

How the study of polychromy sheds fresh light on a previously proposed laser treatment

Camille De Clercq

Royal Institute for Cultural Heritage (KIK-IRPA, Brussels)

Introduction

The statuary of the western facade (Fig. 2) of the cathedral of Our Lady of Tournai (Belgium) has been mutilated and transformed throughout its history, resulting in an eclectic combination of Gothic, Renaissance, early Baroque and late Baroque sculpture (Fig. 1). Protected by a sixteenth-century porch, the many reliefs and statues form an ensemble that occupy the entire width of the facade.

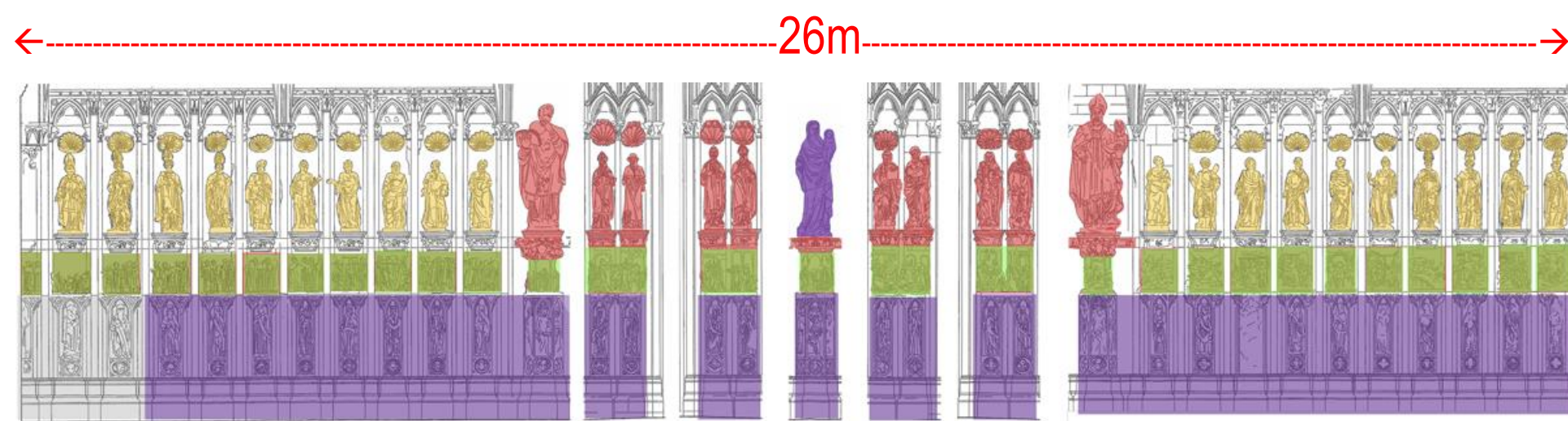


Figure 1



Figure 2

Polychromy

The stratigraphic study revealed that the ensemble was originally completely embellished with polychromy. The colors have completely disappeared on the gothic statuary made of stone of Tournai and largely disappeared on the renaissance elements (Fig. 5). The Baroque statues still contain large polychrome areas underneath the black gypsum crusts, allowing to reconstruct the original color scheme. A striking example is the statue of Saint Eleutherius (Fig. 3). Painted *en camaïeu* and adorned with gilded details to create highlights, the statue gives a vivid picture of the early baroque color scheme and of the modeling obtained by light and shade.

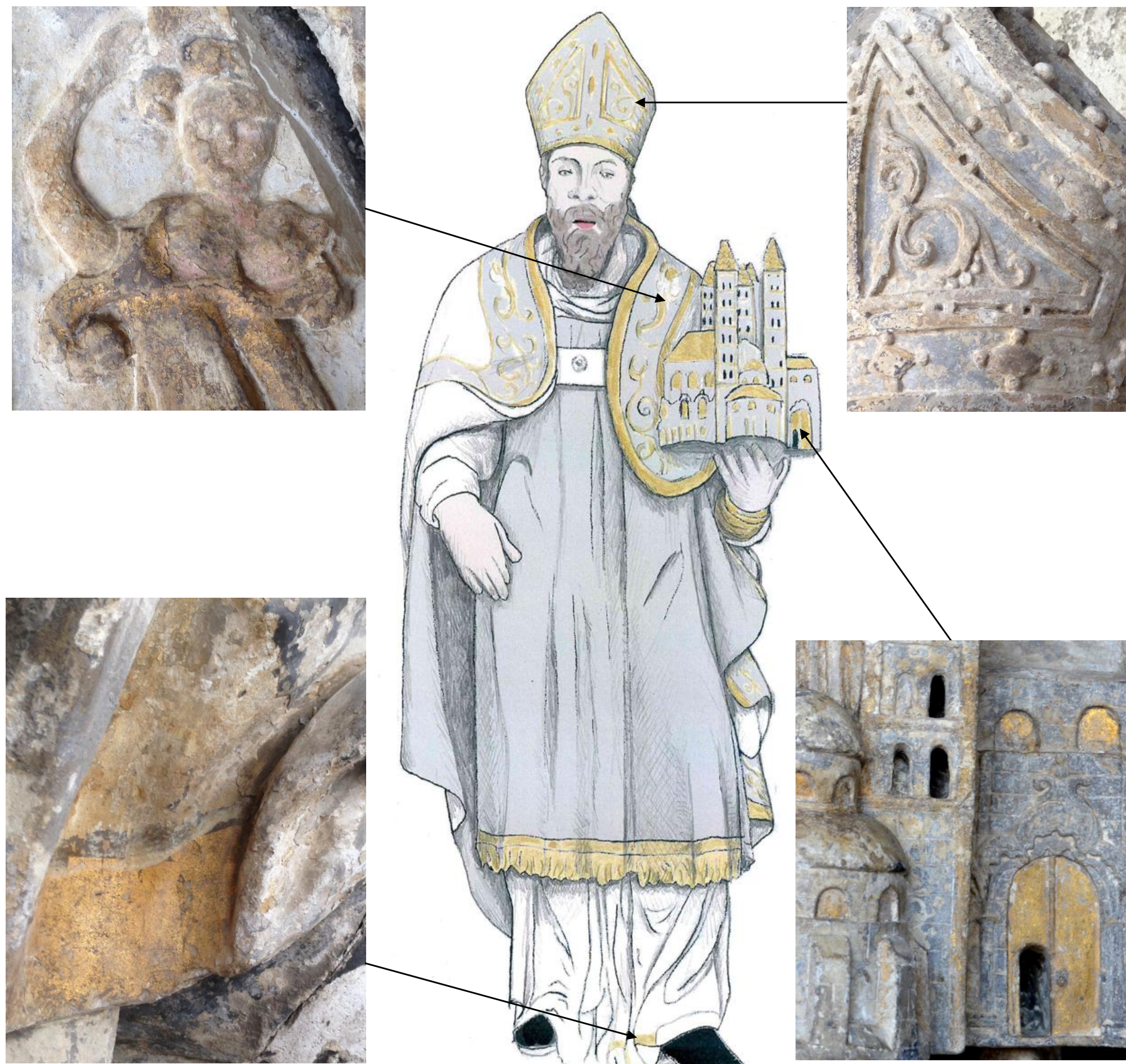


Figure 3

Special care

It is important to protect and preserve the polychromy remnants hidden behind the black gypsum crust. Pouli [3] has shown that some pigments are sensitive to laser heating, leading to chemical and physical changes. Given the limitations of the laser cleaning it was decided to proceed largely with mechanical methods (in very sensitive areas without polychromy, the use of laser can be considered to gently reduce the crusts).



Figure 4



Figure 5

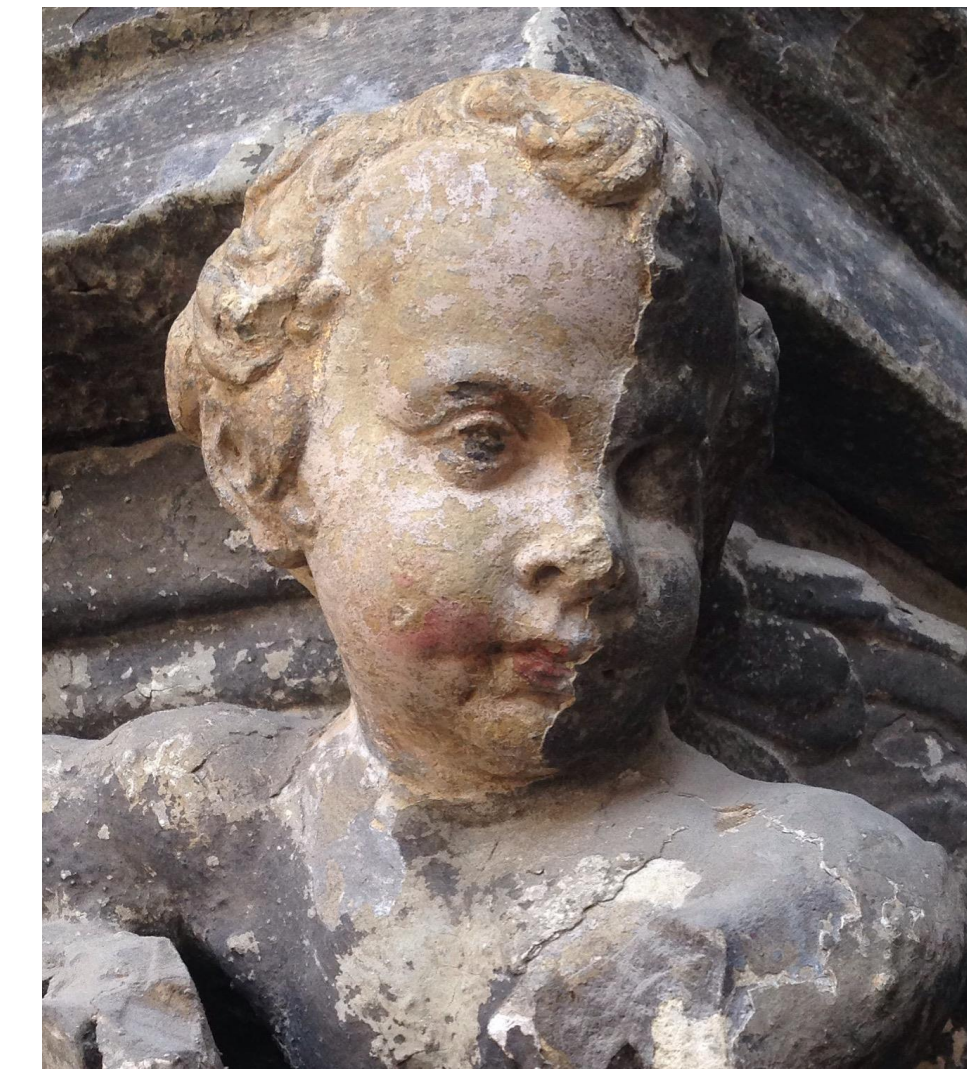


Figure 6



Figure 7

Pilot project

In 2015 KIK-IRPA was called upon to evaluate the results of conservation treatment tests carried out in the 1990s. The proposed application of laser-ablation (Fig. 8,10) to remove the very dense black crusts was questioned because the appearance of the paint layers and stone support behind the removed black crust was unnatural. The goal of this pilot project was to formulate a new proposal to present the statuary in a rewarding way and to improve its aesthetic appearance while respecting its history.



Figure 8



Figure 9

Comparative cleaning analysis

In order to compare the laser cleaning method with mechanical cleaning, a head of a statue in Avender stone with monochrome paint layers adjacent to the statue with the laser test was chosen. The laser cleaning (Fig. 10) is able to remove ingrained crusts and clean fissures on the stone surface. However a yellowish surface remains and results in an unnatural appearance.

A possible explanation for the aspect difference could be the fact that Q-switched laser pulses can cause the temperature to be increased significantly because of the high temperature gradient of 10sK/cm [1] (Cooper [2] estimated that a Q-switched Nd: YAG pulse can induce a temperature rise of -1500°C to the carbon layer and -170°C to the limestone).



Figure 10

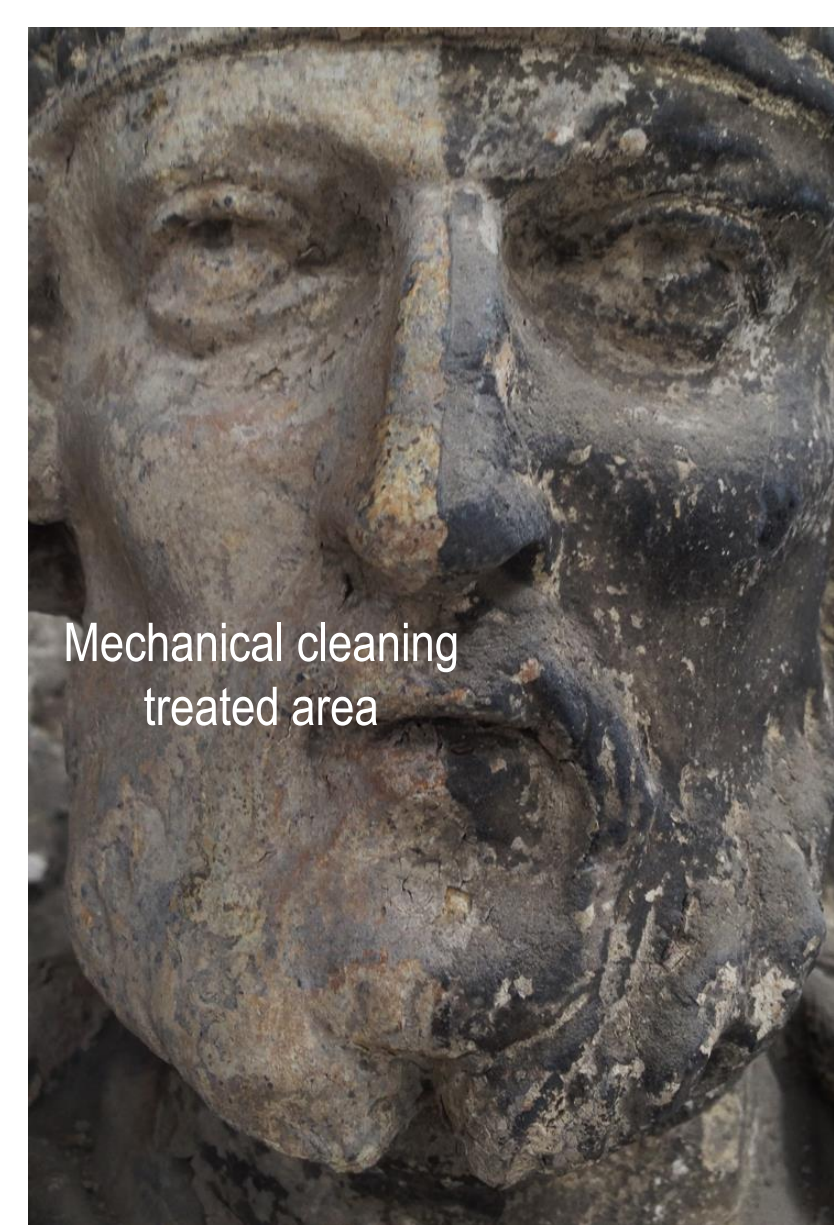


Figure 11



Figure 12

Treated areas

The pilot project included several tests on different large areas (Fig. 13) to evaluate the compatibility and aesthetic result of our newly proposed treatment.

Previous laser cleaning test
KIK-IRPA pilot project

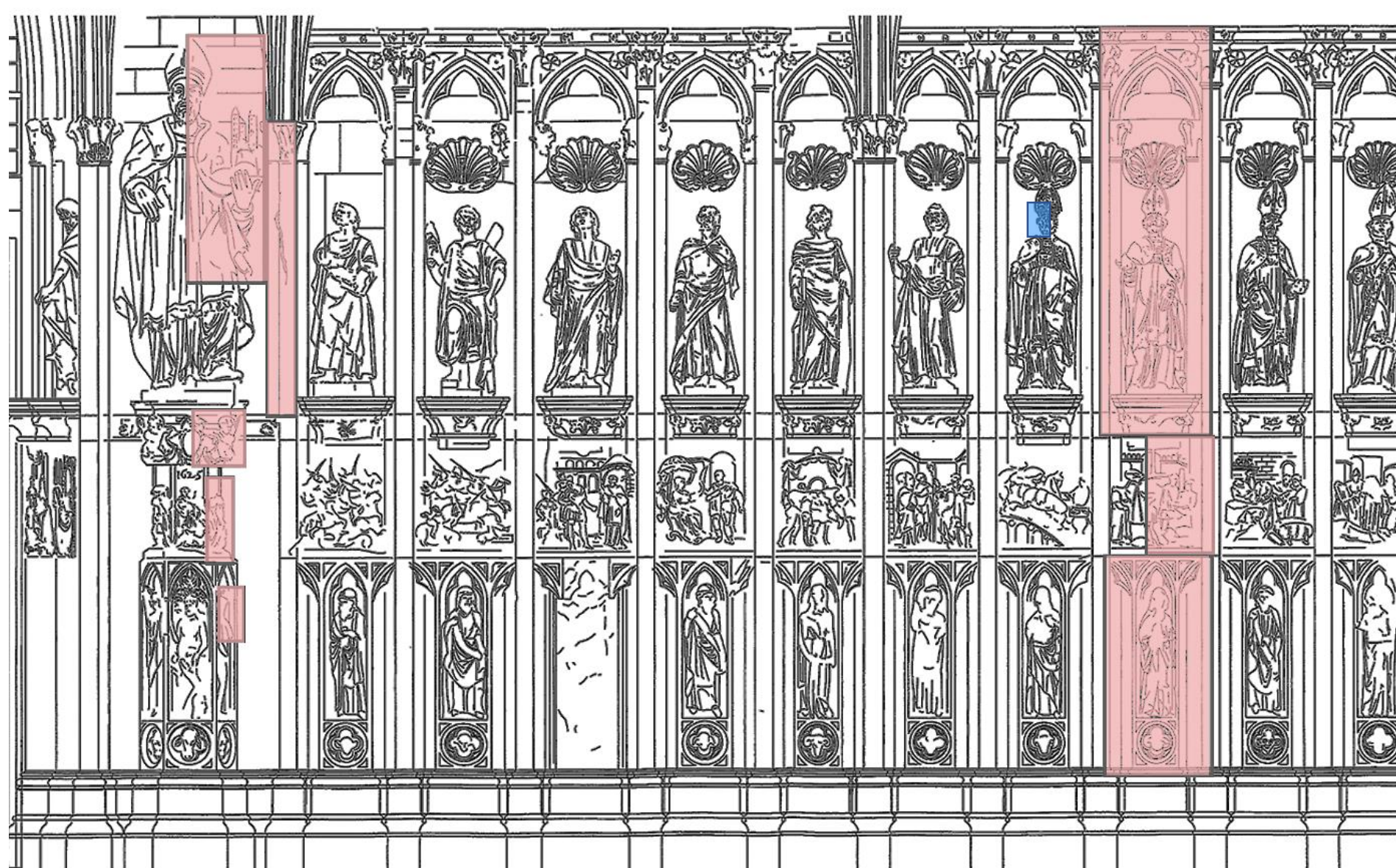


Figure 13

Conclusion

A large-scale pilot project has shown that extensive stratigraphic research is needed to determine the presence of polychromy. By comparing different cleaning techniques, it was found that the size of the tests determines the technique to be used: the test surfaces must be in proportion to the area to be fully treated. Even if, at first sight, the laser cleaning method seems effective to remove the black crusts, further testing on a greater scale clearly shows that mechanical methods would be more suitable to treat the monochrome and polychrome statuary.

References

- [1] Kelley JD, "Particle removal from Surfaces by pulsed laser irradiation" SPIE Vol.1 624 Laser-induced Damage in Optical Materials: 1991 pp. 153- 160.
- [2] Cooper MT, "Laser cleaning of stone sculpture". PhD Thesis. Loughborough University, 1994.
- [3] Pouli P, "Laser cleaning studies on stonework and polychromed surfaces". PhD Thesis. Loughborough University, 2000.

Multidisciplinary team

Stone conservation

Camille De Clercq

Judy De Roy

Sam Huysmans

Nicolas Verhulst

Tanaquil Berto

Laurent Fontaine

Jana Sanyova

Cécile Glaude

Consolidation study

Natural stone identification

Paint layers identification

Contact Information

Camille De Clercq

camille.de.clercq@kikirpa.be

Instagram: stone_conservation_studio

Website: www.kikirpa.be

