

Darkening of lead pigments:

Development of a new restoration technique using irradiation laser

Program

Previous research works of CICRP have led to understand the chromatic transformation of lead pigments as blackening or whitening; they were more particularly focussed on the behaviour of wall painting minium over natural ageing.

During the alteration, minium and lead white (hydrateous lead carbonate) generally change into secondary phases as PbO_2 which blacken wall paintings colours. This phenomenon is considered as irreversible and depends on different factors as scientific references propose: the painting technique (a fresco, a tempera etc.), the environment (humidity, pollutants, temperature, sunlight etc.), and the microbial activity. Our results showed that the manufacture of minium is also able to favour the blackening because this worked pigment is generally made up of a mixture of lead oxide compounds (Pb_3O_4/PbO) and the lead monoxide is very sensitive to alteration.

The current wall painting restoration techniques are quite inadequate. Some chemical treatments are sometimes done on blackened white lead but they can be inefficient and can weaken the support. No specific technique to minium restoration exists.

Our previous works along with other scientific studies showed that PbO_2 could be chemically reduced under a thermal treatment with successive oxygen losses. The irradiation laser was notably able to reverse darkened pigment and brings back the original colour.

Our current work aims to:

- Find the most efficient laser source which permits this treatment and to adjust its main parameters (including wavelength, absorption coefficient)
- Develop an appropriate protocol of the darkened minium treatment including the treatment duration, the surface density of the power
- Verify the amplitude of the treatment: would the reversion be total or not? Does the treatment induce disorders? Would some complementary treatment be associated? Will the treatment increase or decrease the duration of the restoration?

Research team on the irradiation laser technique

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Publications

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