

<b>ARTIST:</b>	Milena Lah
<b>TITLE OF THE WORK and YEAR OF EXECUTION:</b>	Galebovo krilo / Seagull's Wing (1973)
<b>MATERIALS:</b>	Painted steel

	Name and description of the sample	Analytical methods	Notes
1	2/1- coatings (cross section)	Optical microscopy , micro FTIR, SEM/EDS	In order to get the insight in the layers of the coatings and their composition sample 2/1 was prepared as cross section and analysed by optical and electron microscopy. Since sample 2/2 was taken from the same position micro FTIR spectroscopy was performed on cross section of sample 2/1. Sample 2/3 was sent to Torino University.
2	2/4- analysis of metal and corrosion products	SEM/EDS	

#### Description of the analytical methods, equipment and procedures:

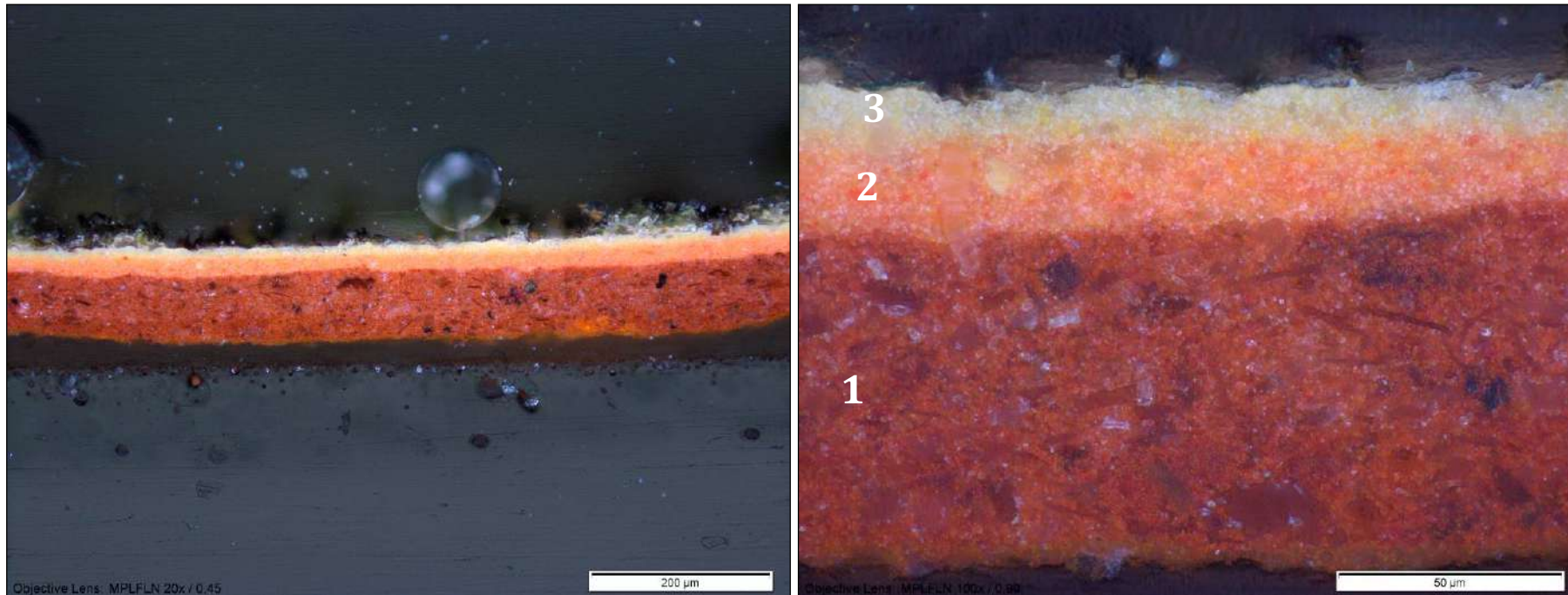
**-Optical microscopy:** analysis performed on sample or cross section using visible (VIS), ultraviolet (UV), polarized (POL) or infrared (IR) light depending on the characteristic of the observed sample. Observation and images taken from 50X to 1000X magnification. **Equipment used:** Optical microscopy Olympus BX51 and optical microscopy Carl Zeiss Image m2M.

**-Fourier Transform Infrared Spectroscopy (FTIR):** analysis performed using KBr pellets preparation (2 mg sample + 120 mg KBr). Each spectrum is a result of 64 scans taken at resolution of 4 cm<sup>-1</sup> in the range from 4000 to 400 cm<sup>-1</sup>. Collected spectra were baseline corrected and when necessary smoothed according to Savitzky/Golay algorithm. **Equipment used:** FTIR spectrometer Tensor 27 Bruker.

**-Micro Fourier Transform Infrared Spectroscopy (μFTIR):** analysis performed on prepared cross section using Attenuated Total reflection objective (ATR) suitable of analysis on area of approximately 50 x 50 μm. The spectra are the results of 32 scans taken at resolution of 4 cm<sup>-1</sup> in the range from 4000 to 600 cm<sup>-1</sup>. **Equipment used:** FTIR microscope Hyperion 1000 Bruker and as source FTIR spectrometer Tensor 27 Bruker.

**-Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS)- SEM/EDS:** analysis performed operating under low vacuum conditions for non-conductive samples (80 Pa) and under high vacuum for conductive samples. Images were recorded with Backscattered electrons detector (BSED) with spot from 3 to 5, working distance 10 mm, acceleration voltage from 20 to 30 kV. **Equipment used:** FEG Quanta 250 FEI. EDS microanalysis were performed on observed samples at acceleration voltage of 30 kV and working distance 10 mm. **Equipment used:** Penta FET X-act detector Oxford Instruments. NOTE: The EDS microanalysis of the chemical composition by SEM is performed by analysing the chemical composition in a small sample segment and under a certain magnification, whereby the results are not quantitatively comparable, i.e. the measurements vary considerably from one point to another due to inhomogeneity of the tested samples, surface contamination, segregation of the elements and sensitivity of the method. The results of EDS analysis do not represent the chemical composition of the whole sample but the chemical composition of the examined point/field on the sample's surface.

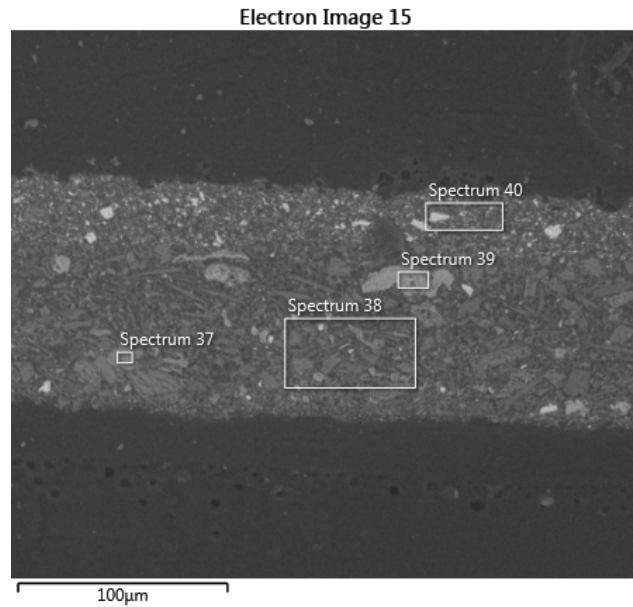
**Results:**  
**Sample 2/1**



**Sample 2/1** – optical microscopy at 200X and 1000X magnification, SEM/EDS and micro FTIR analysis has shown the following structure and composition

- 1- Base coat of regular thickness about 70 µm, containing iron oxide, chalk, silicates, alkyd binder and probably red organic pigment quinacridone.
- 2- Orange paint layer, average thickness 25 µm, containing barite, titanium white, chalk, silicates and most probably the same binder. The micro FTIR spectra collected are heavily affected by the area beneath (mainly epoxy resin used for cross section preparation). In this layer lead could be present also as red lead ( $Pb_3O_4$ ) or as lead white ( $(PbCO_3)_2 \cdot Pb(OH)_2$ ).
- 3- Yellow paint layer, average thickness 15 µm containing barite, most probably chalk, chrome and lead suggesting that lead chrome yellow is present. ( $PbCrO_4$ ).

### Sample 2/1 - SEM/EDS analysis



Spectrum 37	Wt%	Wt% Sigma
C	38.71	1.27
O	32.99	1.12
Fe	26.80	0.97
Ca	1.04	0.18
Si	0.46	0.15
Total	100.00	

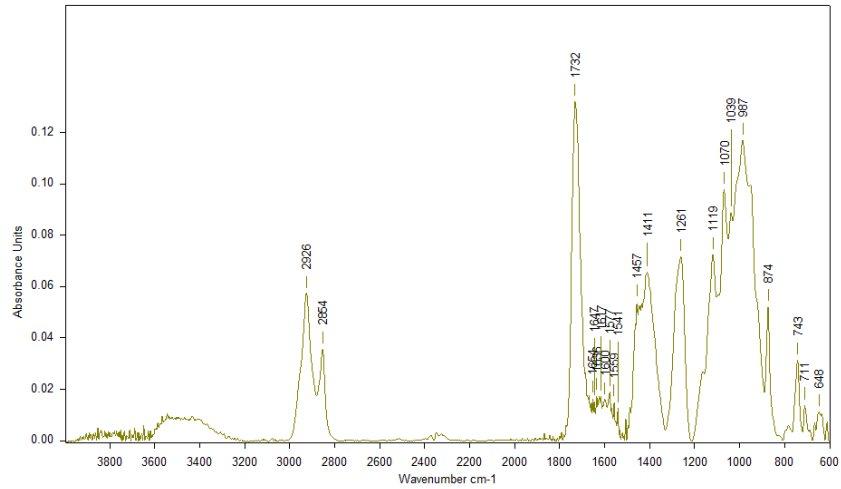
Spectrum 38	Wt%	Wt% Sigma
C	47.44	1.35
O	32.98	1.27
Fe	9.77	0.67
Ca	3.99	0.29
Si	3.05	0.24
Mg	1.73	0.22
Al	0.66	0.16
Cl	0.37	0.13
Total	100.00	

Spectrum 39	Wt%	Wt% Sigma
C	33.78	1.45
O	32.44	1.22
Fe	32.14	1.14
Ca	1.07	0.21
Cl	0.57	0.16
Total	100.00	

Spectrum 40	Wt%	Wt% Sigma
C	54.76	0.97
O	28.24	0.92
Pb	5.99	0.62
Ba	4.78	0.53
Ti	1.62	0.25
Ca	1.24	0.13
S	1.22	0.15
Fe	0.98	0.20
Cr	0.62	0.17
Si	0.55	0.09
Total	100.00	

## Sample 2/1 - Micro FTIR analysis

2 1 RED LAYER



Experiment HYPERION1000\_ATR.xpm

Operator Name Administrator

Instrument Type TENSOR 27

Resolution 4

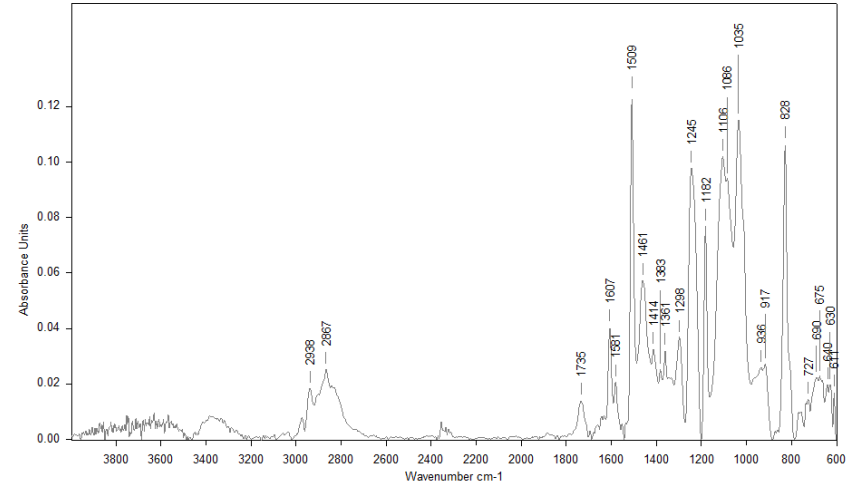
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Date of Measurement 23.7.2019.

Sample Form HYPERION 1000\_15x objective

Sample Scans 32

2 23 RED AND YELLOW LAYER



Experiment HYPERION1000\_ATR.xpm

Operator Name Administrator

Instrument Type TENSOR 27

Resolution 4

Path of File C:\CAPUS\MICRO FTIR

Date of Measurement 23.7.2019.

Sample Form HYPERION 1000\_15x objective

Sample Scans 32

### Sample 2/4 - SEM/EDS analysis

Electron Image 1			Spectrum 1			Spectrum 2		
Spectrum	Wt%	Wt% Sigma	Spectrum 2	Wt%	Wt% Sigma			
1			Fe	44.03	0.72			
Fe	86.68	1.56	O	35.79	0.74			
C	13.32	1.56	C	19.73	1.03			
Total	100.00		Cl	0.44	0.06			
			Total	100.00				

The analysis indicates that the metal composition consists of iron and carbon (steel). The corrosion consists of iron oxide formed as globular nodules.