



Article: The Influence of Adhesives on the Appearance of Albumen Photographs

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THE INFLUENCE OF ADHESIVES ON THE APPEARANCE OF ALBUMEN PHOTOGRAPHS

NATHALIE MINTEN

Abstract

During the last two years of my Conservation / Restoration Photography studies at the Hogeschool Antwerpen, Belgium, I was working as an intern at the Nationaal Fotorestauratie Atelier in Rotterdam, The Netherlands. Part of my job was to work on the “*Gandhāra-album*”, a photographic album with 250 albumen photographs of archaeological sites and objects in the Gandhāra-region (N.-W. – Pakistan / E. – Afghanistan). The album was severely damaged by manipulation, the album pages were cockled and approx. 50% of the albumen photographs were damaged by mould.

Because the photographs are frequently examined by researchers the decision had already been made that all of the photographs should be mounted in a similar, newly made album. After removal of the photographs they were to be remounted in the new album with an adequate adhesive and mounting technique. I decided to do some research upon this topic and to write my graduating thesis about the subject.

The thesis consists of two parts:

Part 1: a bibliographic study: a study of historic and recent literature on albumen photographs (preparation, degradation, use,...), photographic albums, mounting techniques and adhesives

Part 2: research to find a suitable mounting technique and adhesive

Criteria to be considered during research

These are the criteria that were taken into account after the bibliographical study. All of these criteria helped to decide which adhesives and mounting techniques could be tested during research.

- albumen photographs are very sensitive to humidity => eliminate as much as possible the use of water / try to find a solvent-soluble adhesive
- albumen photographs are sensitive to heat => the use of heat-mounted tissues is not possible
- the photographs have to be re-mounted in an existing album => some mounting techniques cannot be used
- flexibility of the adhesive and mounting technique => the album will be used / the pages have to be turned
- reversibility of the adhesive
- time to do the research is limited to 1 year

Selection of materials and techniques

Adhesives

Historic literature:

- wheat starch paste (TWZ)
- Arabic gum
- dextrin

Recent literature:

- dextrin based adhesive – Eukalin 1300
- gelatine
- methylcellulose – Culminal MC 2000 (MC)
- hydroxypropylcellulose - Klucel G (HPC)
- methylhydroxyethylcellulose - Tylose MH 300 P2 (MHEC)
- Jade 403
- Beva 371
- Mowilith DMC 2
- Paraloid B 72
- Rhoplex AC 73 and AC 234

Rhoplex AC 73 and AC 234 were immediately excluded from research because they were being revised and were no longer available

Jade 403 could not be supplied in time and was also excluded.

After some tests we decided to exclude all synthetic adhesives from research because there was not enough time to study their chemical influences on the albumen photographs, their reversibility and their ageing characteristics.

Support / paper

Mirage vellum (used for the leafs of the new album) and Mirage plate paper

- P.A.T.
- 310 g/m²
- 100% cotton
- acid free
- neutral pH

Mounting technique

Based on the bibliographic study two mounting techniques were selected:

- mounting of the 4 edges (drum mounting)
- overall mounting

Research

In this part only a summary of the research will be given. The most important conclusions are quoted.

Step 1: Evaluation of adhesive strength

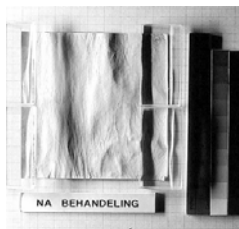
No albumen photographs are used because this test will only examine the strength of adhesives in different concentrations and different mixtures water/ethyl alcohol. All of the selected adhesives (natural, semi-synthetic and synthetic) are used in this test.

- 3 x 3 cm pieces of Silversafe Photostore Paper ¹ (80 gms) are pasted on dry Mirage paper
- the adhesives are used in different concentrations
- the use of water is limited by trying different mixtures water / ethyl alcohol
- the adhesive is applied with a brush
- the Silversafe paper is mounted on the Mirage paper
- both are dried under weight
- after drying the samples are evaluated: an adhesive has either enough or not enough strength
- the adhesives that have sufficient adhesive strength (52 samples) are tested during step 3

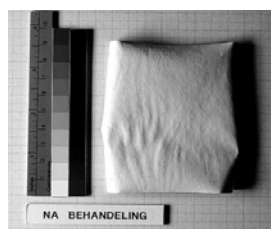
Step 2: Evaluation of the influence of the adhesive on the appearance of an albumen photograph

Only the adhesives that scored best during step 1 (52 samples) are used during step 2

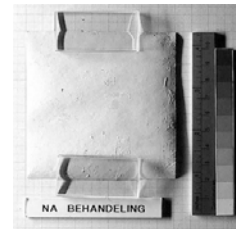
- 9 x 9 cm pieces of historical albumen photographs are rubbed with adhesive
- the samples are air-dried
- some adhesives deform the samples, others dry flat
- after drying the samples are evaluated for deformation



Arabic gum



MHEC 4% 100% water



Paraloid B72 30% 100% ethanol

After a few more tests (lining / no lining) and the decision that all synthetic adhesives should be excluded from further testing, 13 adhesives were selected for step 3.

ADHESIVE	[C]	WATER / ETHANOL
TWZ	10%	100
MHEC	4%	100 90/10
MHEC	3%	100
MHEC	5%	100 90/10 80/20
MC	4%	100 90/10 80/20
MC	5%	100 90/10 80/20

Selection of 13 adhesives after step 1 and 2 e.g. 90 / 10 = 90 ml water / 10 ml ethyl alcohol

¹ 103 samples are tested during step 1

Step 3: Lined albumen photographs – overall mounting

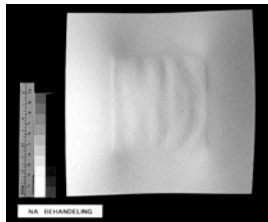
All of the albumen photographs are relaxed before being glued to avoid curling.

All of the samples are lined with tissue (9 g/m²) because this might influence the curling of the photographs after drying and to strengthen weak photographs.

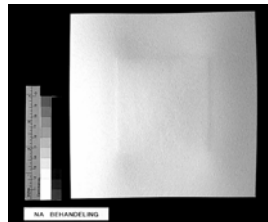
- samples of historical albumen photographs (9 x 9 cm) are rubbed with adhesive
- all samples are lined with tissue
- the lined samples are immediately rubbed with the same adhesive
- the samples are adhered onto a piece of Mirage paper (18 x 18 cm)
- the samples are dried under weight
- after drying, the samples are evaluated

ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE STRENGTH
MHEC	3%	100*	insufficient
	4%	100*	insufficient
	4%	90/10*	insufficient
	5%	100*	sufficient
	5%	90/10*	sufficient
	5%	80/20*	insufficient
MC	4%	100*	insufficient
	4%	90/10*	insufficient
	4%	80/20*	insufficient
	5%	100*	sufficient
	5%	90/10*	insufficient
	5%	80/20*	insufficient
TWZ	10%	100*	sufficient

Evaluation overall mounting



MHEC 3% (100 / 0)



MHEC 5% (90 / 10)

Step 4: Lined albumen photographs – 4 edge-mounting

All of the albumen photographs are relaxed before being adhered to avoid curling.

All of the samples are lined with tissue (9 g/m²) because this might influence the curling of the photographs after drying and to strengthen weak photographs.

- samples of historical albumen photographs (9 x 9 cm) are rubbed with adhesive
- all samples are lined with tissue
- the four edges (1 cm each side) are adhered with the same adhesive
- the samples are adhered onto a piece of Mirage paper (18 x 18 cm)
- the samples are dried under weight
- after drying the samples are evaluated

ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE .STRENGTH
MHEC	3%	100*	insufficient
	4%	100*	sufficient
	4%	90/10*	sufficient
	5%	100*	sufficient
	5%	90/10*	sufficient
	5%	80/20*	sufficient
MC	4%	100*	sufficient
	4%	90/10*	insufficient
	4%	80/20*	insufficient
	5%	100*	sufficient
	5%	90/10*	sufficient
	5%	80/20*	insufficient
TWZ	10%	100*	insufficient

Evaluation four-edge-mounting

Conclusions step 3 and step 4

- lining the albumen photograph has no observable influence on the deformation and adhesion of the photograph – all photographs will still be lined to strengthen the weak albumen photographs (Gandhara-album)
- the influence of the mounting technique is at this point not clear
- the following adhesives are selected:
 - MHEC 5% (100 / 0)
 - MHEC 5% (90 / 10)
 - MC 5% (100 / 0)
 - TWZ 10% (100 / 0)

Step 5: Testing adhesion and physical deformation. Historical albumen photographs (18 x 24 cm) on dry Mirage paper (27 x 34 cm) – overall mounting and four edges.

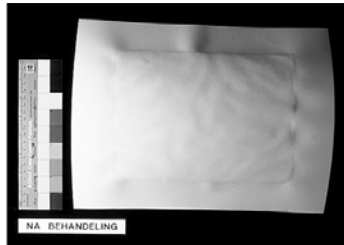
All of the albumen photographs are relaxed before being adhered to avoid curling.

All of the samples are lined with tissue (9 g/m²) to strengthen weak photographs.

- historical albumen photographs are rubbed with adhesive
- all photographs are lined with tissue
- the lined photographs are rubbed with the same adhesive (overall or four edges)
- the photographs are adhered onto a piece of Mirage paper
- the photographs are dried under weight
- the blotting paper is changed 3 times during the first 15 minutes (every 5 minutes)
- after the first 15 minutes the blotting paper is changed after a longer period of time
- the photographs remain under weight for one week

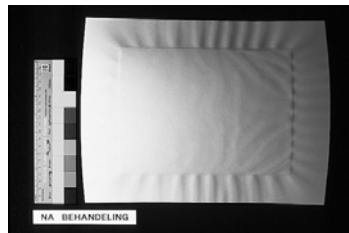
ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE STRENGTH	DEFORMATION
MHEC	5%	100*	sufficient	big
MHEC	5%	90/10*	sufficient	big
MC	5%	100*	sufficient	big

Overall mounting on dry Mirage paper

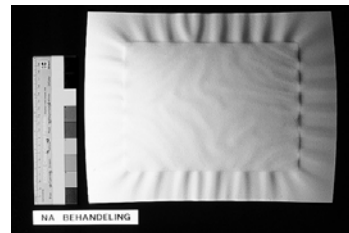


Overall mounting - dry Mirage paper

MC 5% (100 / 0)



MHEC 5% (90 / 10)



MHEC 5% (100 / 0)

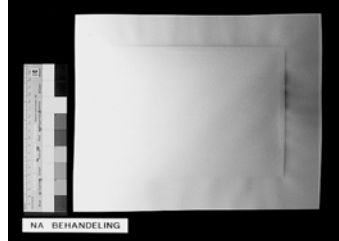
ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE STRENGTH	DEFORMATION
MC	5%	100*	insufficient	big
MHEC	5%	100*	insufficient	big
MHEC	5%	90/10*	insufficient	big

Four edge mounting on dry Mirage paper

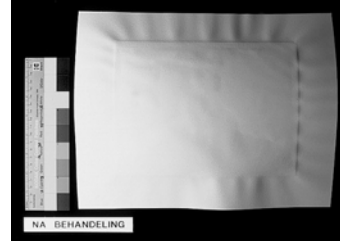


Four-edge mounting - dry Mirage paper

MC 5% (100 / 0)



MHEC 5% (90 / 10)



MHEC 5% (100 / 0)

Step 6: Testing adhesion and physical deformation. Historical albumen photographs (18 x 24 cm) on pre-humidified Mirage paper (27 x 34 cm) – overall mounting and four edges.

Because the mounting of historical albumen photographs on a dry support did not give a

satisfactory result, it was decided to pre-humidify the Mirage paper by using Gore-tex.

All of the albumen photographs are relaxed before being adhered to avoid curling.

All of the samples are lined with tissue (9 g/m²) to strengthen weak photographs.

- historical albumen photographs are rubbed with adhesive

- all photographs are lined with tissue

- the lined photographs are rubbed with the same adhesive (overall or four edges)

- the photographs are adhered onto a piece of pre-wetted Mirage paper

- the photographs are dried under weight

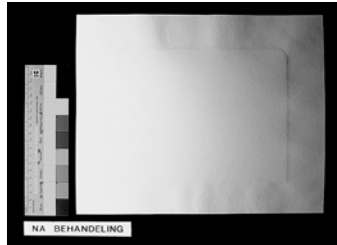
- the blotting paper is changed 3 times during the first 15 minutes (every 5 minutes)

- after the first 15 minutes the blotting paper is changed after a longer period of time

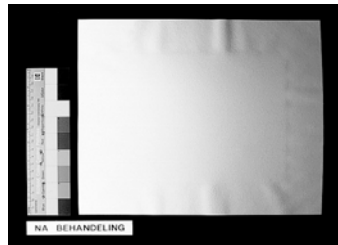
- the photographs remain under weight for one week

ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE STRENGTH	DEFORMATION
MHEC	5%	100*	sufficient	limited
MHEC	5%	90/10*	sufficient	limited
MC	5%	100*	sufficient	limited

Overall mounting on pre-wetted Mirage paper



Overall mounting – pre-wetted Mirage paper
MC 5% (100 / 0)



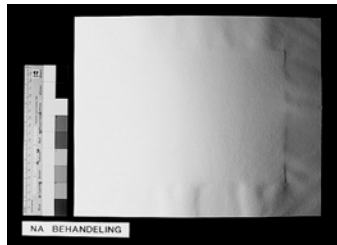
MHEC 5% (90 / 10)



MHEC 5% (100 / 0)

ADHESIVE	CONCENTRATION	WATER/ETHANOL	ADHESIVE STRENGTH	DEFORMATION
MHEC	5%	100*	sufficient	limited
MHEC	5%	90/10*	insufficient	limited
MC	5%	100*	sufficient	limited

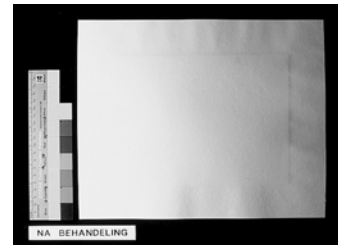
Four edge mounting on pre-wetted Mirage paper



Four-edge mounting – pre-wetted Mirage paper
MC 5% (100 / 0)



MHEC 5% (90 / 10)



MHEC 5% (100 / 0)

Conclusions

- The adhesive strength increases with higher concentration. This also means that the viscosity of the adhesive increases and the smear ability decreases. Because of the sensitivity of albumen photographs to humidity; we opted for an adhesive that was just about smear-able enough to be applied on the surface of the photograph.
- Adhesives made with solvents other than water dried much more flat than adhesives solved in water. Unfortunately these were the adhesives (Paraloid B72 and Beva 371) that were excluded from the research because of lack of time. Further research on these adhesives might bring a solution. Especially the interaction between adhesive and albumen photograph and reversibility should be examined.

- Some of the adhesives had enough adhesive strength when used with paper samples, though not enough adhesive strength once used with albumen photographs. The tension in the albumen photographs should not be underestimated.
- The use of a pre-wetted support gave a much flatter result than the use of a dry support. Unfortunately it is not possible to pre-humidify the album-pages.
- The use of four-edge mounting should be dissuaded because tensions are visible – there is a real danger of tearing of the albumen photograph.
- A lined photograph gave comparable results to a non-lined photograph.

Eventually the research did not bring a solution for the problem of the Gandhāra-album. I could only conclude that remounting the albumen photographs in the existing album with one of the previous mounting techniques or adhesives would cause problems and should therefore not be used. Certain techniques described in this article can be used to mount albumen photographs on separate supports.

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