Buffered vs. Non-Buffered Matboard

By Jeffrey L. Neumann

Should I use only non-buffered board for mounting and matting valuable color photos? Do albumen prints require non-buffered board? I've heard that all protein-based materials should be mounted on non-buffered board. Does that mean all gelatin photographic prints, too? Since silk and wool are protein-based materials, should they be separated from buffered conservation-quality board? What about Oriental woodblock prints? I've heard that some of the inks used are alkaline sensitive. Should they only be matted using non-buffered board?

These kinds of frequently asked questions come up time and again as picture framers and museum preparators seek to "do the right thing" when mounting and matting valuable works of art. The purpose of this article is to attempt to clarify some of the confusion surrounding this issue by relating the current thinking of some eminent preservation scientists and conservators.

As a former product manager for a line of museum board, I have heard opinions that are all over the map on this subject: from the "less is more" mindset held by some conservators who feel that adding any material to museum board compromises its purity and hence, its safety, for use on all kinds of artwork; to those who feel that "more is more" and advocate the idea that simply buffering the board is not enough; that we need to go beyond the traditional buffering with calcium carbonate by adding molecular sieves, a.k.a. molecular traps or zeolites; crystalline aluminosilicates which may have the ability to adsorb pollutants that come in contact with the board.

What is Museum Board?

The FACTS definition for museum board is: "This generic term refers to quality matboard. The properties required for this product are generally the same as any 'permanent' paper. Usually all cotton."[1] It is often called conservation-quality matboard as well.

Defining Buffered And Non-Buffered

When referring to museum board, the terms "buffered" and "non-buffered"(also called unbuffered, though less technically correct) refer to the presence or absence of alkaline filler (calcium carbonate) in the board. This affects the pH of the board. Buffered museum board is usually in the range of 8 to 9.5 with an "alkaline reserve" or percentage of calcium carbonate, of two to five percent. Non-buffered board has no alkaline filler added and is usually in the pH range of 7 to 7.5

How Buffering Of Papers Began

W. J. Barrow Research Labs did the seminal research in the 1950's and 1960's.[2] William Barrow was looking at papers that were 100 years old and older when he noticed that the best preserved examples were from areas where the regional water came from limestone aquifers. The water content had naturally high levels of calcium carbonate that created a reserve of alkalinity in the paper. Barrow began to advocate the intentional addition of calcium carbonate as a means for extending the life of paper.

Why Non-Buffered Museum Board Was First Produced

In the early 1980's, James Reilly, Director of The Image Permanence Institute (IPI), and his team of scientists were studying albumen prints, working on developing ANSI Standard IT 9.2 and working on microfilm blemish problems. Reilly did an incubation study on albumen prints. In these experiments, conservation board (buffered kraft paper) was used. They noticed that the presence of calcium carbonate seemed to cause more yellowing in the albumen prints.

When the research was published,[3] other people concluded by extension that since gelatin was also a protein-based material, gelatin prints would be similarly affected. Around this same time, Kodak published advice based on theoretical grounds that color photos may also be harmed by alkaline environments. Ilford, manufacturer of the Cibachrome dye transfer print process, also published advice to use only non-buffered boards in the mounting

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of their product. There came to be a consensus within most conservation circles and the picture framing community that it was generally safer to use non-buffered museum board for mounting and matting of all albumen prints, chromogenic, and dye transfer prints.

A situation occurred at the George Eastman House in the early 1980's where some photos, including an albumen print and a color print, were taken off exhibit after many years. These photos were presumably matted with buffered board. Under the window mat where the photo was overmatted, there were color changes—a purple color on the albumen print and yellow on the color. The initial assumption was that buffered board was the culprit.[4]

The ANSI Standard IT 9.6 1988 specified that, "Paper that is in direct contact with processed color photographic material should have a similar composition to that used for black and white except that the pH should be between 7.0 and 7.5 and the two percent alkaline reserve requirement shall not apply."

Around this same time, The Library of Congress issued its Specifications for Mat/Mounting Board for Photographic Materials 400-402 and in this early version, it was specified that this board should be pH 7 to 7.5 and contain no alkaline fillers.

The combination of these events and other anecdotal evidence led conservators to start recommending only non-buffered materials for enclosures and matting of albumen and color photos. Manufacturers of museum board responded by producing board that was not buffered with calcium carbonate. This board was marketed under the name of "Photographic Board," "Archival Photo Mount," "Non-Buffered Museum Board," or "Unbuffered Museum Board."

Where The Confusion Begins

Most picture framers, even in museum environments, are not able to easily identify albumen prints, or to be sure about what kind of color prints they may encounter. So, wanting to be on the safe side, many framers conclude that non-buffered boards are a good choice for all photographs. Although well intentioned, the marketing of non-buffered board under names like "Photographic Board" or "Archival Photo Mount," has had the effect of furthering the confusion.

Further Research At IPI Leads To A Reversal

Meanwhile, Jim Reilly and his team at IPI were conducting more research, doing additional experiments on both albumen and gelatin prints under carefully controlled conditions. Interviewed for this article, Reilly relates that, "We later learned that we had drawn the wrong conclusions, that there are other things, like residual chemicals and the presence of lignin, that play a far more important role in the degradation of these materials."

In the early 1990's, Reilly put forth a reversal of his earlier findings. Working with the ANSI IT9 Standard Committee and in other forums, he has tried to correct what seemed to be a groundswell of opinion in favor of unilateral specification of non-buffered board for photography. Reilly openly states, "I regret that my earlier less complete research has had such a profound impact."

The P.A.T. Is Most Important Criteria

Since the late 1990s, Reilly and IPI have taken the position that both buffered and non-buffered board can be acceptable within photo storage. But Reilly says that only in one or two circumstances would he recommend using non-buffered board. Those are: Kodak Dye Transfer prints, because of an acid mordant[5] that is used in manufacturing; and possibly cyanotypes, because of a known sensitivity of the blue pigment to alkalinity.

For almost all photographs, including color, silver gelatin black and white, and albumen prints, Reilly states that mounting and matting board that passes the P.A.T. test[6] is the most important criteria. "The presence or absence of calcium carbonate is a moot point," says Reilly. "But calcium carbonate buffering is desirable in photo storage materials because it helps to protect the enclosure."

"In the world of paper in general, buffering with calcium carbonate is a good idea. It is valid because it can slow down acid hydrolysis which is the leading cause of physical weakness in any grade of paper."

When asked about buffering as protection from atmospheric acids, Reilly responds that, "it helps a little, but this issue is not so simple for there is evidence that acids can co-exist with calcium carbonate. It does not provide complete protection."

"The main thing to remember when seeking to preserve photography is to buy good quality board. Paper containing groundwood is not a good choice even with added

buffering. Yes, adding buffering will significantly extend the life of this kind of paper, but you should never buy board that has been buffered to cover poor raw materials."

"Museum quality board is mechanically strong and excellent with or without buffering and will last a long time. The important thing to remember is that buffering is not enough. The board should have no residual bleach or other chemicals, no lignin, and should pass the Photographic Activity Test."

Library Of Congress Changes Specifications

The most recent edition of the Library of Congress Specifications for Mat/Mounting Board for Non-Photographic Materials and their Specifications for Mat/Mounting Board for Photographic Materials[7] are virtually identical. The one exception is that the Specification for Photographic Materials requires that the board pass the P.A.T. Both specifications call for an alkaline reserve of a minimum of two percent and a maximum of five percent.

Library of Congress Specifications Rule Out "Molecular Traps"

The other interesting change to this edition of the Library of Congress specifications is the addition of a paragraph to both Mat/Mounting Board Specifications that reads as follows: "Additional components included in the matboard which may or may not improve the performance of the matboard are not considered within the scope of this specification. Matboard manufactured with additional components will be considered as not meeting the specification."[8]

It should be noted that these specifications are written for Library of Congress purchasing purposes only. The Library of Congress has never intended to set standards for the picture framing industry, but due to great respect for the institution's paper conservation expertise and the fact that, until recently[9], no other standards specific to mat/mounting board had existed, these specifications had become the industry standards by default.

Rationale For Non-Buffered Board Controversial Among Conservators

Some of the reasoning that has led the trend toward the use of non-buffered board has been based on findings that color photos have exhibited changes when immersed in alkaline solutions or when exposed to prolonged high relative humidity. Some conservators also cite opinions that materials containing protein should be stored only with non-buffered materials. This is based on theory that proteinaceous materials are most stable in storage when kept in proximity to other materials with similar isoelectric points.[10]

Sarah Wagner, Photograph Conservator at The National Archives, and Member of ANSI Imaging Stability Standards Committees, states, "My personal view is that a dry envelope in contact with a photo stored in the recommended environmental conditions is quite different from immersing a photo in an alkaline solution—albeit a situation which may be replicated in a flood where long periods of immersion might occur and if one has newly made buffered envelopes for enclosures. Under such circumstances, I would be more concerned about other issues such as mold, delaminating emulsions, and absorption of harmful contaminates dissolved in the water."

"I have never seen fading, staining, or emulsion physical damage that I could definitively attribute to buffered enclosures. I have seen plenty of damage which I could definitively attribute to poor environmental conditions, poor quality enclosures that don't pass the PAT (especially lignin-containing papers), and poor handling."

Paul Messier, Photo Conservator of Boston Art Conservation agrees. "The ANSI Standards are currently under revision. There is clearly significant momentum away from non-buffered enclosures. I have seen no evidence that cyanotypes matted with high quality buffered boards are affected by pH under normal storage and display conditions. Comparing complete immersion of a print in a bath to storing it in contact with dry buffered board is like comparing open heart surgery to a skinned knee."

Messier also comments on the rationale for specifying non-buffered board based on comparable isoelectric points. "The chemistry comes from biology, but as it relates to conservation, people are making a great leap to conclusions based on concepts that are highly theoretical."

He advises that for preservation of photography, the most important factors to consider are: exposure to light (both UV and visible) and the relative humidity at which the photos are kept. He says that buffered vs. non-buffered board "is way down on the list in order of importance... The issue has been overstated significantly." But he adds, "If framing for permanence, we are learning that buffered is the right choice."

Textile Conservation

Deborah Bede of Stillwater Textile Conservation Studio in Bradford, New Hampshire, says that in textile conservation, "the general rule of thumb is to avoid contact

with buffered boards." Bede relates that, "this is primarily because alkalinity can change the color of some dyes" and that she has seen evidence of this.

"Protein fibers, such as silk and wool, and old and fragile cellulose fibers, such as cotton and linen, are known to be damaged when put in contact with alkaline materials," she says. "Although direct observation of damage caused by buffered boards and papers has not been reported, textile conservators generally isolate textiles from buffered materials with a layer of non-buffered tissue or other neutral material."

What About Japanese Woodblock Prints?

There are differing opinions among conservators specializing in Asian Art on the non-buffered vs. buffered issue, just as there are in paper, photography, and textile specialty areas. Elizabeth Coombs of Warwick, Rhode Island, conservator in private practice and specialist in Japanese prints, feels that there is substantial empirical evidence to support the exclusive use of non-buffered museum board when mounting and matting this type of art.

She cites the facts that Japanese papers were made from bast[11] fibers processed under alkaline conditions. "These papers have lasted for many centuries and have not significantly discolored except when sized with an excess of alum in the printmaking process."

Coombs continues, "We do know that the traditional colorants remain unchanged even under acidic conditions, whereas changes have occasionally been observed in some colors in direct contact with buffered materials." She is concerned that, "this could be exacerbated under conditions of elevated relative humidity."

"There is more than one way to be preservation minded" says Coombs, "and one way is to try to replicate the conditions under which they were originally produced and stored."

Coombs stresses that the main things to remember when considering the framing and display of Oriental prints are that, "they are light sensitive and should never be hung in direct light—if possible they should not be on continuous display. These prints are treasures; they are a great rarity and we need to be respectful of this. Anything we can do to give the best care possible is vital."

Like Coombs, many others feel that the safest choice for Japanese prints is non-buffered board. One reason for this widely held opinion in conservation circles may be the advice on storage of Japanese prints that was expressed in a paper presented at The International Institute for Conservation's Kyoto Congress in September 1988. It was entitled, "The Conservation of Far Eastern Art," and written by the late Kieko Keyes, a highly respected and influential conservator specializing in this area.

Quoting from this paper, "It may be preferable to use unbuffered materials for Japanese prints, since many colorants are pH sensitive and empirical observations show that these colorants are best preserved under neutral or even slightly acidic conditions. Prints which are already matted in buffered board should perhaps be shielded from the board with neutral interleaving paper during storage."[12]

Sondra Castile, Conservator, Department of Asian Art at The Metropolitan Museum of Art feels that, "this is not that critical of an issue." She says that although some aniline dyes may be alkaline sensitive, they were only used in one brief period in Asian Art, that the vast majority of oriental prints were made with vegetable dyes which are not particularly alkaline sensitive.

At the Metropolitan, most prints are only matted while on display and, for most shows, exhibit time is usually only about six weeks. Buffered museum board is used at the Met for matting of all kinds of Far Eastern art, including art from Southeast Asia and India. For practical purposes, when restoring large collections, it does not make sense to purchase non-buffered board. They routinely use buffered museum board on a diverse array of objects including silk items, prints, screens, scrolls, and other wall hangings with no ill effects. Castile feels that the specification of non-buffered board is "overkill" and is "splitting hairs."

Specification Of Non-Buffered Matboard And Storage Enclosures May Be Counterproductive

Says Sarah Wagner, "The pH of all papers drops with time, more rapidly if there is no buffering, or if highly acidic materials are in contact with them. Therefore, unbuffered papers can be expected to become acidic in a relatively short time, (especially if they start out slightly acidic as I found), and will require replacement sooner than buffered papers."

"It's been my experience that in institutions where there are many people processing and or rehousing large diverse research collections, it can be difficult to maintain separate enclosure stocks—it seems that people intermix the papers, lose institutional memory with staff turnover, or lose commitment to the policy. Under these circum-

stances, having one paper stock may seem saner. If one chooses only unbuffered enclosures as the single stock, then one may lose the benefits of an enclosure paper that meets paper permanence standards."

Carl Mendoza, Paper Chemist, Director of Commercial Development at Crocker Technical Papers, confirms the findings of Sarah Wagner that non-buffered papers may be less than pH 7 at the time of manufacturing. "Even cotton, which is inherently neutral, is, after being processed into pulp, slightly acidic." Mendoza continues, "One of the best reasons for buffering museum board is to protect the contents from the enclosure itself."

Too Much Alkalinity Is Not A Good Thing

However, Mendoza cautions against creating specifications for board that is too alkaline because he has seen damage to photos caused by pH levels of 10. He advises that by specifying pH levels up to 9.5, the creators of these specifications "are not jumping off the cliff but walking dangerously close to the edge."

Mendoza advises that the pH of calcium carbonate is 8.2 to 8.6 and that, no matter how much calcium carbonate is added to the paper during manufacturing, the pH of the paper will never go above that level. Papermakers are forced to add soda ash (sodium carbonate)[13] to the paper to bring it to a level above 8.2.

In the 1970's, responding to government specifications for alkaline paper, some paper mills added sodium hydroxide[14] to paper runs to bring the pH up to specified levels. This may account for the fact that tests done at the National Standards Institute found examples of government bond and writing papers with a pH of 10 and no alkaline reserve. This kind of papermaking may also account for the examples of photos mentioned earlier at The George Eastman House which were found to have damage resulting from high pH levels.

The addition of sodium hydroxide to paper, a practice that could produce damaging results, apparently was stopped long ago. My experience has been that all of the paper manufacturers I have worked with were conscientious in making the best paper possible within their capabilities. The papermakers rely on the paper conservation professionals to dictate what the specifications should be.

The picture framing industry also depends on the conservation professional to keep them informed on how to "do the right thing" for the protection of valuable works of art. As we have seen, the answers to these questions are not always simple. The science and the opinions continue to evolve as more research is done. It seems that the more we learn about this, the more obvious it becomes that there is a real need for some definitive research on this topic. ■

Endnotes

1. FACTS International Standard G 07-12-01 Guide for Permanence in Mat and Mounting Boards
2. Two Studies on the Permanence of Book Paper, Conducted by W.J. Barrow. Edited by Randolph W. Church. 1959. Virginia State Library Publication 10: W.J. Barrow Research Laboratory, Inc. Physical and Chemical Properties of Book Papers, 1507-1949. 1974
3. James M. Reilly. Care and Identification of 19th Century Photographic Prints. Rochester, NY: Eastman Kodak Company, 1986
4. information provided by Sarah Wagner
5. A substance which, by combining with a dyestuff to form an insoluble compound, serves to produce a fixed color
6. The Photographic Activity Test, developed by The Image Permanence Institute at Rochester Institute of Technology, described in ANSI IT9.16-1994
7. LC Specifications Nos. 400-401-8/26/98 and 400-402-8/26/98 respectively
8. LC Specs: 400-401-8/26/98 A. 11, 400-402-8/26/98 A. 12
9. FACTS Standard: G 07-12-01, Guide for Permanence in Mat and Mounting Boards can now be considered an industry standard.
10. When electrodes are immersed in an aqueous solution of an amino acid, molecules in a certain form migrate to the negative electrode. Molecules in another form migrate to the positive electrode. Those in the dipolar form do not migrate at all. Molecules in this form are isoelectric; the number of (+) charges equals the number of (-) charges and the molecule is electrically neutral. At a particular pH the system will behave as if all ions were isoelectric and no migration in an electric field will occur. The pH value at which no net migration occurs is called the isoelectric point.
11. Also known as kozo, made from the inner bark of the paper mulberry tree.
12. The Conservation of Far Eastern Art, K.M. Keyes, Edited by J.S. Mills, P. Smith and K. Yamasaki, Pub. by The International Institute for Conservation of Historic and Artistic Works, London
13. a mildly alkaline substance usually added in ratios of 1/2000 lbs.
14. a highly alkaline substance, also known as caustic soda

Jeffrey L. Neumann is a 20-year art industry veteran. He has served on The Image Permanence Institute Advisory Board, FACTS Mat and Mounting Board Committees, and The Berkshire Paper Industry Alliance Executive Board. A featured speaker on Fine Art Papers at NAMTA's International Convention, he has recently joined Canson, Inc. as Product Manager for Arches Papers and Talens Colors.

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