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Becoming a Paper Conservator in France: Education and Internships, Featuring a Silica Gel Research Project

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ABSTRACT

The National Institute of Cultural Heritage (Inp) is one of the two education programs in France that gives a master's degree in conservation, which allows conservators to work for National Museums. This state school, funded by the French Cultural Ministry provides training in seven different specialties: ceramics, paper, textiles, furniture, painting, photography or sculpture. This specialization is determined before the student enters graduate school and the educational program is entirely dedicated to the particular specialization.

This paper will introduce the different conservation education programs in France and will focus on the National Institute of Cultural Heritage. Of particular interest are the partnerships with French museums that allow students access to various collections from which to gain experience. The presentation will then highlight the importance of internships through the example of Ms. Barbisan's time at the Louvre. Finally, the paper will touch on a project carried out in the Inp's paper lab, concentrating on the properties of silica gel. This material has been used before as a drying agent to regulate relative humidity. Building upon a work in progress by Duranton[1], and Hennion[2], silica gel was used here in a humidification chamber to reach a very controlled level of relative humidity. This technique permits for a gentle humidification, useful for fragile media such as gouache or iron-gall ink.

[1] Scientist working in Inp's analytical lab
[2] Textile conservator in private practice

INTRODUCTION

The *Institut National du Patrimoine* (the National Institute of Cultural Heritage) is an institution of higher education, supported by the French Ministry of Culture and Communication.

Its purpose is to recruit through competitive exams and initial training programs both curators and conservators of French cultural heritage. Training programs of both complementary trades within the same institute is a unique and original organization one not found anywhere else in Europe.
The Inp annually admits between 40 to 50 curatorial students and about 20 students specialized in conservation. The training period for students in the discipline of conservation is five years in one of seven specialties: ceramics, paper, textiles, furniture, painting, photography and sculpture.

The Inp (fig.1) offers a wide array of training programs. It also serves as a place of cultural education through seminars and conferences which are both a ways and means to work with other academic institutions linked to cultural heritage, be they French or foreign.
Last but not least, part of the mission of the Inp is its campaign to send its students abroad through internships and to welcome foreign interns, all the while learning from other institutions and exporting its knowledge.

The aims of this presentation are to review the practical training program of French paper conservators through internships and projects in museums. This paper will then highlight a particular project: the use of silica gel for humidification purposes.

Figure 1: The Inp's building located in Aubervilliers, in the Parisian suburban area, © Nelly Koenig

I. PAPER CONSERVATION EDUCATION IN FRANCE

A. Overview of the different French training programs in the field of conservation

The French law called "loi Musées" effective the 4th of January 2002 specifies the status of French conservators. To reinforce control over conservation treatments and to protect works of arts belonging to museums, the French government decided that only conservators who graduated from certain schools would be able to work on works of art belonging to "*Musees de France*"[3]. There are four schools in France that are accredited by the French state: the Inp (*Institut National du Patrimoine*), the Sorbonne's master degree called CRBC (*Conservation-Restauration des Biens Culturels*), the school of Avignon, and the school of Tour. The only places delivering a master's degree specializing in paper and parchment conservation are the Inp and the CRBC, with two or three students graduating per year in each training program.

Figure 2: example of a drawing made for the academic drawing test. Grade: 17/20

© G.Vanneste/Inp

[3] Label of state museums

Students of both programs are recruited through a competitive exam and have usually been studying in a different field before entering a conservation training program, such as history of art, science or applied arts. These previous studies usually help them to prepare for the competitive exam and acquire previous knowledge before specializing. The only difference between the Inp and the CRBC is that the Inp is funded by the French Ministry of Culture and Communication, whereas the CRBC is funded by the French Ministry of Education. This results in small differences in the educational methods.

The Inp's competitive exam takes place in two parts: acceptability and admission. First the student must determine in which specialization he or she wants to take the exam, as the tests differ by specialization. The acceptability part is more general and is made of three tests: art history, science and academic or technical drawing (fig. 2).

Figure 3: Test of manual abilities

© G.Vanneste/Inp

The student must pass these three tests to take the second part of the competition: the admission. This admission exam is made of three other tests: a 20 minutes oral examination in front of a jury, a copy of two drawings during five days and a test of manual abilities such as color matching watercolor swatches and careful incising with a scalpel (fig. 3). Every year, more than 150 students take the competitive exam, but only around 20 of them pass, and usually 2 or 3 are specialized in paper.

B. The Inp's training program

Figure 4: Students learning conservation in the Inp's paper lab, © Nelly Koenig

The Inp's training program alternates core curriculum offering, specific instruction in each specialty and two long periods of internship in a professional setting. Students also take part in onsite projects about preventive preservation and conservation conducted in French museums.

They are classes such as history of art, history of conservation, professional code of ethics, preventive preservation, cultural heritage law, physics, chemistry, biology, applied sciences to the materials of the cultural heritage, hands-on training (fig. 4) and artistic teachings, such as drawing. This theoretical knowledge is the same for the seven specialties of the Inp. Another part of the program is dedicated to specific lectures which differ from specialty to specialty. The end of the year is usually dedicated to various workshops depending upon the specialization of the student. Some of the different workshops the paper conservation students attend include parchment making, book binding, engraving techniques, manuscript illumination or seal conservation.

The first two years are devoted both to theoretical knowledge and practical training, which takes place in the specialty conservation labs, two days a week. The third year starts with a three month internship in France. Students can choose public collections or private studios, or do both. As a student advances in his/her studies, hands-on training becomes increasingly important. Six months of the fourth year are dedicated to an internship in a foreign country, such as my current internship at the Straus Center for Conservation and Technical Studies. One of the other challenges of the fourth year is to determine a research subject for the final year.

The final last year of training is devoted to a work of research and conservation in the chosen specialty. The student chooses a work of art, loaned by a French museum. During that time, the future paper conservator studies the work of art from a historical and technical point of view, conducts scientific research on a treatment that could be applied to the work of art and finally performs conservation treatments on the work. This assignment culminates in the writing of a thesis and a public oral examination.

C. The uniqueness of the Inp

One of the unique aspects of the Inp is the fact that it is responsible for training both curators and conservators. This allows the students to work together on different projects organized inside museums. As a matter of fact, this facilitates exchanges between the two professions. Moreover, the school is the only one in France that has a library and an analytical lab.

The library is a reference space for consultation and research on the preservation and conservation of cultural heritage, both in France and in Europe.

It also serves as an educational resource for activities organized by the department of the conservators and its collections reflect its teachings: theoretical knowledge, artistic, technical and scientific knowledge. The library, filled with 56,000 volumes, allows specific research among 25,000 references both ancient and modern, 27,000 articles or excerpts of congress proceedings, 500 titles of periodicals, 900 theses or memories and 300 multimedia documents.

Figure 5: The Inp's analytical lab, © Studio13Paris

Working with scientists in the analytical lab (fig.5) is part of the training program of the Inp. Located near the conservation labs, the analytical lab welcomes students for experimentations and analyses and, in a broader sense, provides them with regular educational tools in the scientific field.

It is thus entrusted to collect scientific files prior to works of preservation and conservation conducted in all the specialties. Within the institution, it has at its disposal equipment of scientific imaging and several techniques of microanalysis adapted to the characterization of materials of cultural heritage, such as partnerships with other analytical labs belonging to the Ministry of Culture and with various universities have allowed it to offer a wide array of analytical approaches.

II. PARTNERSHIPS AND INTERNSHIPS WITH MUSEUMS: THE IMPORTANCE OF HANDS-ON TRAINING

A. Working within the museums

The Inp enjoys a close relationship with museums across France, especially those in Paris. This enables hands-on training at the Inp's labs to be performed on works of art from those museums and also to do projects within these institutions. These partnerships allow students to train directly on works of art belonging to museums, preparing them to deal with professional responsibilities.

Figure 6: 3rd year students working in the storages of the CNAM (Conservatoire National des Arts et Metiers, Paris)

Indeed, as part of the training program, students intern at other institutions (fig.6), geared to particular needs within the museum. These projects usually last for a week or two and culminate with the writing of a report and an oral examination. As many French museums do not employ permanent conservators, some of their collection can be in poor condition.

Considering the educational potential of some of the museum's issues, the Inp organizes public outreach in these museums to help them treat parts of their collections. The end of the first year of Inp's training program is usually dedicated to a project involving the seven specialties of the school.

In 2011, the Inp's students went to south France to a small village called Saorge. The monastery of this village belongs to the *Centre des Monuments Nationaux*, responsible for public French buildings. An inventory of the collection of works of art within this monastery needed to be done, as well as preventive conservation treatments. The students also helped to design the new storage. This type of project is organized to encourage interdisciplinary work, as well as dealing with the challenge of assessing a whole collection in a limited amount of time.

Other museum partnerships usually concern only one specialization. A whole project can be dedicated to conservation treatments. An example of that is the project held at the Museum Bonnat-Helleu of Bayonne (South-West France) by the third year paper conservation students. As the museum does not have any conservation lab, the drawings from this institution were transported to the Inp's paper lab. These works of art were 19th century drawings, made by Achille Zo, a local artist. The drawings were mounted on acidic board and most of them were in bad conditions. The aim of the project was to perform appropriated conservation treatments (fig.7) on all of these drawings of various media such as watercolor, graphite, black ink or gouache. The different types of paper, including tracing paper, made it so one approach couldn't be applied to all the works.

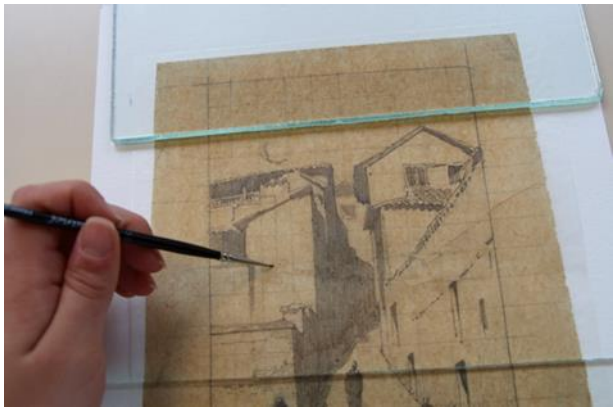
The conservation treatments involved dry cleaning, washing, blotter washing, lining with appropriate paper and adhesive, mending tears, filling losses and toning. Tracing papers were particularly challenging due to their high reactivity to moisture and had to be treated carefully. At the end of this two week project, over thirty drawings were treated.

Figure 7 : example of treatments performed on drawings from the Bonnat-Helleu Museum (Bayonne)

Dismounting

Washing

Lining



Toning

Last but not least, another example of the Inp's partnership is the one made with the CNAP-FNAC (*Centre National d'Art Contemporain – Fonds National d'Art Contemporain*). The fourth year paper conservators were responsible for *Knochen*, a work of art made in 2007 by Mark Lammert, a German contemporary artist. The institution had recently acquired this object and was looking for solutions regarding storage and display. The work of art was complex, made with 42 note-books that form a large scale panel on the wall. All of these note-books were open in the middle, covered with white paint, pen inscriptions and drawings. Even if the set was in a fair condition, the paint covering the binding was starting to flake. To avoid this problem, the note books must remain open even in the storage.
The students wrote condition reports, observed the work of art and experimented with different solutions of matting and storage by making models, using different materials and then comparing them. The most challenging issue was the matting, which had to remain invisible or at least very discreet. To achieve this aim, the students experimented different ways of matting with magnets and hidden strapping. This project culminated with the writing of a report, advising the museum on the most appropriate storage. This report also gave precise instructions so that the museum could continue the project by hiring a paper conservator to do the matting.

Those numerous partnerships allow students to learn in a professional setting, dealing with a wide range of expectations, aims and problems encountered by the museums. Only three of them where discussed here, but students usually do projects three or four times a year. This way, students are familiar with museum work and its challenges.

B. Required internships: learning in a professional setting

During my third year, I was lucky enough to have two internships in two different institutions: the Museum of Fine Arts of Orleans (West France) and the Louvre. Despite the numerous interesting conservation treatments performed at the Museum of Fine Arts, the presentation will mainly focus on the Louvre, emphasize the functioning of the biggest institution of France and one of the biggest in the world.

Holding over five hundred thousand works of art, the Department of Drawings at the Louvre places itself amongst the greatest drawing collections in the world. The Department contains

three different institutions. Most of its collection, the Drawings Cabinet, belonged to the Kings of France.

The second institution is the *Chalcographie*, created in 1797 and the third is the collection of Edmond de Rothschild, donated in 1935. Despite the exhibition constraint, due to the fragile material, three of the galleries of the Louvre are dedicated to drawings. Temporary exhibits are regularly organized in these areas to present the splendour of the collection.

Owning such a collection, the Louvre museum had to have a laboratory exclusively dedicated to paper conservation. It was created in 1989 by Andre Le Prat who headed the paper lab for more than twenty years. Currently under the direction of Valentine Dubard since 2011, the paper lab employs over thirty paper conservators on a temporary basis. They are mainly working on loans and exhibitions. The daily conservation work is usually conducted by the head of the paper lab, as well as the administrative paper work.

Various treatments were performed during this internship. One of them concerned drawing mounts. Indeed, the Department of Drawing has chosen years ago to systematically inlay its drawings in paper windows. Drawings are often consulted at the Louvre by experts who usually want to see the verso. To reduce handling, drawings are mounted into paper windows so the researcher need not touch it directly. The paper used for this is the paper Lana©[4] (200 g/m^2) as well as double layer Japanese tissue. Small strips of thin Japanese paper are used to link the paper window and the drawing. Usually the adhesive used is methylcellulose.

Over time, paper conservators have noticed problems with this way of mounting. Due to hygroscopic variations, the two papers react differently causing rippling in both papers. Paper conservators are still trying to find new ways to inlay, by reactivating methycellulose with moisture, or using smaller strips of Japanese tissue. Despite its defaults, windows paper are still nowadays the most convenient and adapted solution for the drawings collection.

[4] Machine made wove paper: www.lanapapier.fr/

Another mounting method (fig.8) is used for thick paper, under the advice of Hugh Phibbs who has taught workshops at the Louvre. Instead of doing a whole paper margin, only a wide stripe of double layer Japanese tissue is attached to the drawing, along the right edge with another strip of very thin Japanese tissue.

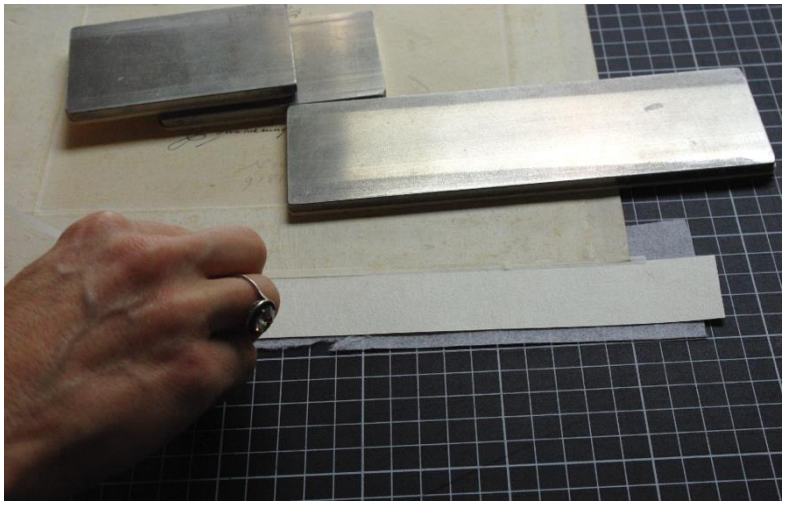


Figure 8: the drawing is mounted to a stripe of double layer japanese tissue. This type of mouting permits to reduce handling and not to touche the drawing directly.

Finally the drawing is mounted to the back board with a Japanese tissue hinge along the left edge, but the glue is not applied overall. To reduce risks of rippling and to make the hinge easier to remove, the glue is applied in small lines through a mask.

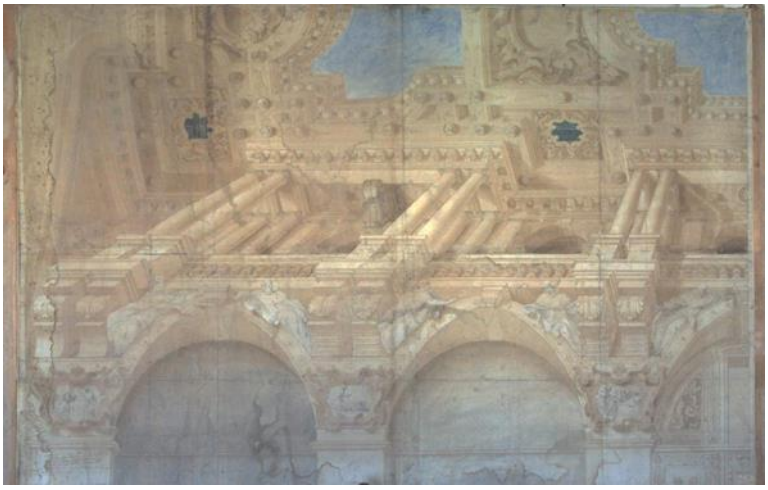


Figure 9: The drawing before treatment, Sandrino Tommaso, Etude pour un plafond d'église enrichi d'ornements, colonnes et caissons, Cabinet des dessins, Louvre Museum

During the time of the internship, a big scale drawing[5] made by the Italian artist Sandrino (fig.9) was brought to the paper lab. It was supposed to be part of a temporary exhibition organized by the Louvre about the design of Italian ceilings during the 18th century.

The poor condition of this drawing made it inacceptable for exhibitions standards. Indeed, the work of art had suffered from an old water damage that had caused numerous tidelines. Traces of mould were visible as well as overall surface dirt.

[5] H. 1,050 m ; W. 1,550 m

This drawing was made with several sheets of antique laid paper glued together to form a large sheet. These pieces of paper were mounted to canvas. A first dry cleaning was performed with a vacuum cleaner before the drawing was separated from the canvas mechanically. The removal of the paper from the canvas was not problematic, since the glue had lost its adhesive power probably because of the water damage. A second dry cleaning was done, using various materials such as latex or Wishab©[6] sponges. Adhesives residues on the verso where removed with methycellulose gel and the tidelines were treated on the suction table. Finally, the drawing was lined overall with Japanese tissue and wheat starch paste. The numerous losses were filled with toned antique laid paper. At the end of the treatment, we all had the satisfaction to see the drawing exhibited.

This internship challenged me with various types of work and gave me an overview of daily life at the Louvre's very large and dynamic paper lab. This huge institution has its own way of working, to be able to cope with its enormous collection.

[6] http://www.conservation-by-design.com/ProductDetails.aspx?id=193&itemno=SUERAS0004

III. THE EXAMPLE OF A RESEARCH AT THE INP: THE USE OF SILICA GEL IN A HUMIDIFYING CHAMBER

A. The drawings of Anthony Berrus: a beautiful but fragile media

One of the 3rd/4th year projects was the conservation of eight drawings made by Anthony Berrus, belonging to the CNAM (*Conservatoire National des Arts et Metiers*). This 19th century artist was an acclaimed French shawl designer, with a very sophisticated drawing technique. The works of art (fig.10) were painted on wove paper using gouache with a very thin brush, allowing delicate details.

Figure 10: The drawings in their frame

Considering the fragility of the media, students searched for new ways to humidify the paper, in order to proceed to flattening. Traditional methods for humidification seemed inappropriate for two reasons. First, the delicacy of the media could not permit regular humidification that might damage the precision of the details.

Secondly, the drawing had iron-gall ink inscriptions along the edges. Indeed recent research shows that iron-gall ink diffusion inside the paper starts at a RH of 85%[7].

Therefore, the students needed a humidification process that would permit them to control the RH. Research conducted at the Inp during the thesis of Hennion[8] recommended the use of silica gel for gentle and precise humidification. This type of humidification had been applied

[7] Belhadj O., C. Phan Tan Luu, E. Jacobi, S. Meslet-Struyve, S. Vez, B. Reissland, V. Rouchon, "The Dutch Fe-Migration Mending Test", *Journal of paper Conservation*, vol.15 n°1, 2014

[8] Gaëlle Hennion, *"Se vêtir du divin", conservation-restauration d'une tunique talismanique à écriture, Iran XVIIIe-XIXe siècles, Collection Krishnà Riboud, Musée Guimet, Paris, Mise en place d'un traitement d'humification adapté à la sensibilité à l'eau d'un textile amidonné et son décor*, Mémoire de fin d'études , Institut National du Patrimoine, 2013

during her thesis on textiles, with an iron-gall ink pattern and showed potential for use on works on paper[9].

Because of its chemical and physical properties, silica gel is suitable both as a drying agent and as a humidity buffering agent, to maintain the RH to a constant level. Properly conditioned at a RH of 70% and placed inside a sealed chamber, the silica gel can humidify gently without getting above the desired RH. A special workshop was built, under the supervision of Maroussia Duranton, so that students would learn about the properties of silica gel and how to use it to their advantage. The results of this work in progress are going to be presented in two forthcoming publications by Duranton and Hennion in the *Journal of Paper Conservation* and *Support Tracé*[10].

B. *Silica gel properties*

Figure 11: Close-up image of Silicagel M©

Silica gel, mainly made from amorphous silicon dioxide[11], is a material that can be used to control RH within micro-climates, being able to create and maintain both high and low humidity level in a well-sealed enclosure. It is a hard, crystalline material that can absorb up to 40% of its weight in moisture. This material is particularly useful in museums environment because it is non-toxic and inert.

Its internal structure is made of micropores, which can absorb or desorb water in the gas state thanks to capillarity and the Si-OH bounding, until equilibrium with the environment is reached.

They are numerous types of existing silica gel but the one chosen for this experiment was Silicagel M®[12] (fig.11), which has been determined as the most effective product through the

[9] Cindy Landry, *Une reliure atypique de la Renaissance en peau retournée rose : étude et conservation-restauration d'un ouvrage conservé à la Bibliothèque municipale Louis-Garret à Vesoul). Évaluation de l'effet de l'humidité sur les peaux mégissées et recherche des matériaux et d'une mise en œuvre adaptée pour la réintégration de lacune*., Mémoire de fin d'étude, Institut National du Patrimoine, 2014

[10] Duranton M, Hennion G, "Fiche technique : Utilisation du Silicagel M pour un traitement d'humidification", *Support Tracé*, n°14, 2014, p. 163-167.

[11] SiO_2

[12] Sold by Chirstopher Waller: http://www.cwaller.de/english.htm

research of Hennion and Duranton. Indeed, this silica gel is not only the least expensive, it is also the purest.

Silica gel has numerous physical and chemical properties that should be understood before using it. Silica gels have pores of various sizes that divide them into two categories: the macroporous[13] and the microporous[14]. This porosity controls the amount of water that the silica gel can absorb: the bigger their pores are, the more it can absorb and desorb water. For example Silicagel M® is described as a macroporous material. Therefor its adsorption capacities are increased.

Two important physical phenomenon of silica gel should also be considered: hysteresis and isotherm properties. Hysteresis can be defined as the dependence of the output of a system not only on its current input, but also on its history of past inputs. The dependence arises because the history affects the value of an internal state. If a given input alternately increases and decreases, a typical mark of hysteresis is that the output forms a loop as in the figure (fig. 12). In other terms, the hysteresis phenomenon explains why silica gel can act as a buffering agent.

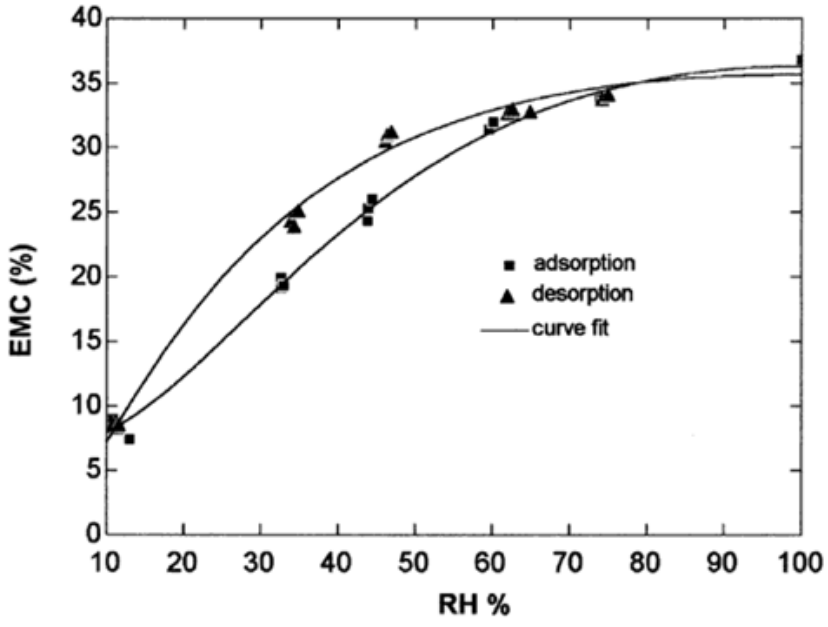


Figure 12: Figure showing the hysteresis property of regular density slilica gel[15]

[13] Having pore size exceeding 50,0 nm
[14] Having pore diameters up to 2 nm
[15] Graph from the publication by David Yu, S. A. Klein, Ph.D, and D. T. Reindl, Ph.D, PE, *An Evaluation of Silica Gel for Humidity Control in Display Cases*, http://cool.conservation-us.org/waac/wn/wn23/wn23-2/wn23-206.html

In this type of hysteresis, the quantity adsorbed is different when water vapor is being added (adsorption) than it is when being removed (desorption). The specific causes of adsorption hysteresis are still an active area of research, but it is linked to differences in the nucleation and evaporation mechanisms inside mesopores[16].

This hysteresis property influences the buffering capacity of the silica gel used. In fact, each type of silica gel has a RH value for which it is most efficient. This is defined by the variable M_H, which indicates the moisture content gained or lost per kilogram for each 1% change in RH. This is determined by repeatedly cycling silica gel between adsorption and desorption within a specific range RH range until a constant value is measured. By taking hysteresis into account, M_H reflects actual buffering performance. The higher this value is, the more efficient the silica gel is for a specific RH. For example, the highest values for Silicagel M® are those between a RH of 70-90%[17] (fig.13).

RH	EMC	M_H
10%	2%	1
20%	3%	1
30%	4%	1
40%	5%	1.5
50%	6.5%	1.5
60%	8%	3
70%	11%	6
80%	17%	15.5
90%	32.5%	61

Figure 13: Silica gel M© data[18]

Last but not least, it is critical to understand the concept of EMC/RH isotherm[19] when considering silica gel functionality. At equilibrium, the relationship between water content and equilibrium humidity of a material can be displayed graphically by a non-linear curve, the so-called moisture sorption isotherm. For each humidity value, a sorption isotherm indicates

[16] Porous materials with pores sizes between 2,0 nm and 50,0 nm
[17] Respectively, for 70% M=6, for 80% M=15 and for 90% M=61.
[18] Data from the thesis of Gaëlle Hennion
[19] Equilibre Moisture Content

the corresponding water content value at a given, constant temperature. This curve shows us that the EMC of Silicagel M® rise between a RH of 80% and 100% (fig.14).

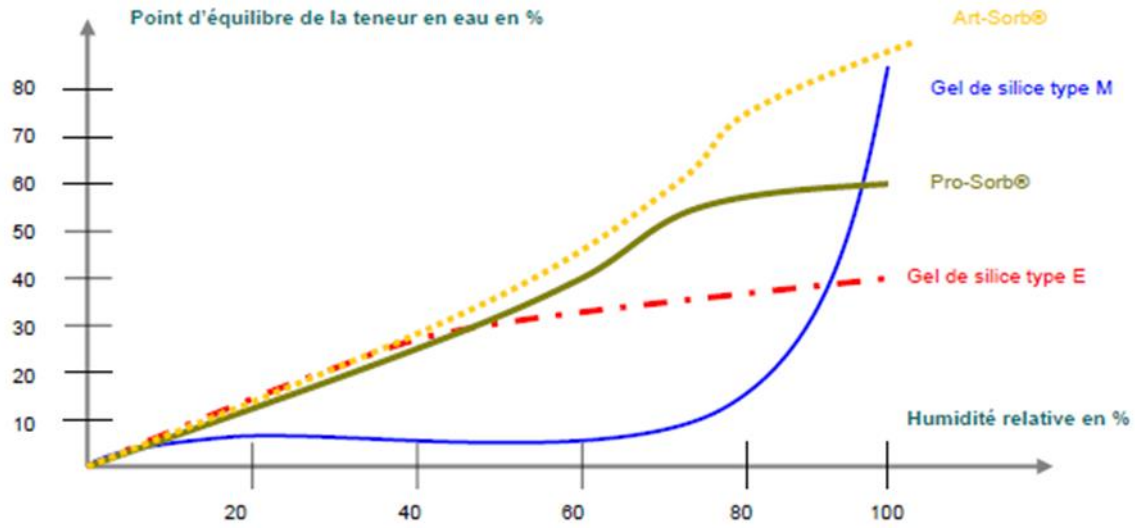


Figure 14: Moisture sorption isotherm figure showing the behavior of different brands of silica gel[20].

In other words, the quantity of moisture in hygroscopic materials depends on the temperature and the RH of the surrounding air. If this temperature[21] or RH changes, the moisture content of the silica gel will also change so that it will come into equilibrium with the environment. The EMC is the moisture content of the silica gel in equilibrium in a specified RH. For example, the EMC of Silicagel M® is 11% at 70% RH. This means that for a RH of 70%, the silica gel is able to hold an amount of water equal to 11% of its dry weight, once it has reached equilibrium with the surrounding air.

C. Using silica gel in a humidifying chamber

The students made their own humidifying chamber, adapted to the size of the Berrus drawings. Indeed most of them where quite large[22] and could not fit in a regular chamber. To build the chamber, the students picked the same materials used to perform anoxic treatments, such as transparent barrier films that can be sealed with heat.

[20] Figure from the research of Gaëlle Hennion, "*Se vêtir du divin", conservation-restauration d'une tunique talismanique à écriture, Iran XVIIIe-XIXe siècles, Collection Krishnà Riboud, Musée Guimet, Paris, Mise en place d'un traitement d'humification adapté à la sensibilité à l'eau d'un textile amidonné et son décor,* Mémoire de fin d'études , Institut National du Patrimoine, 2013, p. 113

[21] Nevertheless, it seems that only high changes in the temperature can really influence this parameter

[22] The dimension of largest drawing was H. 106 cm x W. 42 cm

Figure 15: photography of the humidifying chamber in use

The material is a multi-layers barrier film that resist oxygen transmission, water vapor and includes a polyethylene layer that can be sealed at temperature around 117°C (350°F), with barrier sealer. It permits the building of chambers whose size can be adapted to the work of art as well as a well-sealed enclosure. Moreover, the transparency of the barrier film allows the conservator to see how the drawing reacts to the humidification. Last but not least, the very same humidification chamber can be used for conditioning the silica gel because it can be opened and sealed again.

After properly conditioning the silica gel, the work of art was placed inside the chamber (fig.15) with the amount of silica gel needed. The silica gel is spread out in different containers. In fact, the more the silica gel is in contact with the surrounding air, the more it exchanges with its environment, the more efficient it is. As silica gel can produce dust, the containers must be covered with an appropriate material, such as non-woven polyester fabric, to avoid any dust deposition on the works of art. The humidifying chamber is then closed, for example with tweezers, but not sealed with heat, as the conservator wants to access the drawing quickly. In order to follow the RH, a hygrometer is placed inside the chamber as well.

The humidification process takes several hours and once the drawing is properly humidified, it is then put between non-woven, blotters and under weights for minimum two weeks.

D. Results and discussions

This humidification technique was applied to four Berrus drawings. The RH was recorded to determine how long it takes to reach the desired humidity inside the chamber and condition were monitored to make sure it did not get above this desired humidity.

Figure 16 shows that once the HR has reached around 70%, it is stable, though that the final RH reached is a little bit above 70%.

For the first drawing, only 200g of silica gel was used[23], which resulted in a very slow rise of the RH. The paper was not moisturized enough by the end of the day and the flattening was unsuccessful. For the other drawings, 1kg and then 2kg were used[24].

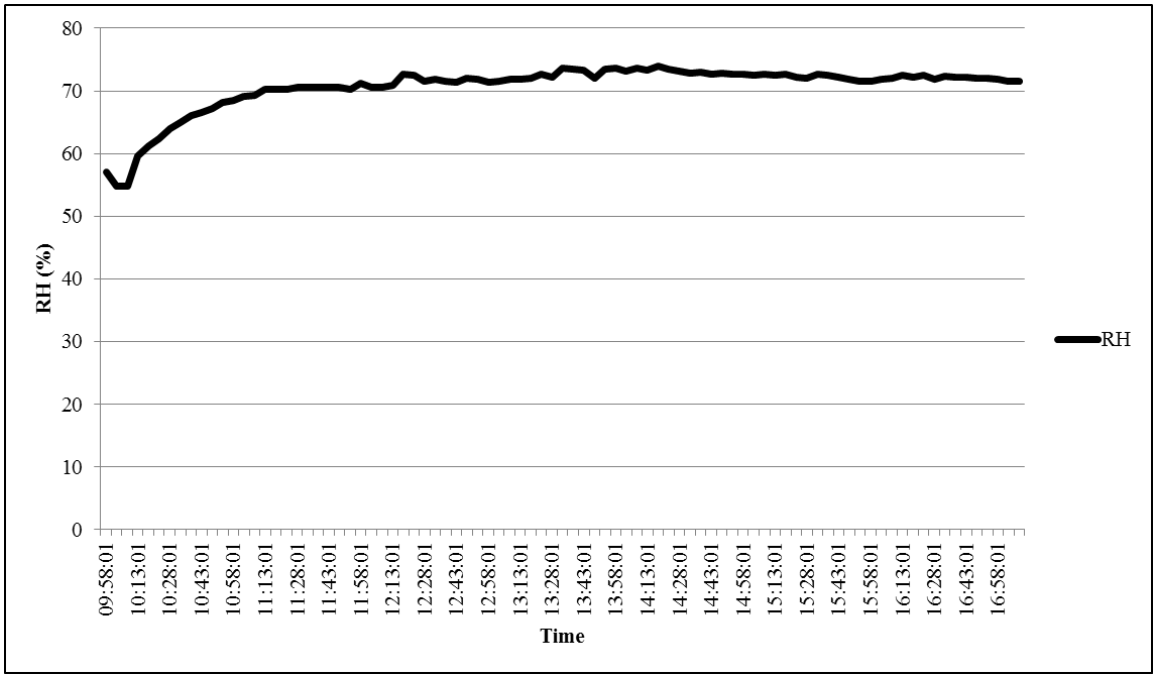


Figure 16: Figure of the RH over time in the humidifying chamber

As the experiment could only be conducted during the day, it was not possible to leave the drawings in the humidifying chamber for more than 8-9 hours. As a result, the humidifying process was probably not complete, and the flattening was only partly successful.

This experiment demonstrates that controlled humidification is a process that involves many parameters. The drawings should remain for more than 8-9 hours in the humidifying chamber,

[23] The chamber had a volume of 0,2 m^3. We first respected the recommendation that 1kg of silica gel should be used for 1 m^3.

[24] See appendix p. 25

in order to humidify the paper evenly. 70% may also be not enough for humidifying purposes, and could be raised to 75-80%.
The aim of this project was to adapt and to estimate, in a practical way, how to use this humidification technique with sensitive work on paper. Silica gel is a convenient material that can be re-used endlessly and once conditioned can last for a very long time if properly stored. The humidifying chamber can be built to suit very large works of art and can also be re-used.

This technique shows promising results but more adjustments need to be done. The drawings are still treated at the Inp and first, second and third year students are still carrying on this project. The slow humidification process, as well as its ability to stabilize at a certain RH, makes it ideal for very fragile media. This type of humidification is a very safe technique, which may be especially suitable with iron-gall ink. .

Finally, this type of work permits the students to approach new conservation techniques such as the silica gel project described above. Its use for humidification could become a new treatment option for very fragile works of art. This solution shows great safety and is going to be the subject of further investigations lead by Duranton at the Inp in the next few years.

CONCLUSION

The Inp's training program tries to balance theoretical knowledge and hands-on training. The education program is still evolving every year, working to adapt constantly to students' needs and to the latest conservation techniques. The student specializes for five years, which allows solid hands-on training and a wide range of lectures on various subjects. The writing of a thesis and the fact that the students focuses on only one object for his/her last year is also something very unique.

This system permits research, something that is often rarely possible in the conservator's professional life in France. Through internships, the Inp send its students in a professional setting, encouraging them to learn from conservators in other countries and to create long term bond with these foreign institutions.

Ongoing projects and studies inside the Inp permits the students to continue research started by their predecessors, to adapt it and learn how to use it in the conservation labs. This allows research to continue to be refined and allows the Inp to regularly update its teaching in order to give the students the best education possible.

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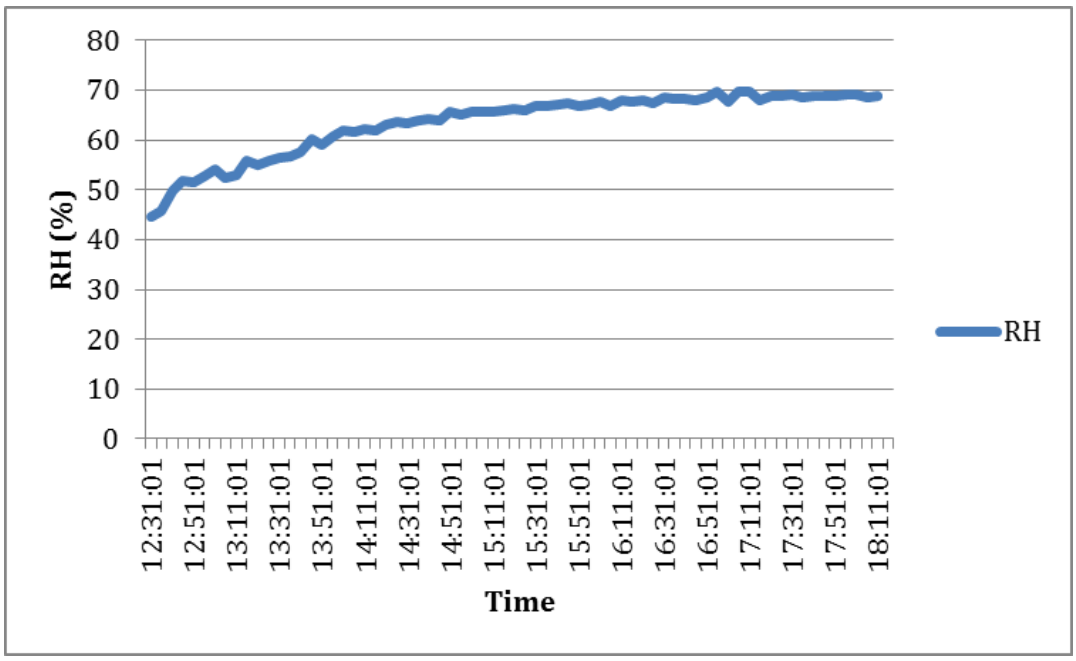
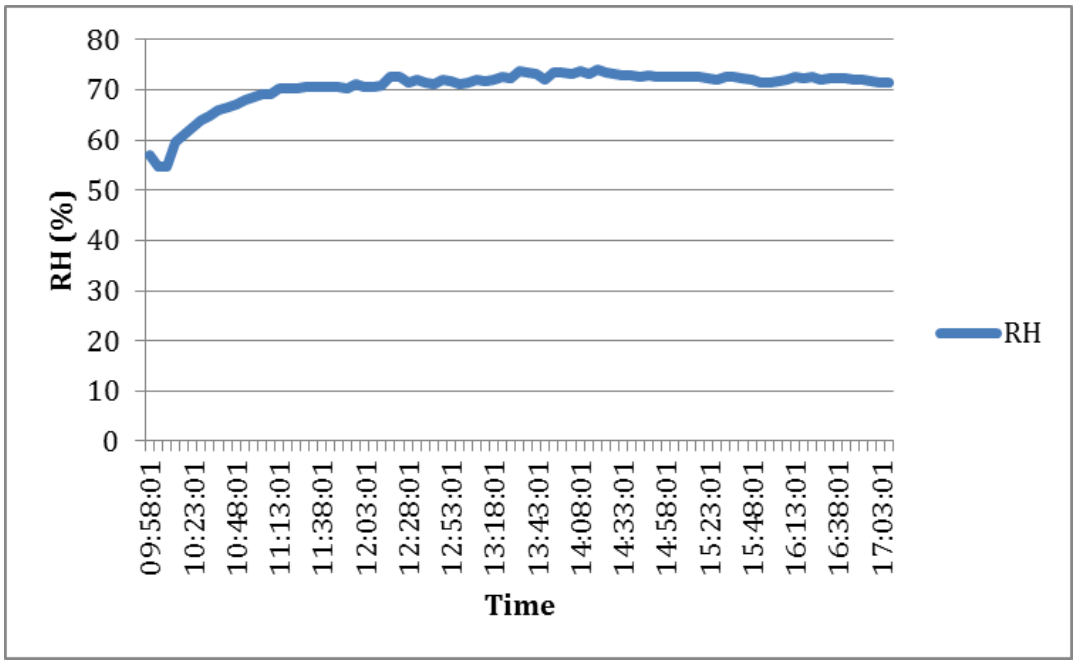
APPENDIX

Figure of the RH over time in the humidifying chamber

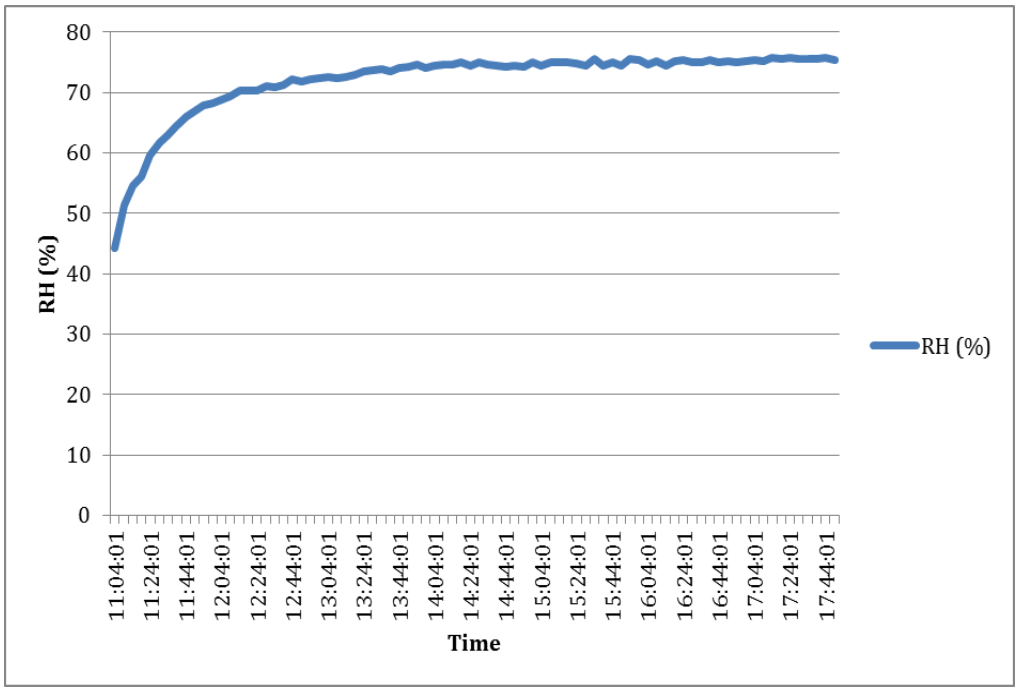
Date: 11/20/14



Date: 11/28/14



Date: 12/5/14


80
70
60
50
40
30
20
10
0
RH (%)
11:04:01
11:24:01
11:44:01
12:04:01
12:24:01
12:44:01
13:04:01
13:24:01
13:44:01
14:04:01
14:24:01
14:44:01
15:04:01
15:24:01
15:44:01
16:04:01
16:24:01
16:44:01
17:04:01
17:24:01
17:44:01
Time
RH (%)

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Sophie Barbisan is currently completing a six month internship at the Straus Center for Conservation and Technical Studies at the Harvard Art Museums. At the end of this internship, she will have completed her 4th year of graduate study. She will be graduating from the National Institute of Cultural Heritage (Paris, France) in 2016, specializing in paper and parchment conservation. She has held two internships at the Louvre (Paris) and one at the Museum of Fine Arts in Orleans (West France). As part of the education program of the Inp, Ms. Barbisan also worked with other students on preservation projects at various French museums such as the Museum of Fine Arts (Paris), the National Historic Museum of the Navy (Paris), the Bonnat-Helleu Museum (Bayonne) and the National Center of Contemporary Art (Paris).