

Characteristic damage and restoration of translucent paper demonstrated on case studies

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ABSTRACT

This article focuses on the long-term experience and restoration of translucent archival supports and tracing cloth. The Studio of Restoration and Conservation of Artworks on Paper, belonging to the Faculty of Restoration, at the University of Pardubice, has cooperated with The State Regional Archives of Litomerice, the State District Archives in the town of Most for many years. Over 15 years ago, we started working on the restoration of translucent supports from the archives collection. In the course of that time, we have developed our restoration methods to treat those unique materials. The information and experience collected throughout the years should help increase the awareness of the issues in the restoration of translucent supports.

Introduction

This article deals with the long-term experience and restoration of translucent archival supports. First, it will introduce the Faculty of Restoration at the University of Pardubice, and its cooperation with the State Regional Archives of Litomerice, Department of the State District Archives, in Most¹. Then, it will introduce several common types of damage to translucent paper and the methods of restoration. Finally, it shows a study case of frequent damage to this specific type of support.

The Faculty of Restoration at the University of Pardubice was established in 2005 in Litomysl, the Czech Republic. The faculty offers four study programmes, including Restoration and Conservation of Stone and Related Materials, Restoration and Conservation of Wall Painting, Sgraffito and Mosaic, Restoration and Conservation of Paper, Bookbinding and Documents and Restoration and Conservation of Artworks on Paper. *“Special attention is paid to the ethics and aesthetics of restoration, interdisciplinarity, international and national historical monument care principles, technology and relevant legislation.”*²

The training in the studio of Restoration and Conservation of Artworks on Paper *“focuses on the study of restoration techniques of drawing, graphic art and painting, chiefly on paper support”*³ including translucent paper and tracing cloth. We have been cooperating with The State Regional Archives of Litomerice, Department of the State District Archives in Most, for more than 15 years; however, we

have been working with translucent paper in the studio much longer. Complex restoration⁴ of transparent support is part of the studies of one semester in our studio. Besides, at our faculty, there was a workshop focused on the restoration of translucent supports in December 2010⁵, where students tried out new procedures. The workshop was taught by a restorer Veronika Kopecká.⁶

Most often, we have encountered technical drawings (mine plans, architectural designs and elements, working drawings and mosaic designs)⁷ with extensive mechanical damage, such as cracks, waves, losses of paper support and other typical degradation by mechanical stress. In our opinion, in the course of time, we have developed our restoration methods to treat those unique materials. The information and experience collected throughout the years helps to increase awareness of the issues of translucent supports.

Translucent paper and tracing cloth

Although translucent paper dates back to the 19th century, there was very little information about it. This lack of knowledge could have

⁴ *Complex restoration: A student restores the whole piece of art from designing the plan, carrying out invasive and non-invasive examination, taking photos to mounting and final restoration documentation.*

⁵ *The workshop took place within the framework of European project: Projekt ESF “Restaurátoři pro evropskou unii – inovaci bakalářského studijního programu Fakulty restaurování Univerzity Pardubice”. Kopecká/Hurtová et al. (2010).*

⁶ *Veronika Kopecká was the head of the studio in 2009–2014.*

⁷ *In our studio, we have restored for example: a stucco ceiling design from the State Castle of Bouzov dating back to the 19th century or a large-format pencil drawing by Alfons Mucha dating back to 1935 “Poddaní Nymburští L. P. 1421, Bohu a Pražanům” (1570 mm × 6062 mm) from The Museum of Letohrad. Neslerová (2006); Kopecká (2008), pp. 26, 35.*

¹ *State Regional Archives, Litomerice, Department of the State District Archives, Most: www.soalitomerice.cz/soka-most/*

² *Faculty of Restoration, the University of Pardubice: <https://fr.upce.cz/en/fr/faculty/about.html>*

³ *Restoration and Conservation of Artworks on Paper: <https://www.fr.upce.cz/en/fr/srcaprm.html>*

been caused either by inaccuracies in manufacturing patent records, or the records missing completely. Fortunately, over time, more knowledge has been gained on transparent paper properties, which allows us to approach restoration of this unique material in a more responsible way.⁸ The restoration is planned according to the requests of the Archive, because mine plans and designs are usually used by researchers. Due to the cooperation with the Department of Chemical Technology and their analysis capacity, we are able to identify the type of translucent paper⁹ and its approximate composition¹⁰. Thanks to the cooperation with the archives, a different type of translucent support has been recently rediscovered in our country which is called tracing cloth¹¹.



Fig. 1: Mine plan “Johann Richard” after restoration – transparent paper and starch cloth. Photo by Anežka Šebestová. (restored in 2023)

8 Van der Reyden – Hofmann – Baker (1993), pp. 177–206; Page (1997), pp. 67–73; Homburger – Korbel (1999), pp. 25–33; Kissel – Vigneau (1999); Kopecká (2008); pp. 24–26, 35; Price (2010); Glück – Barkhofen – Brücke (2012).

9 There are three production methods of translucent paper: 1 impregnation 2 acid treatment and 3 overbeating paper pulp. Homburger – Korbel (1999), pp. 25–33.

10 We get the composition from the data from the Department of Chemical Technology and their analyses. The FTIR (Fourier Transform Infrared Spectrophotometry) analysis was carried out using a Nicolet 380 Fourier Transform Infrared Spectro-photometer with a diamond ATR crystal, optical microscopy analysis was carried out using an optical microscope Nikon ECLIPSE LV100) and Herzberg colouring test (ČSN ISO 9184-3).

11 Price (2010) p. 49.

Essentially, it is plain woven cotton fabric impregnated with wheat starch, which causes partial transparency of the support.¹² Tracing cloth as well as translucent paper have been used since the mid-19th century mainly for architectural designs. Tracing cloth is a relatively stable support as it is solid and dimensionally stable; on the other hand, its disadvantage is high sensitivity to water and humidity – it loses its shine in contact with water. The State District Archives at Most have an extensive collection¹³ of tracing cloths; unfortunately, these are registered as translucent papers. Usually, there are other added pieces of translucent supports because the size of the original plan needed an extension. Currently, we are planning to focus on this unique material.¹⁴

Causes of damage and its way of restoration

Translucent paper damage is mostly caused by deterioration of mechanical properties, and partly by the production method, such as acid left from production causing degradation, colour changes and support embrittlement. Another problem is mechanical stress.¹⁵ At the State District Archives at Most, they often encounter mine plans and architectural designs; therefore, we can often see folded sheets, cracks, abrasions and smudged media.

Drawings on translucent paper comprise a large scale of media, including ink, pencils, crayons, markers, watercolours,

12 Price (2010), pp. 88–93.

13 The collection contains 28,791 pieces of mine plans, mostly hand-drawn. The collection is not processed so we do not know how many documents made of translucent paper, tracing cloth or other paper supports the collection contains. However, there are probably thousands of them.

14 Stropková (2022).

15 Nesslerová (2008), pp. 16–17.

stamps etc. All those materials have to be included in the restoration treatment because many of them are easily water-soluble – in such cases, we carry out fixing of media with *Cyclododecane*¹⁶.

Paper rupture – tears

In general, it is crucial to repair tears so that they do not enlarge and to be visually acceptable for transparent support. It is essential to mend the tears and then to secure them. Securing tears is performed using adhesives such as *Thylose MH6000*, *Klucel G* or starch paste, and Japanese paper (depending on the thickness of the support). Adhesives such as *Thylose* and *Klucel* do not affect the transparency of the support.¹⁷ However, we use wheat starch or wheat starch combined with *Thylose MH6000*, as the composition of these adhesives is closer to the support material.



Fig. 2: Mine plan “Anton Újezdeček, 1894 – 1896” before restoration. Tears. Photo by Danica Čulenová. (restored in 2007)

¹⁶ *Cyclododecane* is a saturated alicyclic hydrocarbon, completely evaporating binder. Possibilities of use: time-limited hardening of the surface to be protected and time-limited hydrophobization. *Cyclododecane melt* is used for isolation www.eshop.ceiba.cz/cyclododecan

¹⁷ Kopecká et al. (2010), pp. 10–11.

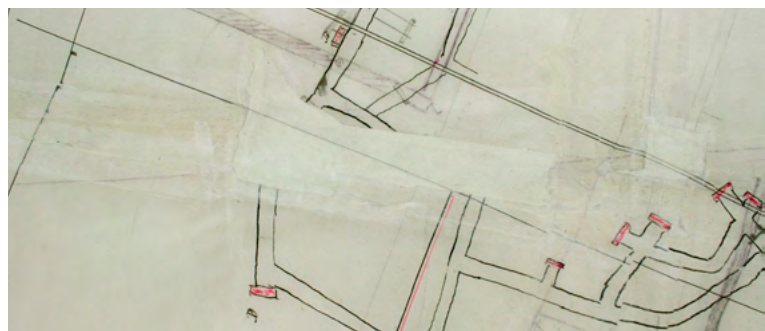


Fig. 3: Mine plan “Anton Újezdeček, 1894 – 1896” after restoration. Tear repair with Japanese paper and *Thylose MH 6000*. Photo by Danica Čulenová. (restored in 2007)

Previous treatments

One of the most frequent non-professional interventions is mending tears with a self-adhesive tape. Those interventions were executed probably during the use of the mine plans in the past. Because the plans had been used daily, folded in piles, or rolled onto tubes in storage, transparent supports were often damaged. Repairs with an adhesive tape secure the position, so the fragments stay together, but using low-quality and partially irreversible materials may cause acidification, wrinkling and colour shifts.¹⁸ Two types of tape are used most often for such mending: brown glue tape and pressure-sensitive tape. To remove the former, we can use a small amount of warm water, while in the latter case, we need to use organic solvents – usually acetone applied with a cotton swab.¹⁹ However, the tapes are often degraded, and can be easily removed dry with a metal spatula.²⁰ The method of removing the tape is done after prior individual examination.

¹⁸ Vlková (2017), pp. 18–19.

¹⁹ Acetone and ethanol cause small changes. However, acetone lowers transparency, while ethanol lowers shine. Toluene is the most sensitive solution to paper support but it is less effective and toxic. Page (1997), p. 20 Page (1997), pp. 69, 71



Fig. 4: Mine plan “Uiersichtskarte 1: 2880” before restoration. PVC tape. Photo by Markéta Krausová. (restored in 2018).



Fig. 5: Mine plan “Uiersichtskarte 1: 2880” after restoration. PVC tape. Photo by Markéta Krausová. (restored in 2018)

Losses

Mine plans and architectural designs are mechanically damaged; as a result, losses in the paper support occur. In such a case, we perform filling the losses with Japanese paper of suitable weight and adhesive depending on the surface type. We choose the appropriate type of Japanese paper based on the type of paper support. We try to select the one that is the most similar to the appearance of the paper – based on the thickness and paper structure. We tint the colour shade of the supplement by using water-soluble and light-stable Saturn dyes²¹. Another method is filling the

²¹ Direct dyes – Saturn® – Saturn dyes are water-sol-

losses with paper pulp. In the past, the Faculty of Restoration also carried out research into filling of losses with prepared dyed suspension of hand-cast transparent paper²². The best result was achieved when the paper pulp was prepared using multiple grinding without glue.²³ Linseed oil can be used for increasing transparency level; nevertheless, using the oil causes gradual yellowing over time. Unfortunately, we do not have enough space in the studio for the paper mill, thus we do not use transparent pulp anymore.

Cockling, folds and creases

Cockling, caused chiefly by humidity, appears in different sizes and quantities. For overall surface flattening, it is important to humidify the paper support with demineralised or enriched water²⁴ at first. Every step in which water is involved is extremely risky, so we have to be careful to avoid size and structural changes.²⁵ Humidification is done through the vapour-permeable membrane *Sympatex* or in a climatic chamber and lasts at least 15 minutes. Then, the archival support is flattened in a hard/soft sandwich²⁶ under pressure for two weeks.²⁷ If heat needs to be employed,

able direct light-stable dyes with a strong affinity for cellulosic substrates. They are especially suitable for the extraction procedure of dyeing. They can be combined with each other. They are suitable for dyeing articles that require good light fastness. They are supplied in powder form with a non-dusting finish. Letter of approval No. GOTS-ECOCERT-08-00016. <https://dyes.synthesia.eu/cze/organicka-barviva/textilni-barviva#Saturn>.
²² Paper – 40:60 linen:cotton. Special paper mill borrowed from the Faculty of Chemical Technology – Institute of Chemistry and Technology of Macromolecular Materials, University of Pardubice. Kopecká – Hurtová (2010), p. 12.

²³ Martinková (2008), p. 90; Neslerová (2008), p. 89.

²⁴ Enriched water does not provide alkaline reserve; however, it permits to sufficiently increase pH value of the paper support.

²⁵ Vlková (2017), pp. 18–19.

²⁶ Homburger – Korb (1999), p. 29.

²⁷ It is slightly different from the case study in Paper,

a low-pressure suction table is used.²⁸ The temperature and the pressure depend on the type of transparent paper; however, it mostly worked for us to use about 45°C and 190 Pa.²⁹ In the case of tracing cloth – if it is unsafe to use water, local flattening is recommended – at first, creases are moistened with *white spirit*³⁰ and then flattened with a hot spatula.³¹ After local flattening, the entire cloth is put under pressure for a few days.

Stains

Unsightly stains can be caused by rising humidity and water action, inappropriate handling of the paper support or "by absorbing extraneous materials such as adhesives, resulting in embedded stains that are difficult to remove".³² It is almost impossible to remove such stains due to the characteristics of the support. Nevertheless, we are able to tone down the stains to a certain extent; therefore, we have to use organic solvents such as *acetone*, *ethanol*, *isopropyl alcohol*, or *white spirit*. If we need to increase the cleaning effect, we use *toluene*.³³ Of course, the use of organic solvents requires carrying out tests in every single case.³⁴ Toning down the stains with solvent can be done in a few ways, e.g. by application of wet blotter poultices, gently patting the stain with a sponge on a suction table, or with a cotton swab.

line, light. Glück – Barkhofen – Brücke (2012), pp. 33–40.

28 Van der Reyden – Hofmann – Baker (1993), pp. 192–193.

29 Janská (2010), 19; Kopecká – Hurtová (2010), p. 12; Kudová (2010), p. 17; Van der Meer (2023).

30 Application of white spirit was chosen based on solubility tests of the media and surface finish. Homolová (2008), p. 9, Čulenová (2007), p. 11; Kopecká (2008), p. 11.

31 Homolová (2008), p. 9.

32 Van der Reyden – Hofmann – Baker (1993), p. 178.

33 Van der Reyden – Hofmann – Baker (1993), pp. 197–200.

34 Kopecká – Hurtová (2010), p. 11.



Fig. 6: Mine plan "Friedrich Střimice" before restoration. Stain. Photo by Veronika Kopecká. (restored in 2008)

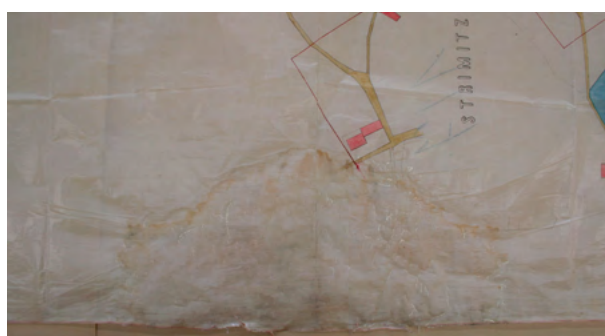


Fig. 7: Mine plan "Friedrich Střimice" after restoration. Stain bleaching with 5% NaBH₄. Photo by Veronika Kopecká. (restored in 2008)

Embrittled support

If the transparent paper is damaged, embrittled, is fragile, ruptures easily or consists of several pieces, it is dangerous because some fragments might get lost. In this case, backing with Japanese paper can be used, employing *BEVA 371 film*[®] adhesive at the activation temperature of 65°C. At first, we apply *BEVA* film on Japanese paper; then, we put the pieces of the transparent paper over it. It has several advantages – one of them is a relatively low activation temperature (except for *Filmoplast R* – activation temperature of 110°C) or waterless methods³⁵ and easy manipulation with fragment assembly.³⁶

35 Unlike when *Thylose MH6000* or *Klucel G* are used. Page (1997), pp. 71, 73.

36 Homburger – Korb (1999), pp. 26–27; Vlková (2017), pp. 47–54.

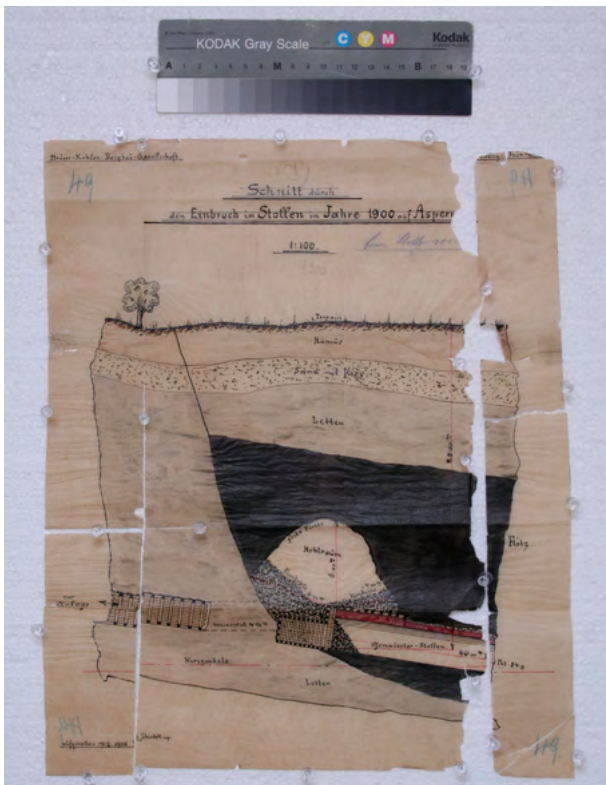


Fig. 8: Mine plan “Aspern, 1900” before restoration. Fragile support. Photo by Barbora Martinková. (restored in 2007/08)

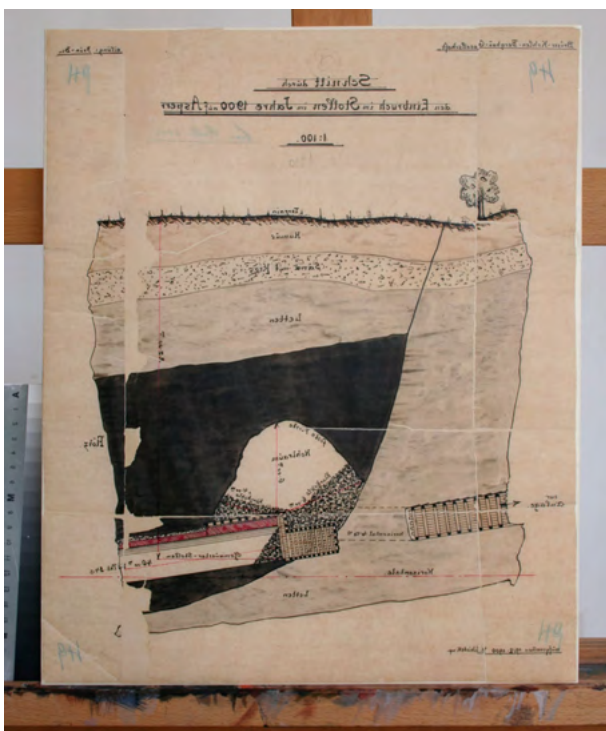


Fig. 9: Mine plan “Aspern, 1900” after restoration. Application on BEVA 371 film. Photo by Barbora Martinková. (restored in 2007/08)

Mounting methods

Mounting is an individual solution for the safety of a treated artwork for storage with

archival-quality materials. It protects treated artworks from mechanical damage during manipulation and physical or chemical changes during storage. After a discussion with the Archive in Litomerice, we proceeded to two mounting methods. For oversized objects, we prefer rolling them onto an acid-free cardboard tube; on the other hand, smaller transparent papers are mounted to an acid-free *Alphacell* board with *Melinex* tapes after the treatment. In the past, archival support was firmly fixed to cardboard using the strip-lining method. This allows plans to be accessed more easily for digitisation and research; and with less risk of damage when it is used in the future.³⁷ However, this method was rejected because such transparent paper loses its essential character, and it is not possible to employ transmitted light anymore.

The final stage is putting the restored paper that has been rolled up onto a tube or attached to an *Alphacell* board into an envelope made of *Melinex*.³⁸ The recommended values for archiving transparent paper are 18°C (0±2 °C) and 30–50% relative humidity.³⁹

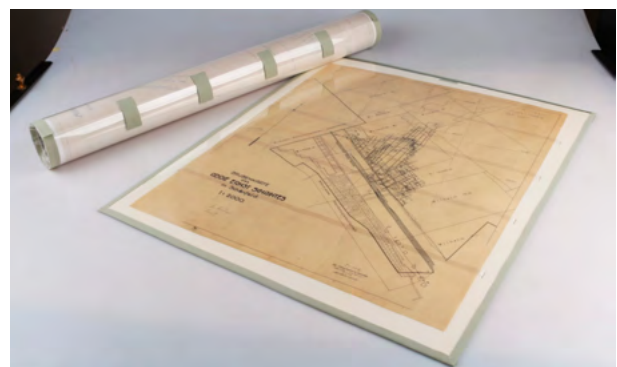


Fig. 10: Different mounting methods – envelope made of *Melinex*®

³⁷ Glück – Barkhofen – Brücke (2012), p. 55.

³⁸ *Melinex*® 401 – 100% polyester sheet (100 µm).

https://www.eshop.ceiba.cz/melinex_401

³⁹ Environmental Conditions for Exhibiting Library and Archival Materials. Version for the Czech Republic – ČSN ISO 11799 (010169) Informace a dokumentace – Požadavky na ukládání archivních a knihovních dokumentů.

Conclusion

There are many questions in the field of translucent paper and tracing cloth restoration. Its great sensitivity to humidity, high fragility and presence of many different media (e.g. pencils, markers, stamps and other media) rank among the biggest problems for conservators, not to mention the lack of written resources dealing with the conservation of these delicate materials. That is why we must pay special attention to all steps of conservation treatment. In our practice, we have developed certain treatment operations that are considered safe for archival materials. In spite of this fact, we feel that we are still at the beginning of the process of understanding these unique materials.

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