International Course on Stone Conservation SC13

SESSION: Methods of desalination - control & mitigation, poulticing for salts

INSTRUCTOR: Véronique Vergès-Belmin

TIME: Thursday, 6th June/ All day

Friday, 7th June/ 9:30 – 11:00 (1.5 hours) & 11:30 - 13:00 (1.5 hours)

SESSION OUTLINE

ABSTRACT

For this hands-on exercise the students will be divided in seven groups.

4 groups will focus on drying shrinkage and clearance issues. The students will prepare different poultice formulations, will measure their water content and apply them on two different substrates: a coarse porous and a fine porous. In a second step they will measure the drying shrinkage of the poultice. The poultice-substrate systems will dry overnight in a ventilated oven set at a temperature of 60°C. On the second day, they will again measure for drying shrinkage, and they will observe and quantify the poultices premature detachment and assess the clearance difficulties noting the amount of residues left on the substrate surfaces.

2 groups will focus on the influence of poultice and substrate types on the amount of water delivered to the substrate, and on the depth of water penetration into the substrate. On the first day, they will prepare four formulations and apply them onto two different substrates. The systems poultice/substrates will not be allowed to dry. On the second day they will measure the amount of water that has penetrated the substrates and they will quantify the depth reached by the water front.

1 group will focus on the concepts of consistency and adherence of poultices in their fresh state. On the first day, the students will prepare two poultice formulations of different water contents and will make an evaluation of their consistency. On the second day they will apply the better of the two formulations on two substrates and will measure the adherence of the fresh poultices to the substrates.

OBJECTIVES

- To manipulate (hands on) different types of poultices (cellulose fibre based - BWW40 and BC1000; and commercial products Remmers and Supermold)
- To learn about different poultice materials – their properties and their influence on poultice performance
- To understand how shrinkage effects poultice performance and how it relates to poultice materials, substrate, environmental conditions and adhesion
    - How to measure shrinkage of poultices
    - How to reduce shrinkage with poultice components (sand)
- To learn about depth of water penetration into a substrate from a poultice
- How to evaluate consistency and adherence of fresh poultices

CONTENT OUTLINE

The students will be divided into seven groups. Each group will be given a different question to answer. All groups results will be reported in a common table prepared by the instructors. On the second day (June 15th), once the table has been completed by the students, each group will present its own results and the overall results will be discussed with the instructors during the second session of the hands on exercise.

Figure 1 Preparing poultice samples in the laboratory, 2013. Photo: Benjamin Marcus.

DETAILED GROUP ACTIVITIES

- **GROUP 1:** With this exercise, the students will investigate in what respect **poultices shrink through drying**. Students will manipulate **four poultice formulations**: **BC200**, **BC200 + Sand**, **Supermold** and **Remmers** that will be applied on a coarse porous substrate, and will try to determine the parameters influencing drying shrinkage.

- **GROUP 2, exercises 2-1** and **2-2**: With this exercise, the students will investigate whether **poultice thickness influences drying shrinkage**. The experiment will be conducted with **two grades of cellulose, BWW40 and BC 1000.** Each grade will be applied at two different thicknesses : 1cm and 0.5 cm on a coarse porous, very capillary **substrate (exercise 2-1)** and on a fine porous low capillary **substrate (exercise 2-2**).

- **GROUPS 3 and 4:** With this exercise, the students will investigate **how much an inert additive can influence drying shrinkage**. The experiment will be conducted on a coarse porous substrate with a mixture of cellulose **BC200 (GROUP 3)** and with the commercial product **Supermold (GROUP 5).** An inert additive, sand, will be added at increasing proportions. The influence of **sand addition** on drying shrinkage will be measured.

- **GROUPS 5 and 6:** When water penetrates too deep, there is a risk to push salts into the substrate instead of extracting them. **How deep does water delivered by a poultice penetrate into the substrate?** This hands on exercise will allow the students to find some answers to the question. The experiment will be conducted with **cellulose BWW40** and with either **Supermold (GROUP 5) or Remmers (GROUP 6)**, **on a coarse porous substrate and on a fine porous** substrate. The students will allow the water originating from a selection of two poultices to enter the substrates without allowing any evaporation to take place during ca. 16 hours. After 16 hours, they will observe and record the water front penetration depth on the basis of pictures shots taken with a digital camera.

- **GROUP 7: Conservators need desalination poultices to adhere well to the substrate and to be easily workable**. With this hands-on exercise, we will explore the influence of water content on workability and adherence of **two formulations**: cellulose BWW40 and the ready to use Remmers.

OVERVIEW OF POULTICE RECIPES

group 1	BC200 (g)	Sand (g)	Supermold (g)	Remmers (g)	Water (g)	SUBSTRATE
BC200	52	-	-	-	234	CP
BC200/Sand (CS3)	52	208	-	-	234	CP
SUPERMOLD	-	-	22	-	44	CP
REMMERS	-	-	-	50	17	CP

group 2 exercise 2-1	BC1000 (g)	BWW40 (g)	Water (g)	SUBSTRATE
BWW40 1/2 cm	-	34	153	CP
BWW40 1 cm	-	68	306	CP
BC1000 1/2 cm	18	-	90	CP
BC1000 1 cm	36	-	180	CP

group 2 exercise 2-2	BC1000 (g)	BWW40 (g)	Water (g)	SUBSTRATE
BWW40 ½ cm	-	34	153	FP
BWW40 1 cm	-	68	306	FP
BC1000 ½ cm	18	-	90	FP
BC1000 1 cm	36	-	180	FP

group 3	BC200 (g)	Sand (g)	Water (g)	SUBSTRATE
BC200 (CS0)	52	0	234	CP
BC200/Sand (CS1)	52	52	234	CP
BC200/Sand (CS2)	52	104	234	CP
BC200/Sand (CS3)	52	208	234	CP

group 4	SUPERMOLD (g)	Sand (g)	Water (g)	SUBSTRATE
SUPERMOLD (SPM 0)	22	0	44	CP
SUPERMOLD /Sand (SPM 1)	22	22	44	CP
SUPERMOLD /Sand (SPM 2)	22	66	44	CP
SUPERMOLD /Sand (SPM 3)	22	132	44	CP

group 5	BWW40 (g)	SUPERMOLD (g)	Water (g)	SUBSTRATE
BWW40 - fine porous	34	-	153	FP
BWW40 - coarse porous	34	-	153	CP
SUPERMOLD - fine porous	-	22	44	FP
SUPERMOLD - coarse porous	-	22	44	CP

group 6	BWW40 (g)	REMMERS (g)	Water (g)	SUBSTRATE
BWW40 - fine porous	34	-	153	FP
BWW40 - coarse porous	34	-	153	CP
REMMMERS - fine porous	-	50	16.7	FP
REMMMERS - coarse porous	-	50	16.7	CP

group 7	BWW40 (g)	REMMERS (g)	Water (g)	SUBSTRATE
BWW40 Wc A	68	-	136	FP + CP ?
BWW40 Wc B	68	-	204	FP + CP ?
BWW40 Wc C	68	-	272	FP + CP ?
BWW40 Wc D	68	-	312.8	FP + CP ?
REMMMERS Wc A	-	100	20	FP + CP ?
REMMMERS Wc B	-	100	33	FP + CP ?
REMMMERS Wc C	-	100	40	FP + CP ?
REMMMERS Wc D	-	100	70	FP + CP ?

Only two CP and two FP necessary :

On day 2, only one BWW40 and one REMMERS poultice will be applied on each substrate type.

❖ CP : means « Coarse porous substrate » FP : means « Fine porous substrate »

GROUP 1
Experiment : DAY 1

Question: During this hands on exercise, students will manipulate four poultice formulations: cellulose BC200, cellulose BC200 + Sand, Supermold and Remmers They will investigate how much these different poultice formulations shrink over drying on a coarse porous substrate, and will try to determine the parameters that influence drying shrinkage.

Material

- BC 200
- BC 200 / Sand
- Supermold
- Remmers
- Coarse porous substrate (CP)
- 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, a measuring cup (1/2 liter content, graduations every cl).

The experiment is conducted this way :

- Prepare four poultice formulations

group 1	BC 200 (g)	Sand (g)	Supermold (g)	Remmers (g)	Water (g)	Destinated to SUBS.
BC 200	52	-	-	-	234	CP
BC 200 /Sand (CS3)	52	208	-	-	234	CP
SUPERMOLD	-	-	22	-	44	CP
REMMERS	-	-	-	50	17	CP

- Calculate the Wc (water content, ie the ratio water/dry mix) of each poultice, record

	Water content Wc (weight water / Weight dry mix/)
BC 200	
BC200/Sand (CS3)	
SUPERMOLD	
REMMERS	

1. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces free.
2. set each block, face up into a pre-designed extruded polystyrene mould, leaving the walls of the mould half a centimeter higher than the surface of the blocks
3. fix the mould with two elastic tapes
4. apply each poultice recipe on one block
5. Measure the length of each poultice, record (L1)
6. Let the systems poultice + substrate dry at room temperature for 1 hour
7. Remove the mold
8. Measure the length of each substrate and the length of each poultice, record (L2)
9. Place the blocks+ poultice systems in a ventilated cabinet at 60° overnight.

GROUP 1
Experiment : DAY 2

Remove the blocks + poultice systems from the ventilated cabinet

- Tap the surface of the poultices. Any detachments? Record

	Proportion of the surface detached (%)
BC200	
BC200/Sand (CS3)	
Supermold	
Remmers	

- Measure the length of each substrate and the length of each poultice, record (L3)
- Calculate the drying shrinkage (% of initial length)

	Length poultice just after application L1	Length poultice after 1hour L2	Drying shrinkage 1 hour [(L1-L2)x100]/L1	Length poultice one day L3	Drying shrinkage one day [(L1-L3)x100]/L1
BC200					
BC200/Sand (CS3)					
Supermold					
Remmers					

- Report the drying shrinkage results (at 1 hour and 1 day) in the general table provided by the instructors
- Remove the poultices. Any difficulty to clear the poultice from the substrate? Any residues, any other remarks?

	Clearance *	Residues (%)	Other remarks (%)
BC200			
BC200 /Sand (CS3)			
Supermold			
Remmers			

* ** very easy ** easy * difficult

- Report the results in the general table provided by the instructors

GROUP 2 (part 1 of 2)
Experiment : DAY 1

Question: With this exercise, the students will investigate whether poultice thickness influences drying shrinkage. The experiment will be conducted with two grades of cellulose, BWW40 and BC 1000. Each grade will be applied at two different thicknesses : 1cm and 0.5 cm on a coarse porous, very capillary substrate.

Material

- Dry poultice ingredients : Cellulose BWW40 and Cellulose BC1000
- Coarse porous substrate (CP) : four blocks
- Deionized water, 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, a measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare four poultice formulations

group 2	BC1000 (g)	BWW40 (g)	Water (g)	SUBSTRATE
BWW40 ½ cm	-	34	153	CP
BWW40 1 cm	-	68	306	CP
BC1000 ½ cm	18	-	90	CP
BC1000 1 cm	36	-	180	CP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water/ Weight dry mix/)
BWW40 ½ cm	
BWW40 1 cm	
BC1000 ½ cm	
BC1000 1 cm	

- **Poultice application**

1. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
2. Arrange extruded polystyrene plates around the substrate blocks – uncovered face (5x10 cm) up- to form moulds, in a way that the moulds delimitate a volume to cast the poultices :
   - 0.5 cm higher than the surface for two blocks
   - 1 cm higher than the surface for two blocks
3. Fix each mould with two elastic tapes
4. Apply **BWW40** poultice in one of the **½ cm** height moulds,
5. Apply **BWW40** poultice in one of the **1 cm** height moulds
6. Measure the length of each poultice, record (L1, table next page)
7. Apply **BC1000** poultice in one of the **½ cm** height moulds,
8. Apply **BC1000** poultice in one of the **1 cm** height moulds
9. Measure the length of each poultice, record (L1, table next page)
10. Let the systems poultice + substrate dry at room temperature for 1 hour at least
11. Carefully remove the mould
12. Measure the length of each poultice, record (L2)
13. Place the blocks + poultice systems in a ventilated cabinet at 60° overnight.

GROUP 2
Experiment : DAY 2

Remove the blocks + poultice systems from the ventilated cabinet

- Knock the surface of the poultices. Any detachments? Record; report on the general table provided by the instructors

	Poultice detachment (%)
BWW40 ½ cm	
BWW40 1 cm	
BC1000 ½ cm	
BC1000 1 cm	

- Measure the length of each substrate and the length of each poultice, record (L3)
- Calculate the drying shrinkage (% of initial length), record

	Length poultice just after application L1	Length poultice After 1hour L2	Drying shrinkage 1 hour [(L1-L2)x100]/L1	Length poultice one day L3	Drying shrinkage one day [(L1-L3)x100]/L1
BWW40 ½ cm					
BWW40 1 cm					
BC1000 ½ cm					
BC1000 1 cm					

- Report the drying shrinkage results (at 1 hour and 1 day) in the general table provided by the instructors
- Remove the poultices. Any difficulty to clear the poultice from the substrate? Any residues, any other remarks?

	Clearance*	Residues (%)	Other remarks (%)
BWW40 ½ cm			
BWW40 1 cm			
BC1000 ½ cm			
BC1000 1 cm			

* ** very easy ** easy * difficult

- Report the results in the general table provided by the instructors

GROUP 2 (PART 2)
Experiment : DAY 1

Question: With this exercise, the students will investigate whether poultice thickness influence drying shrinkage. The experiment will be conducted with two grades of cellulose - BWW40 and BC1000. Each grade will be applied at two different thicknesses : 1cm and 0.5 cm on a fine porous low capillary substrate.

Material

- Dry poultice ingredients : Cellulose BWW40 and Cellulose BC1000
- Fine porous substrate (FP) : four blocks
- Deionized water, 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, a measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare four poultice formulations

group 2	BC1000 (g)	BWW40 (g)	Water (g)	Destinated to SUBSTRATE
BWW40 1/2 cm	-	34	153	FP
BWW40 1 cm	-	68	306	FP
BC1000 1/2 cm	18	-	90	FP
BC1000 1 cm	36	-	180	FP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water /Weight dry mix)
BWW40 1/2 cm	
BWW40 1 cm	
BC1000 1/2 cm	
BC1000 1 cm	

Poultice application

1. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
2. Arrange extruded polystyrene plates around the substrate blocks – uncovered face (5x10 cm) up-to form moulds, in a way that the moulds delimitate a volume to cast the poultices :
   - 0.5 cm higher than the surface for two blocks
   - 1 cm higher than the surface for two blocks
3. Fix each mould with two elastic tapes
4. Apply **BWW40** poultice in one of the ½ **cm** height moulds,
5. Apply **BWW40** poultice in one of the **1 cm** height moulds
6. Measure the length of each poultice, record (L1, table next page)
7. Apply **BC1000** poultice in one of the ½ **cm** height moulds,
8. Apply **BC1000** poultice in one of the **1 cm** height moulds
9. Measure the length of each poultice, record (L1, table next page)
10. Let the systems poultice + substrate dry at room temperature for 1 hour at least
11. Carefully remove the mould
12. Measure the length of each poultice, record (L2)
13. Place the blocks + poultice systems in a ventilated cabinet at 60° overnight.

GROUP 2 (PART 2 cont'd)
Experiment : DAY 2

Remove the blocks + poultice systems from the ventilated cabinet.

- Knock the surface of the poultices. Any detachments? Record; report on the general table provided by the instructors

	Poultice detachment (%)
BWW40 1/2 cm	
BWW40 1 cm	
BC1000 1/2 cm	
BC1000 1 cm	

- Measure the length of each substrate and the length of each poultice, record (L3)
- Calculate the drying shrinkage (% of initial length), record

	Length poultice just after application L1	Length poultice After 1hour L2	Drying shrinkage 1 hour [(L1-L2)x100]/L1	Length poultice one day L3	Drying shrinkage one day [(L1-L3)x100]/L1
BWW40 1/2 cm					
BWW40 1 cm					
BC1000 1/2 cm					
BC1000 1 cm					

- Report the drying shrinkage results (at 1 hour and 1 day) in the general table provided by the instructors
- Remove the poultices. Any difficulty to clear the poultice from the substrate? Any residues, any other remarks?

	Clearance*	Residues (%)	Other remarks (%)
BWW40 1/2 cm			
BWW40 1 cm			
BC1000 1/2 cm			
BC1000 1 cm			

* ** very easy ** easy * difficult

- Report the results in the general table provided by the instructors

GROUP 3
Experiment : DAY 1

Question : With this exercise, the students will investigate how much an inert additive can influence drying shrinkage. The experiment will be conducted on a coarse porous substrate with a cellulose BC200. An inert additive, sand, will be added at increasing proportions. The influence of sand addition on drying shrinkage will be measured.

Material

- Dry poultice ingredients:
  - Mixture Cellulose BC1000 / BWW40
  - Sand
- Coarse porous substrate (CP): four blocks
- Deionized water
- 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, a measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare four poultice formulations

group 3	BC200 (g)	Sand (g)	Water (g)	Destinated to SUBSTRATE
BC200 (CS0)	52	0	234	CP
BC200 (CS1)	52	52	234	CP
BC200 /Sand (CS2)	52	104	234	CP
BC200/Sand (CS3)	52	208	234	CP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water /Weight dry mix)
BC200 (CS0)	
BC200/Sand (CS1)	
BC200/Sand (CS2)	
BC200/Sand (CS3)	

Poultice application

1. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
2. Place the extruded polystyrene plates around the substrate blocks – uncovered 5x10 cm face up - to form a mould, in a way that the mould delimitates a volume to cast the poultice**, half a centimeter** higher than the surface of the blocks
3. Fix the mould with two elastic tapes
4. Apply each poultice on the 5x10cm free face of each block
5. Measure the length of each poultice, record (L1, table next page)
6. Let the systems poultice + substrate dry at room temperature for 1 hour at least
7. Carefully remove the mold
8. Measure the length of each poultice, record (L2)
9. Place the blocks + poultice systems in a ventilated cabinet at 60° overnight.

GROUP 3
Experiment : DAY 2

Remove the blocks + poultice systems from the ventilated cabinet

- Knock the surface of the poultices. Any detachments? Record; report on the general table provided by the instructors

	Poultice detachment (%)
BC200 (CS0)	
BC200/Sand (CS1)	
BC200/Sand (CS2)	
BC200/Sand (CS3)	

- Measure the length of each substrate and the length of each poultice, record (L3)
- Calculate the drying shrinkage (% of initial length), record

	Length poultice just after application L1	Length poultice After 1hour L2	Drying shrinkage 1 hour [(L1-L2)x100]/L1	Length poultice one day L3	Drying shrinkage one day [(L1-L3)x100]/L1
BC200 (CS0)					
BC200/Sand (CS1)					
BC200/Sand (CS2)					
BC200/Sand (CS3)					

- Report the drying shrinkage results (at 1 hour and 1 day) in the general table provided by the instructors
- Remove the poultices. Any difficulty to clear the poultice from the substrate? Any residues, any other remarks?

	Clearance*	Residues (%)	Other remarks (%)
BC200 (CS0)			
BC200/Sand (CS1)			
BC200/Sand (CS2)			
BC200/Sand (CS3)			

* ** very easy ** easy * difficult

- Report the results in the general table provided by the instructors

GROUP 4
Experiment : DAY 1

Question: With this exercise, the students will investigate how much an inert additive can influence adhesion, early detachment, drying shrinkage, clearance and substrate staining. The experiment will be conducted on a coarse porous substrate with the commercial product Supermold. An inert additive, sand, will be added at increasing proportions.

Material

- Dry poultice ingredients:
- Supermold
- Sand
- Coarse porous substrate (CP): four blocks
- Deionized water
- 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, a measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare four poultice formulations

group 4	SUPERMOLD (g)	Sand (g)	Water (g)	Destinated to SUBSTRATE
SUPERMOLD (SPM 0)	22	0	44	CP
SUPERMOLD /Sand (SPM 1)	22	22	44	CP
SUPERMOLD /Sand (SPM 2)	22	66	44	CP
SUPERMOLD /Sand (SPM 3)	22	132	44	CP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water /weight dry mix)
SUPERMOLD (SPM 0)	
SUPERMOLD /Sand (SPM 1)	
SUPERMOLD /Sand (SPM 2)	
SUPERMOLD /Sand(SPM 3)	

Poultice application

1. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
2. Place the extruded polystyrene plates around the substrate blocks – uncovered 5x10 cm face up - to form a mould, in a way that the mould delimitates a volume to cast the poultice**, half a centimeter** higher than the surface of the blocks
3. Fix the mould with two elastic tapes
4. Apply each poultice on the 5x10cm free face of each block
5. Measure the length of each poultice, record (L1, table next page)
6. Let the systems poultice + substrate dry at room temperature for 1 hour at least
7. Carefully remove the mold
8. Measure the length of each poultice, record (L2)
9. Place the blocks + poultice systems in a ventilated cabinet at 60° overnight.

GROUP 4
Experiment : DAY 2

Remove the blocks + poultice systems from the ventilated cabinet

- Knock the surface of the poultices. Any detachments? Record; report on the general table provided by the instructors

	Poultice detachment (%)
SUPERMOLD (SPM 0)	
SUPERMOLD /Sand (SPM 1)	
SUPERMOLD /Sand (SPM 2)	
SUPERMOLD /Sand (SPM 3)	

- Measure the length of each substrate and the length of each poultice, record (L3)
- Calculate the drying shrinkage (% of initial length), record

	Length poultice just after application L1	Length poultice after 1hour L2	Drying shrinkage 1 hour [(L1-L2)x100]/L1	Length poultice one day L3	Drying shrinkage one day [(L1-L3)x100]/L1
SUPERMOLD (SPM 0)					
SUPERMOLD /Sand (SPM 1)					
SUPERMOLD /Sand (SPM 2)					
SUPERMOLD /Sand (SPM 3)					

- Report the drying shrinkage results (at 1 hour and 1 day) in the general table provided by the instructors
- Remove the poultices. Any difficulty to clear the poultice from the substrate? Any residues, any other remarks?

	Clearance*	Residues (%)	Other remarks (%)
SUPERMOLD (SPM 0)			
SUPERMOLD /Sand (SPM 1)			
SUPERMOLD /Sand (SPM 2)			
SUPERMOLD /Sand(SPM 3)			

** very easy ** easy * difficult

- Report the results in the general table provided by the instructors

GROUP 5
Experiment : DAY 1

Question: When water penetrates too deep, there is a risk to push salts into the substrate instead of extracting them. How deep water delivered by a poultice penetrates the substrate?. This hands on exercise will allow the students to find some answers to the question. The experiment will be conducted with cellulose BWW40 and with Supermold, on a coarse porous substrate and on a fine porous substrate. The students will allow the water originating from the poultices enter the substrates, without letting any evaporation to take place during ca. 24 hours. After 24 hours, they will visualize and record the water front penetration depth, on the basis of pictures shots taken with a digital camera.

Material

- Dry poultice ingredients : **Cellulose BWW40**, **Supermold**
- Coarse porous substrate (CP) : two blocks
- Fine porous substrate (FP) : two blocks
- Digital camera, a pole to fix the digital camera
- Deionized water, 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, scotch tape, a parallepipedic object to fix the ruler on, a measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare two poultice formulations

group 5	BWW40 (g)	SUPERMOLD (g)	Water (g)	Destinated to SUBSTRATE
BWW40 - fine porous	34	-	153	FP
BWW40 - coarse porous	34	-	153	CP
SUPERMOLD - fine porous	-	22	44	FP
SUPERMOLD - coarse porous	-	22	44	CP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (/weight water/ Weight dry mix)
BWW40 - fine porous	
BWW40 - coarse porous	
SUPERMOLD - fine porous	
SUPERMOLD - coarse porous	

Poultice application

- Record each block number, Weigh each block, record (in the last table next page)
- Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
- Place the extruded polystyrene plates around the substrate blocks – uncovered 5x10 cm face up - to form moulds, in a way that the moulds delimitate a volume to cast the poultices 0.5 cm higher than the surface for two blocks
- Fix each mould with two elastic tapes
- Apply BWW40 poultice on one block coarse porous and on one block fine porous substrate
- Cover the moulded specimens with polyvinyldene film to prevent poultice/substrate from drying
- Apply Supermold poultice on one block coarse porous and on one block fine porous substrate,
- cover the moulded specimens with polyvinyl film to prevent the poultice/substrate from drying
- Let the systems poultice/substrates at room temperature overnight

GROUP 5
Experiment : DAY 2

1. Place the camera and the ruler in the appropriate position to record pictures of the 10x10x5 faces of the samples.
2. Remove the polyvinyldene sheets cover
3. Remove the moulds carefully
4. Unwrap the system BWW40 on **coarse** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
5. Unwrap the system BWW40 on **fine** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
6. Unwrap the system Supermold on **coarse** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
7. Unwrap the system Supermold on **fine** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record

	Water penetration depth (cm)
BWW40 - fine porous	
BWW40 - coarse porous	
SUPERMOLD - fine porous	
SUPERMOLD - coarse porous	

- Any comment? Record.
- Report the results in the general table provided by the instructors

	Substrate Weight day 1 P1 (grams)	Substrate Weight day 2 P2 (grams)	Moisture content [(P2-P1)*100]/P1 (%)
BWW40 - fine porous			
BWW40 - coarse porous			
SUPERMOLD - fine porous			
SUPERMOLD - coarse porous			

- Compare the poultices: any differences in moisture content? Record
- Report the results in the general table provided by the instructors

GROUP 6
Experiment : DAY 1

Question: When water penetrates too deep, there is a risk to push salts into the substrate instead of extracting them. How deep water delivered by a poultice penetrates the substrate?. This hands on exercise will allow the students to find some answers to the question. The experiment will be conducted with cellulose BWW40 and with Remmers, on a coarse porous substrate and on a fine porous substrate. The students will let the water originating from the poultices enter the substrates, without letting any evaporation to take place during ca. 24 hours. After 24 hours, they will visualise and record the water penetration depth, on the basis of pictures shots taken with a digital camera.

Material

- Dry poultice ingredients : Cellulose BWW40 - Remmers
- Coarse porous substrate (CP) : two blocks
- Fine porous substrate (FP) : two blocks
- Digital camera, a pole to fix the digital camera, a laptop computer
- Deionized water
- 1 Ruler, 4 elastic bands, extruded polystyrene plates, polyvynildene film, a calculator, kitchen wooden tools, gloves, scotch tape, a parallepipedic object to fix the ruler on, 1 measuring cup (1/2 liter content, graduations every cl).

Poultice preparation

- prepare two poultice formulations

Group 6	BWW40 (g)	REMMERS (g)	Water (g)	Destinated to SUBSTRATE
BWW40 - fine porous	34	-	153	FP
BWW40 - coarse porous	34	-	153	CP
REMMMERS - fine porous	-	50	16.7	FP
REMMMERS - coarse porous	-	50	16.7	CP

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water /Weight dry mix/)
BWW40 - fine porous	
BWW40 - coarse porous	
REMMMERS - fine porous	
REMMMERS - coarse porous	

Poultice application

1. Record each block number, Weigh each block, record (in the last table next page)
2. Wrap the four substrate blocks on 5 out of their 6 faces with a polyvynildene film, leaving one of the 5x10 cm faces uncovered.
3. Place the extruded polystyrene plates around the substrate blocks – uncovered 5x10 cm face up - to form moulds, in a way that the moulds delimitate a volume to cast the poultices 0.5 cm higher than the surface for two blocks
4. Fix each mould with two elastic tapes
5. Apply BWW40 poultice on one block coarse porous and on one block fine porous substrate
6. Cover the moulded specimens with polyvinyl film to prevent the poultice/substrate from drying
7. Apply Remmers poultice on one block coarse porous and on one block fine porous substrate,
8. Cover the moulded specimens with polyvinylfilm to prevent the poultice/substrate from drying
9. Let the systems poultice/substrates at room temperature overnight

GROUP 6
Experiment : DAY 2

1. Place the camera and the ruler in the appropriate position to record picturesof the 10x10x5 faces of the samples.
2. Remove the polyvinyldene sheets cover
3. Remove the moulds carefully
4. Unwrap the system BWW40 on **coarse** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
5. Unwrap the system BWW40 on **fine** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
6. Unwrap the system Remmers on **coarse** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record
7. Unwrap the system Remmers on **fine** porous, trace immediately the limit wet/no wet using the pencil , remove the poultice weigh the block, record

	Water penetration depth (cm)
BWW40 - fine porous	
BWW40 - coarse porous	
REMMMERS - fine porous	
REMMMERS - coarse porous	

- Any comment? Record.
- Report the results in the general table provided by the instructors

	Substrate Weight day 1 P1 (grams)	Substrate Weight day 2 P2 (grams)	Moisture content [(P2-P1)*100]/P1 (%)
BWW40 - fine porous			
BWW40 - coarse porous			
REMMMERS - fine porous			
REMMMERS - coarse porous			

- Compare the poultices: any differences in moisture content? Record
- Report the results in the general table provided by the instructors

GROUP 7
Experiment : DAY 1

Question: Conservators need desalination poultices to adhere well to the substrate and to be easily workable. We will explore with this hands on exercise the influence of water content on workability and adherence of two formulations: the cellulose BWW40 and the ready to use Remmers.

Material

- Dry poultice ingredients : Cellulose BWW40, Remmers
- Coarse porous substrate : two blocks
- Fine porous substrate : two blocks
- Deionized water
- A calculator, kitchen wooden tools, gloves, 1 measuring cup (1/2 liter content, graduation every 1mL) one permanent marker
- 1 shock table

Poultice preparation

- Prepare eight poultices

group 7	BWW40 (g)	REMMERS (g)	Water (g)	Destinated to SUBSTRATE
BWW40 Wc A	68	-	136	FP + CP (?)
BWW40 Wc B	68	-	204	FP + CP (?)
BWW40 Wc C	68	-	272	FP + CP (?)
BWW40 Wc D	68	-	312.8	FP + CP (?)
REMMMERS Wc A	-	100	20	FP + CP (?)
REMMMERS Wc B	-	100	33	FP + CP (?)
REMMMERS Wc C	-	100	40	FP + CP (?)
REMMMERS Wc D	-	100	70	FP + CP (?)

2FP & 2CP (see the protocol)

- Calculate the **Wc** (water content, ie the ratio water/dry mix) of each poultice, record, report on the general table provided by the instructors

	Water content Wc (weight water /Weight dry mix)
BWW40 wc1	
BWW40 wc2	
BWW40 wc3	
BWW40 wc4	

	Water content Wc (weight water /Weight dry mix)
Remmers wc1	
Remmers wc2	
Remmers wc3	
Remmers wc4	

Fresh poultice consistency

	Consistency
BWW40 wc1	
BWW40 wc2	
BWW40 wc3	
BWW40 wc4	

	Consistency
Remmers wc1	
Remmers wc2	
Remmers wc3	
Remmers wc4	

Consistency : * too dry ** OK *** too fluid

- Which are the best formulations? Record on the table provided by instructors. Keep each one of the best recipes (one for BW40, one for Remmers in an hermetic vessel and leave it overnight.

GROUP 7
Experiment : DAY 2

Preparation of the substrate blocks for adherence test

1. Place the extruded polystyrene plates around the substrate blocks – leaving one of the 10x10 cm faces up - to form moulds, in a way that the moulds delimitate a volume to cast the poultices 1 cm higher than the surface. Put a 1X2x10cm extruded polystyrene parallepiped into the mould (ask an instructor for positioning)
2. Fix each mould with two elastic tapes

Poultice application on part of the substrate blocks surface

For each poultice, follow the same instructions.

1. Mix the poultice for 1 minute
2. Check that the moulds are ready to cast the poultice,
3. Check that the 1X2x5cm extruded polystyrene parallepiped (EPP)is in place
4. Apply the poultice on one of the substrate block 5X5 surface .
5. Remove the mould
6. Remove the EPP

Measurement of fresh poultice adherence

1. Place the block in vertical position, with the part of the surface uncovered by the poultice in contact with the bench or the shock table
2. If a shock table is available, apply 15 shocks (1 per second). Record the number of shocks (X) necessary to reach the first detachment of poultice
3. If no shock table is available, apply 15 shocks (1per second : let the sample fall down from 1cm height - ask instructors on how to proceed). Record the number of shocks (X) necessary to reach the first detachment of poultice

		Number of shocks X until first detachment	Adherence (X*100/15)
BWW40 Wc ? (optimum)	Coarse porous substrate		
	Fine porous substrate		
REMMERS Wc ? (optimum)	Coarse porous substrate		
	Fine porous substrate		

❖ Record the results on the general table provided by the instructors

READINGS

📖 = Essential reading material

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Look, David W. 1976. Review of *Desalination of Stone: A Case Study* by M. J. Bowley. *Bulletin of the Association for Preservation Technology* 2 (2): 78-79.

Lubelli, Barbara, and Rob P.J. van Hees. 2010. Desalination of masonry structures: Fine tuning of pore size distribution of poultices to substrate properties. *Journal of Cultural Heritage* 11 (1): 10-18.

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📖 Vergès-Belmin, Véronique, Alison Heritage, and Ann Bourgès. 2011. Powdered cellulose poultices in stone and wall painting conservation: Myths and realities. *Studies in Conservation* 56 (4): 281-97.

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