

## Summary of results

of  
material analysis of stucco decoration  
of cabinet and salon of

**Kamienica Pod Gruszką**  
ul. Szczepańska 1, Cracow, Poland

Carried out with the support of the STUCCO DECORATION ACROSS EUROPE project  
reg. č. 2022-1-CZ01-KA220-HED-000085652



The historical rooms, Cracow, Poland

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Prague 2025



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## Samples

Samples taken on February 11, 2025. House under the Pear.

SPH 1	A stucco fragment of a rose leaf. Wall panel decoration of the left-side window bay. Right window from the interior point of view.
SPH 2	A fragment from a leaf covering the rib. Top section of the vault. Repair (?)
SPH 3	A ball – typically additional piece to enrich the main stucco shapes.
SPH 4	Left side of the left window bay. Frame of the decoration panel.
SPH 5	Samples positioned under the frame SPH 4, 5A – stucco mortar corresponding to the background existing before the profiled frame. 5B – sample of the stucco mortars existing before the layer 5A which is superimposed. Both stuccoes are coated.
SPH 6	Fruit decoration – edge of a quince. The stucco sample contains a treated surface (coated?).
SPH 7	Fruit decoration or mortar in between the fruits. In the middle there is a hanging gap in which the shape is either missing or has never been fitted.
SPH 8	Adhesive mortar of the shape SPH 7 – the quince.
SPH 9	A coated render from the background. Plaster/stucco with a treated surface.

## Aim of the analysis

The material analysis is carried out as a part of Stucco Decoration across Europe Erasmus+ project (2022-1-CZ01-KA220-HED-000085652).

The research focuses on original stucco work from the late 17th century associated with the circle of artists around Baldassare Fontana (1661 Chiasso – 1733 *ibid.*). The aim is to describe the materials and stucco techniques used and thus create a basis for further research that can compare the findings with other contemporary works or build on them in an interdisciplinary manner with questions regarding authorship, preferences and knowledge of techniques and material processing, or even an assessment of the ability to use local resources, including the qualities they offer.

**Photodocumentation**









## Applied analytical methods

### Optical Microscopy (PLM)

Mortar characteristics and composition were analysed in detail by means of polarised light microscopy and scanning electron microscopy. For these microscopic observations polished cross-sections were prepared. The thin-sections were studied in plane (PPL) and crossed polarised transmitted lights (XPL), polished sections were studied in reflected (RL) and fluorescent (UV) lights using an Olympus BX53M microscope with digital camera Olympus DP27.

### Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS)

Scanning electron microscopy (SEM) was performed by using a Tescan MIRA II LMU instrument, with an energy dispersive analytical system (EDS) from Bruker AXS. The EDS measuring conditions were as follows: carbon coated polished surface, accelerating voltage of electrons 15 kV, WD of 15 mm, high vacuum. The images were taken with a back-scattered electron (BSE) detector. The sites where the elemental composition was determined were chosen with respect to the homogeneity of the measured areas.

### Thermal Analysis (TA)

The composition of the binder component of the mortars was characterised by a thermogravimetric analysis (TGA/DTG) and XRD. Firstly, coating layers were mechanically removed and the purged samples were gently crushed. The obtained material was passed through a sieve, the fraction below 63  $\mu\text{m}$  was used further for analyses.

The instrument SDT Q600 (TA Instruments) was used to measure thermal behaviour between 25°C and 1000°C for which a sample of approximately 10 mg was heated at the rate of 20°C/min in nitrogen atmosphere. Endothermic decomposition of calcite occurs between 600°C and 900°C, the exact temperature depends on the crystallinity, and the amount and type of calcium carbonate phase (**30**).

### X-ray powder diffraction (XRD)

A diffractometer D8Bruker Advance Pro (Cu K $\alpha$  radiation, 40 kV and 40 mA) with 0.01°C step size  $2\theta$  and counting time 0.4 s/step was used to acquire mineralogical data. The crystalline fraction was determined with combined Rietveld-RIR method.

Overview of the polished cross-sections (different scale)



SPH 1



SPH 2



SPH 3



SPH 4



SPH 5a



SPH 5b



SPH 7



SPH 8



SPH 9

**SPH 1**

Stucco decoration on the wall of the window niche. The sample is part of a flower petal. (6909), (6912)

**Aim of the analysis:** composition of the mortar and the coating layers

**Methods**

Documentation. Part of the sample was crushed, fraction under 63  $\mu\text{m}$  was used for XRD and TA, the other part was used to make a polished section for microscopic analyses optical microscope and SEM-EDS.

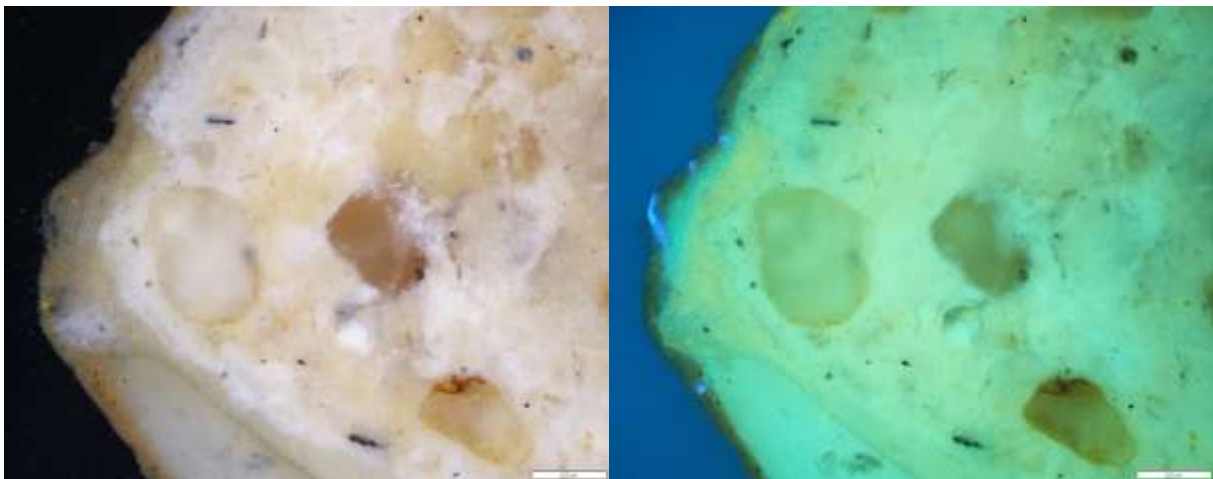


Sample SPH 1 DSC\_7208, DSC\_7209



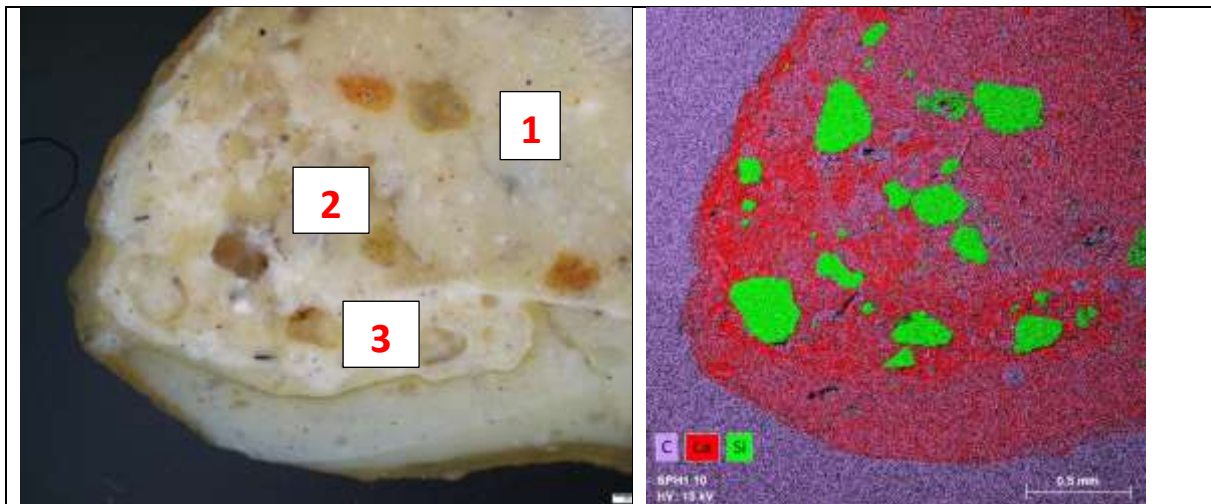
**Polished section**

Mortar: binding matrix with aggregate, largest grains under 0.5 mm, local cracks, contains gypsum particles. Tip of the leaf shows several repair/remodelling (?) layers.

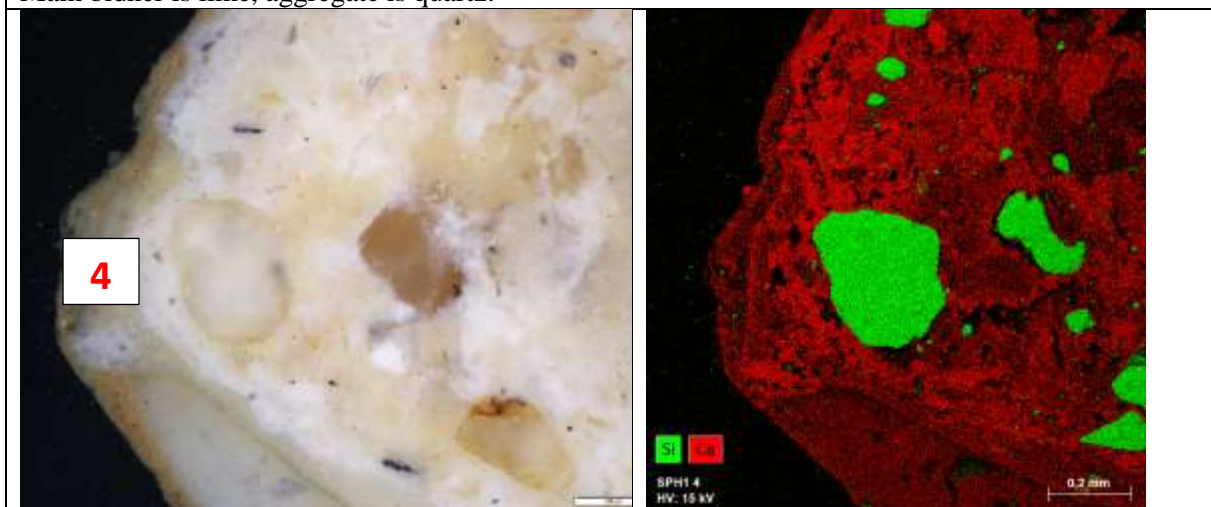


Detail of the tip. The mortar is coated, top layer is orange, as also visible on macroscopic scale.

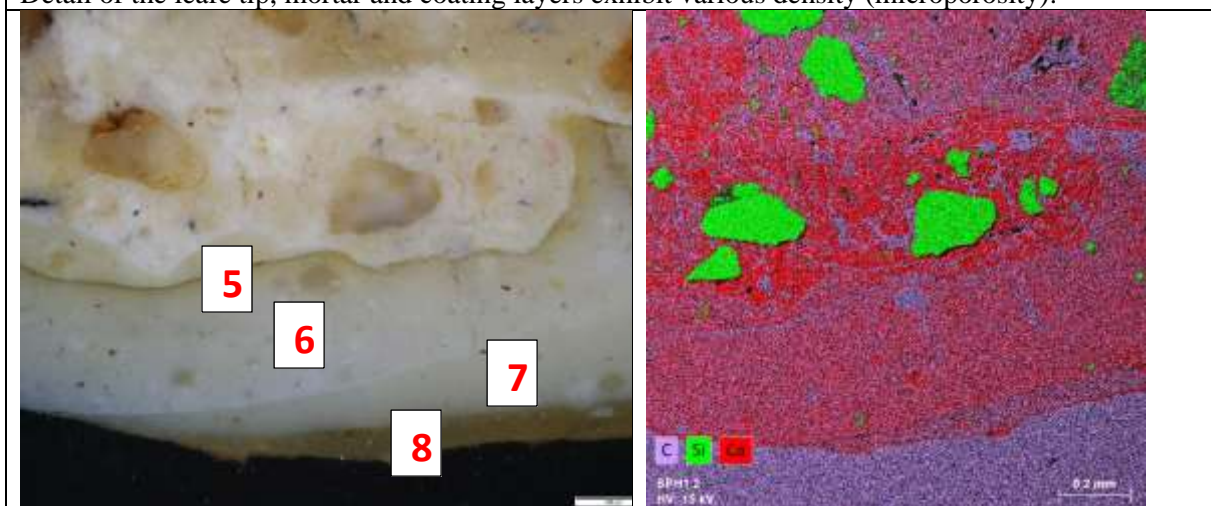
SEM-EDS




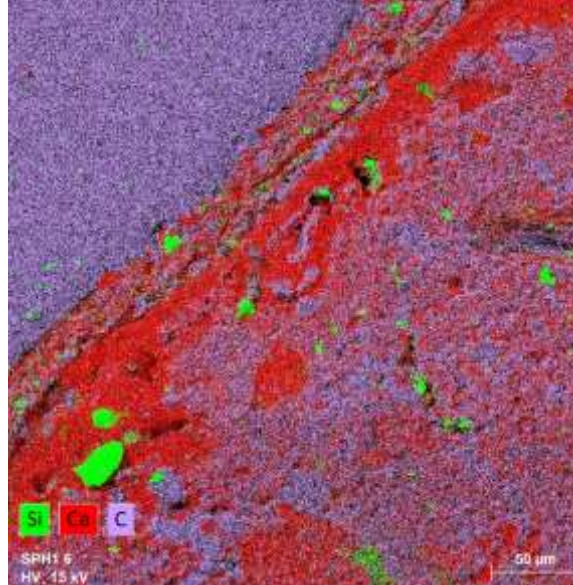
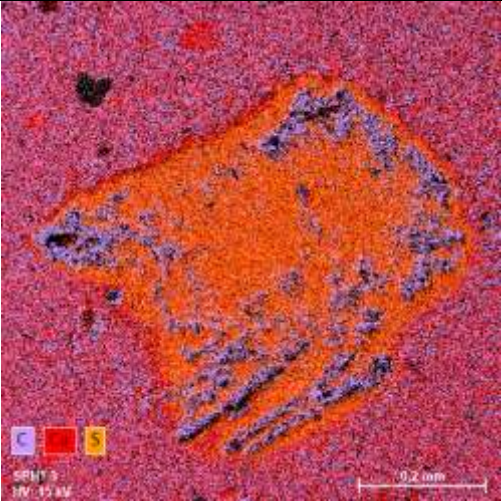
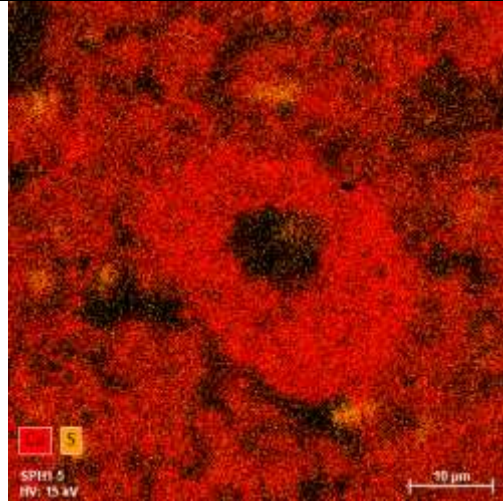
Main binder is lime, aggregate is quartz.



Detail of the leaf tip, mortar and coating layers exhibit various density (microporosity).



Coatings are composed of lime binder, they vary in density.

	 <p>SPH1 5 HV: 15 kV 50 µm</p>
<p>Orange coating on top is composed of lime binder, iron yellow and chromium green.</p>	
 <p>SPH1 5 HV: 15 kV 10 µm</p>	 <p>SPH1 5 HV: 15 kV 10 µm</p>
<p>BRP composed of gypsum (<math>\text{CaSO}_4</math>), sharp edges suggest it was crushed, high porosity points to dissolution.</p>	<p>BRP – lime particle, core contains <math>\text{SiO}_2</math>. Scattered gypsum.</p>

**SEM – point analysis**

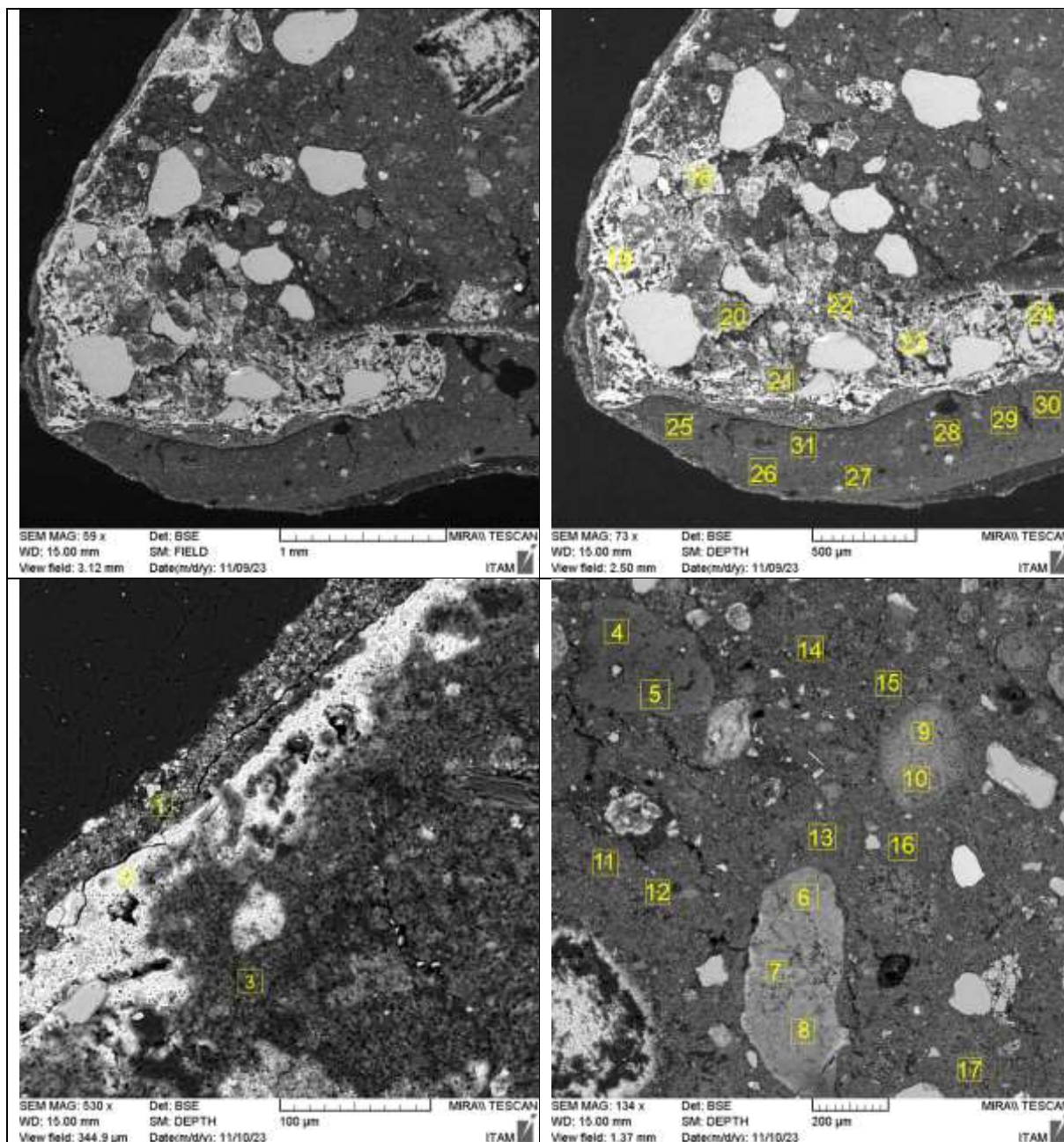


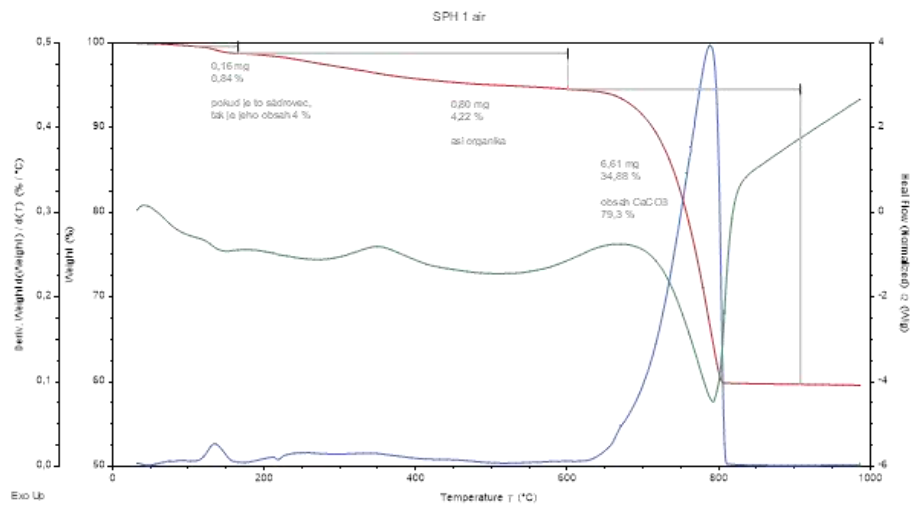
Table 1. Description of the layers observed in the cross-section SPH1.

Layer No	Description
1	Light cream plaster
2	The area between layer 1 and 2 could be a deteriorated part of L1
3	Secondary plaster
4	Secondary coating/surface smoothing layer
5	Ochre layer – organic conservation material or paint layer
6	Smoothing layer
7	Smoothing layer
8	Ochre paint layer

Table 2. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	FeO	SO <sub>3</sub>	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Cr <sub>2</sub> O <sub>3</sub>	Cl	Interpretation
31	92.5	1.1	1.6	0.5		2.5	1.2				0.6	L6
30	92.9	1.0	1.6	0.6		1.7	1.3		0.3		0.6	
29	94.7	0.5	1.4			1.9	0.9				0.5	
28	93.8	0.9	2.0	0.4		1.6	0.7				0.6	
27	92.2	1.3	2.1	0.7		1.7	1.4				0.6	
26	92.8	1.1	1.7	0.7		1.8	1.4				0.6	
25	89.6	1.3	2.5	1.0		2.2	1.5		1.1		0.8	
24	91.5	0.6	2.8	0.7	1.3	1.1	1.2		0.4		0.3	L3
23	94.0	0.4	1.9	0.5		2.1	0.9	0.0			0.3	
22	94.8	0.2	2.0	0.2		1.7	0.5	0.1			0.4	
21	92.0	0.7	3.2	0.8		1.6	1.2	0.3			0.4	
20	86.8	1.2	3.2	1.3		4.8	1.9				0.7	
19	97.1	0.2	0.8	0.2		1.0	0.6	0.2				
18	95.2	0.6	1.0	0.4		1.3	1.1	0.2			0.3	
17	91.8	0.7	2.8	0.5		3.2	0.5				0.4	L1
16	92.9	0.8	1.6	0.6		2.6	0.9				0.5	
15	91.7	0.9	1.9	1.2		3.1	0.8				0.5	
14	93.7	0.7	1.3			2.8	0.5		0.6		0.5	
13	93.7	0.8	1.5	0.3		2.7	0.6				0.3	
12	93.0	0.7	1.6	0.3		3.2	0.7				0.5	
11	91.0	0.9	2.5	0.6		3.5	0.9				0.6	
10	95.4	0.6	1.2			1.8	0.5				0.4	
9	96.4	0.6	0.8			1.6	0.3				0.3	
8	96.2	0.4	0.5			2.2	0.4				0.3	
7	96.2	0.3	0.7			2.0	0.3				0.3	
6	96.2	0.5	0.6			2.0	0.4				0.3	
5	94.6	0.5	0.8			3.3	0.5				0.3	
4	93.8	0.8	1.0			3.2	0.6				0.5	
3	89.4	1.0	3.4	0.6		3.7	1.3				0.6	L2 or L3
2	95.3	0.3	0.6	0.3		2.2	1.1	0.3				L7 or L4
1	73.7	0.6	17.3	1.9	2.2	0.8		0.3		3.0	0.2	L8

## TA



4% gypsum and 79.3% carbonate. Hydrogen is developing ( $m/z$  41), which is a product of thermal decomposition in all non-aromatic hydrocarbons, so probably some organic matter, either added or obtained. Measured in air.

**XRD - QPA:** 91.1 calcite, 5.7 quartz, 3.2 gypsum

## SPH 2



A fragment from a leaf covering the rib. Top section of the vault. The small fragments are detached from the main bulk of the rib.

**Aims**

The two pieces look like additional repair layers. The aim of the analysis is thus confirmation of this observation. In addition, if confirmed that they are repairs, they can be associated with the same repair phases elsewhere including the coating sequence.

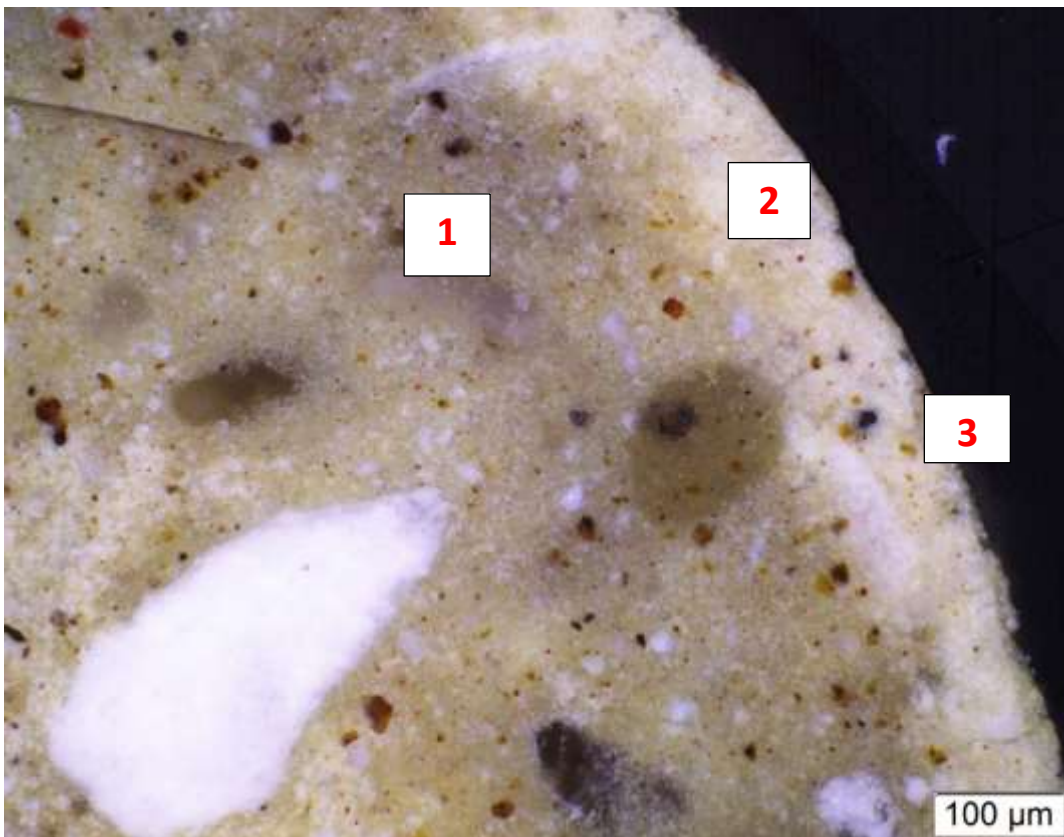
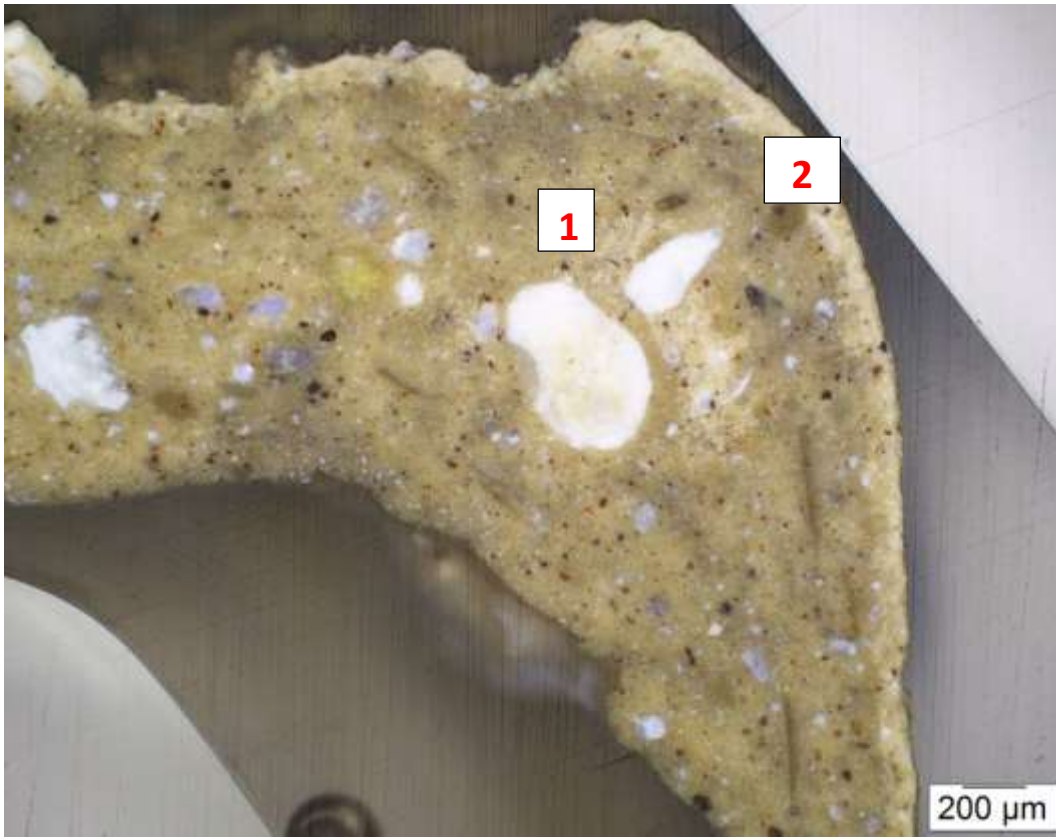
**Sample preparation**

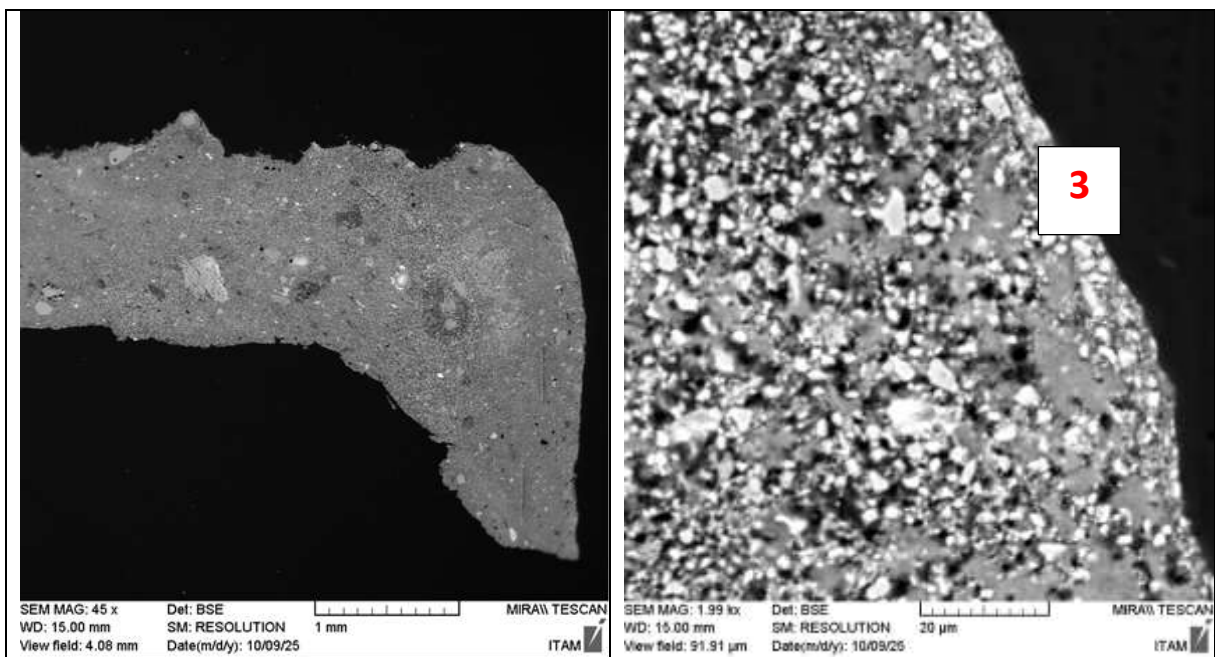
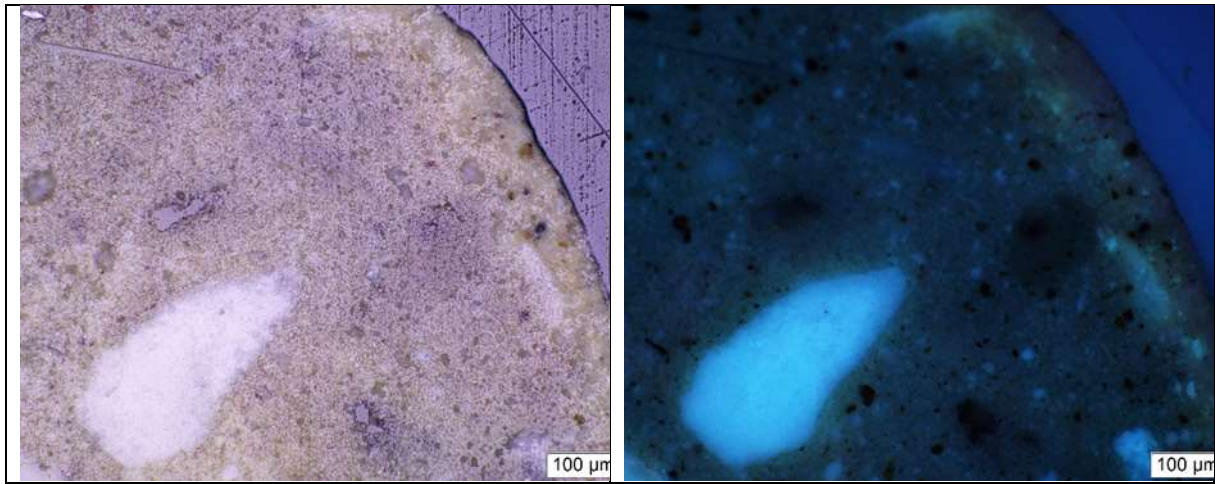
An L-shaped piece with white material at the back was selected for the analysis by means of OM and SEM EDS. Preparation of a polished section across.

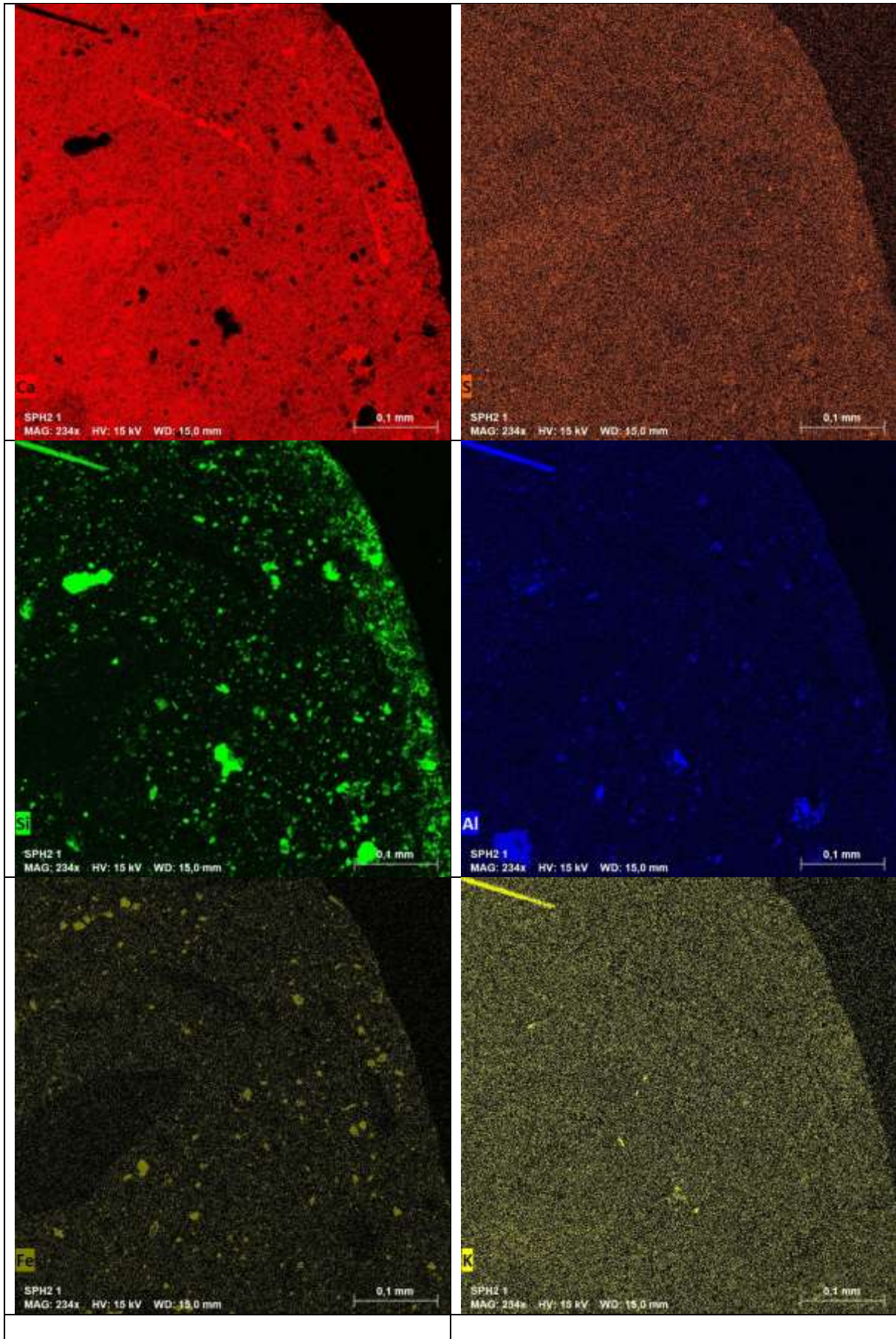
**Methods**

Polished section – OM, SEM+EDS

**Results**







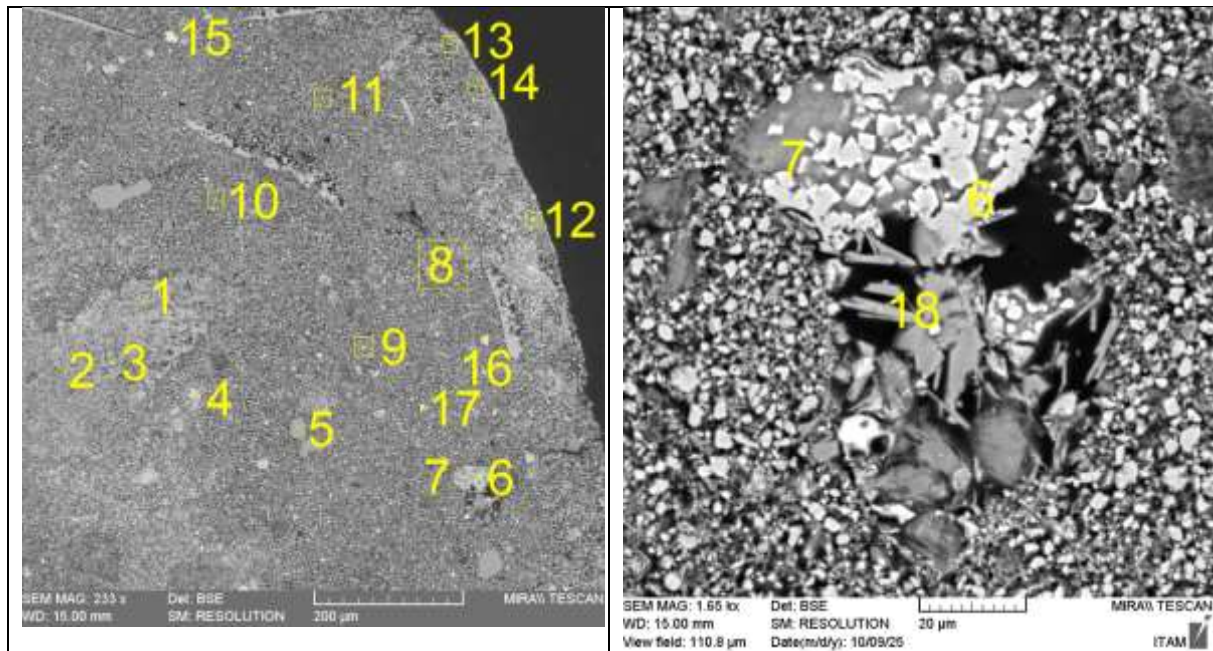


Table 3. Description of the layers observed in the cross-section SPH2.

Layer No	Description
1	Ochre plaster with big white calcitic particles and small brown iron rich spread in the layer; smooth contact with the overlying layer
2	The morphology of the layer is similar to layer 1, but the matrix is much lighter
3	Thin beige layer

Table 4. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	MnO	K <sub>2</sub> O	Na <sub>2</sub> O	Cl	Interpretation
18	68.0		1.0	28.2	1.0	1.9						L1 – degradation products
17	65.1				2.3		32.6					L1 : apatite?
16	5.6	2.0	18.2	3.3	55.9	0.7	0.6	12.6	0.3	0.8		L1: Fe-rich particle
15	4.3	1.0	17.0	1.6	62.4	0.6		12.7	0.3			
14	64.6	0.6	25.7	1.3	5.7	1.6					0.4	L2 – matrix composition
13	57.2	0.5	35.3	1.0	4.2	1.4					0.4	
12	68.1	0.5	23.2	1.0	5.1	1.8					0.3	L3
11	81.0	0.7	10.5	1.4	5.2	1.1						L1 – matrix composition
10	79.9	0.9	10.4	1.9	5.5	1.5						
9	85.3	0.8	6.8	1.5	4.5	1.1						
8	82.7	0.8	7.7	1.4	6.0	1.5						
7	25.5		74.0			0.5						L1 – degradation products
6	93.6		4.9			1.5						
5			100.0									L1 - quartz
4	6.8	1.7	15.7	2.9	65.5	0.6	0.6	5.8	0.3			L1: Fe-rich particle
3	93.8	0.6	3.4			2.3						L1. White calcitic particle
2	95.3	0.6	2.8			1.4						
1	92.6	1.1	4.0	0.6		1.8						

## SPH 3

**Aims**

The ball is likely to be original and thus contain information about the material used for small stucco pieces. The coating stratigraphy could show several treatments since the original phase. The ball was attached to the surface profile with a different mortar – an adhesive mortar, possibly based on gypsum.

**Sample preparation**

CT – 3D model based on X-ray  
Cut to halves – fine saw  
Polished thin section  
Polished section – just coatings

**Methods**

PLM, SEM EDS

TA – whole stucco mortar

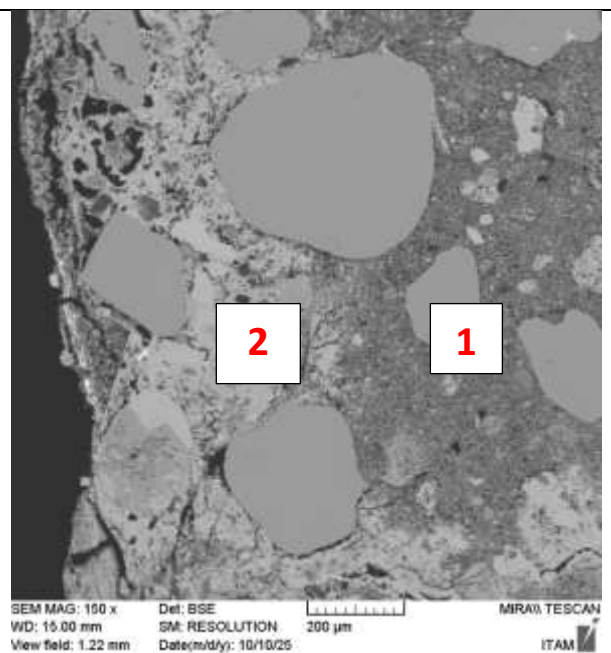
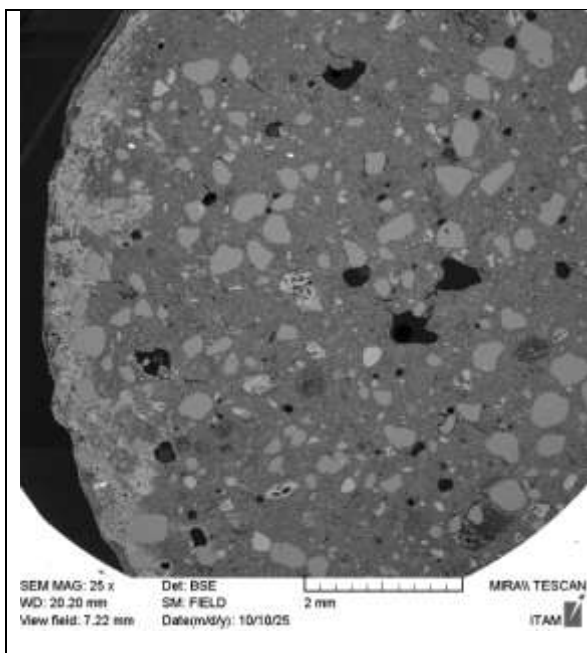
Organic additives in the stucco

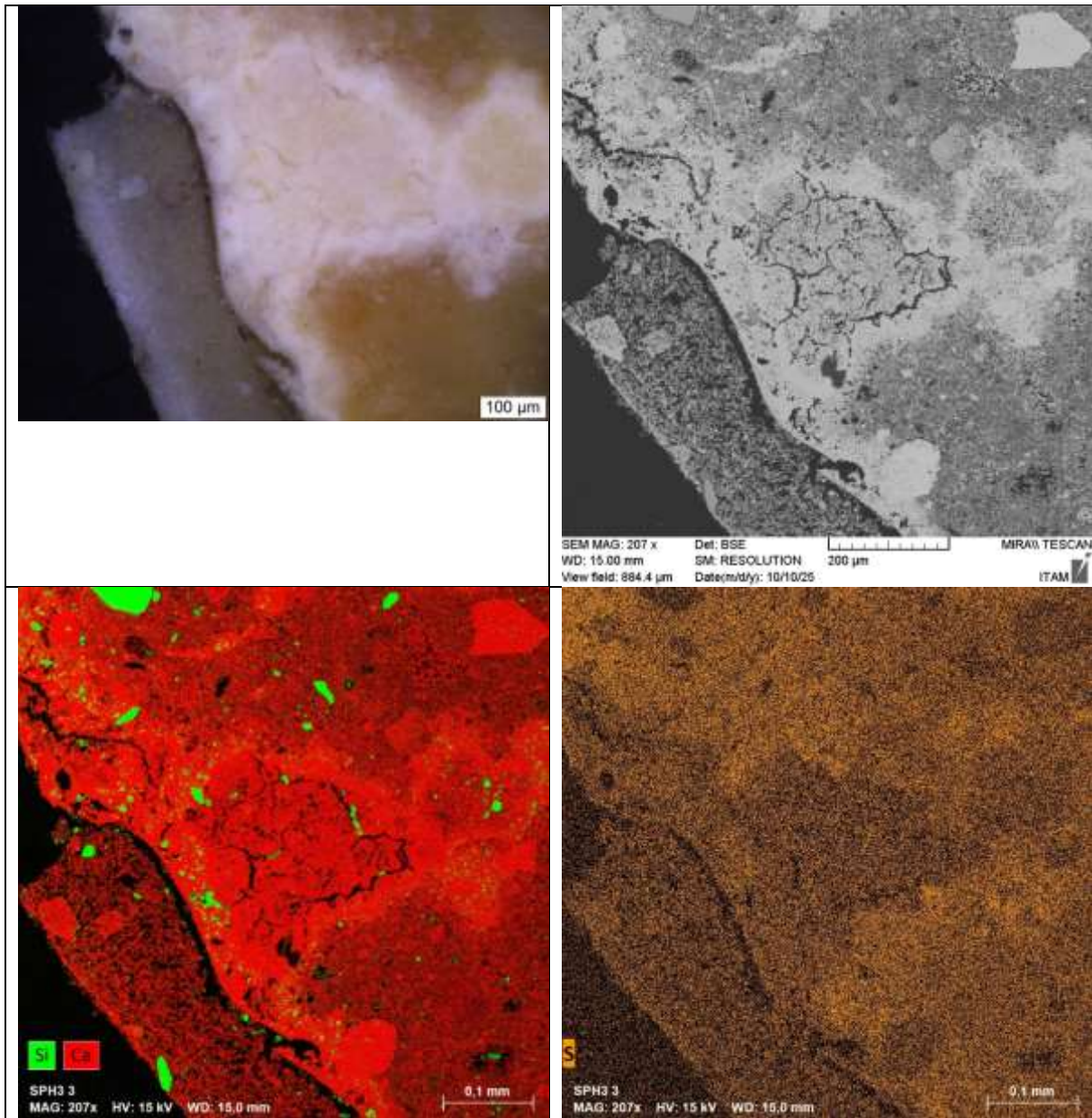
Coating – FTIR to identify PVA?

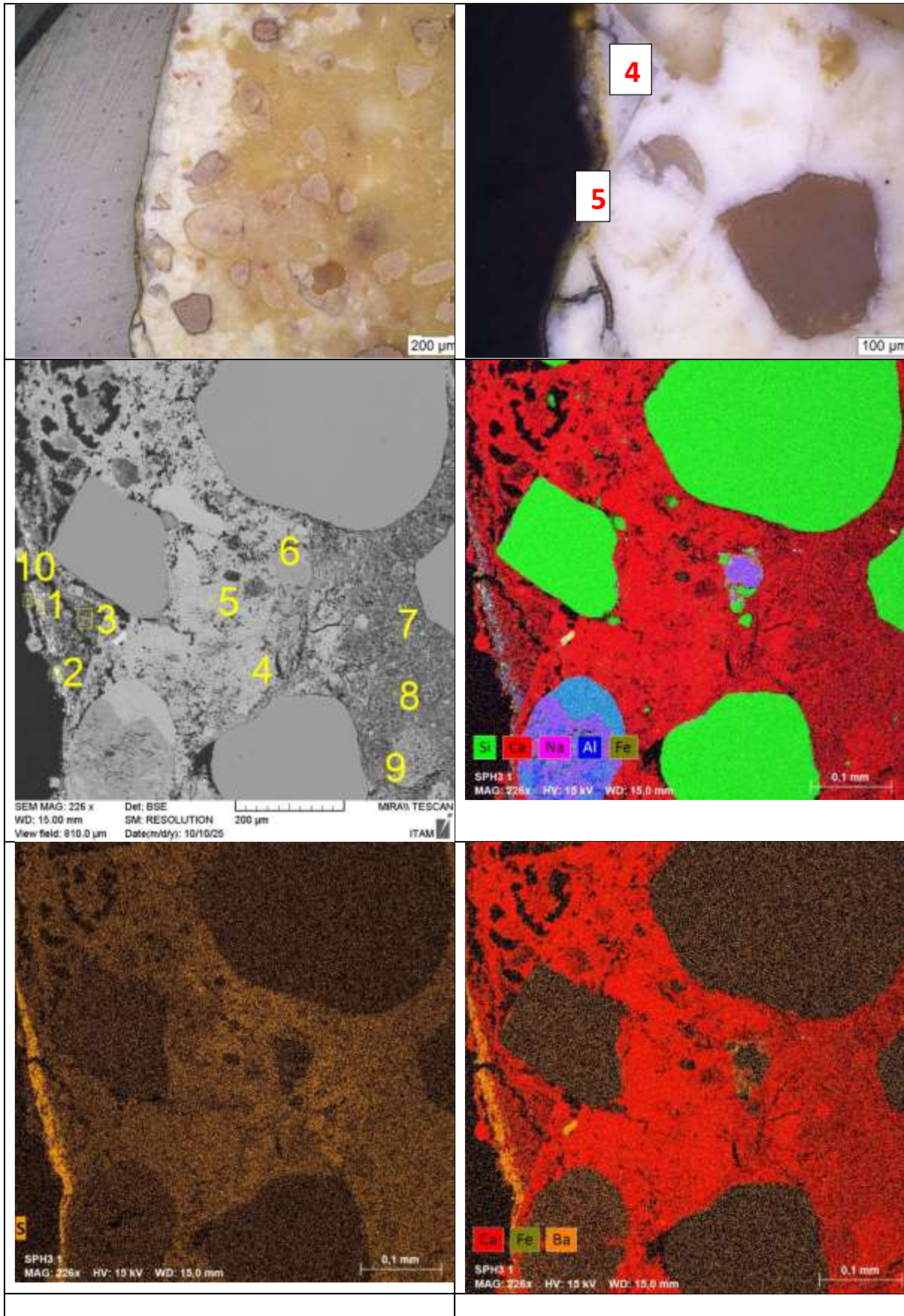
Stucco – proteomic analysis

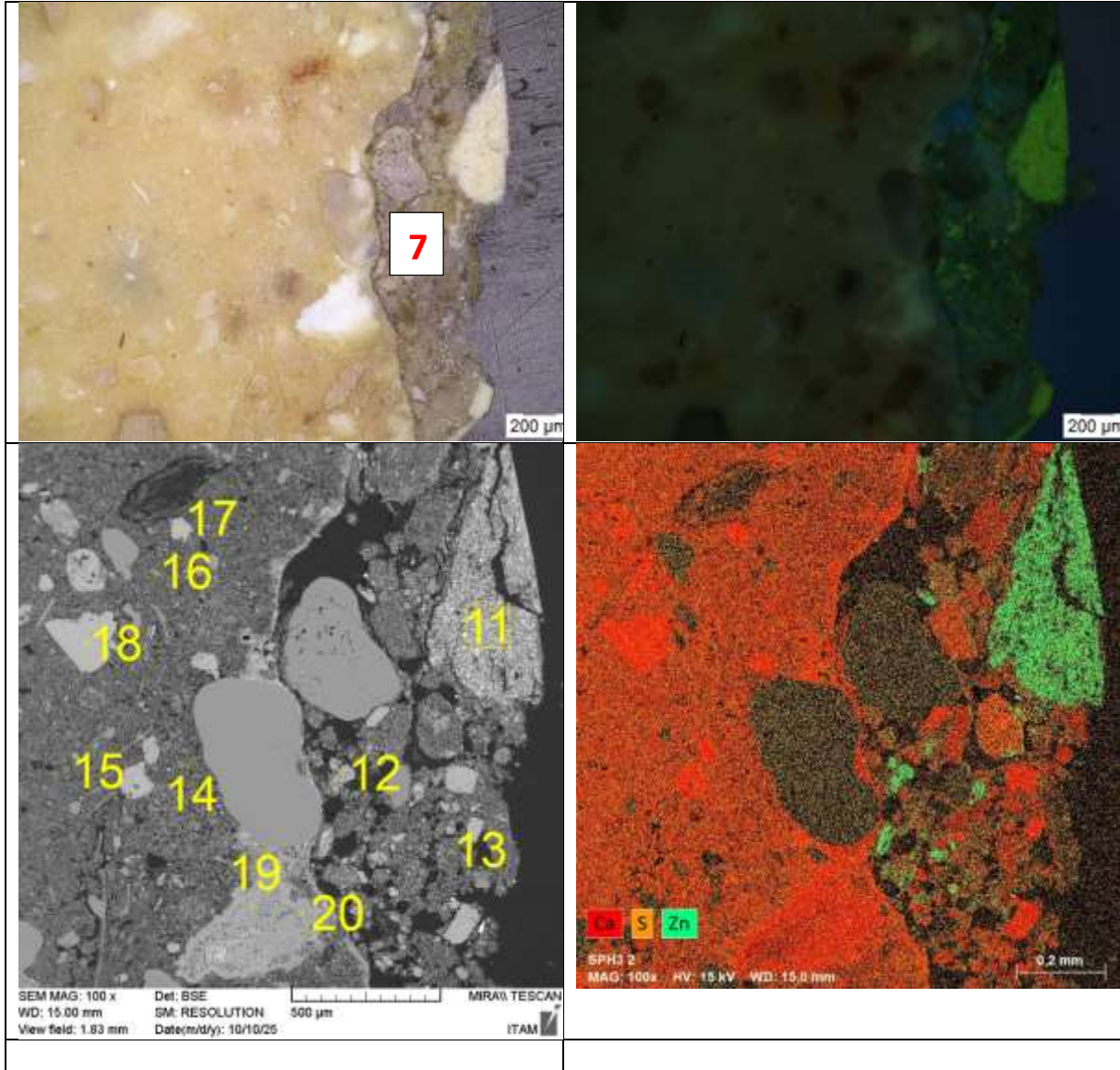
## Results











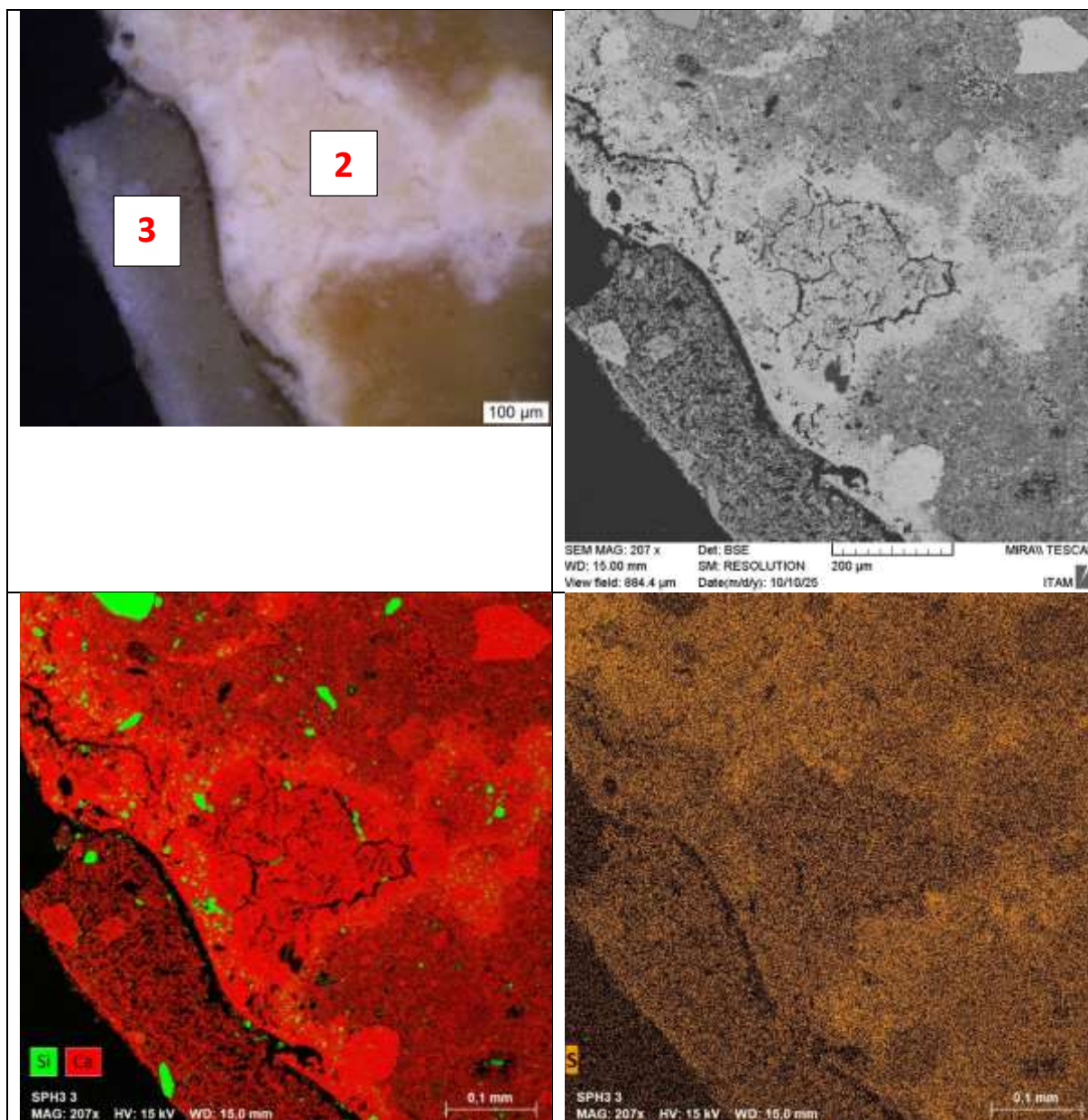


Table 5. Description of the layers observed in the cross-section SPH3.

Layer No	Description
1	Ochre plaster; the colour of the matrix seems lighter in the middle of the “ball”; this might be the result of impregnation of the surface; smooth contact with the overlying layer
2	The morphology of the layer is similar to layer 1, but the matrix is much lighter
3	Thick limewash layer; discontinuous
4	Limewash linked rather to layer 5
5	Yellow paint layer contains barium white, produced on large scale from 1830/1850
6	Deposits or paint layer
7	The chronology of the layer is uncertain; based on the presence of ZnO, it could come from the same period as layer 5

Table 6. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	ZnO	BaO	K <sub>2</sub> O	Na <sub>2</sub> O	Cl	Interpretation
20	97.8		0.7				1.5						L1 – white, calcitic BRP particle
19	99.4		0.6										
18	99.3												L1 – crushed marble
17	98.6	1.4											
16	92.9		3.6			3.5					0.8		L1 – matrix from calcium carbonate and gypsum
15	88.9	1.4	4.1	0.6		4.0	1.0						
14	86.1	0.8	7.2	1.2		4.0							
13	90.5		3.3			5.0							L7 – matrix from calcium carbonate with small amount of gypsum
12	0.4		17.0	12.5		0.7		68.1		1.3			L7 – layer containing zinc white
11	0.6		41.6	15.3		0.6		40.6		1.3			
10	70.3	1.0	15.1	3.1	7.3	1.2	1.6					0.5	L6 – deposits or thin white wash
9	82.2	0.8	9.4	2.3		3.6	0.8					0.4	L1 – matrix composition: calcium carbonate with small amount of gypsum and aluminosilicates coming from clay?
8	85.1	0.9	7.7	1.7		3.4						0.5	
7	90.5		4.7	0.9		3.3						0.6	
6	96.7					3.3							L2 – white area – calcium carbonate with small amount of sulphur
5	97.1		0.7			1.4							
4	94.5		2.0			2.9							L4 – limewash
3	86.9		8.1	1.1		2.2						0.9	
2	11.1		20.6	7.4	2.3	19.5			37.0	1.3			L5 – paint layer barium white, iron yellow
1	11.9	0.5	28.0	14.1	6.8	12.2			23.8	2.0			

**SPH 4****Aim**

The profiled frame of the decorative panel seems to be added later, possibly also other repairs were carried out on the background and the flowers. The aim is to determine the composition of the repair and compare it with SPH 2. The repair is coated – determination of the stratigraphic sequence.

**Sample preparation**

Separation of the film layer under stereomicroscope.

Powdered sample (not selective but probably without the coating) – TA

Piece with surface finish – polished section.

**Methods**

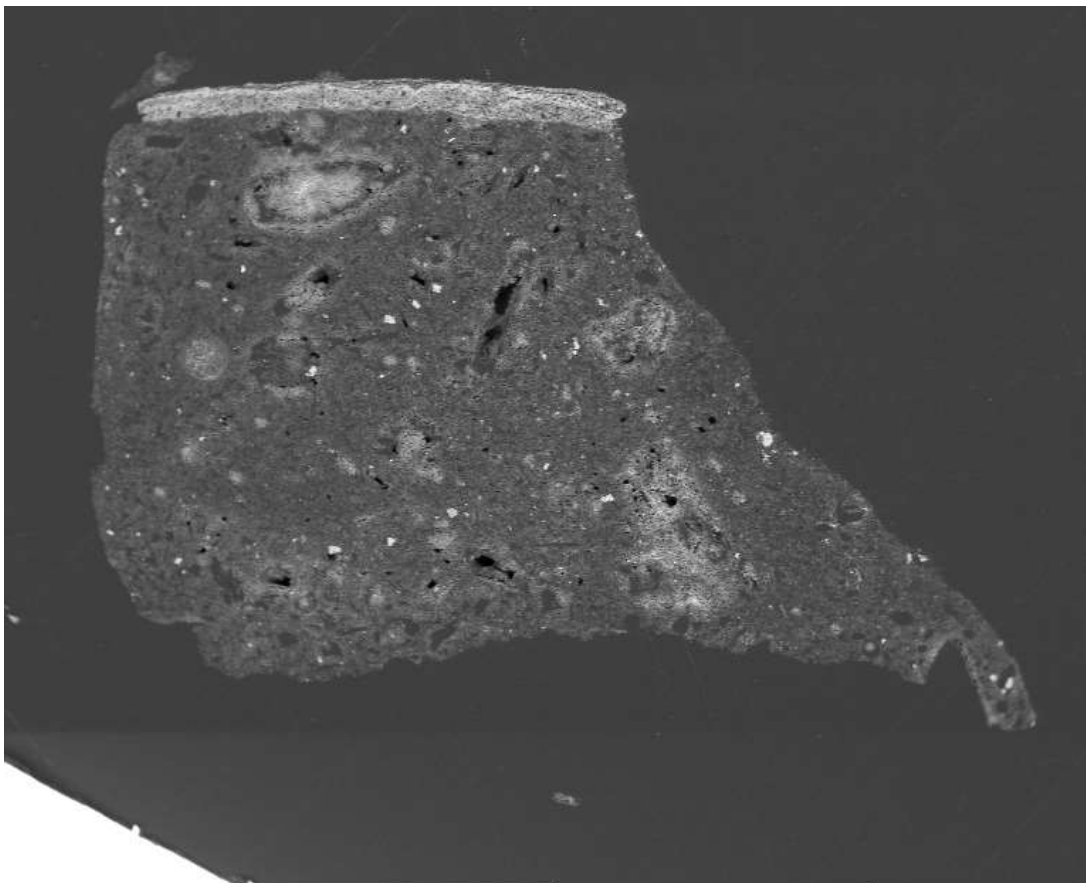
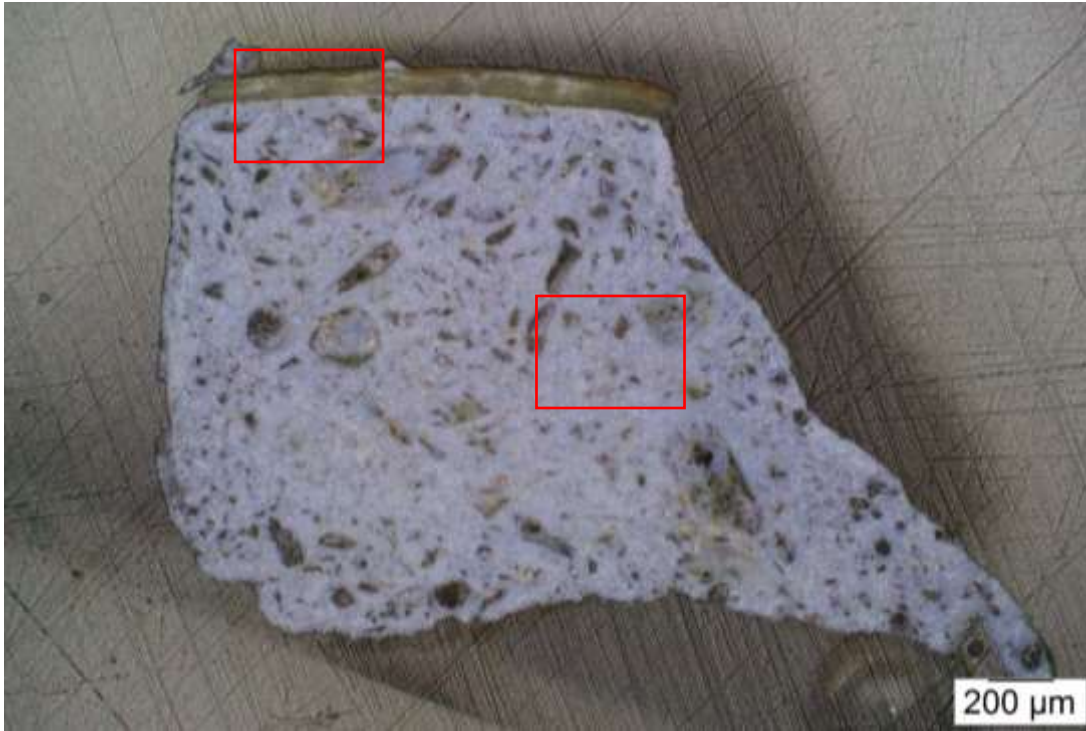
Coating, film see microphoto – FTIR

Polished section - OM, SEM EDS

Powdered sample - TA

**Results**





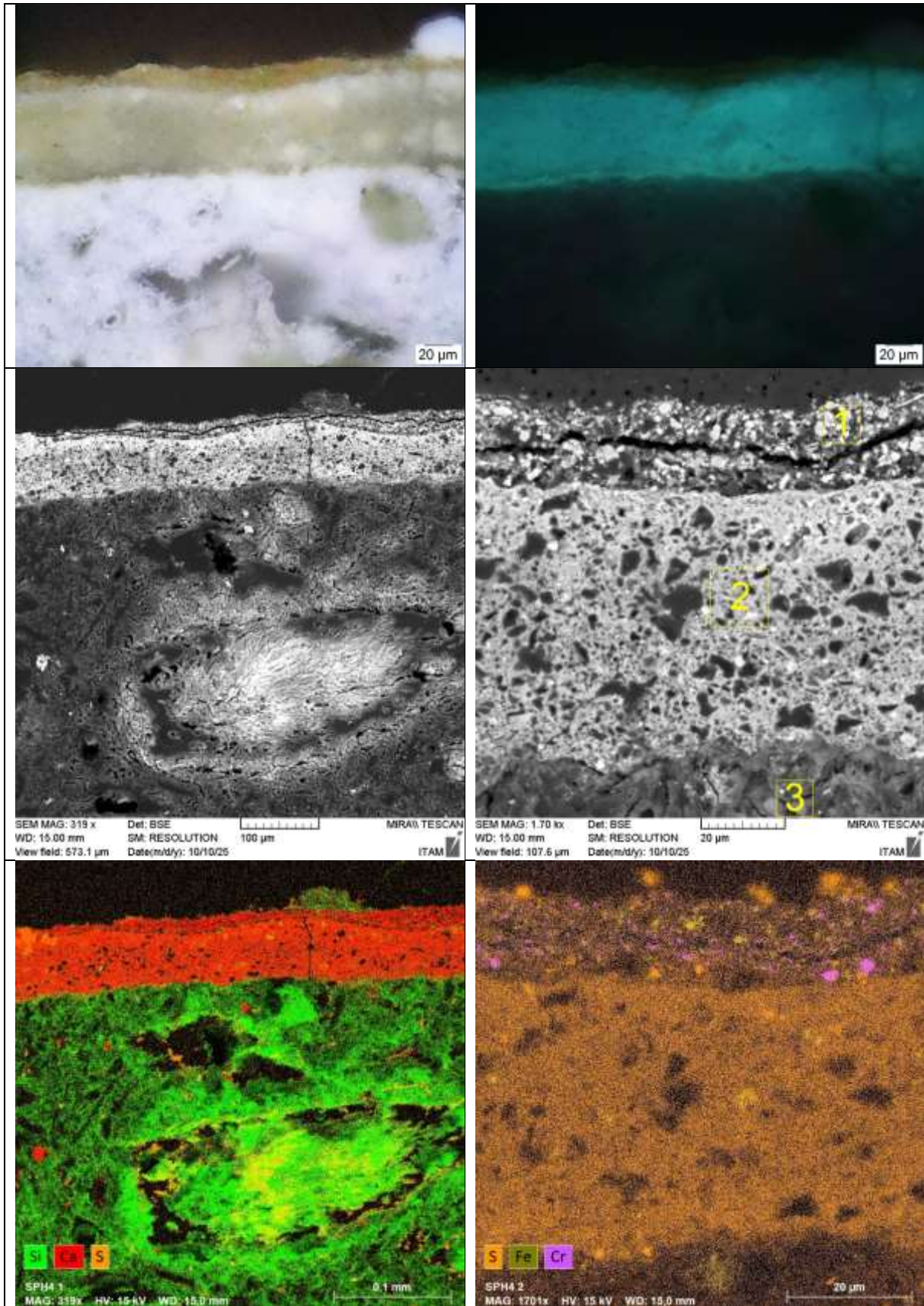
SEM MAG: 55 x  
WD: 15.00 mm  
View field: 3.33 mm

Det: BSE  
SM: RESOLUTION  
Date(m/d/y): 10/10/25



MIRAX TESCAN





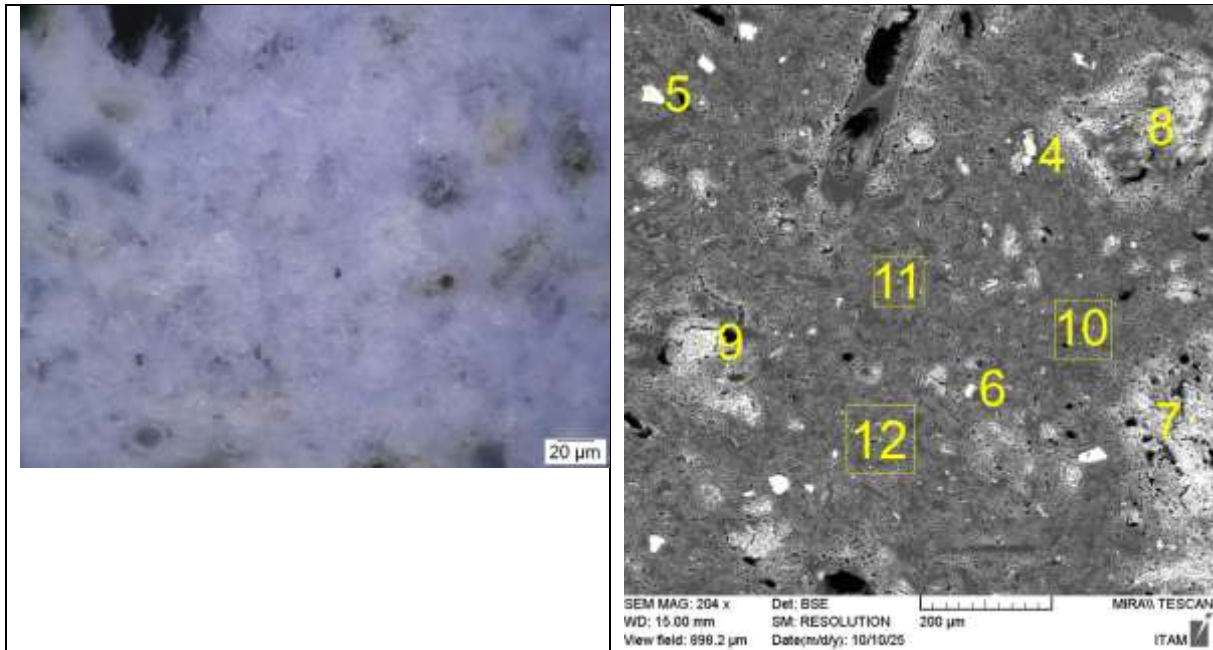


Table 7. Description of the layers observed in the cross-section SPH4.

Layer No	Description
1	Whitish crystalline plaster – quartz with big gypsum particles
2	Lime and gypsum layer
3	Yellow paint layer containing iron yellow and most probably chromium green; the layer is divided horizontally – cracked or painted in two sublayers

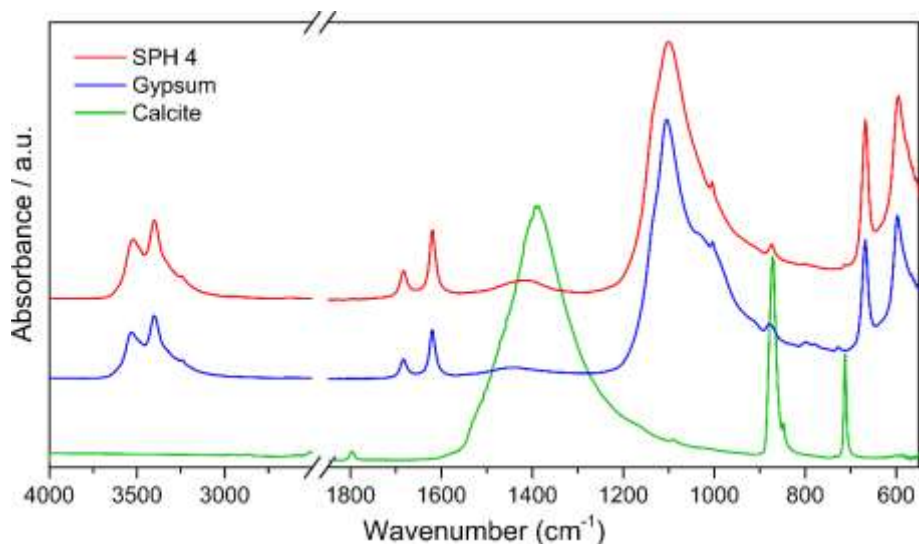
Table 8. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	Cr <sub>2</sub> O <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	Na <sub>2</sub> O	Cl	Interpretation
12	3.2		91.5	1.7		0.7				0.9	L1 – matrix composed of quartz and small admixture of calcium carbonate and gypsum
11	4.3		91.6			0.6				0.8	
10	3.6	1.0	91.3	1.5		1.2				0.9	
9	1.2	0.8	98.8			3.6					L1 - quartz
8	13.5	0.9	69.7			3.4					L1 – calcium carbonate and gypsum?
7	5.0		86.1	1.1		3.3		1.0			L1 – possibly gypsum particle
6	98.6		0.6			3.3					L1 – quartz particles
5	98.4					1.4					
4	98.4		0.9			2.9					
3	5.1		92.7			2.2				0.6	L1 – quartz
2	79.6		5.0	2.9	2.1	19.5			1.6	0.6	L2 – calcium carbonates and gypsum
1	86.9	0.5	5.0	1.1	3.3	12.2	2.1				L3 – iron yellow, chromium green, calcium carbonate, gypsum

## FTIR analysis of sample SPH4

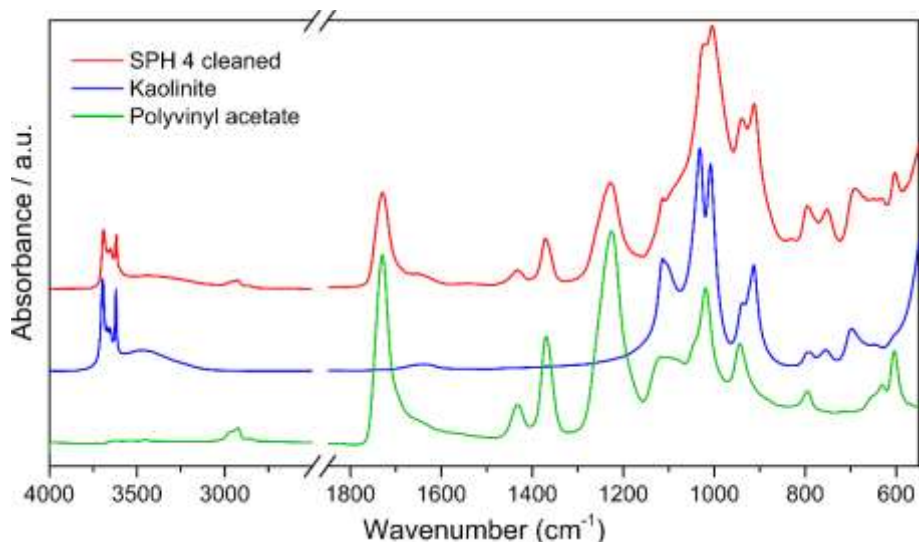
The sample was measured on the secondary module of the iZ10 FTIR microscope iN10 (Thermo Scientific) using the ATR (diamond crystal) technique in the spectral range of 4000-525  $\text{cm}^{-1}$  with a spectral resolution of 4  $\text{cm}^{-1}$ .

After measuring the sample directly from the surface, the spectrum is dominated by gypsum bands and, to a lesser extent, calcium carbonate bands. The measured spectrum together with the spectra of the standards is shown in the figure below.



FTIR spectrum of the sample compared to the spectra of standards from spectral libraries.

The surface of the samples was then cleaned using diluted acetic acid and additionally using diluted hydrochloric acid. The spectrum of the cleaned sample is shown in the figure. The spectrum shows bands corresponding to polyvinyl acetate and kaolin.



FTIR spectrum of the purified sample compared to the spectra of standards from spectral libraries.

**SPH 5**

The arrow points at remains of the coating underneath the existing background layers. (DSC\_4238 / DSC\_4243).

**Aim**

Composition and coatings of the two superimposed layers.

**Sample preparation**

Two small pieces were selected to prepare polished sections.

**Methods**

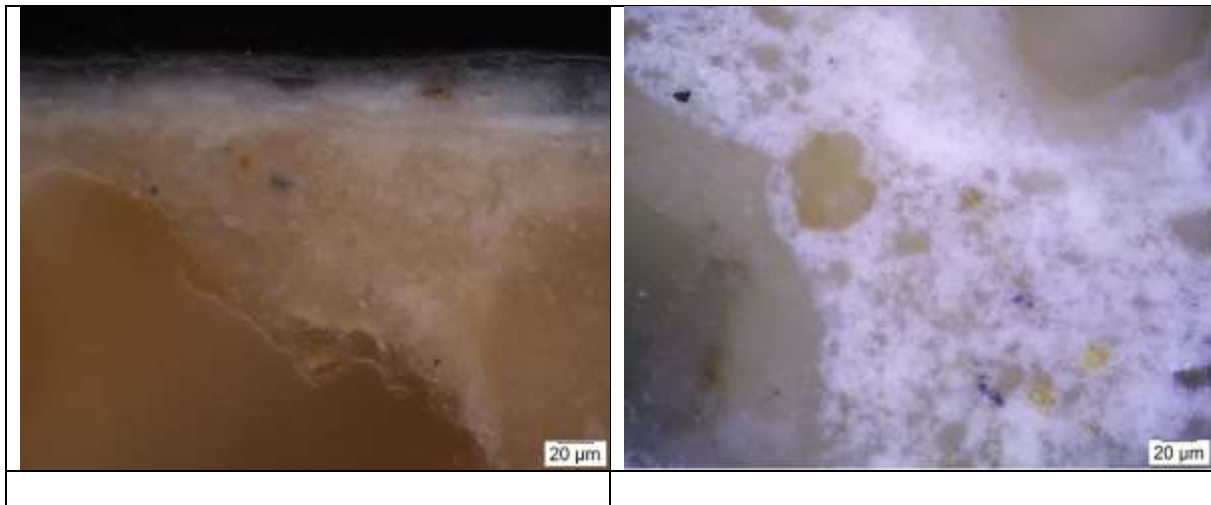
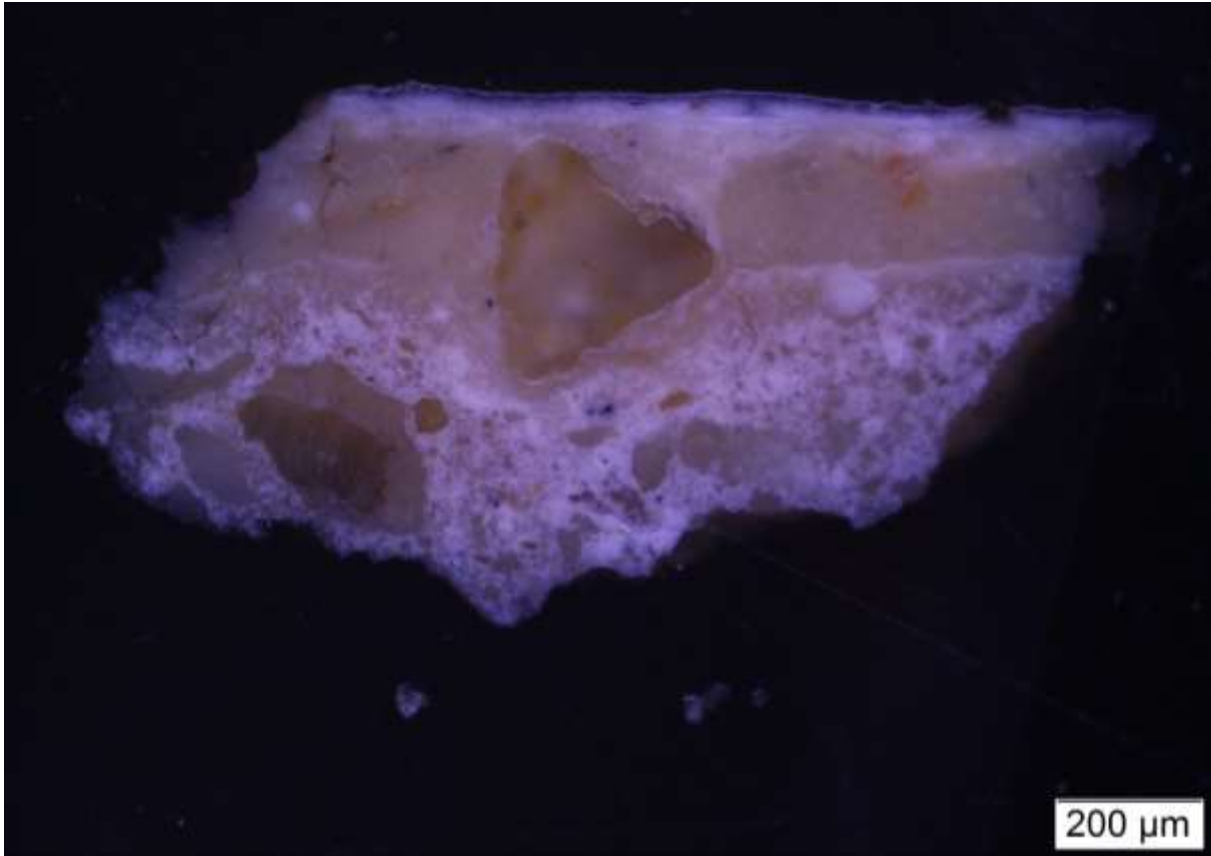
OM, SEM EDS

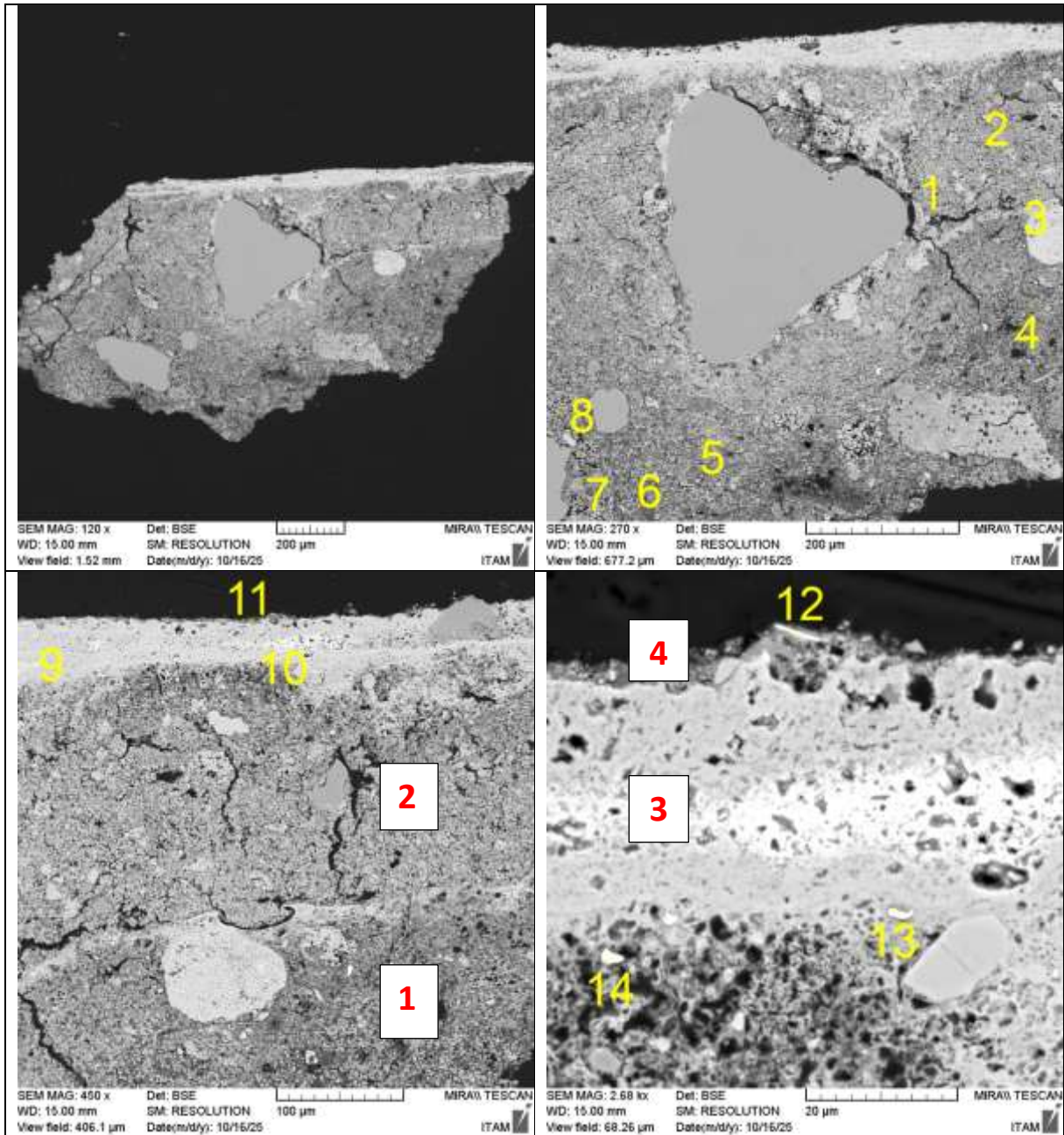
Results



5a







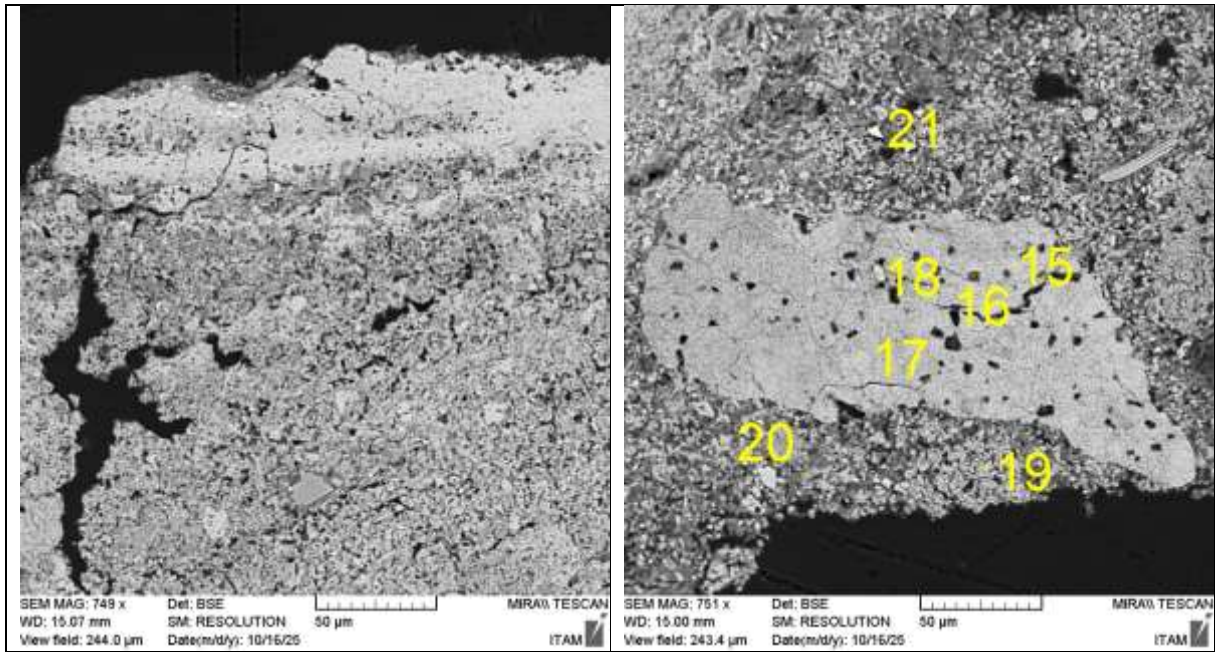


Table 9. Description of the layers observed in the cross-section SPH5a.

Layer No	Description
1	White plaster
2	Limewash
3	Thin limewash layers with several sublayers
4	Deposits

Table 10. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	SrO	TiO <sub>2</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Cl	Interpretation
21	1.7					42.0	56.3						L1 – celestine particle
20	86.9		8.9			3.8						0.4	L1 – matrix; calcium carbonate and gypsum
19	94.8		0.6			3.6				0.5		0.5	
18	39.6	2.8	33.3	18.9	2.7	0.6				0.8	1.1		L1 – aggregate (unburned CaCO <sub>3</sub> ?)
17	96.1		2.0			1.7						0.3	
16	95.0		1.2			2.9						0.9	
15	95.7		1.5			2.3						0.5	
14	42.7	1.0	1.7	0.5	54.2								L2 – iron rich particle
13	3.6		0.5		95.9								L3 – iron rich particle
12	13.0	5.3	37.9	22.5	17.5			1.4	1.7	0.8			L4 – iron rich particle
11	88.3	0.6	6.1	1.0		2.8				0.8		0.4	L4 - deposit
10	92.9		4.4			1.2				1.5			L3 – calcium carbonate
9	93.4		4.1			1.1				1.4			
8	95.5	0.8	1.8	0.6		0.8						0.4	L1 – denser part of matrix around aggregate
7	96.9		1.8			0.9						0.4	
6	93.5		1.9			4.1						0.5	L1 – matrix – calcium carbonate with gypsum (more than in layer L2)
5	84.6		7.6			7.3						0.5	
4	94.0		0.9			4.2						0.9	L2 – matrix – calcium carbonate with small amount of gypsum
3	94.3		1.2			3.6						0.8	
2	93.4		2.4			3.7						0.5	
1	93.9		2.4			2.6				0.6		0.5	



5b



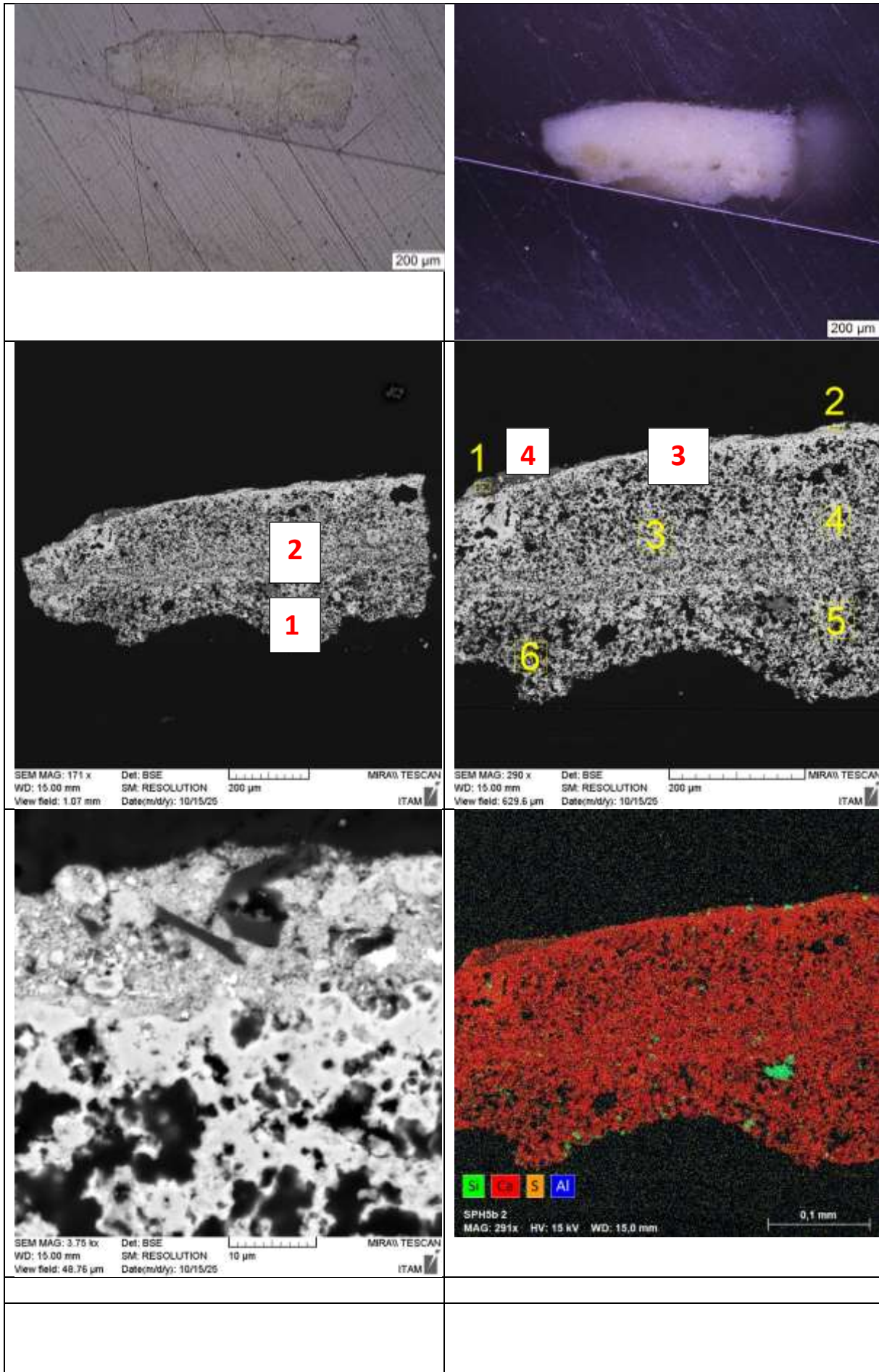


Table 11. Description of the layers observed in the cross-section SPH5b.

Layer No	Description
1	White plaster with yellowish particles
2	Limewash
3	Denser part of the limewash?
4	Deposits

Table 12. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	SO <sub>3</sub>	Na <sub>2</sub> O	Cl	Interpretation
6	96.8		3.2				L1 – matrix – calcium carbonate
5	98.7		1.3				
4	98.8		1.2				L2 – matrix - limewash
3	97.9		1.4			0.7	
2	95.2		2.1	2.1		0.6	L3 – calcium carbonate and gypsum, possibly a grey layer
1	91.5	0.9	2.6	3.2	0.8	1.1	L4 – deposit with calcium carbonate and gypsum

## SPH 6



Position of the sample SPH 6.

**Sample** Composition of the gluing mortar?

**Aims:** Suspicion of chrome yellow pigment inside, ie. after 1810

**Methods**

Fragment with the yellow stain – SEM – EDS

If CY confirmed than we are not interested :-]

***If not***

Thin section - PLM, SEM EDS

TA – whole stucco mortar

Organic additives in the stucco

### Results





## SPH 7



Composition of the mortar and coating layers.

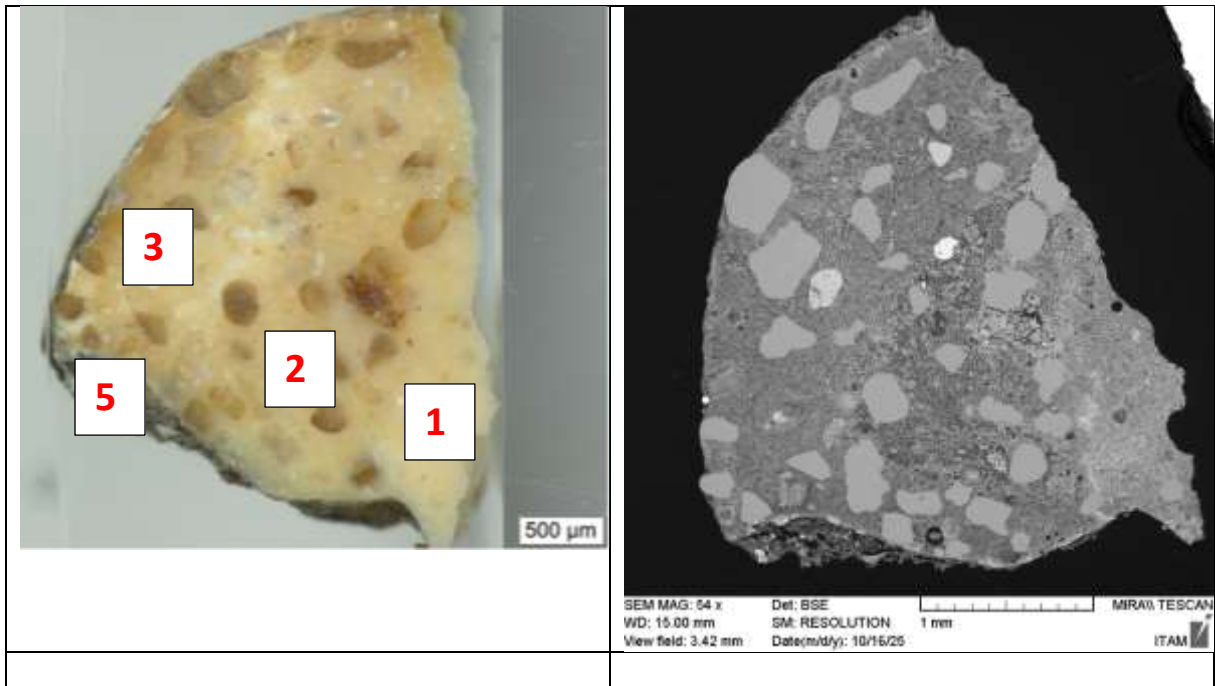
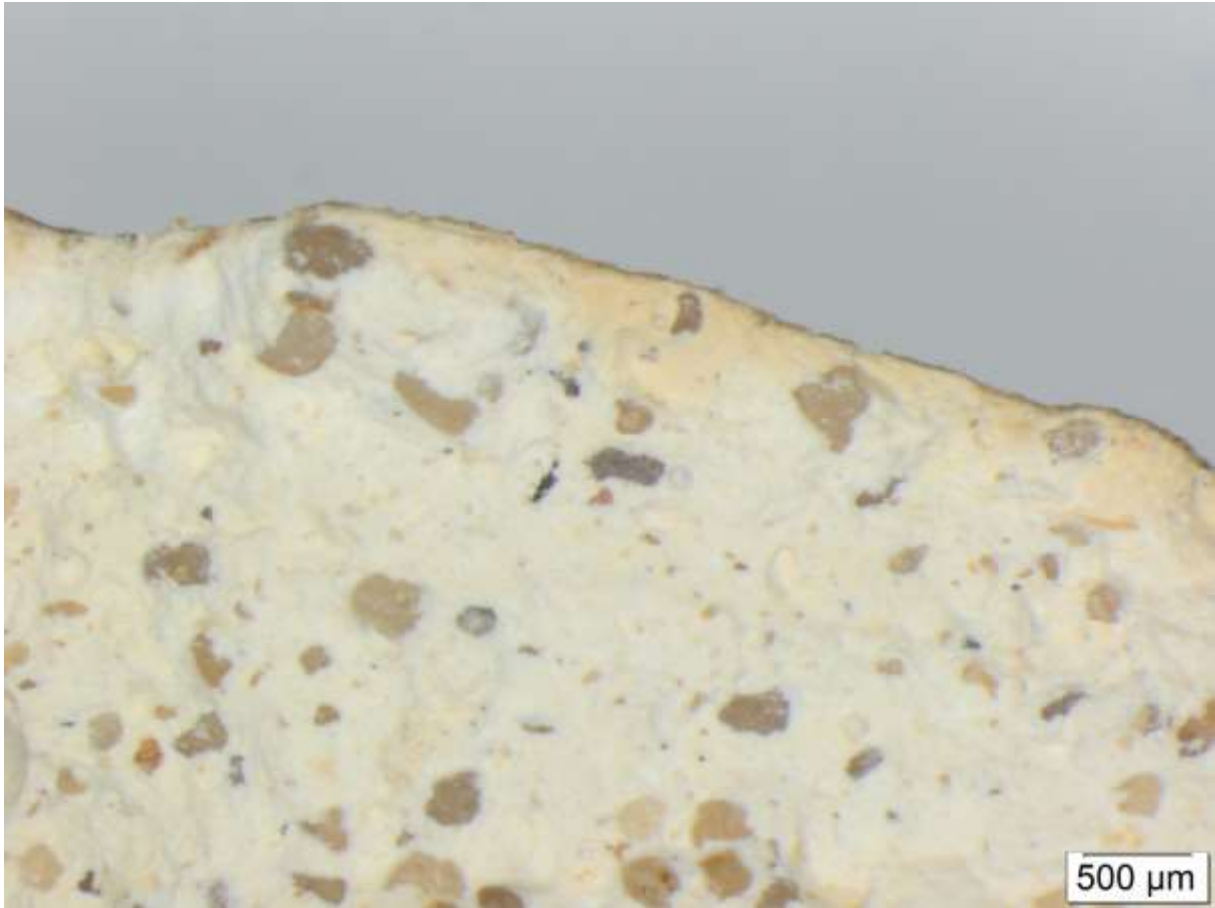
**Methods**

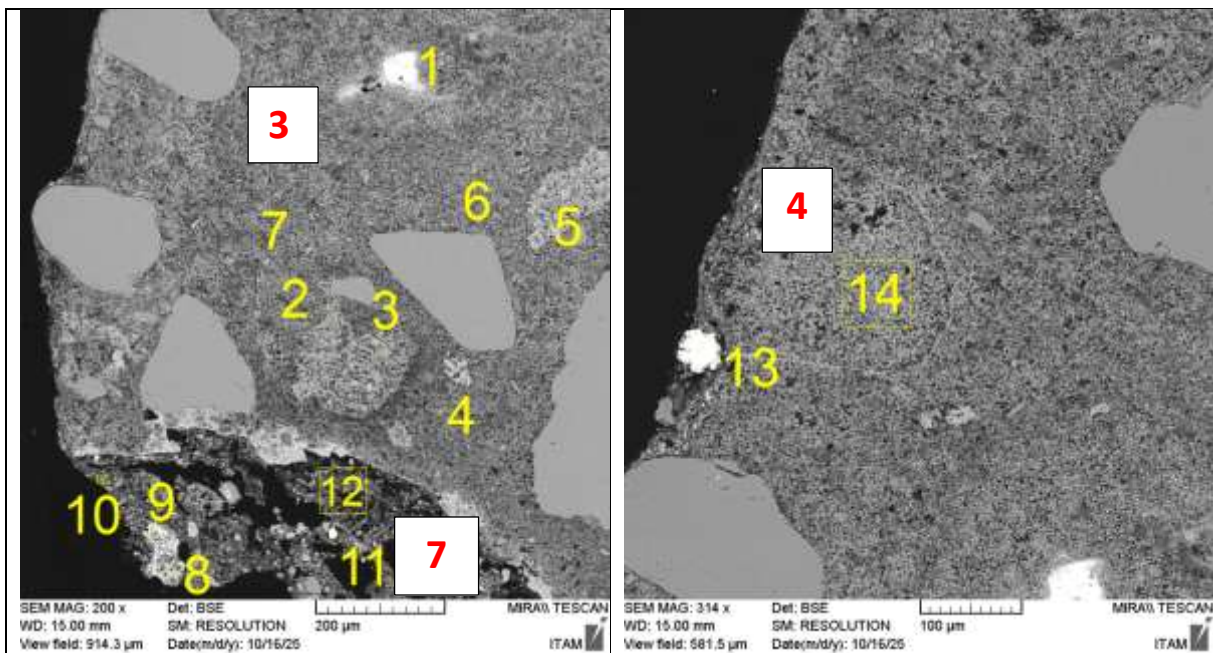
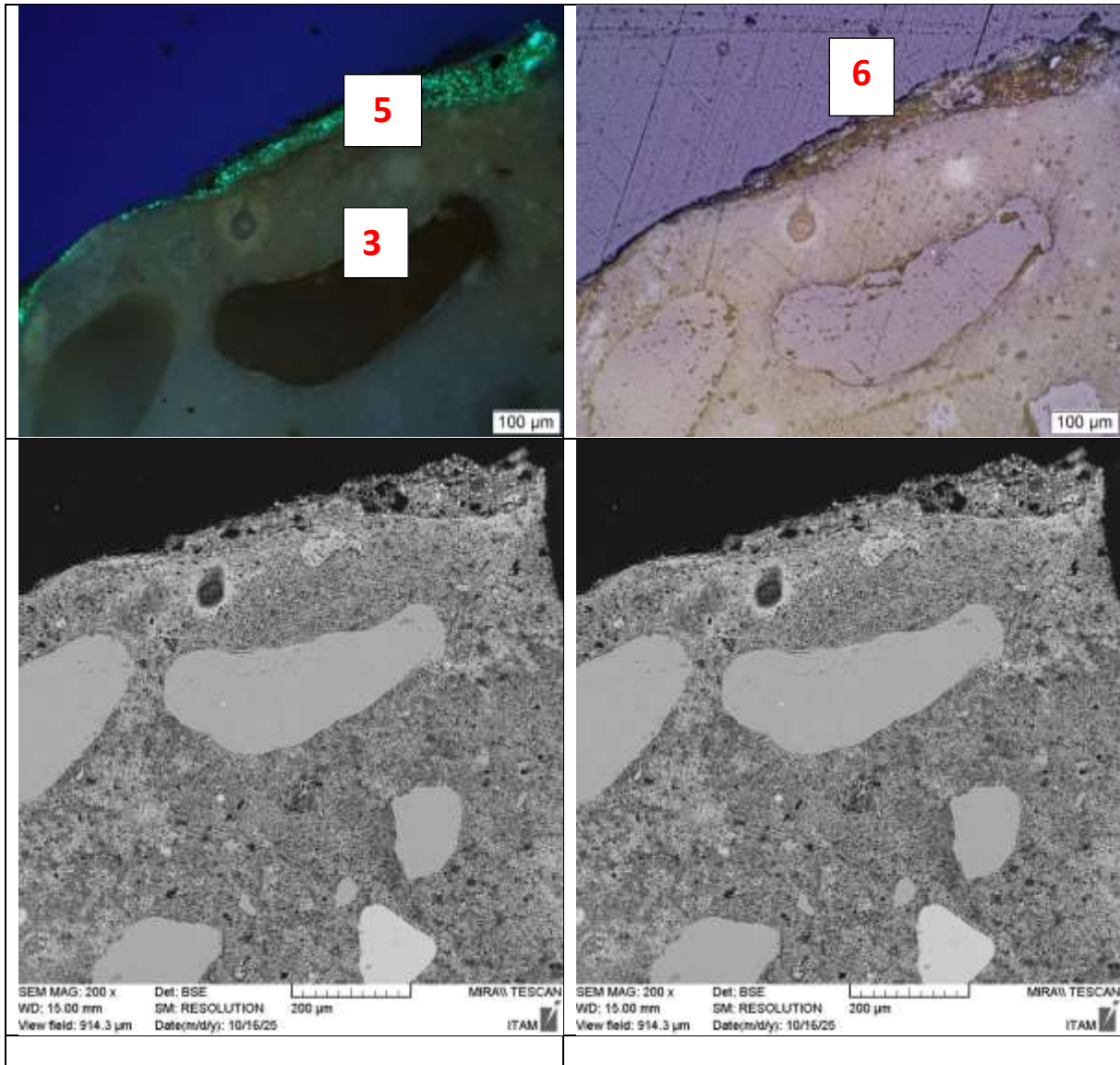
Polished section - PLM, SEM EDS

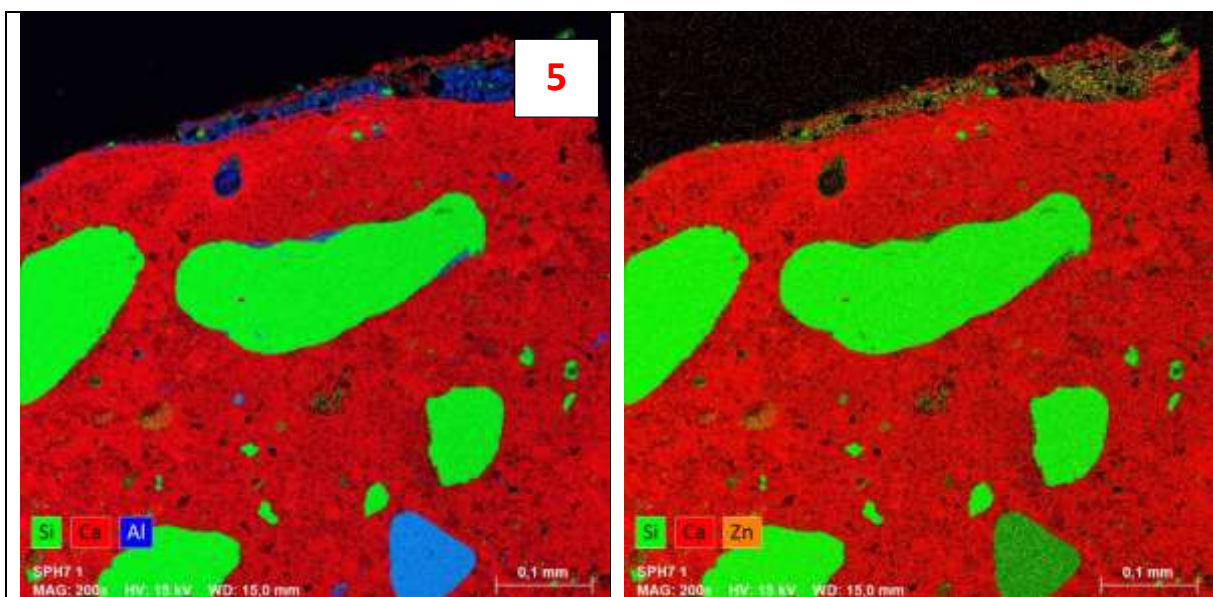
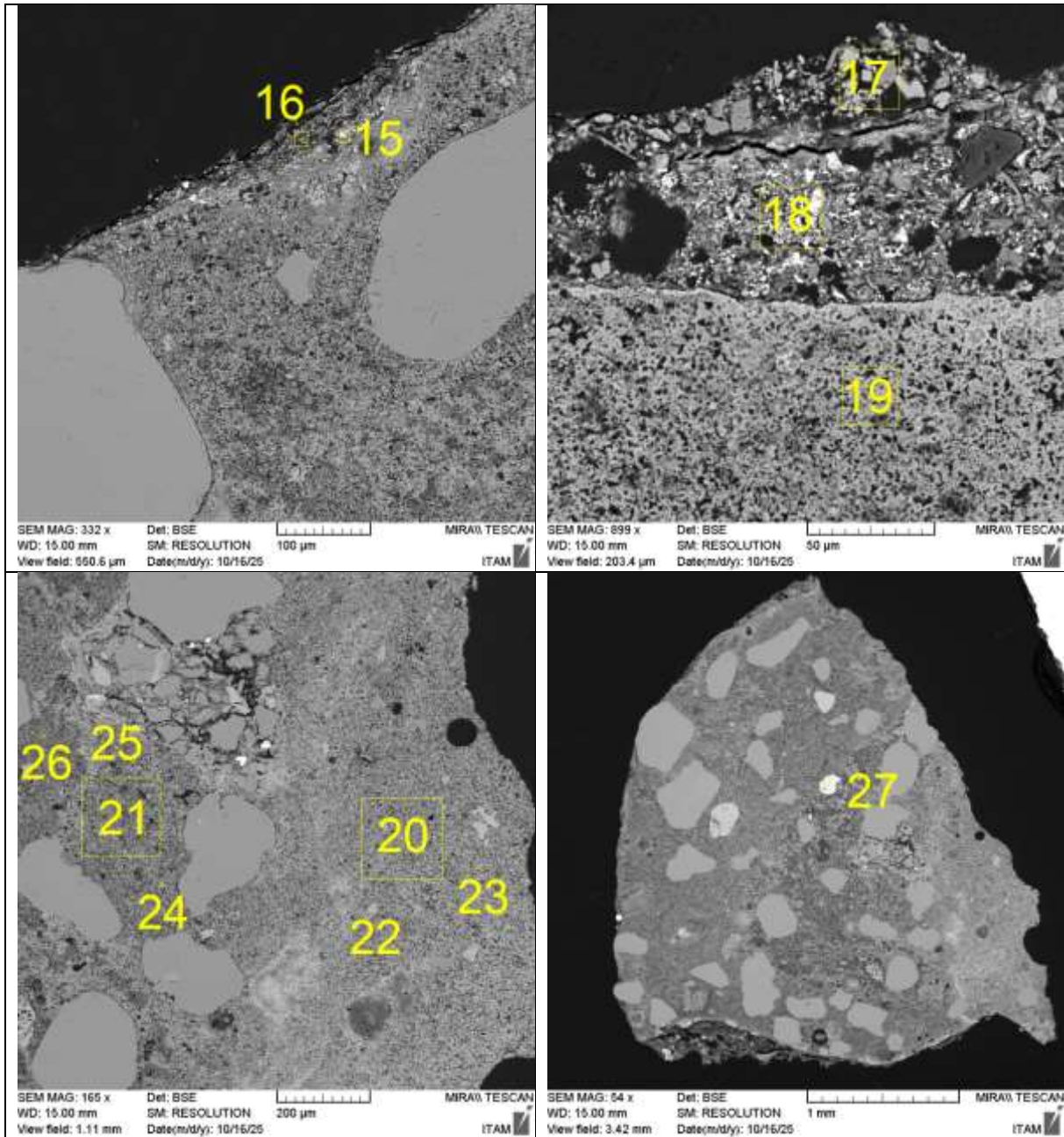
Organic additives in the stucco?

Results









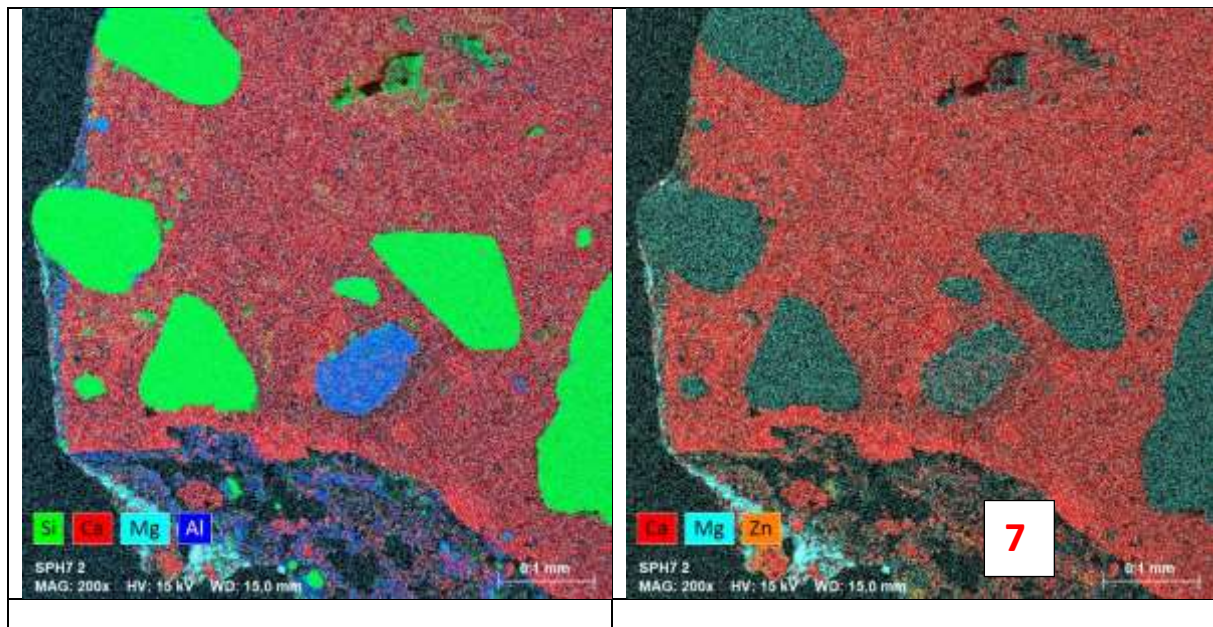


Table 13. Description of the layers observed in the cross-section SPH7.

Layer No	Description
1	Binder layer without any aggregate
2	Porous layer of mortar
3	More compact layer of mortar
4	Smoothing layer
5	Paint layer with strong luminescence in UV light
6	Thin paint layer
7	Deposit or paint layer

Table 14. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spect r. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	Na <sub>2</sub> O	ZnO	TiO <sub>2</sub>	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Cl	Interpretati on
27	24.9		37.3	24.3	13.5								L2/L3
26	96.5	0.7	1.2			1.6							L2 - L1 – calcium carbonate with low content of gypsum
25	98.2		0.9			0.9							
24	97.2		1.7			1.1							
23	97.9		1.2			0.8							L1 – calcium carbonate with low content of gypsum
22	98.2		0.8			1.0							
21	96.8		2.1			1.0							L2
20	96.0		2.7			1.3							L1
19	95.0		1.5			2.7	0.8						L3
18	1.1		30.6	17.4	14.9	2.5	6.1	24.4	1.2	1.8		0.5	L5 – zinc white and iron oxide; perhaps titanium white
17	65.7	4.7	16.8	1.1	2.2	2.0	1.0		5.9			0.4	L6
16	46.9	4.2	18.6	5.2	4.3	3.2	2.1	9.8	4.9	0.4		0.3	L6
15	5.8		33.6	18.4	15.1	1.8	4.4	18.8	0.6	1.2			L5
14	94.0	0.8	1.2			3.0	1.0						L4 - matrix, calcium carbonate with higher amount of gypsum
13					36.1	63.9						0.6	L4 or L5
12	45.0		34.4	13.3		4.6	2.1						L7 – perhaps part of layer 5 rich in zinc white and 6 Mg-rich
11			1.6		35.5	62.9						0.8	
10	41.2	8.7	18.0	7.3	2.3	5.2	2.0	7.1	2.7		4.7		
9	13.0		4.5			1.4		81.0					
8	100.0												
7	96.7		0.9			1.8	0.5						L3 – matrix, calcium carbonate with higher amount of gypsum
6	94.6		1.0			4.5							
5	96.5	0.8	1.5			1.2							
4	94.1		2.7			2.5	0.7						L3 - matrix
3	4.5		62.6	23.7			9.2						L3
2	94.5		4.1			1.4							L3
1	4.7		95.3										L3

**SPH 8**

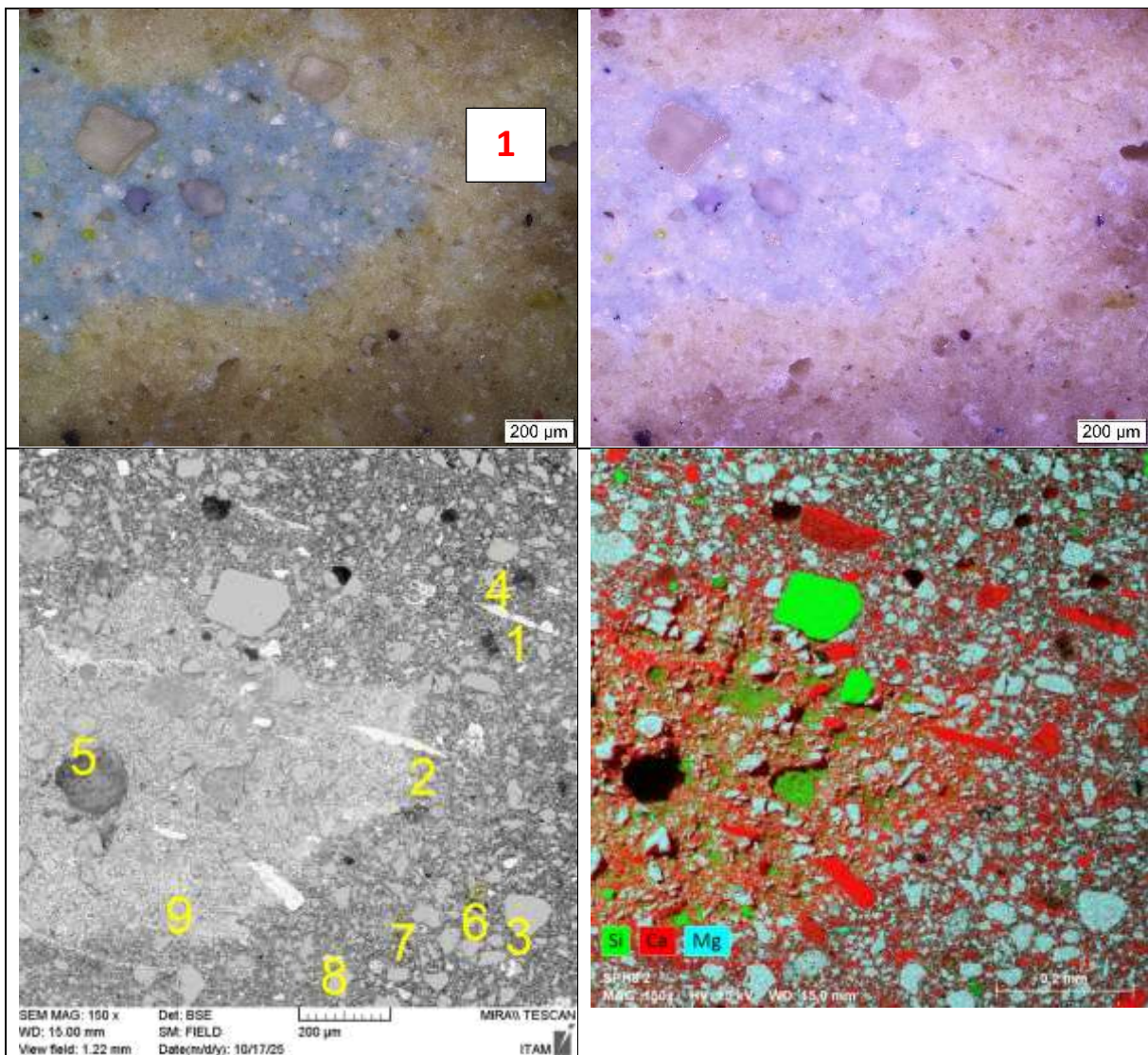
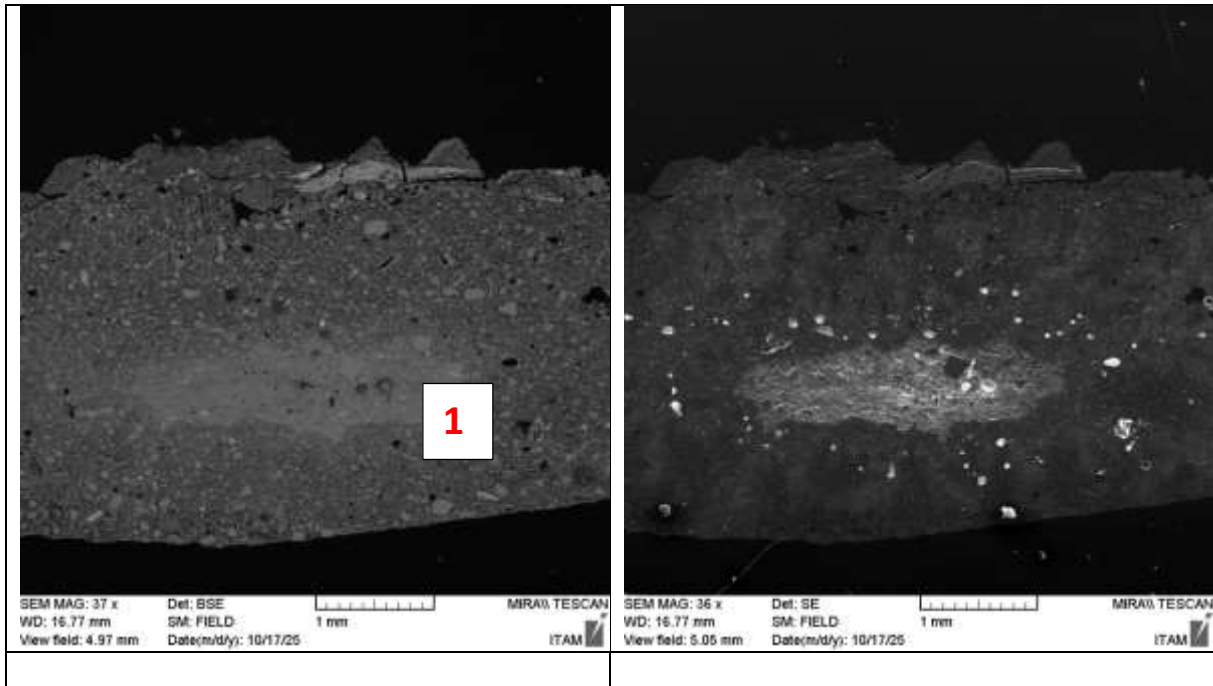
Composition of the gluing mortar/layers between the gluing mortar and the finishing stucco layer!

**Methods**

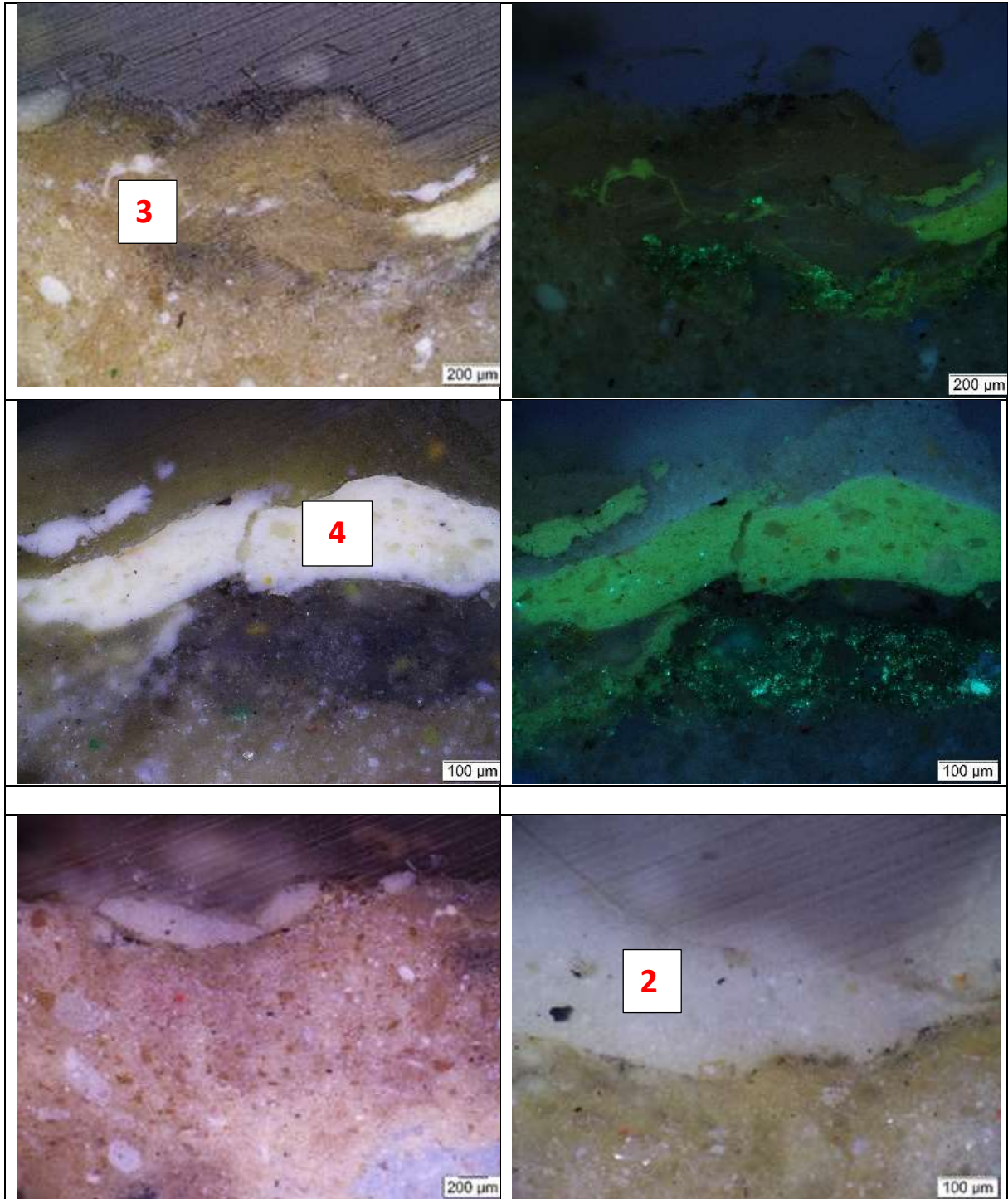
Polished section - PLM, SEM EDS

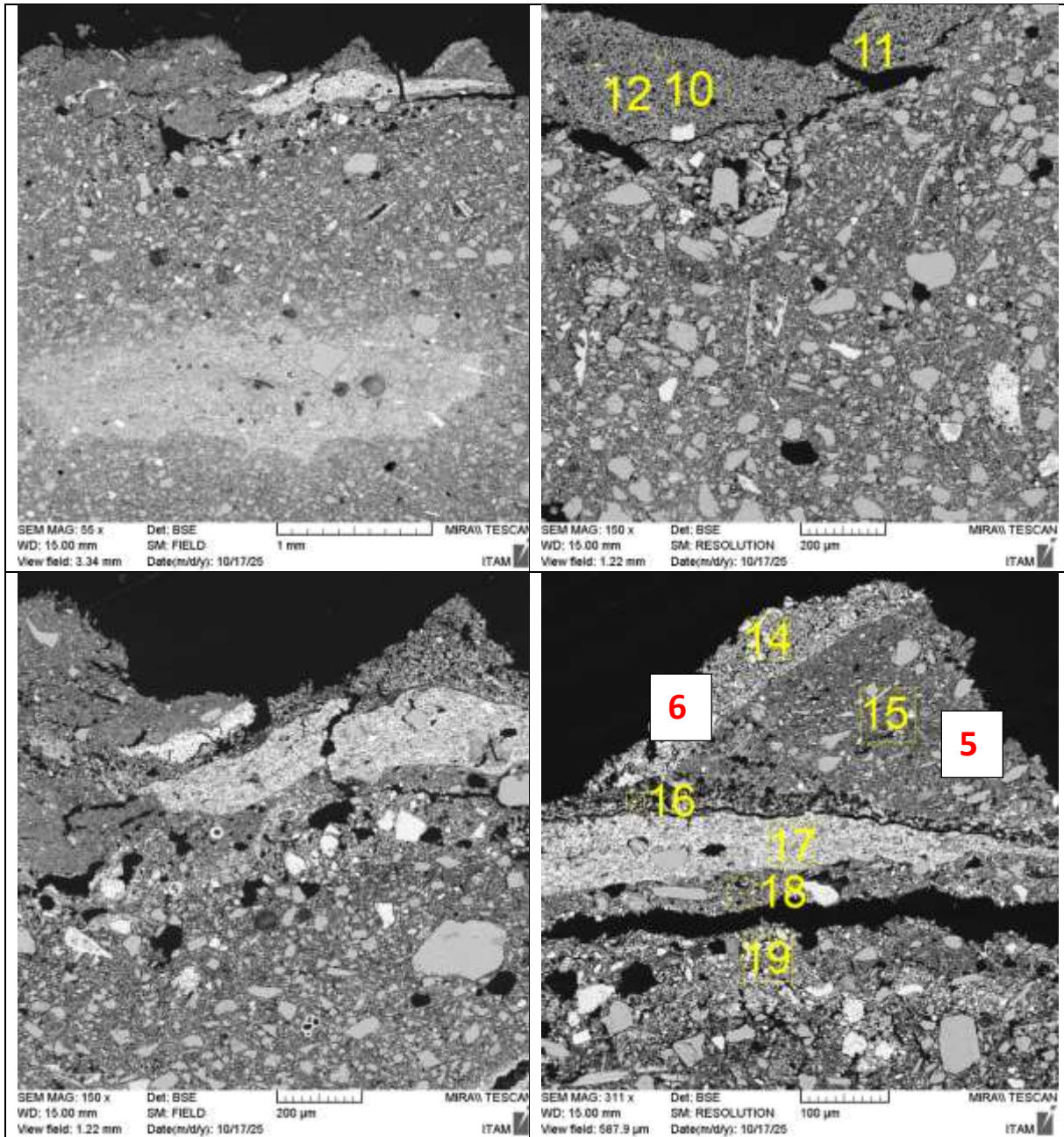
**Results**





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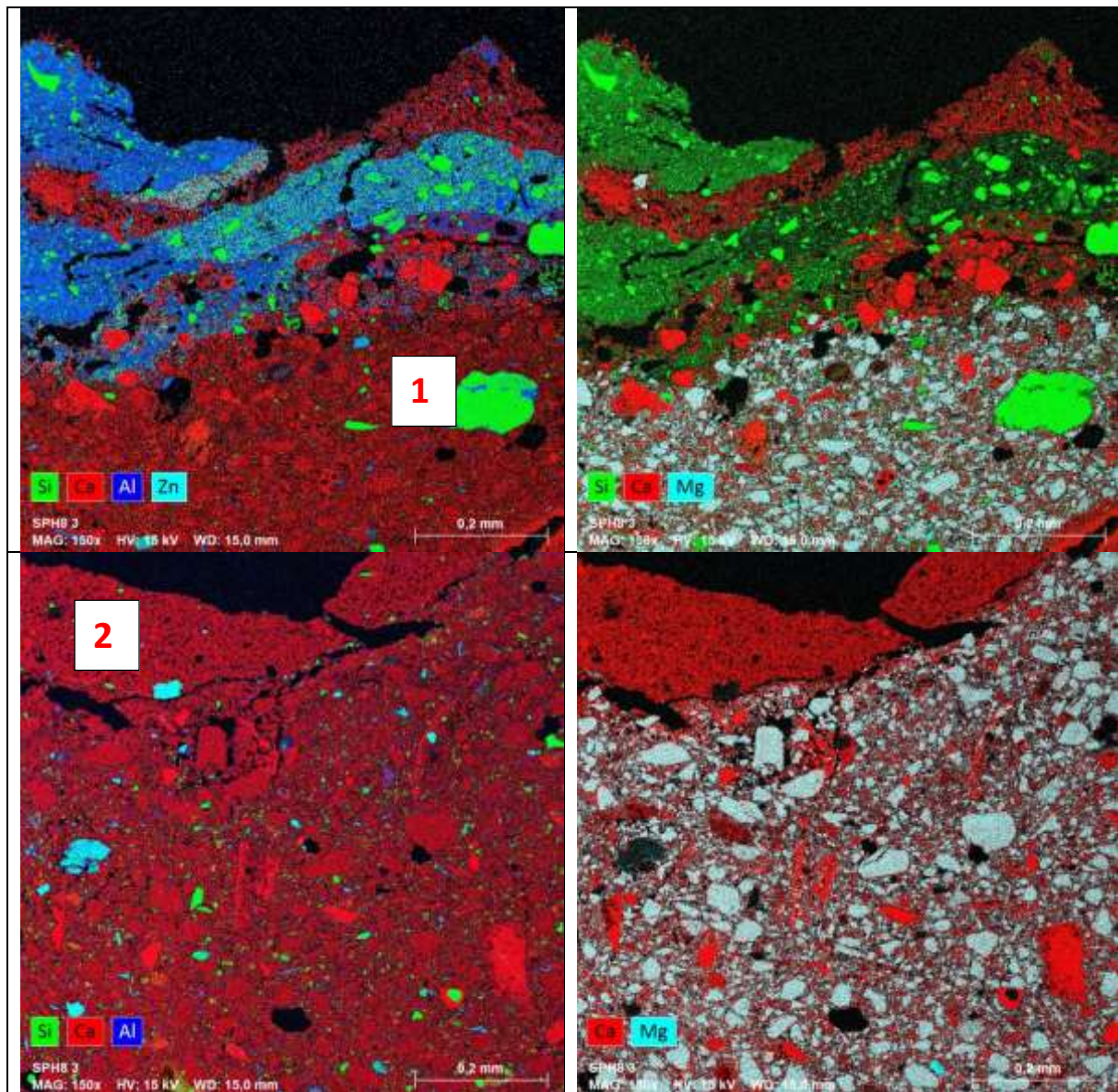


Table 15. Description of the layers observed in the cross-section SPH8.

Layer No	Description
1	Mortar with a void in the central area coloured with polishing dispersion; between the mortar and the first painting layer dirt particles are present
2	White limewash present only in one area of the sample
3	Ochre paint layer mixed with whithe Zn-rich layer
4	White Zn- rich paint layer
5	Ochre lime-based layer perhaps similar to layer 3
6	Paint layer

Table 16. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Sp No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	Na <sub>2</sub> O	ZnO	TiO <sub>2</sub>	MnO	Cr <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Cl	Interpretation
19	76.1		17.2	3.9		1.0	1.8								Part of L1 or L2
18	39.5		34.5	24.8		0.8						0.4			
17	1.9	0.8	30.4	13.3		1.9	7.7	41.4				1.3	1.3		L4- zinc white
16	63.3		12.9	4.7		6.1	1.7	5.1					5.5	0.7	Deposit ?
15	5.3		58.8	29.4	2.1	1.5						2.0	1.0		L5- clay
14	93.4		5.8			0.8									L6- limewa sh
13	16.4	7.1	38.5	23.1	13.2	0.3			0.7	0.5		0.2			Iron rich particle
12	97.3		1.9			0.8									L2 – limewa sh
11	26.7	3.2	59.3	3.1			2.2					3.0	2.3	0.3	
10	92.4		0.2			2.6	0.7						3.8	0.4	
9	77.4	8.5	11.8	0.8		0.8	0.8								L1 – calcium carbonate matrix with dolomitic aggregate; some Cr impurities
8	81.7	7.5	7.0	1.6		0.9	0.8							0.4	
7	77.8	17.8	3.4	1.0											
6	12.5	2.5	1.9								83.2				
5	57.7	42.3													
4	60.6	39.4													
3	61.3	38.7													
2	96.0		0.3			3.7									
1	99.4					0.6									

**SPH 9**

Position of sample SPH 9.

**Aim:** Compare with SPH 2 and SPH 4. Composition of the gluing mortar/layers between the gluing mortar and the finishing stucco layer!

**Methods**

Polished section - PLM, SEM EDS

**Results**





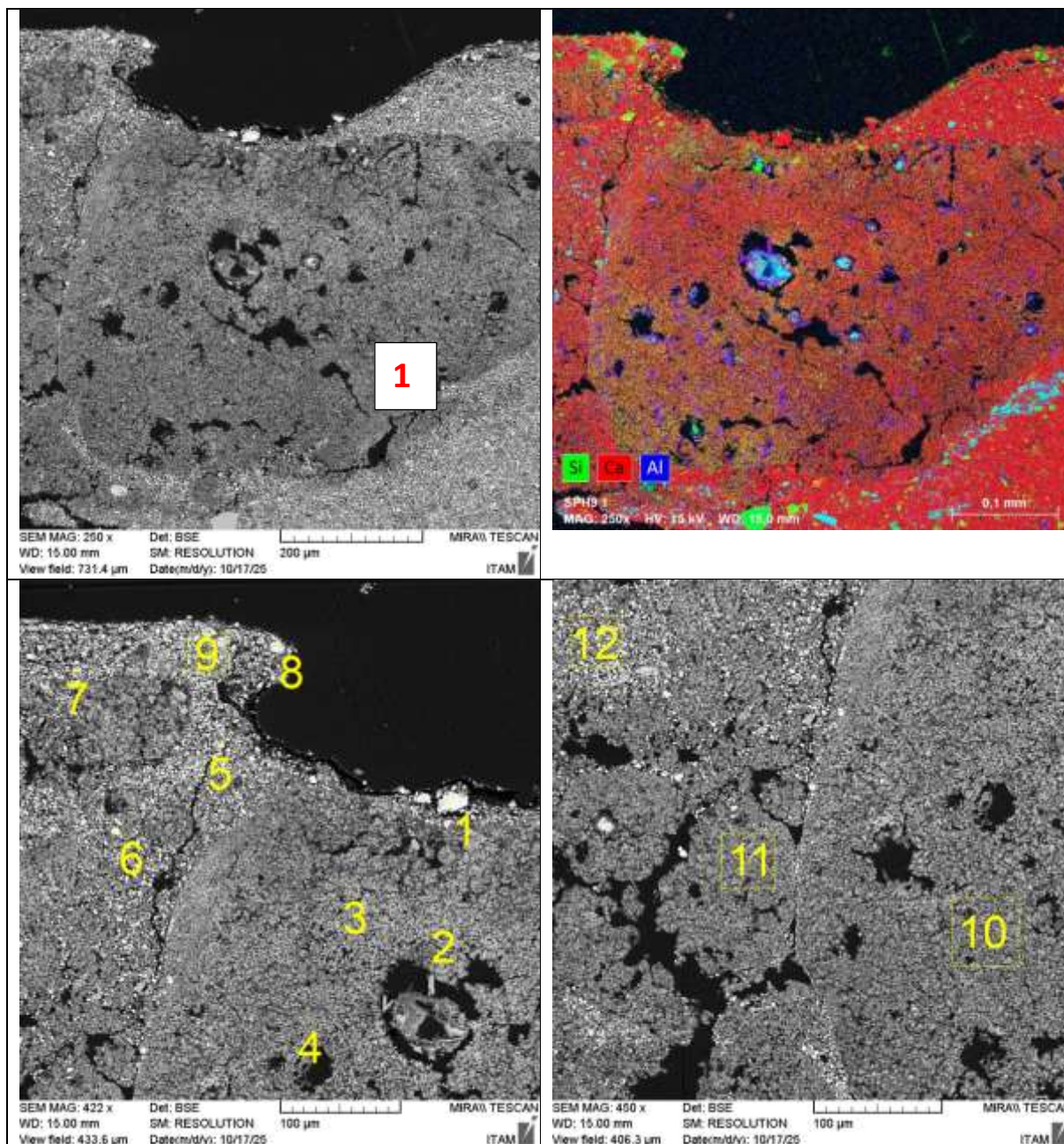


Table 17. Description of the layers observed in the cross-section SPH9.

Layer No	Description
1	Ochre mortar with big BRP in the middle and some white particles; in the upper part the colour of the matrix seems lighter

Table 18. Results of EDS measurements expressed in oxides and normalised to 100%. L=Layer.

Spectr. No	CaO	MgO	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SO <sub>3</sub>	Na <sub>2</sub> O	MnO	P <sub>2</sub> O <sub>5</sub>	Interpretation
12	81.9	0.9	8.9	3.1	3.7	1.5				Matrix -Calcium carbonate with ochre clay and gypsum
11	84.1	1.7	9.6	2.2		2.4				
10	77.1	1.9	14.3	4.8		1.9				
9	77.6	0.9	11.9	3.2	4.1	2.2				Matrix
8	3.6		69.9	0.6	23.9		0.4	1.6		Iron red particle
7	99.0	1.0								
6	4.4	0.5	7.5	2.2	82.7	0.9			1.8	Iron oxide or hydroxide particles
5	5.6	1.0	9.1	1.7	72.5	4.1	0.8	4.4	0.7	
4	87.1	1.5	8.3	1.1		2.1				
3	89.6	0.7	6.9	1.0		1.8				
2	87.7	1.1	7.4	0.9		2.1	0.8			
1	98.9	0.6	0.5							