

DEVELOPMENT OF A NEW MATERIAL FOR RETOUCHING

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ABSTRACT

As a natural outgrowth of research on synthetic low molecular weight resins for picture varnishes, a new retouching paint was developed in a collaborative effort involving conservators, conservation scientists and an artists' materials manufacturer. A urea-aldehyde resin produced by BASF was chosen as a medium because of its photochemical stability, excellent pigment wetting, and working properties similar to those of a natural resin medium. The paints are soluble in relatively low-aromatic hydrocarbon solvents and remain so after extensive accelerated aging. More than twenty-five painting conservators volunteered to use the retouching paints over a period of several years; their opinions and experiences were collected in surveys. Issues of manufacturing were considered, including the benefits of milled paint, product shelf life, and the use of lightfast substitutes for historically important but fugitive pigments.

INTRODUCTION

Conservators put great demands on materials that they choose for use in their work. Retouching materials in particular must be stable, reversible, versatile, and suitable for use with a vast array of artistic styles and techniques. In the past, a limited number of commercially produced retouching materials have been available for use in the field of conservation. For many conservators, these materials have been found to have shortcomings: they may require the use of relatively polar or toxic solvents, the stability of both the pigments and the resins used may be unacceptable or unknown, or the paints may lack certain optical and handling properties. Such issues suggested a need for the development of a new retouching material. For the past several years, the authors have been working towards the development of a new material for use in retouching in a collaborative effort involving conservators, conservation scientists and a manufacturer of artists' materials.

Discussions among three of the authors (ML, JW and ERdlR) concerning the development of a new material for retouching began in 1993. These discussions resulted from their collaboration in the study of synthetic low molecular weight resins for use as picture varnishes. These resins presented some interesting possibilities for use as a medium for retouching paints.

Prior to 1993, a few test panels had been made at the J. Paul Getty Museum using some commercially available retouching materials. These test panels were sent to the National Gallery of Art in Washington for accelerated aging studies.¹ At about the same time, several paint manufacturers were contacted in an effort to find someone who would be willing to participate in a project designed to develop a new retouching paint. This effort was based upon the belief that commercial production, which would allow for industrial milling of the paints rather than hand mixing, would produce paint of the highest quality. Hand mixing never attains the high degree of consistency and thorough wetting of

pigment particles achieved in commercial milling. Unfortunately, these initial efforts proved to be unsuccessful; even those companies that expressed some interest in specialized paint manufacture were not able to accommodate experimentation with new materials.²

In the fall of 1994, Gamblin Artists Colors Co., a small firm that produces a variety of high quality artists' materials, was contacted. The company agreed to collaborate in a project directed towards the development of a new retouching material that would be manufactured using a three-roll mill. Gamblin Artists Colors contributed its 20 years of experience formulating artists colors to the project. The important goals were to enhance working properties while maintaining the permanence of the materials.

TEST BATCHES USING AN EXPERIMENTAL ALDEHYDE RESIN

For many applications, better optical results can be achieved using a retouching paint containing a low molecular weight resin binder rather than using a paint based on a polymeric resin [1]. Better handling properties may be achieved as well. For this reason, retouching paints based on natural resins are still in use. The authors concentrated therefore on synthetic low molecular weight binders.

In the fall of 1995, one of the authors (JW) started work as a guest conservator in the paintings conservation department of the J. Paul Getty Museum. It was there that she started to prepare a hand-ground palette of paint. The resin chosen was an experimental, purified form of an aldehyde resin. This resin, prepared in small batches by BASF, is a member of the aldehyde family of resins that the company markets under the Laropal® A brand name.³ The experimental aldehyde resin had already been tested at the National Gallery of Art for photochemical stability [2-4]. Aldehyde resins are more appropriate paint media than some other low molecular weight resins, such as the hydrocarbon resins Arkon® P-90 (Arakawa) and Regalrez® 1094 (Hercules), because of the fact that they are slightly polar and therefore wet pigments more easily. The experimental aldehyde resin produced by BASF appeared to be the most promising candidate for this project in terms of stability and ready solubility in low-aromatic hydrocarbon solvents.

In November of 1995, the authors convened in Portland, Oregon, at Gamblin Artists Colors Co. During this initial visit, an ivory black paint was made with the experimental aldehyde resin using a three-roll mill designed for making smaller paint batches. Discussions of manufacturing issues followed, such as working properties, degree of gloss, and handling properties on the palette. Pigment particles come in a wide variety of shapes and sizes; they differ in polarity and the amount of medium they can absorb. Differences in absorption lead to different pigment loads when making paints; all of these factors affect the pigment to binder ratios as well as the gloss and final texture of each color.

Upon return to the Getty, an initial palette of twenty-one colors of aldehyde resin paints was mixed by hand over a period of several days. The paints were used in several retouching projects (including three 17th-century Dutch paintings from the Getty collection) and showed great promise. It was clear from these initial treatments that the experimental aldehyde resin could be used successfully as a retouching medium. It was also obvious, however, that hand-grinding resulted in a somewhat coarse, glossy paint

which lacked the smooth paste consistency of commercially prepared paints. Over the subsequent weeks, additional individual colors were prepared at the factory and sent to the paintings conservation studio at the Getty Museum for use in retouching. Finally, the authors agreed that the new paints should be fairly lean and slightly matte, as increased gloss could always be achieved through the addition of more resin.

After four trial batches of test paints, a group of twelve sets of twenty colors was produced in June of 1996 (see Table 1). The colors in these initial sets had been selected by first surveying the preferred palettes of a number of paintings conservators and then identifying the twenty most frequently used pigments; the number was limited to twenty to keep the project costs down. The new retouching colors were formulated to have strong tinting strengths, be highly pigmented, be finely ground and evenly dispersed using a three-roll mill. Tinting strength is related to pigment concentration and milling. The higher the pigment percentage the higher the tinting strength. Proper milling brings tinting strength to its optimum. The binder to pigment ratio was designed to allow for smooth brushing and fast and easy reducibility with medium. All pigments used are rated Lightfastness I (excellent lightfastness) in Table 1 of ASTM D-4302 [5]. Lightfast substitutes were used to recreate the more fugitive colors of indian yellow, alizarin crimson and brown madder alizarin.

After arrival of the paints at the Getty, some test panels were made in order to become acquainted with the handling properties of the new paints. The paints were found to be better dispersed, more finely ground and less glossy than the hand-mixed paints. In addition, subsequent brushstrokes could be applied and the paints would not re-dissolve, an important characteristic for a retouching paint. Sets of these paints (as well as a small amount of the experimental aldehyde resin) were distributed to paintings conservators working at several museums, including the Art Institute of Chicago, The J. Paul Getty Museum, Los Angeles County Museum of Art, Museum of Modern Art (New York), National Gallery (London), National Gallery of Art (Washington, D.C.), the Wadsworth Athenaeum and the Yale University Art Gallery. During the course of the project, several private conservators in the United States and England also volunteered to try the new paints.

Conservators who had agreed to participate in the project were initially surveyed as to their individual working methods and choice of retouching materials. The participants were asked to use the paints in the course of a complete treatment to become familiar with the properties and employ a full range of inpainting techniques. Some instructions were included with the paints, but information was deliberately limited to basic properties of low molecular weight resins and solubility to see what would develop from experimentation.

After a period of several months, responses were gathered from surveys that were distributed to all conservators who had worked with the new paints. Not surprisingly, there was a significant variety in established working methods among those who had agreed to use these initial test paints. Some had worked primarily with dry pigments mixed with a resin on the palette while others preferred commercially available paints. Some used a two-step method of retouching, such as application of a watercolor or gouache underpaint followed by glazes or scumbles of a resin-based paint, while others applied opaque retouches in a single step. Despite these varying approaches, the general response to the new paints was positive; most paintings conservators found the aldehyde

resin colors to be quite versatile and were able to tailor the use of the paints to their individual techniques.

TEST BATCHES USING LAROPAL® A 81

Encouraged by the responses, the authors continued their practical and analytical testing. A temporary setback occurred when the experimental aldehyde resin used to manufacture the first sets of paints did not become available commercially. Despite some initial optimism that BASF would be willing and able to produce larger quantities of the resin, it became clear that an alternative resin would have to be found. Fortunately, another member of the aldehyde resin family, Laropal® A 81, which BASF produces in large quantities⁴, proved to be a good substitute for the experimental aldehyde resin. Another twelve sets of the same twenty colors used in the previous batch (see Table 1) were produced in 1997 using Laropal® A 81 as the binder, and these sets were distributed to the same conservators for further use and experimentation. Although the newer sets of colors required use of a slightly more polar solvent than that necessary for the experimental aldehyde resin, responses were again positive and the handling properties were found to be similar to those of the initial set of paints.

The binder, Laropal® A 81, was dissolved in a mineral spirit mixture. During the initial test batches a problem with vehicle separating out of the finished paint had to be solved. The authors found that a small percentage of acetone that had been added to the binder solution to lower the aromatic content of the solution caused the finished paint to “throw off” binder upon storage. This caused the initial squeeze of paint to be too fluid and the last squeezes to be too dry. This was solved in two ways: first, by eliminating the acetone and increasing the aromatic percentage of the solvent mixture, and second, by increasing the pigment to binder ratio for a few colors, which made these paints stiffer. As a result, the resin solution remained homogeneous after more than a year of shelf storage.

Still, the paint tube is an imperfect container for a solvent borne system. There may be some colors that tend to dry out in the tube through solvent evaporation. For this reason, it would be an advantage to produce the paints in small jars rather than tubes.

RESPONSES GATHERED FROM SURVEYS

The paints were well received by everyone who used them in a complete treatment. Conservators who were already using some type of commercially prepared paints made the transition to the new paints easily, perhaps because the handling characteristics compared favorably. Positive attributes noted include good covering power, versatility in the achievement of a variety of effects, little change in color upon drying, usefulness for both glazing and scumbling and ease in “editing” with a silk cloth. At two institutions, objects conservators also found the paints useful for retouching losses in ceramics and wooden artifacts. There were a few responses indicating some dissatisfaction with the paints, mostly among conservators who were accustomed to using dry pigments in a medium, such as poly (vinyl acetate). It is possible that conservators who have mastered this technique are less inclined to experiment with prepared paints.

Since the beginning of the project, the paints have been used for retouching in over one hundred treatments, ranging from Trecento Italian pictures to twentieth century paintings. All of the participants in the project were sent a final questionnaire in the fall of 1998 to document their experiences with the Laropal® A 81 paints, as well as to give their preferences concerning packaging. They were also asked to provide a list of pigments that they would consider to be indispensable.

In critiquing the handling properties, a few selected comments included observations such as the fact that the smoothness of the paints allowed for smaller marks than could be achieved with polymer resins, that it was easier to layer and gain opacity than with some other tube paints, and that the colors remained true when mixed. When asked about solvent preferences, it was discovered that some participants had used solvents that were stronger than necessary. The responses varied but included: methylproxitol (propylene glycol monomethyl ether), xylene, Shell Cyclosol 53 (100% aromatic-now called Shell Cyclosol 100), petroleum benzine or Shell TS-28 (75% aromatic), toluene and 5% methylproxitol, xylene with Cellosolve® to “control” the evaporation rate, xylene and ethanol.

It became clear from the surveys that additional information about diluents would prove useful. Laropal® A 81 is soluble in hydrocarbon solvents that are 25% aromatic and oxygenated solvents such as isopropanol, ethanol and acetone. It is therefore unnecessary to use highly aromatic solvents with the aldehyde resin paints. The more polar, oxygenated solvents are fairly fast evaporating and may prove useful when inpainting on resins that are insoluble in such solvents, and when crisp brushstrokes and low gloss are desired. A number of useful solvent mixtures have been found for these paints, including a mixture of equal parts (1:1:1) petroleum benzine, Shell TS-28, and isopropanol; dilute (1:4) mixtures of isopropanol in mineral spirits (15% aromatic); and Arcosolv TM (propylene glycol monomethyl ether, called “methylproxitol” in the UK).

Gamblin Artists Colors Co. intends to produce and market Laropal® A 81 paints and make them available in an expanded palette that is based upon responses from the participating conservators. The initial palette of colors was primarily traditional mineral colors, but in the future modern organic pigments may be added.

CONCLUSION

This collaborative project has allowed the authors to assess the requirements for a new retouching paint and to lay the groundwork for their production. As with any conservation material, this new retouching paint will not solve all retouching problems. However, Laropal® A 81 paints appear to have met the authors' initial criteria concerning stability, safety of use, quality of manufacture, and optical and working properties. They have also satisfied the needs of a variety of practicing conservators. It is hoped that these paints will provide a welcome and useful addition to the retouching materials currently available for use by conservators.

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NOTES

1 The accelerated aging studies were carried out at the National Gallery of Art. The (unpublished) results were assembled in December, 1990 and July, 1991.

2 Quaker Color, in Quakertown, Pennsylvania, does manufacture and sell in dry chip form pigments ground and dispersed in Acryloid B-72. However, their paints are primarily intended for commercial use, particularly in the automotive industry, and the colors they manufacture suit the needs of that industry.

3 The aldehyde Laropal resins should not be confused with the ketone family of resins produced by BASF, which are also marketed under the Laropal® brand name, but which have a "K" rather than an "A" as part of their nomenclature.

4 In 1996, BASF produced Laropal® A 81 at a rate of 1 - 1.5 tons per hour, 24 hours a day. Private communication from Hellmuth Kasch, BASF to ERdlR.

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5 "ASTM Standard Specification for Artists' Oil, Resin-Oil, and Alkyd Paints D 4302-96a," in: *Annual Book of ASTM Standards*, Vol. 06.02, American Society for Testing and

Materials, West Conshohocken, PA 1998.

6 Colour Index, 3rd ed., 5 Vols and Revisions, The society of Dyers and Colourists, London, 1971-75.

MATERIALS

"Typical Properties" charts of Shell Hydrocarbon solvents can be obtained directly from Shell Chemical Company at 1-800-USA-SHELL (1-800-872-7435), or, outside the U.S., through Pecten Chemicals, Inc., in Houston, Texas, at 713- 241-6161.

Laropal® A 81 can be obtained directly from BASF Corporation Chemicals Division, 100 Cherry Hill Road, Parsippany, New Jersey, 07054. Telephone 201- 316-3000. It is also available from Gamblin Artists Colors Co. (see below).

Gamblin Conservation Colors are available from Gamblin Artists Colors Co., 323 SE Division Pl, Portland, Oregon, 97202 Telephone 503-235-1945 ex 10; fax 503-235-1946 e-mail rgamblin@conservationcolors.com web site www.conservationcolors.com.

AUTHORS

Mark Leonard earned his undergraduate degree in Art Conservation at Oberlin College, and subsequently received an M.A. in Art History and a Diploma in Conservation from the Institute of Fine Arts at New York University. He worked in the paintings conservation department at the Metropolitan Museum of Art in New York for five years, and joined the staff of The J. Paul Getty Museum in 1983, where he is now Conservator of Paintings, Department Head in the Paintings Conservation department. Address: The J. Paul Getty Museum, 1200 Getty Center Drive, Suite 1000, Los Angeles, California 90049-1687.

Jill Whitten is a painting conservator in private practice in Houston, Texas. She received a B.F.A. in Painting from the University of Texas at Austin, and an M.A. and Certificate of Conservation from Buffalo State College, New York, in 1992. Her graduate internship and a three-year Mellon Fellowship were undertaken at the Art Institute of Chicago. She was Resin Research Coordinator and Painting Conservator for 20th-Century Paintings at The National Gallery of Art in Washington, D.C. from 1996 to 1998, and a sabbatical replacement lecturer at the Buffalo State College of Art Conservation Department in the spring of 1996. A Kress Grant allowed her to be a guest conservator at The J. Paul Getty Museum in the winter of 1995. She has lectured and led workshops for conservators in the United States and Europe on the use of new materials for varnishing.

Robert Gamblin Robert Gamblin founded Gamblin Artists Colors Co., a company manufacturing artists' grade oil painting materials in 1980. After working for over 25 years of making oil paints and 40 years as a painter, Robert Gamblin is considered America's premiere colorman. He has assisted painters, including Nathan Oliveira, Tom Wasselman, David Kapp and Elizabeth Murray, select painting materials. Through lectures and the web, Robert Gamblin has also educated a generation of painters by

providing technical information on oil painting and oil painting materials.

Robert now focuses his attention on Gamblin Conservation Colors and making an artisan line of special colors for painting conservation and restoration. Also, he has served on the Board of Visitors for the Department of Architecture and Allied Arts at the University of Oregon, the Board of Trustees of the Vermont Studio Center, as president of the Board of the Sitka Center for Art and Design, and has acted as the Chair of the Physical Properties Task Group of the ASTM D01-57 Committee on Artists' Materials.

E. René de la Rie received an M.S. and Ph.D. in chemistry from the University of Amsterdam, The Netherlands. He has been Head of Scientific Research at the National Gallery of Art in Washington, D.C. since 1989, where he directs a staff of researchers who study artists' methods and materials, and test and develop conservation materials. Before coming to the National Gallery of Art, he held positions at the Metropolitan Museum of Art, New York, and the Training Program for Conservators and the Central Research Laboratory for Objects of Art and Science, both in Amsterdam. He has been an editor of *Studies in Conservation* since 1994.

TABLE 1: Palette used for test batches of experimental aldehyde resin paints and Laropal® A 81 paints. Colour Index [6] names are in parentheses. Titanium White, titanium dioxide (PW 6) Yellow Ochre, natural hydrated iron oxide, (PY 43) Permanent Indian Yellow, diarylide yellow HR 70, (PY 83) Cadmium Yellow Light, concentrated cadmium zinc sulfide, (PY 35) Cadmium Yellow Medium, concentrated cadmium sulfide, (PY 37) Cadmium Red Light, concentrated cadmium sulfo selenide, (PR 108) Cadmium Red Medium, concentrated cadmium sulfo selenide, (PR 108) Permanent Alizarin Crimson, quinacridone red b, perylene red, ultramarine blue, (PV 19, PR 149, PB 29) Indian Red, synthetic red iron oxide (PR 101) Permanent Brown Madder Alizarin, calcined natural iron oxide containing manganese, quinacridone red b, perylene red, ultramarine blue, (Pbr 7, PV 19, PR 149, PB 29) Cobalt Blue, oxides of cobalt and aluminum, (PB 28) Prussian Blue, ferri-ammonium ferrocyanide (PB27:1) Ultramarine Blue, complex silicate of sodium and aluminum with sulfur (PB 29) Chrome-Oxide Green, chromium oxide (PG 17) Viridian, hydrated chromium oxide (PG 18) Raw Umber, natural iron oxide containing manganese (PBr 7) Burnt Umber, calcined natural iron oxide containing manganese (PBR 7) Raw Sienna, Natural iron oxide (PBR 7) Burnt Sienna, Calcined natural iron oxide (PBr 7) Ivory Black, bone black (PBk 9)