Germolles case study

Contribution of spatial and spectral imaging techniques to the re-examination of conserved but poorly documented wall paintings for their long term preservation: application to Germolles

Christian Degrigny, Haute Ecole Arc Conservation-restauration, Neuchâtel, Switzerland
A countryside palace in Burgundy

Best preserved residence of the Dukes of Burgundy
Listed but private
10,000 visitors / year
The princes of Germolles...

Philip the Bold
Vienne, Hofburg, 16th c.

Margaret of Flanders
Lille, Musée de l’Hospice Comtesse, 16th c.
1380-1400

Germolles around 1778
Rare records... **medieval accounting notes**

- Materials purchased to make letters **P** and **M** as well as **floral decorations**: roses, marguerites and thistles
- Large quantity of **tin foils** (white, green or vermeil coated) was purchased
- & **organic compounds** (linseed oil, ynde fin (indigo), bresin (dark red) and berry (yellow))

**Use of tin?**

**(decors in relief, applied motifs, cheap replacement to gold)**

- Attribution to **Jean de Beaumetz’** workshop
<table>
<thead>
<tr>
<th>Material</th>
<th>Germolles</th>
<th>Rouvres</th>
<th>Argilly chapel</th>
<th>Champmol abbey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold foils</td>
<td>2 400</td>
<td>2 400</td>
<td>61 841</td>
<td>66 850</td>
</tr>
<tr>
<td>Gilded tin foils</td>
<td>720</td>
<td>348</td>
<td>288</td>
<td>1 524</td>
</tr>
<tr>
<td>Green tin foils</td>
<td>1 908</td>
<td>60</td>
<td>17</td>
<td>1 524</td>
</tr>
<tr>
<td>White tin foils (unprepared)</td>
<td>540</td>
<td>492</td>
<td>612</td>
<td>840</td>
</tr>
<tr>
<td>Bresin (lb)</td>
<td>1 ¼</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vermillion (lb)</td>
<td>8</td>
<td>4</td>
<td>86</td>
<td>59</td>
</tr>
<tr>
<td>Lead red (mine) (lb)</td>
<td>59</td>
<td>6</td>
<td>158</td>
<td>110</td>
</tr>
<tr>
<td>Indigo (lb)</td>
<td>1</td>
<td>10</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Blanc de Pouille (CaCO3) (lb)</td>
<td>60</td>
<td>6</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Ochre – berry (lb)</td>
<td>120</td>
<td></td>
<td>68</td>
<td>46</td>
</tr>
<tr>
<td>Linseed and walnut oils (pints)</td>
<td>18</td>
<td></td>
<td>238</td>
<td>190</td>
</tr>
<tr>
<td>Varnish (lb)</td>
<td>89</td>
<td>22</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>Paper (quires)</td>
<td>9</td>
<td>4 ½</td>
<td>72</td>
<td>82</td>
</tr>
</tbody>
</table>

Wall paintings were decorating the first floor.
Surviving similar wall paintings are unknown.

Jessé tree, around 1500, Saint-Prix-et-Saint-Cot. Church, Burgundy
Similar symbols on Louis d’Anjou’s tapestries

Tenture de l’Apocalypse, 5th piece, scene 59: The flask poured on the waters, 1380-1382, wool, Angers, musée des tapisseries.

Tenture de l’Apocalypse, 3rd piece, scene 39: The dragon fighting God servants, 1380-1382, wool, Angers, musée des tapisseries.
General description

2.9m
Paintings that adapt to the shape of the walls...
Paintings that adapt to the shape of the walls...
Similarities between «M» letters?
One stencil?
A stencil **with** additional arabesques?
Thistles are all different...
Is what we see correct?

A recent re-discovery

Dressing room of Countess of Nevers (Margaret of Bavaria)

1933

Around 1940
History of the conservation work

- **Around 1970**: Removal of poorly attached 19th c. plaster
- **December 1978**: The wall paintings of Countess of Nevers’ dressing room (dn) are listed as “Historical Monument” (French law)
- **End 1988-mid 1990s**: De-restoration and conservation work by I. Takahashi (reintegration with tratteggio technique + consolidation / protection with Paraloid B72©)
- **1989**: 1st analyses by LRMH and the whole château is list as “Historical Monument”
QUESTIONS

• Distinguishing original material from restoration work?
• Characterization of original materials?
• Analysis of original materials
• Understanding the painting technique
• Management of all collected data
GERMOLLES case study

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CICRP, Marseille

Marcello Picollo, IFAC-CNR, Florence

Julien Guery (Captair) is absent
Construction of basemaps for future documentation

Orthophotographies: Captair Sarl

Countess of Nevers’ dressing room

Interpolation

Dense point cloud

Texture
Distinguishing original from added material
Macro and micro-technical photography

Countess of Nevers’ Dressing room

UV light: visual examination of painted surfaces to assess extent of restoration

Macro technical photography

Normal VIS  IRr  UVf

© F. Piqué
© N. Papiashvili
Distinguishing original from added material
Macro and micro-technical photography
Profile of the letters: a rather respectful restoration
Multispectral imaging

Addition of arabesques to «P» validated
Characterization of original materials

Stratigraphy of paint layers on «M» and «P» letters
Characterization of original materials

Stratigraphy of paint layers on «M» and «P» letters
Characterization of original materials

Stratigraphy of paint layers on «M» and «P» letters
Stratigraphy of paint layers on the thistles
Stratigraphy of paint layers on the thistles

© N. Papiashvili
Analysis of original materials
Non invasive portable XRF analysis

Pb
Original white

Zn, Ti
Repainting

© F. Piqué
In total 100 points investigated
Micro-destructive: Laser Induced Breakdown Spectroscopy - LIBS

« P » ➔ Validation of micro-observation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Lithopone (BaSO₄ – ZnS) and Titane white</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ti, Zn, Ba, traces Pb</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pb, Zn, Ti, Ba, Ca,</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Pb, Ca, traces de Ti, Ba, Fe</td>
<td>Lead white</td>
</tr>
<tr>
<td>4</td>
<td>Fe, Pb, Ca</td>
<td>Yellow Ochre</td>
</tr>
<tr>
<td>5</td>
<td>Fe, Pb, Ca</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ca, Pb, Fe</td>
<td>Ca carbonate</td>
</tr>
</tbody>
</table>

Green background

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Copper green, Paraloid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ca, Pb, Cu, organic bands</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cu, Pb, Ca, organic bands</td>
<td>Copper green + Paraloid</td>
</tr>
<tr>
<td>3</td>
<td>Fe++, Cu, Ca+ Al</td>
<td>Yellow ochre</td>
</tr>
<tr>
<td>4</td>
<td>Fe+, Cu, Ca ++, Al</td>
<td>Ca carbonate</td>
</tr>
</tbody>
</table>

Multiplication of shots in depth analysis ➔ Validation of micro-observation
1. Titanium white
2. Gold foil
3. Mordant
4. Copper (resinate)
5. Tin
6. Mordant
7. Copper (Cu) green + lead (Pb) white
8. Yellow ochre (Al, Si, Fe)

» Validation of micro-observation
Study of a loose fragment from a thistle

On cross-section

Countess of Nevers’ dressing room

Sampling
03 Yellow

04 White green (FTIR) (20 μm) _ Lead white, oil binder and Cu-based green

05 Green Cu-based mixed with lead white (30-60 μm)

06 Brown red oil-resinous based mordant – mission (20-70 μm) (FTIR)

07 Tin leaf (20 μm)

08 Green resinate (20 μm) _ Cu, (FTIR)

09 Mission-mordant (5 μm)

10 Yellow mordant for gold (ca. 5 μm) _ Ca, S

11 Gold leaf (ca. 300 nm)

12 Layer over gold (not very visible)

Further validation of micro-observation

200,0μm
Additional decoration of the gold foils

Saint André cathedral, funeral paintings of Arnaud de Puylehaut, rose, Bordeaux, 14th c., © Mounier
Understanding the painting technique

- Application of a preparation layer (yellow ochre)
- Positioning of «P» and «M» stencils
- Application of the green background (two layers of Copper green + lead white) in between the letters
- Painting of the letters with lead white
- Further decoration of the extremities of the «P» with arabesques
- Fixing the metallic thistles in between the letters with mordant
Current activities
Physical stability of the wall paintings

Stimulated IR thermography

Finger tapping analysis
Investigation of the possibilities of augmented reality
Investigation of the possibilities of augmented reality
Thank you for your attention