HISTORICAL MATERIALS ISSUE

JUST PAINT

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Historical Pigments

The Ever-changing Artist's Palette

Pigment is the very essence of paint. Regardless of the vehicle that is used to adhere it to the substrate, pigment selection is based on one simple criterion. The colorant must be the right hue. Once that factor is met, the artist can compare it to other available pigments of a like hue, and determine the one that is best suited for the project at hand. The final selection may be based on opacity, cleanliness, vibrancy, and of course, permanence.

Ever since the first prehistoric artist picked up a smoldering chunk of charcoal from the fireplace to draw on the cave wall, mankind has striven to produce better art. Each artist from that point on has faced the same question: *"What materials will work the best for what I am trying to do?"* In the case of early man, the answer was found in plants, dirt and other available materials of the right color that could be crushed, ground or squeezed, and applied to the painting. In today's world we have at our disposal an incredible number of materials in a vast array of hues.

Modern technology affects materials and tools alike. This muller was used by Sam Golden for hand grinding pigments.

From these, for use in artwork intended to last, we can choose colorants with an emphasis on permanence. If a painting's characteristics are to remain consistent for generations to come, we cannot remain indifferent to the fact that certain pigments are going to fade. Such pigments should not be incorporated into a palette based on decisions made by artists centuries ago. Old choices should be continuously compared to new alternatives, with selections based on current information. Similar reasoning can be applied with regard to the characteristic of pigment toxicity.

There are pigments that have survived for centuries as reliable and safe colorants. Some of the inorganic pigments used since prehistoric times, such as the Ochres and Bone Black, are still in use today. Along with these, we long ago made room on the palette for their refined counterparts, synthetics such as Mars colors (Iron Oxides) and Carbon Black. We also have replaced many pigments on the palette, both naturally occurring and synthetic, with newer inventions. These additions and changes have collectively yielded improvements in color consistency, durability, safety, and range.

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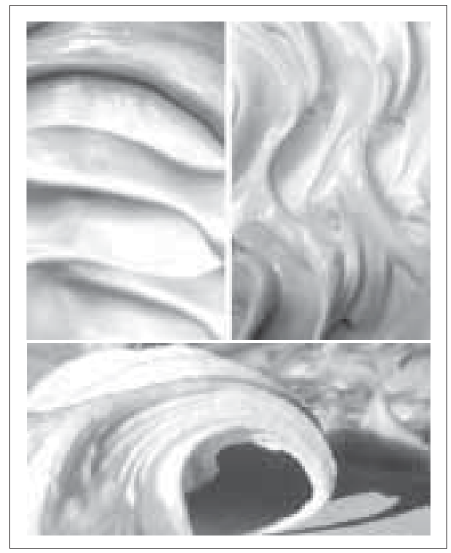
GOLDEN Molding Pastes Offer Many Textural Options!



Artists are often asking why our product is called "Molding Paste" while everyone else's is called "Modeling Paste", and is there any difference? First, I have no idea why the product was called Molding Paste. It can be placed in a mold, but it wasn't particularly developed for that purpose. Molding Paste is what Sam Golden called a similar product at Bocour and he simply carried the name forward to his new company. GOLDEN Molding Paste is made similarly to other brands of acrylic modeling pastes. Basically, they are all a medium of acrylic polymer that is filled with hard solids.

Molding Pastes are probably one of the more commonly used products when working with acrylics or providing a base for other media. They can easily be

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Historical Pigments

Some Historical Pigments and their Replacements

Alizarin Crimson

(PR 83:1)

Alizarin Crimson was created in 1868 by the German chemists, Grabe and Lieberman, as a more lightfast substitute to Genuine Rose Madder. This was accomplished by isolating part of the madder root colorant,1,2 dihydroxyanthraquinone (Alizarin), from the more fugitive 1,2,4 trihydrozyanthraquinone (Purpurin). This is historically significant as it represents the first synthetic duplication of a pigment. Madder dates back to before the time of the ancient Greeks. Pliny the Elder termed it "Rubia", and it has been found in Egyptian tombs. Madder came to Europe during the time of the Crusades. The use of Genuine Madder practically ceased after the introduction of Alizarin. Lightfastness III, Alizarin Crimson was replaced 90 years later by the Lightfastness I Quinacridones, developed by Struve in 1958.

Asphaltum

Also known as Bitumen, Asphaltum is a solution of asphalt in oil or turpentine, used since prehistoric times as a protective coating. Although Rembrandt used Asphaltum with good success, there is much evidence that other painters' work did not fare as well, and severe darkening was the result.

Aureolin

(PY 40)

Also known as Cobalt Yellow, Aureolin replaced an earlier pigment called Gamboge, which was an Asian yellow gum used until the 19th century. Aureolin was first introduced in 1851. Aureolin (chemically known as Potassium Baltintrite) was popular until the late 19th century, when less expensive, cleaner and more lightfast pigments like the Cadmiums were introduced. Although true Cobalt Yellow can be found, it is generally not in use.

Cobalt Violet

(PV 14)

In 1860, Cobalt Violet was introduced and gradually developed, refined, and later created synthetically. Two costly versions, anhydrous cobalt phosphate or cobalt ammonium phosphate, (sometimes combined) were used. Cobalt Violet is toxic and costly to produce, and the weak pigment quickly was replaced by the cleaner, stronger Manganese Violet.

Hooker's Green

(PY 24/PB 27)

The earliest Hooker's Greens were a blend of Gamboge and Prussian Blue. More lightfast varieties were later created with Aureolin. Modern Hooker's Green is usually a blend of Phthalo Blue and Cadmium Yellow. There is a pigment, (PG 8) that is sometimes called Hooker's Green, but this pigment does not offer any significant improvement over blends, as it is (ASTM III) fugitive.

Indian Yellow

Also known as Puree, Peoli, or Gaugoli, True Indian Yellow (euxanthic acid) was produced by heating the urine of cattle fed mango leaves. The process was introduced to India by the Persians as early as the 15th century. Bengal, India was the chief exporter to Europe from the early 19th century until 1908. Local records indicate that the sale of Indian Yellow was prohibited as an act of preventing cruelty to animals, as mango leaves do not have the proper nutrients for cattle.

Malachite

Also known as Mineral Green or Verdeazzuro, Malachite is a pigment that was used by many early civilizations. Derived from native carbonate of copper, it is perhaps the oldest known bright green pigment. Azurite is its blue counterpart. The synthetic variety is called Bremen Green. Malachite fell out of use in the 18th century. The pigment is not permanent, and has a gritty texture.

Manganese Blue

(PB 33)

Manganese Blue, or Barium Manganate, has been produced since the 19th century. The synthetic variation was patented in 1935, but neither variety is commonly produced anymore, as the coarse, weak pigment was replaced by more intense blues.

Manganese Violet

(PV 16)

Also known as Permanent Violet, Nuremberg Violet or Mineral Violet, Manganese Violet replaced Cobalt Violet in 1890. It is understood to have been first made by E. Leykauf in 1868. It was a cleaner alternative to the Cobalt Violet and was less toxic. It also had better opacity.

Naples Yellow

(PY 41)

Also known as Antimony Yellow and Juane Brilliant, Naples Yellow is a lead-based pigment made from Lead Antimoniate. It was produced as early as the 15th century, although it is said to have been found on tiles of ancient Babylonia. The first formulae date from 1758.

Naphthamide Maroon

(PR 171)

Also known as Benzimadazolone Maroon, Naphthamide Maroon was first produced in 1960, along with other Benzimadazolone pigments. Recently discontinued from the GOLDEN palette because the pigment manufacturer halted production as cheaper alternatives became more common place. Promising new alternatives should be available in the near future.

Prussian Blue

(PB 27)

Prussian Blue is of significant importance in the art world as it is known to be the first man-made pigment. It was invented accidentally by the Berliner Diesbach in 1704, when he was trying to create a Florentine Lake. Also known as Chinese Blue, Berlin Blue, Paris Blue, Steel Blue, Iron Blue, Bronze Blue, Paste Blue, and Milori Blue. The Milori Blue variety is typically what makes up today's Prussian Blues. The pigment is alkali sensitive, and therefore cannot be made in an acrylic emulsion.

Sap Green

Sap Green is made from the unripe berries of the Buckthorn. It is highly fugitive, as is another Sap Green, or Iris Green, made from the juice of the Iris Flower. In medieval times it was reduced to a heavy syrup and sold in bladders, not dry pigment form. Modern Oil paints under this name are actually coal tar lakes.

Sepia

Replacing Bistre (a brown made from boiled wood soot) in the 18th century, true Sepia Ink is made from the ink sacs of animals such as the cuttlefish. It is said that the secretions of just one cuttlefish can turn a thousand gallons of water opaque in seconds. Like most naturally derived organic colorants, it is not lightfast. Modern oil paints under this name are typically hues made from Burnt Umber, Van Dyke Brown and Carbon Black.

Smalt

The earliest of the Cobalt pigments, Smalt was artificially made from coarsely ground Cobalt Blue Glass as it becomes very transparent when finely ground. The earliest use was by the ancient Egyptians. It was also used as a glass colorant by Venetian glassblowers until the 17th century when Ultramarine and Azurite became scarce. The name Cobalt comes to us from the Bohemian Miners who had troubles obtaining the mineral and named it “kobolds”, which was their word for spirits or ghosts, which they believed inhabited the pigment. Cobaltite and Smaltite were produced from these mines. Smalt was abandoned as Cobalt Blue and Ultramarine became available in the 19th century.

Terre Verte

(PG 23)

Green Earth is known by an assortment of names such as Stone Green, Verdetta, and Celadonite. Other names refer to the source of the native iron / magnesium colored clay, such as Bohemian, a high quality grade of pure green hue. It has been popular for centuries with many cultures. Native Americans also were fond of using Green Earth as a colorant. Since Medieval times it has been used as an underpainting color for flesh tones in portraits.

Van Dyke Brown

(NBr 8)

Also known as Cassel Earth, Rubins Brown, and Cologne Brown, this pigment dates from around the 17th century and is a blend of clay, iron oxide, humus and bitumen. Due to the humus and bitumen (Asphaltum), true Van Dyke Brown turns dark and/or fades. The transparency of Van Dyke Brown made it ideal for glazing, rather than umbers and ochres.

Venetian Red

Venetian Red, Sinopia, Venice Red, Turkey Red, Indian Red, Spanish Red, Pompeian Red, and Persian Red (or Persian Gulf Red, still considered the best grade for the natural pigment) are names used to describe locations where the natural red iron was extracted from the

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From Cover

Molding Pastes

worked with a brush or pallete knife and readily mixed with acrylic colors. GOLDEN Molding Paste is often used to build texture and depth before subsequent application of additional colors. It is the "auto body filler" of acrylic paints. Sam once actually used it for filling a gap in the back fender of his beat-up station wagon. He said the stuff lasted for years.

Currently, three products make up the range of GOLDEN Molding Pastes. They all have a thick consistency derived from the high levels of added solids. For *Molding Paste* and *Hard Molding Paste*, these solids include marble dust, a large particle-size calcium carbonate. Calcium carbonate imparts significant whitening and is also often used to create the tooth in acrylic gesso. The solids in *Light Molding Paste* include hollow spheres which provide even greater whitening. All of these products dry to a fairly opaque white or light buff-gray. It is this opacity that makes them quite different to work with than other mediums, especially when adding color.

The Molding Paste Choice: Mix Color With It or Apply Color Over It.

GOLDEN Molding Pastes tend to tint colors that are added to them. This can be overcome by adding a large amount of color, but in doing so, many of the attributes for which the artist might have chosen the Molding Pastes may be diluted. This tinting property is most noticeable when mixing with reds. When adding a small amount of any red to any Molding Paste, the resulting tint is always pink. This is not as great a problem in the other hue ranges. It is quite possible to get a deep blue, green or purple using Anthraquinone Blue, Phthalo Blue, Phthalo Green, or Dioxazine Purple. It is also possible to get brilliant yellows, especially when mixing with Cadmiums, because of their incredible opacity. If a red is desired, the most promising route is with the Pyrrole Reds, because they have the greatest tinting strength.

Molding Paste may be applied as a separate layer and subsequently painted. The Molding Pastes accept such application of color with great ease. They have excellent tooth and great absorbency, which can be exploited with a wide range of techniques. GOLDEN Molding Pastes are quite thick.

Preparing Substrates for Molding Pastes

When using these materials, it is important that the support be properly prepared. A ground of gesso or size of thin acrylic medium should be applied. Alternatively, the Molding Paste may be thinned with a fluid acrylic medium or an acrylic/water mixture and applied as a ground. This will assure good bonding with the support. If it is necessary to use Molding Paste without thinning or prior sizing as a ground, it is essential that the product be forcefully brushed or otherwise pressed into the substrate. Like other acrylic paints and mediums, the Molding Pastes will adhere best to absorbent surfaces like canvas or wood. They will not adhere to greasy or oily surfaces. It is also best to roughen up slick surfaces to increase the tooth, making the surface profile rougher for additional bonding.

From Light to Hard; 3 Molding Pastes Provide Options for Artists

GOLDEN Light Molding Paste was originally developed for an artist who needed to support sculpted canvas forms arising from the surface of her paintings. Using normal Molding Paste to fill the large voids resulted in incredibly heavy paintings. We were requested to make a material that would have the support capability of Molding Paste, but at a reduced weight. Even though the resulting product is only 1/3 the weight of its heavier cousins, it will hold peaks that are much higher and more detailed than either the Molding Paste or Hard Molding Paste. It has a consistency between cake frosting and shaving cream and can be shaped quite readily. As with the other Molding Pastes, shrinkage is minimal due to its high solid load. Light Molding Paste dries to an extremely flexible film, which can be rolled without cracking. It is also very absorbent and works exceptionally well as a ground, to create stain effects using thinned acrylic colors.

GOLDEN Molding Paste dries a great deal harder than Light Molding Paste. It will dramatically increase the stiffness of a flexible support and provides a harder surface to work against. Unlike Molding Pastes from most other manufacturers, it can be rolled without cracking. It dries to a light gray finish and is not as opaque as the Light Molding Paste, so less color is required to overcome its tinting ability. The surface of Molding Paste has a fair degree of absorbency which will allow for the application of stains of thinned down color. It also provides great adhesion for subsequent coats of acrylic colors. Molding Paste will not hold high peaks unless puddled in large quantities.

GOLDEN Hard Molding Paste was developed for artists who wanted to sand down the acrylic paints. Anyone who has ever put sandpaper to acrylic paint knows the frustration of trying this. The paint film begins to heat and soften because of the friction, quickly gumming up the sandpaper. Hard Molding Paste can be used to modify acrylic colors, making them more readily sanded. When used by

Continued next page...

itself, Hard Molding Paste can be sanded to an incredibly smooth, almost glass-like surface. Among other things, this allows an artist to prepare a variety of surfaces for drawing techniques. In addition it can be shaped with a knife, carving tools, electric sanding equipment and drills. This allows for subtractive techniques when working with the dried paint. Typical acrylics are much too flexible for carving and tend to bind even the sharpest razor blades and knives. Hard Molding Paste dries to a light gray color. It is quite absorbent like the Molding Paste and will accept overpainting readily. However, it forms a more brittle film and, unlike the other Molding Pastes, if this product is applied to a flexible support, it should not be rolled. Cracking will potentially develop if used on an unsupported flexible substrate. Hard Molding Paste has self-leveling qualities not found in other Molding Pastes. High peaks formed in application will settle out before it is completely dry.

Molding Paste Maintenance

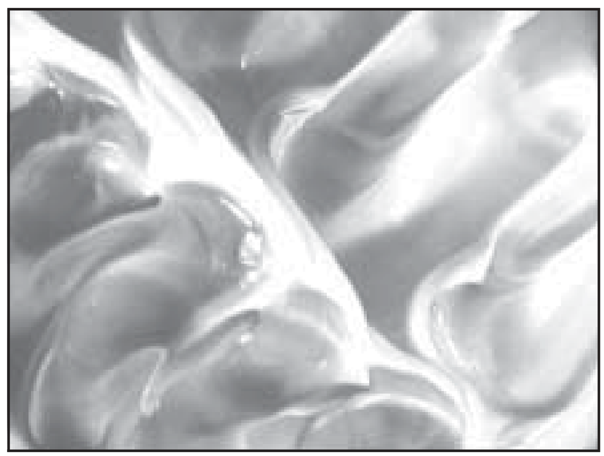
Care should be taken when using any of the GOLDEN Molding Paste products without a protective final coat. Because of their absorbency, it is quite possible that dirt, pollution or finger marks will leave stains. It is best to consider using a sealing coat and a final varnish if these materials are exposed on the surface of the painting. Also, as with all acrylics, avoid rolling, hitting or banging them in cold weather, as it is very possible to crack the cold acrylic film.

Gel/Molding Paste Hybrid

A final product to consider is a hybrid material called *GOLDEN Extra Heavy Gel/Molding Paste*. This product was produced for an artist who wanted the greater translucency that a gel offers as well as the ability to build up higher, more accurate peaks. GOLDEN Extra Heavy Gel/Molding Paste provides that bridge between a Gel Medium and a Molding Paste. Although still drying to a light gray color, it allows the artist to achieve greater depth of color than that achievable with the standard Molding Pastes.

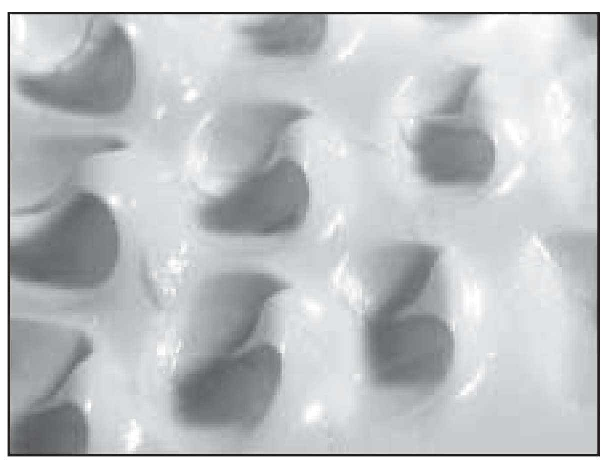
So whether you mold with Molding Pastes or model with it, each one has versatility and options worth exploring!

Light Molding Paste: Light weight, high peaks, dries to a very absorbent opaque white surface.



Molding Paste: Good peaks, dries to an opaque film, carvable.

Hard Molding Paste: Self leveling for smooth surfaces, dries to an opaque smooth film. Carvable and sandable.



Extra Heavy Gel/Molding Paste: Good peaks, dries to a flexible semi-opaque film.

Frequently Asked Questions

Why aren't ASTM Lightfastness ratings provided for your Interference and Iridescent colors?

The labels describe their Lightfastness as "Excellent" while your other colors are labeled with ASTM Lightfastness ratings of I or II.

Are these different systems?

The paint sample on the left shows the degradation of some pigments after laboratory exposure to damaging ultraviolet (UV) light. The Red Oxide sample on the right shows no color shift after the same UV exposure testing.

ASTM (American Society for Testing and Materials) bases Lightfastness categories on the measured amount of color change (typically fading) that occurs as a result of standard levels of accelerated or long-term ultraviolet light exposure. Although remarkably lightfast, Interference and Iridescent pigments cannot be instrumentally measured in the manner specified by the present ASTM Test Methods. Therefore, they must be evaluated following exposure by visual comparison with a retained sample, rather than by using a spectrophotometer.

We use the term "Excellent" to describe that after the ASTM prescribed exposure, these pigments reveal no color shift upon close visual inspection. ASTM Lightfastness category I is also described as "Excellent". Although we cannot spectrophotometrically measure the difference and assign an official ASTM rating of category I, we can attest to the fact that under the same test conditions, these pigments perform as well as any type we've ever tested.

The inherent durability of these pigments results from the stability of their components. Iridescent and Interference pigments share common building blocks with the most lightfast class of pigments, metal oxides. They are comprised of mica particles coated with a transparent layer of Titanium Dioxide and/or Iron Oxide. They are entirely inorganic and resist degradation not only from ultraviolet radiation, but also from water, heat and acidic or basic compounds.

Historical Color Matches

Historically Significant Colors Recreated with GOLDEN Acrylics

To the right are mixing ratios for historically important colors and some recently discontinued GOLDEN colors. We have tried to duplicate each hue as closely as possible, however, pigments often have unique attributes which make exact color matching impossible. When using this guide bear in mind which characteristics are important for your application, such as chroma, opacity/translucency, masstone, undertone, etc. Also note that some historical pigments are much grittier than their refined counterparts. If this is significant to your work, a textural medium can be added, such as GOLDEN Acrylic Ground for Pastels, to mimic the roughness. Transparency also can greatly vary depending on the source of the pigment and the strength of each mixture.

Table 2:

Historical Color To Match	Titanium White
1. Alizarin Crimson	
2. Asphaltum	
3. Aureolin	
4. Cobalt Violet	
5. Cobalt Violet Deep	
6. Hooker's Green	
7. Indian Yellow	
8. Malachite	40
9. Manganese Blue	
10. Manganese Violet	3
11. Naples Yellow	30
12. Olive Green Deep	
13. Prussian Blue	
14. Sap Green	
15. Sepia	
16. Smalt	
17. Terra Rosa	16
18. Terre Verte	
19. Van Dyke Brown	
20. Venetian Red	10
21. Viridian Green	1
22. Vermillion	7

Table 1: Color Matches Using GOLDEN Heavy Body Acrylics

Historical Color To Match	Part 1	Part 2	Part 3	Part 4	Part 5
1. Alizarin Crimson	Quinacridone Crimson				
2. Alizarin Crimson *(Alternative Match)*	Quinacridone Violet (10)	Quinacridone Burnt Orange (12)			
3. Hooker's Green (1)	Jenkin's Green				
4. Hooker's Green (2)	Anthraquinone Blue (1)	Nickle Azo Yellow (3)			
5. Indian Yellow	Nickle Azo Yellow (15)	Transparent Pyrrole Orange (1)	Regular Gel (Gloss) (50)		
6. Malachite	Titanium White (8)	Phthalo Green (BS) (3)	Cobalt Titanate Green (4)		
7. Naples Yellow	Titan Buff (20)	Yellow Oxide (2)	Diarylide Yellow (1)		
8. Naphthamide Maroon *(Masstone)*	Quinacridone Violet (11)	Quinacridone Burnt Orange (11)	Dioxazine Purple (2)	Carbon Black (0.7)	
9. Naphthamide Maroon *(Undertone)*	Quinacridone Violet (11)	Quinacridone Burnt Orange (12)	Dioxazine Purple (2)		
10. Sap Green	Quinacridone Gold (30)	Phthalo Green (YS) (10)	Quinacridone Magenta (1)		
11. Sepia	Raw Umber (20)	Burnt Sienna (3)	Carbon Black (0.7)		
12. Smalt	Ultramarine Blue (5)	Naphthol Red Light (0.4)	Red Oxide (0.15)	Regular Gel (Gloss) (10)	Acrylic Ground for Pastels (6)
13. Terra Rosa	Red Oxide (10)	Yellow Ochre (1)			
14. Terre Verte	Cobalt Green (1)	Cobalt Titanate Green (8)	Regular Gel (Gloss) (40)		
15. Van Dyke Brown	Burnt Umber (20)	Quinacridone Bt. Orange (0.5)	Carbon Black (0.3)		
16. Venetian Red	Red Oxide				
17. Viridian Green	Cobalt Green (2)	Phthalo Blue (GS) (1)	Phthalo Green (BS) (6)	Zinc White (14)	Regular Gel Gloss) (20)
18. Vermillion	Quinacridone Red				

Color Matches Using Just the GOLDEN Color Mixing Guide Set of Colors

Zinc White	Quinacridone Magenta	Naphthol Red Light	Hansa Yellow Medium	Phthalo Green (BS)	Phthalo Blue (GS)	Yellow Ochre	Regular Gel (Gloss)
	100		25		3		
	25		50	3			
5			30			9	
15	40	2		15			50
10	30			18			
2	8		9	8			
		2	30	.1			
	11		30	12			
70				.5	15		50
	38		3	.2	12		
			20			30	
		20	40	18			
	30			15	20		
	15		60	20			
	40	5	25	15			
	40	5			10		100
		50	41	.8			
23	10		12	7			50
	40		30	8			
	40	26		1			
	3			20		10	15
	27	20	5	.3			

From Cover

The Ever-changing Artist's Palette

However, change does not come without skepticism and reluctance. Max Doerner reflected on this issue in his circa 1921 book, *The Materials of the Artist*:

'It is often heard said among artists that the old masters had no "chemical" pigments, and for that reason their pictures are so well preserved. This, however, is a misconception, for the old masters had lead white, Naples Yellow, Vermilion, copper and sulphur colors, etc. The reason for the greater permanency of many of the old pictures lies in the fact that they were built up in a correct, craftsman like manner.'

The acceptance of new pigments for use in painting has always been subject to differing opinions. Then and now, as each new colorant appears, it ranges from rapid embracement to disdainfulness. A pigment may be readily used by some based solely on hue, while the more cautious will inquire as to its permanence. Historically, the latter group gained this information from the fate of the former. Innovators, at their own risk, proved or disproved the archival merit of materials. Followers could then couple this information with the aesthetic and working attributes of the new pigment to see if it met their criteria. However, the rate at which a new pigment gained acceptance was often greatly accelerated if it filled a previously vacant color space, regardless of other criteria.

This procedure of evaluating pigments formerly required generations, as time was the most reliable indicator of lightfastness. The careful artists of each time period used past experience to create the most permanent paintings of their day. However, with modern test methods, this no longer is the case. It is now the pigment and artists' material manufacturer's role to provide this information concurrent with the introduction of the colorant.

As new pigments are discovered, or as known ones are refined, todays artist can much more readily assess whether colors they currently are using, which have been so familiar to them, are still the best possible choice. With the issue of durability much more assured, they are at greater liberty to pursue a new material based solely upon its representation of their vision.

New does not always mean better, but the discovery of certain pigments were monumental. True Ultramarine Blue, or Lapis Lazuli was extremely expensive, but other than the translucent Smalt, there wasn't an alternative for centuries. Prussian Blue was synthesized from ferric-ferrocyanide in 1704, and marks the first truly man-made pigment. It was accidentally made by the Berliner Diesbach [7], and was hailed as a great achievement by the artists and colourmen of the day. In retrospect, we can recognize that Prussian Blue was indeed a great replacement pigment, as it offered a durable, but much more economical intense blue. In contrast, the synthetic "coal tar" colors, although breakthroughs in color chemistry, were used too hastily. In 1856, 18 year-old William Henry Perkin was awarded a patent for discovering that coal tar bases could produce intense bright bluish purples. Although these dyes proved not to be lightfast, the chemistry involved paved the way for future successful organics. Shortly after this discovery, other chemists were stimulated by the methods used to produce them and carried out similar experiments, which soon led to dramatic discoveries. [8]

GOLDEN Pigment Selection for Acrylic Paints

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As a paint manufacturer, GOLDEN has always made products with the professional artist in mind. The pigments are carefully selected for clarity, consistency and permanence. In fact, every lot of pigment we receive is pre-tested before use in our paints to ensure consistent color.

From time to time, artists will ask us why we don't make historically produced colors. The choice not to make certain colors is based on one of several reasons. Sometimes the particular pigment is no longer commercially available. It is also true that certain pigments, such as Prussian Blue and Viridian Green, are not stable in acrylic emulsion paints. Other pigments may have an unacceptable level of toxicity. Often, as is the case with true Alizarin Crimson or Sap Green, our response is that we do not want to use pigments that do not have an ASTM Lightfastness rating of I or II. It is a very easy decision to eschew such colorants if lightfast alternatives exist in the same color space.

When alternatives do not exist, the most important attribute of a color, still may be... color. That is why GOLDEN sells fugitive Fluorescent paints and Phosphorescent Medium. They are truly unique. We also make it well known that these materials will not stand the test of time. One day there may in fact be fluorescent pigments that are lightfast. If and when that day comes, today's pigments will be replaced. The attribute of being irreplaceable is likely the most valid argument for incorporating fugitive material into artwork, and comes at a known cost. Conversely, failure to embrace better replacements, when merited, may cost posterity that work which could otherwise have endured.

This argument is nothing new to the art world. Take for example the use of Madder. This plant's root has been used for centuries as an artist pigment. The brilliant rose madder was extracted and processed into a "lake" (a lake pigment is made by using a substratum, typically a clay, as an inert base to absorb an ink-like colorant, so that it may be applied as a pigment[1]). In 1868, the German chemists, Grabe and Lieberman, first synthesized 1, 2 dihydroxyanthraquinone, or the color material in Madder, known as Alizarin. The process created a much more lightfast pigment [2]. While some artists argued that the genuine Madder pigment was brighter, Alizarin's permanency was so much greater that it immediately became the preference of most artists of the time. While the lightfastness was a great improvement, it is still only an ASTM category III pigment (Fair) by today's standards.

Use of the fugitive Madder pigment, derived from this plant, gave way to Alizarin Crimson (Lightfastness III) after its discovery in 1868.The modern Quinacridone Crimson shares the same desirable characteristics, but with the most permanent ASTM rating (Lightfastness I).

In 1958, Struve discovered methods of preparing linear-*trans*quinacridones in a form useful for pigments[3], which paved the way for development of the family of pigments we call Quinacridone. Just as the coaltar derivative Alizarin Crimson set a new standard for synthetic organic pigments, the development of Quinacridones made it possible to achieve the same desirable characteristics of the original Madder, but in a Lightfastness I (Excellent) pigment. As a result, GOLDEN is able to offer Quinacridone Crimson as a modern, and dramatically more permanent alternative.

Why Some Pigments are No Longer Available

Many of the historical colors have become obsolete for a variety of reasons. Today's pigments are not made with the artist in mind, but for the production of industrial coatings, such as house paints, appliances, and automotive paints. For this reason when a color is out of favor, or replaced by a cleaner, more lightfast pigment, production of the older pigment can be halted almost immediately. This was recently the case with GOLDEN Naphthamide

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The Ever-changing Artist's Palette

(Benzimidazalone) Maroon. As new pigments of similar hue became available, that were either cheaper or easier to process, most industries stopped using Naphthamide. Hence, demand fell sharply, and it is no longer profitable for the pigment manufacturer to produce.

Ethics caused the disappearance of Indian Yellow. This pigment was commercially produced in Bengal, India by feeding the leaves of mango trees to cattle and collecting their urine. The dried product (chemically known as euxanthic acid) produced an intense, vibrant yellow that was used for years as a dye and an artist's pigment [4]. The process of feeding only mango leaves to cattle had adverse effects on the animal as they didn't contain sufficient nutrients. In 1908, production of Indian Yellow was terminated as an act of the Indian Government, which prohibited the manufacturing as prevention of the cruelty of animals [5].

Toxicity may also cause a pigment to fall into disfavor. Pigments made from lead or mercury, such as Naples Yellow or Vermilion, can be poisonous and may have inadvertently killed many early artists. It is believed that Vincent Van Gogh's mental illness and suicide may have been due, in part, to his frequent use of true Naples Yellow [6]. Many of these very toxic pigments were replaced by the Cadmium family of pigments, which in turn are yielding to better choices in the evolution of pigment selection.

Although Cadmium is less toxic than lead and mercury, it is still a heavy metal with an uncertain future due to continued regulatory concern. As part of GOLDEN Artist Colors' ongoing efforts to provide safe products, we have introduced several organic colors as replacements to the Cadmiums. These include Pyrrole Red, Pyrrole Red Light, Pyrrole Orange, and Hansa Yellow Opaque. In addition to being similar in hue and chroma, these colors have greater exterior durability than cadmium pigments.

References:

1. Doerner, Max, The Materials of the Artist. *p. 47.*
2. Gettens & Stout, Painting Materials. *p. 126.*
3. Zollinger, Heinrich, Color Chemistry. *p. 193.*
4. Gettens & Stout, Painting Materials. *p. 119.*
5. Feller, Robert L. Artist's Pigments. *p. 19-20.*
6. Moss, Matthew. Caring for Old Masters Paintings. *p. 78.*
7. Gettens & Stout, Painting Materials. *p. 149-150.*
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From Page Three

Historical Pigments and their Replacements

earth. Today, Red Iron Oxide is synthetically manufactured resulting in better consistency. Oxides have been used since pre-historic times and are still important pigments today. Venetian Red usually refers to a specific bluish hue of Red Oxide, but variations range from violet reds to yellowish ones.

Viridian Green

(PG 18)

Viridian Green was discovered in 1797 by Vauquelin, but wasn't developed into the modern color until 1838 in Paris. It immediately replaced a fugitive color known as Emerald Green, but was called Emerald Green, Vert Emeraude, Celedon Green, Pannetier's Green, Guignet's Green, and even Transparent Oxide of Chromium until it became widely known as Viridian. Hydrated Chromium Hydroxide is a difficult pigment to formulate in acrylic emulsions, and although GOLDEN has made many attempts to do so, it appears unlikely that true Viridian will remain part of our palette.

Vermilion

(PR 106)

Vermilion is a toxic pigment made from Mercuric Sulfide. This naturally occurring ore is the source for Mercury, and was ground up as a pigment for centuries and termed Cinnibar or Zinnober. Early cultures of the Greeks, Romans and Chinese created Cinnibar artificially for centuries, as early as 6th century B.C., but it wasn't until the 15th century that it was termed Vermilion. Direct sunlight causes it to darken substantially, and it was quickly replaced by the Cadmium Reds upon their arrival.

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1. Doerner, Max. The Materials of the Artist.
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BOOK REVIEW

By Mike Townsend

Silvestrini/Fischer
<u>Cataloque I</u>:
<u>Color Systems in Art and Science</u>
A cultural commitment by Caran d'Ache Switzerland

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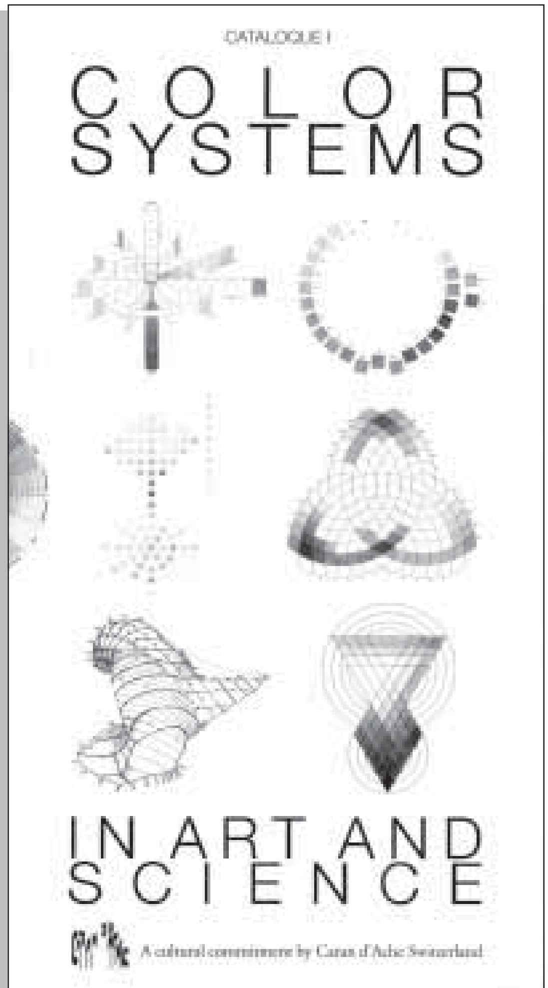

<u>Color Systems in Art and Science</u> is a collection of 60 different color theories originally assembled for an exhibition on color theory at Hunter College. The essence of this book is the same question every artist and scientist trying to develop their own color system asks: How many primary colors are needed to produce the infinite variety of colors that exist? Although most theories are based on three and four primary colors, it is interesting to follow the progression (and regression) throughout history. What is also equally absorbing is the vast number of major artists, physicists, physiologists, mathematicians and others who have devoted so much effort to grasping a working knowledge of the color spectrum. If you have ever wondered how today's color systems evolved, this book is a must. Each chapter gives the reader good detail of surrounding factors, preliminary theories and other influences that shaped each conception of the absolute color system.

The chapters are broken down by each individual's or organization's theory and begin with Aron Sigfried Forsius's 1611 color configuration. Forsius developed the first known color sphere (white and black at the poles, red, yellow, green and blue on the equator) from Leonardo Da Vinci's linear six color system. The book also reveals that for many years it was Francis Glissen, not Forsius, who was mistakenly credited with the creation of the color solid (sphere) and the neutral gray scale.

As its title infers, this book does not only focus on color theory for the benefit of the artist; a good number of the systems involve the perception of light as interpreted by the human eye. A good analogy is to relate what we view to what we hear. In music we can perceive tone, pitch, and volume, and distinguish between differences in each. The eye, although reading hue, value, and chroma, cannot perceive differences of amounts of the primary colors in a particular mixture, and in turn renames the mixture as "orange" or some other blend. This is somewhat related to what impressionists attempted, with small dabs of pure color next to each other to make the eye read them as a different color altogether.

One of the chapters is dedicated to perhaps the most influential color theorist of all time, Albert Henry Munsell. His color tree, first published in his *Color Atlas* (1915), was based on a "perceptually measured equidistant" space between each color. Incredibly, he spun multicolor, painted tops to determine these spaces, not wishing to depend on physically blending colors.

The final chapter concludes with the latest computerized system: Italy's CMN-86 (1986 version). Ironically, this most recent and highly technical arrangement is based on a tetrahedron, similar to Plato's ancient color theory design (circa 400 B.C.).

<u>Color Systems in Art and Science</u> has been written in a way that the artist, as well as the scientist, can appreciate. Its glossary of terms is comprehensive and the text aptly follows the illustrations of varying color lines, wheels, spheres, cubes, trees, and graphs. Any student of physics or art who has concerned themselves with color theory should take a look at this publication, as it will give an immediate insight into their world of color.

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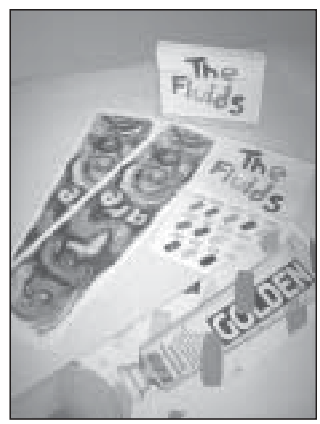

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