltd., c. 1891–1976

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FIG. 322

Painting case with eighteen palettes, c. 1800

Made for Edward Green Malbone (1777–1807)

Ivory, pigments

5½ x 12 x 9 inches (14 x 30.5 x 22.9 cm)

Museum of Fine Arts, Boston. The M. and M. Karolik Collection of Eighteenth-Century American Arts, 39.117

Early watercolor cakes were rubbed against ivory or porcelain saucers filled with water to solubilize the paint. For ease of use, the diluted paint would be left to dry out on each saucer and the palettes stored in a cylindrical container for the next painting session.



bought off the shelf. One of the earliest references to watercolor supplies is a 1736 advertisement in which the Bostonian John Merritt announced the sale of "Painter's Colours and Gums of every Kind, for House-painting, Face-painting and Water Colours."²³ At this time the artist himself would grind and then disperse his purchased pigment in prepared gum water (fig. 319), forming the paste into irregular cakes to dry. Because the gum in the dried cake was not readily soluble, the paint could not be lifted with a wet brush. The artist had to chip or grate the cake against an abrasive surface and dissolve the small pieces in water, or wet and rub the cake against a porcelain saucer. In short, these paints were difficult to use. By the 1760s the artist and colorman John Gore had begun to simplify the artist's task,²⁴ offering "colours prepared for House and Ship Painting" and "Watercolours ready prepared in shells" (fig. 320).²⁵

The few artists in the nineteenth century who persisted in preparing their own watercolors found that recipes and guidance were harder to come by. Manuals that once may have given detailed instructions for making paint instead urged artists to buy ready-made supplies to avoid the trouble and risk of failure inherent in producing their own watercolors. The challenge is intrinsic to the medium—watercolor paint is comprised of tiny solid particles suspended in a relatively weak gum binder. The paint typically is diluted and applied to an absorbent and flexible surface such as paper, so the physical properties of the pigments and the gum, as well as any additives, are more consequential than they would be on a less porous, more rigid support. Paint lacking in gum binder can be difficult to apply and result in a powdery paint film. Conversely, too much binder will create a brittle paint film that is prone to cracking, cupping, and flaking, especially on a flexible paper support.

In Britain, the eighteenth-century boom in landscape painting stimulated the development of convenient ready-made watercolor cakes, introduced in 1781 by the London firm of William and Thomas Reeves. Reeves paint was formulated with honey as a

humectant to attract and retain moisture, which made the cakes more soluble and less likely to crack in storage. William's prior training as a wire maker, when he learned to pass silver and gold through dies of diminishing diameter to "draw" it into wire, presumably inspired him to extrude paint paste in thick filaments and chop it into rectangular pieces.²⁶ The dried cakes were wrapped in damp cloths to soften the surface, then stamped with the firm's name and wrapped in paper or foil (fig. 321).²⁷ The award-winning paints were still hard and needed "rubbing out" in water (fig. 322),²⁸ the morning chore of many Victorian watercolor painters, but they were a marked improvement in terms of both usability and packaging. The jewel-like cakes were sold in attractive sets packaged in wooden (or paper) boxes that were immediately popular (fig. 323). By 1806 large quantities of these watercolor cakes were being imported to the United States: in December alone, Samuel Tuck imported four hundred boxes for his thriving color shop in Boston.²⁹ The first commercial manufacturer of watercolor cakes in the United States was Lewis J. B. Wells in New York, beginning in 1811–12.³⁰ Other early watercolor-paint manufacturers were the chemists Joseph Boston (est. c. 1823), Joseph Brutsche (c. 1830s), and A. P. Homer (c. 1850s), all in Philadelphia.³¹ The lack of existing records for these enterprises suggests that they were short-lived.

In 1824 the colorman George C. Osborne partnered with the pharmacist Daniel B. Smith in Philadelphia to manufacture high-quality watercolor-paint cakes (figs. 324–26).³² Osborne had emigrated from London to New York in 1808, and he started his paint business there before moving a few years later to Philadelphia,³³ where he was listed as "painter & c." in the 1816 city directory, as "colourman" in 1818, and as "watercolourman" by 1821.³⁴ Osborne was notable as one of the few American makers of artists' paints whose company won "premiums" for its products,³⁵ and he created a brand name that was maintained even as the actual manufacturer of the product changed several times in subsequent decades.³⁶ Advertisements and packaging for Osborne



FIG. 323
Watercolor box belonging to Thomas Eakins, c. 1850–80
Box manufactured by Waring & Dimes, London
Pigment cakes manufactured by Waring & Dimes, Winsor & Newton, Ackermann, and Newman
12 x 7 x 3 inches (30.5 x 17.8 x 7.6 cm)
Pennsylvania Academy of the Fine Arts, Philadelphia. Charles Bregler's Thomas Eakins Collection*

FIG. 324
Detail of Osborne label inside the box lid (fig. 326), similar to designs by British and European colormen firms

FIG. 325
Green verditer watercolor cake, front (top) and back (bottom)
Manufactured by George C. Osborne, Philadelphia, 1836–37
31 x 19 x 5 mm
Courtesy of the Winterthur Museum, Delaware. Museum purchase with funds provided by the Special Fund for Collection Objects, 1993.12



FIG. 326
Watercolor box
Manufactured by George C. Osborne, David B. Smith, and William Hodgson Jr. (the commissioning merchant), Philadelphia, 1836–37
Courtesy of the Winterthur Museum, Delaware. Museum purchase with funds provided by the Special Fund for Collection Objects, 1993.12



FIG. 327
Watercolor box belonging to Winslow Homer, 1900–1910
Manufactured by Winsor & Newton
Watercolor pigments and metal
8½ x 8¼ inches (20.6 x 21 cm) open
Bowdoin College Museum of Art, Brunswick, Maine.
Gift of the Homer Family, 1964.69.191*

Portable and inexpensive paint boxes such as this Japanned tin case with fold-out palettes were extremely popular: eleven million were sold in the twenty years after their introduction in 1853.



FIG. 328
Moist watercolor pans
Manufactured by Winsor & Newton,
c. 1990–2005

The madder lake (*top left*) and cadmium red (*top right*) watercolor cakes were formed by extruding paint paste through a die and chopping the filament into tablets. The paint can also be poured into pans, which were originally porcelain but today are usually made using plastic in either full (31 x 19 x 9 mm) or half-pan (20 x 16 x 9 mm) sizes (*bottom*).

FIG. 329
Rose madder moist tube watercolor from John Singer Sargent's studio,
c. 1900–1925 (detail of fig. 338)
Manufactured by Winsor & Newton
Fogg Art Museum, Harvard University Art Museums, Cambridge, Massachusetts.
Edward W. Forbes Collection of Artists' Materials, Straus.1083

& Company products included artist testimonials, a mainstay of nineteenth-century American product literature, which frequently included claims that the products were at least as good as any that were imported.³⁷ That Osborne watercolors were marketed to professional artists, or as professional artist paints, perhaps to appeal to aspiring amateurs, is telling of the changing regard for watercolor painting.

American colormen such as Wells and Osborne, who had likely learned about paint making in England before emigrating to America in the 1800s, began to introduce their own paint formulations to improve upon the ready-made cakes invented by Reeves. Meanwhile, innovation in watercolor manufacture continued apace in Great Britain, where in 1835 the firm Winsor & Newton of London capitalized on the moisture-retaining properties of glycerin, recently discovered by the French chemist and color theorist Michel Eugène Chevreul.³⁸ Adding glycerin to its

watercolor paints, Winsor & Newton introduced “moist watercolor” in pans. For the first time, color could be easily released from the cake with the touch of a wet brush. The paint paste was still extruded and cut, but instead of being stamped, each cake was placed in a small porcelain pan (of various sizes) (fig. 328).³⁹ By the late 1830s the moist colors were available in portable sets (fig. 327), offering strong competition to the harder, pressed cakes.

In 1841 the American artist John Goffe Rand, looking for a better way to store his oil paints than the messy, unsealable pig bladders or fragile syringes then in use, invented the collapsible metal tube with a screw cap.⁴⁰ The design was quickly adopted and modified by Winsor & Newton, which obtained its own patent in 1842 and sold the innovation exclusively for its line of oil paints. Following on the success of the tubed oil paints, in 1846 the firm added even more glycerin to its watercolor formula to produce semi-liquid watercolor paint packaged in tubes. But watercolor in tubes was not introduced to the American market until the 1850s, and was then imported from British and European manufacturers (fig. 329). The semi-liquid watercolor paint is described in trade catalogues of New York firms such as Goupil & Cie and Masury & Whiton⁴¹ as “particularly adapted for large works, as any quantity of colour can be immediately obtained . . . ; they present a range of pigments which, in brilliancy and similarity of manipulation, much resemble Oil Colours.”⁴²

A review of American trade catalogues from the late nineteenth century suggests that watercolor manufacturers in the United States were slow to produce their own tubed watercolor paints. In its 1888 catalogue, the Philadelphia firm F. Weber & Company touted the “introduction of Moist Water Colors, in half and whole pans and tubes” as its “latest effort in the manufacture of Artists’ Materials,” about forty years after Britain.⁴³ By this time most American firms were manufacturing oil paints and other products in tubes, so the delay can be ascribed either to the technical challenge in formulating the liquid watercolor or to a lack of demand. The latter seems unlikely, as

nearly every company had continued importing watercolor in tubes and offered special portable cases to hold them.

Paint Formulation and Technology

In this transitional period, paint formulas were experimental, evolving, and transient. In order to appreciate the significance of the nineteenth-century developments and their impact on the works of art produced during this time, it is important to understand how the physical properties of watercolor paint affect painting techniques. The paint does not form a cohesive layer, as do acrylic and oil, but scatters pigment particles across the paper surface. The smaller, sparser particles allow the paper to reflect light between them, creating images that are notably “transparent” and luminous. However, the increased surface area of finely ground pigments, used in thin washes with minimal binder, makes watercolor pigments especially vulnerable to damage from exposure to light and other chemicals.

Fine particle size is essential in watercolor paint and allows the pigment to remain suspended when the paint is mixed with water to create a homogeneous wash of color. But the balance is delicate: if the pigment is ground too fine, particles tend to clump and fall out of suspension; if too large, the paint has a granular quality. Mineral pigments such as natural ultramarine (lazurite) or vermillion tend to have a larger particle size range with greater density than organic pigments such as gamboge or carmine, and thus often only the finest particles were collected to prepare these watercolors. Several mineral pigments have a particle size at which they appear most brilliant, so some granularity had to be accepted.⁴⁴ Nevertheless, the particle sizes of many early pigments produced unique optical effects that are difficult to achieve with modern paints (fig. 330). The largest particles in natural yellow ochre, for example, are more than 80 times the size of the average particle in the synthetic version, which by the twentieth century had largely replaced the natural product. The broad size range (~1–80 microns) caused the particles to settle differentially into the valleys of a textured paper sheet,

creating subtle effects. Additionally, the larger pigment particles did not sink quickly into the paper and could be lifted easily to reclaim highlights.

The invention of new synthetic pigments with a smaller, more homogenous particle size, and the improvement of grinding and milling technology, made mechanization viable for artist-grade paints and had the greatest impact on watercolor paint in the mid- to late nineteenth century. Before the 1860s, the new colors were mostly synthesized mineral pigments, until techniques were invented for producing organic pigments derived from coal tar, a byproduct of coal gas and the coke manufacture that was fueling the industrial revolution.

In the eighteenth century, the artist’s palette was limited. Roughly thirty pigments were available for all types of painting, and only half were suitable for fine artists’ paints. Two of these were recent inventions suitable for watercolor: Prussian blue (created in 1704)⁴⁵ and cobalt green (1780s). By contrast, more than twenty intensely chromatic pigments were introduced between 1800 and 1870, many of them derived from the newly isolated elements chromium, barium, and cadmium (fig. 331). Previously, most green paint was a mixture of blue and yellow pigments, since

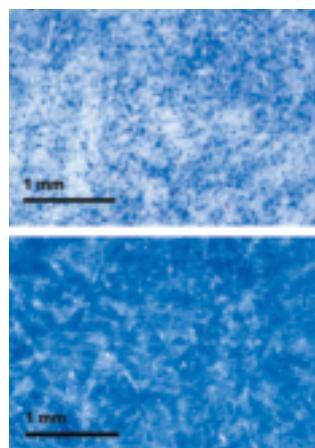
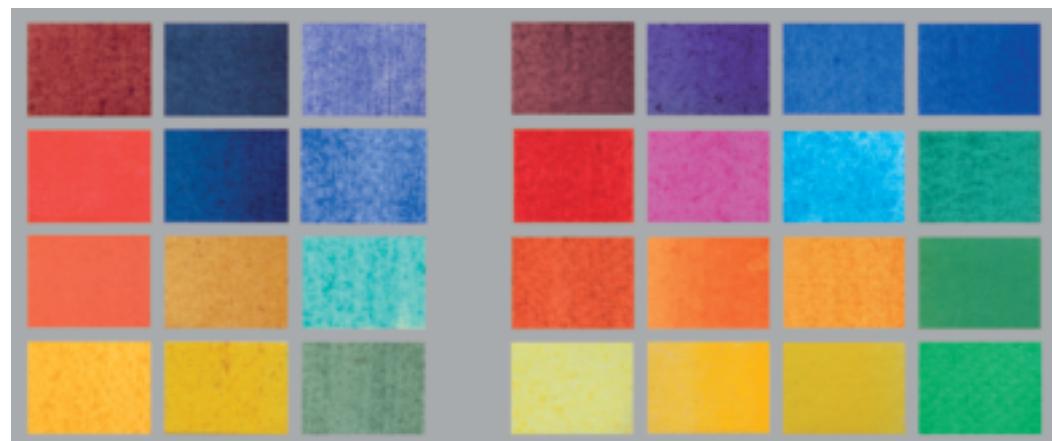


FIG. 330
Finely ground natural ultramarine (top) is more granular than the synthesized product (bottom). The natural pigment settles into the recesses of the paper surface, creating uneven washes that can be used to good effect on heavily textured watercolor paper. The synthetic pigment is very fine and uniform in size, creating a continuous wash of saturated color that still reflects the brightness of the paper sheet. Field of view approximately 2.5 x 4 mm

FIG. 331
(Left grid) The eighteenth-century watercolor palette was relatively limited and included several opaque and granular colors. (Right grid) In the nineteenth century, watercolorists employed new colors and synthetic replacements for traditional pigments, among them brilliant greens, cool yellows, and bright blues that washed beautifully.



Madder lake	Indigo	Smalt		Indian red	Cobalt violet	Cobalt blue	Synthetic ultramarine
Vermilion	Prussian blue	Lapis		Alizarin crimson	Rose madder lake	Cerulean blue	Viridian
Venetian red	Yellow ochre	Cobalt green		Mars red	Cadmium orange	Mars yellow	Chrome oxide green
Gamboge	Indian yellow	Green earth		Cobalt yellow	Cadmium yellow	Chrome yellow	Emerald green

FIG. 332 (left)
Lothar Schreyer (German, 1886–1966)
Detail of **Color Form 2 (Night)**, 1921
Hand-colored lithograph
11½ x 7 inches (29.2 x 17.8 cm)
Philadelphia Museum of Art. Gift of Curt Valentin, 1950.116.1

The lead white (basic lead carbonate) watercolor paint used in this drawing has reacted with sulfur in the air to form lead sulfide, a brown or silver-black product.

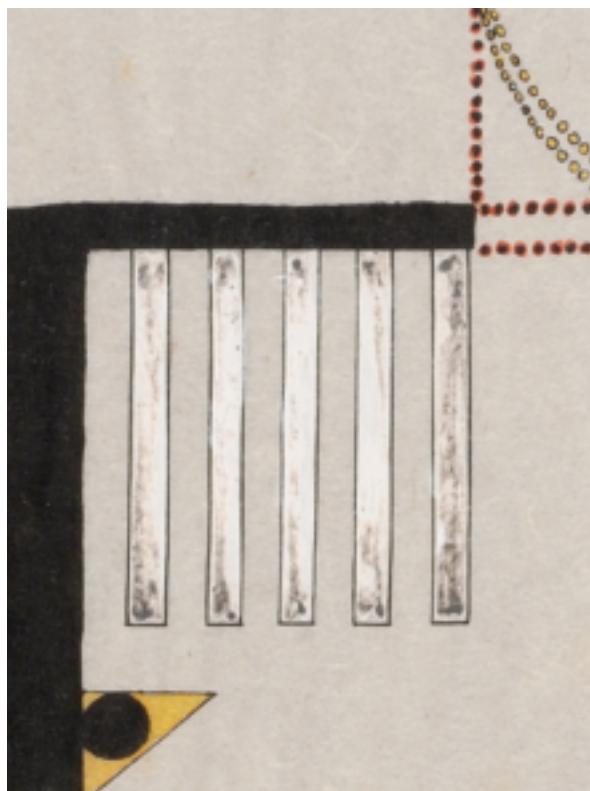


FIG. 333 (right)
John Singer Sargent (1856–1925)
Detail of **A Venetian Trattoria**, c. 1902–3
(see fig. 271)
Watercolor and white opaque watercolor over graphite on wove paper

Zinc white was used to heighten areas of this drawing on a cream-colored paper. The pigment was identified by visual examination with long-wave ultraviolet radiation (no instrumental analysis was performed).



FIG. 334
Chinese white in tubes and bottles
Manufactured by Winsor & Newton
Illustration from A. H. Abbott, *Catalogue no. 162A of Artists' Materials* (Chicago: A. H. Abbott, c. 1910), p. 72A



there had never been a strong chemically stable green suitable for watercolor. The syntheses of chrome oxide green (in 1809), emerald green (1814), and viridian (1840) bolstered the palette as artists were moving outdoors to capture the landscape *en plein air*. Mars colors, artificial preparations of natural earth pigments (introduced in the 1820s), largely supplanted natural iron-oxide pigments in artists' paints. Zinc white (introduced in 1834; figs. 332–34)⁴⁶ and chrome (1818) and cadmium (1840s) pigments provided the first bright, opaque yellow paints that were not expensive or highly toxic. Cobalt blue (introduced in 1802)

and synthetic ultramarine (1830s) were followed by cerulean blue (1860s), alizarin, and manganese violet (both 1868). These pigments also were cheaper and easier to produce in large quantities. The expanded palette allowed watercolorists to use pure colors instead of mixtures, which often have a dulling effect, and imparted unprecedented brilliance and clarity to their compositions (figs. 335, 336).

Until the late nineteenth century, many watercolors continued to be prepared in small batches by hand grinding on a stone or a glass slab, using a muller to evenly disperse paint particles (see fig. 319). If done correctly, this process takes a very long time, but it helps to prevent pigments from clumping or settling out of a wash. Yet some pigments are prone to flocculation (clustering together) and appear granular, similar to larger particles. Prussian blue, for example, could not be dispersed effectively until steam-powered mills, developed in the 1830s, made mechanical pressure possible.⁴⁷

The availability of ready-mixed commercial paints in cans revolutionized industrial paint production, but the pursuit of a shelf-stable, profitable prod-

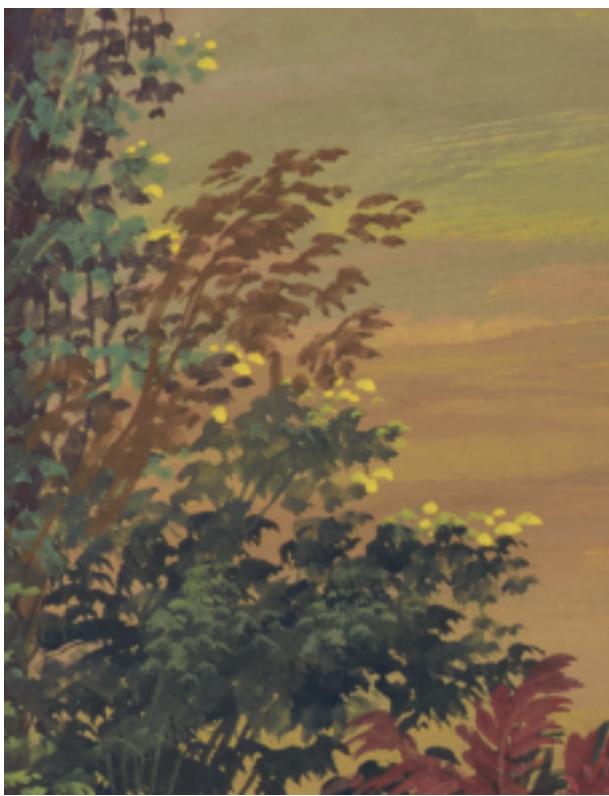


FIG. 335 (left)
Niccolino Calyo (born Italy, 1799–1884)
Detail of *View of the Waterworks at Fairmount*, 1835–36 (see fig. 8)
Opaque watercolor on wove paper, mounted on board

FIG. 336 (right)
Winslow Homer (1836–1910)
Detail of *Bermuda*, 1900 (see fig. 267)
Watercolor and graphite on wove paper

(Left) Opaque painting techniques popular in the 1860s and 1870s used the traditional oil-painting method of working from dark to light, first applying darker washes and then creating highlights with opaque paints (often admixtures with white pigments). (Right) The transparency and brilliance of many new synthetic colors made them well suited for working from light to dark, using the brightness of the paper to create highlights, a practice considered by many artists to be the true watercolor technique.

uct put the priorities of paint makers and sellers at odds with those of the fine artist. Formulation of pre-packaged semi-liquid watercolor in tubes required additives to contend with the settling, hardening, and spoiling to which water-borne paints are prone. Wetting agents and dispersants reduced milling time and cut labor costs. Humectants, plasticizers, fillers, and preservatives improved flexibility, controlled tinting strength, added body, and lowered the cost of the paint. However, these advancements occurred through a process of trial and error, sometimes resulting in an inferior product for artists. The new formulations and methods of manufacture affected watercolor painting in unintended ways. For instance, in the nineteenth century the older dry-cake colors were preferable to moist colors for preliminary tints because the extra sugar or glycerin used in the latter to increase solubility also made the moist paints unintentionally “pick up” from the paper sheet during later washes. Moreover, the added viscosity might cause pigment particles to settle unevenly on the paper surface—a desirable effect to some, but a failing to others.⁴⁸ Newer pigments with smaller particles, especially the coal-tar (organic) pig-

ments, settled more deeply into the paper fibers than mined pigments, staining the paper and making the colors difficult to “lift” when desired (fig. 337).

A new type of technical literature emerged in the nineteenth century to address artists’ questions about the quality, purity, and permanence of the new array of colors on offer. The recommendations drew on research of a “new breed of color technologists: men who were chemically adept, familiar with the latest color theories of scientists such as Chevreul, Helmholtz, and Maxwell, and intimately connected to the world of fine art.”⁴⁹ The London chemist George Field was an influential color maker who performed early studies on pigment stability (first published in 1835) that stimulated scientific research in the field.⁵⁰ Field maintained a close relationship with the color-men William Winsor, a chemist, and Henry Newton, an artist. They exchanged pigments and took an active interest in Field’s research. Their firm Winsor & Newton included technical information on its pigments in various publications in the 1870s and 1880s, and by the 1890s would regularly publish technical information on the chemical stability and lightfastness



FIG. 337
Genuine and synthetic madder lake watercolor, Kremer pigments, 2016

Genuine madder lake (left) and synthetic alizarin crimson (right) watercolors were diluted with water and brushed out on Whatman “Creswick” paper (from 1916). A damp cotton blotter was then gently pressed over the top half of the applied paint. The madder lake lifted from the sheet easily, while the alizarin pigment (a synthetic coal-tar derivative) immediately embedded in the paper fibers.



FIG. 338
John Singer Sargent's moist watercolors
in tubes, c. 1900–1925
Manufactured by Weber & Co.; Newman;
Winsor & Newton; Hatfield; and
Schmincke-Hordam
Harvard University Art Museums,
Cambridge, Massachusetts. Edward W.
Forbes Collection of Artists' Materials
(Straus.1083)*

of its paints. Similar studies were undertaken in the United States, and in 1886 the Philadelphia colormen Charles Janentzky and Frederick Weber (of Janentzky & Weber) published a manual of their pigments based on their own “reliable tests.”⁵¹ This transparency earned artists’ trust, but as established colors were substituted or enhanced with new pigments, color names persisted for products that were increasingly distant from the original chemical compositions.⁵² In their treatise on modern watercolors, Winsor & Newton let it be known that several colors had been improved but not renamed, and so were unjustly saddled with a bad reputation.⁵³ Indian red, for example, previously was made using a reactive natural iron oxide from the Persian Gulf that was observed to accelerate the decomposition of indigo. This color and other “earth” pigments, including Venetian red and light red, were by the 1880s produced synthetically by calcination and were very stable.⁵⁴

The continuation of color nomenclature served to evoke a familiar hue,⁵⁵ and perhaps stirred the romantic sensibilities of Europhilic artists in America. In his entertaining 1920s memoir of the early paint industry, George Heckel, the longtime secretary-treasurer of the Paint Manufacturers’ Association, reflected on Americans’ conviction of the superiority of European goods in the late nineteenth century:

Notwithstanding our boasting and our blustering . . . , notwithstanding the exalted sentiment of our national songs, we have all—till the great war gave us our true measure—entertained a secret furtive notion that “they do this better in France,” or in England or in Germany. That was the real reason for “Oxford ochre” long after there was none available; . . . for “Old Dutch process white lead” long after the Dutch process had been improved in America out of all recognition, for “Turkish umber” and “Italian sienna” from Pennsylvania, for “French zinc” made also in Pennsylvania, and for a host of “imported” products that never smelt salt water.⁵⁶

In the same spirit, colorman trade catalogues or advertisements continued to bolster American products with testimonials from amateurs and professionals alike. These artist testimonials hint at personal relationships among American manufacturers, suppliers, and artists, but there is scant documentation of such exchanges.⁵⁷

Despite the production of fine artist-grade watercolors in the United States by midcentury at firms such as Osborne, Janentzky & Company (later F. Weber & Company),⁵⁸ F. W. Devoe & Company,⁵⁹ and, later, Joseph Hatfield (in the 1900s),⁶⁰ many professional artists continued to select imported materials. George Field's preference for Winsor & Newton watercolors in his influential publication *Chromatography; or, A Treatise on Colours and Pigments* (1835), and in later works, solidified the firm's reputation for quality products and the highest standards of research. By the 1880s Winslow Homer used solely English materials to create his watercolors. His two extant watercolor boxes contain only Winsor & Newton paints,⁶¹ and after 1878 all his formal watercolors are on Whatman paper, another English product.⁶² A watercolor box used by Thomas Eakins between about 1850 and 1880 (see fig. 323) contains cakes from four different English firms, despite his proximity in Philadelphia to the majority of American suppliers.⁶³ The tube watercolors found in John Singer Sargent's Boston studio in 1925 (fig. 338) are again mostly English and European imports, but a few are American brands, including Hatfield, Weber, and Prang.⁶⁴ Childe Hassam, however, is notable for his ardent use of domestic materials. In response to the question "Do you find Winsor & Newton about as good as any?" he defended American-made paints, replying, "Yes, but I like American colors. I thought the Devoes colors as good as any others. It is absolutely foolish to say that any colors made in Europe are better than colors made here."⁶⁵

American artists doubtless were aware of subtle differences in color and character in paints of the same name, but obtained from different manufacturers or suppliers. Natural ochers and umbers might be sourced from different locations, so that a yellow ochre from Osborne might look or behave differently



FIG. 339
Winslow Homer (1836–1910)
Detail of *Bermuda*, 1900 (see fig. 267)
Watercolor and graphite on wove paper

Fading is evident along the left edge of this watercolor, where a prior window mat protected the perimeter of the sheet from exposure to light. The purple of an afternoon sky, which appears to be a mixture of blue and red paints, has cooled from the fading of the red pigment, which was likely organic.

Field of view 51 x 64 mm

than one from Weber or Reeves. To benefit from these distinctive qualities, an artist might keep in active use several pans of Hooker's green, a commercial color prepared using a mixture of yellow and blue—usually Gamboge and Prussian blue—from different suppliers.⁶⁶ But the notion that the quality of European- and American-manufactured watercolors differed in the late nineteenth and early twentieth centuries may have been more pervasive than it was accurate. There has been little analysis of early American watercolor paint, with existing studies limited to basic pigment and binder identification.⁶⁷ Evaluating the physical properties of existing samples of American paints, such as the range of particle sizes and changing mixture proportions over time, would provide a valuable comparison to well-documented color preparations of the time, from English color firms in particular.⁶⁸

After the Golden Age

At the height of watercolor's international popularity and artistic regard in the 1880s, it was almost impossible for the color industry to keep up with demand. By the end of the nineteenth century, however, middle-class collectors who had embraced the art form watched their investments shift color, darken, and fade (fig. 339). George Field's early study on the permanence of colors became more or less obsolete. The



FIG. 340
Watercolor set, c. 1830s
Manufactured by George C. Osborne
5 x 3½ x 1¾ inches (12.7 x 3.3 x 2.1 cm)
Private collection

The paper label adhered to the tray reads, "Manufactured and sold at D. B. Smith & W. Hodgson, Jr.'s Drug and Chemical Store, North East Corner of Arch & Sixth Streets, Philadelphia"

number of available pigments had multiplied greatly, and formulations for established colors had changed, so that his recommendations were no longer applicable to existing products. Watercolor came to be regarded as an unreliable and unprofitable medium. Prompted by the implications for the textile industry (in which many of the new colorants were primarily used), the British government got involved for the first time and in 1888 updated Field's work.⁶⁹

By the time American manufacturers established their own testing standards in the early twentieth century, energy was being redirected to paint products for a wider market. While some domestic color firms, such as Devoe, incorporated scientific product research early on, most American manufacturers were slow to follow suit. Guarded formulation secrets and a nonscientific trial-and-error approach to product development also hindered progress. Eventually, the trade associations would move things forward,⁷⁰ "with the co-operative spirit they engendered, and the hard-won tolerance of the technical man, with his exact methods and his intolerance for guess-work and unfounded belief."⁷¹

By the 1920s nearly all American manufacturers of high-quality artists' paints had been enveloped by larger corporations, and the "artist-grade" product lines were discontinued.⁷² In 1925 Devoe & Reynolds acquired Wadsworth, Howland & Company, a Boston

firm nationally famous for making artists' paints, which was also one of Frederick Devoe's "hobbies," as these required "the pinnacle of exactness in the science of color-making."⁷³ But the acquisition was driven by Wadsworth's durable line of Bay State exterior paints, since the Devoe firm was expanding into the new market of industrial finishes. In Europe, incorporation initiatives had been less rapid. The conservative postwar paint market in Britain continued to invest in traditional materials and manufacturing methods, and was slower to embrace the new synthetic polymers that were immediately popular with Americans glad to have minimized reliance on scarce raw materials during the war years. Both during and after World War I, the United States excelled in large-scale production, quickly developing a self-sufficient industry for synthetic organic colorants formerly imported from Germany.

Ultimately it was the schoolchild, and not the professional, who would determine American production of watercolor paint. Early commercial sets marketed to children, such as "Toy Colors" made by George C. Osborne (fig. 340), included toxic pigments containing lead, chrome, and mercury. In the 1850s, spurred by the desire to teach his young daughter art, the Boston publisher Louis Prang developed nontoxic watercolors and contracted the American Crayon Company in Ohio to manufacture moist pan sets for students (fig. 341).⁷⁴ The child-safe materials he produced supplemented an educational initiative to promote art in public schools that was both sincere and savvy—the eight-color oval-pan set has been an iconic product for over 150 years.⁷⁵ Production of scholastic or "student-grade" paints offered several lucrative advantages. With safety and economy the primary concerns, student paints were composed of cheap pigments and dyes in a limited range of colors, using fillers and a sugary binder. Incorporation of watercolors into educational programming guaranteed a market and introduced the medium to budding artists early on and at a low cost relative to artists' paints.

Prang is one of only two mid-nineteenth-century American companies still making watercolor

paint today. The other, the Martin F. Weber Company (formerly F. Weber & Company; see p. 380), is a Philadelphia firm that took over the manufacture of Osborne watercolors in the 1870s. Weber succeeded with a different strategy than Prang's—appealing to artists' nostalgia for a time before the "Machine Age" with the slogan "The Colors the Old Masters would have used."⁷⁶ In the spirit of the early twentieth-century Arts and Crafts movement, some artists took a greater interest in making their paints by hand. This labored control over their materials was perhaps "an antidote to the modern industrial production of paint by companies that were seen as cynical or corrupt."⁷⁷ Frederick Weber, Jr., the company's owner and technical director from 1920 to 1967, purportedly advised many prominent twentieth-century artists—including Thomas Hart Benton, Arthur Dove, N. C. Wyeth, and Andrew Wyeth—on their methods and materials.

Watercolor manufacture underwent great change from the mid-nineteenth through twentieth century, led primarily by innovations in England and Europe. Firms such as Winsor & Newton were consistent pioneers in paint formulation and packaging, and adopted scientific methodology for testing and reporting the stability of their products. Although American companies eventually produced high-quality watercolor paints that rivaled those of Britain and the rest of Europe, their products were not broadly adopted by American artists of the era. Ultimately, American watercolor manufacturers found a steady but less prestigious market in amateur- and student-grade paints. The development of synthetic pigments, milling technology, and paint formulations also paved the way for the production of commercial and industrial paints and coatings, a burgeoning market in the United States in the twentieth century.

Throughout this period, American artists remained sensitive to the unique properties that different pigments and methods of manufacture imparted to watercolor paint, from the appearance and color saturation of the paint to the way it could be manipulated on the support. American watercolorists energized by



the forthright medium exploited its immediacy and brilliance to evoke their experiences and artistic vision with luminous clarity.

FIG. 341
Prang watercolor set "No. 8"
(Top) Illustration from "*Old Faithful*"
Products (Sandusky, OH: American Crayon
Company, 1925), p. 23
(Bottom) Photograph courtesy of the
Dixon Ticonderoga Company

