



# RESULTS FOR SOILING

Aurélie VERNEY-CARRON, Yesmine BEN AMOR, Clarisse BALLAND-BOLOU-BI

Meeting in Paris – 24-26 June 2019



# Welcome to the 35<sup>th</sup> Meeting of the International Co-operative Programme on Effects on Materials, including Historic and Cultural Monuments



# Summary of the campaign

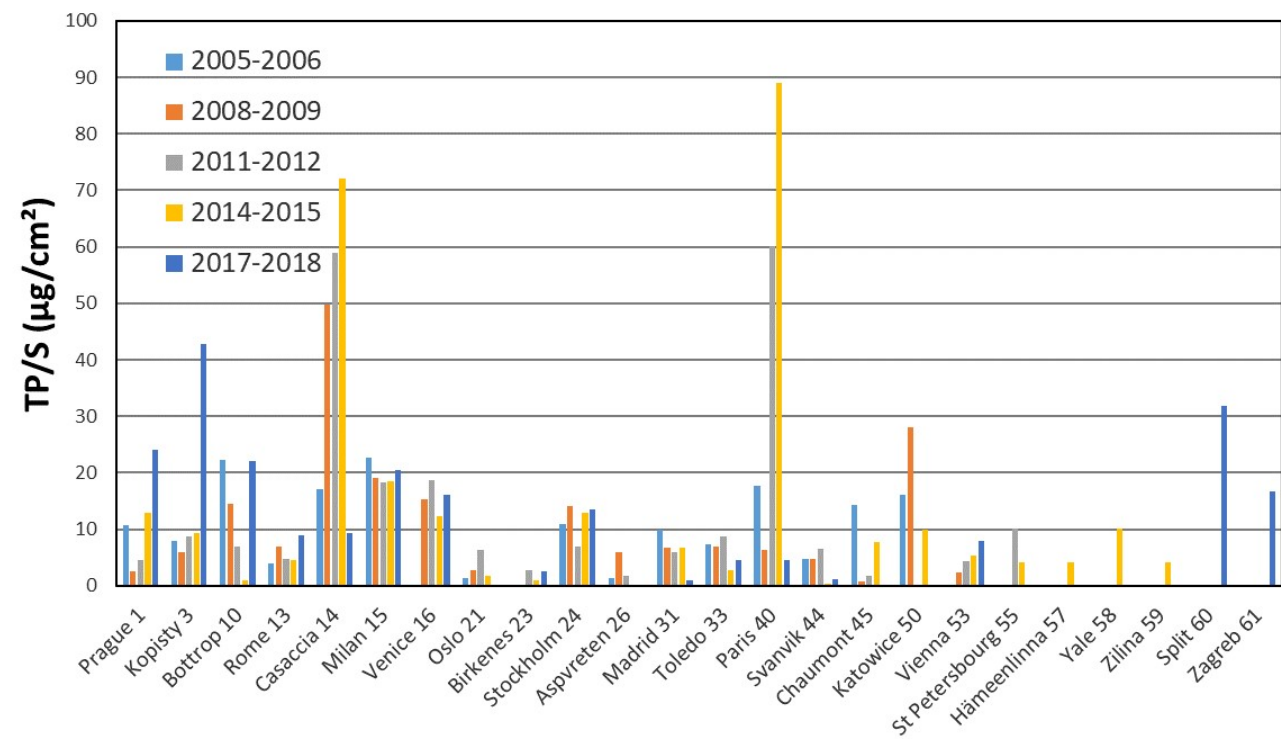
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	glass T	limestone O	marble P
1 Prague	1	1	1
3 Kopisty	1	1	1
10 Bottrop	1	1	1
13 Rome	1	1	1
14 Casaccia	1	1	1
15 Milan	1	1	1
16 Venice	1	1	1
21 Oslo	1	1	1
23 Birkenes	1	1	1
24 Stockholm	1	1	1
26 Aspvreten	1	1	1
31 Madrid	1	1	1
33 Toledo	1	1	1
40 Paris	fallen	1	1
41 Berlin	not received	1	1
44 Svanvik	1	1	1
45 Chaumont	1	1	1
50 Katowice	1	1	1
51 Athens	1	lost	lost
53 Vienna	1	1	1
57 Hämeenlinna	lost by the	French post	office
58 New Haven	1	1	1
59 Zilina	broken	broken	1
60 Split	1	1	1
61 Zagreb	1	1	1
TOTAL	21	22	23

# GLASS

- Mass of the deposit (TP/S in  $\mu\text{g}/\text{cm}^2$ )

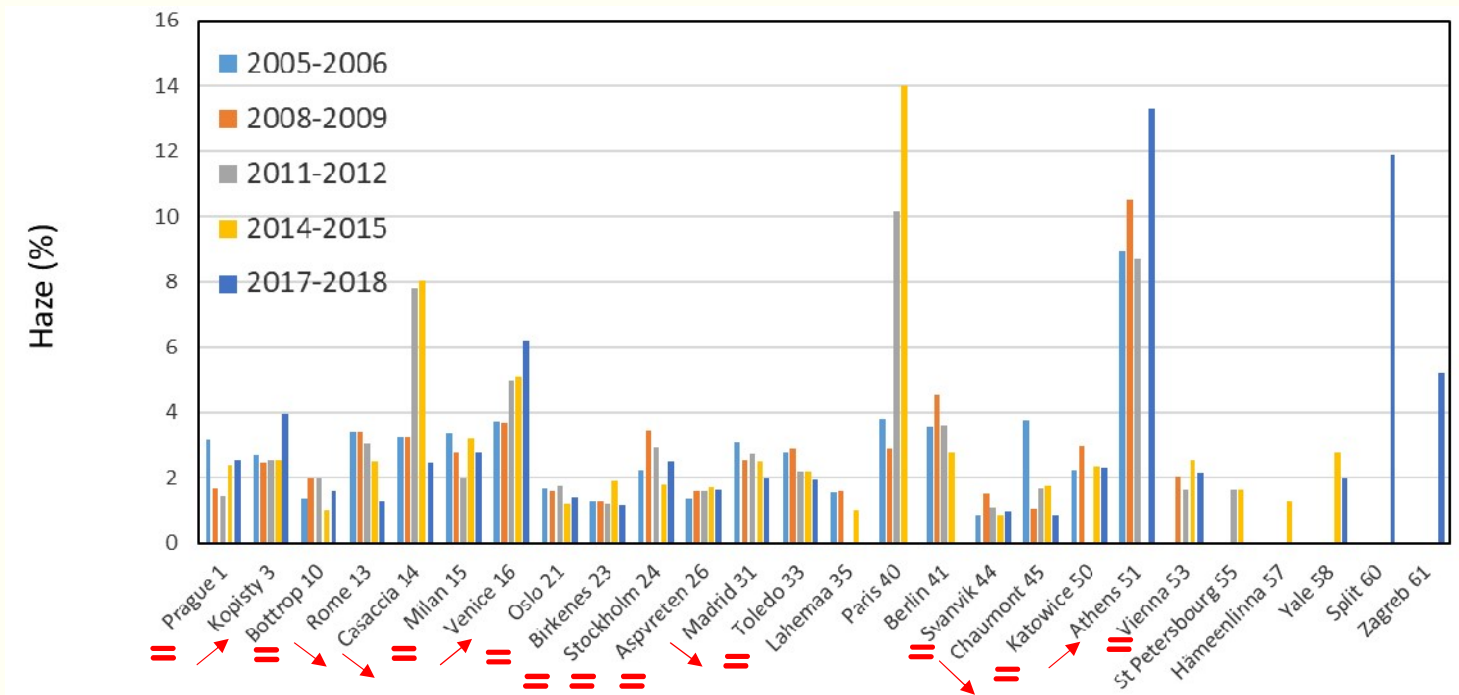
	glass T
1 Prague	24,8
3 Kopisty	42,9
10 Bottrop	22,0
13 Rome	8,9
14 Casaccia	9,2
15 Milan	20,5
16 Venice	16,2
21 Oslo	X
23 Birkenes	2,5
24 Stockholm	13,6
26 Aspvreten	X
31 Madrid	1,0
33 Toledo	4,5
40 Paris	lost
41 Berlin	not received
44 Svanvik	1,2
45 Chaumont	X
50 Katowice	X
51 Athens	X
53 Vienna	7,8
57 Hämeenlinna	Lost
58 New Haven	X
59 Zilina	broken
60 Split	31,9
61 Zagreb	16,7



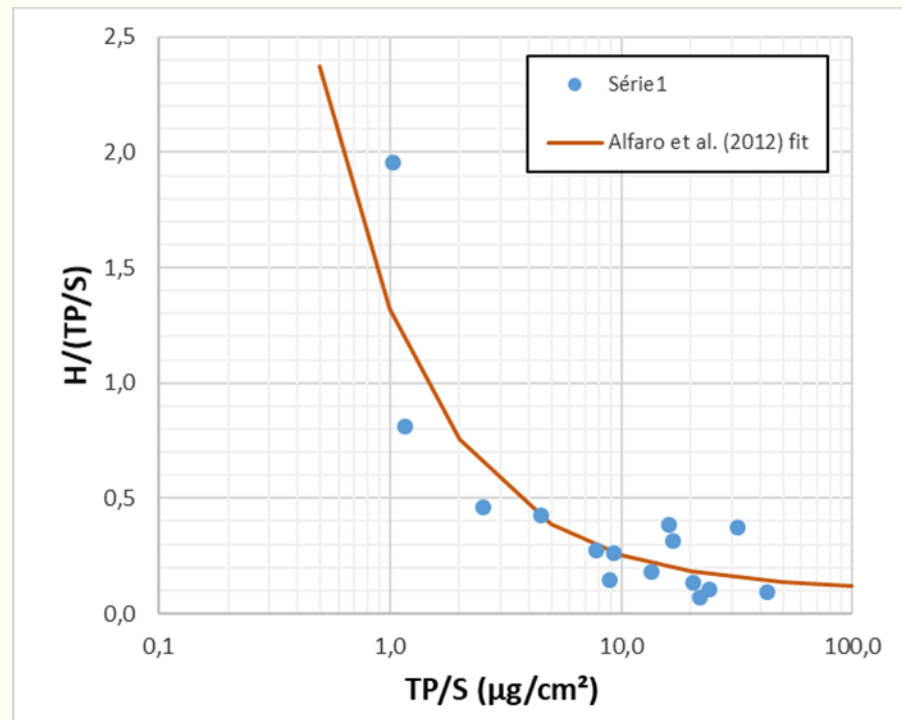
▪ Haze (%)

$$H = \frac{Td}{TL} \times 100$$

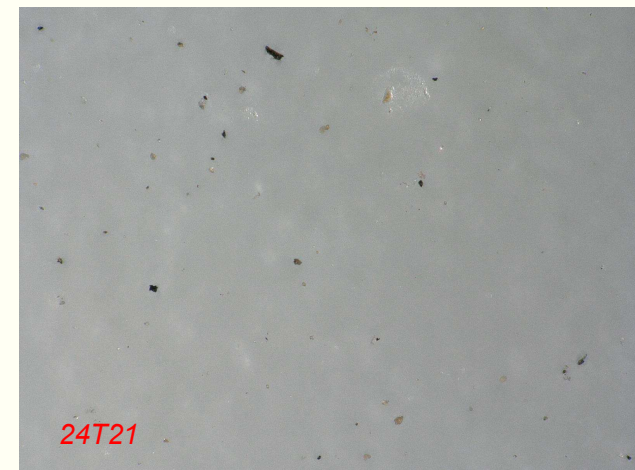
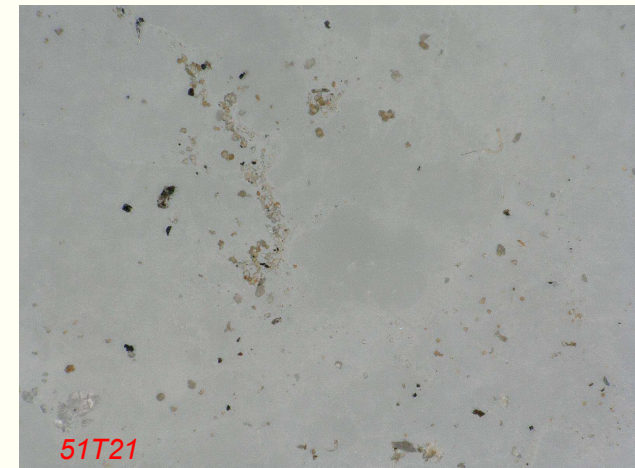
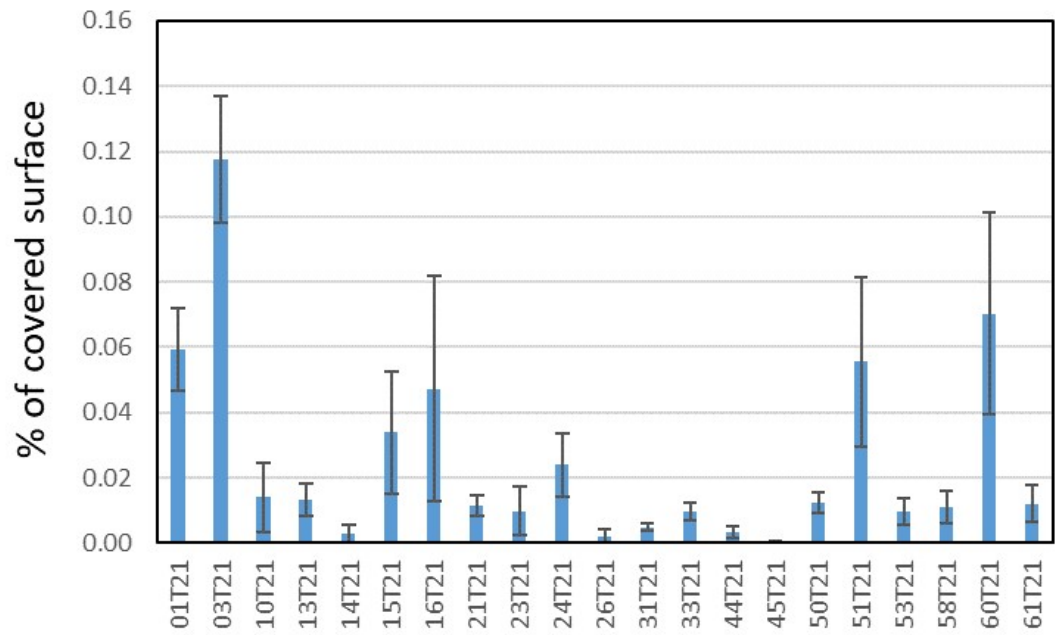
	glass T
1 Prague	2,5
3 Kopisty	4,0
10 Bottrop	1,6
13 Rome	1,3
14 Casaccia	2,4
15 Milan	2,8
16 Venice	6,2
21 Oslo	1,4
23 Birkenes	1,2
24 Stockholm	2,5
26 Aspvreten	1,6
31 Madrid	2,0
33 Toledo	1,9
40 Paris	lost
41 Berlin	not received
44 Svanvik	0,9
45 Chaumont	0,8
50 Katowice	2,3
51 Athens	13,3
53 Vienna	2,1
57 Hämeenlinna	Lost
58 New Haven	2,0
59 Zilina	Broken
60 Split	11,9
61 Zagreb	5,2



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- Correlation between mass and haze



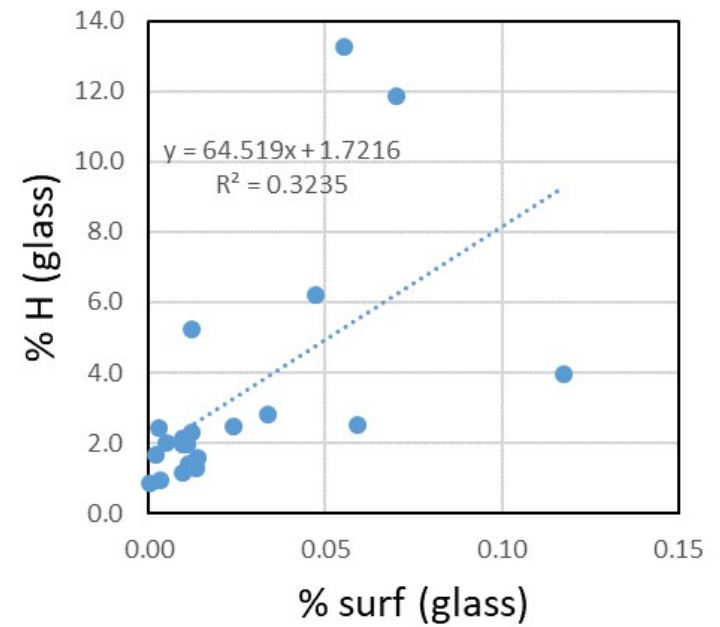
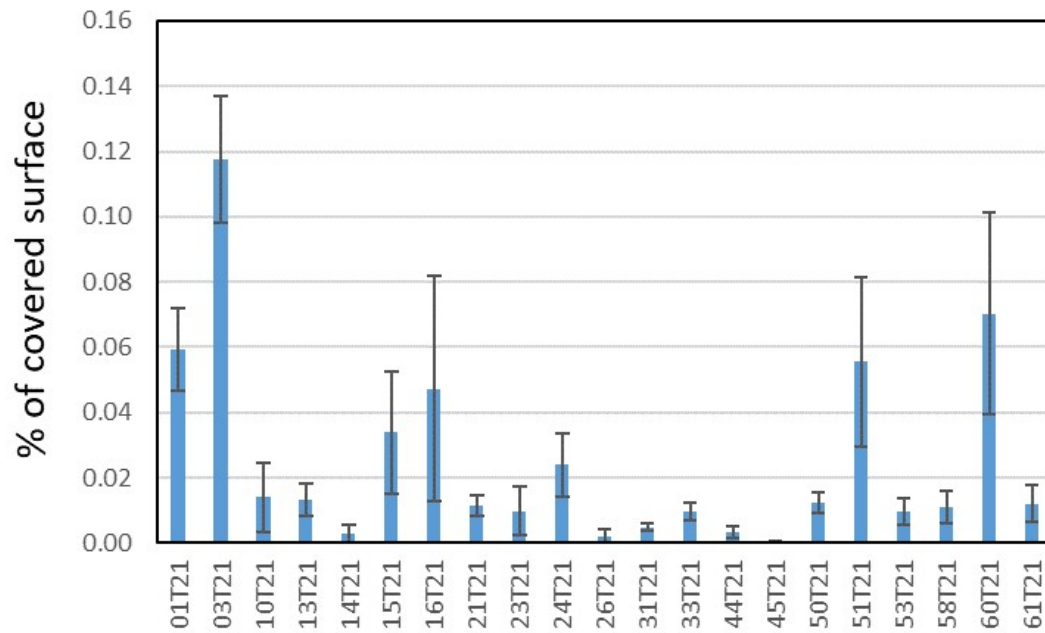
- Percentage of covered surface



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- Percentage of covered surface

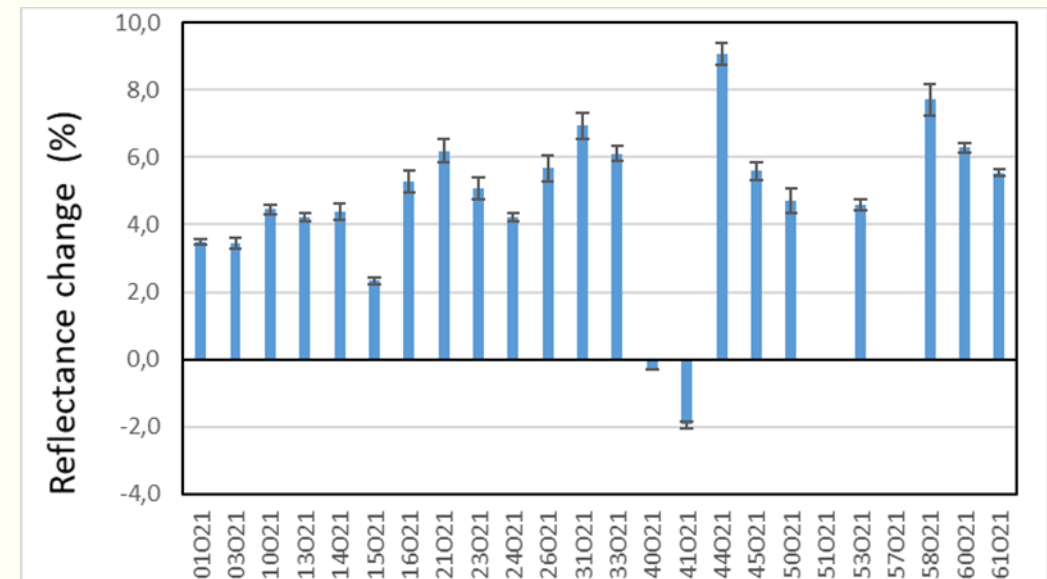
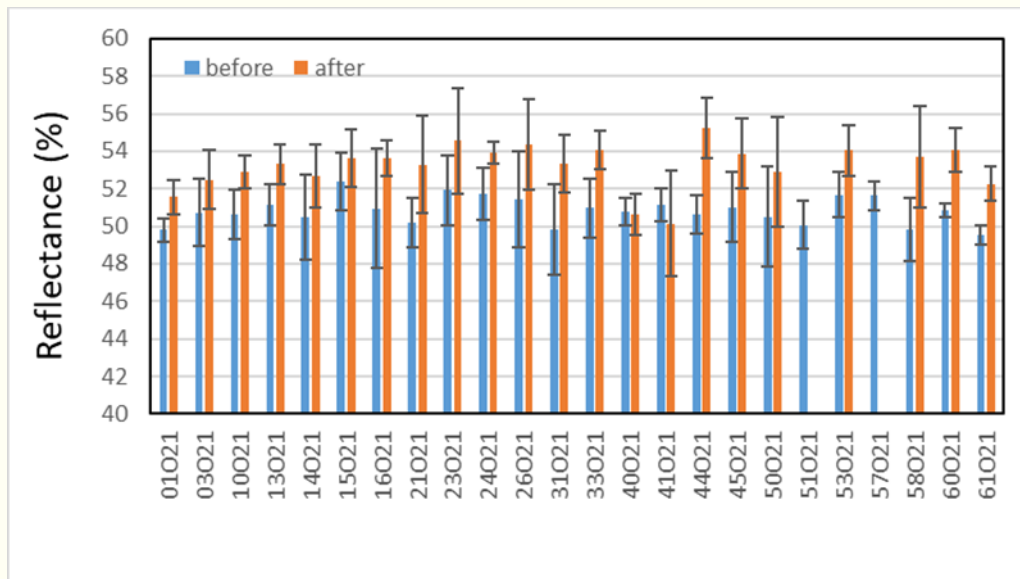




# LIMESTONE

- No mass data (too much loss of material during the ship)
- Measurement of the reflectance

$$\% R \text{ change} = \frac{(R - R_0)}{R_0} \times 100$$

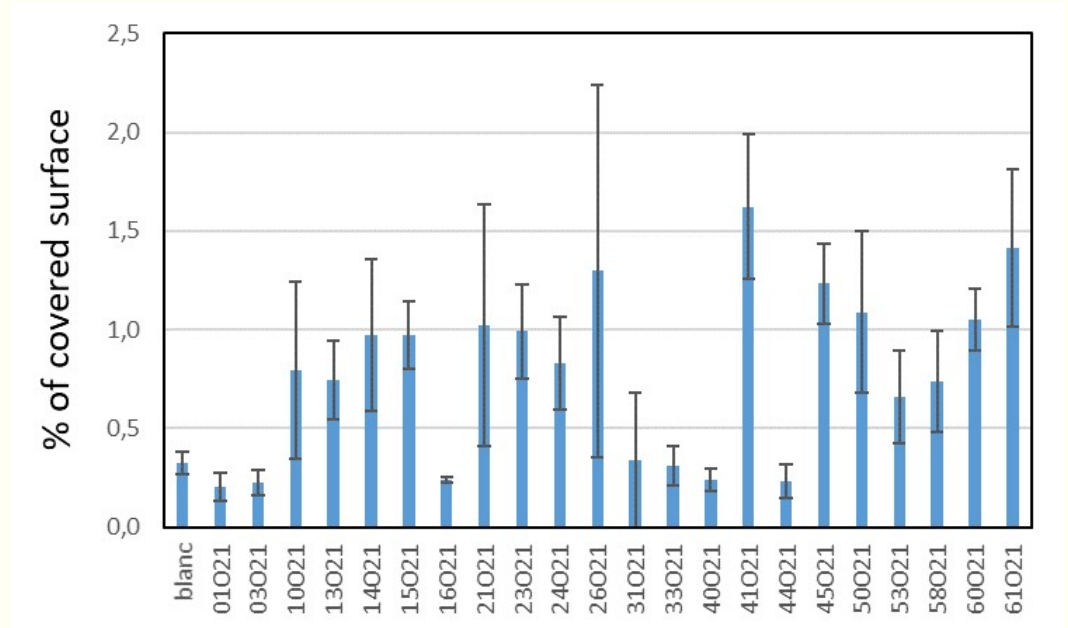
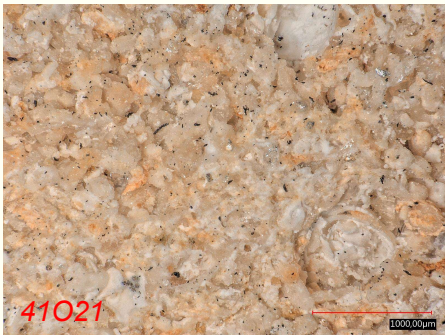


⇒ Increase of the reflectance (already observed in the first stages) except for Paris and Berlin

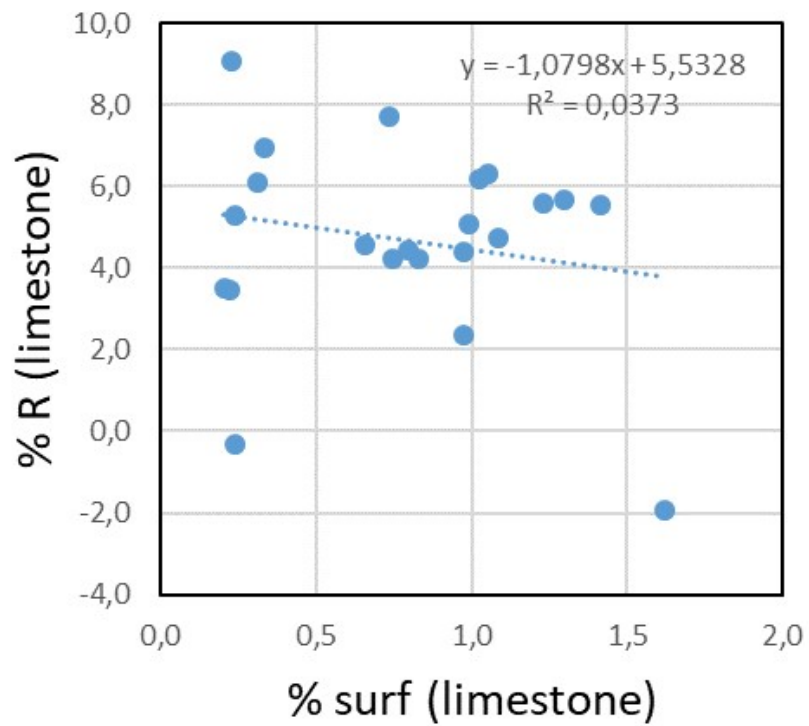
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- Percentage of covered surface



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- Correlation between % covered surface and % reflectance

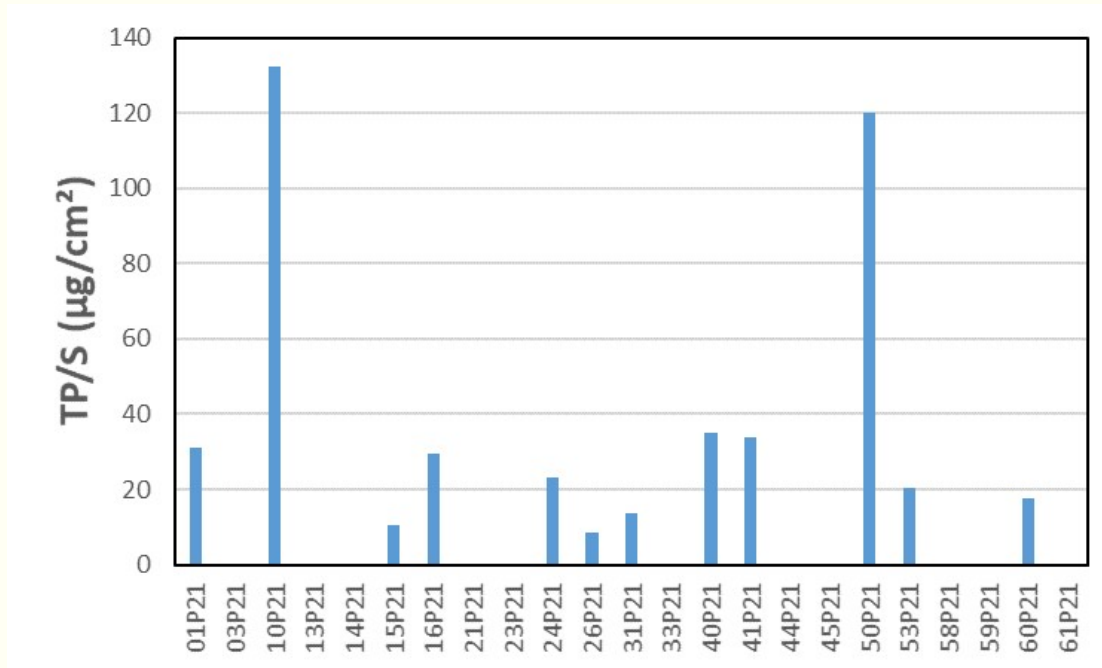


⇒ No clear correlation

# MARBLE

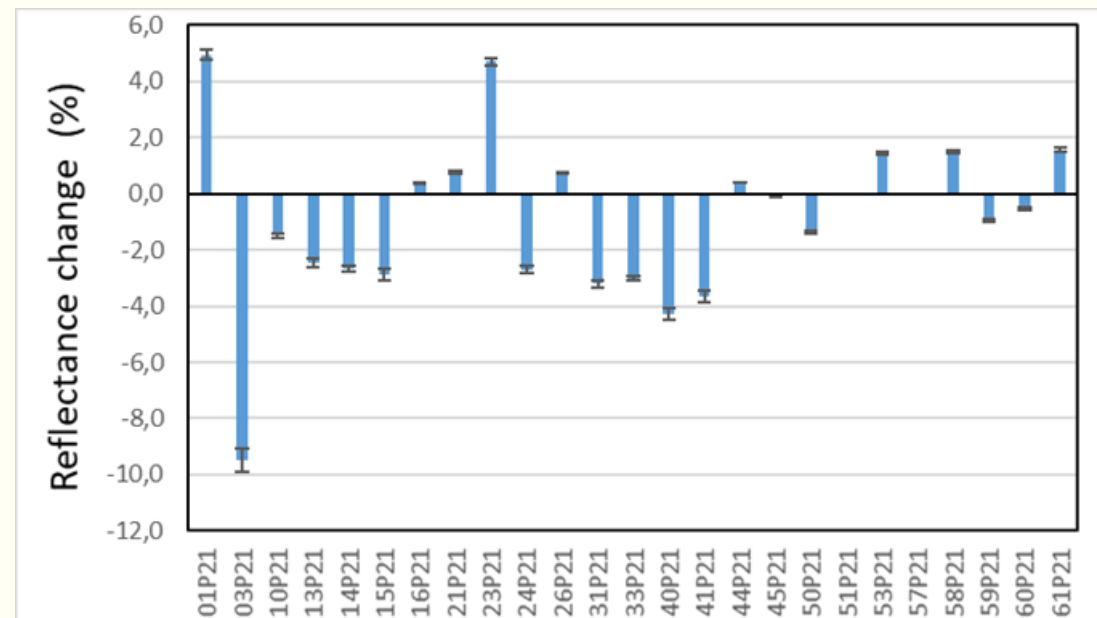
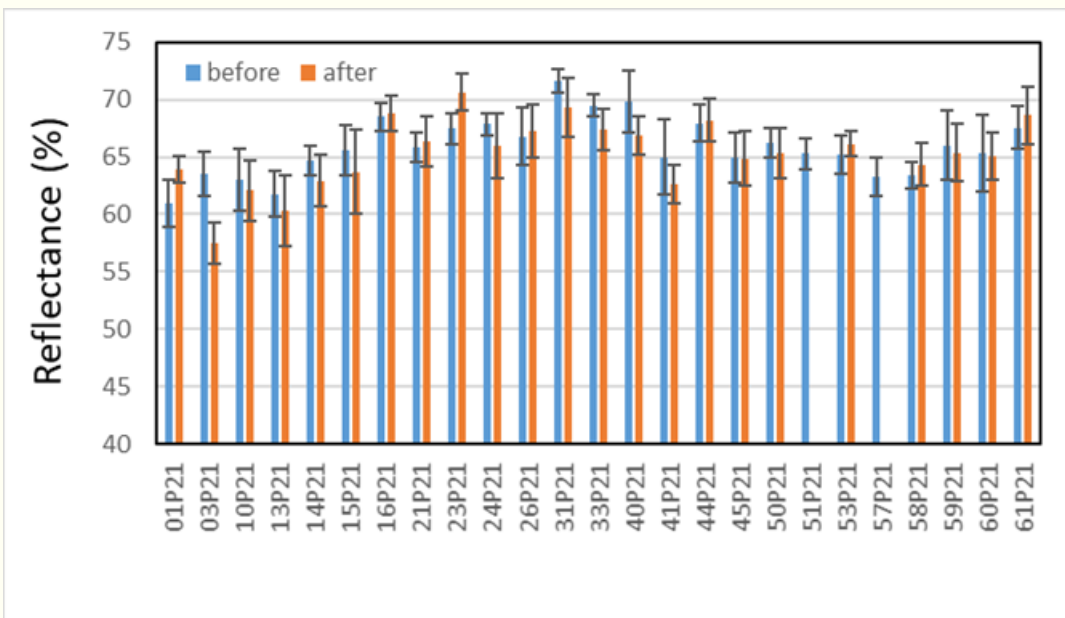
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- Mass: a lot of uncertainties



# MARBLE

- Reflectance:

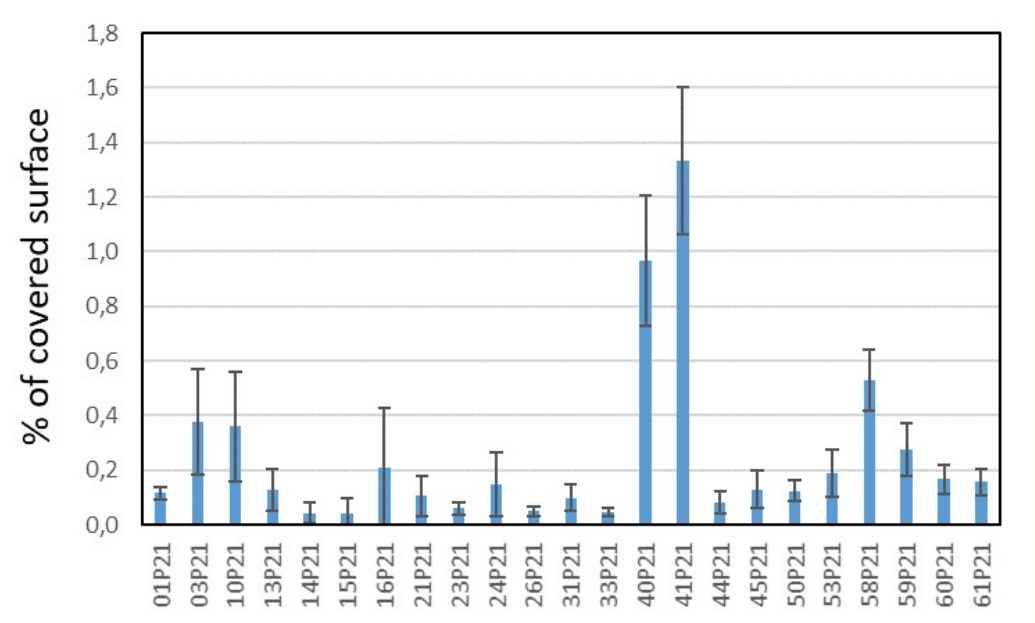
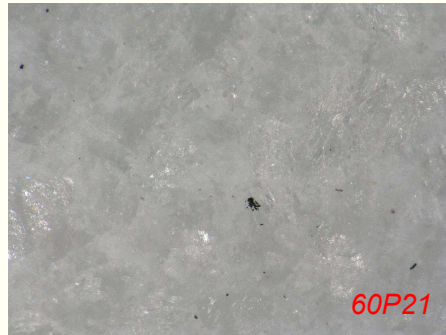
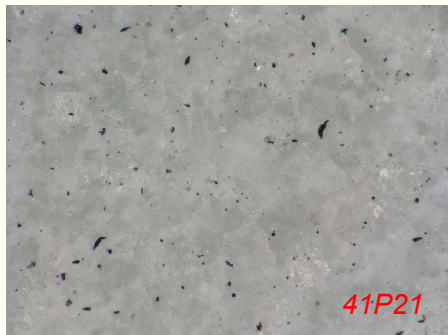
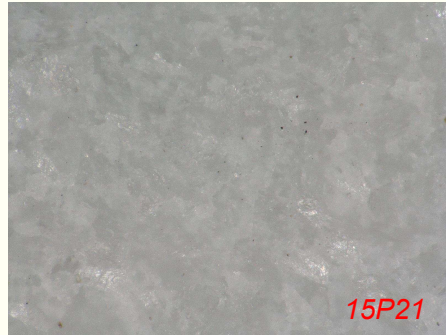
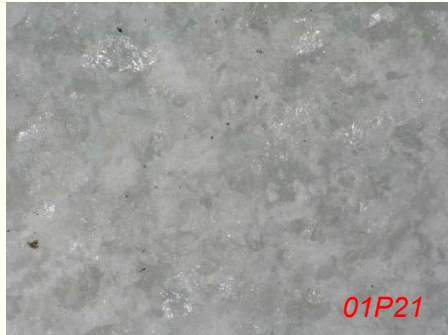


⇒ Increase or decrease of the reflectance

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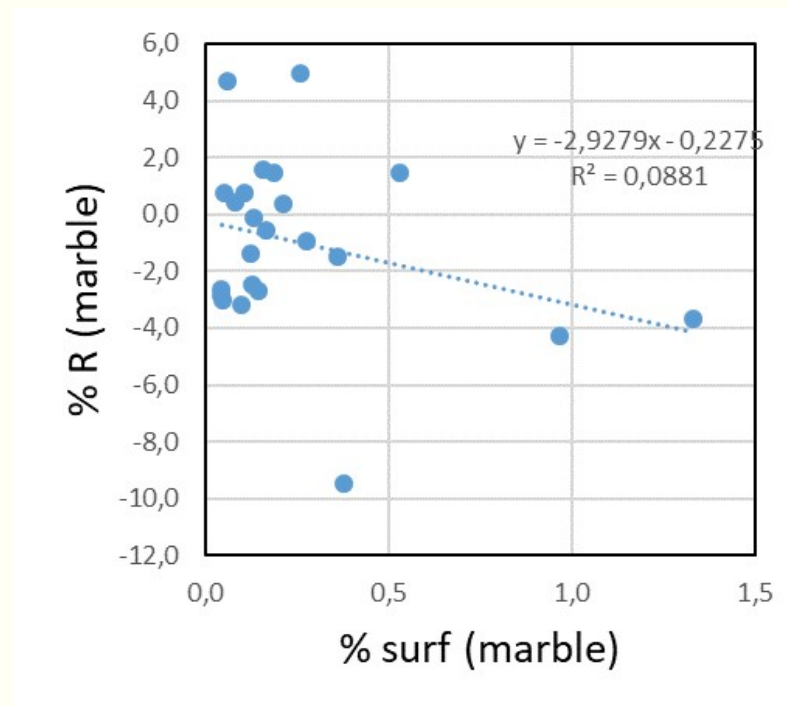
- Percentage of covered surface



# MARBLE

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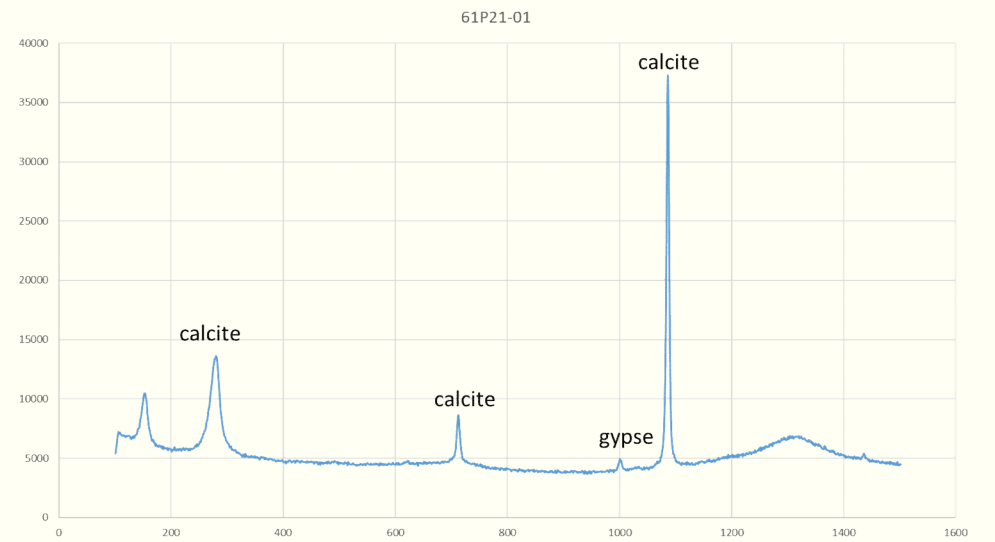
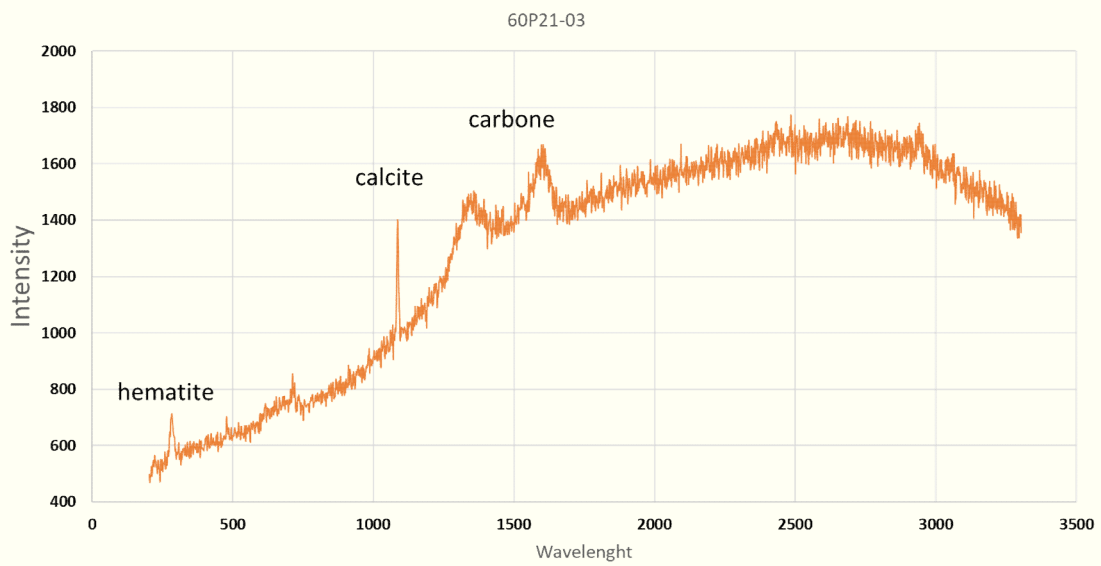
- Correlation between % reflectance change and % covered surface :



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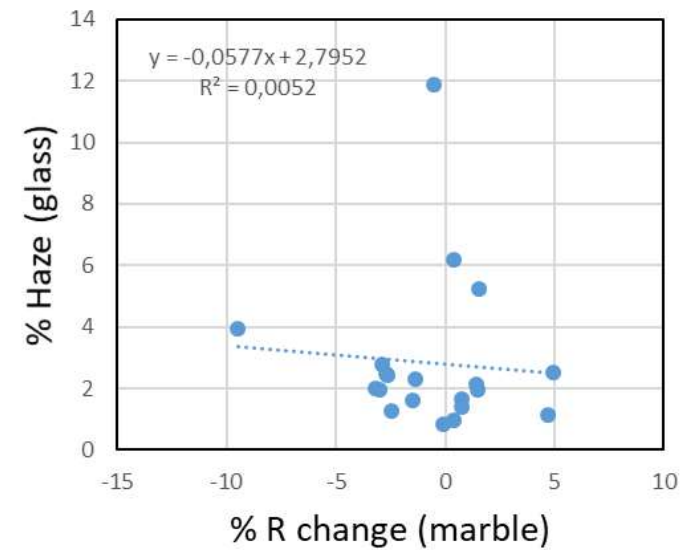
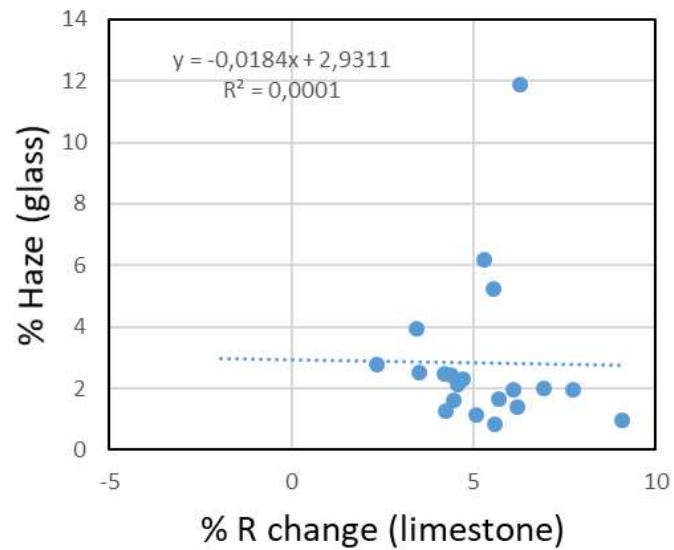
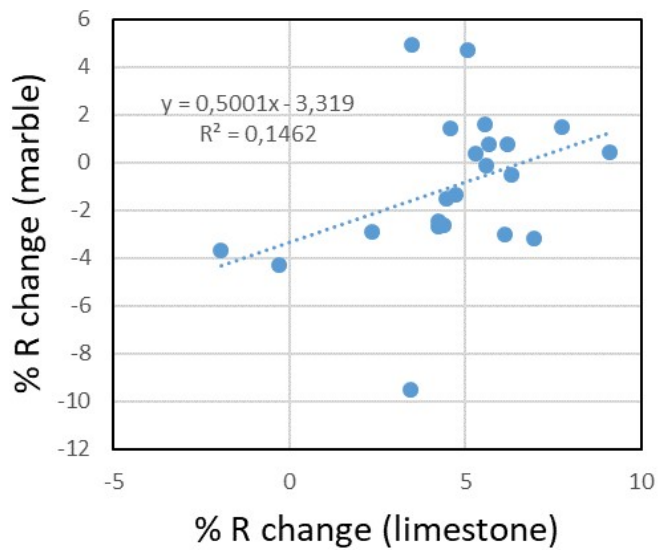
- Raman analyses of black spots





# Correlation between materials

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- ⇒ No clear correlation
- ⇒ Too short exposure time for stone samples?

## Summary and future prospects

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- Pursuit of the temporal trend of glass soiling
- New set of data to test the dose-response functions
- For the stone samples, the exposure time seems too small

→ longer campaigns (to be discussed) ? Local analyses ?

Next steps (ion chromatography for soluble species and ICP-MS for trace metals)